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BIODIVERSITY CONSERVATION PLAN

FOR

VAZHACHAL HIGH VALUE BIODIVERSITY AREA

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(Final report of the project KFRI 587/2009 November 2009-March 2010)

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Project proposal

Project No.	: KFRI RP 587/2010
Title	Biodiversity conservation plan for Vazhachal High Value Biodiversity Area
Investigators	C. Renuka, S. Sankar, K. K. Ramachandran, P. Vijayakumaran Nair, K. Swarupanandan, U. N. Nandakumar, George Mathew, V. V. Sudheendrakumar, T. V. Sajeev, E. A. Jayson, N. – Sasidharan, C. Mohanan, U. M. Chandrasekhara
Objectives	1. Identification and consolidation of available data sets including maps and images 2. Preparation of a plan for biodiversity management plan
Duration	November 2009-March 2010
Budget	2 Lakhs
Funding Agency	Kerala Forests & Wildlife Department, GOK

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BIODIVERSITY CONSERVATION PLAN FOR VAZHACHAL HIGH VALUE BIODIVERSITY AREA

CHAPTER 1: DESCRIPTION OF THE LANDSCAPE

1.1. Name, Location, Constitution and Extent

1.1.1. Name : Vazhachal Forest Division

1.1.2. Location :

The Vazhachal Forest Division falls in Mukundapuram Taluk of Thrissur District and Aluva Taluk of Ernakulam District and lies distributed in Sholayar, Kollathirumedu, Vazhachal, Charpa and Athirappilly Ranges. The tract dealt with falls between 10° 14' and 10° 23' North latitudes and 76° 25' and 76° 54' East longitudes (Map 1).

1.1.3. Constitution

The present Vazhachal Forest Division came into existence with effect from 1.8.1981 with its Headquarters at Chalakudy consequent to the reorganization of the erstwhile Central Circle, Thrissur and Industrial Plantation Circle, Thrissur. The areas of this Division fall in Kodassery Reserve, Malayattur and Idayara Reserve and Athirappilly Reserve. The areas of this Division were formerly parts of Chalakudy Division and of Industrial Plantation Divisions of Perumuzhi and Vazhachal. There are five ranges belonging to Vazhachal Forest Division (Table 1.1).

Table 1.1. Ranges of Vazhachal Forest Division

Sl. No.	Name of the Range	Headquarters
1	Athirappilly	Ezhattumukham
2	Charpa	Vazhachal
3	Kollathirumedu	Kollathirumedu
4	Sholayar	Ambalappara
5	Vazhachal	Pokalappara

Administration

A Range is the unit of administration, which is divided in to Forest Stations. The boundary descriptions of the Division and the five Ranges are provided in **Appendix- I.**

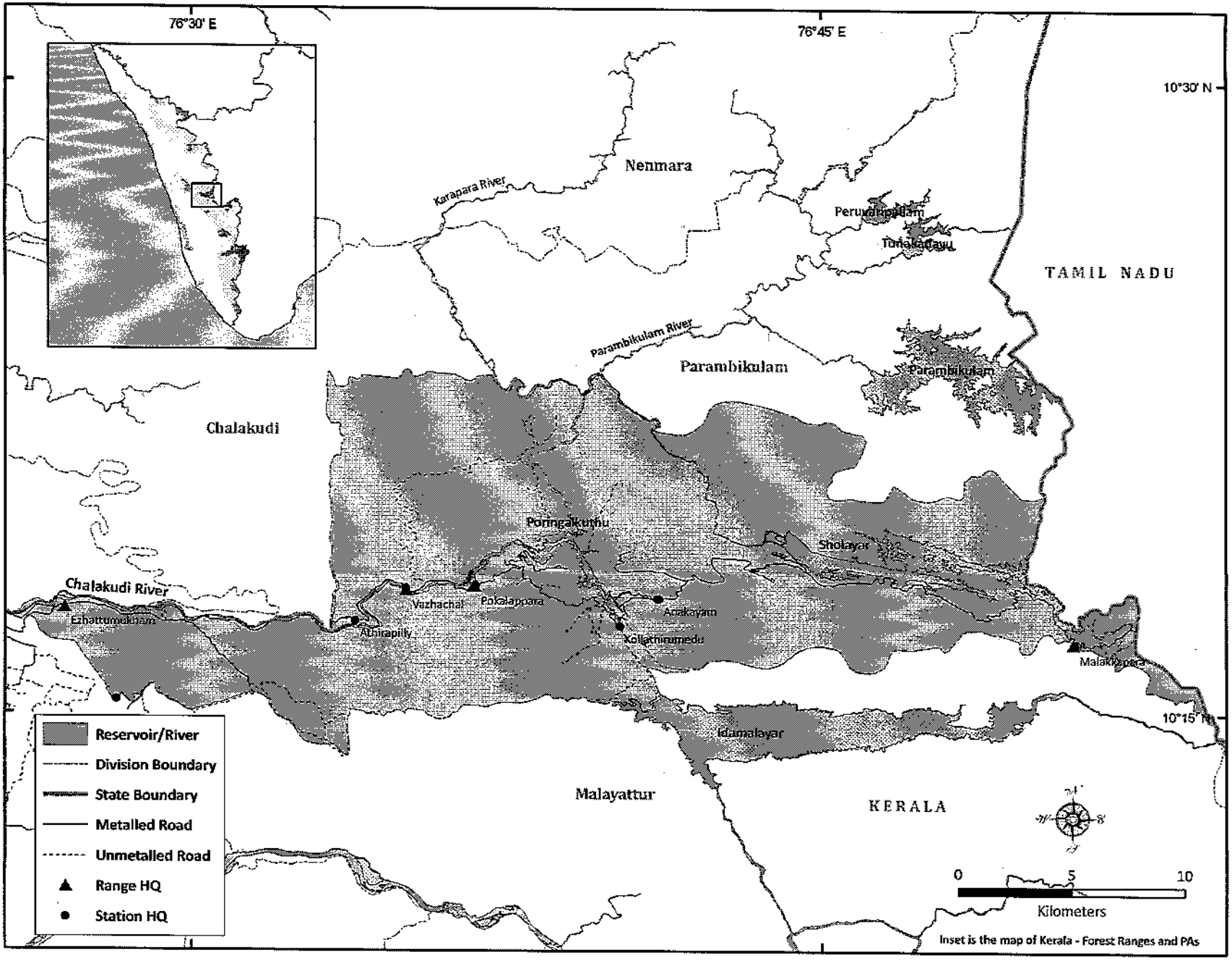
The details of the Ranges, Stations, Sections and Beats with their Headquarters coming under the Vazhachal Division are provided in Table 1.2 and Map 2.

Table 1.2. Administrative units in the Division

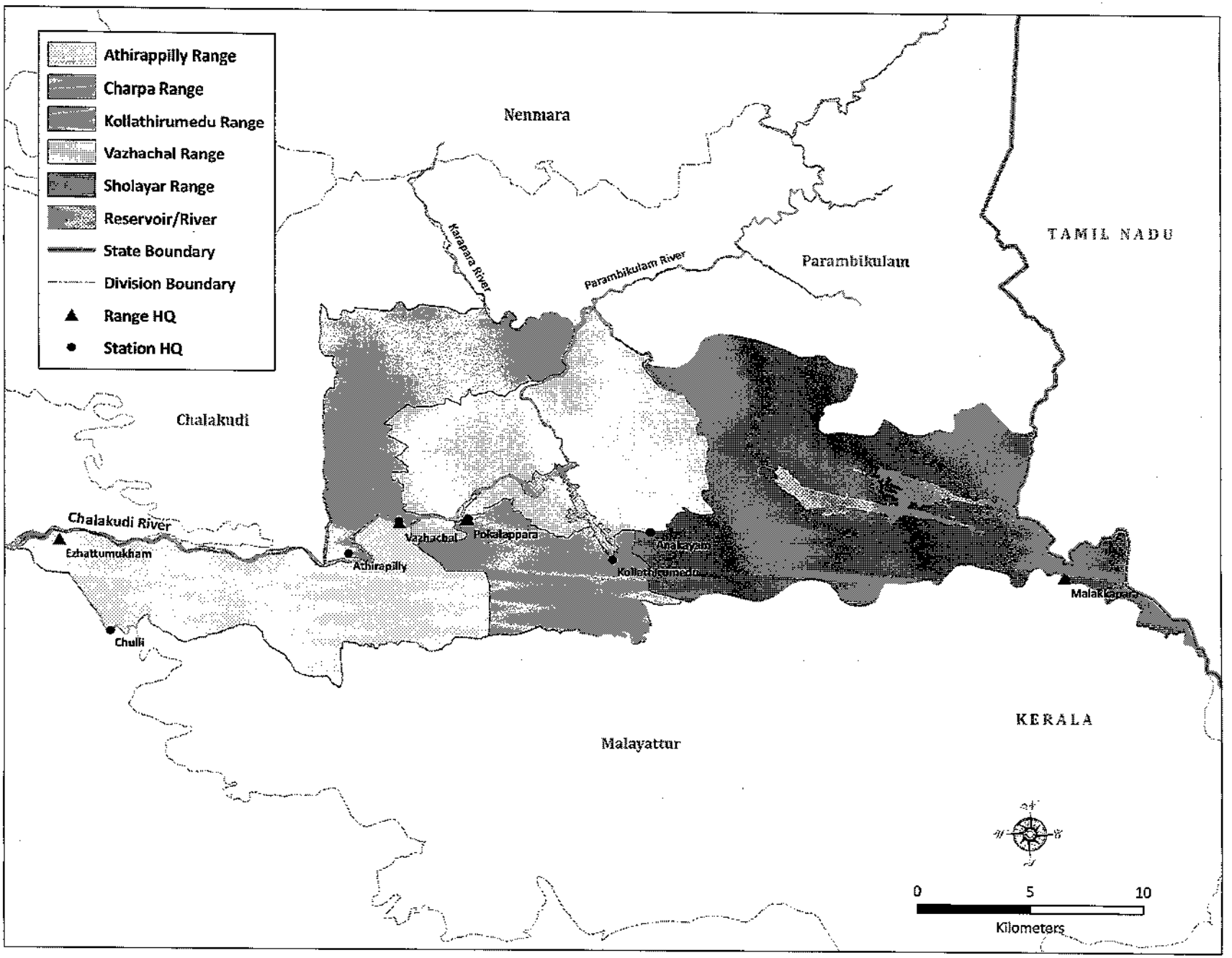
SI. No.	Range	Station	Section	Beats	Head Quarters
1	Athirappilly	Athirappilly	Athirappilly	Athirappilly	Athirappilly
				Oolassery	
		Ezhattumukham	Vadamuri	Vadamuri	Ezhattumukham
				Thadimudi	
			Ezhattumukham	Ezhattumukham	
				Chulli	
2	Charpa	Kannamkuzhi	Kannamkuzhi	Kannamkuzhi	Vazhachal
				Karingampara	
			Charpa	Charpa	
				Panjanamkuthu	
			Karanthodu	Karanthodu	
				Kundurmedu	
3	Vazhachal	Vazhachal	Pokalappara	Pokalappara East	Pokalappara
				Pokalappara West	
			Vazhachal	Vazhachal	
				Poringal	
		Mukkumpuzha	Mukkumpuzha	Orukomban	Anakayam
				Mukkumpuzha	
4	Kollathirumedu	Kollathirumedu	Karadippara	Karadippara	Wachumaram
				Rapra	
			Kollathirumedu	Kollathirumedu	
5	Sholayar	Malakkappara	Malakkappara	Malakkappara	Malakkappara
		Sholayar	Sholayar	Anakayam	Anakayam
				Sholayar	
			Chandanthodu	Chandanthodu	

1.1.4. Extent

The total extent of the forests coming under this Division is 41394.398 ha (413.94 km^2) which includes all natural forests and plantations (Table 1.3). The areas handed over for other purposes amount to 1198.714 ha, the details of which are given in **Appendix II.**



Map 1 Vazhachal Forest Division



Map 2 Vazhachal Forest Division - Ranges

Details of long term leases in the Division are given in **Appendix- III.** The major portion of the area of this Division falls within the revenue districts of Thrissur and the balance, in Ernakulam.

Table 1.3. Extent of the natural forests and plantations

Sl. No.	Category	Extent (ha)
1	Natural forests	34114.138
2	Teak plantations	3891.370
3	Teak and Bombax plantations	1777.990
4	Miscellaneous plantations	1610.900
Total		**41394.398**

Distribution of the area

Range - wise distribution of areas in the Vazhachal Forest Division is given in Table1.4.

Table 1.4. Range-wise distribution of the area

Sl. No.	Name of Range	Headquarters	Area (ha)
1.	Athirappilly	Ezhattumukham	9509.810
2.	Charpa	Vazhachal	5997.450
3.	Kollathirumedu	Kollathirumedu	2934.880
4.	Sholayar	Ambalappara	13888.018
5.	Vazhachal	Pokalappara	9064.320
		Total	**41394.398**

Out of these, the area under Sholayar Range, part of Vazhachal and Kollathirumedu Ranges come under the Athirappilly un-surveyed Reserved Forests and the area of Charpa Range and the balance of Vazhachal Range come under the Kodassery un- surveyed Reserve Forests, while that of Athirappilly Range and the balance of Kollathirumedu Range come under the Malayattur un-surveyed Reserve Forests. Details of Reserves and Range-wise reserve areas are given in Tables 1.5 and 1.6.

Table 1.5. Reserves in the Division

Sl. No.	Name of Reserve	Extent (ha)
1	Athirappilly Reserve	22366.95
2	Kodassery Reserve	9517.65
3	Malayattur-Idayara Reserve	9509.80
Total		**41394.40**

Table 1.6. Range - wise and Reserve wise distribution of the area

Sl. No.	Range	Name of Reserve (Extent in ha)		
		Athirappilly Reserve	Kodassery Reserve	Malayattur Idayara Reserve
1	Athirappilly	-	-	9509.80
2	Charpa	-	5997.50	-
3	Vazhachal	5544.15	3520.15	-
4	Kollathirumedu	2934.80	-	-
5	Sholayar	13888.00	-	-
Total		**22366.95**	**9517.65**	**9509.80**
Grand Total				**41394.40**

An extent of 4261.048 ha of forest land coming under Kalady Range, Athirappilly Range, and Pariyaram Range has been leased out to the Plantation Corporation of Kerala Ltd., for the purpose of cultivating rubber or any other plantation crop. Out of this, 3545.510 ha belongs to Vazhachal Division. The Corporation has undertaken oil palm cultivation here. An extant of 1744.124ha area was used for non forestry practices including plantations, hydroelectric projects, churches and human settlements. The details of the area under non-forestry practices are given in the Table 1.7.

Table 1.7. Area under non-forestry practices

Total area (ha)	41394.398
i. Area leased out to private persons for cultivation	813.7291
ii. Area leased out to Plantation Corporation of Kerala Ltd.	545.510
iii. Area leased out for hydroelectric project	249.7329
iv. Poringal Church	0.184
v. Hill-men settlements	134.968
vi. Encroachments	Joint verification yet to be completed
Effective area	**39650.274**

Intra-state boundaries

Wherever possible, external boundaries of the reserve forest have been adjusted along the natural features like rivers, streams and ridges. Quite often roads form external boundaries of the ranges and Division in some areas **(Appendix –I).**

Inter-state boundaries

The only inter-state boundary in this Division is the one lying between Thrissur Revenue District and Coimbatore Revenue District of Tamil Nadu, the length of which is ca. 19 km.

1.1.6. Legal status

All the Reserve Forests dealt are the property of the Government and have been notified under the Travancore and Cochin Forests Acts for the areas covered by the then Travancore and Cochin States respectively. The details of the areas leased out to the Kerala State Electricity Board for the Poringalkuthu Hydro-Electric Project and Sholayar Hydro-Electric Project, the area leased out to the Plantation Corporation of Kerala (Kalady Group of Plantations), area given to Kannamkuzhi Harijan Colony and Tribal Development Department and Hill men Settlements are given in **Appendix –II.**

Rights and concessions

Certain rights and concessions were admitted in the Kodassery Reserve at the time of settlement. The rights and concessions admitted are given in **Appendix- IV.** No rights or

concessions are seen admitted in Athirappilly, Malayattur and Idayara Reserves at the time of settlement. The rights admitted at settlement relate to temples, enclosures and use of road and path which are defined in the notification of reservation under section 18 of the Forest Act in force.

1.1.6. Notification

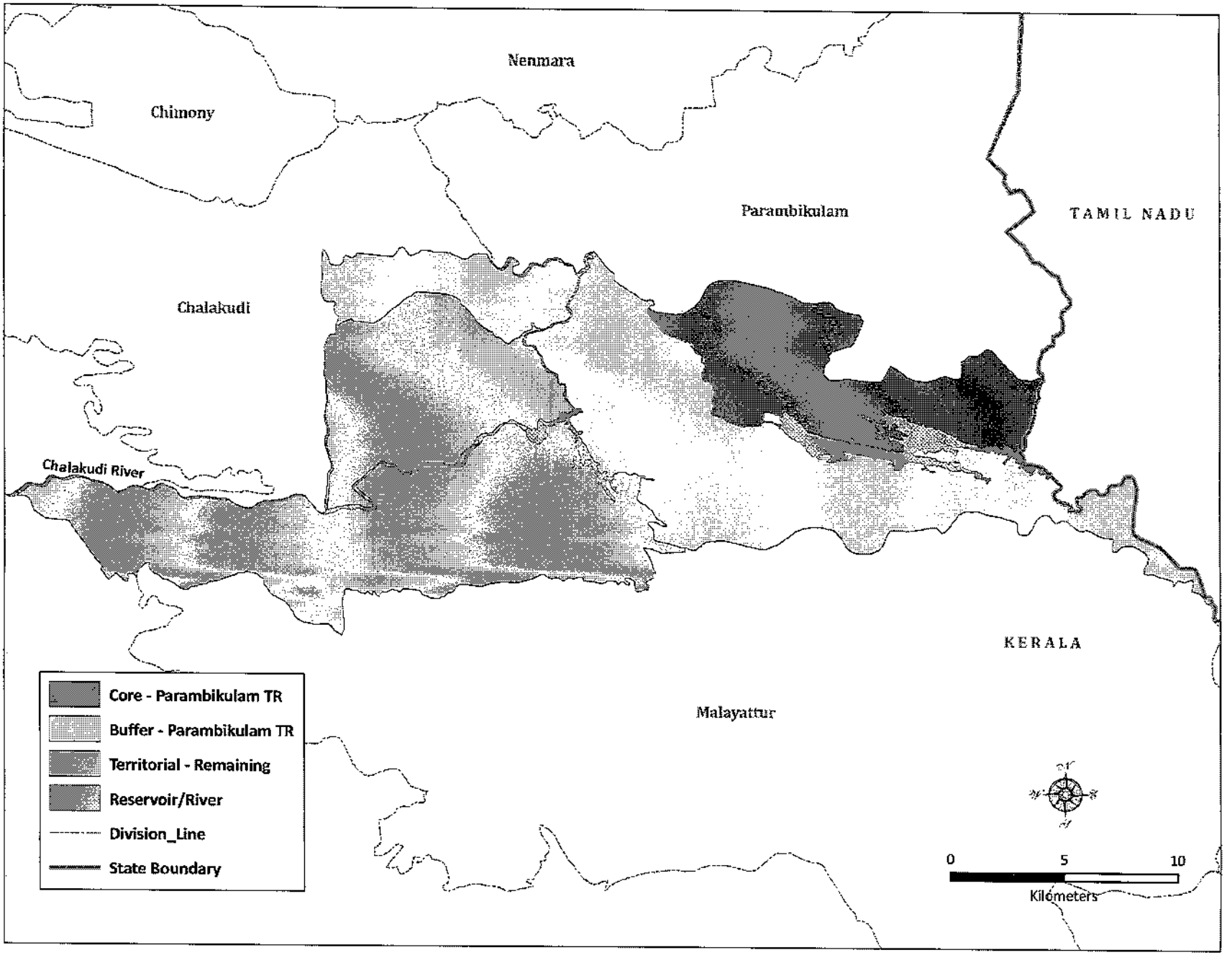
As per G.O.MS.34/81/AD dated 7.2.1981, Government have ordered the re- distribution of territorial jurisdiction of the Divisions in Central Circle by forming one more Territorial Circle called High Range Circle in the place of the Industrial Plantation Circle. The reorganization of Central Circle, bifurcation of Territorial Jurisdiction to form High Range Circle and Central Circle and delineation of Boundaries of Divisions and Ranges of Vazhachal Forests Division orders issued as per the G.O. MS.197/8.1/Forest dated, Thiruvananthapuram, 31st July 1981. The details are given in **Appendix I.**

As per G.O. No.14478/F2/08F & WLD dated 16-12-2009 of Forest and Wildlife Department Thiruvananthapuram, an area of 60.53 km^2 from Sholayar range of Vazhachal Forest Division was additionally proposed as Core area for Parambikulam Wildlife Sanctuary, since the area is contiguous to the existing core and critical tiger habitat of the Sanctuary. For the buffer areas of Parambikulam WLS an extent of areas were additionally added mainly from three ranges, Charpa (26.63 km^2), Vazhachal (50.24 km^2) and Sholayar (78.35 km^2) from the Division (G.O.(P) No.54/09/F & WLD dated 17-12-2009 of Forest and Wild life Department, Thiruvananthapuram). These areas were declared as Tiger Reserve in accordance with sub-section (1) of Section 38 V of the Wildlife (Protection) Act 1972 (Map 3). Details are given in the **Appendix V.**

1.2. Topographical features

1.2.1 Mountain/Valleys

The forests are situated in the Western slopes of the Western Ghats. The altitude varies from 200 m to 1300 m, the highest point being Karimalagopuram in Sholayar Range. The whole area is hilly and undulating, the eastern portion being more rugged than western.



Map 3 Areas Proposed as Parambikulam Tiger Reserve in Vazhachal Forest Division

This rugged eastern portion has many valleys of which Sholayar, Watchmaram, Vazhachal etc. are the important ones. The northeastern portion of this Division viz., Malakkappara, Sholayar, Chandanthodu, Sheikalmudi, Ambalappara, Anakayam etc. and the northern portion of Orukomban, Karanthodu, Orukombankutty, Karimalagopuram and the Southern portion of Rapra, Kalakkallen, Oolassery, Choozhimedu and the Western portion of Vadamuri, Athirappilly, Thadimudi, etc. are with dense forests (Map 4).

1.2.2. Rivers & streams

Drainage: The drainage (Map 5) is mostly towards west. The main rivers and streams in this Division are the following:

Chalakudy River: It flows from the northeastern area towards west and reaches Arabian Sea at Munambam having relics of riparian vegetation in substantial level. The hydro-electric projects on Chalakudy River are Sholayar hydro-electric project and Poringalkuth hydro-electric project. For irrigation purposes the Thumboormoozhy Dam was constructed across this river. Chalakudy River merges with the Periyar River at the village of Puthanvelikkara, North Paravur in Ernakulam District.

Manimaruthuthodu: It flows southwest from Watchmaram- Thavalakuzhipara portion and flows down to the Edamalayar Catchment area.

Anakkayam Thodu: It flows westwards from Ambalappara- Sholayar portion and merges with Poringal Reservoir .

Karanthodu: This flows eastwards and then southwards of Panjanamkuthu area and reaches Chalakudy river.

Kannamkuzhithodu: This river flows from the northeastern area of Charpa Range and flows southwest and merges with Chalakudy River at Kannankuzhy. This forms the western boundary of the Division up to Chalakudy River.

Oolassery-Athirappillythodu: This runs from Oolassery thodu and flows 12 km down in a zig-zag manner and joins into Chalakudy River at Athirappilly.

Chullithodu: This flows southwest from the plantation area and passes through Chully Group of plantations.

Orukombanthodu: This originates from the northern side of this Division and flows westwards and then southwards and merges with Chalakudy River.

Chandanthodu: This flows from Chandanthodu area and passes through Pathadipalam and merges with Sholayar Reservoir.

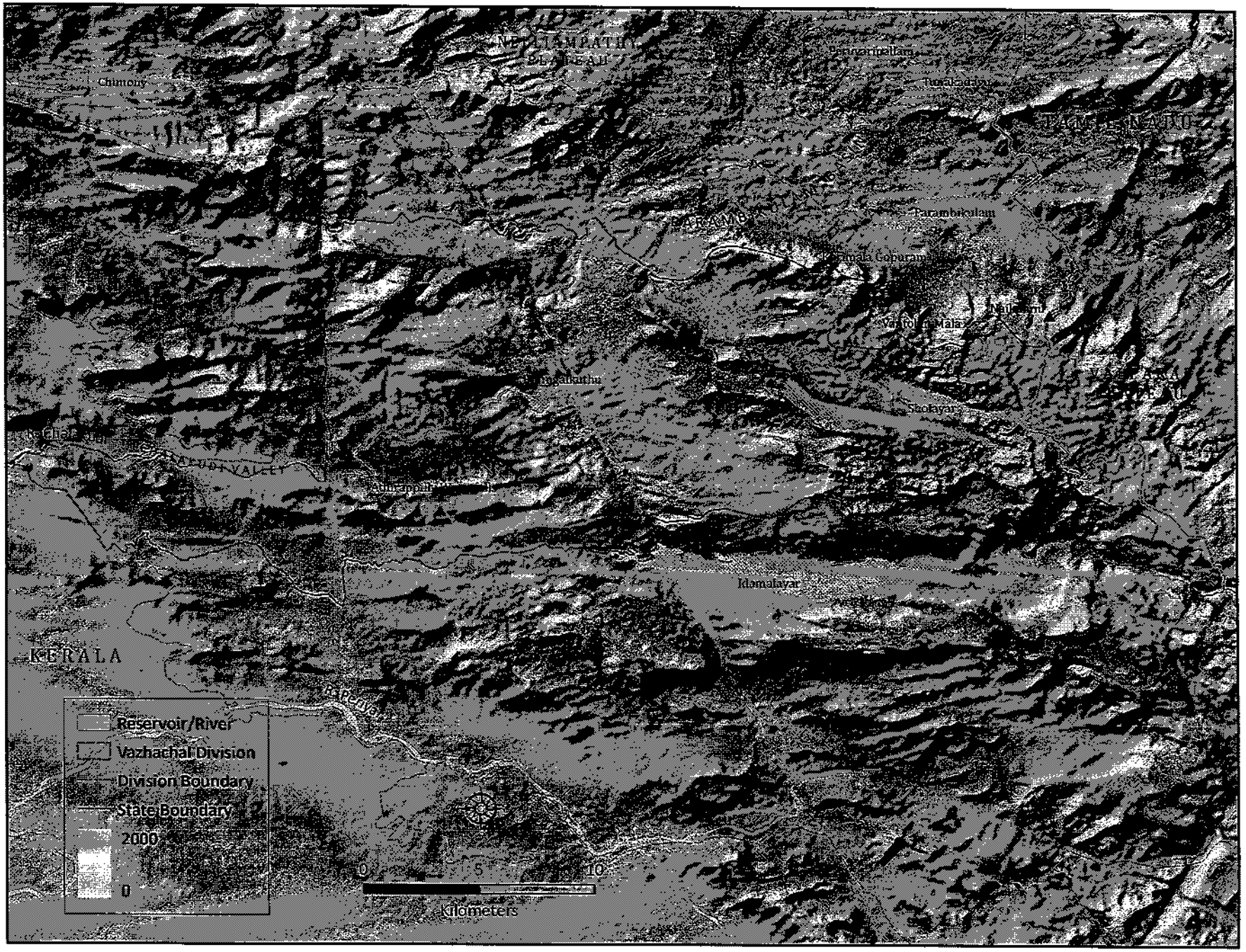
Charpathodu: This starts from Karanthodu area and flows southwest and merges with Chalakudy River at Charpa.

1.3. Approach and access

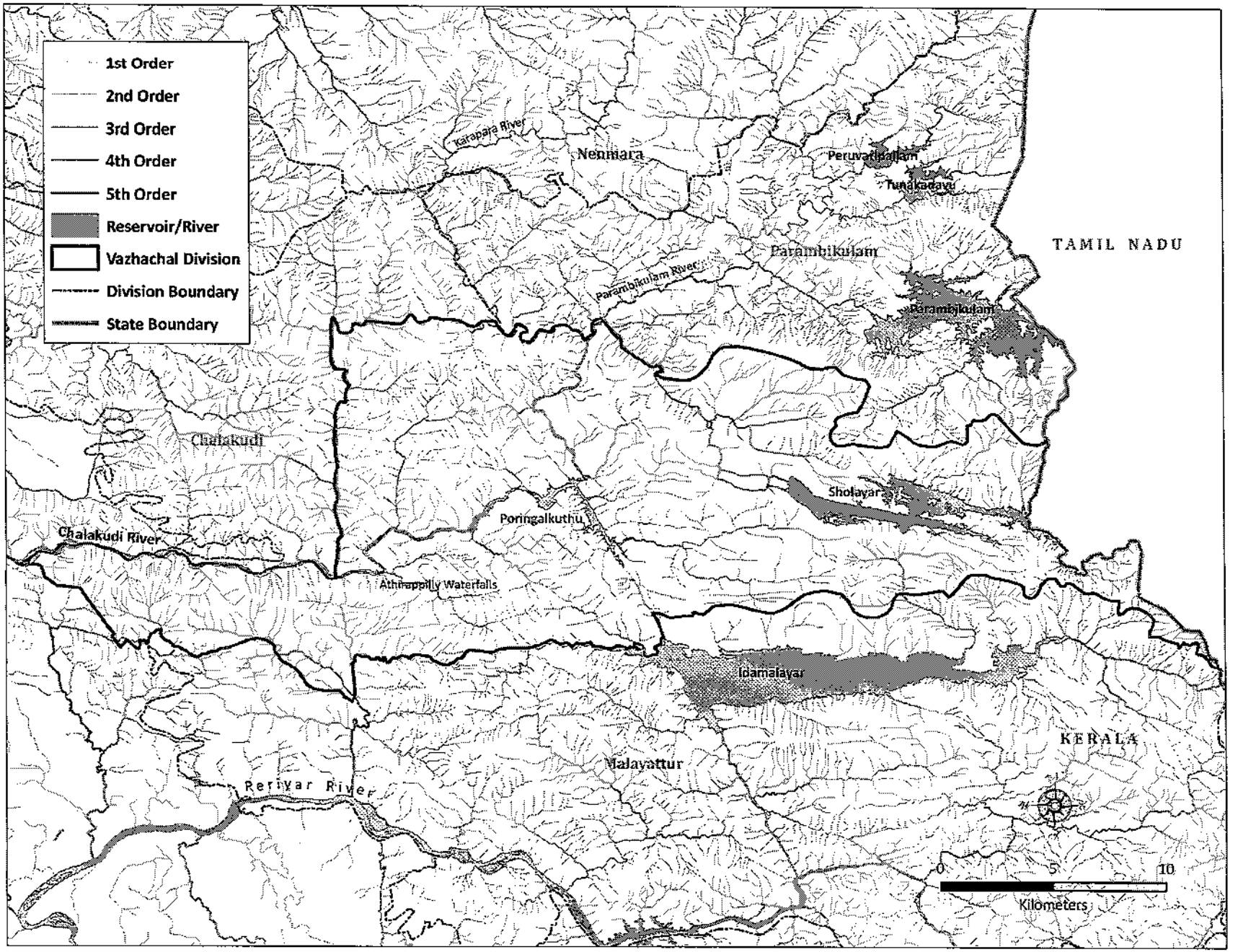
1. **Roads:** The Chalakudy-Anamalai State Highway 21 passing through Athirappilly, Vazhachal, Poringalkuthu, Sholayar and Malakkappara traverses through the Division. There are other roads belonging to Athirappilly Panchayath and the Forest Department (Table 1.8).

Table 1.8. Important roads within the Division

1.	Chalakudy - Anamalai road up to Malakkapara
2	Kalady Plantation Road up to Manjapra
3.	Kalady Plantation Road up to Muringoor
4.	Vazhachal - Nellithodu Road
5.	Thadimudi - Post Office Road
6.	Chulli Plantation Road
7.	Vazhachal - Orukombankutty Road
8.	Poringalkuthu - Karanhodu Road
9.	Watchmaram - Rapra Road
10.	Watchman - Thavalakuzhypara Road
11.	Ambalapara - Orukomban Road
12.	Sami Pocket Road
13.	Athirappilly - Vadamuri Road
14.	Athirappilly - Oolassery Road
15.	Oliveli - Chully Road
16.	Chulli - Chalikandam Road
17.	Vadamuri - Post Office Road
18.	Kannankuzhy - Panjanmkuthu Road



Map 4 Relief - Vazhachal Forest Division



Map 5 Drainage of Vazhachal Forest Division

19.	Ittiany - Panjanamkuthu Road
20.	Tramway Road up to Parambikulam
21.	Sidhan Pocket Road
22.	Choozhimedu - Kalakkallen Road
23.	Pokalppara - Karadipara Road
24	Punnapocket - Kalakkallen Road
25.	Anamukku Road
26.	Athirappilly - Karadippara Road

Railway: The Shornur-Cochin railway line passes through Chalakudy which is 28 km from the Division.

1.5 Geology, rock and soil

Geologically the area consists of crystalline rocks of archean age of either igneous or metamorphic origin. They comprise chiefly of charnockites, granites, and granitic gneisses with narrow bands of pyroxene granulates and magnetite quartz are most widespread. Many of the hornblende and biotite gneisses are of the nature of charnockites. Different types of soil are met within the Division. It varies from very shallow gravelly soil on the upper slopes to deep, fine - textured soil on the lower slopes and in the valleys. This is due to geological erosion and the resultant alluvial deposition. Alluvial deposits are also met with along the stream and riverbanks. The properties of the soil are further influenced by the type of vegetation cover. Places devoid of good cover have a tendency for laterisation and have resulted in laterite cappings on foothills in some areas.

Climate

The area falls in the tropical zone. The moderate rainfall and humid atmosphere found for the major part of the year and the comparison of rainfall and temperature shows that the driest period extends for nearly four months (Figures 1.1; 1.2). The highest evaporation occurs in March with a second maximum in February in all stations. The dry period starts from December and ends by March/April. The high rainfall supports a wide range of vegetation types which is evident from the bioclimatic conditions. Three distinct seasons

are felt in this area viz., cold season, hot season and rainy season. Table 1.9 provides the details of rainfall and temperature in different months.

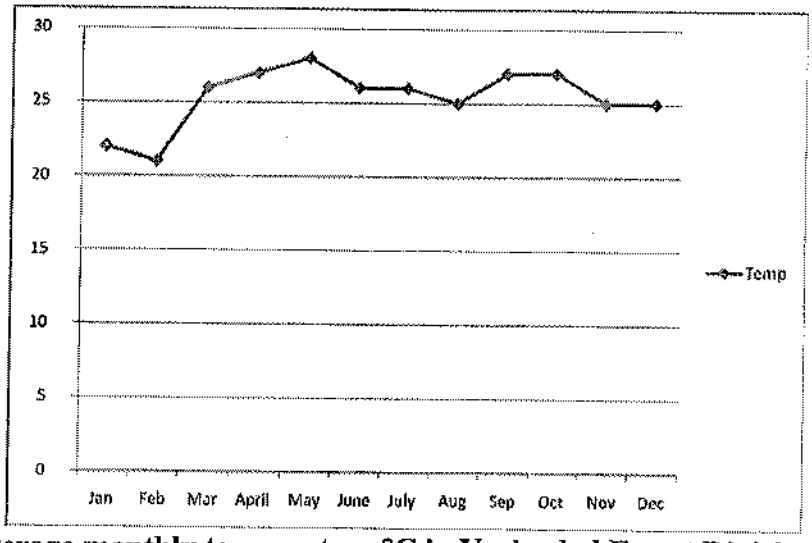


Fig. 1.1. Average monthly temperature °C in Vazhachal Forest Division (30 years)

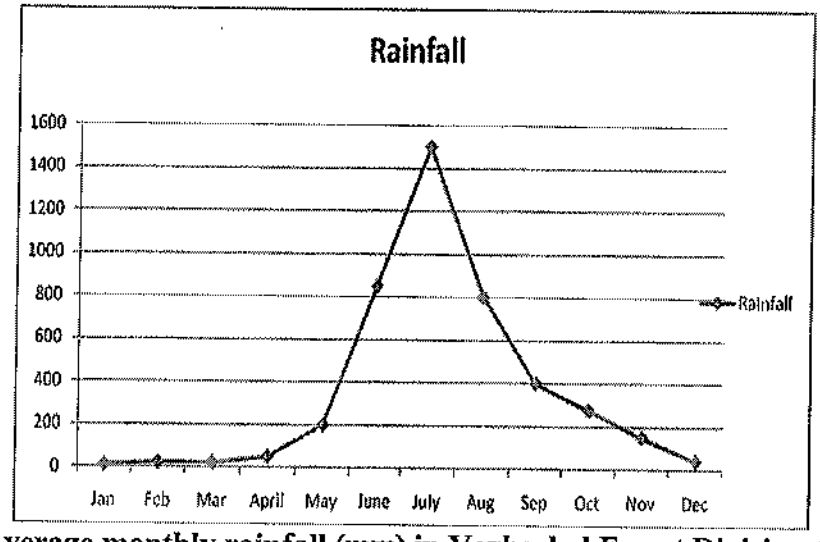


Fig.1.2. Average monthly rainfall (mm) in Vazhachal Forest Division (30 years)

Table 1.9 The details of rainfall and temperature in different months.

Month	Rainfall (mm)	Temperature (^{0}C)
January	10	22
February	20	21
March	22	26
April	50	27
May	200	28
June	850	26

July	1500	26
August	800	25
September	400	27
October	295	27
November	150	25
December	40	25

Source: Jayasree, 1996

Three distinct seasons are felt in this area viz. cold season, hot season and rainy season.

1.6 Hydrology and water sources

Chalakudy River Basin

The Chalakudy River is an inter-state river originating in Tamil Nadu and flowing through Kerala with a total length of 130 km. It has a total drainage area of 1704 km^2. of which 300 km^2 is in Tamil Nadu. By length it is the fifth longest river, by catchment area it is the sixth largest and by annual average yield it is the eighth largest in Kerala State. Its northern tributaries originate from the Nelliampathy hills of Palakkad District in Kerala and its southeastern tributaries originate from the Anamalai Hills of Coimbatore district in Tamil Nadu. The major tributaries of the river include the Karappara River originating from the Nelliampathy hills at an elevation of about 1400 m msl, in the northern part of the catchment, flowing towards west later turning south joining the main river at Orukombankutty. The Kuriarkutty Aar originating from the Chamannampathy hills has two tributaries namely Veetiaar and Thekkadiaar. South of Kuriarkutty valley is the Parambikulam plateau located at an elevation of about 500m msl. The Parambikulam Aar (rivulet), Thunacadavu Aar and Peruvarippallam Aar originate from the Parambikulam Plateau. The Thunacadavu and Peruvarippallam Aar after joining meet the Parambikulam Aar and later are joined by the Kuriarkutty Aar flowing from the southwest at a place called Kuriarkutty. From here the river flows in a westerly direction to meet the Sholayar River, (about two km upstream of Orukombankutty) one of the main tributaries originating from the Anamalai Hills in the east. A unique characteristic of this river basin is that at least 1200 km^2 catchment area in Kerala is under the control of the Forest Department. The total utilisable yield of the river basin is estimated at 2033 Mcum out of which 494 Mcum is received from Tamil Nadu (PWD, 1974).

There is an adequate and satisfactory water supply throughout the area of the Vazhachal Division. Even if most of the streamlets and some streams dry up during the summer season there are many streams and rivers, which are perennial in nature spreading as a network over the entire area. The five major rivers which drain the tract, are perennial while some of the tributaries dry up during summer.

1.7. Vegetation types

General: Different types of forests are met with in this Division. This is due to the variation in the altitude from 200 m to 1300 m, the deeply cut rugged terrain of the tract with the resultant variations in the temperature and rainfall from place to place and annual fire on the hill tops. The variations in the type of forests in some places are due to the influence of the biotic and edaphic factors.

The average annual rainfall in Thrissur District within which the major portion of the forests of this Division lie, comes to about 3000 mm. The temperature varies from 14° C to 36° C. The maximum rainfall is received during May to October (both Southwest and Northeast monsoons are active). These factors are so congenial for the existence of the Tropical Wet Evergreen Forests, provided the soil and other factors are favourable. But on actual examination, it is seen that only the northern and eastern portions of this Division have patches of evergreen forests even though the conditions are quite favourable. The reason for this deterioration can be attributed to biotic factors such as annual fires and grazing, over exploitation in the past and human interferences such as poaching and encroachments. Few areas have been set aside for non-forestry purposes such as projects, colonies etc.

Natural Forests: Based on the Revised Forest Types of India by Champion and Seth (1968), the following types of forests are seen in Vazhachal Forest Division. The area coming under each forest type is given in the Table 1.10.

Group I- Tropical Wet Evergreen Forests

Sub group I A- Southern Tropical Wet Evergreen Forests C- 4 West Coast Tropical Evergreen Forest (IA/C4)

Group II – Tropical Semi-evergreen Forests Sub group 2A- South Tropical Semi Evergreen Forests C2- West Coast Semi Evergreen Forests (2A/C2)

Group III- Tropical Moist Deciduous Forests Sub group 3 B- South Indian Moist Deciduous Forests C2- Southern Moist Mixed Deciduous Forests (3B/C2).

Table 1.10. Forest types in Vazhachal Division.

Sl. No.	Forest type	Extent (ha)
1	Southern Tropical West coast Evergreen forests (IA/C4)	5117.1207
2	Southern Tropical West Coast Semi Evergreen forests (2A/C2)	13645.6552
3	Southern Tropical moist deciduous forests (3B/C2)	15351.3621
4	Plantations	7280.2600
	Total	**41394.3980**

About 15% of the total Natural forest area comes under the category of Tropical Wet Evergreen type. Tropical semi-evergreen forests constitute 40% of the natural forest area and 45% of the natural forest area comes under tropical moist deciduous forests.

West Coast Tropical Evergreen Forests (IA/C4) (Extent: 5117.1207 ha)

This is the southern form of the Tropical Wet Evergreen Forests.

General Description: Dense evergreen forests with lofty trees 45 m or more in height, characterized by large number of species of trees, occurring together - consociations – are rare and ordinarily 2,3 or more, of the upper canopy species individually contributing not more than one percent of the total number. A few species of the top canopy are trees with bole length up to 30 m and girth above 5 m and deciduous in character for a short period which do not affect the evergreen nature of the forest as a whole. Middle canopy is extremely dense, epiphytes occur in large numbers and the presence of woody climbers is noticed. In the typical wet evergreen forests like that of Sholayar, ground vegetation other than the recruits of the main species is very poor or absent.

Under the general climate of the region, the tropical wet evergreen forest of the climax type of vegetation and the typical character of this is the absence of the gregariousness of mature crop. The component species regenerate under their own shade. But a few species like *Vateria, Hopea* etc. respond well to increased light conditions while overhead light is detrimental to the growth of *Mesua ferrea* and *Dysoxylum malabaricum*. This phenomenon of co-existence of wide range of species with varying demands of light condition is termed as climax types and if left undisturbed, this will continue to be stable. In the Central Kerala regions, the most typical wet evergreen forest types are seen in this Division. The trees are of very good bole length, cylindrical in shape having good girth.

The areas representing west coast tropical evergreen forests are:

1. Malakkappara, 2. Thavalakuzhipara, 3. Ambalappara, 4. Sholayar 5. Karimalagopuram, 6. Anakayam, 7. Karanthodu, 8. Rapra, 9. Charpa, 10. Sheikalmudi

Floristic Composition

The common tree species of the top, middle and bottom canopies are listed below:

Species composition in west coast tropical evergreen forests

Upper Canopy

Palaquium ellipticum, Cullenia exarillata, Mesua ferrea, Vateria indica, Calophyllum, Lophopetalum wightianum, Holigarna ferruginea, Artocarpus heterophyllus, Dysoxylum malabaricum.

Middle Canopy

Meliosma simplicifolia, Hydnocarpus macrocarpus, Myristica dactyloides, Bhesa indica, Aglaia lawii, Neloamarkia cadamba (Anthocephalus cadamba), Semecarpus travancorica, Vepris bilocularis, Melicope lunu-ankenda, Drypetes elata, Canarium strictum etc.

Lower Canopy

Ardisia pauciflora, Symplocos laurina, Litsea floribunda, Litsea bourdillonii, Aporusa acuminata, Glochidion ellipticum, Clausena indica, Atalantia racemosa, Agrostistachys borneensis, Phoebe lanceolata.

Undergrowth

Consists of *Laportea crenulata, Sarcococca coriacea, Croton zeylanicus* etc. The common climbers are *Diploclisia glaucescens, Sabia malabrica, Embelia ribes, Ancistrocladus heyneanus, Toddalia asiatica, Ventilago bombaiensis.*

At elevations above 1200 m there is a preponderance of *Heritiera papilio* in the upper canopy trees. *Calophyllum austroindicum* is also found occurring at these elevations.

Among middle storey trees there is the dominance of Lauraceae members like *Neolitsea cassia, Cinnamomum sulphuratum* etc.

Regeneration

Natural regeneration of the evergreen species is prolific but their establishment is a problem amidst the factors of destruction. Where there is opening in the canopy, numerous seedlings of *Vateria, Vitex, Mesua ferrea* are noticed, but their leading shoots are found damaged by biotic influences. Hence in both Sholayar and Vazhachal Ranges, there are schemes for the management of evergreen forests, which provides for bringing up of the seedlings by giving ample chance for the promising seedlings of the valuable species, which does not disturb in any way, the evergreen nature of the forests. Grazing and browsing have to be controlled. Cattle scares may be provided in addition to the barbed wire fencing.

Ecological Status

As already described, these evergreen forests are the climatic climax type of forests in the tract dealt with. This forest type occurs in both Sholayar and Vazhachal Ranges (Portion). Almost all the areas of this Division were having forests of this or similar type with little variation in composition. But large scale clearing of the forests for other purposes, annual fires in areas adjacent to the evergreen, grazing and other biotic factors have greatly influenced the degradation of this type of forests limiting them to certain pockets, as at present. If the area available at present is not kept undisturbed, it is quite sure that, retrogression, which has already set in, will lead the forests to a much degraded type. Strictly speaking, the forest types present in areas of both Sholayar and Vazhachal Ranges are only a degraded type of the tropical wet evergreen forests.

West Coast Semi Evergreen Forest (2A/C2) (Extent: 13645.6552 ha)

This type of forest is very variable and difficult to define, is intermediate between the tropical wet evergreen and moist deciduous forms, generally considered as a transitional stage from evergreen to moist deciduous. Accordingly it forms a closed high forests, the dominant trees sometimes of big dimensions but usually inferior to type I-A and includes both evergreen and deciduous trees, the former predominating in intimate mixture but with a definite tendency to gregarious occurrence. The number of species is high but less than that is true evergreen, and many of the biggest evergreen species are absent. Buttressed stumps occur frequently both in evergreen and deciduous species. The canopy in general is typically less dense than in the original evergreen and the evergreen undergrowth rather more copious. Heavy climbers occur and abundant epiphytes including ferns and orchids are noticed. Areas representing West Coast Semi Evergreen Forest are:

1. Muthuvarachal, 2. Watchmaram, 3. Mukkumpuzha (Swampy pocket), 4. Poringal 5.Manimaruthuthodu, 6. Oolassery.

Floristic composition: The common tree species found in this type are described below:

Upper Canopy

Calophyllum polyanthum, Dysoxylum malabaricum, Myristica dactyloides, Vateria indica, Dipterocarpus indicus, Kingiodendron pinnatum, Pterygota alata, Gymnacranthera canarica, Mangifera indica, Ormosia travancorica etc.

Middle Canopy

Toona ciliata, Carallia brachiata, Polyalthia fragrans, Elaeocarpus tuberculatus, Elaeocarpus glandulosus, Garcinia morella, Humboldtia vahliana, Holigarna grahamii, Atuna travancorica, Euphoria longan, Vepris bilocularis, Hydnocarpus pentandra, Litsea coriacea, Aporusa lindleyana, Knema attenuata, Walsura trijuga, Vernonia arborea etc.

Lower Canopy

Drypetes oblongifolia, Callicarpa tomentosa, Ixora arborea, Xanthophyllum arnottianum, Blepharistemma serratum, Orophea uniflora, Alangium salvifolium, Glochidion zeylanicum, Meiogyne ramarowii, Hunteria zeylanica, Isonandra lanceolata, Symplocos

macrocarpa etc.The under growth consists of *Amomum muricatum, Glycosmis pentaphylla, Laportea crenulata, Thottea siliquosa, Schumannianthus virgatus, Pellionia heyneana* etc. The common climbers are *Caesalpinia cucullata, Entada rheedei, Ventelago bombaiensis, Ancistorcladus heyneanus, Bauhinia phoenicea, Chilocarpus denudatus, Derris brevipes, Artabotrys zeyleanicus* etc.

Regeneration

The natural regeneration is at times checked by factors like luxuriant growth of the weeds and low valued evergreen species and fire hazards. The after effect of this is the deterioration of the stock when the existing mature and over mature trees are removed during exploitation.

Ecological Status

This type of forest was formed from the tropical wet evergreen forests, owing to the heavy biotic interference. It has taken a very long time for changing their characters of the wet evergreen type to the semi-evergreen. There is noticeable change in the environments and accordingly this forest type is in a transitional stage from the evergreen to the deciduous.

Southern Moist Mixed Deciduous Forests (3B/C2) (Extent: 22631.6221 ha)

The moist deciduous forests, as the name denotes, is in leafless condition during the dry season, i.e., from January to March. However, most of the species start flushing before the onset of rains. They occur both on the lower slopes and on ridges on lateritic areas and loamy soils.

The common top canopy species are *Albizzia odoratissima, Alstonia scholaris, Bombax malabaricum, Grewia tiliifolia, Miliusa tomentosa, Terminalia crenulata, Xylia xylocarpa* etc.

The lower canopy consists of species like *Bridelia retusa, Careya arborea, Cassia fistula,* etc. *Acacia sinuata, Caesalpinia bonducella* etc. are the main climbers in this type.

Riparian Forests

The riparian vegetation along the Chalakudy river system offers a unique ecosystem. Further, it serves as a link between the varied habitats at lower and higher elevations. Healthy riparian zones maintain the channel form and serve as important filters of light, nutrient and sediment which provide habitats for fish and other riverine organisms, function as corridors for their movement, control river temperatures and maintain bank stability.

The riparian forests of the Chalakudy River have revealed the existence of a thick riparian vegetation of more than 10 m width for a distance of 10.5 km downstream from Poringalkuthu, covering an area of 58.5 hectares. Out of this, 26.4 hectares lie within the Vazachal area, including three large islands densely covered by riparian forests.

The zone starting from just below the Poringalkuthu dam (400m above M.S.L.) upto the Athirappilly waterfalls represents rich low altitude riparian wet evergreen forests. The continuous stretch of riparian vegetation, the river and the Vazhachal and Athirappilly waterfalls makes this zone one of the most beautiful places in South India which attracts lakhs of visitors every year.

This area records maximum biodiversity potential. At Vazhachal there are no residential areas except two Kadar tribal colonies and Forest Department staff quarters. Hence disturbance in this zone is comparatively less. The main disturbance is from tourism activities and is due to the Anamala road passing through the area. Tourism and allied activities are mainly located near the Athirappilly, Charpa and Vazhachal waterfalls and hence other areas in this zone are kept comparatively undisturbed. But nowadays, the intrusion of tourists to the nearby forest areas and riparian zone has increased.

The vegetation cover adjoining the riparian forests in this area consists mainly of deciduous forests and plantations of teak and bombax. From Poringalkuthu up to just before the Vazhachal waterfalls and one km after the Charpa waterfalls and the adjoining areas of Athirappilly are represented by plantation of teak. In these areas the width of the

riparian forest varies from 10-50 m. The adjoining land cover of the Charpa area is mainly evergreen and semi- evergreen forest. The deciduous patches were also found downstream to Charpa. The semi - evergreen and deciduous forests are formed by deterioration of the evergreen forests due to disturbances. The characteristics of the land adjoining the riparian area are significant and exert great influence on the riparian vegetation of that area. Small patches of reed brakes are seen near Charpa and bamboo before the Athirappilly waterfalls.

In the area from the Athirappilly waterfalls up to Thumboormuzhi (120-50 M.S.L) the continuity of the riparian forests has been lost due to disturbances. The oil palm, rubber and other plantations of Plantation Corporation of Kerala, tourism activities in the Government and private sector and the activities of the local peoples have contributed very much to the depletion, and loss of continuity of the vegetation. The riparian vegetation especially in the river margins is highly reduced and is mainly due to the rubber and oil palm plantations. A number of small islets are present up to and just after Thumboormuzhi. These islets have good stretches of riparian vegetation. The riparian forest in these islets is also a unique feature of the Chalakudy River.

Dominant species in the riparian zone

The riparian vegetation is dominated by some species like *Syzigium occidentale, Barringtonia acutangula, Madhuca neriifolia, Humboldtia vahliana, Mallotus aureo-punctatus, Homonoia riparia, Hopea, Ochlandra, Bambusa, Vateria* and *Ficus* . These plants are evergreen species and the first six species are endemic to the riparian habitat.

The dominant evergreen and semi - evergreen species found in these zones are *Humboldtia vahliana, Barringtonia acutangula, Syzygium occidentale, Homonoia riparia, Madhuca neriifolia, Hopea parviflora, Vateria indica, Xanthophyllum flavescens, Elaeocarpus Aporusa lindleyana, Xylia xylocarpa, Hydnocarpus alpina, Baccaurea courtallensi* and *Olea dioica.* Of these, most of the species are typical West coast evergreen and semi-evergreen elements and some plants are typical riparian components. The elements also represent various seral and edaphic communities of the west coast evergreen forests. The species like *Ochlandra, Bambusa* and *Macranga peltata* and some deciduous elements

and the presence of weeds indicate the disturbances in the riparian forests. The vegetation above 50m altitude was found to posses this type of vegetation.

Plantations

Realization of sustained yield annually, is the basic principle of scientific forest management. To achieve this goal, equal areas are planted every year which results in the presence of all age classes and age gradations.

In all Ranges other than Sholayar, plantations of various species have been raised. The only plantation raised in Sholayar Range is a 1985 bamboo to an extent of 53 ha. The major portion of this Division comprises areas of the erstwhile Perumuzhy and Vazhachal Industrial Plantation (I.P) Divisions in full and part of Kalady Industrial Plantation Division, where numerous plantations of both hardwood and softwood species were raised. There are pure and mixed plantations of teak, bombax, albizzia, eucalyptus, silver oak etc. There are series of plantations of several species in all the four Ranges. The oldest plantation is that of teak at Chully group of plantations in Athirapally Range, the first plantation of which was raised in 1939 and last in 1944. The total extent of these plantations comes to 96.380 ha. The Range and year - wise list of plantations are given in **Appendix-VI.**

Taungya cultivation was in vogue in this area since 1922. Though this system has the merits of multiple land use and more minor benefits such as lease rent, savings in tending operations like weeding, climber cutting, soil working etc. it has the demerits such as soil erosion, deterioration of soil fertility and occasionally the suppression of the principal crop. Hence, the system was stopped in early 1980s.

1.8. Wild Fauna and habitats

Vazhachal 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 (26 spp.),

amphibians (20 spp.), birds (231 spp.), reptiles (23 spp.), fish (98 spp.), insects (1019 spp.) and butterflies (about 92 spp.).

Mammals- Important mammals include: lion-tailed macaque, bonnet macaque, nilgiri tahr, elephant, tiger, panther, 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, saw-scaled viper, indian python, common Rat snake, Common green Whip snake, Common Indian Krait, Cochin cane turtle, Travancore tortoise, and Western Ghats flying lizard. Other Important reptiles are South Indian rock lizard, Forest Calotes, Common Indian Monitor, Chameleon and Kerala Forest terrapin.

Fish- Chalakudy river basin has exceptionally unique fish diversity. The river has also been the focus of much scientific attention owing to the discovery of several new species, *Horabagrus nigricollaris, Travancoria elongata, Osteochilus longidorsalis* (Pethiyagoda and Kottelat, 1994), *Garra surendranathinii* (Shaji *et al.,* 1998) and *Salarias reticulatus* (Kurup *et al.*, 2005) and most of which are strictly endemic to this river. In addition to the native fishes there are reports on several exotic species in this river viz. *Oreochromis mossambicus, Gambusia affinis, Osphronemus goramy, Xiphophorus maculatus* and *Poecilia reticulata*. A new species of the genus *Newnhamia* (Crustacea), *N. dumonti* n.sp., is also reported from Chalakudy River sand (George and Martens, 2003). The common other fishes are Kuyil, Choora, Pachilavetti, Mooden, Aral, bral, vattudi, noori, poochutti, kollotty and taral. Indiscriminate collection of endemic and threatened ornamental fish species for export, exploitation of endangered food fishes by forest-dwelling communities and local fisher folk, pollution, loss of riparian cover, damming and exotic species threaten the rich ichthyofaunal diversity of Chalakudy River.

Birds- The birds have very high importance in the Vazhachal Forest Division studied by Nameer and Cheeran (1996), Susanth Kumar (1996). Approximately 231 bird species have been recorded from the Division. 121 species are listed as rare and 24 species are endemic to Western Ghats. The important birds are Malabar Pied Hornbill, Great Pied Hornbill, Red Spurfowl, Malabar Trogon, Blue-bearded Bee-eater, Black-naped Oriole, Crested Tree Swift, Brown Fish Owl, Lesser Fish Eagle, Blue-capped Rock Thrush, 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- The riparian ecosystems attract many butterfly species like *Papilio*, *Graphium*, *Appias*, *Melanitis*, *Neptis*, *Euthalia*, *Euploea*, *Prosotas*, *Arhopala* and *Hesperiida*. The Malabar banded Swallowtail (*Papilio liomedon* Moore), an endemic and endangered butterfly to Western Ghats, is reported from this Division. The Tawny Rajah, (*Charaxes bernardus)* one of the most powerful and impressive insect of South India (rather uncommon species) was observed at Charpa range. The Other endemic species such as Malabar banded Peacock, Five-bar Swordtail, Cruiser, Common Imperial, Malabar Raven, Golden Tree Flitter, Dark Wanderer and Blackvein sergeant are mainly found in Puliyilappara, Watchumaram, Anakayam, Charpa and Kannankuzhithodu

Amphibians- Athirappilly – Vazhachal Reserve Forests has an exceptionally diverse assortment of Amphibians. 20 species of amphibians were identified. *Rana temporalis*, White-nosed bush frog- *Philautus leucorhnus*, Indian Paddy field frog - *Linnonectus liannocaris,* Common Tree frog - *Polypedatus maculates* and Bedomie's Leaping frog were some significant species recorded from this

Division. The other amphibians such as Southern Hill toad - *Bufo microtympanum* Boulenger, the threatened Red, narrow mouthed frog- *Microhyla rubra* Jerdon, the sharp nosed bull frog -*Philautus nasutus* Gray, The Indian bull frog *Hoplobatrachus tigerinus* Daudin are also found in this region.

Insects - One hundred and sixty three species belonging to 27 families of 9 orders and 63 species of insects belonging to 27 families of the same orders were collected from the disturbed and undisturbed area Sholayar areas of Vazhachal Forest Division (Mathew *et al.* 1998). The overall diversity index was 3.13 for plants and 4.74 for insects. The disturbed area had less number of plants and insects compared to the undisturbed area. The insect and plant diversity indices were significantly correlated (r = 73.49% at P = 0.05) which indicates that plant and insect diversity are interrelated and reduction in plant diversity will adversely affect insect diversity. Undisturbed area contained more of arboreal feeding insects belonging to the families, Geometridae, Saturnidae and Cossidae whereas the disturbed areas were abundant in herbaceous feeding forms belonging to the families Pyralidae, Noctuidae and Chrysomelidae.

Micro-Arthropods and Annelids- The studies on Sanalkumar *et al.,* (1999) on population density and diversity of micro-Arthropods and Annelids in the reed growing soil of Vazhachal Reserve Forest reveal that reed growing area has high diversity and density of soil fauna. The soil is high in organic carbon content due to humus formation process of soil fauna. The earthworm population was well represented during the month of July and August and absent during the month of March, May, September and December. The density of Isopods and oligochaetes, were more or less uniform throughout the year and they are important soil fauna that enrich soil fertility. The population density of Isoptera or termites was very high during the month of March, May, June, and September. The least represented insects groups were Diptera, Coleoptera, Dictyoptera, Orthoptera, Diplura, Protura, Thysanoptera and Dermaptera. In class Arachnida order Acarina was well represented and population density was high during May, June, July,

September and October and low in April and December. Their high population density indicates high rate of litter composition. Most of the soil micro arthropods and oligochaetes exhibit remarkable power of vertical migration, less population density showed by some groups are due to this migration process. The dominant animal group occuing in the reed soil were Isoptera, Chilopoda, Acarina, Collembola, Isopera and Oligochaeta.

Animal corridor

The area just above the Vazhachal waterfalls especially between the Poringal powerhouse and the Vazhachal Bridge is an elephant corridor (Amitha bachan, 2003). This forest tract is bound by the Poringalkuthu dam on the upper side and the Edamalayar reservoir on the southern side. The lower area is bounded by the Vazhachal and Athirappilly waterfalls. Hence this small tract between the Athirappilly waterfalls and Poringal powerhouse is an animal corridor, which connects the Southern Idamala valley forests and the northern Nelliyampathy forests (Amitha bachan, 2003).

1.9 Forest dependent communities and their interaction with ecosystems: (include dependency on ecosystem and human wildlife conflict).

The Tribes found in the forests of Vazhachal Division are Malayas and Kadas. They live in separate colonies and do not mingle with each other. There are eight tribal colonies in this Division. Of the two, the Malayas are more civilized. They engage themselves in agriculture, making bamboo mats etc. whereas Kadars are lazy and shirk hard work. 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 Malaya Colonies at Thavalkuzhypara and Watchmaram and Kadar Colonies at Vazhachal, Pokalappara, Malakkappara, Poringalkuthu,Watchmaram and Ambalappara.

The Kadar, being a primitive group they depend the river and the vegetation to a considerable extent. Collection of non-wood forest products is a main source of income. (Plate 1).Tribal Welfare Society receives these collected NTFP from the tribals through their collection centres. Sholayar Scheduled Tribal Co-operative Society, Malakkappara is the functioning society in this area. Their areas of operation include the Forest Ranges of Sholayar, Vazhachal, Kollathirumedu, Charpa and Athirappilly. This co-operative society was started in 1981-82 as a part of the Western Ghat Development Programme. The society was formed for the sake of tribals for preventing exploitation from external agencies and their agents. Vazhachal has one collection centre. Tribals from the Pokalappara and Vazhachal settlements are linked with the Vazhachal society. In the upstream areas like Watchmaram and the Sholayar there are other collection centers. They have fixed rates for each product and also give financial support to the tribal people.

Kadars are becoming more market oriented and dependent on the external community for their survival due to lack of food. This condition brings changes in the attitude of the new generation. They are also becoming more dependent on the external society for financial resources due to the habitat destruction.

If the forest resources and riverine habitats are rich enough and abundant they could have attained more freedom than any other tribes because of the nomadic nature and non agriculture based economy. From the past they were used for destruction of their own habitats and the deterioration of the forests especially of the riparian habitat. This has become a critical factor in their cultural as well as social deterioration.

Agricultural Customs & Wants of the local population:

The people of the villages adjoining to the Reserve Forests are mostly agriculturists, so that their demands from the forests of this Division are primarily firewood, small timber for both agricultural and constructional purposes, green manure and facilities for grazing their cattle. It is a fact that almost all the dwelling houses have small private land holdings. But it seldom meets all their requirements. The excess demands are to be met by the forests of the adjoining areas.

Bamboos, Reeds, Canes, fuel wood, small timber etc. are always in demand by the population in the nearby villages and towns. At present the department finds it difficult to meet the above requirements. The following are the species usually used for making agricultural implements by the local people.

1.	*Tectona grandis*	:	for making ploughs, carts etc.
2.	*Pterocarpus marsupium*	:	for making ploughs.
3.	*Schleichera oleosa*	:	for making tool handles
4.	*Adina cordifolia*	:	for making yokes
5.	*Grewia tiliaefolia*	:	for making tool handles
6.	*Xylia xylocarpa*	:	for making ploughs & tool handles
7.	*Terminalia paniculata*	:	for making yokes.

There is good demand for cheaper constructional timber since good quality constructional timber cost heavily. Part of this demand is met with the local species like Plavu, Ainy, Karimaruthu etc. growing in the private holdings in the lowest country. This is quite insufficient to meet the local demands thereby increasing the pressure on the forests.

Green manure is also of great importance to the agriculturists. A small revenue is collected for permitting the agriculturists for collecting the green manure from the under growth. Wherever close supervision is impossible, as it often happens, there is the possibility of lopping of superior species and cutting of established regeneration. Cattle enjoy free grazing in all the Reserves of this Division and it is common that the local cattle are driven into the forests everyday and in some cases herds of cattle are allowed to graze freely for weeks and even months together.

Agroforestry:

The taungya system i.e., the system of growing agricultural crops in conjunction with the forest crops at the early stages were prevalent in this Division in the regeneration areas. The taungyadars are responsible for the upkeep of the plantations during the lease period.

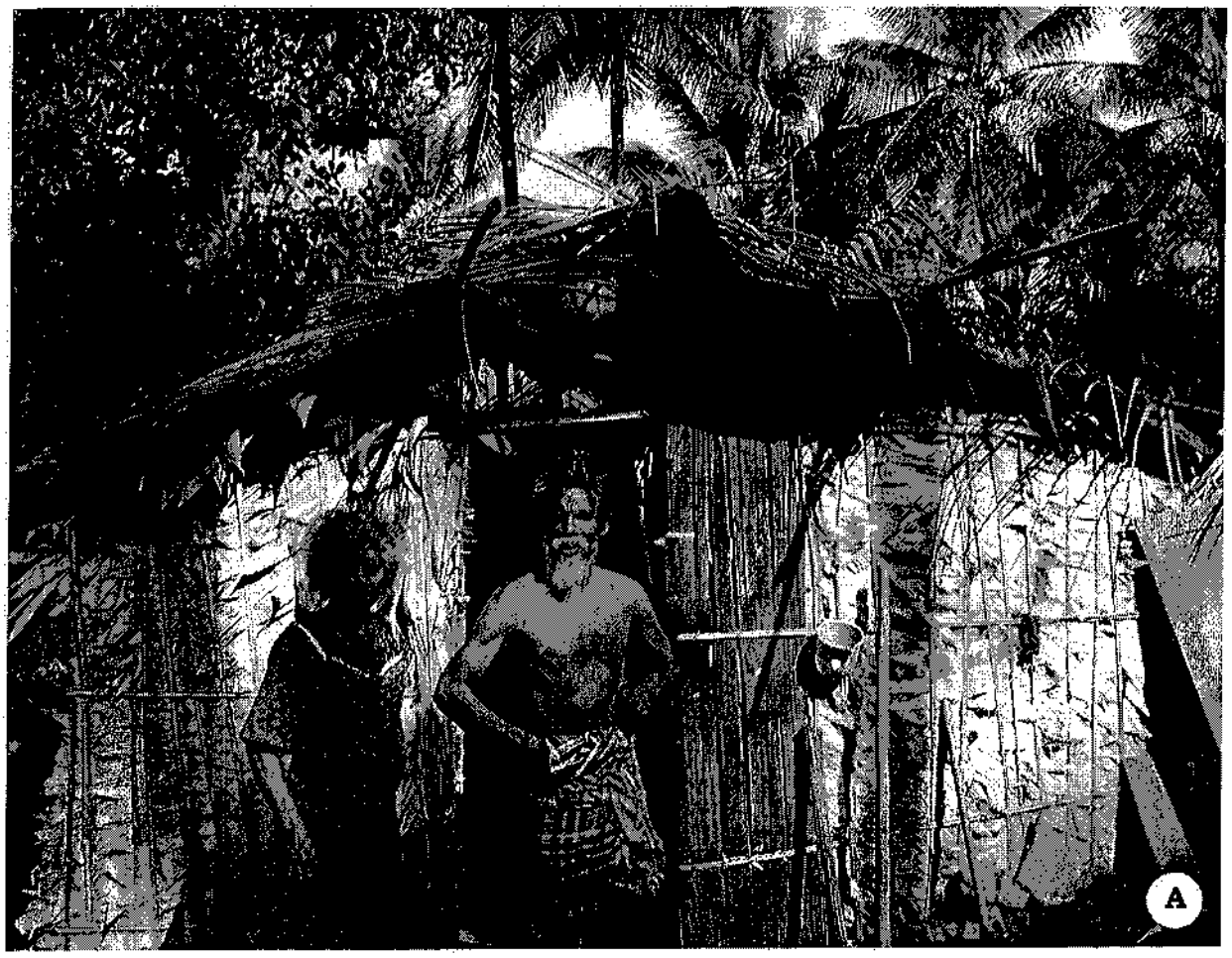


Plate.1. A. A Kadar family. B. Tribal settlement in Vazhachal

It incidentally yields some revenue also. Although this system has the merits of augmenting the production of agricultural crop and meeting the land hunger up to a certain extent it has at times the demerits of suppressing the principal forest crop. It was therefore decided to dispense with taungya system.

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 Sholayar Range. Compensation are being given to the concerned parties by the Department.

1.10 Forestry goods and services commercially harvested.

Markets and Marketable Produce:

Thrissur, Chalakudy and Ernakulam are the main local markets for timber and other forest produce. A large quantity of timber and other forest produce are exported, if available, to places like Coimbatore, Pollachi, Salem, etc. There is great demand for Teak in all the markets. The common hardwood species, which are in demand in the above markets, are Venga, Irul, Chadachi, Akil, Pullamaruthu, Karimaruthu, Thambakam, Venteak etc.

There are units of packing case industries, which consume the available softwoods for making packing cases. The match industries consume a very good quantity of softwood like Bombax, Nasagam etc. P.W.D., Post and Telegraph and K.S.E.B. depend on the forests for their requirements of timber and transmission poles. The main species in demand are Teak, Thambakam, Irul etc. The tile factories at Chalakudy, Pudukkad and Karuvannur areas require a large quantity of firewood. Private holdings, estates and private rubber plantations cater to the needs of firewood to a large extent. But they mainly depend on the supply from the Reserve Forests. There is a steady demand for bamboo for temporary construction, fencing, scaffolding etc. Reeds are in good demand for making mats, baskets, etc. Kalady and Angamaly are the nearest centers of the cottage industries. Honey, cardmom, incha, wax etc. have a fairly steady demand. Canes are also of importance in the M.F.P collection and a large quantity is exported to Pollachi every year.

Canes are extensively used in the area for making furniture like chairs, teapoys etc. Softwood plantations have been raised for meeting the increasing demand for softwood.

To meet the demand for pulpwood for paper mills and rayon pulp factory, plantations of *Eucalyptus grandis* and *Eucalyptus tereticornis* were raised. But from the very beginning the plantations were affected by diseases, adverse climatic conditions etc. The reason for large scale failure of Eucalyptus plantations are attributed mainly to fungal attack, the main culprits being (1) *Cylindrocladium quinquiseptatum* (leaf blight fungus) (2) *Corticium salmonicolor* (pink disease fungus). An alternate species suitable for pulpwood, which can be successfully grown in the forests is Murikku. Other suitable species are yet to be identified.

Lines of Export:

Anamalai -Chalakudy road, Chalakudy, Thrissur Road, Chalakudy -Angamaly road and Cochin -Shornur railway are the important and principal lines of export in this Division. Since facilities for rafting timber is limited to Chalakudy River from Echippara, the river navigation is not common.

Method of Extraction:

There is no extraction either by clear felling or by selection felling at present. Only thinning and other tending operations are carried out departmentally. Lorry transport is relied on to transport materials to the depots of nearby markets.

Past and Current Prices:

The prices obtained for timber in auctions conducted in the Government Timber Depot, Chalakudy from 1975-76 till its closure in 1981-82 are given **Appendix - VII**.

1.11 Ecosystem services provided.

Humankind benefits from a multitude of resources and processes that are supplied by natural ecosystems. Collectively, these benefits are known as ecosystem services and include products like clean drinking water and processes such as the decomposition of

wastes. The Forests of Vazhachal 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.

'Ecotourism' or ecological tourism means responsible travel to fragile, pristine, and usually protected areas, which conserves the environment and improves the welfare of tribal people in that area. The forests of Vazhachal region are managed for conservation and tourism, offering spectacular natural attractions and an abundance of indigenous flora and fauna. The management of the forests involves local tribal people who are employed as tour guides. They also sell handicrafts made from sustainably managed non-timber forest products such as bamboo and reeds. Fees collected from tourists are used to conserve the forests, make the tourism infrastructure more environment friendly and to build awareness of conservation issues. Fees are also used to fund social services for villagers, training for guides, handicraft production and to establish medical clinics. The Kerala Forest Department and local forest protection committees jointly formulate management plans for the forests. The present major tourist attraction zones are the water falls of Athirappilly, Charpa, Vazhachal, and Poringalkuthu. Similarly there are some other not so popular water falls in the area like Walarkuthu, Kalakallan, Rapra and Kundoormedu and they also have immense tourism potential. The wild attractions like populations of elephants, Gaur, Sambar deer, Lion-tailed macaque, Nilgiri langur, and the rare hornbills like Malabar pied hornbill and Great horn bill exist in this forests.

A major part of tourists paying visit to Kerala are visiting the Protected Areas. In Periyar Tiger Reserve alone, more than 2, 38,047 tourists visited in 1991-92, of which foreign tourists accounted for 8.4 % (Manoharan, 1997). The report from Animon *et al.*, (1997) indicates similar high influx of tourists in Vazhachal forests also. The negative impacts of

unscientifically planned ecotourism on wildlife and their distribution pattern in Vazhachal Forest Division was reported by Animon (1996).

1.12 Participatory Forest Management in Vazhachal Forest Division

Vana Samrakshana Samithy (VSS)

A total of 11 VSS units are working in Vazhachal. The details are shown in Table 1.11.

Table 1.11 The details of Vana Samrakshana Samithy, Vazhachal

Sl. No.	Name of VSS	Type (Fringe/ Tribal)	No. of family			Total	Area (ha)	Range
			SC	ST	Others			
1	Athirappilly	Fringe	135	4	110	249	300	Charpa
2	Vazhachal	Tribal	-	48	-	48	5097	Charpa
3	Olivelichira	Fringe	20	-	130	150	300	Athirappilly
4	Erumathadam	Fringe	23	-	175	198	300	„
5	Ezhattumugham	Fringe	5	3	123	131	100	„
6	Pukayilapara	Tribal	-	49	-	49	9064	Vazhachal
7	Puliyilapara	Fringe	36	-	57	93	300	„
8	Malakkapara	Tribal	-	48	-	48	4000	Sholayar
9	Thavalakuzhipara	Tribal	-	42	-	42	2000	Sholayar
10	Sholayar	Tribal	-	35	-	35	1200	Sholayar
11	Vachumaram	Tribal	-	57	-	57	2500	Kollathirumedu

Source: Kerala Forest Department – 2009.

Objectives of Tribal VSS

VSS are mainly engaged in NTFP collection. The NTFP collected are sold through the Girijan Society at Vazhachal. The VSS coming under Charpa range is primarly engaged with tourism. They are working in Vazhachal tourism spots as guides, cleaners etc. In Sholayar range they are working in the tea estates and to a small extent in the cardomom

plantations. Participatory Forest Management has been introduced recently with the objective of conserving and protecting the existing forests from various types of biotic interferences for maintaining the environmental hygiene, creating awareness among the people about the needs to conserve the forests and to involve the tribes in the management of forests aiming at enhancing their standard of living. This has been achieved by constituting a Vana Samrakshana Samithy (VSS) of Tribes residing in the Vazhachal colony.

1.13 Major conspicuous changes in the habitat since inception

Large scale destruction of forests in this Division took place after the 1830's. During this period the forests in the Nelliyampathy Hills situated along the North East part and in the Valparai areas to the East were extensively clear felled for raising Coffee Plantations. These higher elevation areas were selected by the British planters for raising coffee. Nelliyampathy Hill ranges now have extensive plantation of coffee, tea, cardamom and pepper. The existing natural forests here are highly fragmented. In the Valparai almost all the forests have been converted into tea plantations.

The Anamala road which connects, Chalakudy town with Tamil Nadu, through the Western Ghats, has a significant role in the destruction of forests in the Division. Before the construction of this road, the tramway was the only route to the forests of this basin and the entire transportation of cut timber was through this funicular railway. In the tramway, after loading the timber from the forest, unloading was possible only at the depot at Chalakudy. Just after the construction of Anamala road, the entire area got opened up for motorized vehicles and illegal plundering of forests and their transportation down the hills became a common feature. Furthermore numerous feeder roads into the forests from the Anamala road came into being which enhanced the ruthless exploitation of timber. In 1942, Anamala road was first constructed from Chalakudy to Poringalkuthu mainly for the convenience of the Poringalkuthu Hydroelectric Project work. Later, in phases, the construction upto Malakkappara was completed by 1950. Clear felling of natural forests for raising industrial raw material and raising plantations began in mid 1960's.

Due to construction of manmade reservoirs extensive areas of forest were cleared. The major river valley project in these periods was Poringalkuthu H.E. Scheme in 1957 and Sholayar H.E. Scheme in 1966.

In almost all the forest ranges in the basin, the Forest Department is having hard wood and soft wood plantations. Most of these plantations were raised after clear felling extensive areas of natural forests. These are either pure or mixed plantations of Teak, Bombax, Albizzia, Eucalyptus, Silver Oak, Bamboo etc. However many of the plantation experiments in the basin have ended up in failure ever resulting in extensive eco-degradation and fragmentation of the natural forests.

The Plantation Corporation has estates of rubber cashew and oil palm. These plantations raised in 1961 – 1977 were known as Kalady and Athirappilly Groups of Plantations. They were raised by clear felling large areas of natural forests. These plantations are distributed in the Vazhachal, Chalakudy and Malayattoor Forest Divisions and total area comes up to 4260.05 ha, out of which Vazhachal Division alone contains 3545.51 ha.

Details of these plantations are as follows

(1) Athirappilly Estate: Total area is 1524 ha of which 1332 ha is under rubber and 192 ha are under cashew.

(2) Vettilappara Estate: Total area is 541.50 ha of which 399.51 under rubber, 120 ha is under cashew, 22 ha is under Matty.

(3) Kallala Estate: Total area is 1480 ha of which 1261 ha is under rubber and 219 ha under cashew.

In 1991 – 92 around 200 ha (area was extended later) of oil palm (*Elaeis guineensis*) was planted in the area of the Plantation Corporation which is along the river margins at Vettilappara. After clear felling rubber, this area was planted with oil palm after taungya cropping of banana, tapioca, ginger, bitter guard etc. leading to severe soil erosion.

1.14 Assessment of inputs of line agencies.

There is a Girijan Development Society functioning at Malakkapara, a co-operative society was started as part of the Western Ghat Development Programme during 1981-82. Its area

of operation includes Sholayar, Vazhachal, Kollathirumedu, Charpa and Athirappilly Forest Ranges. The scheduled tribes living within these areas alone can be the member of this society. The Head Office is at Malakapara with depots, one at Wachumaram and another at Vazhachal. The activities of this society include (a) collection of non timber forest produce, its storage and marketing (b) management of plantations owned by society (Rubber, Coffee and Cardamom) and (c) provision sales. The society has 202.4 acres of plantations, out of which 90 acre are coffee, 40 acre cardamom, 25 acre lemongrass and the rest pepper and rubber. Approximate yearly collection of non wood forest produce of this society is as follows: 500 Kg of Beewax, 4 to 8 tonnes of honey, 1.5 tonnes of Kattupathry, 12 tonnes of Manjakuva and one tonne of Kakkumkaya. Collection prices for some of the produces are: Honey Rs.50/kg, Beewax Rs.50/kg, Black dammer Rs.20/kg, White dammer 27/kg, Manjakuva Rs.19/kg, Kakkumkaya Rs.5/kg and Kattupathry Rs.120/kg. The members are given yearly bonus depending upon the quantity of non timber forest produce they are collecting. Some of the members have received Rs.8000/ as bonus last year. From the records it was understood that around 225 individuals are actively involved in the collection of these produces. The annual turnover of this society comes up to rupees 25 to 40 lakhs. Out of this non timber forest produce alone contribute rupees 20 to 30 lakhs.

There is one Primary Health Centre and One Upper Primary School functioning at Malakkappara. The Health Department has initiated a Rehabilitation of Child Programme through VSS here. In addition, there are some private estates and two hydro electric projects. The details of the projects range wise and the extent of area utilised for the projects are given in Table 1.12.

Table 1.12 Details of projects in the Division

Projects	Range	Extent (ha.)
Sholayar Hydro Electric Project	Sholayar	29.5791
Poringal Hydro Electric Project	Vazhachal	220.1538
Plantation Corporation of Kerala Ltd	Athirappilly	3545.5100

Sholayar Hydro Electric Project:

This project is situated at Ambalappara in Mukundapuram Taluk of Thrissur District at 10.77 North latitude and 76.45 East longitudes. Sholayar River is one of the main tributaries of Chalakudy River, the other important tributaries being Parambikulam Ar, Thekkady Ar, Karappara Ar and Anakkayam Ar. The river originates in the Western Ghats at Anamalai hills at an elevation of 1200 m and flows in a westerly direction for about 45 km through a plateau and then turns towards north and flows rapidly to join Parambikulam Ar at Orukombankutty at an elevation of 450 m. About 1.5 km down stream of the confluence of the Sholayar and Parambikulam River the Karappara River joins the main river and from this point onwards the river is known as Chalakudy River which after meandering course of 150 km joins the northern arm of Periyar and finally drains into the backwaters of Arabian Sea. The river from its source flows within Tamil Nadu for about 25 km and for another 8 km along the Boundary hills of Kerala and Tamil Nadu and from the point where it enters Kerala State it flows for another 25 km and joins Parambikulam Ar. The Sholayar Project commands a catchment 186.48 km^2 of which an area of 120 km^2 lies within Tamil Nadu. The catchment is mainly reserve forests. In the upper reaches of Sholayar, there are a few Coffee, Tea and Cardamom estates. The forests are very thinly populated by tribals and other than them there are no human habitations of any kind. Wild animals, particularly Elephants and Gaur are found in the forests in plenty. The dam is accessible from Pollachi in Tamil Nadu and Chalakudy in Kerala, the nearest Railway station being Chalakudy.

Salient features

Catchment area (Sq.km)	*- 186.48*
Average Runoff (M.Cu.m)	*- 396.43*
Design flood (Cu.m/sec)	*- 1710.33*
Type of dam	*- Masonry gravity*
Full reservoir level (Meters)	*- 811.68*
Number of generating units	*- 3*
Date of Commissioning	*- 1966*
Installed Capacity	*- 54.0 MW*

Poringalkuthu Hydro Electric Project:

This project is situated at Puliyilappara in Mukundapuram Taluk of Thrissur District at 10°26' North latitude and 76°44' East longitude. This Dam is constructed across the Chalakudy River, the details of which have been given under the head Sholayar Hydro Electric Project.

Salient features

Catchment area (Sq.km)	*- 752.20*
Average Runoff (M.Cu.m)	*- 538.01*
Design flood (Cu.m/sec)	*- 2265.35*
Type of dam	*- Masonry gravity*
Full reservoir level (Meters)	*- 423.97*
Number of generating units	*- 4*
Date of Commissioning	*- 1957*
Installed Capacity	*- 32.0 MW*

Kalady Group of Plantations:

The Plantation Corporation of Kerala Ltd., Kottayam has a few estates of Rubber, Cashew, Matti etc. known as Kalady Group of Plantations in the erstwhile Chalakudy Forest Division with its Headquarters at Kallala. These plantations were raised during 1961- 77. These plantations are distributed in Chalakudy, Malayattur and Vazhachal Forest Divisions. The total extent of these plantations is 4260.965 ha of which 3545.510 ha falls in Vazhachal Division. The Kalady Group of Plantations consist of 3 estates viz. Athirappilly, Vettilppara and Kallala estates. All the 3 estates lie spread in the 3 forest Divisions mentioned above. The relevant details of the 3 estates pertaining to Vazhachal Forest Division are given below.

A. Athirappilly Estate:

The total area of this estate is 1524 ha of which 1332 ha is under rubber and 192 ha is under cashew. The average annual yield of Rubber is 1000 Kg of latex/ha The net revenue obtained from the Cashew estate during 1988-1989 was Rs.3,00,000/-. This estate provides

employment to 9 officers, 72 staff and 818 permanent labourers apart from the large number of casual labourers engaged as and when needed.

There are 50 residential buildings to accommodate the officers and the staff and 628 labour tenements for the occupation of the labourers. There is a High School in the estate for the education of the children with a facility to teach 1000 students. A group hospital is provided in the estate with facility to treat 20 in patients to cater the needs of all the 3 estates. A post office and a recreation club are also functioning in the estate.

B. Vettilappara Estate:

The total area of this estate is 541.510 ha of which 399.510 ha is under Rubber, 120 ha under Cashew and 22 ha under Matti. The average annual yield of Rubber is 700 MT of latex. The revenue obtained from the Cashew plantations during 1988-89 is Rs.100000/-. There is a latex centrifugal factory within the estate for processing latex. A centralized water supply system is functioning in this estate. For providing medical facility a dispensary is functioning in the estate premises.

C. Kallala Estate:

The total area of the estate is 1480 ha of which 1261 ha tender Rubber and 219 ha tender Cashew. The yield of Rubber was 1295 MT of latex during 1988-89. The net revenue obtained from Cashew plantations during 1988-89 was Rs. 4,00,000/-. There are 18 officers (including 3 Engineers and 2 Doctors- whose services are intended for all the 3 estates) 177 staff and 955 permanent labourers working in this estate. As and when needed they used to engage required number of casual labourers.

The construction, maintenance and repairs of the buildings and roads are executed by the Civil Engineering Wing of the Plantation Corporation of Kerala, Kottayam and a Senior Construction Engineer is stationed at Kallala. The employees are provided with residential accommodation. A latex centrifugal factory is provided in this estate also. There are 3 recreation clubs and one dispensary functioning in this estate. There are two creches here.

To facilitate transportation of employees and vehicles, a ferry is being operated across the Chalakudy River at Vettilappara. Telephone facility is also available in all the estate. All

the areas of the estates are covered by a network of bituminous roads, which are maintained by the Plantation Corporation of Kerala themselves.

The details of the lease rent collected from the Plantation Corporation of Kerala is not available in the Vazhachal Division since, the same is quoted by the Chalakudy Division for the entire area handed over to the Plantation Corporation from the erstwhile Chalakudy Division. The lease period of the lands handed over to the company is 50 years from 9/7/1971. Since the major portion of the estate falls within the jurisdiction of Vazhachal Forest Division, action may be initiated for surveying and demarcating exact area of the estate falling in Vazhachal Division and also for collecting the lease rent of the estate area pertaining to this division.

Proposed dams in the Division

Athirappilly Hydro Electric Project

The proposed Athirappilly Hydro Electric Project is to be located 39 km from Chalakudy, along Chalakudy River at Vazhachal almost 3 km downstream of the existing Poringalkuthu left bank powerhouse. Here a 23m high dam is to be constructed and water will be diverted through a 4533 m long tunnel to a powerhouse to be constructed nearby Kannamkuzhy Thodu, a tributary of Chalakudy River. However this proposed project is being questioned at the Kerala High Court and at present the hearing is going on.

1.15 Adjoining landscape description.

The Vazhachal Forest Division is bordered to the north by the protected areas of the Parambikulam WLS, to the south by Thundathil, Kuttampuzha, Kalady ranges of Malayattur forest division and the west by Chalakudy Forest Division. The eastern part of the Division is more rugged than the west, consisting of Mountain ranges of Anamalai hills.

CHAPTER 2: BIODIVERSITY SIGNIFICANCE

Forests are the richest of all terrestrial ecosystems containing the greatest assemblages of species and the status of biodiversity is, in itself, an indicator of forest condition. The conservation of biodiversity is one of the fundamental guiding principles for ecologically sustainable forest management (Hunter, 1999) because declining the biodiversity results loss of natural capital that supplies ecosystem goods and services. 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 Vazhachal 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. The forest areas fall into three forest types viz. Southern Tropical Wet Evergreen, Southern Tropical Semi Evergreen and Southern Tropical Moist Deciduous. The altitude varies from 200 m to 1300 m. Hence every developmental activity in this area has to be in tune with conservation of its bio-diversity.

The forest areas in Vazhachal Forest Division can be broadly categorized as follows:

a) Virgin forests area: The total extent under this category is around 300 ha, situated on the valley below Karimalagopuram in Sholayar Range (Plate 2). It is a piece of untouched forest existing in the division. Earlier selection felling was proposed in this area but due to the inaccessibility it was not carried out. This areas has to be retained as such and due importance should be given for adequate protection against poaching, theft and fire.

b) Selection felled areas, which are totally degraded.

c) Selection felled areas, which are impoverished due to defective or excessive felling, but limping back to original state.

d) Successful plantations with optimum stocking where only regular cultural operations are required.

e) Under stocked plantations and plantations with poor growth where intensive cultural operations are required.

f) Failed plantation areas where eco-restoration works are required.

g) Reed brakes.

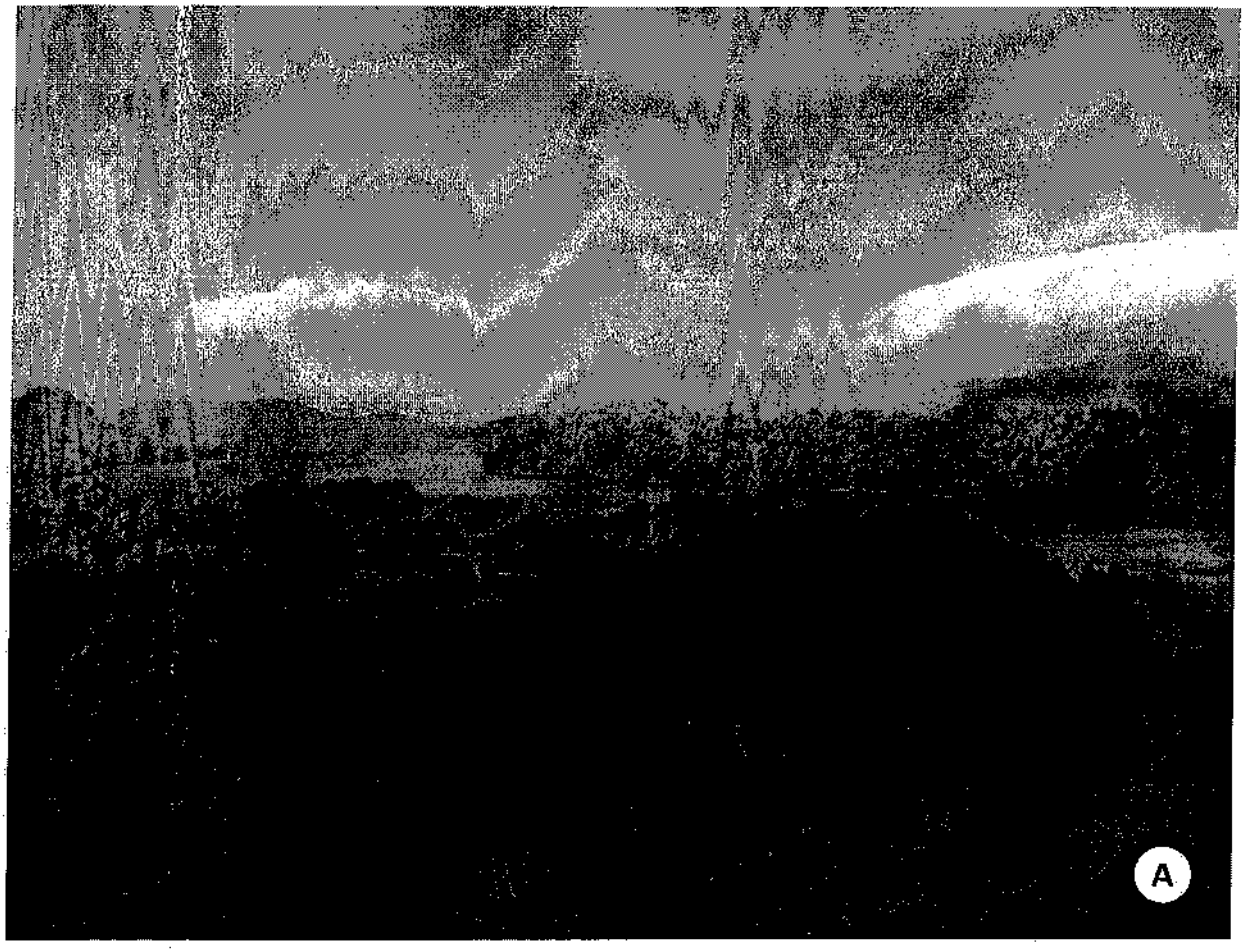
These categories of forest areas have to be managed on a scientific basis in view of the public requirements, and environmental consideration.

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

➢ Vazhachal forests: The unique gene banks of endemic flora and fauna

The floristic study reports 823 species of flowering plants, including 657 dicotyledonous, 166 monocotyledonous plants from this Division, of which 138 are endemic to the Southern Western Ghats and Peninsular India. There is one gymnosperm, *Gnetum edule* (Willd.) BI. (Gnetaceae) is also found in this Division. The most dominant families are Fabaceae (62 sps.) Euphorbiaceae (54 sps.), Orchidaceae (52 sps.), Poaceae (44 sps.), Rubiaceae (31 sps.) and Acanthaceae (27 sps.) and the dominant genera are *Ficus* (9 sps.), *Diospyros* (7 sps.), *Impatiens* (6 sps.), *Dalbergia* (6 sps.) *Syzigium* (6 sps.) and *Litsea* (5 sps.). Sasidharan and Sivarajan (1996) reported *Bidaria khandalense* the world's smallest plant belonging to *Eriocaulon* genus, has been recorded from this division and this species is enlisted in the red data book and was supposed to be restricted in distribution and limited to Khandala Ghats only. Over and above this there is a large number of micro flora too, of which no exhaustive list has been made. The number of endemic species found in these forests indicates the bio-geographic significance of the area. A checklist of flora is given as **Appendix – VIII.**

Many of the endemic species to the Western Ghats such as *Holigarna beddomei, Blepharistemma serratum, Gluta travancorica, Haplothismia, Diospyros bourdillonii, Indotristicha, Litsea bourndillonii, Pterospermum reticulatum, Bidaria khandalensis, Polyalthia fragrans, Orophea uniflora* and *Spondias indica* are found in this region. Some of the endangered species include: *Aporosa bourdillonii, Atuna travancorica, Cordia wallichi, Hydnocarpus macrocarpa, Syzigium travancoricum, Dysoxylum malabaricum, Hopea ponga, Impatiens auricualta, Impatiens tenella, Palaquium ellipticum, Psychotria anamallayana* and *Tarenna monosperma.* Forty one plant species endemic to southern Western Ghats and 97 plants to Peninsular India have been recorded (Plate 3 and 4; Tables 2.1 and 2.2).



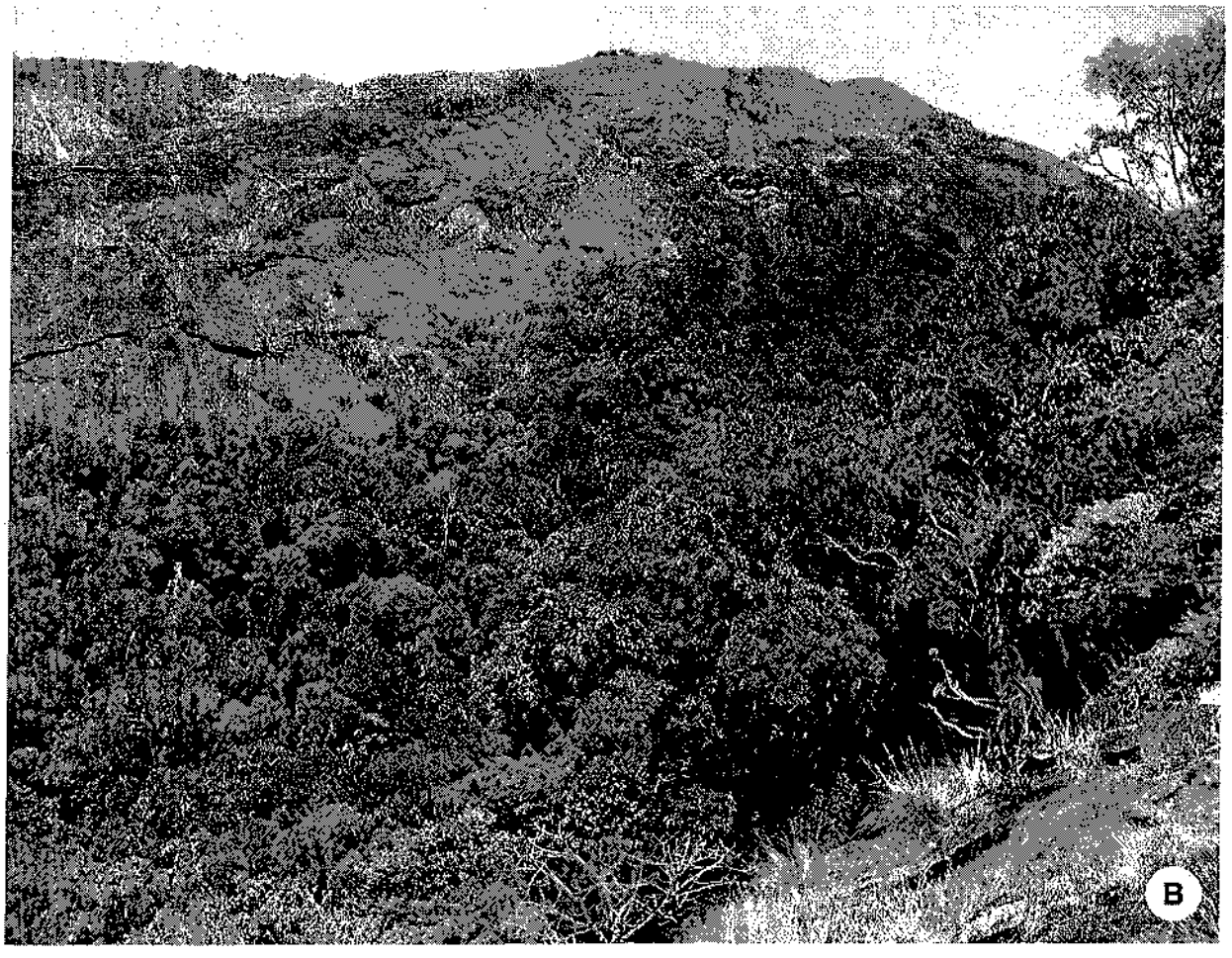
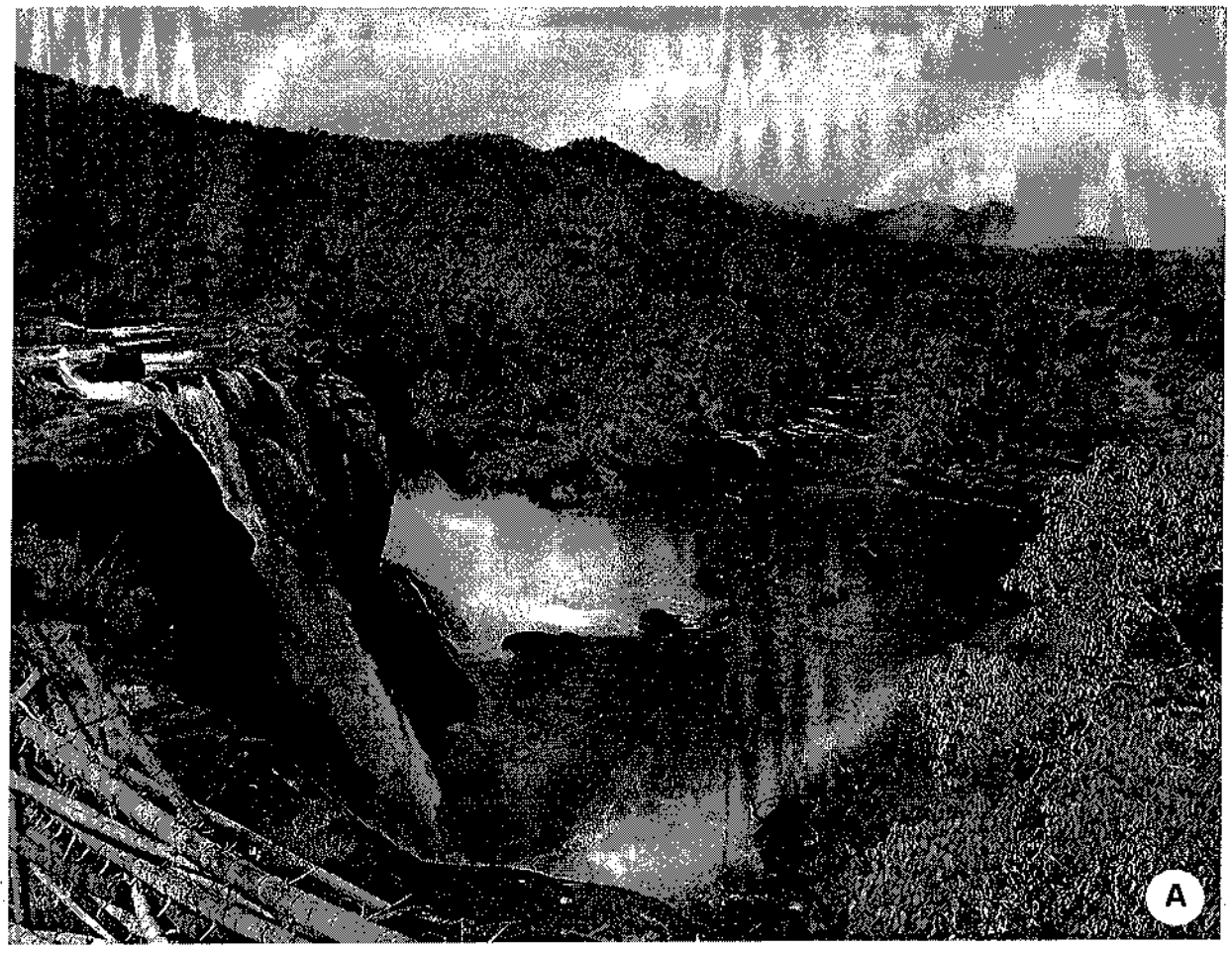
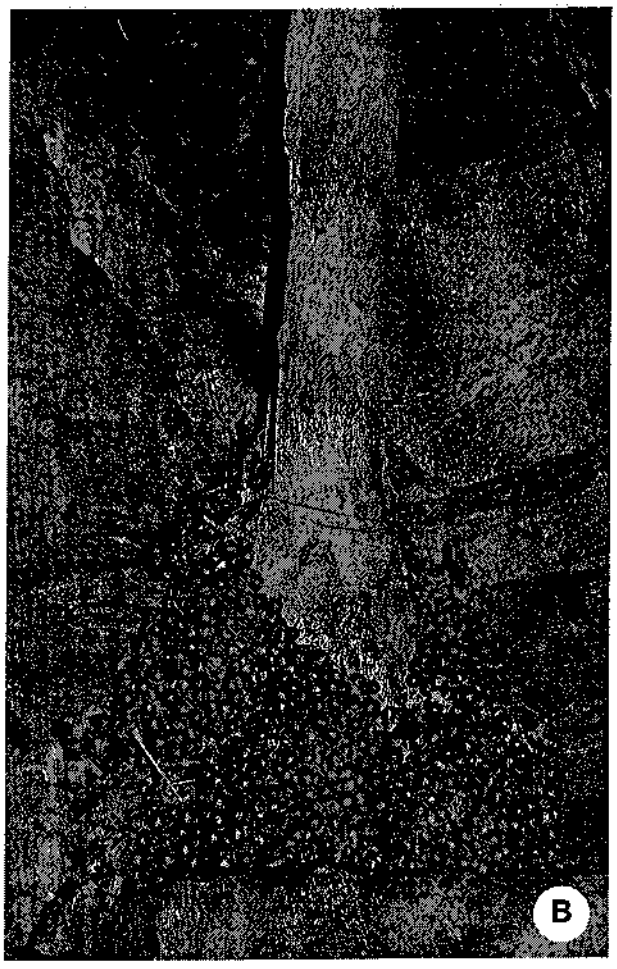


Plate 2. A. Natural forest of Sholayar. B. 'Karimala Gopuram'





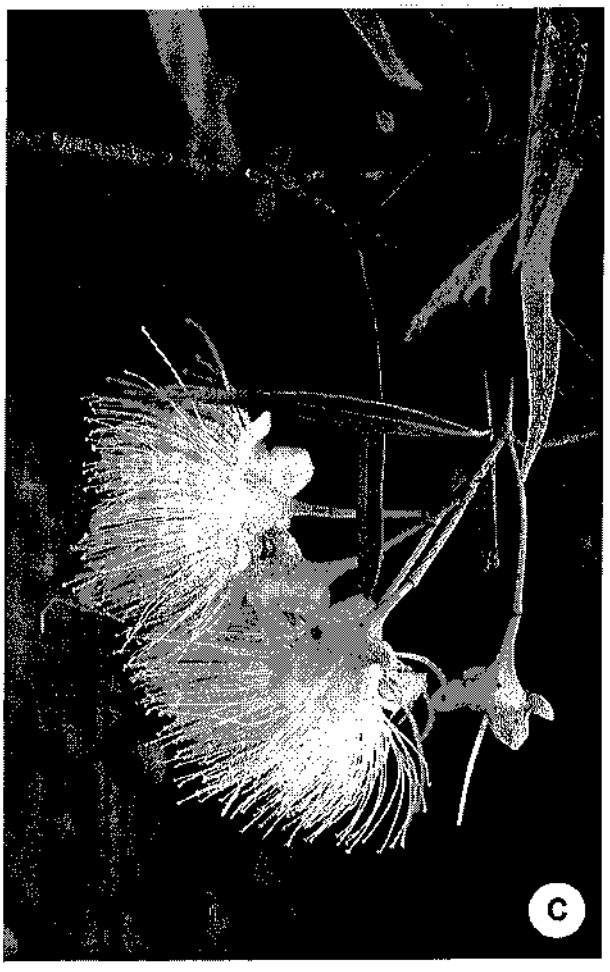


Plate 3 A. Athirappilly water falls B. *Baccaurea courtallensis* **C.** *Syzygium occidentalis*

Plate. 4. **A.** *Blepharistemma serratum*. **B.** *Syzygium travancoricum*. **C.** *Canarium strictum*. **D.** *Cullenia exarillata*.

Table 2.1 List of Plants found in Vazhachal Forest Division endemic to Southern Western Ghats.

Sl.No	Name of the plant	Family	Habit	Conservation status
1	*Holigarna beddomei* Hook.f.	Anacardiaceae	Tree	Vulnerable (Nayar, 1996)
2	*Nothopegia colebrookeana* (Wight) Blume	Anacardiaceae	Medium tree	
3	*N. travancorica* Bedd. *ex* Hook.f.	Anacardiaceae	Shrub to small tree	
4	*Gluta travancorica* Bedd.	Anacardiaceae	Large tree	Lower risk; near threatened (IUCN, 2000)
5	*Spondias indica* (Wt. & Arn) Airy Shaw & Forman	Anacardiaceae	Small tree	Rare (Nayar, 1996)
6	*Meiogyne ramarowii* (Dunn) Gandhi in Sald. & Nicols.	Annonaceae	Large shrub to small tree	
7	*Orophea uniflora* Hook.f. & Thoms.	Annonaceae	Shrub to small tree	Vulnerable (IUCN, 2000)
8	*Polyalthia fragrans* (Dalz.) Bedd.	Annonaceae	Large tree	
9	*Aralia malabarica* Bedd.	Araliaceae	Small tree	Vulnerable (IUCN, 2000)
10	*Cullenia exarillata* Robyns	Bombacaceae	Large tree	
11	*Humboldtia vahliana* Wight	Caesalpiniaceae	Medium tree	
12	*G.wightii* T.Anders.	Caesalpiniaceae		
13	*Dipterocarpus indicus* Bedd.	Dipterocarpaceae	Large tree	
14	*Hopea Parviflora* Bedd.	Dipterocarpaceae	Large tree	
15	*Vateria indica* Linn.	Dipterocarpaceae	Large tree	
16	*Hopea ponga* (Dennst.) Mabb.	Dipterocarpaceae	Large tree	Endangered (IUCN, 2000)
17	*Diospyros bourdillonii* Brandis	Ebenaceae	Medium tree	
18	*Aporosa bourdillonii* Stapf in Hook.	Euphorbiaceae	Small tree	Endangered (IUCN, 2000)
19	*Baccaurea courtallensis* (Wight) Muell.- Arg.	Euphorbiaceae	Small tree	
20	*Ormosia travancorica* Bedd.	Fabaceae	Large tree	
21	*Hydnocarpus macrocarpa* (Bedd.) Warb.	Flacourtiaceae	Medium tree	Endangered (IUCN, 2000)
22	*Actinodaphne malabarica* Balakr.	Lauraceae	Large tree	Rare (Nayar, 1996)
23	*Litsea wightiana* (Nees) Hook. f.	Lauraceae	Small tree	
24	*Cinnamomum riparium* Gamble	Lauraceae	Medium tree	Vulnerable (IUCN, 2000)
25	*Litsea coriacea* (Heyne ex Meisner) Hook. f.	Lauraceae	Medium tree	
26	*Litsea bourndillonii* Gamble	Lauraceae	Small tree	
27	*Aglaia barberi* Gamble	Meliaceae	Small to medium tree	Rare (Nayar, 1996)
28	*Aglaia minutiflora* Bedd.	Meliaceae	Small to medium tree	
29	*Dysoxylum malabaricum* Bedd. ex Hiern in Hook.f.	Meliaceae	Large tree	

30	*Ficus dalhousiae* Miq. in Hook.	Moraceae	Small tree	
31	*Syzygium Occidentalis* (Bourd.) Gandhi in Sald. & Nicols.	Myrsinaceae	Small tree	Vulnerable (IUCN, 2000)
32	*Syzygium malabaricum* (Bedd.) Gamble	Myrsinaceae	Medium tree	
33	*Syzygium travancoricum* Gamble	Myrsinaceae	Medium tree	Critically endangered (IUCN, 2000)
34	*Blepharistemma serratum* (Dennst.) Suresh in Nicols.*et al.*,	Rhizophoraceae	Large shrub to small tree	Vulnerable (Nayar, 1996)
35	*Clausena dentata* (Willd.) Roem.	Rutaceae	Shrub	
36	*Euodia lunu-ankenda* (Gaertn.) Merr.	Rutaceae	Medium tree	
37	*Pterospermum reticulatum* Wt. & Arn.	Sterculiaceae	Medium to large tree	Vulnerable (IUCN, 2000)
38	*Symplocos macrophylla* Wall. ex A. DC ssp.	Symplocaceae	shrub	Threateded
39	*Garcinia wightii* Anders.in Hook.f.	Clusiaceae	Small tree	Vulnerable (IUCN, 2000)
40	*Atuna travancorica* (Bedd.) Kosterm.	Chrysobalanaceae	Small to medium tree	Endangered (IUCN, 2000)
41	*Bidaria khandalensis* (Sant.) Jagtap & Singh	Asclepiadaceae	Climbing shrub	Rare (Nayar, 1996)

Table 2.2 List of Plants found in Vazhachal Forest Division endemic to Peninsular India and critical endemic species having small population in Peninsular India

Sl.No	Name of the plant	Family	Habit	Conservation status
1	*Andrographis elongata* (Vahl) Anders.	Acanthaceae	Perennial herb	
2	*Barleria courtallica* Nees in DC.	Acanthaceae	Erect shrub	
3	*Barleria Prattensis* Sant.	Acanthaceae	Under shrub	
4	*Dicliptera cuneata* Nees in Wall.	Acanthaceae	Herb	
5	*Gymnostachyum canescens* (Nees) Anders.	Acanthaceae	Subshrub	
6	*Gymnostachyum febrifugum* Benth.	Acanthaceae	Scapigerous herb	
7	*Justicia santapaui* Bennet	Acanthaceae	Shrub	
8	*Justicia trinervia* Vahl	Acanthaceae	Herb	
9	*Kanjarum palghatense* Ramam.	Acanthaceae	shrub	Rare (Nayar, 1996)
10	*Thunbergia mysorensis* (Wight) Anders.	Acanthaceae	Woody climber	
11	*Indobanalia thyrsiflora* (Moq.) Henry & Roy	Amarantha ceae	Herb	
12	*Holigarna arnottiana* Hook.f.	Anacardiaceae	Large tree	

13	*Ancistrocladus heyneanus* Wall. ex Graham	Ancistrocladaceae	Woody climber	
14	*Desmos lawii* (Hook.f. & Thoms.) Safford	Annonaceae	Climbing shrub	
15	*Meiogyne pannosa* (Dalz.) Sinclair	Annonaceae	Small tree	
16	*Gymnema sylvestre* (Retz.) R. Br. ex Schult.	Asclepiadaceae	Climbing shrub	
17	*Gynura nitida* DC. in Wight	Asterceae	Herb	
18	*Gynura travancorica* W. W.Smith	Asterceae	Herb	
19	*Impatiens auriculata* Wight	Balsaminaceae	Perennial herb	Critically endangered
20	*Impatiens goughii* Wight	Balsaminaceae	Herb	
21	*Impatiens tenella* Heyne ex Hook.f.	Balsaminaceae	Herb	Endangered (Nayar, 1996)
22	*Begonia trichocarpa* Dalz. in Hook.	Begoniaceae	Herb	Vulnerable
23	*Drymaria cordata* (Linn.) willd.ex.Roem & Schult.	Caryophyllaceae	Herb	
24	*Microstylis Stocksii* Hook.f.	Celastraceae	Terrestrial herb	
25	*Mesua ferrea* L.	Clusiaceae	Large tree	Endangered (Nayar, 1996)
26	*Zehneria mysorensis* (Wight & Arn.) Arn. in Hook.	Cucurbitaceae	Climber	Possibly Extinct
27	*Diospyros paniculata* Dalz	Dioscoreaceae	Medium tree	
28	*Epiprinus mallotiformis* (Meull.-Arg.) Croizat	Euphorbiaceae	Small tree	
29	*Euphorbia vajravelui* Binoj. & Balakr.	Euphorbiaceae	Small tree	Vulnerable (IUCN, 2000)
30	*Glochidion ellipticum* Wight	Euphorbiaceae	Small tree	
31	*Mallotus aureo-punctatus* (Dalz.) Muell.-Arg. in DC.	Euphorbiaceae	Shrub	
32	*Mallotus beddomei* Hook.f.	Euphorbiaceae	Shrub	
33	*Sauropus saksenianus* Manilal et al.	Euphorbiaceae	subshrub	
34	*Trewia polycarpa* Benth. in Benth. & Hook. f.	Euphorbiaceae	Medium tree	
35	*Dalbergia horrida* (Dennst.) Mabb.	Fabaceae	Climbing shrub	Small population Threatened
36	*Derris brevipes* (Benth.) Baker in Hook.f.	Fabaceae	Woody climber	Possibly extinct
37	*Kunstleria keralensis* Mohanan & Nair	Fabaceae	Climbing shrub	Rare
38	*Millettia rubiginosa* Wight & Arn.	Fabaceae	Climbing shrub	
39	*Mucuna pruriens* (L.) DC.	Fabaceae	Slender climber	
40	*Vigna trilobata* (L.) Verdc.	Fabaceae	Herb	Insufficiently known
41	*Cinnamomum sulphuratum* Nees in Wall.	Lauraceae	Medium tree	
42	*Lagerstroemia microcarpa*	Lythraceae	Large tree	

	Wight			
43	*Medinilla beddomei* Clarke in Hook.f.	Melastomataceae	Epiphytic shrub	Vulnerable
44	*Melastoma malabathricum* L.	Melastomataceae	Shrub	Vulnerable
45	*Osbeckia aspera* (L.) Blume	Melastomataceae	Erect shrub	Threatened
46	*Sonerila rheedei* Wight & Arn.	Melastomataceae	Herb	Rare (Nayar, 1996)
47	*Sonerila versicolor* Wt. var. *axillaris* (Wt.) Gamble	Melastomataceae	Herb	Rare (Nayar, 1996)
48	*Sonerila wallichii* sensu Clarke in Hook.f.	Melastomataceae	Herb	
49	*Knema attenuata* (Hook. f. & Thoms.) Warb.	Myristicaceae	Medium tree	
50	*Chionanthus mala-elengi* (Dennst.) P.S. Green	Oleaceae	Small tree	Rare
51	*Ventilago bombaiensis* Dalz.	Rhamnaceae	Climber	
52	*Ixora malabarica* (Dennst.) Mabb.	Rubiaceae	Shrub	Vulnerable (IUCN, 2000)
53	*Knoxia sumatrensis* (Retz) DC. Var.	Rubiaceae	Herb	Possibily extinct (Nayar, 1996)
54	*Neanotis indica* (DC.) Lewis	Rubiaceae	Climbing shrub	
55	*Neolamarckia cadamba* (Roxb.) Bosser	Rubiaceae	Large tree	
56	*Ochreinauclea missionis* (Wall. ex G. Don) Ridsd.	Rubiaceae	Small tree	Vulnerable (IUCN, 2000)
57	*Ophiorrhiza brunonis* Wt. & Arn.	Rubiaceae	Erecet herb	Possibly extinct
58	*Pavetta calophylla* Bremek.	Rubiaceae	Shrub	
59	*Psychotria anamalayana* Bedd. Ic.	Rubiaceae	Small tree	
60	*Tarenna monosperma* (Wight & Arn.)	Rubiaceae	Shrub	Endangered (IUCN, 2000)
61	*Atalantia wightii* Tanaka	Rutaceae	Shrub to small tree	
62	*Otonephelium stipulacem* (Bedd.) Radlk.	Sapindaceae	Medium tree	
63	*Palaquium ellipticum* (Dalz.) Bail.	Sapotaceae	Large tree	
64	*Grewia umbellifera* Bedd.	Tiliaceae	Woody climber	
65	*Elatostema lineolatum* Wight	Urticaceae	Herb or subsherb	Insufficiently known
66	*Ampelocissus arnottiana* Planch	Vitaceae	Climbing shrub	Rare (Nayar, 1996)
67	*Cayratia Pedata* (Lam.)A. Juss. Ex Gagnep. Var.	Vitaceae	Shrub	Vulnerable (Nayar, 1996)
68	*Pinanga dicksonii* (Roxb.) Blume	Arecaceae	Tree	
69	*Arenga wightii* Griff.	Arecaceae	Tree	Vulnerable (IUCN, 2000)

70	*Caryota urens* L.	Arecaceae	Tree	
71	*Calamus hookerianus* Becc.	Arecaceae	Climbing palm	
72	*Calamus gamblei* Becc.	Arecaceae	Climbing palm	
73	*Calamus vattayila* Renuka	Arecaceae	Climbing palm	
74	*Calamus psuedotenuis* Becc.	Arecaceae	Climbing palm	
75	*Fimbristylis kingii* Gamble ex. Boeck.	Cyperaceae	Herb	
76	*Fimbristylis uliginosa* Hochst. ex Steud.	Cyperaceae	Herb	
77	*Ensete superbum* (Roxb.) Cheesman.	Musaceae	Tall herb	
78	*Anoectochilus elatus* Lindl.	Orchidaceae	Terrestrial herb	
79	*Dendrobium herbaceum* Lindl.	Orchidaceae	Perennial herb	
80	*Dendrobium heyneanum* Lindl.	Orchidaceae	Herb	
81	*Epipogium mysorensis* Lindl.			
82	*Eria pauciflora* Wight	Orchidaceae	Herb	
83	*Oberonia brachyphylla* Blatt. & McCann	Orchidaceae	Herb	Rare (Nayar, 1996)
84	*Oberonia brunoniana* Wight	Orchidaceae	Herb	
85	*Oberonia santapaui* Kapad.	Orchidaceae	Epiphytic herb	
86	*Trias stocksii* Benth. ex Hook .f.	Orchidaceae	Epiphytic herb	
87	*Vanilla wightiana* Lindl.ex.Hook.f.	Orchidaceae	Herb	Rare (Nayar, 1996)
88	*Agrostis peninsularis* Hook.f.	Poaceae	Herb	
89	*Arundinella leptochloa* (Nees ex Steud.) Hook .f.	Poaceae	Herb	
90	*Arundinella purpurea* Hochst. ex Steud.	Poaceae	Herb	
91	*Eragrostis unioloides* (Retz.) Nees ex Steud.	Poaceae	Herb	
92	*Amomum microstephanum* Baker in Hook.f.	Zingiberaceae	Herb	Rare (Nayar, 1996)
93	*Amomum muricatum* Bedd.	Zingiberaceae	Rhizomatous herb	
94	*Boesenbergia pulcherrima* (Wall.) O.Ktze.	Zingiberaceae	Annual herb	Threatened (Nayar, 1996)
95	*Curcuma ecalcarata* Sivar & Indu Blacha.	Zingiberaceae	Rhizomatous herb	Threatened
96	*Curcuma peethapushpa* Sasidh. & Sivar.	Zingiberaceae	Herb	Threatened
97	*Zingiber cernuum* Dalz.	Zingiberaceae	Herb	

Matching the floral wealth, the faunal wealth in Vazhachal forests also is endowed with fantastic diversity. The diversity in wildlife 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. 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 reported from Vazhachal Forests Division. The tahr populations of about 10-15 numbers were recorded from Charpapadam areas of the Division (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 the landscape unit is poaching. Cattle grazing and alteration of habitat for commercial and forestry plantations exert severe impact on these scattered populations. 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. 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 this Division. This species is listed in Appendix I of CITES and Schedule I of the W P A, 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. 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. 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 (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. In

Vazhachal forests the LTM troops have been observed in evergreen patches of Sholayar, Anakkayam, and Malakkappara areas. The presence of extensive patches of almost undisturbed medium elevation evergreen forests (*Cullenia-Mesua-Palaquium* type) provides an ideal habitat for the species, since they mostly feed on fruits and young leaves of *Cullenia exarillata* (Ramachandran and Joseph, 2000). 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 Vazhachal forests and very low abundance were reported in the regions near human settlements. The threatened amphibians in the Division are *Bufo microtympanum*, *Rana malabarica,* and *Microhyla rubra.* The important reptile species are *Draco dussumieri, Echis carinatus, Trimeresurus gramineus* and *Vijayachelys silvatica.* The estimated population of mammals in Vazhachal Forest Division is given in table 2.3

Table 2.3 Estimated populations of mammals in Vazhachal Forest Division.

Sl. No	Name of the mammal	Density (No/Sq km^2.)		
		1997	% CV	2002
1	Sambar deer	0.1961	19.75	0.1039
2	Barking deer	0.1162	32.2.	-
3	Bonnet Maccaque	0.4720	35.45	0.4059
4	Common langur	0.0145	68.97	0.1039
5	Elephant	0.2179	38.94	0.0892
6	Gaur	0.5084	27.82	0.0581
7	Malabar Giant squirrel	0.3849	14.92	0.2078
8	Nilgiri Langur	0.5519	21.97	0.4638
9	Spotted deer	-	-	0.0658
10	Wild boar	0.2614	41.02	0.1063

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

From wildlife conservation point of view also the forest areas of Vazhachal Division deserves special care and treatment. It is located in continuation to Parambikulam and Chimmony Wild life sanctuaries of our state and Indira Gandhi National Park of Tamil Nadu. It also forms part of corridor connecting Parambikulam, Chimmoney, Chinnar

Sanctuaries and Eravikulam and Indira Gandhi National Park. The elephant migratory route connecting Parambikulam WLS with Pooyamkutty forests passes through this area. A major portion of this Division has been included under Project Elephant (Anamudi Elephant Reserve). Larger mammals like elephants, Gaur, Sambhar, Nilgiri Langur, Lion tailed macaque, Malabar Giant Squirrel and the Tiger are frequently spotted in this area. The conservation status of RET mammals and Amphibians is provided in Tables 2.4 & 2.5. Much study is yet to be conducted in this regard. A checklist of fauna is given as **Appendix – IX**

Table 2.4 Status of mammals recorded from Vazhachal 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)
3	*Trachypithecus johnii* (J. Fischer)	Nilgiri langur	VU	(BI, B2; C1a)	EN-WG	A-II	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	*Melursus ursinus* (Shaw)	Sloth bear	VU	--		A-I	A-I (1)
9	*Paradoxurus hermaphroditus* (Pallas)	Common palm civet	LRIc	--		A-III	A-II (2)
10	*Viverricula indica* (Desmarest)	Small Indian civet	LRnt	--		A-III	A-II (2)
11	*Bos gaurus* H.Smith	Gaur or Indian bison	EN			A-I	A-I (1)
12	*Hemitragus hylocrius (Ogilby)*	Nilgiri tahr	EN	(B1, 2acd; C2a)	EN-WG		A-I (1)
13	*Axis axis* (Erxleben)	Spotted deer or chital	LRIc	--			AII(3)

14	*Cervus unicolor* Kerr	Sambar	LRlc	--			AII (3)
15	*Muntiacus muntjak* (Zimmermann)	Barking deer	LRlc	--			AII(3)
16	*Sus scrofa* Linnaeus	Wild boar	LRlc	--			AII(3)
17	*Moschola meminna* (Erxleben)	Mouse deer	LRnt	(A1d)			A-I (1)
18	*Manis crassicaudata* Gray	Indian pangolin	LRnt	--		A-II	A-I (1)
19	*Hystrix indica* Kerr	Indian (crested) porcupine	LRlc	--			A-II (4)

Source, Ramesh et al., 2003.

Table 2.5 Status of some RET Amphibians recorded from Vazhachal Division

Sl. No	Species	IUCN		Endemism	CITES
		Status	Criteria		
1	*Rana malabarica* Tschudi	LR-nt	--	EN-WG	--
2	*Microhyla rubra Jerdon*	LR-nt	--		
3	*Bufo microtympanum* Boulenger	Near threatened			

➢ **Integral part of elephant reserve and Wildlife corridor**

The Vazhachal 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, is 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 small stretch of 80 Km of the river from its source now contains only one elephant corridor which passes through the Vazhachal forest areas. The stretches upstream are mountainous, have deep gorges and the area is also over exploited. Down stream of the area is fully inhabited and consequently the only undeveloped area which remains in use, as an elephant corridor, is through the proposed Athirappilly Hydro electric project site in Vazhachal forests. The reservoir of the proposed project begins from just next to the power house of the

Poringalkuthu hydro electric project. The impact of the loss of the migratory corridor will have serious adverse consequences on the elephants.

The census reports of Asian Elephant Research and Conservation Centre shows that the highest density of Asian elephants in Kerala State is found in the Vazhachal Forest Division. According to the 1993 census 947 elephants were reported in the division. The Asian Nature Conservation Foundation has conducted a study of the different forest divisions within the Anamudy Elephant Reserve No.9. It was noticed that the elephant density/sq. km. is second highest in the Vazhachal Forest Division. The highest density is noted in the adjacent Malayattor Division, which indicates elephant movement along the corridor. The details of estimated elephant density in Vazhachal Forest Division in the year 205 and 2007 are shown in Table.2.6

Table.2.6. Details of estimated elephant density in Vazhachal Forest Division

Year	Number of Elephant sighted	Estimated elephant density (No./km^2)
2005	108	0.6317
2007	60	0.3489

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

- **Chalakudy river - A 'Mahseer' fish bank of India**

There are around 218 species of primary and secondary freshwater fishes in the Western Ghats. Fifty three per cent of all fish species (116 species in 51 genera) in the Western Ghats are endemic. The river system is known to harbour an exceedingly rich ichthyofauna (Fishes) of around 98 species (Ajithkumar *et al.*, 1999), many of which are endangered and endemic. In fact, Chalakudy river is one of the high fish diversity rivers in India (104 sp.) and the upstream areas of the river has been recommended for a fish sanctuary by the National Bureau of Fish Genetic Resources (NBFGR) with regard to endemic and endangered fish population. Nine species are already critically endangered and twenty two species are vulnerable and of as per IUCN norms. The endemism is reported to be 54.3%. Even the Periyar, with 244 Km is the longest river in the state, has only 77 recorded fish species and their threat status is lower than that of the fish species noted in the Chalakudy River.

Between 1994-97 itself five new species were recorded form this river, viz. *Garra surendranathanii, Osteochilichthys longidorsalis, Horabagrus nigricollaris, Travancoria elongata* and *Puntius chalakkudiensis*. *Glyptothorax lonah* from Karappara tributary of Chalakudy River was the first record of the species from Kerala. *Barilius bendelisis* from Thekkady tributary was the first report from a west flowing river in Kerala. *Macrospinosa cuja* was the first report from the freshwater of Kerala. Apart from these *Hypselobarbus kurali, Puntius dorsalis, Travancorica jonesi, Euryglossa orientalis, Nemacheilus guentheri, Ompok malabaricus* and *Tetraodon travancoricus* were reported for the first time from Chalakudy River.

Of the total fishes reported from this river, 15 species were found to be very common and out of which, 11 had a uniform distribution throughout the river system; 32 species were common while 19 species were rare. Six species were considered very rare. The rare fishes are *Hypselobarbus thomassi, Labeo calbasu, Glyptothorax madraspatanam, Hypselobarbus kolus, Glyptothorax lonah* and *Travancorica jonesi.* Five species that have been introduced were collected. Among the introduced species *Oreochromis mossambica* had become well established and was recorded from all zones. Twelve species are secondary freshwater fishes or migratory fishes and all these fishes were collected from, low land area that lies <75 m above MSL except for *Megalops cyprinoids* and *Euryglossa orientalis*, which were reported from even 50 km away from seacoast. Survey conducted by Ajithkumar *et al*., (2000) in Chalakudy River, could not locate 15 species that were recorded by earlier workers. Of the total species recorded, 36 species are considered to be endemic to Western Ghats, of which 10 species are endemic to Kerala part of Western Ghats. *Horabagrus nigricollaris, Travancoia elongata,* and *Osteochilichthys longidorsalis* are known only from the Chalakudy River. There are about 57 economically important species, of which 27 species can be used as food while 30 species are ornamental.

Similarly, detailed study conducted by the School of Industrial Fisheries, Cochin University of Science and Technology indicates that out of six critically endangered species restricted to the Chalakudy River two are restricted to a single location at Vazhachal. Two of the five new species of fish have been found only at Vazhachal. The study has found that the Chalakudy River has the highest diversity index ranging from

1.76 to 3.9. The details of the fish fauna, endemism and IUCN status is given in Table 2.7.

The newly reported species such as *Horabagrus nigricollaris, Travancoria elongata, Osteochilus longidorsalis* (Pethiyagoda and Kottelat 1994), *Garra surendranathinii* (Shaji *et al.,* 1998) and *Salarias reticulatus* (Kurup *et al.*, 2005) are highly threatened and strictly endemic to this river. The field study carried out by Rajeev *et al.*, (2007) as part of the All Catfish Species Inventory Project (ACSI 04-17) of the United States National Science Foundation led to the identification of several exotic species in this river such as *Oreochromis mossambicus, Gambusia affinis, Osphronemus goramy, Xiphophorus maculatus and Poecilia reticulata.* These exotics gains importance because the threats to the indigenous fish fauna of the River. The studies show that a new species of the genus *Newnhamia* (Crustacea), *N. dumonti* n.sp., is collected recently from Chalakudy River sand. *Newnhamia* was thus far only known from Australia and adjacent islands. Rajeev *et al.*, (2008) collected 71 species belonging to 27 families and 50 genera from various sampling sites spread along the upstream and downstream parts of the Chalakudy River. Among them, cyprinids were the most dominant group represented by 24 species belonging to 13 genera, followed by the catfishes of the family Bagridae (7 species from 2 genera) and loaches belonging to the family Balitoridae (5 species from 5 genera). Of the 71 species, 4 belong to the 'critically endangered' (CR) and 16 to the 'endangered' (EN) category. 3 of the critically endangered species are strictly endemic to the Chalakudy river system and 3 species were strictly endemic to the Chalakudy River (viz. *Homaloptera montana, Horabagrus nigricollaris* and *Osteochilus longidorsalis).* Some of the rare critically endangered species are catfish *Horabagrus nigricollaris, Puntius mahecola* (Cyprinidae) and *Travancoria elongata,* (Balitoridae).

Table 2.7 Fish fauna of River Chalakudy, their threat status and endemism

Sl. No	Species	IUCN status	Endemism
1	*Amblypharyngodon melettinus*	Low risk	-
2	*Ambassis gymnocephalus*	Low risk least concern	Chalakudy
3	*Amblypharyngodon microlepis*	Nearly threatened	Chalakudy,
4	*Anabas testudineus*	Vulnerable	-

5	*Anguilla bicolor bicolor*	Endangered	-
6	*Aplocheilus lineatus*	Low risk	Chalakudy
7	*Awavous gutum*	Low risk least concern	
8	*Barbodes carnaticus*	Vulnerable	-
9	*Barilius bakeri*	Vulnerable	Western Ghats
10	*Barilius gatensis*	Low risk least concern	Western Ghats
11	*Batasio travancoria*	Endangered	Chalakudy
12	*Bhavania australis*	Endangered	Western Ghats
13	*Brachiurus orientalis*	Data deficient	-
14	*Carinotetraodon travancoricus*	Endangered	Western Ghats
15	*Channa panctatus*	Low risk least concern	Chalakudy
16	*Channa marulius*	Low risk	-
17	*Channa striatus*	Low risk	-
18	*Cirrhinus mrigala*	Low risk least concern	-
19	*Clarias dussumieri*	Vulnerable	Chalakudy
20	*Ctenopharyngodon idellus*	Introduced	-
21	*Dayella malabarica*	Critically endangered	Western Ghats
22	*Devario malabaricus*	Low risk	Western Ghats
23	*Eleotris fusca*	Data deficient	-
24	*Elops machnata*	Data deficient	-
25	*Esomus danricus*	Vulnerable	-
26	*Etroplus maculatus*	Low risk	-
27	*Etroplus suratensis*	Low risk	-
28	*Gambusia affinis*	Exotic	-
29	*Garra mullya*	Low risk	-
30	*Garra surendranathanii*	Endangered	Kerala
31	*Glossogobius giurus*	Low risk	-
32	*Glyptothorax annandalei*	Endangered	-
33	*Gonoproktopterus kolus*	Endangered	Chalakudy
34	*Heteropneustes fossilis*	Vulnerable	-
35	*Homaloptera montana*	Critically endangered	Chalakudy
36	*Horabagrus brachysoma*	Endangered	Western Ghats

37	*Horabagrus nigricollaris*	Critically endangered	Chalakudy
38	*Hypselobarbus curmuca*	Endangered	Western Ghats
39	*Hypselobarbus kolus*	Endangered	Western Ghats
40	*Lepidocephalus thermalis*	Low risk	-
41	*Labeo calbasu*	Nearly threatened	Chalakudy
42	*Mastacembelus armatus*	Low risk	-
43	*Mastacembelus oatesi*	Nearly threatened	Chalakudy
44	*Macrognathus guentheri*	Vulnerable	-
45	*Megalops pyprinoids*	Data deficient	-
46	*Mesonemacheilus guentheri*	Low risk	-
47	*Mesonemacheilus triangularis*	Low risk	-
48	*Mystus armatus*	Low risk	-
49	*Mystus cavasius*	Low risk	-
50	*Mystus gulio*	Low risk	-
51	*Mystus keletius*	Data deficient	-
52	*Mystus malabaricus*	Endangered	Western Ghats
53	*Mystus oculatus*	Low risk	-
54	*Nandus nandus*	Low risk	-
55	*Nemacheilus triangularis*	Nearly threatened	-
56	*Ompok bimaculatus*	Endangered	-
57	*Oreochromis mossambicus*	Exotic	-
58	*Osphronemus goramy*	Exotic	-
59	*Osteobrama bakeri*	Endangered	Western Ghats
60	*Osteochilus longidorsalis*	Critically endangered	Chalakudy
61	*Parambassis dayi*	Endangered	Western Ghats
62	*Parambassis thomassi*	Vulnerable	Western Ghats
63	*Poecilia reticulata*	Exotic	-
64	*Pristolepis marginata*	Vulnerable	-
65	*Pseudeutropius mitchelli*	Data deficient	Kerala
66	*Pseudosphromenus cupanus*	Data deficient	-
67	*Pseudambassis ranga*	Low risk least concern	-
68	*Puntius amphibious*	Low risk	-

69	*Puntius bimaculatus*	Data deficient	-
70	*Puntius chalakkudiensis*	Critically Endangered	
71	*Puntius denisonii*	Endangered	Kerala
72	*Puntius dorsalis*	Endangered	-
73	*Puntius fasciatus*	Endangered	-
74	*Puntius filamentosus*	Data deficient	-
75	*Puntius mahecola*	Not assessed	-
76	*Puntius micropogan micropogan*	Data Deficient	Chalakudy
77	*Puntius sarana*	Vulnerable	-
78	*Puntius ticto*	Low risk	-
79	*Puntius vittatus*	Vulnerable	-
80	*Rasbora daniconius*	Low risk	-
81	*Salarias reticulates*	Low risk	Chalakudy
82	*Scatophagus argus*	Data deficient	-
83	*Salmostoma Sardinella*	Nearly threatened	Chalakudy
84	*Sicyopterus griseus*	Vulnerable	-
85	*Tetradon travancoricus*	Vulnerable	-
86	*Tor mussullah*	Critically endangered	Chalakudy
87	*Tor khudree*	Vulnerable	-
88	*Travancoria elongata*	Critically endangered	Kerala
89	*Travancoria jonesi*	Endangered	
90	*Wallago attu*	Low risk	-
91	*Xiphophorus maculatus*	Exotic	-

Comparative examination of fish biodiversity at various altitudes from 6 rivers (Bharathapuzha, Chalakudy, Pamba, Periyar, Kallada and Kabbin of Kerala showed that species diversity was inversely related to altitude (Table 2.8). In the Chalakudy River system the diversity index ranged between 1.76 - 3.8 between altitudes of 0 - 1032 m. The highest diversity was found between 0-65 m while it was lowest at reaches between 516-580 m. The results of this study revealed that fish diversity was highest in the lower stretches of the Chalakudy River system (0-65 m). Among the six river systems studied, the Chalakudy and Kabbini River systems showed the highest diversity index ranging between 1.76 - 3.8 and 1.24 - 3.37 respectively.

Table 2.8 Shannon-Weiner diversity index at different altitudes in Chalakudy with compared to other major 5 river systems of Kerala.

Altitude Range (m)	Name of the river system					
	Bharathapuzha	Chalakudy	Pamba	Periyar	Kallada	Kabbini
0-65	2.9	3.8	2.64	3.056	0.99	-
65-129	1.76	2.73	2.33	-	-	-
129-194	1.86	-	-	2.68	2.13	-
194 -258	-	3.28	2.2	1.55	1.8	-
258-323	1.9	2.21	2.4	1.69	2.25	-
323-387	1.76	-	-	-	1.5	-
387-452	-	2.58	1.44	1.88	-	-
452-516	1.9	2.97	-	-	-	-
516-581		1.76	-	2.05	1.44	-
581-645	0	-	1.62	1.88	-	-
645-710	-	-	-	2.27	1.37	-
710-774	1.2	2.24	-	1.81	1.45	3.37
774 -839	-	2.74	1.72	2.76	-	3.25
839-903	-	2		2.66	-	1.24
903-968	-	-	0.67	2.79		2.84
968-1032	-	2.75	-	-	-	-
1032-1097	-	-		-	-	-
1097-1161	-	-	2.44	-	-	-

➢ Important Bird Area and Conservation units of Hornbills

Vazhachal Reserve Forests lies in ***Western Ghats Endemic Bird Area*** (EBA). Sixteen species have been identified in this EBA (Stattersfield et al., 1998). The site lies in ***Biome-10*** (Indian Peninsula Tropical Moist Forest) where nine out of 15 biome-restricted species have been seen till now, but more are likely to occur as the habitat is still intact. This site fits two IBA criteria: ***A2 (Restricted Range species: EBA),*** and ***A3 (Biome-restricted assemblages).*** It is also included in the IBA list (IBA Code- IN-KL-22; Area – 41300 sq. km) as the site has good representative of Tropical Secondary Evergreen, Tropical Wet Evergreen and Tropical Moist Deciduous Forest of the Western Ghats Endemic Bird Area. The species details in EBA and Biome 10 are shown in Table 2.9.

Table 2.9 Species details in EBA and Biome 10 in Vazhachal forests

Endemic Bird Area 123: Western Ghats		
1.	Blue-winged Parakeet	*Psittacula columboides*
2.	Malabar Grey Hornbill	*Ocyceros griseus*
3.	Grey-headed Bulbul	*Pycnonotus priocephalus*
4.	Indian Rufous Babbler	*Turdoides subrufus*
5.	White-bellied Blue-Flycatcher	*Cyornis pallipes*
6.	White-bellied Treepie	*Dendrocitta leucogastra*
Biome-10 Indian Peninsula Tropical Moist Forest		
1	Small Green-billed Malkoha	*Phaenicophaeus viridirostris*
2	Indian Edible-nest Swiftlet	*Collocalia unicolor*
3	Malabar Pied Hornbill	*Anthracoceros coronatus*
4	White-cheeked Barbet	*Megalaima viridi*
5	Crimson-throated Barbet	*Megalaima rubricapilla*
6	Malabar Whistling-Thrush	*Myiophonus horsfieldii*
7	Yellow-browed Bulbul	*Iole indica*
8	Black-headed Babbler	*Rhopocichla atriceps*
9	Loten's Sunbird	*Nectarinia lotenia*

Twelve of the 16 species (75%) of the endemic species of birds seen in the Western Ghats are present in the Athirappilly - Vazhachal area. Recognising the high diversity in birds, Bird Life International (based in Cambridge), in a process of identifying important areas for bird conservation all over the world in 1995, identified the Vazhachal - Sholayar area as an **Important Bird Area (IBA).** The survey report of the birds of Athirappilly and Vazhachal area prepared in 2001 by Warblers and Waders reveals that 196 species of birds were sighted in the project area. According to the report the total number of species recorded up to 2001 is 222. The Common Birds Monitoring Programme records (1991-2007) 234 species from this the area. Total diversity and species richness of birds indicate that there are at least 264 birds species within a small stretch of 7 Kms between Athirappilly and Vazhachal. The list of endemic and RET birds are shown in Table 2.10.

Table 2.10 Status some endemic and RET birds recorded from Vazhachal Division

Sl. No	Common Name	Scientific Name	ENDEMISM	CITES	IBA	IUCN category
1	Nilgiri wood pigeon	*Columba elphinstonii* (Sykes)	EN-WG		*	Vulnerable
2	Malabar grey hornbill	*Ocyceros griseus griseus* (Latham)	EN-WG			
3	Malabar pied hornbill	*Anthracoceros coronatus coronatus* (Boddaert)		A-II		Near threatened
4	Great pied Indian hornbill	*Buceros bicornis homrai* Hodgson		A-I		
5	Blacked winged kite	*Elanus caeruleus vociferus* (Lantham)		A-II		
6	Crested ghoshawk	*Accipiter trivirgatus peninsulae* Koelz		A-II		
7	Black eagle	*Ictinaetus malayensis perniger* (Hodgson)		A-II		
8	Crested serpent eagle	*Spilornis cheela melanotis* (Jerdon)		A-II		
9	Indian kestrel	*Falco tinnunculus objurgatus* (Stuart Baker)		A-II		
10	Grey junglefowl	*Gallus sonneratii* Temminck		A-II		
11	Rufous babbler	*Turdoides subrufus hyperythrus* (Sharpe)	EN-WG			
12	White bellied blue flycatcher	*Muscicapa pallipes* Jerdon	EN-WG			
13	Nilgiri verditer flycatcher	*Muscicapa albicaudata* Jerdon	EN-WG			Near threatened
14	Grey headed bulbul	*Pycnonotus priocephalus* (Jerdon)	EN-WG			
15	Bluewinged or Malabar parakeet	*Psittacula columboides (Vigors)*	EN-WG	A-II		
16	Forest eagle owl	*Bubo nipalensis nipalensis* Hodgson		A-II		
17	Darter	*Anhinga melanogaster*				Near threatened

Bird diversity is very high in Vazhachal - Puliyilappara and Athirapilli - Kannankuzhithodu region. In a five-day survey in April 1996, 139 species of birds were

recorded by Nameer and Cheeran (1996), of which 24 were migrants. SusanthKumar (1996) has recorded 120 species from Vazhachal – Sholayar forests. Detailed study in different months would reveal more species, as many forest birds could not be seen or identified (especially warblers). The sighting of Malabar Pied Hornbill *Anthracoceros coronatus* was noteworthy. This is one of the uncommon hornbills of the Western Ghats with patchy distribution. The other rare birds seen were Great Pied Hornbill (*Buceros bicornis)*, Great-eared Nightjar (*Eurostopodus macrotis)*, Rufous-bellied Hawk Eagle (*Hieraaetus kienerii)*, Darter (*Anhinga melanogaster)* and Broad-billed Roller (*Eurystomus orientalis)*. Although no globally threatened species was sighted in this IBA, there are chances of occurrence of threatened Nilgiri Wood Pigeon (*Columba elphinstonii)* as this bird moves around in search of fruiting trees. Suitable habitat for this species (wet evergreen and semi- evergreen forest) is present in this site.

Occurrences of nocturnal birds were also less. Important species recorded were Malabar Trogon, Blue-bearded Bee-eater, Green Imperal Pigeon, Crested Goshawk, Black-naped Oriole, Drongo Cuckoo, Wayanad Laughing Thrush, Forest Eagle Owl and Black Wood Pecker. The endemic birds to Western Ghats sighted in this forest area include Malabar Grey Hornbill, Malabar Parakeet, White-bellied Blue Flycatcher, Small Sunbird, Niligiri Pipit, Nilgiri Wood Pigeon, Grey-headed Bullbul and Nilgiri Flycatcher. Lesser Fish Eagle and Large Hawk Cuckoo are the two new bird species were also recorded at Vazhachal. 12 of the 16 species (75%) of the endemic species of birds seen in the Western Ghats are present in the Athirappilly - Vazhachal area. Raju (2002) records 195 species of birds of which 160 species were recorded from the 2 km riparian area upstream to the Vazhachal waterfalls. Of this 8 species are endemic to Western Ghats and five species are endangered including the Malabar and great pied hornbill, fishing eagle and darter. A critically threatened species ie., the *white backed vulture* also has been recorded from here.

All the four species of hornbills found in Kerala, namely Malabar Grey Hornbill (*Ocyceros griseus*), Grey Hornbill (*Ocyceros birostris*), Malabar Pied Hornbill (*Anthracoceros coronatus*) and Great Indian Hornbill (*Buceros bicornis*) occur in Athirappilly – Vazhachal area and this is a very rare phenomenon. Based on the occurrence of the four hornbill species, the encounter rates/densities from the sites, for which indices of abundance are available, and the configuration and size of contiguous

protected areas along the Western Ghats, Anamalai – Parambikulam - Vazhachal region is identified as one of the important hornbill conservation units. A survey conducted during 2004-05 with the support of the forest department and endemic Kadar tribal people identified 23 nests of Great Hornbills and 2 nests of Malabar Pied hornbills. This is the only known available nesting location of the near threatened Malabar Pied Hornbill in Kerala state. The estimated mean density of Malabar Grey Hornbills in Reserved Forests is 67.4 individuals/km² (Vazhachal-Sholayar and Malayattur) with a 95% confidence interval of 40.4 to 94.4 individuals/km². This appeared to be significantly higher than 95% CI of densities in the wildlife sanctuaries (23.9 to 33.1 individuals/km²) or rainforest fragments (18.6 to 33.4 individuals/km²) — the latter two strata thus appearing not to differ significantly from each other. The importance of moist forests for the Malabar Grey Hornbill and the larger hornbills also stands out. In addition, the Malabar Pied Hornbill appears to prefer lower elevation riverine areas, including many sites outside designated PAs—habitats prone to a range of threats such as encroachments, agriculture, monoculture timber plantations, hydro-electric and irrigation projects, tourism and urban development (e.g.,Vazhachal-Athirapilly population along the Chalakudy river threatened by the proposed Athirappilly dam). The Vazhachal forest dept., the River Research Centre and the Kadar Tribes had been conducting survey and taking steps to protect the nesting and breeding sites of hornbills. The forest department is in fact, following a unique conservation technique for the protection of the hornbills involving the Kadar Tribes. Twelve nests were identified in the Vazhachal area and "Kadar" tribal people were deployed to watch them. It was developed into a participatory monitoring and conservation programme with the involvement of the community groups (VSS—Vana Samrakshana Samithy) of the forest dwelling Kadar tribes.

Since this region is one of the strongholds for the Great Indian hornbill and other sympatric species, a study of the minimum viable population would further provide a focus for the interpretation of ecological and genetic factors that influence the persistence of a threatened population. A comprehensive demographic monitoring throughout its range is essential to target effective conservation action of the Great Indian Hornbill in this region.

Recent studies on dispersal modes of tree species in forests of the Western Ghats indicates a high number of plant species depends on birds for seed dispersal. Large bird-

dispersed species include *Dysoxylum malabaricum, Litsea insignis* and *L. glabrata. Dysoxylum malabaricum* is dispersed by imperial pigeons and occasionally by the wood pigeons. In fact, the dominant species in the forests such as *Cullenia exarillata, Palaquium ellipticum* and *Aglaia elaeagnoidea* were dispersed mechanically or by mammals.

➢ **Riparian ecosystem**

Riparian ecosystems are important natural bio-filters, protecting aquatic environments from excessive sedimentation, surface runoff and erosion. These zones also provide wildlife habitat, increase biodiversity, and provide wildlife corridors, enabling aquatic and riparian organisms to move along river systems avoiding isolated communities (Plate 5).

The riparian vegetation along the Chalakudy river system offers a unique ecosystem which serves as a link between the varied habitats at lower and higher elevations. These are the remaining patches of Low elevation riparian forest habitat; extremely rare in the Kerala part of Western Ghats. Thick riparian vegetation exists for a distance of 10.5 km with 10 m width downstream from Poringalkuth, covering an area of 58.5 hectares. Out of this, 26.4 hectares lie within the Vazachal area, including three large islands densely covered by riparian forests. The riparian forests are characterized by the presence of typical riparian species of plants, in addition to evergreen and semi-evergreen species. Out of the 319 species of flowering plants identified from the study area, 24 are endemics. The riparian vegetation is indispensable for the survival of the mammal species of the Western Ghats of which and 10 are rare and endangered (Amitha bachan, 2003). In the Chalakudy River, highly niche specific riparian forests within a 60 km stretch are already submerged on account of man made projects. 28.815 km of the river has dried up due to the existing project. Nearly 40-50% of the river course and the connected riparian vegetation have been lost.

The riparian faunal-plant assemblages in these ecosystems have been little studied, but there is no doubt that there is a strong relationship between biotic diversity and the presence of riparian ecosystems.

➢ **Medicinal plants**

The Vazhachal forests are home to a diversity of wild aromatic and medicinal plants. The Kadar and Malayan tribes of this area have a rich ethnic knowledge of these plants. NTFP collection, including the medicinal plants is their main source of income. The details of medicinal plants and ethnic uses of Kadar tribes of in Sholayar areas in Vazhachal forests (Udayan *et al.*, 2005) are given in **Appendix X** . Thelli (*Canarium strictum* Roxb.), Koova (*Maranta sp.*), Manjakoova (*Curcuma zedoaria*) Pathiripoovu (*Myristica malabarica* Lam. And *M. beddomei* King.,), Cheenikka (*Acacia sinuata* (lour.) Merr., Maravettikkuru (*Hydnocarpus pendandra* (Buch.-Ham.) Oken,), Urunjikai (*Sapindus trifoliate* L.,), Kallurvanchi (*Rotula aquatica* Lour.), Analivenga (*Pittosporum neilgherrense* Wt. & Am.) and Kattupavakka (*Momordica dioica* Roxb. Ex Willd) are collected from the forests. The other important medicinal plant resources are *Coscinium fenestratum, Dicliptera cuneata, Ecbolium viride, Gymnostachyum febrifugum, Justicia gendarussa, Justicia procumbens* L., *Peristrophe paniculata, Rungia parviflora, Thunbergia fragrans, Allmania nodiflora, Cyathula prostrate, Gluta travancorica, Holigarna arnottiana* Hook.f., *Lannea coromandelica* (Houtt.) Merrill, *Nothopegia colebrookiana* Bl.., *Spondias pinnata* (L.F.) Kurz., *Miliusa tomentosa* (Roxb.) Sinclair, *Polyalthia fragrans* Benth. & Hook. F.ex Hook. F., *Anodendron paniculatum* A.DC. , *Holarrhena pubescens* (Buch.-Ham.) Wallich ex DO, *Wrightia tinctoria* R.BR., *Wrightia arborea* (Dennst.) Mabb., *Schefflera venulosa* (Wight & Arn.) Harms, *Aristolochia indica* L., *Aristolochia tagala* Cham., *Thottea siliquosa* (Lam.) Ding Huo, *Asclepias curassavica* L., *Cosmostigma racemosa* WT., *Gymnema khandalense* Santapau., *Gymnema sylvestre* R.BR., *Holostemma ada-kodien* Schult., *Wattaka volubilis* (L.F.) Stapf., *Curcuma pseudomontana* Grah., *Alstonia venenata* R. Br. and *Vernonia cinerea* Less.

The Conservation of medicinal plants deserves special attention due to the increasing popularity of Indian systems of medicines all over the world. A large number of medicinally valuable trees, shrubs and herbs are available in this eco-climatic region. A Medicinal Plant Conservation Area (MPCA) was established by Foundation for Revitalization of Local Health Traditions (FRLHT) at Athirappilly, about one kilometer north of famous Athirappilly waterfalls in the Charpa forest range of this division. The total extent of the MPCA is 111.68 ha. 238 species are recorded from this area (Sasidharan *et al.*, 1996).

Plate. 5. A. A Degraded forest. B. Riparian vegetation

➢ **Bamboo-reed -rattan patches**

Bamboo and reeds are available in large quantity in this Division. 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.

In almost all areas of the wet evergreen, semi-evergreen, and moist deciduous forests of this Division, which spread in both Sholayar and Vazhachal Ranges, canes (rattan) occur. But at present, due to overexploitation, rattans are not abundant here. Recently, The Forest Department has started rattan plantations in the natural forests. The *Dalbergia* germplasm plot in the Charpa range has some mature canes also, which is protected. As in the case of Reed, rattan is also susceptible to damage by fire.

➢ **Vazhachal Forests : A land of wild forest beauty**

Due to their ecological value, protected areas, especially those found in the tropics and in less-developed countries, contain many of the world's greatest ecotourism attractions. These attractions may consist of one or a combination of rare or endemic species of flora and fauna, abundant wildlife, high indices of species diversity, unusual or spectacular geomorphological formations, or unique historic or contemporary cultural manifestations in a natural context. Ecotourism has become an important economic activity in natural areas around the world. It provides opportunities for visitors to experience powerful manifestations of nature and culture, and to learn about the importance of Biodiversity Conservation and local cultures. At the same time, ecotourism generates income for conservation and economic benefits for communities living in rural and remote areas.

The enchanting mystery of the jungle, blanketed dense forests, magnificent water falls, small streams and other forest tract of scenic beauties attracts thousand of nature admirers and tourists to Vazhachal forests. The biggest waterfall in Kerala is at Athirapally in

Chalakudy River and in addition to this there is a beautiful cascade and a seasonal waterfall at Charpa. There are two hydel projects namely Sholayar and Poringalkuthu on the upstream side of Athirappilly falls. This Division has evergreen, semi-evergreen and moist deciduous forests, with vast variety of flora and fauna. There are hills and dales with rocky outcrops. All these make Vazhachal a potential area for developing eco-tourism and attract lakhs of tourists from all over the world. The tourism at Vazhachal forests is nature based. The natural ecosystem here has a high potential for ecotourism development. The visitor flow on an average is 2.3 lakh and 5.3 lakh visitors/ year at Vazhachal and Athirappilly respectively. The revenue generating potential of the sites indicates a positive relationship between the revenue, number of visitors and number of vehicles. The total Affected Forest Area (AFA) is approximately 1.33 sq km (Anitha and Muraleedharan, 2007).

- **Primitive tribes**

Kadar

Kadar, otherwise known as "Kadir" (Thurston, 1906), is short statured, dark skinned and platyrhined (flat nosed) and is the primitive inhabitants of Anamalai hills. "The Kadar may be considered as the best representative of the integrated food-gathering tribes of South India" (Mathur, 1997). Traditionally they used to live in neatly constructed bamboo huts, thatched with teak leaves. According to Thurston (1906), they are nomadic. Though their main livelihood was collection of NWFP, they had been working for the Forest Department since a long time. This tribal community is regarded as one of the six endangered food gatherers and shares a very good relation with other tribes. They are non vegetarian, do not rear cattle and frequent consumption of the seeds of *Cycas circinalis* is noted. They maintain their originality and culture without adapting the changes over the years. In Kadar community traditionally the bridegroom gave dowry to the bride and widow remarriage was never permitted. Polygamy used to be the practice. Worship of stone images was practiced mainly that of the goddess "Kali". Kadars used to bury the dead.

In Vazhachal forest division, there are there are 44 Kadar families, their settlements scattered in the forests of the river basin. These families are migrants from Ettyani –

Kuriyarkutty areas during the period of 1945-47. They are mainly depending NTFPs for income source. But the liquor addiction is one of the main problems in all of these settlements which retard their socio-economic upliftment. This community plays a key role in the conservation of hornbills through participatory monitoring and with the involvement of the community groups (VSS). Among them peoples were selected based on their previous experience with hornbills or their knowledge of the forest and they were trained in the field to monitor hornbills during the nesting season. The protection of nesting trees was ensured with regular patrolling of the selected tribal guards.

Malayas

The Malayan tribes too have adapted to various jobs like bamboo carving and fishing. Gathering of the products from the dense forest areas is also a lucrative occupation of most of the Malayan tribes. Instances are also found, where these Malayan tribes have rented their cultivating lands and also get involved as manual laborers in the fields. Today, these Malayan tribes have taken active participation in all educational as well as cultural fetes. It has been found out that due to their liquor consumption and rampant smoking, there has been a degradation in both health and morality. Festivals and fairs play an important part in the society of these Malayan tribes, which also emphasizes the cultural exuberance of the community.

- **Important Source of Watersheds**

Most of the forest areas of Vazhachal Division form catchment areas for Chalakudy River and its tributaries. Water from a small portion is drained to Edamalayar. There are two hydel projects in this Division; one at Sholayar across Sholayar River and the other at Poringal, across Chalakudy River. The proposed Anakkayam Hydel Project is also within the jurisdiction of this Division. This project is intended to make use of the tail race water from Sholayar project. Recently, Kerala State Electricity Board has made a canal to deliver excess water from Chalakudy River basin to Edamalayar River basin by connecting Poringal Reservoir and Edamalayar Reservoir. Water from Sholayar and Poringal Reservoirs is used for generation of Electricity at Sholayar and Poringal powerhouses and for irrigating areas of Thrissur and Ernakulam district. A weir has been constructed across Chalakudy River at Thumboormuzhy for diverting water for Irrigation. Drinking water supply schemes for Ayyampuzha Panchayath, Melur Panchayath, Chalakudy Municipality, Annamada Panchayath and for Mala, Poyya,

Vynthala areas are dependent on Chalakudy River. Extensive paddy fields of Annamanada, Poovathussery, Vythalmala Kurumassery, Chengamanadu, Kundoor and Kuzhoor areas are irrigated by lift irrigation from Chalakudy River. Maintenance of a steady perennial flow of water in Chalakudy River is highly inevitable not only for the above purposes, but also for checking the extension of salinity in water. Chalakudy River is gradually drying up aggravating the salinity problems in the agricultural lands down below. Further reduction in the flow will aggravate, and extend the salinity problems to other areas as well. In view of these facts, the river basin of Chalakudy River requires very careful and scientific water conservation measures. Intensive soil and moisture conservation measures are highly essential for minimizing sedimentation in the reservoirs of hydel projects, lest it should reduce the longevity of the hydel projects.

2.2 Factors affecting values.

- Forest degradation and removal of evergreen patches
- High influx of tourism with low carrying capacity
- Human-Wild life conflicts
- Infestation of noxious weeds
- Habitat degradation of riparian ecosystems
- Degradation of watersheds
- Alteration of Wildlife corridors
- Overexploitation of NWFPs including reeds, bamboos and medicinal plants

Threats

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.

Major threats in Vazhachal Forests

More than 7000 ha of natural forests in Vazhachal forests had been clear felled and converted into various types of plantations. A large extent of Evergreen and Semi Evergreen forests had been worked under selection felling system in two felling series namely Chandanthodu and Anakkayam. The balance area remains as undisturbed natural forests with a rich diversity of flora and fauna. The main threats to the forests in the division are the following.

- **Habitat degradation of riparian zone.**

Riparian ecosystems are vital components to be protected as landscapes change, especially during of urbanization in watersheds.The meandering curves of a river, combined with vegetation and root systems, dissipate stream energy, which results in less soil erosion and a reduction in flood damage. The riparian zones also provide wildlife habitat, increased biodiversity, and provide wildlife corridors, enabling aquatic and

riparian organisms to move along river systems avoiding isolated communities. There exist a thick riparian vegetation of more than 10 m width for a distance of 10.5 km downstream from Poringalkuth, covering an area of 58.5 hectares. Out of this, 26.4 hectares lie within the Vazachal area, including three large islands densely covered by riparian forests. The riparian forests of the area have been found to be characterized by the presence of typical riparian species of plants, in addition to evergreen and semi-evergreen species. Out of the 319 species of flowering plants identified from this area, 24 are endemic species to Western Ghats and 10 are rare and endangered. The vegetation deterioration in the riparian zone, stream bank destruction, deterioration of faunal habitats are the main problems addressing the riparian vegetation in this division.

Riparian vegetation in the upper reach (from Thumboormuzhi to the upper tributaries) has been degraded primarly due to the construction of reservoirs, clear felling of forest, raising of both private and government plantations and also through the canalization of streams. Hence the riparian zone management receives increased attention, because these areas are important for protecting stream habitat and maintaining the water quality.

- **Deterioration of watersheds**

Watershed can be defined as a unit of area, which covers all the land which contributes runoff to a common point or outlet and surrounded by a ridge. The upstream watershed deterioration affects the downstream water resources and the landuse practices. The reason for deterioration is attributed mainly to biotic factors like over exploitation in the past, clear felling on steep slopes, drastic thinning of plantation along slopes, annual fires and grazing and human interferences like poaching and encroachments. The semi evergreen and deciduous forests in Vazhachal forests were clear felled and planted with teak and soft wood species. A considerable extent of these plantations are now under stocked or failed. The degradation occurs mainly in Athirappilly Range compared to other Ranges. The watershed in Mukkumpuzha, Karadipara and Choozhimedu, are under the threat of deterioration.

- **Rattans, Reeds, Bamboos and Medicinal plants**

Over harvesting of reeds (*Ochlandra* sp.) to the tune of 200 metric tonnes annually, is leading to the destruction of these group of plants. The felling prescriptions of the reed, bamboos and rattans in the forests of Vazhachal Division need to be reinvestigated. Laborers are always tempted to harvest reed and bamboos from the easily accessible areas, usually from the banks of perennial streams. Therefore, bamboos are over

exploited in these accessible areas. Overexploitation causes a gradual degeneration in health and sizes of the bamboos. Hence, systematic action should be taken in Vazhachal forests to develop *in situ* conservation of the genetic resources of different reed/bamboo species. The main prescription that a bamboo extractor was expected to follow was that the number of bamboo extracted should be no more than the number of new shoots produced in the year plus an equal number of mature (i.e., more than three-year-old) culms. Strict adherence to this formula for selection felling and allotting the coupe in such a manner that no extraction was carried out during June, July, and August were expected to ensure sustainable yield. At present, both young and mature shoots of reed extracted simultaneously, which seriously affects the growing stock and food for elephants. The rattans are extracted before flowering and fruiting which affects the natural regeneration and the wild stock of the populations of *C.travncoricus* and *C. hookerianus* are severely depleted and urgent measures have to be adopted to maintain the remaining viable population for the future.

- **Annual forest Fires and forest degradation**

Annual fires are common in evergreen, semi-evergreen, deciduous forests and plantations caused by hill men for hunting game or collecting NWFP, by graziers for promoting a flush of young grass by negligence by wayfarers. Forest fires usually occur during the months of December to May each year.

During 1970- 72, there were very heavy fires in the softwood plantations, especially in the Eucalyptus Plantations and the adjacent evergreen patches. During the last few years also forest fires were frequently reported during summer months. In 2007 -2008 area of 30 ha teak plantation were completely affected by fire. These fires affected not only the plantations but the nearby natural forests also which caused large tracts of forests, included in this working circle, to degrade. Adjoining to these degraded areas there are pockets of blank areas also. The main evil effects of fire are:

a. Loss of humus by burning them down
b. Loss of moisture from the soil
c. Injuries to the standing crop making them susceptible to diseases and
d. Annihilation of microbes.

99% of the annual fires are due to human activities. Fire control measures should be effective to protect the forests and the crop.

Another reason for the degradation was due to the biotic factors like illicit firewood collection, heavy grazing etc. Examples can be seen in Vazhachal and Panjanamkuthu areas of Charpa Range, Karanthodu of Vazhachal Range, Choozhimedu of Kollathirumedu Range, Oolassery, Athirappilly, Vadamuri, Ezhattumugham and Thadimudi of Athirappilly Range and Chully and Ambalappara of Sholayar Range. In Ambalappara area of Sholayar Range, the degradation might have caused due to over exploitation of timber when this area was worked under selection felling system. Attempts have been made to afforest the degraded patches in Charpa, Vazhachal and Kollathirumedu Ranges by artificial means, which also could not prove to be a success. Human encroachments of forest land, penstock pipelines disrupting connectivity for terrestrial mammals and high-tension powerlines disrupting canopy contiguity for arboreal mammals are some of the other threats to the forests of Vazhachal.

- **High infestation of *Mikania* and *Lantana***

The invasive alien species such as *Mikania* and *Lantana* are ready colonizers in disturbed areas and cause considerable ecological damage to India's natural areas, speed the disappearance of threatened and endemic species, reduce the carrying capacity of pastures. These invasive alien plants can prevent or retard natural succession and reforestation by forming dense infestations. Major weeds in the plantations are *Mikania, Lantana camara* and *Eupatorium*. The weeds compete with main crop for nutrients and space, suppress the young regeneration of valuable species and attract fire during summer. The climber *Mikania macrantha* is posing a serious menace to the plantations and natural forests of these areas. So far no effective remedial measures have been developed to eradicate this obnoxious weed. It causes serious damage not only to the plantations but also in Reed brakes. Cutting and removal of *Mikania* are not found to be successful since several shoots develop from the cut portions. Uprooting is a very expensive process. One has to take extreme caution for the destruction of the cut materials so that they may not sprout and establish. Kerala Forest Research Institute, Peechi and several other research institutes are engaged in developing a successful method to eradicate this weed. The forest officers have to keep in constant touch with these research institutions and implement their suggestions in this regard. Till a successful method is devised uprooting is the only way to remove *Mikania*. The uprooted materials may be put in pits along with a few kilograms of common salt.

➢ **Forest pathogens and insects**

The insects include stem borers, sap sucking insects, defoliators, etc. Among these, teak defoliators (*Hyblea puera*) and teak skeletoniser (*Eutectona machearalis)* are the most destructive pests. These pests attack young leaves and there by affect the growth of teak trees in natural forests and plantations. *Tingis beesoni, Calopepla leayana* and *Pteroma plagiphleps* are the other pests of common occurrence. Some of the insects act as vectors in spreading plant diseases. Borers in older trees cause qualitative damage by boring holes in the trunk; termites, aphids, hoppers and root grubs are known to affect nurseries.

Cylindrocladium quinquesptatum, C. ilicicola, C. parvum are the most common fungi. They cause seedling blight, leaf spot, shoot blight, stem canker in species of *Eucalyptus. Corticium salmonicolor* causes stem canker (pink disease) in *Eucalyptus* species.

➢ **High influx of tourism**

Recent survey reveals more than 6 lakhs tourists visit both Athirappilly and Vazhachal water falls each year. The scenic beauty of Athirappilly water falls has always been attractive to filmmakers from Bollywood and South India. Forest Protection Committee of tribes of Vazhachal Forest Division helped to reduce pollution created by tourists, at the same time enhanced the annual income by 8.46 lakhs rupees while generating 1090 man-days of work (KFWD, 2002). However, the negative impacts of unscientifically planned ecotourism on wildlife and their distribution pattern in Vazhachal Forest Division was reported by Animon (1996). The high influx of tourists and their vehicles pose great threat to the wild life and the serenity of the forest area. More over the pollution form plastic bags, unused bottles, deliberate fires are threat to biodiversity.

➢ **Threat to the wildlife**

The alteration of habitats, hunting and poaching the wildlife cause damage to the ecosystem by removing species key to the system's functioning. Vazhachal forests are one of India's highest elephant density habitats and are a crucial corridor between Parambikulam and Malayattur. The change of land use patterns and the proposed Athirappilly Hydroelectric Project by KSEB which involves building a 23 m. high dam to divert water from the Poringalkuthu left bank project through a tunnel and two penstock pipes to a power house will adversely affect elephant movements in the Vazhachal Forest Division. The loss of habitats, hunting, poaching are the main threat to the remnants population of the Western Ghats' endemic and endangered fauna such as forest cane

turtle - *Vijayachelys silvatica*, lion-tailed macaque - *Macaca silenus*, spotted deer. etc. in Vazhachal forests.

➢ **Threat to Fish and bird diversity**

Freshwater fishes are the most diverse group of India's vertebrates with a minimum of 600 species (Talwar and Jhingran, 1991). Conservation Assessment and Management Plan (CAMP) workshop (Molur and Walker, 1998) assessed the conservation status of 327 species and nearly 100 more species have not been assessed to date. Based on the recent conservation assessment, 88 species in Western Ghats streams and 82 species in Eastern Himalayas are in threatened category. Of the threatened species nearly 25-30% are highly endemic to their geographic realms. Habitat alterations and degradation, hydrological alterations, introduction of alien/exotics into reservoirs and over exploitation are the major threats to the rain forest streams of India.

Chalakudy River, the fifth largest river in Kerala, which has never been dried yet, emerges from high ridges of the Western Ghats, harnessed by Sholayar dam flows through the Vazhachal forests. This river is one of the fish diversity centre of India with a total of 104 species including 5 species new to science. The critically endangered fresh water species like *Horabagrus nigricollaris* restricted to a single location of upper reaches of Chalakudy River. Similarly other critically endangered species like *Osteochilichthys longidorsalis, Tor mussullah, Travancoria elongate* and *Travancoria jonesi,* are so far known from the Chalakudy River. The study shows that (Rajeev *et al.,* 2008) indiscriminate collection of ornamental species for international trade is considered to be the major threat to the fish fauna of Chalakudy River. Among them are four critically endangered species (*Homaloptera montana, Horabagrus nigricollaris, Osteochilus longidorsalis* and *Travancoria elonagata*) and as many as ten endangered species, including the most celebrated endemic ornamental species of Kerala, *Puntius denisonii*. Of the critically endangered species, *Osteochilus longidorsalis*, strictly endemic to Chalakudy River is reported to have shown a population decline of 99% in the last two decades (Kurup *et al.* 2004). Similarly, the wild stock of *P. denisonii* is known to have dwindled at a rate of 70% during the years 2000 to 2004 (Sudhi, 2004). The native ornamental fish resources of Chalakudy river is known to be in high demand in the export markets (Sekharan *et al.* 2002) and the river has currently turned into a

hotspot for their indiscriminate collection for international trade. Tribes and forest dwelling communities along the river basin are also highly dependent on the native fish species for their livelihood. Major species exploited by the forest dwelling communities and local fisher folk include big-sized cyprinids like *Tor khudree, Hypselobarbus curmuca, Barbodes carnaticus, Osteochilus longidorsalis*, snakeheads (*Channa* spp) and various bagrid catfish. Species like *H. curmuca, O. longidorsalis* and *B. carnaticus* have medium resilience and their minimum population doubling time extend from 1.4 to 4.4 years, while *T. khudree* has a low resilience and a longer population doubling time of 4.5 to 14 years (Froese and Pauly 2007). Large scale exploitation of such low resilient species as food fish is of critical concern as populations of such species will take long time to recover. Table 2.12 provides details of most common food and ornamental fishes exploited by the local communities around Chalakudy, their threat status and resilience.

Table 2.12 Ornamental and food fishes of River Chalakudy commonly exploited and their threat status

Sl. No.	Species	Threat status	Resilience
	Ornamental		
1.	*Carinotetraodon travancoricus*	Endangered	High
2.	*Devario malabaricus*	Low risk	High
3.	*Etroplus maculatus*	Low risk	High
4.	*Mesonemacheilus triangularis*	Low risk	Medium
5.	*Puntius denisonii*	Endangered	High
6.	*Puntius fasciatus*	Endangered	High
7.	*Puntius filamentosus*	Data deficient	High
8.	*Puntius mahecola*	Not assessed	High
	Food		
9.	*Channa marulius*	Low risk	Medium
10.	*Heteropneustes fossilis*	Vulnerable	Medium
11.	*Horabagrus brachysoma*	Endangered	Medium
12.	*Barbodes carnaticus*	Vulnerable	Medium
13.	*Hypselobarbus curmuca*	Endangered	Low
14.	*Osteochilus longidorsalis*	Critically endangered	Medium
15.	*Tor khudree*	Vulnerable	Low

The main threats to fish resources are due to

- Fishing using chemical and herbal poisons: - Diverse types of fish poisons both of plant chemical origin are widely used in upstream, middle and downstream parts of most rivers including Chalakudy
- Use of chemicals as poisons: - In certain instances copper sulphate and bleaching powder are widely used in areas of rivers where water velocity is low. Fishes become inactivated or intoxicated and fishes including fingerlings are easily caught.
- Using seeds bark and leaves of plants as poisons: - Leaves, stems and seeds of different types of plants are used as poisons in shallow or low velocity waters. The seeds of rattans, palm, Othalathumkaya, Vakkanakkaya are regularly used for fishing.
- Using explosives:- Dynamiting is a major method for catching fishes but is less commonly used to catch ornamental varieties since it kills fishes instantaneously.
- Destruction and modification of habitats: - Dams, bunds and levees act as barriers for free migrations of fish in the rivers. Deforestation accelerated the decline of fish populations due to excessive siltation and soil erosion. The loss of riparian zone is another major threat.
- Introduction of exotic species :- The introduction of exotic and alien species like *Oreochromis mossambicus, Gambusia affinis, Osphronemus goramy, Xiphophorus maculatus* and *Poecilia reticulata* will result in competition for food and space and ultimately in the decline of indigenous species.
- Illegal collection of ornamental species like *Homaloptera montana, Horabagrus nigricollaris, Osteochilus longidorsalis* and *Travancoria elonagata*

The 12 of the 16 species (75%) of the endemic species of birds seen in the Western Ghats are present in the Athirappilly - Vazhachal area. Recognizing the high diversity in birds, Bird Life International (based in Cambridge), in a process of identifying important areas for bird conservation all over the world in 1995, identified the Vazhachal - Sholayar area as an **Important Bird Area (IBA).** It is reported that endemic birds are unable to utilize non-forest habitats resulting from deforestation and conversion of land to other uses, the forest fragmentation and loss of habitat of the restricted range species threatens their very survival and extinction of endemic species is primarily driven by the loss of potential breeding habitat (BirdLife International, 2001).

➢ **Habitat alteration of Horn bills**

The Vazhachal forest division is one of the five important hornbill conservation landscapes, identified in the Western Ghats. The four hornbill species found in the Western Ghats biological diversity hotspot *ie., Ocyceros birostris, Ocyceros griseus, Anthracoceros coronatus, Buceros bicornis*) are found in the evergreen patches in Vazhachal forests division. Due to ongoing habitat loss and hunting in some areas, these species are evaluated as Near Threatened in the IUCN Red List and population of these species are yet to be estimated. Surveys in the fragmented landscape of the Anamalai hills during the year 2000 by NCF, revealed that hornbills can be sensitive to rainforest fragmentation, particularly related aspects such as the decline in the diversity of tree species that provide fruit year-round for hornbills. The studies (Kaimal *et al.,* 2008) on Participatory Rural Appraisal (PRA) to explore and evaluate the relationships between natives of the region and the hornbill population decline which was then incorporated into a Risk Assessment Model. Stella 8.1. Modeling used to quantitatively predict effects of these stressors on the hornbill populations suggests that the populations could drastically decline within ten years. The anthropogenic stressors affecting hornbill populations were identified as logging of primary forests and hunting.

One limiting factor experienced by hornbills is the deficiency of nest holes. So preventing the cutting of old trees will help in a long way to find nest holes. Kannan *et al.,* (2009) indicate that hornbills need evergreen habitats with trees having at least 1.43 m average breadth and 43 m height for their nesting. The Great Indian Hornbill (*Buceros bicornis*), a large frugivorous rainforest bird is among the endangered faunal groups in the Vazhachal Reserve forests. The anthropogenic stressors affecting hornbill populations were identified as logging of primary forests and hunting. The Vazhachal region is one of the strongholds for the Great Indian hornbill and other sympatric species that co-exist there. Twelve nests were identified in the Vazhachal area and "Kadar" tribal people were deployed to watch them. It was developed into a participatory monitoring and conservation programme with the involvement of the community groups (VSS—Vana Samrakshana Samithy) of the forest dwelling Kadar tribes. Since this region is one of the strongholds for the Great Indian hornbill and other sympatric species, a study of the minimum viable population would further provide a focus for the interpretation of ecological and genetic factors that influence the persistence of a threatened population. A

comprehensive demographic monitoring throughout its range is essential to target effective conservation action of the Great Indian Hornbill in this region.

The rainforest fragments of Valparai plateau, and the four protected areas (IGWLS, Chinnar WLS, Eravikkulam NP, and Parambikulam WLS) and the Vazhachal forests serve as important corridor for large mammals such as Asian elephant (*Elephas maximus*), tiger (*Panthera tigris*, leopard (*P. pardus*) and wild dog (Cuon alpinus) and hornbills species. Similar to the other areas the evergreen patches in Vazhachal Division is under threat from human disturbances due to deforestation, developmental activities, conversion to plantation, and habitat fragmentation. This area also represents the elephant migratory route connecting Parambikulam WLS with Pooyamkutty forests.

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

STRENGTH	WEAKNESS	OPPORTUNITY	THREAT
Low elevation evergreen forests	Plantations and reservoirs have fragmented the forests	Biodiversity studies, Easy accessibility	Chalakudy – Pollachi trunk Road bisecting the Division, New projects
High rainfall area located along a single elongated river basin	Five Dams in the River basin	Large area of Riparian forests	Climate Change, Change in Forest type
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
Large resource of Reed and bamboo	Commercial exploitation Increasing human intervention	Food for larger mammals	Overexploitation and possibility of fire
High density of larger mammals	Man - Wildlife conflicts	Notified under proposed core and buffer of PAR-TR Elephant reserve No.9	Poaching due to accessibility, Loss of migration corridors
Best Hornbill habitat in Kerala Cochin forest cane turtle – *Geomyda sylvatica* Rich population of *Dysoxylum*	Loss of absence of lofty trees	High conservation potential	Poaching and inundation, Proposed Athirappilly Hydroelectric project

malabaricum			
High Endemism in fish fauna in Chalakudy River	Erratic flow of water due to impoundments	Potential for developing ornamental fish (Miss Kerala) Declaring as a fish Sanctuary.	Heavy fishing, invasion of exotic fishes Loss of riparian ecosystems.
Athirappilly Waterfall – the best in Peninsular India.	Flow of water in to the fall controlled by electricity generation.	Unique aesthetic landscape, High tourism potential	Proposed Athirappilly Hydroelectric project/ dynamic lighting
Tourism potential	Lack of facilities and trained staff	Carrying capacity based eco tourism	Unregulated crowd, Pollution
Contiguous with Anamalais (Parambikulam TR, Idamalayar-Pooyamkutty Valley), Second largest evergreen block in Western Ghats	Fragmentation due to projects and settlements.	High conservation potential at a landscape level	Chalakudy – Pollachi trunk Road bisecting the division and developing projects
Primitive Kadar tribe in the Watershed	Marginalized	Indigenous knowledge on forest protection Ethnomedicine	Modernization and declassification, Degradation
Plantations of cash crops	Poor performance of oil palm	Afforestation of degraded / failed plantations	Threat to biodiversity, forest fragmentation, human-wildlife conflicts
Large areas of Riparian vegetation	Destruction due to development	Bio prospecting opportunities	New projects

2.4 Strategies to address threats

Strategy 1 Conserve critical species, ecosystems and gene pools

- Endemic and Rare, 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 Minimize the impact of eco- tourism

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

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

2.5 Indicators of success

Criteria and indicators of sustainable forest management are widely used and many countries produce national reports that assess their progress toward sustainable forest management. 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 2.13).

Table 2.13 Criteria, monitoring indicators and Research needs in Vazhachal Forest Division

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. Eg: *Michania* and *Chromolaena*	• Mapping and analysis of Biodiversity hot spot areas. • Identification of threatened species. • Monitor collecting of NTFPs and NTFP dependency of Tribes and fringe area people • 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.
2	Watershed management	• Percent of water bodies in forest areas with significant impairment. • Number of sites with significant soil erosion • Area treated with pesticides, fertilizer, etc. • Waste disposal areas	• Impacts of groundwater development on forest ecosystems, including surface water systems • Inventories of ground water resources. • Baseline data for monitoring changes to biological diversity, pH, sedimentation and temperature change • Aquatic life diversity inventories.
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 quality indicators. • Methodologies for measuring soil quality. • Methodologies for restoring soil quality.

		soil physical properties resulting from human activities.	
4	Forest ecosystem health and vitality	• Area of forest affected by pests, disease, wildfire, etc. (e.g., insect and disease/tree mortality listings/maps, damage appraisal reports, wildfire listings). • Number of sites where illegally deposited wastes and its effects on Wildlife. • 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. •Estimation of tourism carrying capacity
6	Socio-economic function.	People's benefits are enhanced.	• Forest and NTFP dependency of Tribes and fringe area people • Value additions and marketing of NTFP
7	Legal, policy and institutional framework.	Planning and budget allocation available.	• Monitoring of illegal hunting poaching and forest offences.

CHAPTER 3: HISTORY OF PAST MANAGEMENT, PRESENT PRACTICES AND FUTURE CHALLENGES

3.1. Conservation and forest management history

Before the integration of the then Travancore and Cochin States, the forest areas were in the possession and control of Naduvazhis -the Feudal Chiefs who in turn owed allegiance to the Raja of Cochin. On many occasions these forests were claimed from several quarters, few instances of which are:

1. In 1853, Coimbatore claimed the famous Parambikulam valley, which was rejected by the Jury, after an inquiry.
2. In 1886, Travancore claimed the whole of Idiyara Valley
3. In 1893, Malabar also put forth a claim for Parambikulam Valley.

The claim of Malabar was allowed. As a result Parambikulam Valley was handed over to Malabar. However, the claim of Travancore was allowed only partly i.e., the forests from Athirappilly to Ezhattumukham were handed over to Travancore.

The forests were first divided into territorial Divisions during 1809-1810. But again in 1907-1908, the above system was abolished and the whole forests of Cochin were divided into 3 Ranges with sub Ranges under them. Again, since the system was not good in decentralizing the powers, a change was effected during 1937-38. This is the starting of the administration with Ranges as its units. Till 1944, this system continued and due to pressure of works again the Division system was restored. Consequent to the integration of the then Travancore and Cochin States in 1949, the forests of Cochin were divided into two Divisions viz., Chalakudy and Thrissur with their headquarters at Chalakudy and Thrissur respectively.

Abolition of monopoly: The teak, rosewood and ebony trees were the monopoly trees and were the property of the State Government wherever they grew. But by a Royal

proclamation issued on 13.10.1928, the full rights for the monopoly trees standing in private lands were conferred to the owners or the occupants as the case may be.

Four out of five Ranges of the present Vazhachal Division were part of one Range viz. Vazhachal and the remaining one Range i.e. Athirappilly was part of Kalady Range of Chalakudy Division. Sholayar Range was formed in 1962 and the remaining three Ranges, viz. Athirappilly, Charpa and Kollathirumedu, in 1981. All the above Ranges of the Division except Athirappilly were part of former Vazhachal Range, Athirappilly being formed in 1981 out of a portion of Kalady Range of Chalakudy Division.

Working plans and scientific management of the forests

Before the formation of Vazhachal Division, the forests were managed as per the Working Plan prescription of Chalakudy Division. Sri. T .P. Viswanathan's Working Plan prescribed five working circles:

a) Conversion working circle
b) Selection working circle
c) Bamboo working circle
d) Minor Forest Produce working circle
e) Protection working circle.

a) Conversion working circle: To achieve the aims of management, the working circle was again divided into two felling series (1) Teak felling series and (2) Softwood felling series.

The teak felling series consisted of all the existing teak plantations and the areas suitable for conversion. This falls in the present Chalakudy Division (Pariyaram Range). 2200 Acres (890.300 ha) in Vazhachal Range were set apart for planting softwood during the plan period and the entire area was worked and softwood species planted in softwood felling series. The earliest teak and softwood plantations (Elavu) were raised in

Vazhachal Range in 1972 and 1955 respectively. Mixed plantation of teak and elavu was first raised in Vazhachal Range in 1958.

(b) Selection Working Circle: In selection working circle there were 4 felling series. viz.

a) Kodassery Felling Series.
b) Vazhachal Felling Series.
c) Anakkayam Felling Series.
d) Chandanthodu Felling Series.

During the plan period coupes 1 and 2 of Kodassery felling series and coupes 1 and 2 of Anakkayam felling series were only worked (during the years 1956 -1958). No coupes were worked in other felling series. The reason for not working the entire areas during the plan period is due to obligatory fellings done in the Sholayar reservoir area.

(c) Bamboo working Circle: This working circle overlapped all the areas of conversion, selection, protection and minor forest produce working circles. All the bamboo and reed areas, which were covered by this plan, came under this working circle. The aim was to provide the needs of bamboo and reed for the local population to provide for enough materials for rafting timber when water transport through the proposed lake becomes feasible. The bamboo-working circle was not divided into annual coupes.

(d) Minor Forest Produce Working Circle: This area extends over the whole of the plan area overlapping every other working circle. As such the prescriptions in this working circle will apply equally to all other working circles. The rights of collection of M.F.P. were sold in public auction from each Range separately or if found expedient for the whole Division.

(e) Protection Working Circle: The areas not included in the selection working circle for reasons of inadequate stocking and requiring rest and recuperation, inaccessible areas where from no extraction of timber was possible on account of the extremely difficult terrain and for want of extraction facilities and areas that were preserved for reasons of climate and erosion formed the working circle.

According to the Working Plan for the period from 1969 -70 to 1978 -79 there were 6 working circles. Only those working circles relevant for Vazhachal and Sholayar Ranges are mentioned here.

Softwood working circle: An extent of 814 ha was prescribed for Vazhachal Range. 599.31 ha was cleared and planted during the plan period. 100 ha with Teak and balance 499.31 ha with teak and elavu in mixture. During 1970, 24.21 ha had been planted with silver oak. There are no more areas available under softwood felling series. The reason for planting teak alone is attributed to the failure of softwood nursery.

Evergreen selection working Circle: Total area proposed under this working circle was 5526 hectares. Two felling series were proposed, viz., Chandanthodu felling series 3206 hectares and Anakkayam felling series 2320 ha both in Sholayar Range. Estimated yield per hectare from Chandanthodu felling series was 11.58 m^3 and from Anakkayam felling series 7.13 m^3. The species selected for felling were *Vateria indica, Palaquium ellipticum, Machilus macrantha, Lophopetalum wightianum, Mangifera indica, Dipterocarpus* species, *Cullenia excelsa, Dysoxylum malabaricum* and *Calophyllum tomentosum*. During the plan period 2856.56 ha have been worked in Chandanthodu felling series and 564.04 ha in Anakkayam felling series. It is seen on actual working that 18.82 m^3. of timber per hectare have been obtained from Chandanthodu felling series and 11.05 $m^3$from Anakkayam felling series. The species felled and removed were as per the working plan prescriptions. The number of trees per hectare to be removed as per working plan prescriptions was 25 trees/ha. On actual working it is seen that on an average 6 trees were removed from Chandanthodu and 5 trees from Anakkayam felling series.

Regeneration in Selection Felling Area: The previous Working Plan of Sri. John Koilparambil prescribed cleaning, girdling of valueless species, thinning etc. in the selection felled areas for developing natural regeneration.

History of industrial plantations: This Division was constituted by reorganizing the then I.P. Divisions, Perumuzhy, Vazhachal and part of Kalady (I.P. Range No. I & II Athirappilly) and the areas of Vazhachal and Sholayar Ranges and part of Kalady Range of Chalakudy Division.

In the then industrial plantation circle, Perumbavoor, the major operations carried out were raising species of trees of industrial importance, main species of which were *Eucalyptus, Albizzia, Erythrina, Trema*, Elavu etc. For this purpose, a large tract of good and virgin evergreen and semi-evergreen forests were cut and removed and *Eucalyptus* was planted. But the *Eucalyptus* plantations failed resulting in the extinction of a large tract of both evergreen and semi-evergreen forests from Kannamkuzhithodu to Anakkayam bridge over a length of 22 km.

There was a proposal for sleeper operation in the evergreen and semi-evergreen forests of both Vazhachal and Sholayar Ranges. The marking of trees has been completed, but due to policy changes in barring selection felling, the felling could not be taken up.

These operations were carried out based on the Annual Plan of Operations approved for Vazhachal Division during every financial year.

Result of operations

Teak plantations: In Athirappilly Range majority of the plantations are heavily infested with *Mikania*. The growth of these plantations is affected by the infestation. Elephant attack also damages the younger crop. Overall stock position is below 75%. On an average, stocking is 55-70%.

In Vazhachal Range, besides *Mikania* infestation, grass infestation is more prevalent. Stock is below 70% in all plantations. Stocking varies from 50-70%.

In Charpa Range also stocking is below 75% due to *Mikania* infestation.

In Kollathirumedu also *Mikania* and grass infestation are common.

Miscellaneous plantation: Almost all plantations are attacked by elephants. *Mikania* infestation is prevalent. Growth of Elavu is very poor. The details are given in Appendix XI.

3.2 Other land use – villages, agriculture, developmental programmes, and tourism

Present management of tourism zone: The tourist spots are frequently visited by thousands of tourists through out the year. Hence there is heavy biotic pressure on the forests severely affecting the environmental hygiene and resulting in a lot of soil erosion, accumulation of garbage, occasional instances of fire and spoiling of natural beauty. Participatory Forest Management has been introduced recently with the objective of conserving and protecting the existing forests from various types of biotic interferences and for maintaining the environmental hygiene, creating awareness among the people about the needs to conserve the forests and involving the tribes in the management of forests aiming at enhancing their standard of living. This has been achieved by constituting a Vana Samrakshana Samithy (VSS) of Tribes residing in the Vazhachal colony.

3.3 Research, monitoring and wildlife health

There were many studies in the past conducted by different research institutions and NGOs. The main studies on Vazhachal forests include floristic inventories, riparian ecosystems, population studies of few small mammals, surveys on birds including hornbills, survey on fishes, Chalakudy river basins etc.. Several studies led to the discovery of species new to science. The scientific inventory on floral wealth of the Division has been conducted by Sasidharan and Sivarajan in 1996. Sasidharan, *et al.*, (1996) in their report on botanical studies in the medicinal plant conservation areas in Kerala, pointed out the medicinal plants of this region. Nair and Jayasree (1986) reported the occurrence of fungus *Cylindrocladium colhounii* on eucalypt plantation in Vazhachal. The habitat utilization of animals and their parasitic burden with special reference to elephants in this Division were carried out by Animon (1996). Animon *et al.*, (1997) also

conducted studies on the tourism opportunities and management impacts in Vazhachal areas. Animon *et al.* (1997) studied the debarking behavior of elephants in the Division. Nameer and Cheeran (1996) and Susanth Kumar (1996) recorded the birds in the Division. Raju (2002) conducted some preliminary survey on birds of Athirappilly-Vazhachal area.

Jayasree (1996) conducted detailed research throughout river basin of Chalakudy River and studied the spatial and temporal distribution of rainfall and stream line flow over the basin. George (1998) studied the preliminary assessment of the impact of man-made modifications on Chalakudy River system and the history of the river has been studied by Unnikrishnan *et al.* (2002). In 2002, Sekharan *et al.*, studied about the importance and threats of ornamental fishes of Chalakudy Riverine resources and Amitabachan (2003) conducted studies on riparian vegetation along the middle and lower zones of the Chalakudy River. Gopalakrishnan *et al.* (2004), using micro satellite DNA markers assessed population structure of red tailed barb *Gonoproktopterus curmuca* in Vazhachal and Bhuthathanketuu areas and indicated narrow genetic diversity due to reduction in effective breeding population size possibly due to overexploitation, restricted migrations and habitat alterations.

Mohanan (2004) reported witches' broom disease caused by *Balansia linearis* of reed bamboos in this area. Hosagoudar (2006) in his study of meliolaceous fungi on economically important plants in India discovered three new species from Vazhachal forests. Rajeev *et al.* (2008) conducted detailed study on the patterns of distribution, threats and conservation needs of fish fauna of Chalakudy River. Balasubramanian *et al.* (2007) conducted detailed studies on richness of vertebrates and spatial features of selected large mammals and arboreal fauna in Anamalai region, and pointed out the situation of these groups in Vazhachal forests.

Mathew and Rugmini (2005) conducted a detailed study on the insects of Sholayar region. They reported maximum species richness and species diversity from undisturbed

areas. The insect and plant diversity indices were significantly correlated which shows that reduction in plant diversity will adversely affect insect diversity.

There is a big gap in the knowledge of the biodiversity resources of this forest Division. No systematic studies were carried on lower groups of plant kingdom such as algae, liverworts, mosses, lichens and ferns. There is no information with regard to soil microflora, aquatic microorganisms, arthropods, mollusks and wild animal parasites.

Preliminary studies have shown that there are several species of endemics in all the vertebrate groups, but except the larger mammals nothing or very little information is available about their distribution, abundance and habitat requirements in the Division. 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. The past history of the Division before the construction of the dams is yet to be traced for making an objective assessment of the human impact. At present, there is no institutional arrangement to monitor the wildlife health

3.4. Nature education and interpretation

A Nature Education and Interpretation Centre was established at Vazhachal in 2005. Around 40,000 people visit this centre annually. The details of flora, fauna, and the information on vegetation, landscape and different collection of forest seeds are well displayed here. Kerala Forest and Wildlife Department are conducting nature camps in the centre for the school and college students of Government - recognized educational institutions and for NGOs. The 3 - day camps include the biodiversity classes, field visits, trekking, etc.

3.5. Administration and organization

The Division is headed by Divisional Forest Officer. The Division is further subdivided 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, Athirappilly, Charpa, Vazhachal, Kollathirumedu and Sholayar in the Division (Table 3.1).

Table 3.1. Posts in Vazhachal Division

SI No.	Designation	Sanctioned strength	Present Strength
1	Divisional Forest Officer	1	1
2	Senior Superintendent	1	1
3	Junior Superintendent	1	1
4	Head Accountant	1	1
5	LD/UD Clerk	18	16
6	UD Typist	1	1
7	LD Typist	1	1
8	D' Man	1	0
9	UD Compiler	1	1
10	Driver	6	5
11	Peon	10	7
12	Ranger	5	4
13	Deputy Ranger	8	4
14	Forester	27	21
15	Forest Guard	100	63
16	Watcher cum Cook	1	1
17	PT Sweeper	4	4
Total		**187**	**132**

Forest Department does not maintain any permanent labourers and utilise the services of hired labourers for both skilled and unskilled works. Preference will be given to tribes from nearby tribal settlements from Poringalkuthu, Athirappilly, Vazhachal, Watchmaram and Malakkappara. Work such as raising of nursery, planting, cultural operations and tending, weeding, climber-cutting, soil working, extraction of timber,

poles and firewood, fire-protection, boundary consolidation is carried out either departmentally, by engaging local labourers. For additional support in tourism management and protection, fringe area people are being engaged on daily wages.

3.6. Future challenges

- Climate change: - Due to degradation of evergreen patches and loss of biodiversity.
- Increasing human – wildlife conflicts: - Due to alteration of wild life corridors, change in land use patterns, degradation of watersheds
- Scarcity of drinking water supply: - Due to deterioration of watersheds and river pollution of Chalakudy river basin.
- Increasing environmental pollution:
    - The pollution is mainly due to high influx of tourists in Vazhachal. The tourists dump the plastic wastes and bottles in the forests areas endangering wildlife.
- Non-Timber Forest Products (NTFPs) are of growing importance, particularly in local market for medicinal purposes. Yet there are many data gaps with respect to the production and consumption of NTFPs. Moreover, data need to be collected in a uniform fashion.

Conservation and management of forests in Vazhachal Forest Division need to be guided by the following two principles.

1. Ecosystem integrity has to be maintained /enhanced and
2. People's benefits have to be maintained and enhanced.

The challenges in the future refer to participative conservation and management of the forest cover to derive direct and indirect benefits from the forests. The traditional attitudes and methods of protection by the Department staff alone and keeping the resource away from local population will only cause alienation developed negative

attitude from stakeholders. This will lead to progressive loss of forest cover, extinction of rare fauna and flora and lowering of environmental services of forests. The proposed Athirappilly Hydro-electric Project is also a major threat to the flora and fauna of Vazhachal Forest Division.

Hence the challenge before us is to evolve and implement a prospective, significant, sound, conservation oriented management plan for protecting and enhancing the high biodiversity value of Vazhachal. The present proposal is a humble beginning to this long - term exercise.

CHAPTER 4: FUNCTIONAL SECTORS IN THE LANDSCAPE

4.1 Forestry (D*)

Plantations

The main plantations in the working circles are teak (3891.37 ha), teak – elavu mixed plantations (1777.99 ha) and miscellaneous plantations (1610.90ha) of *Albizzia,, Ailanthus triphisa, Acacia auriculiformis, Swietenia mahagony, Morus alba, Erythrina, Sesbania, Trema orientalis* and *Vateria indica* covering a total extent area of 7280.26 ha. In general, the teak plantations of all these Ranges come up very well, provided they are properly maintained. In many plantations tending operations like weeding, climber cutting, *Loranthus* cutting and thinning could not be carried out in time, which in turn resulted in the poor conditions of the plantations. Most of the plantations are good with regard to growth and stock. The climatic, edaphic and topographic factors are ideal for the growth of the plantations but poor maintenance resulted in the poor condition of some of the plantations. Weeds, climbers and *Loranthus*, which are detrimental to the crop are plenty in almost all the plantations. *Mikania macrantha* is seen smothering teak plants in young and middle aged plantations. The other adverse factors are attack by stem borers, defoliators and wild animals. Grazing and fire in younger plantations retard the growth of teak. Growth of bombax trees on stream banks and in small pockets is good. The performance of softwood in plantations in Vazhachal Division is not good. Some softwood plantations support good natural regeneration of local species especially of reeds.

The productivity and performance of species in miscellaneous plantation in the Division, cannot be assessed as successful except for teak plantations. The failure of these plantations was mainly due to damage caused by fire, fungus and wildlife. Some areas of the Division were converted into pure plantations of Bombax and silver oak. A few mixed plantations were also raised with a mixture of teak, *Bombax* and *Ailanthus*. In Teak-softwood mixed plantations the stocking of softwood such as *Bombax* and *Ailanthus* is very poor, presumably because of the poor survival of *Bombax* and *Ailanthus* seedlings and their replacement with teak stumps during subsequent years. Now these teak-softwood mixed plantations are more or less like pure teak plantations with few softwood saplings here and there. Some other areas were planted with species like *Acacia,*

Mahogany, Mulberry, *Erythrina, Sesbania, Trema* and *Vateria*. These plantations are also poorly stocked.

The purpose for which such species were raised in smaller extents are not very clear. It is presumed that these species were raised on an experimental basis to watch their performance and to meet the demand of plywood, firewood and green manure. But the aim could not be achieved fully since some of the species did not give satisfactory results. It is felt that these areas are primarily suited for teak. In many such plantations natural regeneration of local species and reeds has come up well. Such areas can be protected as such. If these species cannot be economically extracted, the plantations may be left to nature with strict protection to get themselves gradually converted to natural forests. A considerable portion of these plantations are now understocked or failed. This was mainly due to frequent fires, fungus attack and damages caused by wildlife, especially elephants. Attempts were made in the past to restock the areas. But such attempts did not yield desired results. Now these areas support sparse growth of planted species and natural regeneration. In low-lying valleys, the stocking and growth of these tree species are comparatively better. All these areas are covered with dense growth of grasses, *Mikania* and other weeds. In most of this type of areas, slope is steep and hence it resulted in soil erosion and gully formation. Such areas are mainly seen in compact blocks at Charpa, Panjanamkuthu, Lakhsmi-Karanthodu, Orukomban and Anammukku.

The plantations in Vazhachal forests account for the 21.4% of the total area in the Division. The plantations are found lining the entire riparian vegetation from the Poringal up to Athirappilly on either side of the river except some natural forest areas in Charpa region, on the right side of the river. These plantations are found to evade the riparian zone at many places, near Poringal powerhouse, near Vazhachal Bridge and near Ittiany.

Teak plantations and destruction of understory vegetation has caused severe soil erosion in the Division. The riparian vegetation in the Ittiany area is also damaged severely. The plantations have invaded the riparian zones and severe soil erosion and occurrence of fire has noticed in this region. The dry deciduous nature of the plantations and high amount of heat reflections by the teak leaves and high risk of forest fire has seriously damaged the remaining riparian vegetation. The streams in the plantations hardly posses any kind of riparian vegetation and every stream has lost their perenniality.

4.2 Agriculture (D)

Agiculture is practiced in some of the tribal settlements only. In Vazhachal Forest Division large scale argricultural operations are carried out by two major concerns; PCK cultivationg rubber, oil palms in areas of Athirappilly Range (3545.51 ha) and Tata Tea holding some coffe plantations in the border of Tamil Nadu. The existance of these together with the enormous labour force employed is detrimental to the contiguity and integrity of forests. Further, wildlife movement is hampered and there are a number of cases human wildlife conflicts (cattle lifting, elephant and leopard menace). The soil loss caused during replanting operation is unmeasurable. The threat of fire from labour camps of these plantations is severe.

Tribals and certain non tribals living in enclosures within the Vazhachal Forest Division also practice agriculture, but in a very small scale. It is mainly of the homesteads 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 (Ecodevelopment, Development through District administration (D).

Panchayath has a housing scheme in the Vazhachal Division. Kerala State Electricity Board, Tribal Department and Health Department have projects in the Division. There is one Primary Health Centre and one UP School at Malakkappara. A Girijan Development Society, functioning at Malakkapara, is a co-operative society which was started as part of the Western Ghat Development Programme 1981-82. The Jalanidhi Project implemented in Athirappilly Grama Panchayath has supplied potable water to a few tribal settlements. The Panchayath roads are maintained by the LSG Department.

4.4 Tourism (D)

Vazhachal is fast emerging as a potentially sustainable region for ecotourism development and is a viable alternative to the conservation of forest and enhancing the standard of living of the dependent communities. The biggest waterfall in Kerala is at Athirapally. There are two hydel projects namely Sholayar and Poringalkuthu on the upstream side of Athirappilly falls. There is a beautiful cascade and a seasonal waterfall

at Charpa. This Division has evergreen, semi-evergreen and moist deciduous forests, with vast variety of flora and fauna. There are hills and dales with rocky outcrops. All these make Vazhachal a potential area and tourism has been developed and is being managed by VSS on a large scale. The strategy should be to emphasize on pro-poor tourism, focusing on increased economic benefits, enhancing non- economic impacts and promoting a more supportive policy. A participatory approach to the development of ecotourism in the site will ensure both economic and environmental security in Athirappilly –Vazhachal recreation site.

Major tourist attractions

Athirappilly Water falls

Emerging from the high ridges of Western Ghats, Chalakudy River is harnessed by a dam at Sholayar. The tail water is reused at Poringal and it finally emerges out of Vazhachal forests as magnificent natural waterfalls at Athirappilly, with the lush green and enthralling site of the evergreen forests as a backdrop. Height of the falls is 42 m, width 220 m being a place of great scenic beauty; several movies have been shot here. A large number of tourists visit this "falls" round the year.

Charpa Water Falls

This small but magnificent Water falls lies on the left side of the road, 3km from Athirappilly Water falls on the way to Vazhachal I.B. During rainy season this Water falls, having a slanding height of 63 m and width of 28.3 m, presents a beautiful site.

Vazhachal Picnic Spot

This picnic spot is 5 km from Athirappilly Water falls with lush green forests and lofty trees on its left side, a stream having a good fall of water and a small garden. Tourists frequent in this area include students, scientists, nature lovers and foreigners who come here to enjoy natural beauty of these forests. A refreshment stall run by the Vazhachal Staff Co-operative society caters to the needs of the tourists.

Poringalkuthu Hydel Tourism of Athirappilly Hydel Tourism Circuit is located near the Poringalkuthu Dam, just 11 kilometers ahead of the Athirappilly waterfalls, 31 kms east of the town of Chalakudy in Trichur District. Poringalkuthu Hydel Tourism has much in

store for the visitors including boating facilities, medicinal plant garden, and natural forest areas.

Present Management of Tourism Zone

The tourist flow to these sites started since 1980 but after 1990s the tourist flow has increased at an alarming rate, which is a potential threat to the conservation of biodiversity. The continuous presence of tourists and their vehicle pose great threat to the wild life and to the serenity of the forest area. Due to this increasing number of tourists visiting the waterfall and nearby area, the Kerala Forest Department developed a picnic spot at Vazhachal during 1990s. Some trek paths and nature trails were developed in the natural forest to give the visitors a feeling of being amidst nature. A nominal fee was established since 21.12.1993 onwards (Rs.2/- for adults and Rs. 1/- for children) at Vazhachal and at Athirappilly no entry fee was collected during that period. The major economic benefit from tourism in the recreation area is the employment generated and business opportunities.

These tourist spots lie in one of the most important ecotourism zones in Central Kerala. Hence, there is heavy biotic pressure on the forests due to tourists which severely affect the environmental hygiene resulting in a lot of soil erosion, accumulation of garbage, occasional instances of fires and spoiling of natural beauty of the forests. Participatory Forest Management by constituting a Vana Samrakshana Samithy (VSS) has been introduced recently with the objective of conserving and protecting the existing forests from various types of biotic interferences and for maintaining the environmental hygiene, creating awareness among the people about the needs to conserve the forests. The details of VSS are already given in the Chapter 1.12.

Vana Samrakshana Samithy (VSS)

An area of 788 ha has been covered under the above VSS, registered as tribal VSS No. 331-1/2001 with the Conservator of Forests, Central Circle Thrissur, under the provisions of G.O (RT) No. 40/2001/Forests dt. 2-2-2001. The VSS had decided to generate financial resources through levy of service charges @Rs.3/- per adult, Re.1/- per Child (between 12-15 years of age) and parking fee for maintenance of parking place and protection of the vehicle, @ Rs.5/-, Rs.3/- and Rs.2/- for heavy, light and medium and two and three wheelers respectively for Vazhachal Picnic Spot with effect from 15-02-

2001. The resources so generated will be utilized for protecting the forests from various types of biotic interferences developing minimum basic infrastructure facilities for tourists, maintaining environmental hygiene for full enjoyment of tourists which would include drinking water, garbage disposal, toilets, maintenance of existing treck paths, engaging trained tribal men for safety of the tourists, creating awareness among public through classes, distribution of pamphlets etc. and arranging adventurous trekking on the prescribed routes with the help of trained tribal guides.

4.5 Fisheries (D)

Fishing is done in a small scale by the tribals. Fishing is one source of income to the tribals of Malakkappara. Usually conflicts occur between the fishermen from Tamil Nadu and Kerala. The areas of Vazhachal Bridge near Ittiani and Athirappilly falls, stretch between the Poringal powerhouse and Vazhachal waterfalls are the main fish resource areas idenfified by the Kadar communities (Amitabachan, 2003). Fishes weighing upto 7-12 kg have been collected from this area. During favorable seasons they can catch upto 5-15 kg at a time. The common fishes include Choora, Pachilavetti, Modan, Aral and Tilapia.

4.6 Tea/Coffee Estates (I **)

Tata Tea estate at Malakkappara is in the border of the Division with Tamil Nadu.

4.7 Road/ Rail transport (D)

Road: The Chalakudy- Pollachi State Highway 21 passing through Athirappilly, Vazhachal, Poringalkuthu, Sholayar and Malakkappara traverses through the Division. Expansion of traffic and improvement of this road can harm the biodiversity in the area. There are other roads belonging to Panchayath and Forest Department. Strict regulation on traffic has to be enforced on the state highway by:

1. Installing checkposts and regulating odd hour traffic and
2. Installing road signs and boards to alert drivers regarding animal movement, non-littering of the wastes.

Railway: The Shornur-Cochin railway line passes through Chalakkudy which is 28 km from the Division.

4.8 Industry (D)

There is one latex (rubber) processing factory (Plantation Corporation of Kerala) at Athirappilly. Other than this there is no other major industry in Vazhachal Division.

4.9 Mining (D)

There are no mining activities in this Division.

4.10 Thermal power plants (I)

There is no thermal power plant in this Division.

4.11 Irrigation projects (D)

There is no irrigation project in this Division

4.12 Temple tourism (D)

There is no temple tourism in this Division.

4.13 Communication projects (D)

One Mobile Tower is erected in the area which is leased out to KSEB. Other than this there is no communication project in this Division.

4.14 Power line (D)

There is one main powerline extending from Sholayar Power House to Kannamkuzhi traversing through Poringalkuthu Power House having a length 22.44 km. There is another line arising at Vazhachal and traversing south to a distance of 10.25 km. The power lines too bifurcates the forests disrupting continuity.

* D : Affects wildlife directly
**I : Affects wildlife incidentally

CHAPTER 5: LAND USE PATTERNS AND CONSERVATION-MANAGEMENT ISSUES

5.1 Land use classification

The total extent of the forest coming under the Division is 41394.398 ha which include both the natural forests and plantations. An area of 1198.71400 ha is handed over for the purposes of Hydro-electric projects, tribal and harijan colonies and long-term leases for estates. A total of 34114.138 ha area is covered with the natural forests (Table 5.1; 5.2). The effective area to be dealt with in this Working Plan is 41394.398 ha, the details of which are as given below:

Table 5.1. Division of the area

SI No.	Category	Extent (ha)
1	Natural Forests	34114.138
2	Teak	3891.370
3	Teak & Bombax	1777.990
5	Miscellaneous Plantation	1610.900
Total		**41394.398**

Table 5.2. Details of area under non - forestry practices

Total area (ha)		**41394.398**
i.	Area leased out to private persons for cultivation	813.7291
ii.	Area leased out to Plantation Corporation of Kerala Ltd.	545.510
iii	Area leased out for Hydro-electric project	249.7329
iv.	Poringal Church	0.184
v.	Hill men settlements	134.968
vi.	Encroachments	Joint verification yet to be completed
Effective area		**39650.274**

Ramesh *et al.* (2003) carried out a vegetation analysis of the landscape and identified 21 landuse types (Map 6). Percentage-wise distribution of major vegetation types is given Table 5.3.

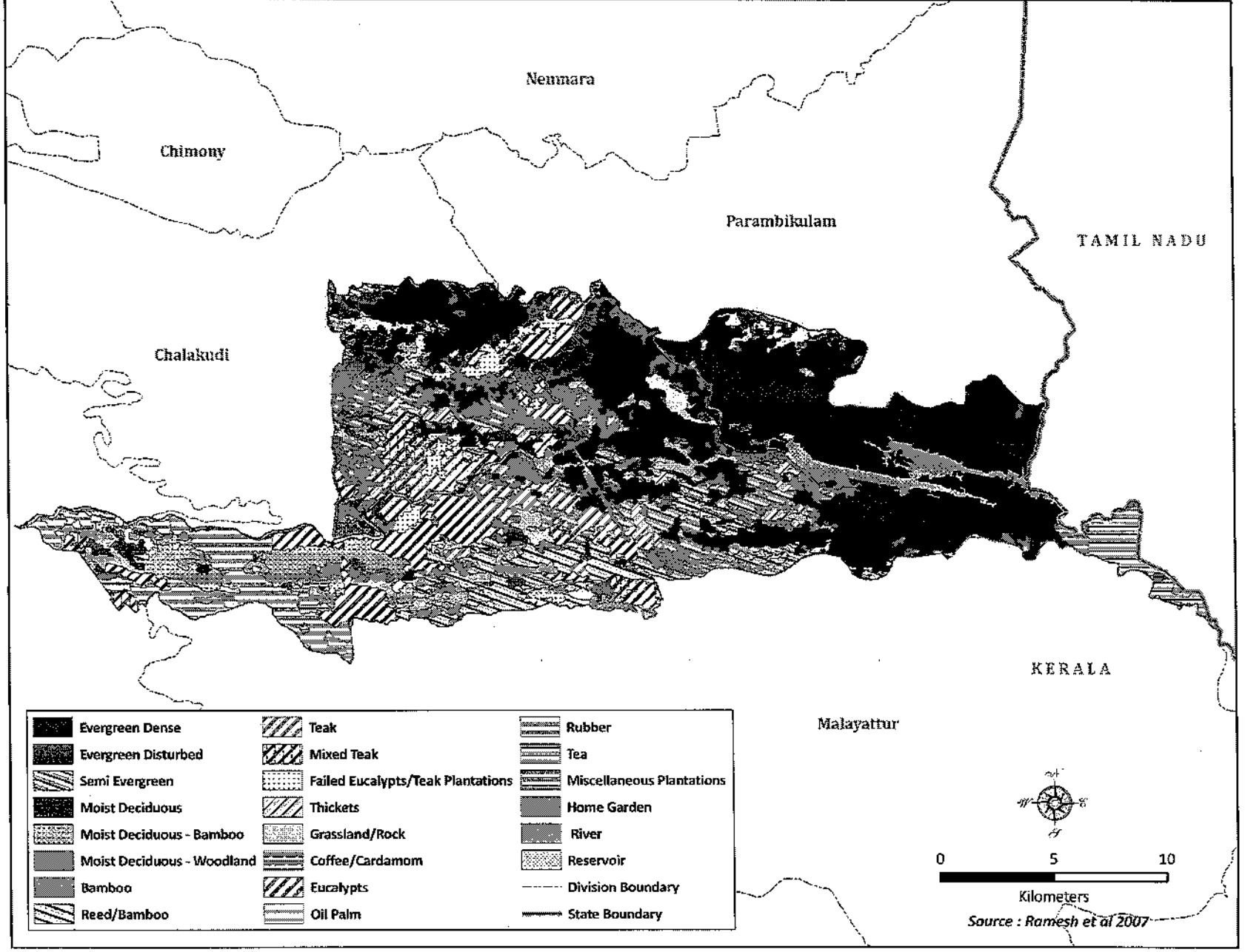
Table 5.3 Present Land use of Vazhachal Forest Division

Sl.No.	Types	Percentage
1.	Evergreen and semi-evergreen	52.1
2.	Secondary moist deciduous	13.3
3.	Degraded forests	3.8
4.	Grasslands	2.7
5.	Forest plantations	22.3
6.	Plantations	3
7.	Water body	2.8
Total		**100**

It is evident from the Table that more than 50 percent of the area belongs to evergreen and semi-evergreen forests which is the repository of high value biodiversity of both flora and fauna. Nearly one-fourth of the area is under forest plantations of different species. The plantations, which are failed or poorly stocked, can be successfully transformed in to natural forests through research and subsequent action.

5.2. Socio economic profile of villages

There are eight tribal settlements in Vazhachal Forest Division (Table 5.4). Seven settlements belong to the primitive tribal group "Kadar" and one to "Malayar". These settlements come under Athirappilly Grama Panchayath. All are dependant on forests and at present are members of Vana Samrakshana Samithi (VSS). Collection and marketing of Non Timber Forest Products is the main source of income and NTFP is sold through Girijan Society (depots are situated in Vazhachal, Watchumaram and Malakkappara).



Map 6 Landuse of Vazhachal Forest Division

Table 5.4. Total population of eight colonies

Colony	Boys (Age up to 14 yrs)	Girls (Age up to 14 yrs)	Men (Age from 15 yrs)	Women (Age from 15 yrs)	Total Male	Total Female	Total
Vazhachal	41	35	50	60	91	95	186
Pokalappara	9	15	30	32	39	47	86
Poringalkuthu	13	14	36	39	49	53	102
Mukkumpuzha	10	11	12	14	22	25	47
Watchmaram	20	22	51	50	71	72	143
Thavalakuzhippara	17	30	42	51	59	81	140
Sholayar	15	22	29	34	44	56	100
Malakkappara	28	42	53	57	81	99	180
Total	**153**	**191**	**303**	**337**	**456**	**528**	**984**

The tribes are slowly getting absorbed into the mainstream through employment, healthcare, education and cultural opportunities. The details of each settlement are provided below:

1. **Vazhachal Colony:** Vazhachal colony is situated 5 km. east of Athirappilly and 44 families of Kadar live there. Of the 44 houses, 9 are terraced, 23 tiled and 12 thatched. Nine families have access to potable tap water (Jalanidhi). The income and expenditure patterns of Kadars in Vazhachal colony are given in Figs 5.1 and 5.2. Figure 5.1 illustrates the major share of the income is from NTFP and tourism. There is a VSS engaged in tourism and members work in Vazhachal picnic spot as guides, cleaners, etc. Honey, black dammar, *Myristica*, etc. are the major non-timber forest products. Over and above, the Kadars are employed in wage labour which is also a main source of income. The main areas of expenditure (Fig. 5.2) are for food, alcohol and social customs. Nine families depend on pipe water connection under Jalanidhi drinking water project.

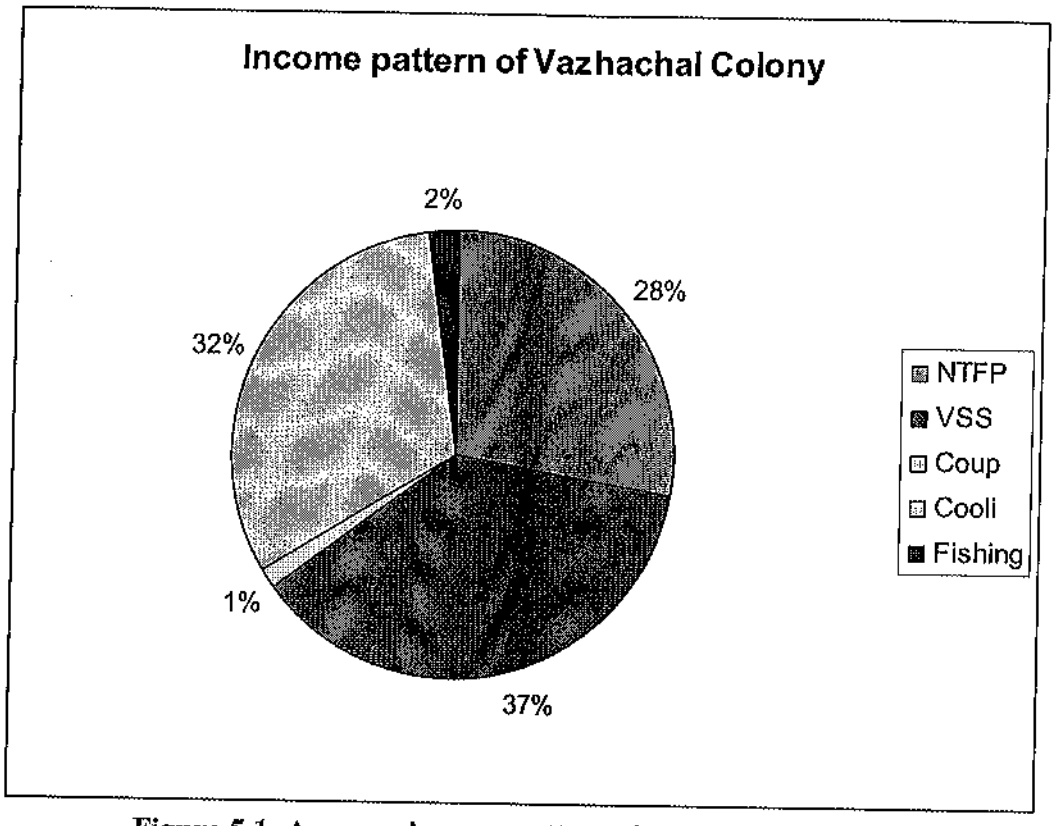


Figure 5.1. Average income patterns in Vazhachal colony

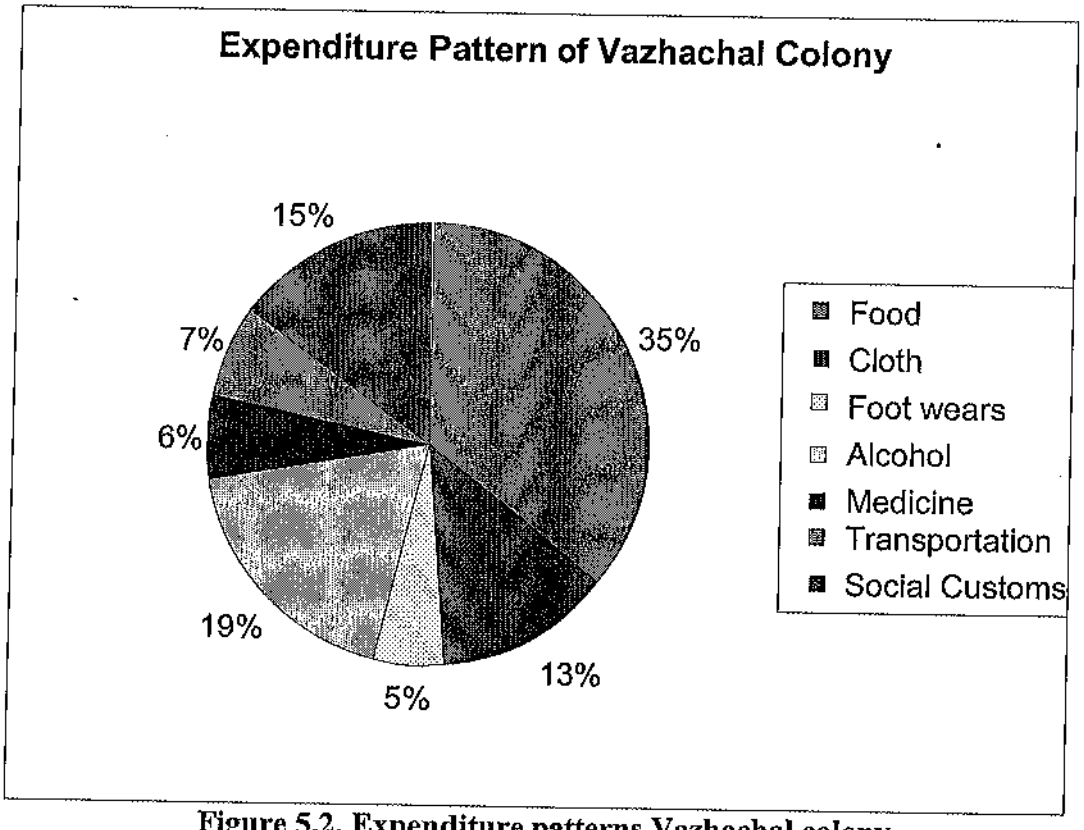


Figure 5.2. Expenditure patterns Vazhachal colony

2. Pokalappara Colony

Situated 9 km to the east from Athirappilly the colony is occupied by the Kadar community. There are 24 families dependent on NTFP, wage labour and VSS activities for their livelihood. The average income is Rs. 4895 and expenditure Rs. 2413 per month. Eleven families in the colony are dependant on NTFP and 16 on VSS. The houses are electrified and few rare cattle. All houses are terraced. Fourteen families rely on river for water while 10 have tap water supply (Jalanidhi). Pattern of income by expenditure are provided on Figs. 5.3 and 5.4 respectively.

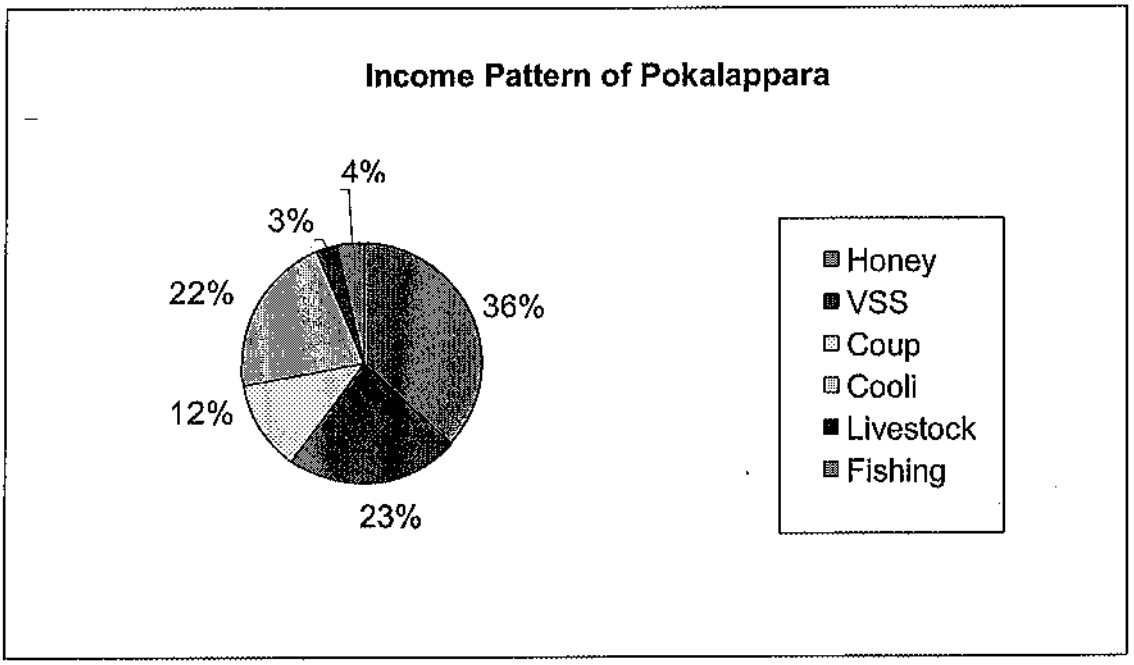


Figure 5.3. Average income patterns in Pokalappara colony

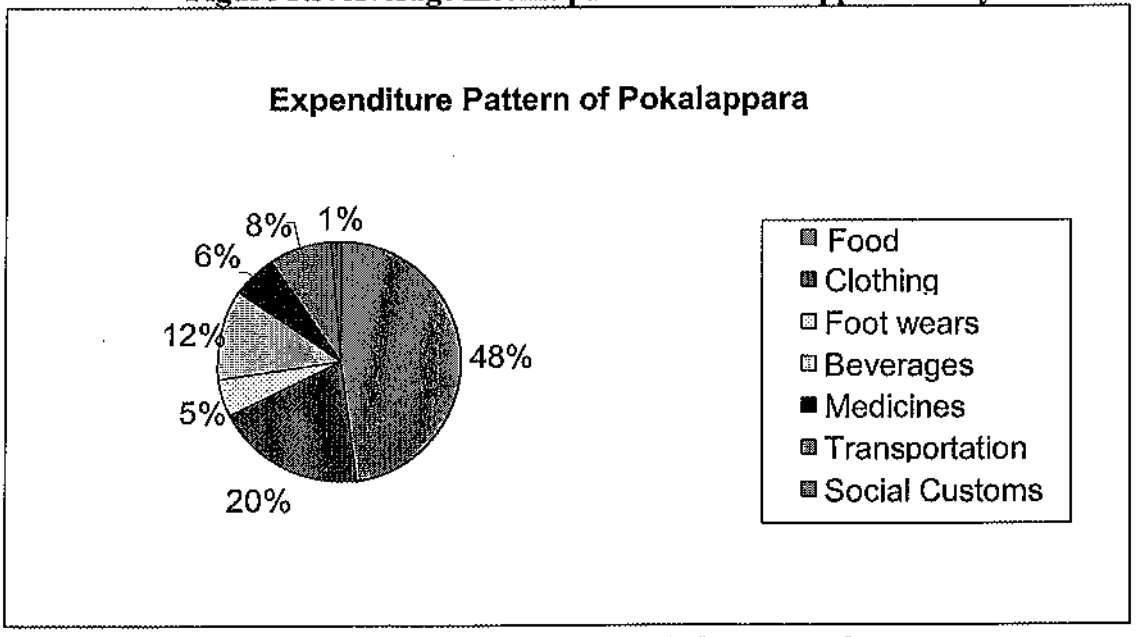


Figure 5.4. Expenditure patterns in Pokalappara colony

3. Thavalakuzhippara settlement

Situated 17 km to the east of Athirappilly, this colony is occupied by 33 families of the tribe "Malayar". All are dependent on NTFP and VSS activities for livelihood (Fig 5.5). The average monthly income is Rs. 3753 and expenditure Rs. 2796 per month. There are 27 terraced and 5 thatched houses. Of the 33 families, 9 depend on river for water, 20 families have tap water supply, while 4 use wells. The expenditure pattern (Fig. 5.6) reveals that food, alcohol and clothing are the major heads.

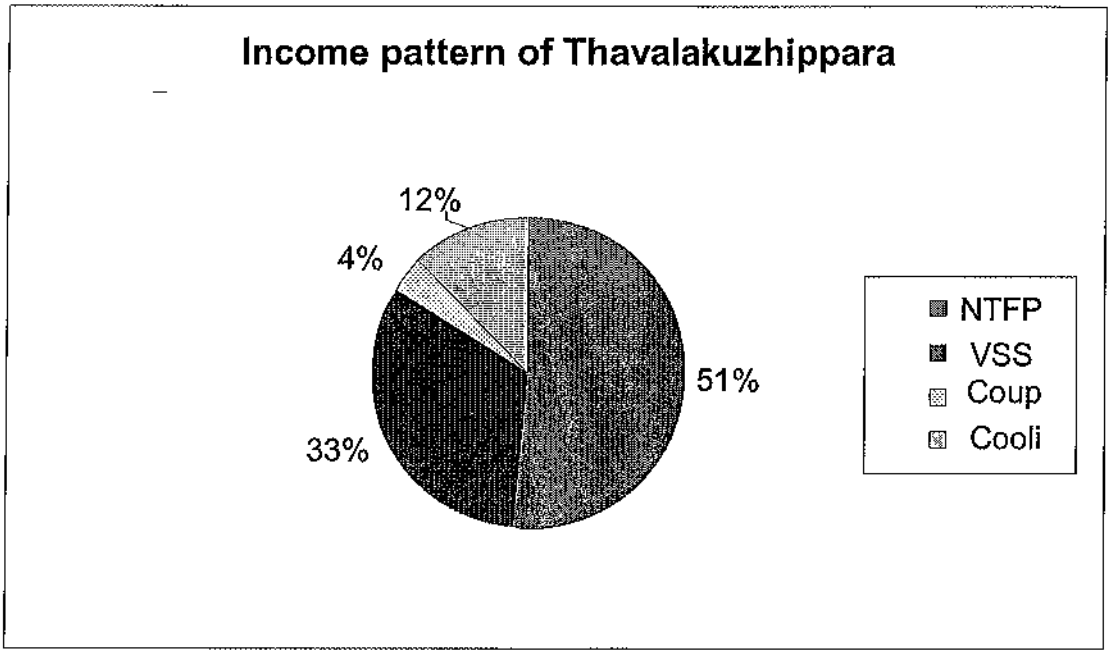


Figure 5.5. Average income patterns of Thavalakuzhippara colony.

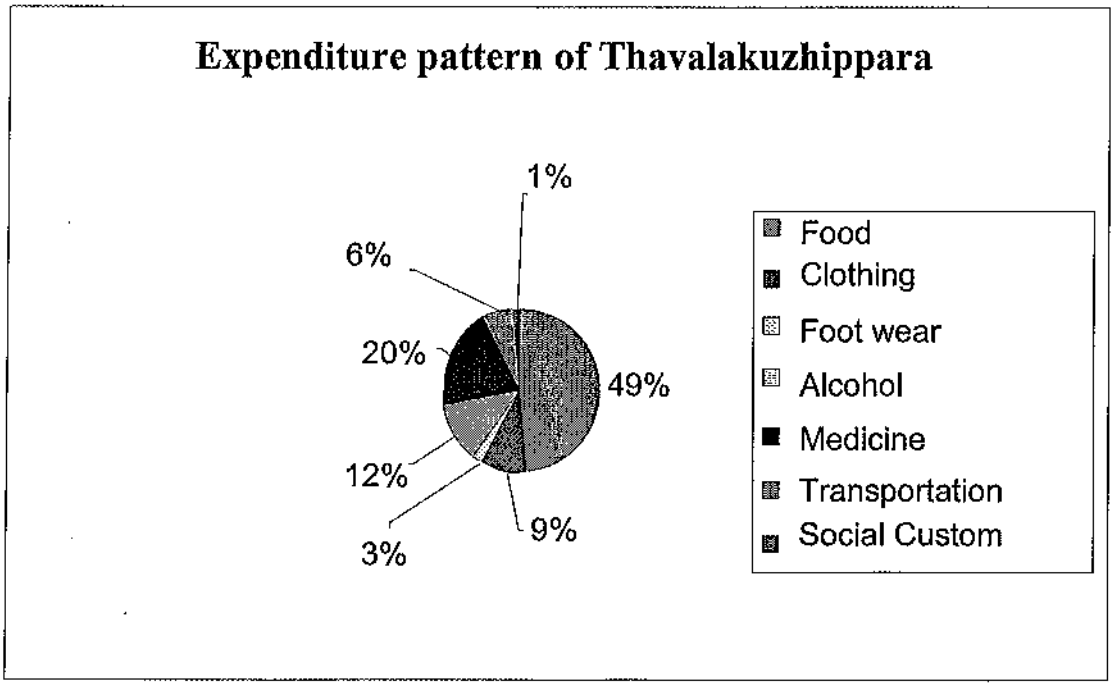


Figure 5.6. Expenditure pattern of Thavalakuzhipara

4. Poringalkuthu Colony

The colony is situated 13 km east of Athirappilly and is occupied by 21 families of Kadar. They are dependent on NTFP and VSS activities for livelihood (Fig. 5.7). The major expenditure is on food and alchohol (Fig. 5.8). There are six terraced, four tiled and ten thatched houses. All families depend on the river for water.

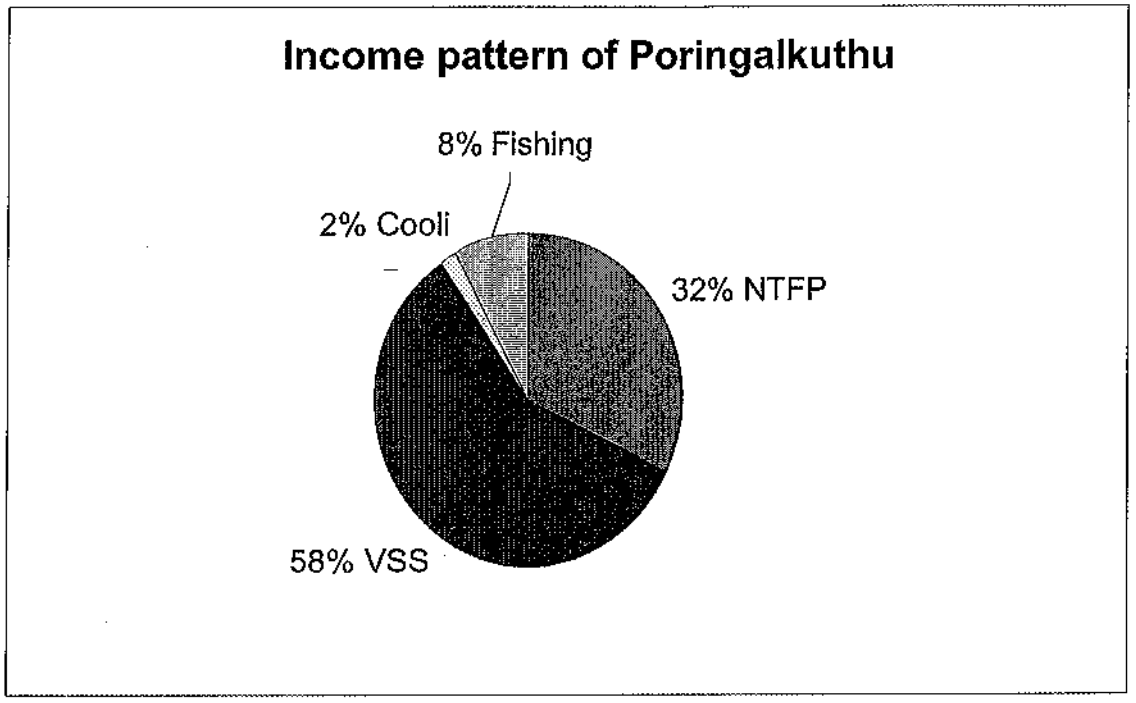


Figure 5.7. Income pattern of Poringalkuthu colony

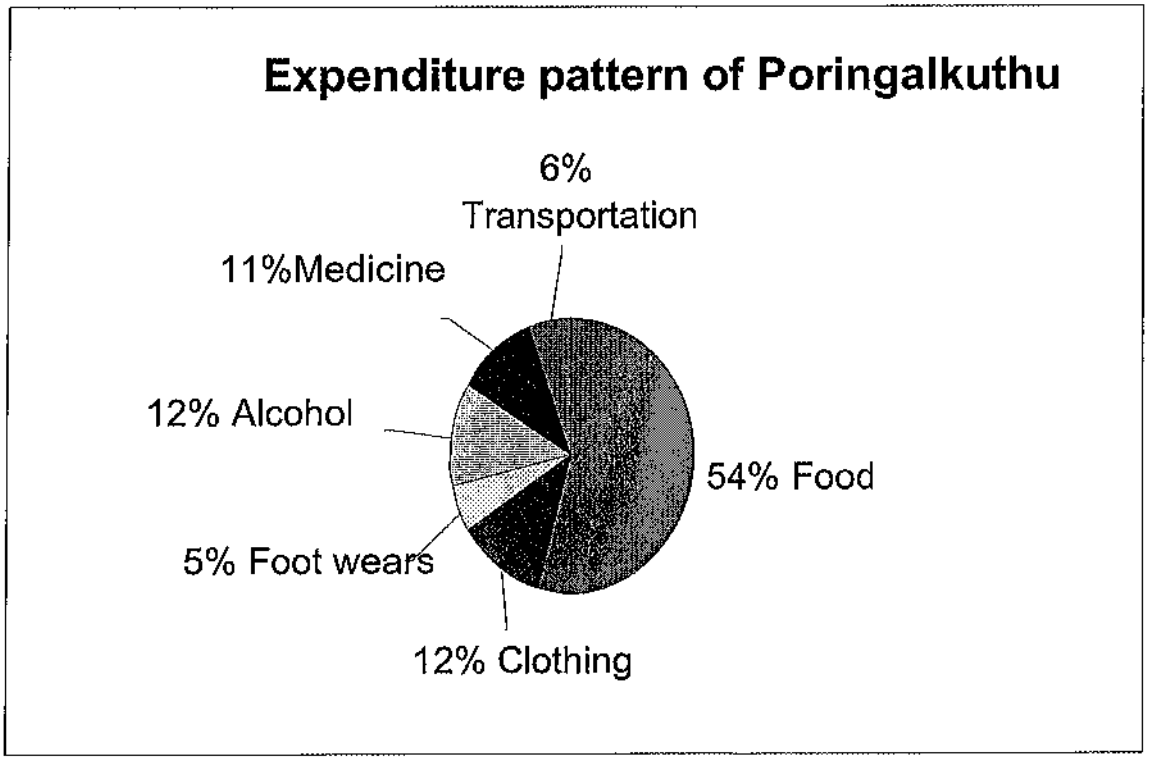


Figure 5.8. Expenditure pattern of Poringalkuthu

5. Watchumaram Colony

The settlement is located 15 km away from Athirappilly to the east. There are 36 Kadar and 9 Malayan families. They are dependent on VSS activities, NTFP and wage labour for livelihood (Fig. 5.9). The average income is Rs. 4903 and expenditure Rs.2411 per month. The major heads of expenditure are food and clothing (Fig. 5.10). Of the 45 houses, 31 are terraced & 14 thatched. Eight families depend on river, two families on tap water and 35 on well for water.

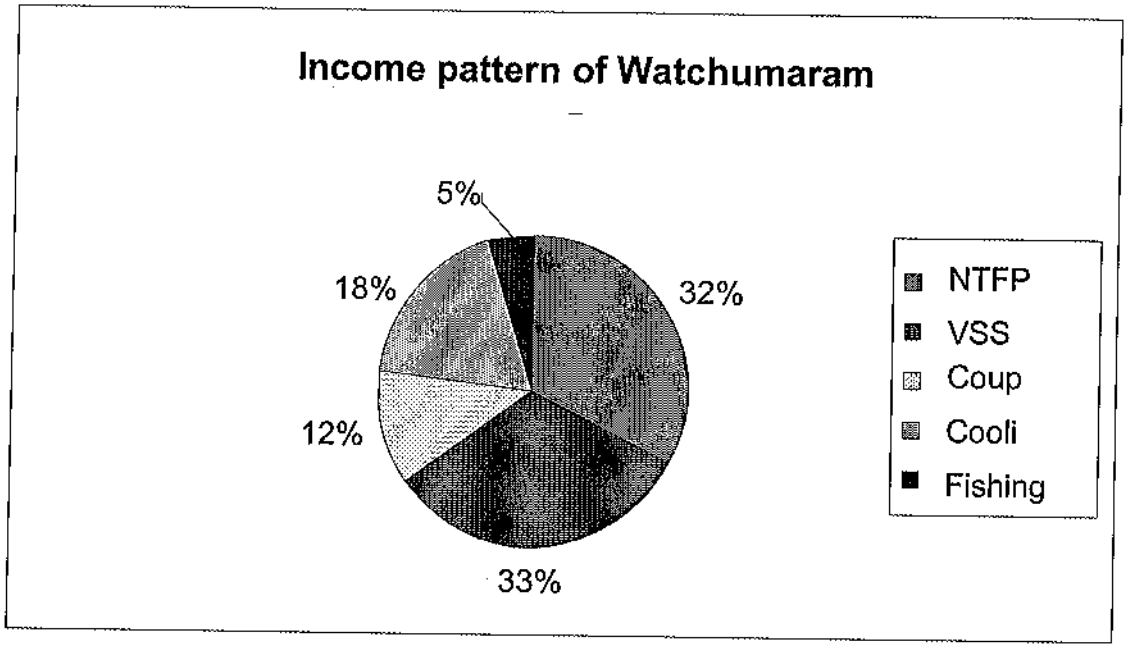


Figure 5.9. Income pattern of Watchumaram Colony

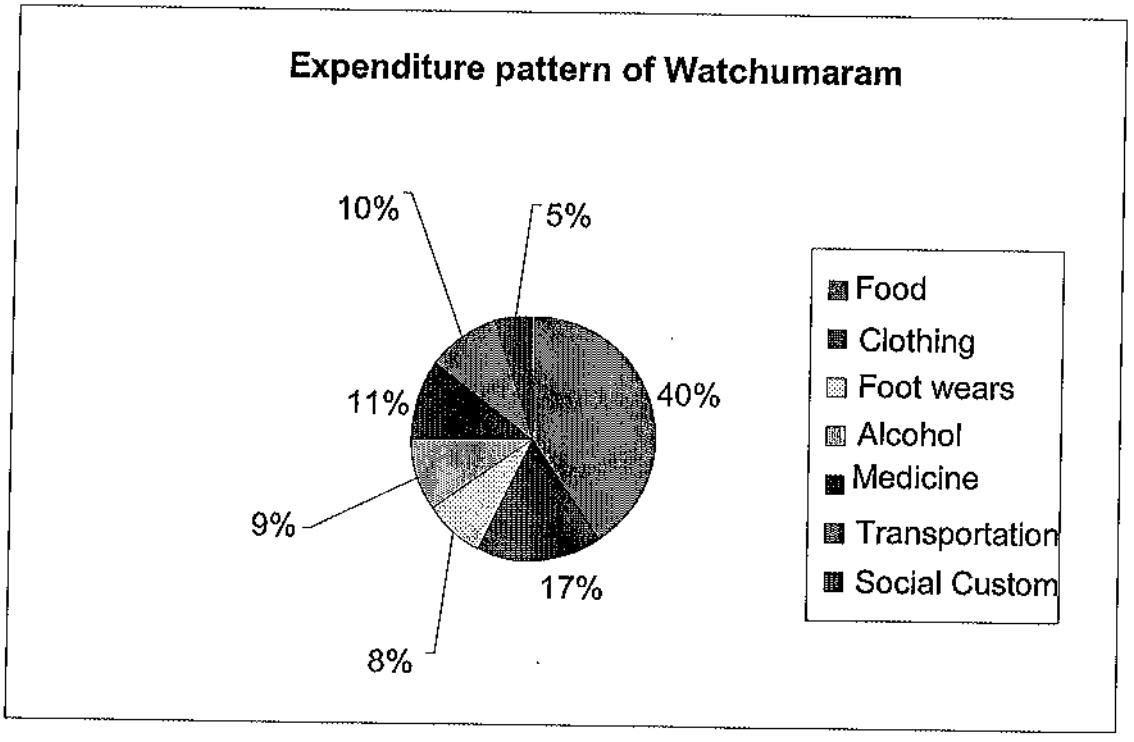


Figure 5.10. Expenditure pattern of Watchumaram Colony

6. Sholayar settlement

Sholayar colony is situated 25 km to the east of Athirappilly. There are 28 Kadar families on this settlement. The population is dependent on NTFP, VSS, Wage labour and employment by Kerala State Electricity Board (Fig. 5.12). The major heads of expenditure are for food, clothing and alcohol (Fig. 5.13). The average income is Rs. 5121 and expenditure 2916 per month per family. All houses are terraced and depend on tap water supply.

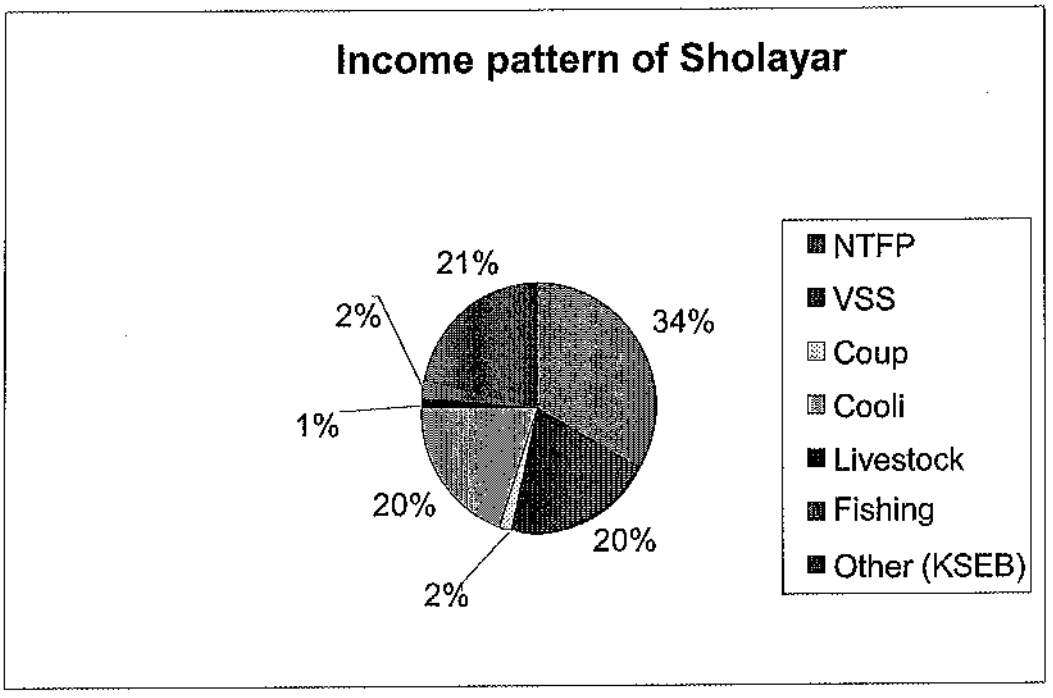


Figure 5.11. Income pattern of Sholayar Colony

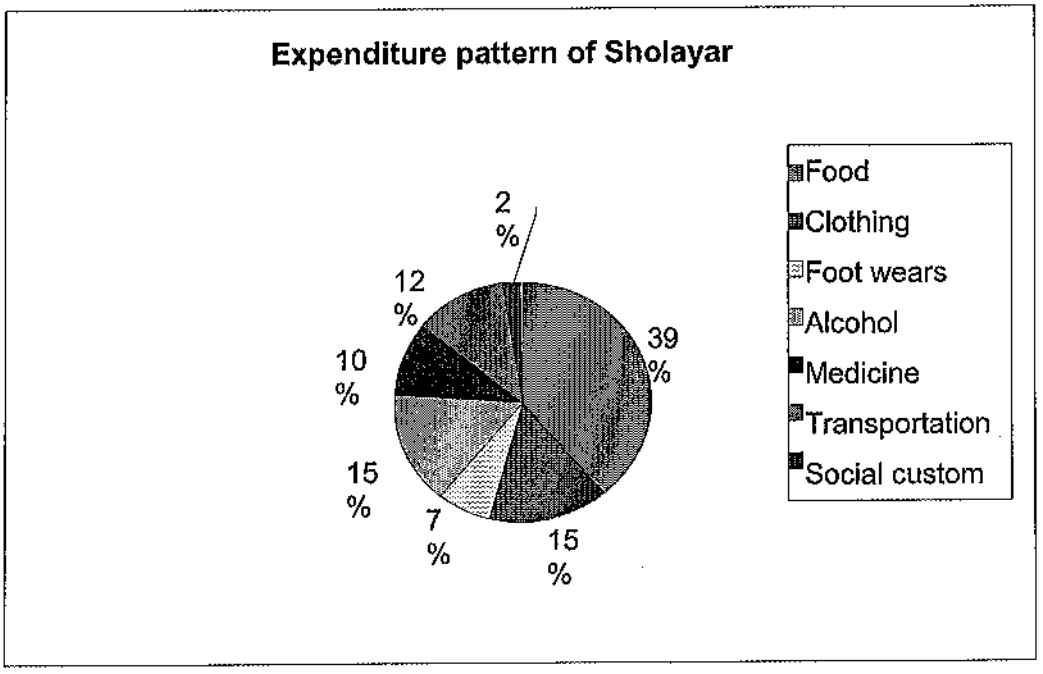


Figure 5.12. Expenditure pattern of Sholayar Colony

7. Mukkumpuzha Colony

Situated 12 km from Athirappilly to the east the settlement has 13 Kadar families. They earn income from NTFP, VSS activities, wage labour and fishing (Fig. 5.13) As the Kadars in this colony are isolated, they were reluctant to share information on income and expenditure. There are five terraced and four thatched houses. All families depend on the river for water.

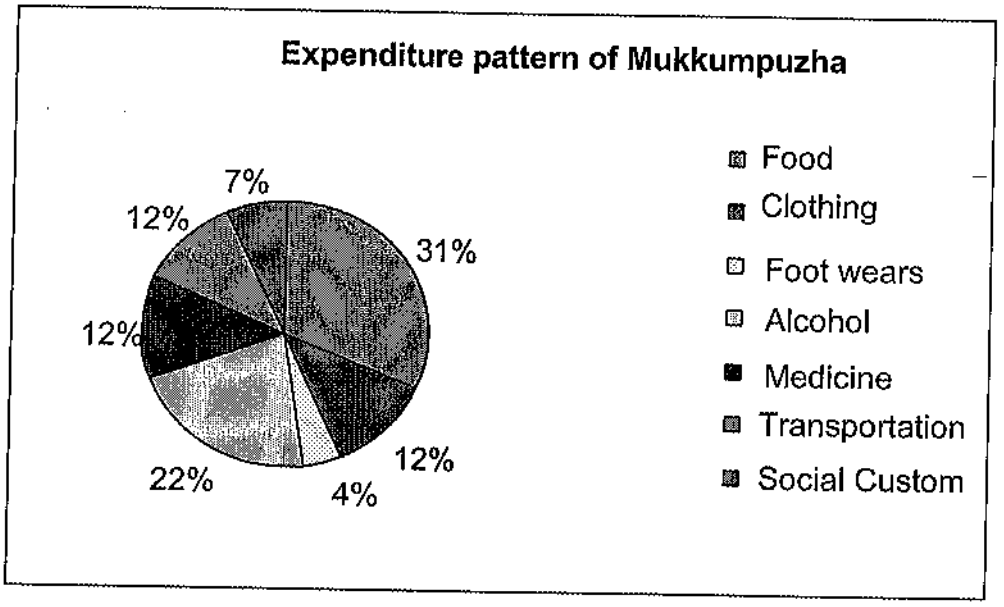


Figure 5.13. Expenditure pattern of Mukkumpuzha colony

8. Malakkappara Colony:

The settlement is located 57 km to the last of Athirappilly. There are 56 Kadar families in this colony. The main sources of income are NTFP, VSS activities and wages from adjacent coffee and tea estates (Fig. 5.14). The main expenditure is on food and alcohol (Fig 5.15). The average income is Rs. 4309 and expenditure Rs. 2685 per month. There are 43 terraced and 13 tiled houses. All families are provided with tap water supply.

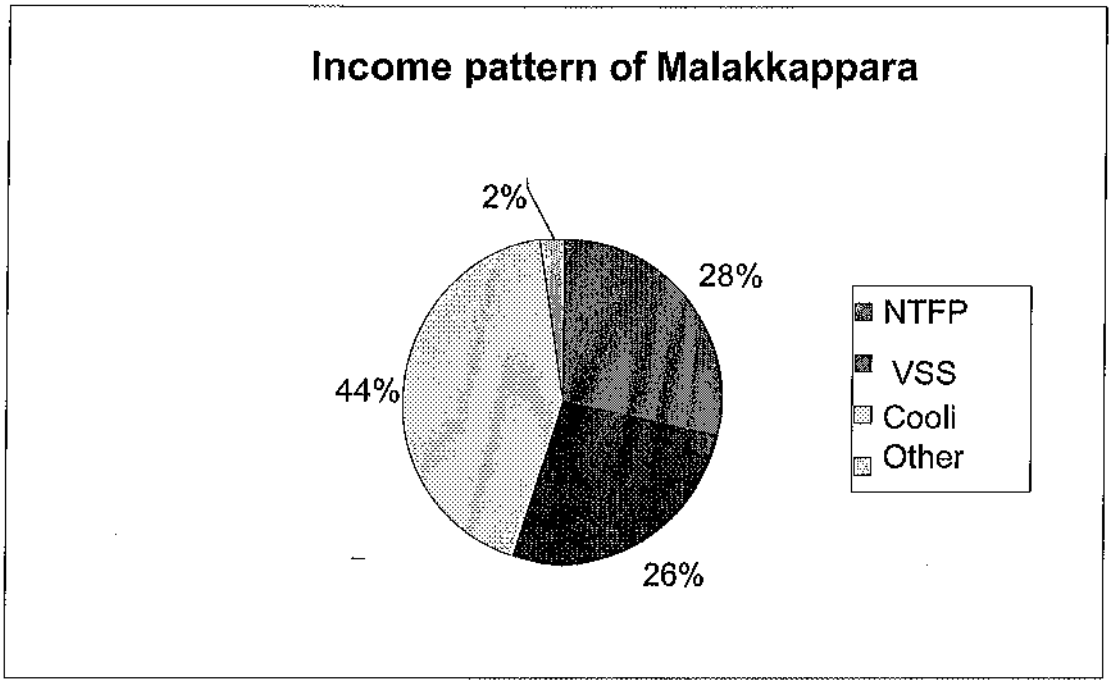


Figure 5.14 Income Pattern of Malakkappara Colony

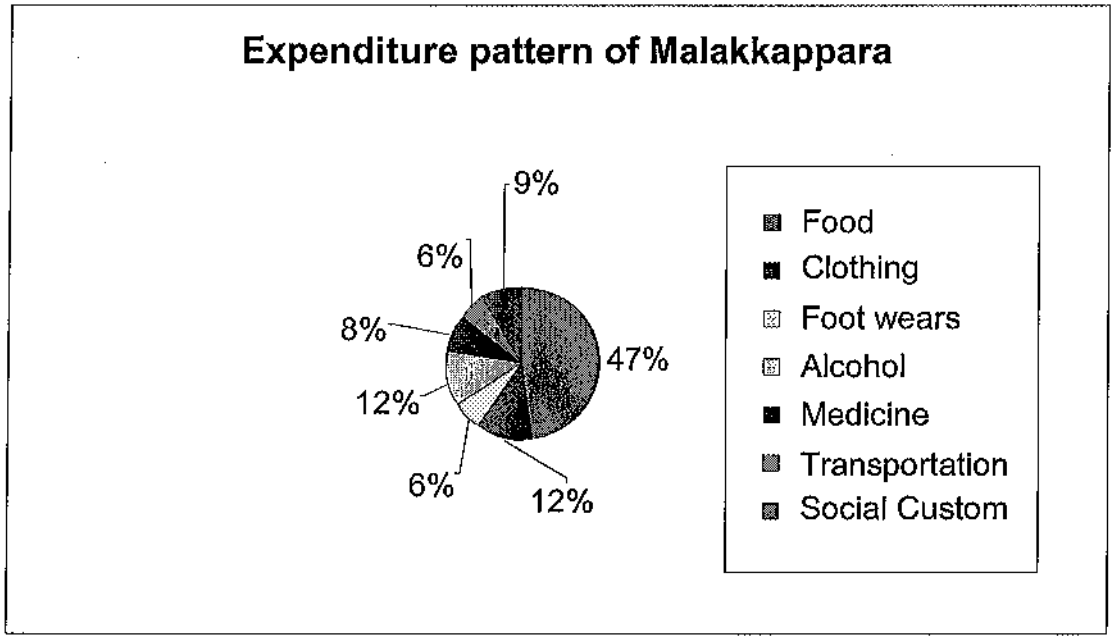


Figure 5.15. Figure Expenditure Pattern of Malakkappara Colony

5.3. Resource Dependence of Villages

The Tribal settlements in Vazhachal 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 (HWC)

Human-wildlife conflict is fast becoming a critical threat to the continued survival of many species, in particular to large and rare mammals and the impacts are often huge. 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. The basic approaches to managing human – wildlife conflicts are prevention and mitigation. A set of global trends has contributed to the escalation of HWC worldwide. These can be grouped into human population growth, land use transformation, 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. Some rare cases of leopard killing human beings and domestic animals are also found. Agricultural crops are damaged by wild boar, pigs, deer and elephants. Elephants attacking human beings are common in recent days. Compensation is being given to the concerned parties by the Department. Conflict is largely confined to the eastern portion of the Division, around the Sholayar - Valparai area, where elephants and leopard regularly traverse the tea estates. Details of various human- wildlife conflicts and compensation paid for the period from 2005 to 2009 are given in Tables 5.5 and 5.6.

Table 5.5. Details of wild elephant attack during the period 2003- 2009

Nature of HWC	2003	2004	2005	2006	2007	2008	2009	Total
Human injury	1	2	1	1	--	--	1	6

Table 5.6. Compensation details of agriculture damage due to wild animals.

Sl. No	Year	Amount
1	2003-2004	1,500
2	2004-2005	2,250
3	2006-2007	5,063
4	2008-2009	32,063

5.5. Assessments of Inputs of Line agencies / Other Departments

Given in 1.13 part in chapter 1.

5.6. Stakeholder support

The key stakeholders in the Division are:

1. Local communities
2. Government agencies
3. PFM Institutions
4. Academic & Research Institutions
5. Tourists and NGOs etc

The achievements in forest management objectives 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 Vazhachal 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

The condition of Forest Department staff working in Vazhachal Forest Division is above average. Most have accommodation and access to transport through the state highway. The

five ranges are equipped with jeeps, wireless sets, etc. and the headquarters is only 40 km away.

Managing human resources (HRM), training needs assessment, capacity building and HRM Plan

HRM is defined as an organized learning experience of all the stakeholders, conducted in a definite time period, to enhance the quality as well as quantity of the output, contributed by the growth of institution. It is the framework that focuses on the organizations competencies at the first stage, training, and then developing the employee, through education, to satisfy the organization's long-term needs and the individual's career goals and employee value to their present and future employers. At the organizational level, a successful Human Resources Management program will prepare the individual to undertake a higher level of work, "organized learning over a given period of time, to provide the possibility of performance change".

HRM 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. HRM 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 HRM plan. Provision for gears such as shoes, rucksack, 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 staff 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 in GPS, biodiversity valuation and biological materials collection should be conducted for foresters and forest guards at KFRI.
- For legal issues training and 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., need 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.

Professionalism – System Protocols

Genuine success in work and life means more than being in a comfortable position to support oneself and his/her family, looking forward everyday to go to work, earning the respect of all including family, friends, colleagues and other stakeholders in business, utilising one's powers and skills towards the betterment and growth of self and others and above all, relaxing and enjoying the leisure time without guilt of work undone. All these are possible only when professionalism at work is developed. 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. Institution of awards and honors.

Gaps in knowledge, Research Priorities and inculcating scientific temper in working

Although various research projects were carried out in the forest areas of Vazhachal, 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

- *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, wildlife 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 (*Amomum microstephanum, Blepharistemma, Curcuma ecalcarata, Curcuma peethapushpa, Bidaria khandalensis, Atuna travancorica, Garcinia wightii, Syzygium travancoricum, Spondias indica*) mammals (Lion-tailed Macaque, Nilgiri langur and Nilgiri tahr), fishes (*Batasio travancoria, Bhavania australis, Carinotetraodon travancoricus, Glyptothorax annandalei, Homaloptera montana, Horabagrus nigricollaris, Osteochilus longidorsalis*), Reptiles (*Rana malabarica, Vijayachelys sylvatica*) birds (hornbills, darter, nilgiri wood pigeon) butterflies and insects need to be done. For plants, the phenology, factors affecting natural regeneration, population size estimation are important. The

habitat, group size, distribution of LTM, population size, specific niches and nesting patterns of hornbills, 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 and mosses) and smaller animals (mollusks, helminthes and even the microbes) also need to be studied.
- Behavioural studies and population structure, mapping movements of elephants and leopards are to be undertaken. The movement pattern of elephants needs to be studied to understand the corridors. Also, the male: female ratio which was earlier skewed (probably due to poaching) needs to be monitored.
- Impact of human interference due to tourism in Athirappilly – Vazhachal areas. The impacts need to be continuously monitored and any revision needed in the management strategy needs to be done as and when required.
- Human - wildlife conflicts, wildlife 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 addition and marketing of NTFP
- Estimation of tourism carrying capacity
- Impact of tourism on Biodiversity

- Ecosystem services of riparian forests
- Monitoring of avifauna with special reference to hornbills
- Monitoring and mapping of elephant movement
- Assessment of fish biodiversity
- Assessment of wildlife health
- Studies on carnivores including leopard
- Inventory of lower forms of fauna and flora
- Developing a GIS - based management system.
- Vayals

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 5.7). 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 5.7. 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	Forester in charge Biodiversity Conservation Programmae (BCP)	Monthly
3	Vegetation	Permanent sampling plots, remote sensing, repeat photography.	Research Associate (RA) of Vazhachal Division	Once in a year
4	Wild life health and veterinary care	Observational methods	Veterinary surgeon	Monthly
5.	Impact of tourists in Vazhachal	Pollution monitoring, vegetation sampling, Animal behaviour study	Researchers employed temporarily	Season Monthly records
6.	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
7.	Human – Wildlife conflicts	Reports from field staffs, office records	Field protection staff of respective areas	Monthly
8.	Eco-development activities	Progress reports from field	DFO of concerned area.	Monthly
9.	Fire prone areas, fire control, illegal hunting	Field visits	Special team BCP	Monthly
10	Social welfare	Tribal hamlet meetings	Special team members BCP	Monthly
11	Library	Observational methods	RO in charge BCP	

5.8 . Wildlife Health Monitoring

The recent outbreaks of fatal diseases such as swine and avian flu, Ebola hemorrhagic fever prove that wildlife has extensive and growing contact with livestock and human populations. An outbreak of these fatal diseases among the populations of wild animals has led to loss of considerable wild fauna in the past in many parts of country. 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 who 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). Surveys of wildlife are essential to be aware of outbreaks and infestations before they become established, to monitor the effectiveness of quarantine procedures and to assist in the allocation of resources in an emergency. In India, an outbreak of Kyasanur forest disease (monkey fever) was reported during April 2004 in the state of Karnataka, India. The causative agent, the Kyasanur forest virus, is a tick borne alphavirus (genus Alphavirus, family Togaviridae). The virus was first isolated in 1957 during a fatal epizootic affecting free living monkeys (species not fully known) from Mysore. Human infection has occurred frequently among forest workers with a mortality rate reaching 10 percent and the principal identified tick vector species is *Haemaphysalis spinigera.* An effective inactivated vaccine is available for protection of those at risk and for post-exposure treatment to moderate the course of the disease. Similarly in other countries also several wildlife diseases were reported such as Bluetongue (USA), Contagious *caprine pleuropneumonia* (Qatar), avian cholera (S. Africa), Bovine tuberculosis (S. Africa), Brucellosis (Canada), Rabies and lyssavirus (Romania),

The main threats to the wildlife health are form

- **Climate Change**

  Shifts in global temperature and precipitation levels, driven by climate change, could welcome some bacteria, parasites, fungi, and viruses into previously inhospitable regions, possibly infecting new species in new ways. Changes in climate can cue wildlife to breed at different times or migrate to different places. Altered distributions of wildlife and livestock, as well as possible reductions in

water availability, may bring livestock and wild animals into closer contact. All of these possible outcomes of global climate change might affect a species' survival or that of other species with which they come into new contact

- **Emerging diseases**

  Emerging diseases such as Ebola, SARS, West Nile virus, avian flu, and swine flu clearly demonstrate the links between the health of wildlife, humans, and their domestic animals. As wildlife trade and the development of wild lands put humans, livestock, and wild animals into closer contact, diseases have more opportunities to emerge and spread, with detrimental effects on human and animal health, biodiversity, and global economies.

- **Environmental toxins**

  Wildlife and human are exposed to toxins via air, water, land, and food. People are responsible for introducing many types of toxins into the environment through industrial emissions, pesticides, medications, fertilizers, oil spills, sewage, garbage, and even lead bullets. The effects of toxins on wildlife is difficult to ascertain and, usually, harder to remedy. Once toxins are released into the environment, they can have detrimental effects on human and wildlife health and take many years, studies, and funds to clear.

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 (Fig. 5.17) 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).

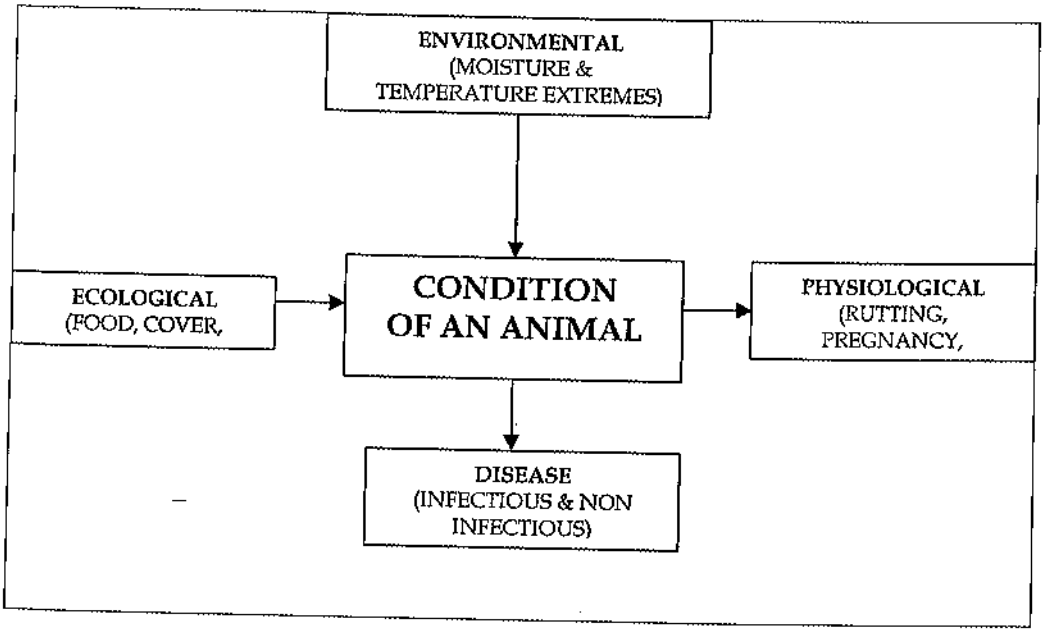


Figure 5.17. Factors affecting condition of an animal

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 (Appendix XII). 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 5.8 the sum of scores (BCI) can range between 0 and 10. Smaller the BCI, better 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 5.8. Generalised 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	
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 5.9.

Table 5.9 Description and evaluation of different body parts of Asian elephants

BODY PART	POINT= 0	POINT=1	POINT=2	Score
. Temporal Depression	Flat and frontal ridge vaguely defined	Slightly concave and frontal ridge defined	Deeply concave	
. Scapula	Spinous process of the scapula not visible	Spinous process visible	-----	
. Ribs	Thoracic barrel smooth and ribs barely visible	Ribs visible	Ribs clearly demarcated with pronounced intercostal depressions	
. Flank Area	Flank are depression barely visible	Sunken flank area Depression visible	---------	
. Pelvic Girdle	External angle of ilium not visible	Visible but not pronounced	External angle jutting and pronounced	
. Tail	Muscular, not bony	Joints of tail vertebrae seen	Thin & bony. Vertebrae can be easily counted	
. 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	
			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 outbreak 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 (Appendix XIII). 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 (Appendix XIV). 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 comprises fixed and frozen tissues, blood smears, sera, paraffin blocks, freeze-dried bacterial isolates is required. The Laboratory specimen form is shown in Appendix XVII.

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 faeces 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 Appendix XV. 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 XVI.

5. Screening for micro-parasites

Bacteria, viruses, blood protozoans, fungi and rickettsiae are referred as microparasites or microbes. Through their prevalence can be, to some extent, known by isolation after post-mortem investigations, a systematic screening of different biological materials can contribute to the understanding of not only 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 fetuses.

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 collectiong 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 livestock 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 idea 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 outbreak**

  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

Mortality means susceptible to death. 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 phenomena. 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

VAZHACHAL 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 "the 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 Vazhachal division should be protected under sound ecosystem management, to retain its natural character and biological diversity.

6.2 Management goals

A goal is a long-term aim, derived from forest policies to provide specific directions in which operations and resources can be focused. Each goal is followed by several objectives that provide specific guidance for future forest management decisions and the allocation of resources. The main goals of the proposed Biodiversity Conservation Plan for Vazhachal Forest Division are given below:

- 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 capacity of staff of Vazhachal Forest Division to achieve the objectives of the Biodiversity Conservation Plan.

6.3 Management Objectives.

- To strengthen the existing infrastructure and staff to implement the plan.
- Identify critical habitats and utilise the information on the current Ranges, distributions, and site-specific locations for conservation of selected flora and fauna.
- Monitor the known populations of RET species.
- Monitor the collection and continuous inventory of the medicinal plants, wild edible resources, NTFPs to determine sustainability.
- Establish protocol for silvicultural practices, seed collection, and propagation and gradual replacement of degraded areas.
- Phasing out failed/poorly stocked plantations and converting them to natural forests.
- Train the forest field staff on identification and management of wild and invasive species.
- 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.
- 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.
- To protect, preserve and improve the vegetal cover of forests over the precipitous slopes and catchment areas of the Chalakudy River perpetually to ensure equitable and regulated flow of clear water in the streams and rivers and to conserve & expand riparian vegetation to mitigate the severity of natural calamities.
- Promote the sustainable management of Vazhachal forest division by working with forest communities and to develop the capacity of Vana Samarakshana Samithis (VSS), Panchayath and other groups having interface with forest as appropriate.
- Develop Sustainable and conservation oriented ecotourism in Vazhachal and make Vazhachal a plastic - free zone.

- Improve the existing infrastructure in the Division through establishment and maintenance of buildings, equipments, interpretation centre and staff quarters.
- To develop training opportunities to equip forest field staff and VSS about the forest resources and the conservation of biological diversity.
- Provide for a wide range of nature-based activities in Vazhachal Forest Division.
- Establish an effective nature education and interpretation centre for tourists and other stakeholders.

CHAPTER 7: MANAGEMENT STRATEGIES

Delineation of High Value Biodiversity Conservation Zone and other Zones

Three zones have been identified in Vazhachal Forest Division for the purpose of implementing the Biodiversity Conservation Plan (Map 7). High Value Biodiversity Conservation Zone (191 km^2), Ecorestoration Zone (57 km^2) and Ecotourism Zone (11 km^2) together constitute 259 km^2 which is 62% of the area of Vazhachal Forest Division.

1. High Value Biodiversity Conservation Zone (191 km^2)

Areas (Sholayar Range, parts of Vazhachal and Charpa Ranges) in conservation zone are to be managed primarily for their conservation values and the activities that endanger these values will be avoided/ restricted. Only, NTFP collection on a sustainable basis will 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 and north direction. These areas are designated as Conservation Zone.

2. Ecorestoration Zone (57 km^2)

It will include areas where degraded natural forests and plantations of poor stocking are available.

3. Ecotourism Zone (11 km^2)

The area encompassing Athirappilly and Vazhachal tourism will be part of the ecotourism zone.

Zone and theme approaches to management strategies

Zone plans

1. High Value Biodiversity Conservation Zone

Details of the Area

The natural patches in Sholayar, Vazhachal and Charpa ranges provide more or less continuous forest cover with three main types of forests viz., evergreen, semi-evergreen and moist deciduous. These forests are very important as they are repositories of unique biodiversity (flora and fauna). The riparian ecosystem along Chalakudy River, unique ecosystems and species specific habitats and wildlife corridors are included in this zone. Locations of high biodiversity value viz., Karadippara, Pachakkad, Panjanamkuthu, Kummatty, Orukomban, Kulamali, Santhanpara, Mechappully, Thumbikaipara, Thottapura, Maippa, Meenchalali, Vazhakkali, Chindukapara, Valanjambalam, Peruchilamban, Chooralvalichapara and Adavara are important conservation areas in Sholayar, Vazhachal and Charpa ranges.

Objectives

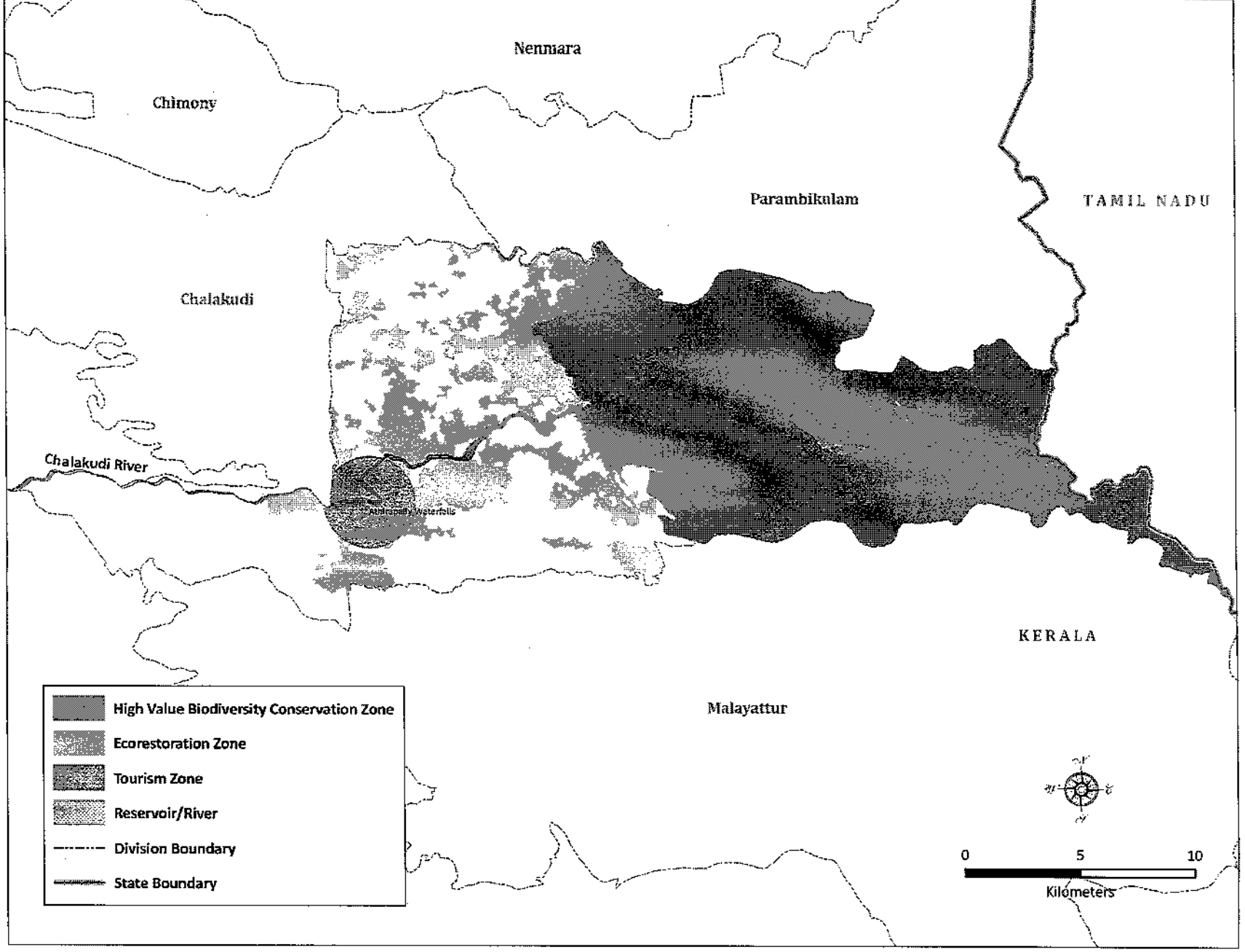
- Assess the vegetation, identify RET species, protect and improve the biodiversity of these areas.
- Assess the diversity of flora and fauna
- Develop GIS based management system
- Identify and restore corridors for movement of wild animals.

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.



Map 7 Management Zones in Vazhachal Forest Division

- 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.
- 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.

C. Unique ecosystems and species-specific habitats

Action Plans

- Identify and assess unique ecosystems and species-specific habitats.
- Unique ecosystems such as riparian zones, species-specific habitats of tahr, elephant, forest cane turtle, 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 riparian ecosystems coming under the Division
- Prepare site-specific management plans.
- For the highly degraded riparian swamps soil binding plants like *Pandanus, Bamboo, Ochlandra* and *Saccharum* can be planted initially for the stabilization of the riverbanks.

- 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 the reed extraction in wildlife corridors.

2. Ecorestoration 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.

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.
- Management of Non-Timber Forest Products (NTFP) will be strengthened by interventions in methods of regeneration, sustainable harvesting and value addition.
- 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 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 stems shall not be felled and no culms shall be

removed with rhizome in the case of bamboos. Overlapping extraction of reeds by HNL / Bamboo Corporation is to be avoided.

- 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 internode 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.
- Extraction in the area is to be phase out the provide disturbance free habitat for elephants, tiger etc.
- Extraction in wildlife corridors should be avoided.

D. NTFP areas

Action plans

- Important NTFPs and their habitats in the forest area are identified.
- Stock maps showing the extent and intensity of availability based on inventory for the selected species should be prepared.
- Total inventory of vegetation should be conducted 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.
- Sufficient rhizomes are to be left behind for propagation for species that regenerate by rhizomes.
- The herbs and shrubs, where fruits are collected shall be done only after seeding, in the 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.
- Cutting deep steps for climbing the trees to collect honey which cause permanent injury and sometimes death of the host should be avoided.
- Tribes should be trained in scientific methods of collection and its proper management.
- 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 valid permits.

3. Ecotourism Zone

Vazhachal Forest Division has a famous tourism destination viz., Athirappilly waterfalls which is attracting millions of tourists annually. Together with cascades at Vazhachal, Charpa waterfall, two reservoirs and wildlife viewing along the Chalakudy – Pollachi road, Vazhachal Forest Division presents an unique selling point as far as tourism is concerned. Although tourism is conducted on a participatory scale under the supervision of the Forest Department through VSS, there exist a number of problems with regard to overcrowding, congestion and pollution. Hence, the Biodiversity Conservation Plan proposes to make tourism at Vazhachal Forest Division more responsible, conservation-oriented and to the benefit of local population.

Objectives

Transform the tourism at Vazhachal Forest Division towards responsible, sustainable and ecologically friendly.

Strategy for tourism development in Athirappilly Vazhachal

The strategy for sustainable tourism in Athirappilly-Vazhachal recreation sites ought to focus on the Pro-Poor Tourism giving weightage to economic benefits, non-economic benefits, and policy reform in the area

Actions

- Research and guidelines on mechanisms to minimize the potential problems of economic leakage, on negative environment and social impacts, inter-generational effects and inadequate income distribution are required.
- The carrying capacity of the recreation sites needs to be worked out. Carrying capacity information is extremely useful in zoning tourism areas and in setting visitation limits by the authorities.
- Access to tourism opportunities should be widely available, including access for local people and for the handicapped.
- The linkages between recreation and other sectors of the economy are to be enhanced.
- Mutual understanding among different Government Departments working in the area is to be improved. In other words, bringing about integrated approach to the management of tourism in these sites is necessary.
- Implementation of the site-specific "One Tourist, One Rupee, Ten trees Programme" to ensure environmental and economic security in the ecotourism based economy with peoples participation (Anitha and Muraleedharan, 2007).

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. Fire management
5. Watershed management
6. Soil conservation
7. Protection and
8. Wildlife health

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

Improve the habitat of flora and fauna.

Actions

- **Weed Eradication:** Weeds like *Mikania*, *Lantana* and *Chromolena* 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 Vazhachal, 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.
- 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 and 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 Vazhachal Forest Division

Actions

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

4. Fire Management

Fire is one of the most destructive elements that disfigures the forests. In natural forests and in plantations the fire is a main problem in recent times which retards wood production.

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 firelines
- Determination of fire weather index with the help of automated weather stations.

5. Watershed Management

The Chalakudy river and its tributaries form one of the major water resources in the central part of Kerala. At least 1200 km^2 catchment area in Kerala of this river is under the control of the Forest Department. The Chalakudy river basin contains about 57 sub watersheds and 140 micro watersheds. The River has 800 lift irrigation schemes and 30 Government - operated drinking water supply schemes and a population of about 10 lakhs directly depend on the river for various uses. Hence, the identification of degraded watersheds and their restoration is an important thing to maintain healthy ecosystem. 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 Chalakudy for the overall benefit of wildlife and the surrounding agro-economy.

Actions

Identify and prioritize watersheds and conduct eco-restoration.

6. Soil conservation

The forest ecosystems of Vazhachal Forest Division are located mostly on steep slopes. 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

7. Protection

The main illegal activities are tree felling, unauthorised NTFPs collection especially medicinal plants, ornamental fish collection, poaching, gañja 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.

8. 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 5.8 –Wildlife Health.

CHAPTER 8: MAINSTREAMING STRATEGY WITH VARIOUS FUNCTIONAL SECTORS

The various production sectors are important to mainstreaming the biodiversity conservation concerns in Vazhachal 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 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
- Protection of riparian zones and aquatic streams
- 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 Wood Forest Produce, protection of the NTFP source areas (Irumpupalam, Poringal, Muthirachal, Velluvara, Thumbikkaipara, Orukomban, Karomthodu, Ambalappara, Thottappura, Kummatty, Chandanthodu, Sindakappara, Meenchalali, Meppa, Thulakkanthodu, Anamadamkuthu, Kulamali, Valanjambalam). 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).*
- Ensuring protection of Maramanjal *(Coscinium fenestratum).*
- The Sholayar area is represented with patches of *Oryza granulata*, an upland wild rice species which represents a unique germplasm possessing abilities of tolerance to shade and drought, immune to bacterial blight and resistance to brown planthopper. Similarly, the wild genetic resource of *Dioscorea bulbifera* Linn., *D. hamiltonii* Hook.f., *D. oppositifolia* Linn., *D. pentaphylla* Linn., *Zingiber cernum, P. longum* Linn., *P. nigrum* Linn., *Asperagus racemosus* Willd., *Elettaria cardmomum* (Linn.)Mat., *Alpinia galanga* (Linn.) Sw., *A. malaccensis* Ros., *Amomum microstephanum* Baker, *A.muricatum* Bedd., *Boesenbergia pulcherrima* (Wall.) O. Ktze. and *Costus speciosus* (Koen.) Sm. are to be protected
- Nurseries to be established for riparian and other forest species (NTFPs, timber, fuel and food) by tribals through VSS and planting in the degraded areas especially in Kollathirimedu.
- Ensuring the availability of species of tubers/ leafy vegetables most frequently used by tribals, in their settlements.
- Ensuring protection and restoration of watersheds frequently used by tribals,
- Restoration of Charpa streams as well as Kannamkuzhi has to be taken up on war footing with the help of Athirappilly and Vazhachal VSS.
- Involvement 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 especially in Puliyilappara areas.

- 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.
- 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)

The agriculture system, wild farming consists of planting crops that are highly associated and supportive to the natural ecosystem. This includes intercropping with native plants, following the contours and geography of the land, and supporting local food chains. The goal is to produce large crop yields, while still promoting a healthy environment. The four basic guiding principles of the wild farming movement are the direct managers to develop long-term vision for future of landscape, basic recognition of ecosystem processes, and high value on biological diversity and to consider the quality of life of the community as well as the self. The wild relatives of crops (CWR), which include crop ancestors as well as other related species, have been used to improve crop resistance to pests, diseases and adverse climate conditions for over 100 years. Many species of CWR are used directly for food, medicine and income and thus are critical to the livelihoods of local communities. The UNEP/ GEF-supported global project, 'In situ conservation of crop wild relatives through enhanced information management and field application' aims to conserve CWR in the wild and thereby ensure that these valuable genetic resources remain available to improve the performance of modern crops. The natural populations of many crop wild relatives are increasingly at risk. They are threatened primarily by habitat loss, degradation and fragmentation. A relatively new and increasingly significant threat is climate change.

There is no large scale agricultural practice or shifting cultivation in the eight tribal settlements of Kadar and Malayar, since they get income through NTFP collection and tourism. However the ginger, curcuma and manjakoova are cultivated in the settlements of Watchmaram and Malakkappara. But these are often failures due to damage by elephants, deer and porcupine. The Agriculture Department is providing the seedlings of ginger, curcuma and banana to all the tribal settlements. In Pokalappara colony destruction of banana cultivation by monkeys has been reported.

- Adoption of 'eco-agriculture' (organic farming) as a land use to produce food as well as to conserve wildlife in tribal settlements.
- Small units of cultivation of 'cattle grass' can be done in each of the tribal colonies using *Pennisetum* sp. for domestic cattle's and thus can avoid grazing in forest areas.
- Discouraging sudden change in cropping patterns to avoid accentuating man-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.
- Suitable place for cremation facility in tribal settlements.
- 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 has to be integrated through agreements between the Forest Department, district authorities and Eco-development committees..

8.4. Tourism (D)

Tourism has become the world's largest industry, with nature-related tourism calculated to be its fastest growing market segment. Since tourism is an enormous and widespread industry all over the world, its impacts such as social, economic, and environmental, are also worldwide. These impacts can be positive, doing good, or negative, doing harm. Sustainable tourism usually aims to have minimal negative impacts, to minimize harm, and to optimize economic benefits. Ecotourism, a type of sustainable tourism, is usually conducted in largely untouched natural areas, where community participation, conservation and management of biodiversity, respect for culture and indigenous knowledge systems and practices, environmental education and ethics as well as economic benefits are fostered and pursued for the enrichment of host communities and satisfaction of visitors. According to the definition and principles of ecotourism established by The International Ecotourism Society (TIES) in 1990, ecotourism is "Responsible travel to natural areas that conserves the environment and improves the well-being of local people" (TIES, 1990). The main characteristics of ecotourism are involving travel to natural destinations, minimizing the environmental impact, respecting the regional culture, providing direct financial benefits for empowerment for local people and conservation and supporting human rights and demographic movements.

Considering the above characteristic features of ecotourism, it should satisfy following criteria such as:

- Conservation of biological and cultural diversity through ecosystem protection.
- Promotion of sustainable use of biodiversity, by providing jobs to local populations.
- Tourism to unspoiled natural resources, with minimal impact on the environment being a primary concern.
- Minimization of tourism's own environmental impact.
- Local culture, flora and fauna being the main attractions.

The tourism in the Vazhachal forests is nature based, with high potential for ecotourism development in the natural ecosystem. Vazhachal area offers excellent possibilities for environmental education for masses and adventure tourism activities like rock climbing, ropeway, trecking, etc. can also be promoted. There is a need to change the job of tribal VSS from just tourism spot cleaning to more pro active roles of restoration.

- Since the tribal settlement is very close to Vazhachal tourist spot, it is recommended to build live fence with local species for privacy, food and nutrition.
- Area used by the Kadar tribes for bathing and fishing should be marked and tourists should be prevented from these zones.
- Strict regulation of dumping of waste from hotels and other establishments to river at Vazhachal.
- Banning of non-degradable objects like carry bags, bottles, tea cups, and snack cases made of plastics.
- The impact of tourism on wildlife and flora to be assessed.

Anitha and Muraleedharan (2007) developed strategies and action plan for the development of ecotourism potential in the Division.

Short - term strategies for tourism development in Athirappilly –Vazhachal

- Compulsorily construct a barricade in the dangerous areas (edges) of the waterfall where the tourists tend to venture

- Visitor/tourist zones need to be earmarked and dangerous/ restricted areas set out of bounds.
- Provide clean toilets, bathing facilities for tourists, and mark out a bathing zone to avert any kind of danger.
- Provide clean drinking water.
- Construct small eco-friendly rest houses for tourists in recreation site in Athirappilly
- Abolish plastic and alcohol/ aerated drinks in the tourist spot and promote local products such as tender coconut.
- Sufficient attractive signboards may be put up at the entry point by the authorities, stating the do's and don'ts of a natural recreation site, a layout of the recreation spots to visit with pictures (the trek paths, among others), and how they may benefit by visiting these places
- Address the various actual commercial threats the sites face (Large number of entry paths, unauthorized collection, unauthorized fishing among others)
- The upland or upstream of Charpa falls need be afforested in order to maintain the perennial flow, which dries up in the summer months and is currently a tourist attraction being en route from Athirappilly to Vazhachal .
- Open up the interpretation center for the common public and have documentary projections, which will enable tourists to get a glimpse of the Athirappilly-Vazhachal forests at close quarters
- Setting up of a solid waste management system.

Nature Education

This is a two - three days camping programme intended for school, college students, members of NGOs and other groups focusing various themes related to environmental education, biodiversity conservation,. The curriculum includes study classes, trekking, field visits, group discussions, interpretation centre visit, film projections etc. This programme has been found to be the most important tool for spreading environmental awareness.

8.5. Fishes (D)

- Granting permits to Vana Samrakshna Samithis (VSS).
- Regulation fishing through the policies of Conservation Committee.
- MoU with VSS for safeguarding nesting sites and breeding zones, especially the following species such as *Osteochilus longidorsalis, Hypselobarbus curmuca, Horabagrus brachysoma, Carinotetraodon travancoricus, Puntius denisonii and Puntius fasciatus, Homaloptera Montana, Horabagrus nigricollaris, Osteochilus longidorsalis* and *Garra surendranathanii.*
- Reciprocal commitments for patrolling, fire protection etc
- Facilitating marketing
- Avoid explosives for fishing; often reported in Watchmaram and malakkapara areas are to be monitored. Sufficient fishing nets to be provided for sustainable fishing practice. Traditional methods of fishing *Choonda* or *Choondal* is to be encouraged.
- Fishing by poisoning (*Nanju*) of barks, seeds of plants have found in Malakkappara, Erumathadam areas, awareness to be created to prevent this practice.
- Avoid and monitoring the illegal collection of ornamental fishes.
- Illegal collection of ornamental fishes to be prevented by laws.
- Existing population status and conservation measures can be adopted by assessing the fish diversity programmes and native and ornamental fisheries breeding programmes can be done through VSS.
- Setting up of an Aquarium with ornamental fishes.

8.6. Tea / Coffee estates (I **)

Impact of estates on wildlife is to be investigated.

8.7. Road / Rail Transport (D)

- The speed limit, noise level of the vehicles should be controlled in the places where there is movement of wildlife.
- Display the signal boards and speed limits sign boards. Traffic signs can be often used to indicate areas of increased animal activity.

- Awareness classes, notices, posters, to the tourist people about wildlife corridors and biodiversity to prevent wildlife road kill.
- Regulation of traffic flow in tourist spots.
- Establishment of local vegetation on filled up area and road side land
- Adoption of erosion control measures
- Protection of drainage system
- Safeguards to prevent road hits to wild animals
- Safeguards to prevent fires
- Compensation for habitat fragmentation and barrier effect.
- Restrict travel on the road from Vazhachal to Malakkappara during night.

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.
- Regulate the activities of resorts in the assigned lands.

8.9. Mining (D)

There is no mining operation in this Division

8.10. Thermal power plants (I)

There is no thermal power plant operating in this Division

8.11. Irrigation projects (D)

There is no irrigation project in this Division

8.12. Temple tourism (D)

There is no temple tourism operating in this Division

8.13. Communication projects (D)

- The new projects should avoid slopes, streams 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 in Vazhachal requires constant training in various subjects:

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

Motivation and building morale of staff is 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 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 Research 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 for modern equipments in computing, satellite maps, GIS and GPS facilities etc. is essential.

Necessary vehicles (Boat with out–board engine), binoculars, camera traps, analytical equipments, weather monitoring station, water monitoring equipments have to be provided. Seminars and workshops will be conducted periodically to review the progress.

9.2.3. Staff Development and 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 is 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

- Mapping and analysis of Biodiversity Hotspot areas
- Mapping of fire - prone, weed infested and degraded areas
- Land use and vegetation assessment
- Identification of threatened species and methods for conservation
- 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
- Assessment of fish biodiversity
- Monitoring and mapping of elephant movement

- 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 Census, Surveys, Plots/ Transects and periodic census. The fire weather index will be determined with the help of establishing automated weather stations.

9.2.5. Education and Awareness

Conservation oriented education and awareness about the Vazhachal 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 Interpretation Themes and use of media:

- Role and significance of Vazhachal HVBA and relationship with long - term conservation of biodiversity.
- Importance of landscape level management in Vazhachal HVBA
- Media- Explained photo panel exhibit in Visitor centre and interpretation centre.
- Conservation History of Vazhachal HVBA
- Media- Explained photo panel exhibit in Interpretation Centre
- Varied ecosystem found in Vazhachal HVBA
- Media- Explained photo panel exhibit in Visitor centre and Interpretation centre,
- Rare and endangered species found in Vazhachal HVBA
- Endemism in Vazhachal 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 and 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 viz., furnished accommodation (staff quarters) with water and energy source and good communication facilities (wireless sets/ mobile phones) for emergency. Each beat will have suitable basic camping facility and other protection measures.

9.3.2. Community beat assistants (four per beat)

Each beat to have four beat assistants to support the beat staff. To begin with two beat assistants may be initially provided. These beat assistants will be drawn from local community and be 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

One jeep and boat for Sholayar Range.

9.3.7. Field rations

All filed 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 office.

9.3.11. Field camps

Each beat will have one field camp with basic facilities and furnishing.

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

Provision for maintenance of existing roads in annually has been provided

9.3.16. Inspection paths

Creation of new 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)

Purchase of mobiles and wireless sets.

9.3.19. Vehicles

Purchase of a boat with out- board engine.

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, captive breeding, ex situ conservation programmes, 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

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/Trench
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) Incentives for protection
e) Eco Development Programmes
f) Eco-tourism
g) Trans-boundary issues (in case of inter-state/country)

9.6. Systems, protocols

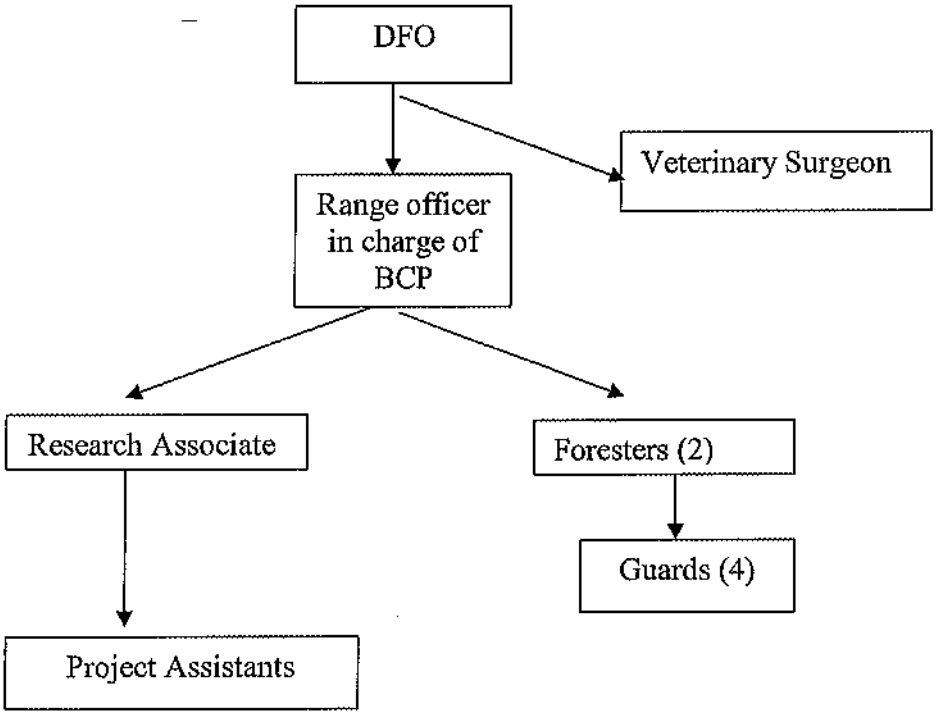
9.6.1. Systems, protocols and its institutional set up

The implementation of the Biodiversity Conservation Plan (BCP) of Vazhachal forests 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 field biologist 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	Improved relations between forest officials and villagers, improved employment opportunities, and livelihood, reduction in human wildlife conflicts.
4	Restoration of habitats	Maintenance of riparian ecosystems, vayals, watersheds and eradication of alien and exotic weeds and eco-restoration of degraded areas	Increased biodiversity ecosystem services
5	Sustainable collection and of NTFPs	Monitoring collection And value addition	Enhanced turn over and profits
6	Human Resource Development	Staff amenities and provision for staff training.	Staff satisfaction, 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	No instance of epidemics, Monitoring the waterholes, 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. No	What (Criteria)	How	By whom	when
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 integrity of the elephant, tiger habitats	RO Biodiversity Conservation Programme	
3	Boundary demarcation	Extent/length	RO Biodiversity Conservation	Yearly

			Programme	
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	Biodiversity Conservation Programme	Yearly
10	Pollution effect of tourist areas	Sample plots in zone of influence	Biodiversity Conservation Programme	Before and after peak tourist season
11	Future of the eucalypt plantation areas	Vegetation Plot monitoring	Biodiversity Conservation Programme	Yearly
12	Socio – economic issues	Functioning of VSS	RA and RO Biodiversity Conservation Programme	Meetings of the Conservation Foundation
13	Recognizing the people's rights	Less number of conflict	RO	Meetings of the Conservation Foundation
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	RA and RO	Yearly
17	Weed removal	Extent (ha)	Range	Monthly/year

	(progress)		Officer	ly
18	Extent of weed invasion	Sample plots in field	RA and RO 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 Biodiversity Conservation Programme	yearly

Strategy

To conserve and enhance the biodiversity wealth of Vazhachal 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

- CCF (Biodiversity Cell) –Chairman
- CF (Central circle)
- DFO Vazhachal

- Range officer (BCP)
- Research Associate
- Territorial ROs
- Scientist (2)
- NGOs (2)
- RO (BCP)- Member Secretary

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
  - Tourism Department
  - Tribal Welfare Department
  - Health Department
  - Agricultural Department
  - Animal Husbandry Department
  - Education Department
  - Power and Irrigation Department
  - Scientists
  - Members of Local Panchayath
  - NGOs

Forest Beat Management and Monitoring Committee

- RO –Chairman
- Dy. Ranger - Member secretary (BCP)
- Concerned Foresters -2
- VSS President

- VSS Secretary
- NGO (1)
- Scientist (1)

Institutional Mechanism

Implementation

The RO (BCP) will implement through VSS (BCP). He will report to the DFO.

Research

The priority of research will be decided and Research Associate will lead the programme assisted by project assistants and report to the RO.

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.

The governing body for Biodiversity Conservation programme at Vazhachal 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 Thrissur Circle), Kerala
8. Divisional Forest Officer, Vazhachal
9. Director, Kerala Forest Research Institute, Peechi, Thrissur
10. Vice chancellor, Kerala Agricultural University, Mannuthy
11. Member of Legislative Assembly, Chalakudy.
12. District Panchayath President, Thrissur.
13. Secretary, DTPC, Thrissur

Executive Committee

1. DFO Vazhachal - Chairperson
2. Range officer in Charge
3. Veterinary Surgeon
4. Research Associate
5. Forester
6. President of VSS
7. Secretary 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 Government 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 Vazhachal Forest Division in Table 10.1.

Table 10.1. Proposed staff for implementing Biodiversity Conservation programme at Vazhachal 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	Research Associate	1	Doctorate in biological sciences, experience in Forest research
5	Veterinary Surgeon	1	BVSc & AH
6	Research Assistants	2	M.Sc. in Botany/Zoology/Forestry with 2 years experience
7	Project Fellows	4	1st Class M.Sc. in Botany/Zoology/Forestry/Sociology
8	Field Staff	2	From VSS
9	B eat 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 Vazhachal forests the Coordination must be ensured with The District Administration, District, Block and Village Panchayaths, Kerala Tribal Welfare Department, Kerala Tourism Department, KSEB, Agriculture, Animal Husbandry, Irrigation Department of Kerala and PWD Departments of Kerala. 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 like River research Foundation, Limnological Association, Chalakudy Puzha Samrakshana Samithy and Tea and coffee planters in Sholayar Anamalai areas, 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 Vazhachal Forest Division. The activities of line Departments such as Rural Development agencies, Panchayats (LSG), Social Welfare, Tribal Welfare, 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	Estimation of tourism carrying capacity		*							
17	Impact of tourism on Biodiversity				*					
18	Ecosystem services of riparian forests					*				
19	Monitoring of avifauna with special reference to Hornbills					*				

20	Monitoring and mapping of elephant movement	*								
21	Assessment of fish biodiversity				*					
22	Assessment of wildlife health			*						
23	Studies on small carnivores including leopard					*				
24	Staff amenities	*								
	Action programmes									
25	Identification of degraded watersheds and restoration	*								
26	Identification of degraded forests and restoration			*						
27	Project support to newly formed VSS	*								
28	Contribution to core fund of newly formed VSS	*								
29	Social welfare monitoring			*						
30	Hamlet meetings	*								

31	Preparation of new Microplans	*								
32	Implementation support	*								
33	Annual review		*							
34	Dissemination programme		*							
35	Livelihood improvement (Value addition, marketing and enterprise development)			*						
36	Anti poaching activities	*								
37	Vigilance	*								
38	Fire Protection	*								
39	Patrolling and communication	*								
40	Disease surveillance	*								
41	Surveillance and monitoring along Chalakudy-Pollachi trunk road	*								

10.6 Activity budget

Budget (Rs. in lakhs) for implementing Biodiversity Conservation Plan in Vazhachal Forest Division												
Sl. No.	**Particulars**	**Para of BCP**	**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	10.0	8.0	5.0	0.0	0.0	0.0	10.0	0.0	0.0	0.0	33.0
b	Status survey	9.2.2	6.0	5.0	0.0	0.0	0.0	0.0	5.0	0.0	0.0	0.0	16.0
c	Development of inventorying, assessing and monitoring protocols for habitat species.	9.2.2	4.0	,3.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0	0.0	10.0
d	Development of regional and landscape plans	9.2.2	0.0	6.0	5.0	0.0	0.0	0.0	3.0	0.0	0.0	0.0	14.0
e	Procurement of hardware, Software, GIS etc.	9.2.2	0.0	5.0	5.0	0.0	0.0	0.0	5.0	0.0	0.0	0.0	15.0
f	Computer (Desktope/Laptope) and accessories	9.2.2	1.5	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0	3.0
g	GPS	9.2.2	1.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	2.0
h	Camera, Camera traps	9.2.2	1.0	1.0	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	1.0	1.0	1.0	1.0	0.0	2.0	0.0	0.0	0.0	0.0	6.0
j	Consultancies	9.2.2	0.0	10.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	50.0
k	Seminars/workshops	9.2.2	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.5	1.5	1.5	11.5
2	**Strengthening Wildlife Research, education and nature awareness**												

a	Research	9.2.4	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	50.0
b	Census, Survey	9.2.4	4.0	1.0	1.0	1.0	1.0	4.0	1.0	1.0	1.0	1.0	16.0
c	Setting up monitoring plots/transects	9.2.4	0.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	10.0
d	Weather stations	9.2.4	0.0	10.0	0.0	0.0	0.0	0.0	10.0	0.0	0.0	0.0	20.0
e	Water monitoring stations	9.2.4	0.0	10.0	0.0	0.0	0.0	0.0	10.0	0.0	0.0	0.0	20.0
f	Monitoring and evaluation	9.8	0.0	0.0	2.0	0.0	0.0	0.0	2.0	0.0	0.0	2.0	6.0
g	Foreign tours	9.2.3	0.0	5.0	0.0	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	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0	9.0
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	1.0	1.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0	4.0
k	Publications	9.2.5	0.0	0.5	0.5	0.5	0.5	0.5	0.5	1.0	1.0	1.0	6.0
l	Visitor centres	9.2.5	0.0	0.0	15.0	0.0	0.0	0.0	5.0	0.0	0.0	0.0	20.0
m	Interpretation centres	9.2.5	0.0	10.0	10.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	34.0
n	Nature camps	9.2.5	2.0	2.0	2.0	2.0	2.0	3.0	3.0	3.0	3.0	3.0	25.0
o	Equipment for research and education	9.2.2	5.0	10.0	5.0	0.0	0.0	0.0	5.0	0.0	0.0	0.0	25.0
3	**Staff Development & Capacity Building**												
a	Basic training in systems and protocols and professional working	9.2.3	4.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	6.0
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	1.0	1.0	1.0	1.0	1.0	2.0	1.0	1.0	1.0	12.0
d	Fair placement norms	9.2.3	1.0	0.0	1.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	3.0
e	Grievance redressal mechanism	9.2.3	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	10.0

f	Awards	9.2.3	0.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	9.0
4	**Independent evaluation and status survey**												
a	An annual audit of the Division, Range, Station, beat	9.2.6	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	10.0
b	An annual audit of individual performance	9.2.6	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	10.0
c	Annual audit of systems and protocols	9.2.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	5.0
II	**Anti-poaching & Infrastructure Development**												
1	**Anti poaching**												
a	Strengthening of beat infrastructure	9.3.1	0.0	5.0	0.0	0.0	0.0	0.0	0.0	5.0	0.0	0.0	10.0
b	Community beat assistants*	9.3.2	4.0	4.4	4.8	5.3	5.9	6.4	7.1	7.8	8.6	9.4	63.7
c	Informant networks	9.3.3	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	5.0
d	Intelligence network	9.3.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	5.0
e	Arms and ammunition	9.3.1	20.0	0.0	0.0	0.0	0.0	10.0	0.0	0.0	0.0	0.0	30.0
f	Communications	9.3.5	2.0	0.5	0.5	0.5	0.5	2.0	0.5	0.5	1.0	2.0	10.0
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	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	5.0
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	10.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	12.0
b	Field camps	9.3.11	0.0	15.0	0.0	0.0	0.0	5.0	0.0	0.0	0.0	0.0	20.0
c	Staff quarters	9.3.12	15.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	17.0
d	Staff quarters at nearest education centre	9.3.13	30.0	0.0	0.0	0.0	0.0	0.0	5.0	0.0	0.0	0.0	35.0

e	Watch towers	9.3.14	8.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	10.0
f	Road network	9.3.15	10.0	10.0	10.0	10.0	10.0	15.0	15.0	15.0	15.0	15.0	125.0
g	Inspection paths	9.3.16	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	11.0
h	Lab and library facilities	9.3.17	10.0	5.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	31.0
i	Communication network (Mobile and Wireless)	9.3.18	2.0	0.5	0.5	0.5	0.5	1.0	1.0	1.0	1.0	0.0	8.0
j	Boat, Jeep and POL	9.3.19	0.0	15.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	23.0
k	Field gear for staff	9.3.20	5.0	0.0	0.0	5.0	0.0	0.0	5.0	0.0	0.0	5.0	20.0
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	15.0	5.0	1.0	1.0	1.0	1.0	1.0	1.0	2.0	28.0
d	Rescue camps	9.3.21	0.5	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.5	0.0	1.5
e	Rescue vehicles	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
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	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	10.0
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	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	5.0
4	**Staff welfare**												
a	Improving living amenities for staff	9.3.22	4.0	2.0	2.0	2.0	2.0	2.0	4.0	2.0	2.0	2.0	24.0
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	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	5.0
III	**Restoration of Habitat**												
1	**Habitat improvement**												

a	Enrichment planting	9.4.1a	0.0	3.0	3.0	3.0	3.0	4.0	4.0	4.0	5.0	5.0	34.0
b	Removal of exotic weeds	9.4.1b	0.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	90.0
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	2.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	47.0
e	Salt licks	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
f	Vista clearance	-	0.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	45.0
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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
IV	**Eco-development & Community oriented activities**												
1	**Human-wildlife conflict**												
a	Fencing	9.5.1 a	3.0	2.0	0.0	2.0	0.0	2.0	0.0	0.0	0.0	1.0	10.0
b	Compensation	9.5.1 b	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	10.0
c	Relocation of problematic animals	9.5.1 c	0.5	0.5	0.5	0.5	0.5	1.0	0.5	0.5	1.0	0.5	6.0
2	**Strengthening co-existence**												
a	Participatory approach (EDC/PFM)	9.2.5a	0.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	9.0
b	Entry point activities	9.2.5b	1.0	2.0	5.0	5.0	0.0	0.0	2.0	5.0	5.0	0.0	25.0
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	Eco-development programmes	9.2.5e	0.0	5.0	5.0	8.0	2.0	2.0	8.0	2.0	8.0	2.0	42.0
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	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	20.0
g	Trans-boundary issues	9.2.5g	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	5.0
V	**Grand Total**		**202.0**	**240.4**	**164.4**	**119.5**	**104.2**	**148.0**	**204.9**	**126.5**	**133.8**	**128.7**	**1572.4**

*10% increase in each year

10.7. Fund Requirement (10 year plan)

For the ten year research operation and all management prescriptions the budget required is Rs.**1572.4 lakhs.**

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LIST OF APPENDICES

APPENDIX - I

Government Order Relating to Formation of Vazhachal Division

Kerala Gazette No.42 dated 20th October 1981

PART I

Government of Kerala

Abstract

Forest Department-Reorganization of Central Circle-Bifurcation of Territorial Jurisdiction to Form High Range Circle and Central Circle – Delineation of Boundaries of Divisions and Ranges-Orders Issued

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G.O. MS.197/8.1/Forest Dated, Trivandrum, 31st July 1981

Read: - 1. G.O.MS. No. 1011/62/Agri.dated 5.9.1962

2. Letter No.Pl-161117/77 dated 11.2.1978 from the Chief Conservator of Forests.

3. G.O.MS.34/81/AD dated 7.2.1981

4. Letter No. Pl-16177/77 dated 2.6.1981 from the Chief Conservator of Forests.

ORDER

In the Government Order read as 3rd paper above, Government have ordered the re-distribution of territorial jurisdiction of the Divisions in Central Circle by forming one mote Territorial Circle called High Range Circle in the place of the Industrial Plantation Circle. The Chief Conservator of Forests in his letter read as 4th paper above, has forwarded detailed proposals to effect the re organization. Government have considered the proposals in detail and they Older that the Territorial jurisdiction of the Central Circle and the High Range Circle will be redefined as follows:

Central Circle

1. Trichur Forest Division
2. Chalakudy Forest Division
3. Vazhachal Forest Division

4. Malayattur Forest Division
5. Timber Sales Division (Functional)

High Range Circle

1. Kothamangalaln 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 Kothamnangalam Division. The detailed boundary description of the Territorial Forest Divisions and the Ranges coming under the Central High Range Circle is given in the Appendix to this order. The Headquarters of the Central Circle will be at Trichur and that of the High Range Circle at Kottayam Jn. 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 Headquarters of the Kottayam Forest Division will be shifted from Kottayam to Painavu as soon as a 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 Peermedu.

3. The re-distribution of Territorial jurisdiction as ordered above will take effect from the 1st August 1981.

By order of the Governor,
K.L.N .Rao,
Special Secretary.

To

The Chief Conservator of Forests Trivandrum
The Accountant General, Trivandrum,
The General Administration (Spl.C) Department
All Forest Sections of Agriculture Department

CENTRAL CIRCLE

Headquarters- Trichur

Under this Circle the following four Divisions. One Functional Division Viz. Timber Sales Division, Kalady in addition to the Mobile squad, will function. The different Divisions and Ranges and Depots coming under this Circle are as noted below:

Name of Division and Headquarters	Name of Range
1. Trichur Headquarters-Trichur	1.Wadakkanchery 2. Machad 3. Pattikad 4. Peechi
2. Chalakudy Headquarters- Chalakudy	1. Palappilly 2. Vellikulangara 3. Pariyaram
3. Vazhachal Headquarters- Chalakudy –	1. Charpa 2. Vazhachal 3. Athirappilly 4. Kollathirumedu 5. Sholayar
4. Malayattur Headquarters – Kodanad	1. Kalady 2. Kodanad 3. Thundathil 4. Kuttampuzha
5. Timber Sales Division Headquarters – Kalady	Name of Depot 1. Ernakulam 2. Varapuzha 3. Mudical 4. Chalakudy 5. Chettikulam 6. Trichur

HIGH RANGE CIRCLE

Headquarters- Kottayam

The following three Territorial Divisions and two Functional Divisions viz. Grassland Afforestation Division, Peerumedu and Timber Sales Division, Perumbavoor, in addition to the Mobile Squad will function under this circle. The Divisions, Ranges and Depots coming under this circle are the Following

Name of Division and Headquarters	Name of Range
1. Kothamangalam Headquarters-Kothamangalam	1. Kothamangalam 2. Thodupuzha 3. Mullaringad 4. Kaliyar
2. Munnar	1. Neriyamangalam

Headquarters-Devicolam	2. Adimaly 3.Munnar 4.Devicolam 5.Marayoor
3. Kottayam Headquarters- Kottayam	1.Ayyappancoil 2.Erumeli 3.Kumily 4.Nagarampara
4. Grass Land Afforestation Division Headquarters – Peermade	4 Ranges
5. Timber Sales Division Headquarters-Perumbavoor	1. Kumily 2. Parampuzha 3. Vetticad 4. Thalakode 5. Kothamangalam 6. Veettoor

The boundary descriptions of various Divisions and Ranges are as follows:-

CENTRAL CIRCLE

Headquarters- Trichur

Ranges	Headquarters
1.Wadakkancherry	Wadakkancherry
2. Machad	Wadakkancherry
3. Patticad	Patticad
4. Peechi	Peechi

Thrissur Forest Division consists of 3 Taluks viz., Thrissur, Palappilly, and Chowghat of Thrissur Revenue District. The detailed boundary description of the Division is as follows:

North: -Southern boundary of Palghat and Malappuram Revenue Districts starting from Arabian Sea runs eastwards, crosses Shornur Railways line at Cheruthuruthy and runs along the Southern bank of Bharathapuzha and reaches Cheerakuzhi.

East: - Eastern boundaries of Thalappally and Thrissur Taluks upto the point where the northern boundary of Mukundapuram Taluk joins, crosses National Highway and reaches Ponmudi Peak.

South: - From Ponmudi peak along Taluk boundary between Thrissur and Mukundapuram reaches Karivannoor River and thence in Northwest direction along the boundaries of Thrissur and Kodungallur Taluks, thence along with river boundary up to its confluence with Conolly Canal, then turn South west and touches Arabian Sea.

West: -Arabian Sea.

BOUNDARY DESCRIPTION OF WADAKKANCHERRY RANGE

Headquarters- Wadakkancherry

North: - Starting from Arabian Sea the boundary proceeds in a North East direction along the Ponnani Taluk boundary till it reaches Bharathapuzha at Cheruthuruthy then along Bharathapuzha till it reaches Cheerakuzhi.

From Cheerakuzhi along the Palghat District boundary till palazhi

South: - Starting from Plazhi proceeds along the Machad Range boundary towards West and reaches Kurancherry the North-West Corner of Machad Range, then again along the Western boundary of Machad Range along Vazhakode- Thrissur Road and then along the Taluk boundary of Thrissur and Thalappilly and thence Thalappilly and Chow ghat ruruting westwards reaches Kandanassery, the boundary runs along the Choonal- Pavarty Road towards South West and reaches Pavarty thence along Pavarty-Chowghat Roads towards North-West and reaches Chow ghat thence to the starting point of Chowghat- Manathala Road from where it proceeds West and reaches Arabian sea.

West:- Arabian Sea.

BOUNDARY DESCRIPTION OF MACHAD RANGE

Headquarters: - Wadakkancherry

North:- From the junction of Vazhacode, through Chelakara, Pazhayannur road up to Palghat District boundary, (This P.W.D road is known as Vazhacode Plazhi Alathur road)

East: - Thence along Pal ghat District boundary up to the boundary of Pattikad Range at Tehrumani

South: Thence along Thalappilly Taluk boundary (Pattikad Range boundary) till it meets Thrissur-Vazhacode P.W.D. road in Thiroor beat.

Western boundary: - From the junction of Talappilly Thrissur Taluks at Thiroor beat boundary (in Pattikad Range) on the Thrissur-Shotanur road P. W.D road upto Vazhacode junction (boundary in the P. W.D. Road).

BOUNDARY DESCRIPTION OF PATTICAD RANGE

Headquarters –Patticad

North: - Starting from the Arabian sea from the point where Chow ghat Manathala road starts and reaches at Chow ghat and passed in south east direction along the Chow ghat Pavaraty road and reaches Pavarty and thence towards north east direction along the Pavarty Choondal road and reaches the inter taluk boundaries of Talappilly and Chow ghat at Kadanissery and proceeds

towards east along the inter taluk boundaries of Talappilly and Chow ghat and thence along the Taluk boundaries of Talappilly and Thrissur where it crosses Kecheri and proceeds east along the inter taluk boundaries of Thrissur and Talappilly into the Thrissur kudukad road and there further eastwards along the inter Taluk boundary upto a point near Odakudu 2.5 miles south to Malaka. Thence from the above point along the Taluk boundary to the east to the peak of Kozhimuttakunnu on the Taluk Boundary of Thrissur taluk boundary at Thirwnani.

East: - Eastern boundary of Thrissur forest Division upto the point where Thrissur Pal ghat road cuts the Division boundary.

South: -From the Inter District boundary into proceeds west along the National high way 4'7 till it reaches Thrissur and thence further west along Thrissur Kanjani road it reaches Vadanappilly.

West: - Arabian Sea

BOUNDARY DESCRIPTION OF PEECHI RANGE

Headquarters: Peechi

North:- Starting from Arabian Sea and runs eastwards along Varandarappilly- A yyatithole-Thrissur road into Thrissur and thence along National High Way and reaches the northeast comer at Vaniampara.

East: - From Vaniampara runs southwards along the District boundaries of Palghat and Thrissur Districts turns southeast and reaches Ponmudi peak.

South: - .From Ponnludi runs westward along the Taluk boundaries between Thrissur and Mukundapuram and along the Southern boundaries of Panacherry Puthur, Ollur, Valiachira, Cherpu, Chazhoor and Thaniam Pan hayats and reaches the confluence of Kanoli canal and karuvannoor river and then in the north-west direction along the taluk boundary between Thrissur and Kodungallur and Chow ghat to the south west touching the western boundary of Thanian and eastern and southern boundaries of Valappad Panchayat and joins Arabian Sea.

West:- Arabian Sea

II. CHALAKUDY DIVISION

Headquarters- Chalakudy

Ranges	**Headquarters**
1. Palappilly	Varandarappilly
2. Vellikulangara	Vellikulangara
3. Pariyaram	Pariyaram

BOUNDARY DESCRIPTION OF CHALAKUDY DIVISION

Headquarters –Chalakudy

North: - Starting from the Arabian sea along the taluk boundary of Kodungallur and Chow ghat taluks and reaches the taluk boundary of Thrissur and Kodungallur towards south east upto the confluence of Karuvannur River and Kanoli canal and thence along Taluk boundary between Mukundapuram and Thrissur towards eastwards and reaches Ponmudi i.e., along the northern boundaries of the Kattur, Porathisseri, Parappukara, Trikkur Panchayats and proceeds to Thandigampara i.e. along taluk boundary and thence passing the ridges 2080, 2803, (Mangattukumban) 2610 towards Ponmudi (3045) and joins the origin of Pullakarithodu thence along that thodu up to Karappara River .

East: - From the confluence of Pulakaithodu and Karappara River proceeds towards south coast along the river up to Muduvarchal (the district boundary between Thrissur and Palghat) and thence along the old tramway line towards west passing Komalappara, Komalappara incline, Pothupara upto kannankuzhithodu (Pothupara bridge) i.e. (1011) and thence southwards along Kannankuzhithodu up to Chalakudy River.

South: - From the confluence of Kannankuzhithodu and Chalakudy River along the river towards west and meets Periyar at Manjaly and thence along Periyar River up to Arabian Sea at Munambam.

West: - Arabian Sea.

BOUNDARY DESCRIPTION OF PALAPPILLY RANGE

Headquarters- Varandarappilly

North: - Starting from the Arabian sea along the Northern Boundary of Kodungallur Taluk i.e along the western and northern boundary Edathiruthy Panchayat and reaches the confluence of Kannoli Canal and Karuvannur river and thence along the Taluk boundary between Mukundapuram and Thrissur towards east and reaches Ponmudi i.e passing Kallai Mangathukumban and thence proceeds to south east direction passed through Vellimudi and reaches Pullakkathodu.

East: - Starts from Pullakkathodu and proceeds to southwest direction passing the ridges Karimadam and reaches Ponmalai (3665)

South: - From Ponmalai westwards passing the Kumalai (2490) reaches Valomugham and then proceeds west along Vaikkattuthodu and reaches Muply river: Thence towards northwest along Muply Puzha up to the confluence of Chimoni and then along Pudukad, Irinjalakuda road up to Irinjalakuda and thence along Irinjalakuda Edamuttam road up to the Arabian Sea.

BOUNDARY DESCRIPTION OF VELLIKULANGARA RANGE

Headquarters- Vellikulangara

North: - Starting from the Arabian sea reaches Edamuttom and thence along the Edamuttom Irinjalakuda road upto Irinjalakuda and thence along Kodungallur Thrissur road upto Mapranam and thence along the Pudukad Irinjalakuda road up to Pudukkad, from Pudukkad boundary line proceeds along the Kurumali river and thence reaches the confluence of Chimmoni and Mupply river. Thence along Muply river upto the confluence of Valikattythodu with Muply river and thence along the Vaikattuthodu passing Valmuga In, Kunlali Puntala upto the origin of kannankuzhithodu and pulakaithodu and thence along the Pulakai thodu upto Karappara river.

East: - From the confluence of the Pulakathodu and Karappara river towards southeast along the river up to Mudavarichal i.e along the Nemmara division boundary

South: - From Mudavarichal along the old tramway line towards west passing Komalappara, Komalappara incline, Pothupara and then crossing the Kannankuzhithodu (Pothupara bridge). Thence along the old tramway line, touching Kavala upto Anapandhan then along Muply river upto the confluence of Muply river and sinik-uzhithodu. Thence along Muply rive upto Chokkana and thence along the old tramway line reaching Vellikulangara and then along the Vellikulangara Chalakudy road upto Kavalakutty portion then along the eastern boundary of the Chettikulam plantation upto Marankode and thence along the Vallikulangara Chalakudy road up to Chaukka. Thence westwards along the Porigalkuthu road up to Potta. Thence along the Chalakudy-Irinjalakuda road crossing the National Highway 47 at Potta up to Irinjalakuda R.S. and thence along railway line up to Alur and thence along the Thzhakad vellangallur road crossing the kottapuram- Guruvayoor road at Sreenarayanapuram and along the northern boundary of Sreenarayanapuram Panchayath upto sea.

West: - Arabian Sea.

BOUNDARY DESCRIPTIONS OF PARIYARAM RANGE

Headquarters- Pariyaram

North:- Starting from Arabian sea proceeds along the northern boundary of Sreenarayanapuram Panchayat and thence along vellangallur-Thazhakad road touching the Railway line at Alur and thence along the Railway line up to Irinjalakuda Railway Station and thence along irinjalakuda-Chalakudy road up to Porta and joins the National highway. Thence along National highway and turns along the Poringal road up to Chauka, then along the Chalakudy-Vellikulangara road up to Maracode. From Maracode runs southward along the eastern boundary of Chettikulam plantation up to kavalakkatty and then along Vellikulangara road up to Vellikulangara junction then along the old tramway line and then Muply river up to Annponthanl and again along the old tramway line till it reaches Kannankuzhithodu.

East :- Kannamkuzhythodu till it reaches Chalakudy river.

South:- Starting from the point where Kannankuzhythodu meets Chalakudy river runs along Chalakudy river till it reaches Arabian sea.

West: Arabian Sea

VAZHACHAL DIVISION
HEADQUARTERS – CHALAKUDY

Ranges	Headquarters
1. Charpa	Vazhachal
2. Athirappilly	Athirappilly
3. Vazhachal	Pokalappara
4. Kollathirumedu	Kollathirumedu
5. Sholayar	Sholayar

BOUNDARY DESCRIPTION OF VAZHACHAL DIVISION
HEADQUARTERS-CHALAKUDY

North: - From Kotharmudi at the point where kannankuzhythodu crosses the old tramway line, the boundary proceeds along the tramway line eastwards upto Muduvarachal and thence along Sholayar River up to Orukombnakutty. From Orukomban along the southern boundary of Nenl.mara Division passing through Majilakunlle, veerappelly Kunne, karimala gopuram and Gadoamali it touches the state boundary near Mudiyampara.

East: - From Mudiyampara to Mukkutumudi along the state boundary.

South: - From Mukkottumudi along Mukundapuram Taluk boundary up to Kulineerkal thodu along its course above Perumuzhy where the Raprathodu joins, that stream vilangupara upto Atlaikampara thence along Raprathodu to Vilangupra road where the boundary outs Athirappilly Vilangupura road. Thence along the Vilangupara rock stretch westwards to Anakampara. Thence along the streamlet from Koorullethodu westwards to Kochumedunlpara, south along Pullanithodu (Perumthodu) till the thodu cuts the road from Chandrapura. From Chandrapura along the Majapra -Angamaly road upto Angamaly. Thence along the National Highway 47 upto Desom. From Desom along the road upto Parur junction and thence along the road to Cherai. From Cherai boundary proceeds due west to meet Arabian Sea.

West: - From the point where the line from Cherai meets the sea, north along the sea to Munambam where the northern branch of Periyar River joins Arabian Sea. Thence along the river eastwards to Majaly the confluence of Chalakudy River with Periyar. From Majaly up along the Chalakudy River eastwards to the confluence of Kannankuzhythodu with Chalakudy River and thence northwards along the Kannankuzhythodu upto the starting point of the old tramway line.

BOUDARY DESCRIPTION OF CHARPA RANGE

Headquarters –Vazhachal

North: - Thence along tramway line till it meets Muthuvarachal river at Muthuvarachal thence along Muthuvarchal river upto Vazhachal- Parambikulam road.

East: - Thence along Parambikulam -Vazhachal road upto Vazhachal where it meets the Chalkudy -Angamaly road, thence along that road upto Vazhachal bridge.

South: - From Vazhachal bridge towards west through Chalakudy river till it meets the confluence of Kannamkuzhithodu.

West: - From Chalakudy river the boundary proceeds along the eastern boundary of Chalakudy Division towards north along Kannamkuzhithodu till it meets the tramway line at Kotharmudy.

BOUNDARY DESCRIPTION OF VAZHACHAL RANGE

HEADQUARTERS-POKALAPPARA

North: - From the point where the Vazhachal -Parambiikulam road crosses Muthuvarachal river and then along that stream upto the confluence of Parambikulam river and then along Parambikulam river upto the confluence of Sholayar and thence along Sholayar upto the point where a due north line starting from 57th Kilom, stone on Chalakudy Anamalai road touches the above river.

East: - Then along that line upto 57th kin stone ori Chalakudy -Anamalai road.

South: - Then along that road upto Pokalappara junction thence along Pokayilapara -Karadipdra road till it reaches the eastern boundary of Athirappilly Range and thence along the eastern boundary of Athitrappilly Range till it reaches Chalakudy river and thence along that river eastwards upto Vazhachal bridge.

West: -The eastern boundary of Charpa Range.

BOUNDARY DESCRIPTION OF KOLLA THIRUMEDU RANGE

Headquarters- Kollathirumedu

North:- From Pokayilapara thence along Chalakudy -Anamalai road upto Anakkayam bridge.

East:- From Anakkayam bridge along the demarcation line towards south-western direction till it reaches the T.C State boundary where the Mukundapuram Taluk boundary crosses Kltlineerkalthodu.

South:-From there along the southern boundary of Vazhachal Division upto Vilangupara.

West:- From there along the eastern boundary of Athirappilly Range upto the point where Pokayilapara -Karadipara road crosses old *T.C* State boundary, then along Karadipara – pokayilapara road till it meets the Chalakudy -Ariamalai road at Pokayilapara.

BOUNDARY DESCRIPTION OF SHOLAYAR RANGE

Headquarters- Sholayar

North: - From Orukombankutty along the northern boundary of Vazhachal Division till it meets the Kerala State boundary.

East: - Along the Kerala State boundary upto Mukkottumudi (3854)

South: -From Mukkottumudi along the old T.C State boundary (Mukundapuram Taluk) till it reaches the southeast comer of Kollathirumedu Range.

West: -Thence along the eastern boundary of Kollathirumedu Range upto Anakkayam bridge and then along the Chalakudy -Anamalai road upto 57th Kilometer and then along the western boundary of Vazhachal Range upto Orukomban.

BOUNDARY DESCRIPTION OF ATHIRAPPILLY RANGE

Headquarters- Athirappilly

South:-From there along the southern boundary of Vazhachal Division upto Vilangupara

North:- Starting from Arabian sea along Periyar upto confluence of Chalakudy river thence proceeds along Chalakudy river towards east upto the point where the erstwhile T.C state boundary reaches Olshorimudi (2040).

East:- From Olshorimudi (2040) (rocktnark) towards south for about 2 kilom along the outline till it reaches the junction of three fair weather roads (1) coming from Watmaram (Kollathirun1edu) at the east (2) coming from Athirappilly falls at the west and (3) coming from Vilangupara at the south. Front this junction proceeds towards south along Vilangupara road upto Vilangupara..

South:- From that point along the southern boundary of Vazhachal Division (Northern boundary of Malayattur Division).

West:- Arabian sea.

IV. 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 Cheran and thence along the road to Paravur junction and thence eastwards along the road to Desom. From Desom towards north

along NH-47 upto Angamaly. From angamaly along the Angamaly -manapra road to Chandrapura and thence along the road upto the point where it cuts Pullanithodu (Perumthodu). Thence along Pullanithoud towards north upto Kochumedumpara and thence along the streamlet towards east where it is called koomelthodu and reaches Anaikampura. From there the boundary proceeds eastwards along Vilangupara rock stretch and reaches Vilangupara where the boundary line cuts Athirappilly -Vilangupara road. From there the line goes along rapra thodu first and then along the southern boundary of the Vazhachal Division. Thus again the line joins the Raprathodu and proceeds along the thodu till it meets the Kulineerkatthodu above Perumuzhy. Thence the boundary proceeds east through Airakunnu, Veehappara and joins the state boundary is Mukkathumudi.

East:- From Mukkuthumidu the boundary turns south through Pannirakutty, Valampara, Avalipala and reaches Penlffibankutty boundary of Munnar Division.

South:- Thence the line turns west through Anakulamagar and reaches Kunjiyar and turns south and reaches parapoya. Thence the boundary line turns west and proceeds through Periyammalai, Pazhamudi and joins Periyar River. Then the line follows the Periyar river work from Palamattam till it joins Edamalayar River at Bhoothathankettu. From Boothathankettu the boundary proceeds along Bhoothathankettu -Thangalam road through Thrikkariyur and gets into Alwaye - Kothamangalam road and reaches Perumbavoor. From Perumabavoor the boundary proceeds along Perumbavoor -Muvattupuzha road (M.C road) upto Muvattupuzha Thence boundary proceeds along Muvattupuzha -Emakulam road upto Kaniyampuzha From Kaniyampuzha reaches Cochin Corporation boundary at Chaboorkavu canal near Thripunithura. Thence the Corporation boundary upto Arabian Sea including Willingdon island.

West:- Arabian sea upto the point where a line running due west from Cherai reaches Arabain sea.

BOUNDARY DESCRIPTION OF KUTTAMPUZHA RANGE

Head Quarters –Kuttampuzha

North:- Starting from Kappayam the boundary line proceeds eastwards through the division boundary upto Kerala State boundary at Mukutumudi.

East:- From Mukutumudi to south along the division boundary upto Perwnbankuthu (right side of the boundary Munnar Division).

South:- From Prunlbankuthu westwards 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 and join ldamalayar. Thence the boundary follows ldamalayar against its flow, turns north where Kuttampuzha joins ldamalyar and precedes upto Perumuzhy where ldamalayar turns east. From Perumuzhy, boundary proceeds north and reaches Kappayam.

BOUNDARY DESCRIPTION OF THUNDATHIL RANGE

Headquarters –Thundathil

North:- Starting from Anaikamppara proceeds east along Vilanguppara rock stretch and cuts Athirappilly -Vilanguppara road at Vilanguppara. 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 Perruzhy.

East:- Thence along right bank of Idanalayar tip to the confluence of Kuttampuzha river and Idamalayar.

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

West:- From the confluence of Mannathuthodu with Periyar it goes along Maunathuthodu towards north along the streamlet originating from Edakallana and then along the ridge from Edamkkalana to Sulanedu via. Erattumugham and thence along the ridge towards northeast till it reaches Anaikamppara.

BOUNDARY DESCRIPTION OF KODANAD RANGE

Headquarters –Kodanad

North:- From Arabian sea along the Malayattur Division boundary upto Oesomand then along right back of Periyar river upstream upto the confluence of Perumthodu and Periyar and then alorig Perumthodu Pullamthodu upto Kochumedutnppara. From Kochumeduppara along Kochunlllool thodu up to Anappara.

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

South:- From Bhoothathankettu along the southern boundary of Malayattur Division up to Arabian sea.

BOUNDARY DESCRIPTION OF KALADY RANGE

Headquarters –Kalady

North:-From Desom along National Highway 47 upto Angamaly and then along division boundary upto Kochumedumppara.

East:- Western boundary of Kodanad range.

South & West:- Right back of Periyar river upto Desom.

HIGH RANGE CIRCLE

KOTHAMANGALAM DIVISION

Headquarters –Kothamangalam

Ranges	Headquarters
1.Kothamangalam	Kothamangalam
2.Mullaringadu	Thalacode
3. Kaliyar	Kaliyar
4.Thodupuzha	Thodupuzha

BOUNDARY DESCRIPTION OF KOTHAMANGALAM DIVISION

North:- starting from Perumbavoor runs along Alwaye-Munnar road and reaches Thangalanl thence along thangalam Bhoothanthankettu road through Thrikkariyoor upto Bhoothathankettu thence along Periyar river to palamattam. (This line is part of southern boundary of Malayattur Division).

East:- From Palamattam along Periyar river upto Neriyamangalam bridge and then along the watershed line along Thusipara and Meenazhinijammudi. The boundary further proceeds along the western boundary of Kottayam Division upto the southeastern and of Arakulam Reserve.

South:- Starting from the south east comer of Arakulam Reserve runs in a north-west direction along the thaluk boundary between Meenachil and Thodupuzha upto the tri junction of Meenachil, Thodupuzha and Vaikom thaluks crossing M.C. road at Kutthattukulam then along Meenachil and Vaikom thaluks upto Piravam and thence along Muringapuzha river upto Murinjapuzha bridge, thence along Vaikom-Ernakulam road upto till it joins the Ernakulam-Muvattupuzha road at Chambarkavu.

West:- Starting from Chambarakavu runs along Emakulam -Muvattupuzha road upto Muvattupuzha, thence along M.C. road upto Perumbavoor the starting point of northern boundary.

BOUNDARY DESCRIPTION OF KOTHAMANGALAM RANGE

Headquarters- Kothamangalam

North: - Northern boundary of Kothamangalam division.

East: - Palamattom to Neriyamangalam bridge along Periyar river.

South: - Neriyamangalam bridge to Kothamangalanl along Munnar-Alwaye road and then southwards Muvattupuzha along Kothamangalam In-Muvattupuzha road up to Muvattupuzha bridge and along M.C. road upto Koothatukulanl to meet the northern boundary of Kottayam Division and then along the Kottayam Division boundary up to Chembarkavu the tri junction of Malayattur, KottayaIl1 & Kothamangalam Divisions.

West: - Western boundary of Kothamangalam Division.

BOUNDARY DESCRIPTION OF THODUPUZHA RANGE

Headquarters –Thodupuzha

North:- Muvattupuzha and Kaliyar river until Kaliyar reaches the Kaliyar-Kunnam road and then along the road up to Kunnam and then towards east through Kunnanl-Udumbanoor up to Parltkavala and then along Parakavala- Katihapptl road until it reaches Veloor-Chapath then towards north-west along Veloor river until it reaches Kaliyar and towards north-east along Kothanlangalam Range boundary up to Meenolinjamudi.

East:- From Menolinjamudi along the division boundary of Kottayam up to the south- east corner of Arakulam Reserve forest.

South:- Thence along the northern boundary of Kottyam Division up to the point where it crosses M.C. road at Koothattukulam.

West:- From Koothatukulam to Muvattupuzha bridge along M.C. road.

BOUNDARY DESCRIPTION OF MULLARINGAD RANGE

Headquarters –Thalakode

North: - Southern boundary of Kothamangalam range i.e., Alwaye Munnar road from Kothamangalam to Neriyamangalam bridge.

East: -Western boundary of present Adimaly range from Neriyamangalam bridge along the watershed line passing through Thusiparamudi upto Venmanithodu.

South:- Present boundary between Nadukadavu and Mullaringad sections a watershed line up to Paingttoor from Venmanithodu along Kottaparanludi and then a straight line till it reaches Kothamangalam-Muvattupuzha road at Puthuppadi junction.

West:- Kothamangalam- Muvattupuzha road from kothamangalam up to Puthuppadi Junction.

BOUNDARY DESCRIPTION OF KALIY AR RANGE

Headquarters-Kaliyar

North:- Southern bollllclary of Mullaringadu range starting from the jllllction at Puthuppadi in Kothamangalam-Muvattupuzha road runs in a straight line towards east to Pyngottur and then runs along the water shed line of ridge from Pyngottur to Venmanithodu passing through the Kottanlapranludi.

East:- Western boundary of Thodupuzha range thorough Vemnanithodu till it reaches Thommankuthu then passing through Veloorpuzha, thence along Veloor road to meet Chappathu at Veloor river.

South:- From Chappathu in Veloor river through Udumbannur road upto Kunnam thence towards north along Kunnam Kaliyar road upto Kaliyar and thence along kaliyar river upto Muvattupuzha bridge.

West:- Kothamangalam--Muvattupuzha road from Muvattupuzha to Puthuppadi junction.

MUNNAR DIVISION

Headquarters- Devikulam

North: - Starting from Pannimadakuthu crosses Perattunlala and reaches Chinnar just by crossing Udumalpet road, which is the northeast corner.

East:- Starting from Chinnar and runs through the State boundary crosses to-station- Bodimettu and reaches Palachanamedu which is the southeast comer.

South:- Starting from Palachananledu runs west passes Kumili road at Parathodu joins Perinjankutty river up to Panmjutty crosses Idukky road west up to Pamba turns south up to Pazhayarikandam thence to west up to Thalakode along the Alwaye- Munnar road up to Neriamangalam and then along Periyar river up to Palamattom.

West:- From PalaInattom runs north east direction and crosses Kuttampuzhayar and reaches Parapoya then along Kanikiyar river up to Kanjiyar then passes through Perumbankuthu and ends at Pannimadakuthu.

BOUNDARY DESCRIPTION OF NERIY AMANGALAM RANGE

North:- Starting from a point at palamattom near Periyar where Columbanthodu joins Periyar river runs towards east along the Division boundary passing through Puzhumudi (1764) Periyarmala (2971) up to Parapoya.

East:- From Parapoya runs towards south through Kwijiyar up to Irumbupalam and then crossing the Alwaye- Munnar road and then again towards south and joins Periyar and then along Periyar up to Panamkutty towards east.

South & West:- Thence towards southwest along the division boundary till it joins the starting point at Palamattom.

BOUNDARY DESCRIPTION OF ADIMALY RANGE

Headquarters-Adimaly

North:- Starting from a point at north eastern of Neriyamangalam range at Panamoya runs west through division boundary then towards division boundaries and joins at Perumala.

East:- Thence running along the concession both towards the north east up to number 10 Pallivasal-Pakkuthi, then turns towards south along the river till it joins with Muthirapuzha then takes a turn towards east along Muthirapuzha and Panniyar joins then towards south Sinapettythodu and joins the division boundary .

South:- Thence runs along the division boundary towards west upto Panamkutty and then Panamkutty towards west through Periyar upto South eastern corner of Valara-Neriyamangalan range.

West:- From this point turns towards north passing Irumbupalam and joins the starting point along eastern boundary of Neriyamanagalam range.

BOUNDARY DESCRIPTION OF DEVIKULAM RANGE

Headquarters- Devikulam

North:- Starting from a point on the concession boundary of K.D.M.P. at Natchivayal Pakuthy where from the eastern boundary of Munnar Range starts going towards east along the concession boundary till it meets with the Division boundary near Top station.

East:- Thence through the Division boundary i.e. state boundary towards south up to Pelchanamedu.

South:- thence towards west along the Division boundary up to the points where Sinapotthodu joins on Perinjankutty river.

West:- The boundary line then goes towards north along the Sinapotthodu through eastern boundary of Mukkudom beat turns towards west and runs along Muthirapuzha river till it meets with Kallar river. Then goes towards north along Kallar River, till it meets the concession boundary number 10 Pallivasal pakuthy, then towards east along the concession boundary till it reaches southeastern boundary of Chokkandae Estate, then runs towards north along the eastern boundary of Munnar Range and joins the concession boundary at Nachivayar pakuthy.

BOUNDARY DESCRIPTION OF MUNNAR RANGE

North:- Starting from the north- west point (1619) in Idamalai river where the state boundary runs south from Mukkottumudi meets the Idamalai river from the north east corner of the Malayattur Reserve Forests, the boundary runs eastwards along the boundary of Kerala State separating it from Coimbatore District to the point where the boundary of K.D.H.P. concession area meets it at south-east of Sandamalai (6367) and then along the concession boundary towards east up to Parathumalai.

East: - Thence southwards along the K.D.H.P. Concession boundary at Marayor pakuthy thence to eastern boundaries of Pambumalai Vaguvarai Gundumalai Estates then through eastern boundary of Headquarters land, northwestern in boundary of "K.A." block then towards the southern boundary of Madupetty Estate towards the south along the western boundary of Headquarters land and Devikulam cutchery land and then joins with the north-western boundary of lock hard estate and goes towards south along the eastern boundary of Chekkamedu Estate. The above boundary will be the western boundary Arivikadu section of Devikulam Range.

South:- The point where the eastern boundary line meets the concession boundary of Chokkanadu Estate is the starting point of the southern boundary of the river. The line then goes towards west along the concession boundary leaving Pallivasal Pakuthy on the south.

West:- Thence northwards along the eastern boundary of concession area and meets the eastern boundary of Malayattur Reserve till it meets the state boundary at the starting point of Idamalai river.

MARAYOOR RANGE

This range has not lost or gained any area due to the formation of new ranges. The section and beats are as follows

Section	Headquarters	Beats	Headquarters
1.Marayoor	Marayoor	1.Marayoor	Marayoor
		2.Chinnar	Chinnar
2.Kanthalloor	Kanthalloor	1.Kanthalloor	Kanthalloor
		2.Vattavada	Vattavada

Boundary description:

Since there is no change of area in the range, sections and beats, the boundaries of the range, sections, and beasts, are the existing ones.

III. KOTTAYAM DIVISION

Headquarters- Kottayam

North: Starting from Arabian sea along the southern boundary of Cochin Corporation up to Chambakkara Canal near Tripunithura thence along Ernakulam-Vaikom road up to Muringapuzha thence along Muringapuzha river upto privam thence along the Taluk boundary of between Vaikom and Muvattupuzha up to tri-junction of the boundaries of Vaikom, Muvattupuzha and Meenachi and Thodupuzha Taluk up to the tri junction of Thodupuzha Meenachil and Peermade Taluks, thence runs towards north along the eastern boundary of Kothamangalam division, up to Pamba and from there runs due east passing through Paramkutty and reaches Palachanamedu at the state boundary.

East:- State boundary from Palchanamadu upto Kumili.

South:- From Kumili along the boundary of the Tiger Project area. Thence along the taluk boundaries of Peermade then along the taluk boundary of Changanassery Taluk then along with Taluk boundary of Ambalapuzha Taluk till it reaches Arabian Sea.

BOUNDARY DESCRIPTION OF KUMILI RANGE

Headquarters- Kumili

North:- Starting from the confluence of Panamkuttiyar and tributary of Munnar River runs eastwards up to Polchanamadu on the state boundary .

East:- From Palachanamadu runs southwards along the state boundary and reaches Kumili.

South:- From Kumili along the boundary of Tiger Project and from Mullaperiyar Dam runs along the course of Periyar river up to Ayyapancoil.

West:- From ayyappancoil runs northwards crossing both the tributaries of Kallar river till it reaches Panamkutty.

BOUNDARV DESCRIPTION OF AYYAPPANCOIL RANGE

Headquarters –Kanjiyar

North:- From Panamkutty runs along Panamkutty river till it meets with the tributary of Munnar River.

East:- From the confluence of Panamktihiyar and tributary of Munnar runs southwards crossing both the branches of Kallar river till it meets Periyar river at Ayyappancoil and then along Periyar fiver up to the starting point.

South:- Southern boundary of Peemlade Taluk.

West:- Along the Taluk boundary of Peennade up to the tri junction of Peennade, Meennchil and Thodupuzha Taluks and then falls eastwards and agaiI1 joins Periyar river just below Ayyappancoil and runs along Periyar river till it reaches PaI1amkutty.

BOUNDARY DESCRIPTION OF NAGARAMPARA RANGE

Headquarters-Idukki

North:- Starting from Pamba rul1S due eastwards till it reaches PananIkutty.

East:- From Panamkutty the boundary furls upwards along Periyar river up to a point just below Ayyappancoil.

South:- From Ayyappancoil along the taluk boundary pf Peeramade till it meets the taluk boundary of Thodupuzha taluk.

West:- From the point where Peeramade Taluk boundary meets Thodupuzha Taluk boundary runs northwards along the eastern boundary of Kothamangalam Division till it reaches Pamba.

BOUNDARY DESCRIPTION OF ERUMELI RANGE

Headquarters: Erumeli

North:- Northern boundary of Kottayam Division up to the tri junction of Thodupuzha, Meenachil and Peennade Taluks.

East:- western boundary of Peennade taluk

South:- Southern boundary of Changanassery and Ambalapuzha Taluks.

West:- Arabian Sea

APPENDIX - II

Details of Areas Handed Over for Other Purposes

SI No.	Purpose for which handed over	Range	Area handed over in ha
1	Sholayar Hydro Electric Project	Sholayar	29.5791
2	Poringal Hydro Electric Project	Vazhachal	220.1538
3	Kannankuzhi Harijan colony	Charpa	55.198
4	Vazhachal Girijan colony	Vazhachal	1.8500
5	Pokalappara Kada Colony	,,	2.7800
6	Poringalkuthu Kada Colony	,,	3.6000
7	Mukkumpuzha Kada Colony	,,	0.5000
8	Watchumaram Kada Colony	Kollathirumedu Range	1.8000
9	Watchumaram Malaya Colony	,,	2.5600
10	Malakkappara Girijan Colony	Sholayar	50.0000
11	Thavalakkuzhippara Malaya Colony	,,	14.6600
12	Sholayar Kummatti Colony	,,	2.1200
13	Christian Church at Poringal	Vazhachal	0.1840
14	Malakkappara Estate	Sholayar	778.5450
15	Perumpara Estate	,,l	35.1841
	Total		**1198.71400**

* The first two items of Appendix – II are long term leases for 60 years. The other areas are not leaseholds. The occupants are permitted to stay and cultivate the land. All these areas were thus diverted well before the enactment of the Forest Conservation Act 1980.

APPENDIX -III

Details of Long Term Leases

Sl. No	Date of Lease Deed	Lease Period	Area	Area Under Possession	Name of Leasee	Remarks
1.	I. Perumpara Estate 11.12.1935	Perpetual from 1935	54.50 Acres	50.50 Acres	S. Ramalingam	Lease right sold Sri A.K. Gopalan Chettiar and Sri. C.C. Mohammed Kassim.
2.	Perumpara Estate 26.9.1938	Perpetual from 1938	39.50 Acres	36.44 Acres	S. Ramalingam	Lease right sold to Smt. K.K.Mehaboob Beevi
3	II. Malayattur Estate 25.02.1922	Perpetual from 1922	2135.65 Acres	1923.785 Acres	Amalgamated Tea Estates	Lease right sold to M/s Tat Finaly (Name changed to TATA TEA)

Note: For details regarding lease of areas to Plantation Corporation of Kerala, the Chapter on 'Projects in the Division' may be referred to.

Details of Forest Land Given To Different Agency in Long Term Basis Up To 31-3-2002

SL No.	Range	Reserve	Type	Extent(Ha)	Date of giving	Date of taking back	Govt. Order and Date	Agency received	Objective
1	Sholayar	Athirappilly	Reserve Forest	778.545	25-2-1922	–	–	Malakkappara Estate	For cultivation of Cocoa, Pepper Rubber.
2	Vazhachal	Kodassery	„	20.4371 14.7470	11-12-1935 26-9-1998	–	–	Perumpara Estate	For cultivation of coffee and Tea
Total				35.1841					
3	Vazhachal	Kodassery	„	220.1538			D.Dis.1902/52/ PWD Dt.05-09-1952	KSEB	For generation of Electricity(Poringalkuthu Hydro Electric Project
4	Sholayar	Athirappilly	„	29.5791			D.Dis 5631/57 Dt.29-05-1957	KSEB	For generation of Electricity(Sholayar Hydro Electric Project
Total				1063.462					

APPENDIX – IV

RIGHTS AND CONCESSIONS

I. KODASSERY

VILLAGE No.41 PARIYARAM

a) The public road from Pariyaram to Athrappilly thorugh the Thumburmuzhi Estate.

b) The watercourse that enters from the Reserve at the eastern side of survey No. E. Puliyannuzhi Estate and a footpath from this estate to Thumburmuzhi Estate. These will be kept in tact.

VILLAGE NO.10 –MATTSHUR

a) A foot-path from survey No.122 to exclusion D (to the Mupply Estate Survey No.1707 to 1711)

b) A canal from the Reserve by the side of Survey No.2, 20, 11, 12,13, 14 falling into survey No.25.

c) The watercourse flowing into the getting out of exclusion A.

d) A footpath from exclusion E to the Canal No.3. These will be preserved.

VILLAGE NO.9 –MUPPLIVAM

a) A canal from survey No.23 flowing into the river.

b) Two canals flowing into survey No.3 and exclusion B respectively by the side of survey No.2.

c) Two channels flowing into the river from survey Nos. A & 2 & B respectively and a canal from exclusion B to the river.

d) A canal entering into exclusion D.

e) A canal from survey No.9 flowing the river by the sides of survey No.8 &6.

f) A canal from exclusion F flowing into the river by the side of Survey No.6.

g) The water curse splitting into two branches to the south of Survey No.19 and g) and flowing into survey No. G and H

h) A foot-path from survey No.23 passing along the northern boundary of survey No.24 and southern and eastern fire lines of Teak plantation and getting out to Survey No. 21/A.

i) Another foot-path from survey No.4 passing the southern and eastern fire lines of the Teak Plantation and getting out to Survey No.9.

j) A foot-path from Survey No.6 passing along the southern and eastern fire lines of the Teak plantation and getting out to Survey No.20.

k) Another footpath connecting Survey No.6 and Survey No.20.

l) Another connecting Survey No. H and Survey No.1

VILLAGE NO. I –VARANDRAPILLY

a) The cart-tract from survey No.59 going through the Teak Plantation and by the side of the Rubber Plantation and by the side of the Rubber Plantation to Kannattupadam Swamp and to Elikkottupadam Survey No. 680

b) The cart tract (known as Chimmony Road) through the reserve and Rubber plantations reaching Survey No. 692 of the Anapandam in the east.

c) A cart track from survey No. G to Survey No.50

d) A footpath from Survey No.50 to Nadampadom Swamp. These will be preserved.

e) A footpath from Survey No.50 to Nadampadom Swamp. These will be preserved (published in page Nos 84-90 in the Cochin Government Gazette dated Kanni 24th 1085)

II. ATHIRAPPILLY RESERVE

RIGHTS ADMITTED: Nil

(Published Page No.87 of Cochin Government Gazette dated Kanni 1st 1085)

III. MALAYATTUR AND IDIYARA RESERVE

RIGHTS ADMITTED: NIL

(Published in Page No.1085 of Travancore Government Gazette volume XXXIII dated 9.07.1985).

APPENDIX – V

Delineation of core and buffer zone of Parambikulam Tiger Reserve

GOVERNMENT OF KERALA

Forests and Wildlife (F) Department

NOTIFICATION

No.GO(P)No.53/20009/F& WLD Dated ,Thiruvananthapuram, 16/12/2009.

SRO No. /2009,- In exercise of the powers conferred under subsection (1) of section 38 V of Wildlife (Protection) Act, 1972 (Central Act 53 of 1972), and in partial super cession of the notification issued under GO (P) No. 75/07/F&WLD dated 31st December, 2007 and published as S.R.O.No. 1089/2007 in the Kerala Gazette Extraordinary NO.2328 dated 31st December, 2007, in so far as it relates to the declaration of core or critical tiger habitat areas of Parambikulam Wildlife Sanctuary, the Government of Kerala hereby declare the following areas of core or critical tiger habitat mentioned in the Schedule hereunder as Parambikulam Tiger Reserve, in the State, in the interest of conservation of Tiger.

SCHEDULE

PARAMBIKULAM TIGER RESERVE

District	:	Palakkad, Thrissur
Taluk	:	Chittur, Mukundapuram, Alathur
Area	:	390.89 Sq. km of the total area situated within the Boundaries mentioned below (Excluding the area of 39.872 Sq. km described as excluded area hereunder).

North: The boundary commences from a point on the Nelliampathy Reserve Forest boundary at the south-east corner of Kalchadi (400m south) and proceeds towards south-east along a stream that flows down from south-west slope of Pullala Mala and till it reaches the saddle point and further along another stream that originates on the south slope of Pullala Mala and ends at a point where the stream and the northern boundary of Karadi estate merges. Thence the boundary proceeds along the northern and western

boundary of Karapara estate, and western boundary of Beatrice estate and ends at the point where the western boundary of Beatrice estate meets the northern boundary of Parambikulam Wildlife Sanctuary. Thence the boundary proceeds towards east along the northern boundary of Parambikulam Wildlife Sanctuary till Kuchimala located on the north east corner of Parambikulam Wildlife Sanctuary.

East: Thence along the inter-state boundary between Kerala and Tamil Nadu from Kuchimala and passing Pandaravaramala, Mount Stuart and Karianshola and Vengolimala peak and thence through the demarcated line passing Varagaliyar and upto the tri-junction of Palghat and Trichur Districts and Tamil Nadu. The boundary proceeds towards south along the interstate boundary and ends at a point where eastern part of Sholayar Reservoir meets the interstate boundary.

South: Thence the boundary proceeds towards west along the northern bank of Sholayar Reservoir and continues along the northern bank of Sholai Ar till it reaches the eastern boundary of Vazhachal Range of Vazhachal Division. The boundary thence proceeds towards north along the eastern boundary of Vazhachal Range of Vazhachal Division (along the Sholai Ar) till a point where the north-western corner of the Sholayar Range of Vazhachal Division meets the southern boundary of Parambikulam Wildlife Sanctuary near Orukomban. Thence pioceeds towards west along the southern boundary of Parambikulam Wildlife Sanctuary till the point where the tramway line crosses the karappara river at Mudarachal. Thence the boundary proceeds towards west along the southern boundary of Kavala Section and ends at Kavala.

West: Thence the boundary proceeds towards north along a stream that comes down from Pundi Mudi (1116m MSL) and ends on the southern boundary of Chimmony Wildlife Sanctuary at Pundi Mudi peak.

Thence it runs in north-eastern direction along the boundary between Chimmony Wildlife Sanctuary and Vellikulangara Range till it touches the tri-junction where Chimmony Wildlife Sanctuary, Vellikulangara Range and Alathur Range meet. Thence the boundary further proceeds towards east along the northern boundary f Vellikulangara Range and ends at a point where south-west boundary of Padagiri Section of Nelliampathy Range, south-east boundary of UTT Company Estate and the northern boundary of

Vellikulangara Range converge. Thence the boundary proceeds towards north along the western boundary of Nelliampathy Range and ends at the starting point.

Excluded area:

Within the above boundary, an extent of 39.872 Sq. km is excluded from the 'Core or Critical Tiger Habitat' which includes (i) 20.659 Sq. km of reservoirs of Parambikula,m (17.570 Sq. km) and Thunacadavu and Peruvaripallam (3.089 Sq. km); (ii) 0.913 Sq. km which includes tribal settlements (34.3ha) and a buffer of 100m from the periphery of the settlements (57ha) i.e., Sungam (3.07ha+9ha), Pooppara (24ha+21 ha), Fifth Colony (1.38ha+7ha), Kuriarkutty (5.09ha+1 Oha)] Earth Dam Colony at Parambikulam (0.33ha+5ha) and Kadar Colony at Parambikulam (0.40 ha + 5 h a) and (iii) about 18.30 Sq. km of teak plantations in Sunga m Range.

By order of the Governor

Dr. A.K Dubey,

Principal Secretary to Government.

Explanatory Note

(This does not form part of the notification, but is intended to indicate its general purport.)

As per sub-section (1) of Section 38 V of Wildlife (Protection) Act, 1972 , the National Tiger Conservation Authority has agreed to a proposal to declare the areas as mentioned in the notification as Parambikulam Tiger Reserve. An Expert Committee has identified and delineated the 'core or critical tiger habitat' based on scientific and objective criteria.

As per GO (P) No. 75/07/F&WLD dated 31st December, 2007 and published as S.R.O.No. 1089/2007 in the Kerala Gazette Extraordinary NO.2328 dated 31st December, 2007, the Government of Kerala has interalia declared an extent of 235 Sq. km (excluding 50 Sq. km from the total area of 285 Sq. km of Parambikulam Wildlife Sanctuary) as 'core or critical tiger habitat' of Parambikulam Wildlife Sanctuary under Section 38 V of Wildlife (Protection) Act, 1972 (Central Act 53 of 1972) based on the recommendation of

the Expert Committee constituted for the purpose. In the present notification an area of 39.872 Sq. km is excluded from the sanctuary, which includes (i) 20.659 Sq. km of reservoirs of Parambikulam (17.570 Sq. km) and Thunacadavu & Peruvaripallam (3.089 Sq. km), (ii) 0.913 Sq. km which includes tribal settlements (34.3ha) and a buffer of 100m from the periphery of the settlements (57ha) i.e., Sungam (3.07ha+9ha), Pooppara (24ha+21 ha), Fifth Colony (1.38ha+ 7ha), Kuriarkutty (5.09ha+ 10ha), Earth Dam Colony at Parambikulam (0.33ha+5ha) and Kadar Colony at Parambikulam (0.40ha+5ha) and (iii) about 18.30 Sq. km of teak plantations in Sungam Range which is proposed to be notified as Buffer for the core or critical tiger habitat. However, the black topped roads from Pollachi to Parambikulam and from Parambikulam to Kuriarkutty pass through the 'core or critical tiger habitat'.

Besides the 235 Sq. km of 'core or critical tiger habitat' already notified, the areas additionally proposed for Parmbikulam Tiger Reserve are 10.128 Sq. km from balance area of Parambikulam Wildlife Sanctuary and the areas from neighboring Forest Divsions include Nemmara (42.99 Sq. km), Chalakkudy (42.24 Sq. km) and Vazhachal (60.53 Sq. km), which are contiguous to the existing core or critical tiger habitat of Parambikulam Wildlife Sanctuary and are prime habitats of Tiger in the State. The said area is suitable for declaration as Tiger Reserve in accordance with sub-section (1) of Section 38 V of the Wildlife (Protection) Act 1972. Hence, the Government of Kerala has decided to declare the said area of 390.89 Sq. km' including 245.128 Sq. km from Parambikulam Wildlife Sanctuary as Parambikulam Tiger Reserve.

The notification is intended to achieve the above object.

GOVERNMENT OF KERALA

Forests and Wildlife (F) Department

NOTIFICATION

G. O, (P) No. 54(09/F&WLD. Dated, Thiruvananthapuram, 17th December, 2009.

S. R. O. No. 107412009.-In exercise of the powers conferred under section 38 V of Wild life (Protection) Act, 1972 (Central Act 53 of 1972), the Government of Kerala hereby declare the following areas of Parambikulam Wildlife Sanctuary and of neighbouring Nemmara, Chalakkudy and vazhachal Forest. Divisions mentioned in the schedule hereunder, which are peripheral and contiguous to the core or critical tiger habit of Parambikulam Tiger Reserve as the buffer zone, In the State, in the interest of conservation of Tiger.

SCHEDULE

BUFFER ZONE OF PARAMBIKULAM TIGER RESERVE

District: Palakkad, Thrissur

Taluk: Chittur, Mukundapuram. Alathur

Area: 252.772 sq km

I. Buffer Zone (Plantations and Roads, Tribal Settlements and Water spread Areasof reservoirs) within Parambikulam Wildlife Sanctuary (39.872 sq. km.).

Boundary description:- An extent of 39.872 sq. km including 20.659 sq. km of reservoirs of Parambikulam(17.570 sq. km) and Thunakkadavu and Peruvaripallam(3.0 89 sq. km), 0.913 sq. km .which include tribal settlements (34.3 ha.) and a buffer of 100 m from the periphery of the settlements (57 ha.) ie., Sungam (3.70 ha. + 9 ha.), Poopara (24 ha = 21 ha)., Fifth colony (1.38 ha+ 7 ha), Kuriyarkuty 5.09 ha + 10 ha), Earth dam colony at Parambikulam (0.33 ha + 5 ha) and Kadar colony at Parambikulam (0.40 ha + 5 ha) and about 18.30 sq. km of teak plantations in Sungam range.

II. Buffer zone outside Parambikulam Wildlife sanctuary (212.9 sq.km.)

(a) Buffer Zone within Nemmara Forest Division

Boundary description of parts of Padagiri, Thiruvazhiod and Pothundi sections in Nelliyampathy Range of Nemmara Division- 46.27 sq.km.

North: -The boundary commencesc from the northern most point of Nelliampatlty Reserve Forest (near Nagar Mala and situated at about 250 m.south of a hill with 406 m. height) and proceeds towards southeast along lhe Nelliampathi Reserve forest boundary through Pulimala, till it meets the western boundary of Govinda Mala estate.

East:- Thence the boundary proceeds towards south along the Nelliampathy Reserve Forest boundary till it meets the western boundary of Pulayampara Government Farm, and further proceeds towards sout.h-west along the western boundaries of Pulayampara Government Farm, Chandramala estate, Munalaru estate, Pothundu estste, Lily estate, .Pullala estate, Victoria estate and ends at a point where a stream that originates from southern side of Pullala Mala (1444 MSL) and flowing down towards south and merges with the northern boundary of Karadi estate.s

South:- Thence,the boundary proceeds towards north along the stream upward till it reaches the saddle point and further along another stream that originates on the south-west slope of Pullala Mala and ends at the Nelliampathy Reserve Forest boundary at south-east corner of Kalchadi (400 m. South).

West:-- Thence the boundary proceeds towards north along Nelliampathy Reserve Forest boundary and ends at the starting point.

(b) *Buffer Zone within Chalakkudy Forest Division:*

(i) Boundary decription of parts of Kavala Section in Vellikulangara Range of Chalaklkudy Division--5.35 sq. km.

North:-- The boundary starts from a saddle point between 850 m. east of a hill with 838 m. MSL and 1 km. west of Pundi Mudi (where a tributary of Mupili Puzha originates and flows down towards south) thence proceeds towards east along the southern boundary of Chimmony Wildlife Sanctuary and ends at Pundi Mudi peak

East: -- Thence the boundary proceeds towards south along a stream that flows down from Pundi Mudi and ends at Kavala.

South: -- Thence the boundary proceeds towards west along the southern boundary of Kavala Section (or the Tramway. line) via. Anapantan and ends at a point where a tributary originating from the starting point merges with Mupili Puzha.

West: - Thence the boundary proceeds towards north along the above said tributary of Mupili Puzha and ends at the starting point.

(ii) Boundary description of parts of Karikadavu Station of Pariyaram Range of Chalakkudy Division-6.06 sq. km.

North:-- The boundary Slarts from Anapantan, where two tributaries form Mupili Puzha, and then proceeds towards east along the southern boundary of Kavala Section up to a point \where it meets the western boundary of Charpa Range (Kannankuzhi Thodu) of Vazhachal Forest Division.

East:--Thence, the boundary proceeds towards south along the western boundary of Charpa Range along Kannankuzhi Thodu and ends at a point where a small tributary, originating from a saddle point between points 790 m. MSL and 800 m. MSL, meets with Kannankuzhi Thodu at about 1 km. upstream of Kundurmedu falls.

South and West:-The boundary thence proceeds towards west along the above said small tributary and the ridge on the saddle point and proceeds further west along the stream which eventually flows down to the starting point.

(c) Buffer Zone within Vazhachal Forest Division:

(i) Boundary description of Karanthodu section of Kannankuzhi Forest

Station in Charpa Range of Vazhachal Division-26.63 sq.km.
(including 6.99 sq.km. of teak plantation).

North:- The northern boundary of Charpa Range.

East:- Thence the boundary starts from the tri-junction where southern boundary of Parambikulam Wildlife Sanctuary, north-eastern boundary of Charpa Range and north-western boundary of Mukkumpuzha Forest Station meet and then proceeds towards the south along the western boundary of Charpa Range(along Chalakkudy Ar) ends at Karanthodu.

South:- Thence the boundary proceeds towards west along a stream that flows down through the teak plantations till it reaches a point where the stream from Lakshmikayattam and another stream originating from 871 m. MSL meet. Thence the boundary proceeds towards north-west along the stream, which flows down on the east of 552 m. MSL and originates from 871 m. MSL, till it reaches ridge at a point having a height 871 m. MSL. Further the boundary proceeds along the ridge through 917 m. MSL (Putattan Mudi) and further proceeds towards west along the ridge till it meets the tributary that originates from Putattan Mudi (between 842 m. MSL and 749 m. MSL and on the west of Charpapadam) and continues along the said tributary till it meets the western boundary of Charpa Range (Kannankuzhi Thodu).

West:- The boundary thence proceeds towards north along the western boundary of Charpa Range and ends at the point where north-eastern boundary of Pariyaram Range, north-western boundary of Charpa Range and southern boundary of Vellikulangara Range meet.

(ii) Boundary description of Mukkumpuzha Forest Station of Vazhachal Range of Vazhachal Division- 50.24 sq.km.

North:- The boundary starts from a point where the Muduvarachal stream crosses the road between Vazhachal-Parambikulam and proceeds along the Muduvarachal stream till a point where Parambikulam river and Muduvarachal strem merges. Thence continue along the Parambikulam river till a merging point of Parambikulam river and Sholayar river. Thence further proceeds along the Sholayar river via. Orukomban and ends at a point where a straight line towards north from 57th milestone on the road between Chalakkudy and Anamalai that cut across the Sholayar river.

East:- Thence the boundary proceeds from a point where the Sholayar river that cut across a straight line towards north from 57th milestone on the road between Chalakkudy

and Anamalai, and proceeds towards south along a straight line and ends at the 57th milestone on the road between Chalakkudy and Anamalai.

South:- The boundary thence proceeds from 57th milestone on the road between Chalakkudy and Anamalai and follows the road towards west till the Anakkayam Bridge. Thence further proceeds along the right side bank of Porinhgalkuttu Reservoir and ends at Poringalkuttu Dam.

West:- The boundary thence proceeds from the Poringalkuttu Dam and after cutting across the dam follows along the right side bank of Chalakkudy River and ends at the starting point.

(iii) Boundary description of part of Sholayar Range of Vazhachal Forest Division (Malakkappara)- 78.35 sq.km.

North:- The boundary starts from the point where Sholai Ar meets with the eastern boundary of Vazhachal Range of Vazhachal Division and continues towards east along the northern bank of Sholai Ar. Thence, proceeds towards further east along the northern bank of Sholayar Reservoir and ends at a point where the Reservoir boundary meets with interstate boundary.

East:- Thence, the boundary proceeds towards south-east along the interstate boundary and ends at the point where northern boundary of Malayattur Forest Division meets with the south-east boundary of Sholayar Range of Vazhachal Division.

South:-Thence, proceeds towards west along the southern boundary of Sholayar Range of Vazhachal Forest Division and ends at the tri-junction of Kollathirumedu Range and Sholayar Range of Vazhachal Forest Division and Edamalayar Range of Malayattur Forest Division.

West:--The boundary thence proceeds towards north along the western boundary of Sholayar Range of Vazhachal Forest Division and ends at the starting point.

By order of the Governor,

Dr. A. K DUBEY,
Principal Secretary to Government.

Explanatory Note

(This does not form part of the notification, but is intended to indicate its general purport).

As per Explanation (ii) of section 38 V (4) of the Wildlife (Protection) Act, 1972 (Central Act 53 of 1972) the areas peripheral to critical tiger habitat or core area, where a lesser degree of habitat protection is required to ensure the integrity of the critical tiger habitat with adequate dispersal far tigers may be established as buffer or peripheral area of the Tiger Reserve or core or critical tiger, habitat area. This area will promote the co-existence between wildlife and human activity with due recognition of the livelihood, developmental, social and cultural rights of local peaple. In accordance with the above position, the peripheral areas which are lying contiguous to the Parambikulam Tiger Reserve, and situated in the Parambikulam Wildlife Sanctuary and the neighbouring Forest Divisions viz., Nemmara, Chalakkudy and Vazllachal are identified as buffer zone. This area is determined on the basis of scientific and objective criteria and in consultation with the concerned local communities and the expert committee constituted for the purpose. The Government have decided to declare the- said area as buffer zone of Parambikulam Tiger Reserve.

The notification is intended to achieve the above object.

APPENDIX-VI

LIST OF PLANTATIONS IN VAZHACHAL DIVISION

Name of the Division: Vazhachal

List of Plantations-As on 31.3.2002

Sl.No.	Range	Name of Plantation	Species Planted	Year of Planting	Area (In Hectre)	Remarks
1	Athirappilly	Chully	Teak	1939 to 44	96.38	Ernakulam District
2	,,	FIT Vadamury	,,	1960	174.03	,,
3	,,	Vadamury	,,	1961	50.00	,,
4	,,	15th Block	,,	1964	82.72	,,
5	,,	,,	,,	1965	98.09	,,
6	,,	Athirappilly	,,	1971	108.46	,,
7	,,	,,	,,	1973	9.75	,,
8	,,	Thadimudi	,,	1974	67.25	,,
9	,,	Athirappilly	,,	1974	129.55	,,
10	,,	,,	,,	1976	48.75	,,
11	,,	,,	,,	1976	35.32	,,
12	,,	,,	,,	1977	76.56	,,
13	,,	,,	,,	1977	79.64	,,
14	,,	,,	,,	1978	71.24	,,
15	,,	,,	,,	1978	43.60	,,
16	,,	,,	,,	1979	39.96	,,
17	,,	Oolassery	,,	1979	11.26	,,
18	,,	,,	,,	1981	8.66	,,
19	,,	15th Block	,,	1982	13.32	,,
20	,,	Oliveli	,,	1984	85.16	,,
21	,,	Oolassery	,,	1990	2.88	,,
22	,,	Karadippara	,,	1990	1.44	,,
23	,,	Oolassery	,,	1992	16.52	,,
24	,,	Chully	,,	1994	94.69	,,
25	,,	,,	,,	1995	15.46	,,
26	Athirappilly	Chully	Teak	1996	8.86	Ernakulam District
27	,,	Vadamury	,,	1997	66.92	,,
28	,,	,,	,,	1998	28.46	,,
	Athirappilly	**Total**	**Teak**		**1564.93**	,,
29	Vazhachal	Karamthodu	Teak	1972	14.28	
30	,,	Choozhimedu	,,	1973	100.00	
31	,,	Irumpupalam	,,	1973	72.52	
32	,,	Panjanamkuthu	,,	1976	208.01	
33	,,	,,	,,	1977	146.32	
34	,,	Irumpupalam	,,	1979	72.39	
35	,,	Panjanamkuthu	,,	1980	30.10	
36	,,	Irumpupalam	,,	1982	43.10	
37	Vazhachal	Vazhachal	Teak	1990	10.80	
38	,,	Panjanamkuthu	,,	1990	4.48	
39	,,	Vazhachal	,,	1990	15.94	
	Vazhachal	**Total**	**Teak**		**717.94**	
40	Kollathirumedu	Rapra	Teak	1972	82.82	
41	,,	,,	,,	1973	115.04	
42	,,	,,	,,	1973	216.94	
43	,,	Karadippara	,,	1974	21.10	
44	,,	Rapra	,,	1977	71.34	
45	,,	,,	,,	1979	104.06	
46	,,	,,	,,	1980	84.93	
47	,,	,,	,,	1981	160.28	

Sl.No.	Range	Name of Plantation	Species Planted	Year of Planting	Area (In Hectre)	Remarks
48	,,	Kalakkallu	,,	1990	8.36	
49	,,	Choozhimedu	,,	1990	6.84	
50	,,	,,	,,	1990	7.32	
51	,,	Rapra	,,	1990	2.67	
52	,,	Choozhimedu	,,	1992	7.02	
53	,,	Kalakkallu	,,	1993	8.00	
54	,,	Choozhimedu	,,	1994	30.00	
55	,,	Watchumaram	,,	1994	5.10	
56	,,	Thavalakuzhipara	,,	1995	11.30	
57	,,	Choozhimedu	,,	1995	7.02	
	Kollathirumedu	**Total**	**Teak**		**950.14**	
58	Charpa	Karamthodu	Teak	1972	197.84	
59	,,	,,	,,	1973	92.76	
60	,,	Charpa	,,	1974	117.88	
61	,,	Kannankuzhi	,,	1976	45.88	
62	,,	,,	,,	1977	38.07	
63	,,	Karamthodu	,,	1979	126.04	
64	,,	Charpa	,,	1988	13.77	
65	,,	,,	,,	1990	14.56	
	,,	,,	,,	1982	40.11	Deleted from the list of plantations as per order No. P6-14152/2001 (N) dt.25.5.2001 of the CCF (Devt), TPM
66	,,	Panjanamkuthu	,,	1995	11.56	
	Charpa	**Total**	**Teak**		**658.36**	
	DIVISION	**TOTAL**	**TEAK**		**3891.37**	
67	Athirappilly	15th Block	Miscellaneous	1959	72.68	Ernakulam District
68	,,	Vadamuri	Teak-elavu	1961	17.69	,,
69	,,	15th Block	Teak-elavu	1965	118.10	,,
70	,,	Oolassery	,,	1973	46.84	,,
71	,,	,,	,,	1975	29.52	,,
72	,,	,,	,,	1975	19.48	,,
73	,,	,,	,,	1976	17.62	,,
74	,,	Karadippara	,,	1978	14.48	,,
75	,,	Oolassery	Teak-elavu	1979	73.18	,,
76	Athirappilly	Oolassery	Teak-elavu	1979	56.12	Ernakulam District
77	,,	15th Block	Teak-elavu	1980	151.24	,,
78	,,	Athirappilly	,,	1991	15.40	,,
79	,,	,,	,,	1992	12.31	,,
80	Vazhachal	Pokalappara	Teak-elavu	1958	11.83	
81	,,	,,	,,	1959	15.36	
82	Vazhachal	,,	Teak-elavu	1960	17.12	
83	,,	,,	,,	1962	59.75	
84	,,	Karadippara	,,	1963	117.21	
85	,,	,,	,,	1964	41.68	
86	,,	,,	,,	1965	9.44	
87	,,	,,	,,	1966	10.40	
88	,,	Choozhimeud	,,	1971	90.22	
89	,,	Karamthodu	Miscellaneous	1972	19.22	
90	,,	Panjanamkuthu	,,	1974	5.52	
91	,,	,,	,,	1976	9.85	
92	,,	Poringal	,,	1988	8.00	
93	,,	Lakshmi	,,	1991	16.28	
94	,,	Pokalappara	,,	1992	6.82	
95	,,	Mukkampuzha	,,	1998	30.00	
96	,,	Karamthodu	,,	1999	30.00	

Sl.No.	Range	Name of Plantation	Species Planted	Year of Planting	Area (In Hectre)	Remarks
97	,,	Lakshmi	,,	1999	12.00	
98	Kollathirumedu	Karadipara	Teak-elavu	1959	12.36	
99	,,	,,	,,	1960	46.40	
100	,,	,,	,,	1961	63.25	
101	,,	,,	,,	1963	17.70	
102	,,	,,	,,	1964	40.43	
103	,,	,,	,,	1965	118.80	
104	,,	,,	,,	1966	47.39	
105	,,	,,	,,	1968	85.75	
106	,,	,,	,,	1969	74.40	
107	,,	,,	,,	1970	51.67	
108	,,	,,	,,	1971	40.40	
109	,,	Chekuzhy	,,	1973	7.00	
110	,,	Kalakkallu	,,	1973	22.33	
111	,,	S curve	,,	1974	1.64	
112	,,	,,	,,	1976	18.61	
113	,,	Choozhimedu	,,	1977	40.70	
114	,,	Karadippara	Miscellaneous	1978	29.76	
115	,,	Kollathirumedu	,,	1981	26.20	
116	,,	,,	,,	1990	2.84	
117	,,	,,	,,	1991	30.77	
118	,,	,,	,,	1992	4.02	
119	Charpa	Kannankuzhi	Teak-elavu	1967	24.37	
120	,,	Charpa	Miscellaneous	1973	13.64	
121	,,	,,	,,	1974	16.19	
122	,,	Kannankuzhi	Teak-elavu	1974	75.00	
123	,,	Charpa	Teak-elavu	1975	48.96	
124	,,	,,	Miscellaneous	1975	10.00	
125	,,	,,	Teak-elavu	1976	55.28	
126	,,	Kannankuzhy	,,	1977	32.37	
127	,,	,,	,,	1977	63.84	
128	,,	Charpa	Miscellaneous	1978	29.23	
129	,,	,,	,,	1979	39.29	
130	,,	,,	,,	1991	9.70	
131	,,	Panjanamkuthu	,,	1991	23.30	
132	,,	Ittiani	,,	1991	13.76	
133	,,	,,	,,	1992	6.84	
134	,,	Panjanamkuthu	,,	1992	14.40	
135	,,	Charpa	,,	1992	7.56	
136	,,	Orukomban	,,	1991	57.80	
137	,,	,,	,,	1991	37.25	
138	Sholayar	Kummatty	Miscellaneous	1996	64.04	Taken charge from the Social Forestry Range, Perumbavoor on 19.10.2001 as per order No. E-2-968/90 dt 26.6.2001 of the Asst. Conservator, Social Forestry Division, Emakulam & added in the list of plantation.
	DIVISION	**TOTAL**	**Teak-elavu**		**1777.99**	
	DIVISION	**TOTAL**	**Miscellaneous**		**1610.90**	
139	Vazhachal	Karamthodu	Eucalyptus	1970	154.39	
140	,,	,,	,,	1972	14.45	
141	,,	,,	,,	1974	42.72	
	Vazhachal	Total	Eucalyptus		211.56	
	DIVISION	**TOTAL**	**Eucalyptus**		**211.56**	

Sl.No.	Range	Name of Plantation	Species Planted	Year of Planting	Area (In Hectre)	Remarks
142	Vazhachal	Vazhachal	Albizzia	1977	8.61	
143	,,	Lakshmi	,,	1990	33.28	
	Vazhachal	Total	Albizzia		41.89	
144	Kollathirumedu	Repra	Albizzia	1972	4.50	
145	,,	Karadipara	,,	1989	19.65	
146	,,	Kalakkallu	,,	1990	15.53	
	Kollathirumedu	Total	Albizzia		39.68	
147	Charpa	Charpa	Albizzia	1973	4.48	
	Charpa	Total	Albizzia		4.48	
	DIVISION	**TOTAL**	**ALBIZZIA**		**86.05**	
148	Vazhachal	Vazhachal	Elavu	1956	34.35	
149	,,	Pokalapara	,,	1957	28.06	
	Vazhachal	Total	Elavu		62.41	
150	Athirappilly	15th Block	Elavu	1959	42.94	Ernakulam District
	Athirappilly	Total	Elavu		42.94	,,
	DIVISION	**TOTAL**	**ELAVU**		**105.35**	
151	Vazhachal	Karamthodu	Bamboo	1972	15.16	
152	,,	Vazhachal	,,	1995	4.92	
153	,,	Panjanamkuthu	,,	1995	8.52	
154	,,	Lakshmi	,,	1998	25.00	
	Vazhachal	Total	Bamboo		53.60	
155	Charpa	Karamthodu	Bamboo	1972	18.88	
156	,,	,,	,,	1998	30.00	
157	,,	Nellipocket	,,	2000	10.25	
158	,,	Charpa	,,	2000	2.75	
	Charpa	Total	Bamboo		61.88	
159	Sholayar	Thavalakuzhipara	Bamboo	1987	53.00	
	Sholayar	Total	Bamboo		53.00	
	DIVISION	TOTAL	BAMBOO		168.48	
160	Charpa	Karamthodu	Murukku	1972	30.30	
161	,,	,,	,,	1974	18.18	
	Charpa	Total	Murukku		48.48	
	DIVISION	**TOTAL**	**MURUKKU**		48.48	
162	Kollathirumedu	Karadipara	Sesbania	1972	21.07	
	Kollathirumedu	Total	Sesbania		21.07	
	DIVISION	**TOTAL**	**SESBANIA**		**21.07**	
163	Vazhachal	Karadipara	Grevelia	1968	16.60	
	Vazhachal	Total	Grevelia		16.60	
164	Kollathirumedu	Choozhimedu	Grevelia	1969	35.74	
165	,,	Karadipara	,,	1970	24.21	
	Kollathirumedu	**Total**	**Grevelia**		**59.95**	
	DIVISION	**TOTAL**	**GREVELIA**		**76.55**	
	Charpa	Karamthodu	Acacia	1988	66.28	Deleted from the list of plantations as per order No. P6-14152/2001 (O) dt.31.5.2001 of the CCF (Devt), TPM
	Charpa	**Total**	**Acacia**		**0.00**	
	DIVISION	**TOTAL**	**ACACIA**		**0.00**	
166	Vazhachal	Mukkampuzha	Medicinal Plants	1996	30.00	
167	,,	,,	,,	1997	22.00	
168	,,	Pokalappara	,,	1999	17.50	
169	,,	Poringal	,,	1999	3.25	
	Vazhachal	**Total**	**Medicinal Plants**		**72.75**	
170	Charpa	Charpa	Medicinal Plants	1998	11.50	

Sl.No.	Range	Name of Plantation	Species Planted	Year of Planting	Area (In Hectre)	Remarks
171	,,	Ittiani	,,	1999	6.50	
	Charpa	**Total**	**Medicinal Plants**		**18.00**	
	DIVISION	**TOTAL**	**Medicinal Plants**		**90.75**	
	Division	**Total**	**Plantations**		**7280.26**	***Ernakulam Dist- Total Pln. area=2252.53 Ha***

APPENDIX–VII

QUANTITY AND PRICE (AVERAGE PRICE FOR CUBIC METER) OBTAINED FOR TIMBER SOLD IN AUCTION THE GOVERNMENT TIMBER DEPOT CHALAKUDY

Sl.No	Year	Teak I		Teak II		Teak III		Teak IV	
		Quantity M^3	Price Rs.	Quantity M^3	Price Rs	Quantity M^3	Price Rs	Quantity M^3	Price Rs
1	1975-76	50.037	323.63	4.704	233.16	1.265	98.00	0.782	668.49
2	1976-77	0.000	0.00	1.200	700.00	3.900	452.00	1.600	273.00
3	1977-78 4.260 996.81	26.412 1286.83 0.814	1803.23 8.379 819.36						
4	1978-79	16.443	2207.36	16.964	709.12	3.578	178.39	1.408	950.49
5	1979-80	17.369	3130.73	9.506	3147.54	8.030	710.05	2 505	1298.28
6	1980-81	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00
7	1981-82	70.22	3158.68	109.58	105.95	2.508	907.26	0.000	0.00

Sl. No.	Year	Teak SL.1 Quantity M3	Price Rs	Teak SL.II Quantity M3	Price Rs	Teak SL.III Quantity M3	Price Rs
1	1975-76	0.000	0.00	0.000	0.00	0.170	565.00
2	1976-77	0.000	0.00	0.200	300.00	201.000	102.00
3	1977-78	0.700	598.00	0.000	0.00	0.000	0.00
4	1978-	0.000	0.00	0.000	0.00	0.000	0.00
5	1979-80	0.334	200.00	0.000	0.00	0.080	1502.00
6	1980-81	0.000	0.00	0.000	0.00	0.000	0.00
7	1981-82	0.000	0.00	1.150	4002.00	0.000	0.00

		IRUL I		IRUL II	
Sl.No	Year	Quantity M3	Price Rs	Quantity M3	Price Rs
1	1975-76	552.657	534.30	107.382	509.72
2	1976-77	777.859	454.67	119.028	420.60
3	1977-78	1093.437	524.10	229.546	476.78
4	1978-79	769.328	1005.47	235.228	893..83
5	1979-80	260.179	1308.74	101.245	1181.89
6	1980-80	99.662	1203.73	57.120	1099.97
7	1981-82	0.00	0.00	0.000	0.00

Maruthu 1 MaruthuII

Sl. No	Year	Quantity M3	Price Rs	Quantity M^3	Price Rs
1	1975-76	301.419	463.36	16.502	389.51
2	1976-77	248.251	548.64	10.611	360.66
3	1977-78	298.752	449.00	27.109	395.63
4	1978-79	116.907	722.98	6.601	634.24
5	1979-80	417.823	1109.69	36.469	997.61
6	1980-80	734.152	1173.94	41.313	1007.63
7	1981-82	8.978	1600.00	1.064	1006.57

THEMBAVU I THEMBAVU II

Sl.No	Year	Quantity M3	Price Rs	Quantity M3	Price Rs
1	1975-76	0.000	0.00	0.000	0.00
2	1976-77	0.000	0.00	0.000	0.00
3	1977-78	0.000	0.00	0.000	0.00
4	1978-79	0.000	0.00	1.44	798.00
5	1979-80	11.816	1688.46	4.884	1388.13
6	1980-80	10.022	1312.64	6.871	1256.59

Venteak I Venteak II

Sl. No	Year	Quantity M3	Price Rs	Quantity M3	Price Rs
1.	1975-76	246.610	392.02	39.002	321.02
2.	1976-77	413.074	487.66	67.726	348.05
3.	1977.78	1200.366	371.83	74.417	455.88
4.	1978-79	377.858	1029.08	41.373	792.50
5.	1979-80	373.010	1242.69	45.676	964.35
6.	1980-80	533.876	1195.36	68.937	1002.92
7.	1981-82	222.086	1604.11	1.579	1006.58

VENGA I VENGA II

Sl.No.	Yr	Quantity M3	Price Rs	Quantity M3	Price Rs
1	1975-76	0.000	0.00	0.000	0.00
2	1976-77	0.000	0.00	0.000	0.00
3	1977-78	0.300	398.00	0.000	0.00
4	1978-79	5.146	792.07	0.504	602.00
5	1979-80	21.824	1459.58	6.045	1241.10
6	1980-80	18.328	1645.65	6.237	1392.78
7.	1981-82	0.000	0.00	0.000	0.00

CHADACHI I CHADACHI II

Sl.No	Year	Quantity M^3	Price Rs	Quantity M^3	Price Rs
1.	1975-76	10.808	523.00	4.800	477.63
2.	1976-77	52.800	538.68	4.016	422.77
3.	1977-78	30.283	569.43	15.496	569.14
4	1978-79	315.984	969.92	17.448	906.50
5.	1979-80	3.647	1285.67	8.900	758.24
6	1980-80	0.000	0.00	0.604	1500.00
7	1981-82	0.000	0.00	0.000	0.00

ANJILY I ANJILY II

Sl.No.	Year	Quantity M^3	Price Rs	Quantity M^3	Price Rs
1	1975-76	4.291	643.06	0.923	530.00
2	1976-77	0.000	0.00	0.000	0.00
3	1977-78	8.600	536.93	0.000	0.00
4	1978-79	64.209	1620.62	3.235	1076.94
5	1979-80	228.425	2102.31	1.674	1598.00
6	1980-80	29.019	1962.00	2.742	1289.30
7	1981-82	0.000	0.00	0.000	0.00

APPENDIX – VIII

LIST OF PLANTS IN VAZHACHAL FOREST DIVISION

Sl. No.	Botanical Name
	ACANTHACEAE
1	*Andrographis elongata* (Vahl) T .Anders.
2	*Barleria courtallica* Nees.
3	*B.cristata* Linn.
4	*B. prattensis* Sant.
5	*B.prionitis* Linn.
6	*Dicliptera cuneata* Nees.
7	*Strobilanthus luridus* Wight .
8	*Dipteracanthus prostratus* (Poir.) Nees.
9	*Ecabolium virde* var. *laetevirens* (Vahl.) Raizada
10	*Gymnostachyum canescens* (Nees.) Anders.
11	*G. febrifugum* Benth.
12	*Hemigraphis elegans* (Hook.) Nees
13	*Justicia betonica* Linn.
14	*J.gendarussa* Burm.f
15	*J .procumbens* Linn.
16	*J.santapaui* Benn.
17	*J. trinervia* Vahl
18	*Strobilanthus dupenii* Bedd. ex Clark.
19	*Nilgirianthus ciliatus* (Nees) Bremek.
20	*Peristrophe montana* Nees in Wall.
21	*P.paniculata* (forsck.) Brummitt
22.	*Phaulopsis dorsiflora* (Retz.) Sant.
23.	*Rhinacanthus nasutus* (Linn.) Kurz
24.	*Rungia parviflora* (Retz.) Nees
25.	*R. wightiana* Nees
26.	*Stauogyne zeylanica* (nees) O.Ktze.
27.	*Thunbergia fragrans* Roxb.
28.	*T.mysorensis* (Wt.) Anders.
	MOLLUGINACEAE
29.	*Glinus lotoides* Linn.
30.	*G.oppositifoloius* (Linn.) DC.
	ALANGIACEAE
31	*Alangium salvifolium* (Linn.f.) Wang
	AMARANTHA CEAE
32.	*Achyranthes aspera* Linn.
33.	*Aerva lanata* (Linn.) Juss.ex Schult.
34.	*Allmania nodiflora* (L.) R.Br. ex Wight. Var. *aspera* (Wight.) Hook.f.
35.	*Alternanthera paronychioides* A. St.Hil
36.	*Amaranthus spinosus* Linn.
37.	*A. viridis* Linn.
38.	*Cyathula prostrata* (Linn.) B1.
39.	*Indobanalia thyrsiflora* (Moq) Henry & Roy
	ANACARDIACEAE
40.	*Holigarna arnottiana* Hook.f
41.	*H.grahamii* (Wt.) Kurz
42.	*Lannea coromandelica* (Houtt.) Merr.
43	*Magifera indica* Linn.
44	*Nothopegia colebrookeana* (Wight) Bl.

45	*Gluta travancorica* Bedd.
46	*Spondias indica* (Wt. & Arn) Airy Shaw & Formann
47	*S.pinnata* (Linn.f) Kurz
	ANCISTROCLADACEAE
48	*Ancistrocladus heyeanus* Wall. ex grah.
	ANNONACEAE
49	*Artabotrys zeylanicus* Hook.f. & Thorns.
50	*Cyathocalyx zeylanica* Champ. ex Hook. f. & Thorns.
51	*Desmos lawii* (Hook. f & Thoms.) Safford
52	*Meiogyne pannosa* (Dalz.) Sinclair
53	*M. ramarowii* (Dunn) Gandhi
54	*Miliusa tomentosa* (Roxb.) Sinclair
55	*Orophea erythrocarpa* Bedd.
56	*O. uniflora* Hook.f & Thoms.
57	*Polyalthia coffeoides* Hook.f & Thorns.
58	*P . fragrans* (Dalz.) Bedd
	APOCYNACEAE
59	*Aganosma cymosa* (Roxb.) G.Don
60	*Alstonia scholaris* (Linn.) R.Br.
61	*A. venenata* R.Br.
62	*Anodendron paniculatum* (Roxb) A.DC.
63	*Carissa spinarum* A.DC.
64	*Chilocarpus atrovirens* (G. Don) Bl.
65	*Holarrhena pubescens* Wall. ex G.Don (Buch. Ham)
66	*Hunnteria zeylanica* (Retz.) Gard.ex Thw.
67	*Ichnocarpus frustescens* (Linn.) R.Br.
68	*Rauvolfia densiflora* (wall.) Benth. ex hook.f
69	*R. serpentina* (Linn.) Benth. ex Kurz
70	*Tabernaemontana gamblei* Subm. & Henry
71	*T. alternifolia* Linn. .
72	*Wrightia arborea* (Dennst) Mabb.
73	*W.tinctoria* R.Br. (Roxb)
	ARALIACEAE
74	*Aralia malabarica* Bedd.
75	*Scheffl era venulosa* (Wt. & Arn.) Harms
76	*S. wallichiana* (Wt. & Arn. Harms)
	ARISTOLOCHIACEAE
77	*Aristolochia indica* linn.
78	*A. tagala* Cham.
79	*Thottea siliquosa* (Lamk.) Ding Hou
	ASCLEPIADACEAE
80	*Asclepias curassavica* Linn.
81	*Ceropegia maculata* Bedd.
82	*C.metziana* Miq.
83	*Cosmostigma racemosum* (Roxb.) Wt.
84	*Cryptolepis buchnanii* Roem. & Schult.
85	*Cynanchum callialatum* Ham. ex Wt.
86	*Gynmema sylvestre* (Retz.) R. chult .
87	*Bidaria Montana* (Roxb. Rahman & Wilcock.
88	*Hemidesmus indicus* (Linn.) R.Br.
89	*Holostemma adakodien* Schult.
90	*Hoya pauciflora* Wight.
91	*Tylophora indica* Merr. (Burm.f.)
92	*T.tetrapetala* (Dennst.) Suresh
93	*Wattakaka volubilis* (Linn.f.) Stapf .

	ASTERCEAE
94	*Acanthospermum hispidum* DC.
95	*Adenostemma lavenia* (Linn.) O.Ktze.
96	*Ageratina adenophora* (Spreng.) King & Robins.
97	*Ageratum conyzoides* Linn.
98	*A.houstonianum* Mill.
99	*Bidens biternata* (Lour. Merr. & Sheriff).
100	*Blainvillea acmella* (Linn.) Philip.
101	*Blumea belangeriana* DC.
102	*B. lanceolaria* (Roxb). Druce
103	*B.membranacea* Wall. ex DC var. gracilis Hook.f.
104	*Chromolaena odorata* (Linn.) King & Robins.
105	*Eclipta prostrata* (Linn.)Linn.
106	*Elephantopus scaber* Linn.
107	*Emilia sonchifolia* (Linn.) DC.
108	*Gynaura nitida* DC
109	*G. travancorica* W. W.Sm.
110	*Mikania cordata* (Burm.f.) Robins
111	*Synedrella nodiflora* (Linn.) Gaertn
112	*Tridax procumbens* Linn.
113	*Vernonia arboria* Buch.- Ham.
114	*V. cinerea* (Linn.) Less.
115	*Wedelia chinensis* (Osbeck) Merr.
116	*Xanthium indicum* Koen.
	BALSAMINACEAE
117	*Impatiens auriculata* Wt.
118	*I. goughii* Wt.
119	*I. hensloviana* Arn.
120	*I. chinensis* L.
121	*I. scapiflora* Heyne ex Roxb.
122	*I. tenella* Heyne
	BEGONIACEAE
123	*Begonia malabarica* lamk.
124	*B.trichocarpa* Dalz.
	BIGNONIACEAE
125	*Oroxylum indicum* (Linn.) Benth. ex Kurz
126	*Pajanelia longifolia* (Wild.) K. Schum.
127	*Radermachera xylocarpa* (Roxb.) K. Schum.
128	*Stereospermum colais* (Buch. Ham.ex Dillw.) Mabb.
	BOMBACAEAE
129	*Bombax ceiba* Linn.
130	*B. insigne* Wall.
131	*Cullenia exarillata* Robyns
	BORAGINACEAE
132	*Coldenia procumbens* Linn.
133	*Cordia wallichii* G.Don
134	*Ehretia canarensis* (Cl.) Gamble
135	*Heliotropium marifolium* Retz.
136	*Rotula aquatica* Lour.
137	*Tournefortia reticosa* Wight.
	BURSERACEAE
138	*Canarium strictum* Toxb.
139	*Garuga pinnata* Roxb.

	BUXACEAE
140	*Sarcococa coriacea* (Hook.) Sweet
	CAESALPINIACEAE
141	*Bauhinia phoenicea* Wt. & Arn.
142	*B. racemosa* Lam.
143	*B. scandens* Linn.
144	*Caesalpinia crista* L.
145	*C.cucullata* Roxb.
146	*Hymenocarpa (*Prain) Hattink
147	*Caesalpinia mimosoides* Lamk.
148	*C.auriculata* Linn.
149	*Cassia fistula* Linn
150	*Chamaecristata mimosoides* (L.) Greene
151	*Kingiodendron pinnatum* (Roxb. ex DC.) Harms
152	*Senna occidentalis* (L.) Link.
153	*Humboldtia vahliana* Wt.
154	*Senna tora* (L.) Roxb.
155	*Bauhinia malabarica (*Roxb.)
	CAMPANULACEAE
156	*Wahlenbergia marginata (*Thunb.) A.DC
157	*W. erecta* (Roth ex Schult.)
	CARYOPHYLLACEAE
158	*Polycarpea corymbosa* (L.) Lam.
159	*P.prostratum* (Forssk.) Asch. & Sehweinf.
160	*Drymaria cordata* (Linn.) Willd.ex.Roem & Schult
	CELASTRACEAE
161	*Bhesa indica* (Bedd.) Ding Hou
162	*Celastrus paniculatus* Willd.
163	*Euonymus indicus* Heyne ex Roxb.
164	*Lophopetalum wightianum* Arn.
165	*Microtropis stocksii* Gamble
166	*M. wallichiana* Wight ex Thw.
167	*Glycopetalum zeylanicum* Thw.
	CHLORANTHACEAE
168	*Sarcandra chlorathoides* Gard
	CAPPARIDACEAE
169	*Cleome monopylla* Linn.
170	*C.viscosa* Linn.
	CLUSIACEAE/GUTTIFERAE
171	*Calophyllum calaba* Linn.
172	*C. polyanthum* Wall.ex Choisy.
173	*Garcinia gummi-gutta(*Linn.)Robs.
174	*G .morella(*Gaertn) Desv.
175	*G. spicata (*Wt & Arn.) Hook.f.
176	*G. wightii* Anders.
177	*Mesua ferra* Linn.
	BONNETIACEAE
178	*Poeciloneuron indicum* Bedd.
	COCHLOSPERMACEAE
179	*Cochlospermum religiosum* (linn.) Alston
	COMBRETACEAE
180	*Calycopteris floribunda* Lam.
181	*Combretum latifolium* Bl.
182	*Terminalia bellirica* (Gaertn.) Roxb.
183	*T. crenulata* Roth

184	*T. paniculata* Roth.
185	*T.travancorensis* Wt. & Arn.
	CONNARACEAE
186	*Rourea minor (*Gaertn.) Merr.
	CONVOLVULANCEAE
187	*Erycibe paniculata* Roxb.
188	*Evolvulus alsinoides (*Linn.) Linn.
189	*Hewittia malabarica (*Linn.) Suresh
190	*Ipomoea campanulata* Linn.
191	*I. eriocarpa* R.Br.
192	*I. hederifolia* Linn.
193	*I. mauritiana* Jacq.
194	*I. pes-tigrides* Linn
195	*I. pileata* Roxb
196	*Lepistemon leiocalyx* Stapf
197	*Merremia chryseides (*Ker. Gawl.) Hall.f
198	*M. tridentata* (L.) Hall. f spp. *hastata*
199	*M. umbellata* Hall.f.
200	*M. vitifolia* (Burm.f.) Hall. f.
	CORNACEAE
201	*M.arboea* ssp. *meziana (*wang) Mathew
	CUCURBITACEAE
202	*Diplocyclos palmatus (*Linn.) Jeffery.
203	*Gymnopetalum wightii* Arn.
204	*Luffa acutanguia* (L.) Roxb.
205	*Melothria zeylancia* Cl.
206	*Momordica dioica* Roxb. ex Willd.
207	*Mukia leiosperma* (Wight. & Arn.) Wight.
208	*M. maderaspatana (*Linn.) Roem.
209	*Trichosanthus nervifolia* Linn.
210	*Zehneria maysorensis (*Wt. & Arn.) Arn.
	DICHAPETALACEAE
211	*Dichapetalum gelonioides (*Roxb.) Engl.
	DILLENIACEAE
212	*Dillenia pentagyna* Roxb.
	DIPTEROCARPACEAE
213	*Dipterocarpus indicus* Bedd
214	*Hopea parviflora* Bedd.
215	*H.Ponga (*Dennst.) Mabber.
216	*Vateria indica* Linn.
	DROSERACEAE
217	*Drocera indica* Linn.
	EBENACEAE
218	*Diospyros assimilis*
219	*D. bourdillonii* Brand.
220	*D. buxifolia (*Bl.) Hiern
221	*D. crumenta* Thw.
222	*D. montana* Roxb.
223	*D.panicltlata* Dalz
224	*D.sylvatica* Roxb.
	ELAEAGNACEAE
225	*Elaeagnus conferta* Roxb.
	ELAEOCARPACEAE
226	*Elaeocarpus glandulosus* Wall.ex.Merr.
227	*E. serratus* Linn.

228	*E.tuberculatus* Roxb.
	ERYTHROPAULACEAE
229	*Erythropalum scandens* BI
	EUPHORBIACEAE
230	*Acalypha brachystachya* Homem.
231	*A. racemosa* Heyne ex. bnaill.
232	*Agrostistachys borneensis* Becc.
233	*A. indica* Dalz.
234	*Antidesma acidum* Retz.
235	*A menasu* (Tul.) Miq.ex Muell.-Arg.
236	*Aporusa acuminata* Thw.
237	*A. bourdillionii* Stapf.
238	*A. lindleyana* (Wt.) Baill.
239	*Baccaurea courtallensis* (Wight.) Muell.- Arg.
240	*Baliospermum monatanum* (Willd.) Muell.-Arg.
241	*Bischofia javanica* Bl.
242	*Breynia retiusa* (De11DSt.) AIston
243	*B. vitisidaea* (Burm.f.) Fischer
244	*Bridelia crenulata* Roxb.
245	*Bridelia scandens* (Roxb.) Willd.
246	*Cleidion javanicum* Bl.
247	*Croton aromaticus* Sensu Hook.f
248	*C. caudatus* Geisl.
249	*C.laccifer* Linn.
250	*C.malabaricus* Bedd
251	*C.zeylanicus* Meull.-Arg.
252	*Dimorphocalyz lawianus* (Meull-Arg.) Hook .f.
253	*Drypetes elata* (Bedd.)Pax. & Hoffm.
254	*D. malabarica* (Bedd.) Airy Shaw
255	*D. oblongifolia* (Bedd.) Airy Shaw
256	*Emblica officinalis* Gaertn.
257	*Epiprinus mallotiformis* (Meull-Arg) Croizat
258	*Euphorbia antiquorum* Linn
259	*E. hirta* Linn
260	*E. vajaravelui* Binoj & Balakrishnan
261	*E. nivulia* Buch.-Ham.
262	*E. thymifolia* Linn.
263	*Paracoton pendulus* (Hassk.) Miq. Spp *zeylanicus* (Thw.) Balakr. & Chakrab.,
264	*Glochidion elipticum* Wt.
265	*G.zeylanicum* (Gaertn.) A. Juss
266	*Homonoia riparia* Lour.
267	*Kirganelia reticulata* (Poir.) Baill
268	*Marcanga peltata* (Roxb.) Muell.-Arg.
269	*Mallotus aureo-punctatus* meull-Arg.
270	*M.beddomei* Hoof.f.
271	*M.Philipensis* (lamk). Meull-Arg.
272	*M.teracpccus* (roxb.) Kurz
273	*Margaritaria indica* (dalz.) Airy Shaw
274	*Micrococcca mercurialis* (Linn.) Benth
275	*Phyllanthus deblis* Klein ex wild.
276	*P. fardnerianus* (Wt.) Baill
277	*P.virgatus* G. Forst
278	*Sauropus quadrangularis* (Willd.) Meull-.Arg
279	*S. saksenianus* Manilal *et al.*
280	*Sapium insigne* (Royle) Benth.

281	*Sebastiana chamaelea* (Linn.) Meull- Arg.
282	*Tragia involucrata* Linn
283	*T.hispida* Willd
284	*Trewia polycarpa* Benth
	FABACEAE
285	*Arbus pulchellus* Wall.ex Thw
286	*Alysicarpus bupleurifolius* (Linn.) DC.
287	*Atylosia lineata* Wt. & Arn.
288	*A. scarabaeoides* (L.)Benth.
289	*Butea parviflora* Roxb.
290	*B.purpurea* (Benth.ex baker) Blatt.
291	*Calopogonium mucunoides* Desv.
292	*Canavalia gladiata* (Jacq.) DC.
293	*Centrosema pubescens* Benth
294	*C. evolvuloides* Wt. & Wt. & Arn.
295	*C.heyneana* Ham ex Wight & Arn.
296	*C. laevigata* Lam.
297	*C.mysorensis* Roth
298	*C.pallida* Dryand.
299	*C.retusa* Linn.
300	*C. walkeri* Arn.
301	*Dalbergia horrida* (Dennst) Mabb.
302	*D.lanceolaria* Linn.f.
303	*D.laifolia* Roxb.
304	*D.sissoides* Graham ex Wt. & Arn.
305	*D.sisso* Roxb.
306	*D.volubilis* Roxb.
307	*Derris brevipes* (Benth.) Baker
308	*D. canarensis* (Dalz) Baker
309	*D. scandens* (Roxb.) Benth.
310	*D. elliptica* (Wall.) Benth.
311	*Desmodium gangeticum* (Linn.) DC
312	*D.heterocarpon* (Linn.) DC. var. *heterocarpon*
313	*D.heterophyllulm* (Willd.) DC
314	*D.laxiflorum* DC.
315	*D.motorium* (Houtt.) Merr.
316	*D.pulchellum* (Linn.) Benth.
317	*D. triangulare* (Retz.) Merr.
318	*D. triquetrum* (L.) DC
319	*D. velutinum* (Willd.) DC
320	*D.heynei* Wt. & Arn.
321	*Erythrina stricta* Roxb.
322	*Flemingia bracteata* (Roxb.) Wight.
323	*F.macrophylla* (Willd.) Prain ex Merr
324	*F.semialata* Roxb.
325	*I. hirsuta* Linn
326	*I.spicata* Forsk.
327	*Kunstleria keralensis* Mohanan & Nair
328	*Millettia rubiginosa* Wt. & Arn.
329	*Mucuna pruriens* (Linn.) DC
330	*Ormosia travancorica* bedd.
331	*Peuraria phaseoloides* Benth.
332	*Pongamia pinnata* (Linn.) Pierre
333	*Pseudartharia viscida* (Linn.) Wt. & Arn.
334	*Pterocarpus marsupium* Roxb.

335	*Rhynchosia hirta* (Andr.) Meikle & Verde.
336	*Sesbania bispinosa* (Jacq.) Wright
337	*Tephrosia purpurea* (L.f.) Pers.
338	*Teramnus labialis* (Linn.) Sperng.
339	*Uraria rufescens* (DC.) Schind
340	*Vigna trilobata* (Linn.) Verdc.
341	*Zornia gibbosa* span.
	FLACOURTIACEAE
342	*Casearia ovata* (Lam). Wild
343	*Flacourtia monatana* Graham
344	*Hydnocarpus alphina* Wt.
345	*H.macrocarpus* (Bedd.) Warb.
346	*H.pentandra* (Buch-Ham) Oken
	GENTIANACEAE
347	*Canscrae pauciflora* Dalz.
348	*C.perfoliata* Lam
349	*Exacum sessile* Linn
350	*Hoppea fastigiata* (Griseb.) Cl.
	GESNERIACEAE
351	*Aeschyanthes perrotteti* A.DC
352	*Didymocarpus tomentosa* Wt.
353	*Epithema carnosum* (G.Don) Benth
354	*Rhynchoglossum notonianum* (Wall.) Burtt
355	*R. permolle* (Ness) Brutt
	HIPPOCRATEACEAE
356	*Loesneriella arnottiana* (Wt.) A.C.Sm.
357	*Reissantia indica* (Willd) Halle
358	*Salacia macrosperma* Wight.
	ICACINACEAE
359	*Gomphandra coriacea* Wt.
360	*Miquelia dentata* bedd.
361	*Nothapodytes foetida* (Wt.) Sleum.
362.	*Sarcostigma kleinii* Wt. & Arn.
	LAMIACEAE/LABIATAE
363.	*Colebrookea oppositifolia* Sm.
364.	*Plectranthus amboinicus* (Lour.) Spreng.
365	*Hyptis suaveolens* (L.) Poit
366.	*Leucas biflora* (Vahl.) R. Br.
367.	*L. ciliata* Benth.
368.	*Ocimum americanum* Linn.
369.	*Orthosiphon aristatus* (Bl.) Miq.
370.	*Plectranthus malabaricus* (Ait.) Spreng.
371.	*Scutellaria violacea* Heyne ex Benth
	LAURACEAE
372	*Actinodaphne malabarica* Balakr
373	*Alseodaphne semecarpifolia* Nees
374	*Cinnamomum riparium* Gamble
375	*C. sulpharatum* Nees
376.	*Litsea boundillonii* Gamble
377.	*L. coriacea* (Heyne ex Meisher) Hook.f.
378.	*L. floribunda* Gamble
379.	*L. insignis* Gamble
380.	*L. wightiana* (Nees) Hook. f.
381.	*Neolitsea zeylanica* (Nees)Merr .

382	*Persea macrantha* (Nees) Kosterm.
383.	*Phoebe lanceolata* Nees
	LECYTHIDACEAE
384.	*Barringtonia acutangula* (L.) Gaertn.
	LEEACEAE
385.	*Leea indica* (Burm. f.) Merr.
386.	*L. marcophylla* Roxb ex Hornem.
	LENTIBULARIACEAE
387.	*Utricularia caerulea* Linn.
388.	*U. graminifolia* Vahl.
389.	*U. striatula* Sm.
	LOBELIACEAE
390.	*Lobelia alsinoides* Lam.
391.	*L. nicotianiifolia* Roth ex Roem. & Schult.
	LOGANIACEAE
392.	*Faraea ceilania* Thunb.
393.	*Strychnos cinnamomifolia* Thw.
394.	*S. minor* Dennst.
395	*S. nux-vomica* Linn.
	LORANTHACEAE
396.	*Helicanthes elastica* (Desr.) Danser
397.	*H. wallichiana* (Schult.) Danser
398.	*Macrosolen parasiticus* (Linn.) Danser
399.	*Taxillus tomentosus* (Heyne ex Roth) Tiegh.
	VISACACEAE
400.	*Viscum angulatum* Heyne ex Dc.
401.	*V. orientale* Willd.
	LYTHRACEAE
402.	*Lagerstroemia microcarpa* Wt.
403	*L. reginae* Roxb.
	MALPHIGHIACEAE
404.	*Aspidopterys canarensis* Dalz.
405.	*Hiptage benghalensis (*Linn.) Kurz
	MALVACEAE
406.	*Abutilon persicum* (Bunn. f.) Merr.
407.	*H. lobatus* (Murr.) O. Ktze.
408.	*H. lunariifoliuss* Willd.
409.	*Julostylis angustifolia* (Arn.)Thw.
410.	*Sida acuta* Burm. f.
411.	*S. cordifolia* Linn.
412.	*S. mysorensis* Wight & Arn
413.	*S. rhombifolia* Linn.
414.	*S. alnifolia* L.
415.	*Thespesia lampas* (Cav.) Dalz. & Gibs.
416.	*Urena lobata* Linn. ssp. *lobata*
	MELASTOMATACEAE
417	*Medinilla beddomei* Cl.
418.	*Melastoma malabathricum* Linn
419.	*Memecylon deccanense* Cl.
420.	*Osbeckia aspera* (Linn.) Bl.
421	*O. truncata* D. Don ex Wt. & Arn.
422.	*O. wynaadensis* Cl.
423.	*Sonerila rheedei* Wt. & Arn.
424.	*S. versicolor* Wt. var. *axillaris (*Wt.) Gamble
425.	*S. wallichii* Bennett.

	MELIACEAE
426.	*Aglaia barberi* Gamble
427.	*A. canarensis* Gamble
428.	*A. lawii* (Wt.) SaId.
429.	*A. tomentosa* Teijsm & Binn.
430.	*Aphanamixis polystachya* (Wall.) Parker.
431.	*Chukrasia tabularis* A. Juss.
432.	*Cipadessa baccifera* (Roth) Miq.
433.	*Dysoxylum malabaricum* Bedd. ex Hiern
434.	*Melia dubia* Cav.
435.	*Munronia pinnata* (Wall.) Harms
436.	*Naregamia alata* Wt. & Arn.
437.	*Toona ciliata* Roerm.
438.	*Trichilia connaroides* (Wt. & Arn.) Bentv.
439.	*Walsura trifolia* (A. Juss.) Harms
	MENISPERMACEAE
440.	*Cissampelos pareia* L.
441.	*Cyclea peltata* (Lamk.) Hook. f. & Thoms.
442.	*Diploclisia glauscesens* (Bl.) Diels
443.	*Stephania japonica* (Thunb.) Miers
444.	*Tiliacora acunlinata* (Lamk.) Miers
445.	*Tinospora sinensis* (Lour.) Merr.
	MIMOSACEAE
446.	*Abarema bigemina* (Linn.) Kostenn.
447.	*A. subcoriacea* (Thw.) Kostenn
448.	*A. sinuata* (Lour.) Merr.
449.	*A. torta* (Roxb.) Carib
450.	*Albizia chinensis* (Osb.) Merr.
451.	*A. lebbeck* (Linn.) Wild
452.	*A. odoratissima* (Linn. f.) Benth
453.	*A. procera* (Roxb.) Benth
454.	*Entada rheedei* Spreng.
455.	*Mimosa invisa* Mart.
456.	*Paraserianthes falcataria* (L.) Neils.
457.	*Pithecellobium gracile* Bedd.
458.	*Xylia xylocarpa* (Roxb.) Taub.
	MORACEAE
459.	*Artocarpus gomezianus* Wall. ex Trecl.
460.	*A.heterophyllus* Lam.
461.	*Dorstenia indica* Wall. ex Wt.
462.	*Ficus amplissima* J. E. Sm.
463.	*F. arnottiana* (Miq.) Miq.
464.	*F. beddomei* King
465.	*F. dalhousiae* Miq.
466.	*F. exasperata* Vahl
467.	*F. hispida* Linn. f.
468.	*F. nervosa* Heyne ex Roth
469.	*F. racemosa* Linn.
470.	*F. tsjahela* Burm. f.
471.	*Streblus asper Lour.*
	MYRISTUCACEAE
472.	*Gymnacranthera canarica* (King.) Warb.
473.	*Knema attenuata* (Hook. f. & Thorns.) Warb.
474.	*Myristica dactyloides* Gaertn.
	MYRSINACEAE

475.	*Ardisia paniflosa*
476.	*A. sonchifolia* Mez
477.	*Embelia adnata* Bedd. ex Cl.
478.	*E. ribes* Burm. f.
479.	*Maesa indica* (Roxb.) Dc
	MYRTACEAE
480.	*Syzigium cumini* (Linn.) Skeels
481.	*S. laetum* (Buch .- Ham.) Gandhi
482.	*S.lanceolatum* (Lamk.) Wt. & Arn.
483.	*S. malabaricum* (Bedd.) Gamble
484.	*S. occidentalis* (Bourd.) Gamble
485.	*S. travancoricum* Gamble
	OLEACEAE
486.	*Chionanthes mala-elengi* (Dennst.) P.S.Green
487.	*Jasminum pubescens* Willd.
488.	*J. rottlerianum* Wall. ex A. DC.
489.	*Ligustrum walkeri* Decne.
490.	*Myxopyrum smilacifolium* (Wall.) Bl.
491	*Olea dioica* Roxb.
	OROBANCHACEAE
492.	*Aeginetia indica* Linn.
	OXALIDACEAE
493.	*Biophytum reinwardtii* (Zucc.) Klotzsch.
494.	*Oxalis corniculata* Linn.
	PASSIFLORACEAE
495.	*Adenia hondala* (Gaertn.) de Wilde
496.	*Passiflora foetida* Linn.
	PEDALIACEAE
497.	*Sesamum indicum* Linn.
	PIPERACEAE
498.	*Paperomia portulacoides* (Lam.) Dietr.
499.	*Piper barberi* Gamble
500.	*P. longum* Linn.
501	*P. nigrum* Linn.
502.	*Pothomophe sunpeltata* (Willd. Miq.)
	PITTOSPORACEAE
503.	*Pittosporum neelgherrense* Wt. & Arn.
	POLYGALACEAE
504.	*Polygala arvensis* Willd.
505.	*P. rosmarinifolia* Wt. & Am.
	POLYGONACEAE
506.	*Polygonum barbatum* Linn.
507.	*P. chinense* Linn.
508.	*P. glaburm* Willd.
	RANUNCULACEAE
509.	*Clematis goriana* Roxb. ex DC.
510.	*Naravelia zeylanica* (Linn.) DC.
	RHAMNACEAE
511.	*Gouania microcarpa* DC.
512.	*Ventilago bombaiensis* Dalz.
513.	*Ziziphus oenoplia* (L.)Mill
514.	*Z. rugosa* Lam.
	RHIZOPHORACEAE
515.	*Blepharistema serratum* (Dennst.) Suresh.
516.	*Carallia brachiata* (Lour.) Merr.

	ROSACEAE
517.	*Prunus ceylanica* (Wt. Miq.)
	CHRYSOBALANCEAE
518.	*Atuna travallcorica* (Bedd.) Kosterm.
	RUBIACEAE
519.	*Argostemma courtallense* Arn.
520.	*Canthium angustifolium* Roxb.
521	*C. travancoricum* (Bedd.) Hook. f.
522.	*Chassalia ophioxyloides* (Wall. Ex Kurz) Craib.
523.	*Haldina cordifolia* (Roxb.) Ridsd.
524.	*Hedyotis auricularia* Linn.
525.	*H. herbacea* Linn.
526.	*H. nitida* (Wt. & Arn.)
527.	*H. orixense* (Roxb.) Mabber
528.	*Ixora brachiata* Roxb. ex DC
529.	*I. malabarica* (Dennst.) Mabb.
530.	*I. nigricans* Roxb. ex Wt. & Arn.
531.	*Knoxia sumatrensis* Retz.
532.	*Lasianthus rostratus* Wt.
533	*Mitracarpus villosus* (Sw.) DC.
534.	*Mitragyna parvifolia* (Roth) Korth.
535.	*M. tubulosa (*Arn.) Hav.
536.	*Mussaenda belila* Buch.-Ham.
537.	*Mycetia acuminata.* (Wight.) Ktze.
538.	*Neanotis indica* (DC.) Lewis
539.	*Neolamarckia cadamba* (Roxb.) Bosser
540.	*Ochreinauclea missionis* (Wall. ex G. Don)
541	*Ophiorrhiza brunonis* Wt. & Arn.
542.	*O. mungos* Linn.
543.	*Pavetta calophylla* Bremek.
544.	*Prismatomeris tetrandra* (Roxb.) K. Schum.
545.	*Psychotria anamallayana* Bedd.
546	*Randia bralldisii* Gamble
547.	*R. rugulosa* (Thw.) Hook. f.
548.	*Spemlacoce hispida* Linn.
549.	*Terenna monosperma* (Wt. & Arn.) Raju
550.	*Xeromphis uliginosa* (Retz.) Mahes.
	RUTACEAE
551.	*Acronychia peunculata* (Linn.) Miq.
552.	*Atalantia racemosa* Wt.
553.	*A. wightii* Tanaka
554.	*Clausena dentata* (Willd.) Roem.
555.	*C. austroindica* Stone & Nair
556.	*C. indica* (Dalz.) Oliver
557.	*Melicope lunu-ankenda* (Gaertn.) Hartley
558.	*Glcosmis macrocarp* Wt.
559.	*G. pentaphylla (*Retz.) DC.
560.	*Luvunga eletherandra* Dalz.
561.	*Murraya paniculata* (linn.) Jack.
562.	*Naringi crenulata* (Roxb.) Nicols.
563.	*Paramignya monophylla* Wt.
564.	*Toddalia asiatica* (L.)Lamk.
565	*Zanthoxylum rhetsa* (Roxb.) DC.
	SABIACEAE
566.	*Meliosma pinnata* (Roxb.) Maxim spp. *barbulata* (Cufod.) Beus

567.	*M. simplicifolia* (Roxb.) Walp. spp. *simplicifolia*
568.	*Sabia limonicacea* Wall. ex Hook. f. & Thoms.
	SANTALACEAE
569.	*Scleropyrum pentandrum* (Dennst.) Mabb.
	SAPINDACEAE
570.	*Allophylus cobbe* (Linn.) Raeusch.
571.	*A. serrtatus* (Roxb.) Kurz.
572.	*Dimocarpus longan* Lour.
573.	*Harpullia arborea (*Blanco) Radlk.
574.	*Lepisanthes erecta (*Thw.) Leenh.
575.	*L. tetraphylla* (Vahl) Radlk.
576.	*Otonephelium stipulaceum* (Bedd.) Radlk.
577.	*Sapindus laurifolius* Vahl.
578.	*Schleichera oleosa* (Lour.) Oken
	SPOTACEAE
579.	*Donella roxburghii (*G. Don) Pierre ex Lecomte
580.	*Isonandra lanceolata* Wt.
581.	*M. neriifolia* (Moon) H.J. Lam
582.	*Mimusops elengi* Linn.
583.	*Palaquium ellipticum* (Dalz.) Baill.
	SCROPHULARIACEAE
584.	*Artanema longifolia (*Linn.) Vatke
585.	*Dopatrium nudicaule* (Willd.) Benth.
586	*Lindenbergia indica* (Linn) O.Ktze.
587	*Lindernia antipoda* (Linn.) Alston
588	*L.tenuifolia* (Colsm) Alston
589	*L. viscosa* (Hornem).Merr.
590	*Scoparia dulcis* Linn.
591	*Sopubia delphinifolla* (Linn.) G. Don.
592	*Striga angustifolia* (D. Don) Sald
593	*S.asiatica* (Linn.) O. Ktze
	SIMAROUBACEAE
594	*Ailantus triphysa* (Dennst).Alston
	SOLANCEAE
595	*Lycianthes laevis(*Dunal) Bitter
596	*Physalis angulata* Linn.
597	*Solanum indicum* Hook.f.
598	*S.nigrum* Sensu Gamble.
599	*S.torvum* Swartz
600	*S.violaceum* Ortega
	STAPHYLEACEAE
601	*T.malabarica* Gamble
	STERCULIACEAE
602	*Firmiana colorata* (Roxb.)R.Br.
603	*Helicteres isora* Linn.
604	*Heritiera papilio* Bedd.
605	*Leptonychia caudata* (Wall.ex G.Don) Burret
606	*Pterospermum diversifolium* Bl.
607	*P.reticulatum* Wt. & Arn.
608	*Pterygota alata(*Roxb.) R.Br.
609	*Sterculia guttata* Roxb.ex Dc.
610	*S.urens* Roxb.
611.	*S.villosa* Roxb.ex Dc.
	SYMPHOREMATACEAE
612	*Sphenodesme paniculata* Cl.

	SYMPLOCACEAE
613	*Symplacos laurina* (Retz.) Wall. ex Rehdr.
614	*S.macrophylla* ssp.*rosea* (Bedd) Nooteb
	TERNSTROEMIACEAE
615	*Gordonia obtuse* Wall.
	TETRAMELACEAE
616	*Tetrameles nudiflora* R Br.
	TILIACEAE
617	*Corchorus aestuans* Linn.
618	*Grewia abutilifolia* Juss
619	*G.disperma* Rottl.ex Spreng
620	*G.tiliifolia* Vahl
621	*G.umbellifera* Bedd.
622	*Triumfetta pilosa* Roth
623	*T.rhomboidea* Jacq.
	ULMACEAE
624	*Celtis philippensis* Blanco var *wightii* (Planch.) Soep.
625	*Holoptelia integrifolia* (Roxb.) Planch
626	*Trema orientalis* (L.) Bl.
	UMBELLIFERAE
627	*Hydrocotyle javanica* Thunb
628	*Pimpinella heyneana* (DC.)
	URTICACEAE
629	*Boehmeria glomerulofera* Miq.
630	*Debregeasia ceylanica* Hook f.
631	*D.longifolia* (Burm f.) Wedd.
632	*Dendrocnide sinuata* (Bl.) Chew.
633	*Elatostemma acuminatum* (Poir.) Bongn.
634	*E.lineolatum* Wt.
635	*Girardinia diversifolia* (Link) Friis.
636	*Laportea interrupta* (Linn.) Chew.
637	*Oreocnide integrifolia* (Gaud.) Miq.
638	*Pellionia heyneana* Wedd.
639	*Pilea melastomoides* (Poir) Bl.
640	*Pouzolzia bennttiana* Wt.
641	*P.zeylanica* (Linn.) Bennet.
642	*Procris wightiana* Wall. ex Wedd.
	VERBENACEAE
643	*Clerodendrom tomentosa* (Linn.) Murrary
644	*C.viscosum* Vent.
645	*Gmelina arborea* Roxb.
646	*Lantana camara* Linn
647	*Tectona grandis* Linn f.
648	*Vitex altissima* Linn .f.
649	*V.leucoxylon* Linn f.
650	*V.trifolia* Linn f.
	VITACEAE
651	*Ampelocissus arnottiana* Planch
652	*Cayratia pedata* (Lam.) A. Juss. Ex Gagnep.
653	*C.tenuifolia* (Wt. & Arn.) Gagnep.
654	*Cissus discolor* Bl
655	*C.heyneana* Planch.
656	*Tetrastigma leucostaphylum* (Dennst.) Alston ex Mabb.
	XANTHOPHYLLACEAE
657	*Xanthophyllum arnottianum* Wt.

	ARACEAE
658	*Anaphyllum wightii* Schott
659	*Arisema barnesii* Fischer
660	*Colocasia esculenta* (linn.) Schott
661	*Lagenandra Meeboldii* (Engl.) Fischer.
662	*L.nairii* Ramam. & Rajan
663	*L.toxicaria* Dalz
664	*Pothos scandens* Linn.
665	*Rhaphidophora pertusa* (Roxb.) Schott
666	*Remusatia vivipara* (Roxb.) Schott
	ARECACEAE / PALMAE
667	*Calamus gamlei* Becc.
668	*C.hookerianus* Becc.
669	*Arenga wightii* Griff.
670	*Calamus psuedotenuis* Becc.
671	*C.thwaitesii* Becc.
672	*C.vattayila* Renuka
673	*Caryota urens* Linn.
674	*Pinanga dicksonii* (Roxb.)Bl.
	AMARYLLIDACEAE
675	*Pancratium triflorum* Roxb.
	COMMENLINACEAE
676	*Aneilema glaucum* Thw.
677	*A.scapiflorum* (Roxb.) Kostel.
678	*Dictyospermum montanum* Wt.
679	*Floscopa scandens* Lour.
680	*Murdannia japonica* (Thumb.) Faden
681	*M.Pauciflora* (Wt.) Brueck.
682	*M.simplex* (Vahl) Brenan
	CYPERACEAE
683	*Carex filicina* Nees
684	*C.lindleyana* Nees
685	*Cyperus iria* Linn.
686	*C.maderasptatanus* Willd.
687	*C.rotundus* Linn.
688	*Fimbristylis eragrostis* (Nees & Meyen) Hance
689	*F.kingii* Gamble *ex* Boeck.
690	*F.pentaptera* (Nees) Kunth
691	*F.uliginosa* Hoechst.ex Steud.
693	*Hypolutrum nemorum* (Vahl) Spreng.
	DIOSCOREACEAE
694	*Dioscorea bulbifera* Linn.
695	*D.hamiltonii* Hook.f.
696	*D.oppositifolia* Linn.
697	*D.pentaphylla* Linn.
	HAEMODORACEAE
698	*Peliosanthes teta* Andr. *humilis* (Andr.) Jessop
699	*Ophiopogon intermedius* D. Don
	HYPOXIDACEAE
700	*Curculio orchioides* Gaertn.
701	*C.trichocarpa* (Wt.) Bennet & Raizada
702	*Hypoxis aurea* Lour.
	LILIACEAE
703	*Protasparagus racemosus* (Willd.) Oberm.
704	*Chilorophytum attenuatum* (Wight) Baker

705	*C.nimmonii* (Graham) Dalz.
706	*Dracaena terniflora* Roxb.
707	*Gloriosa superba* Linn.
708	*Scilla hyacinthina* (Roth.) Macbr.
709	*S.zeylanica* Linn.
	MARANTACEAE
710	*Schumannianthus virgatus* (Roxb.) Rolfe
711	*Stachyphrynium spicatum* (Roxb.) Schum.
	MUSACEAE
712	*Ensete superbum* (Roxb.) cheesm.
	ORCHIDACEAE
713	*Acampe praemorsa* (Roxb.)Blatt. & McCann
714	*A.ringens* Fischer
715	*Anectochilus elatus* Lindl.
716	*Arundina graminifolia* (Don) Hochr.
717	*B.aureum*
718	*B.neilgherrense* Wt.
719	*B.tremulum* Wt.
720	*Calanthe masuca* (Don) Lindl.
721	*Coelogyne breviscapa* Lindl.
722	*Cottonia peduncularis* (lindl.) Reichb.f.
723	*Dendrobium crypidatum* Lindl.
724	*D.herbaceum* Lindl.
725	*D.heyneanum* Lindl.
726	*D.macrostachyum* Lindl.
727	*D.ovatum* (Willd.) Kranz.
728	*Epipogium roseum* (D.Don) Lindl.
729	*E.mysorensis* Lindl.
730	*E.pauciflora* Wt.
731	*Eulophia epidendraea* (Retz.) Fischer
732	*E.nuda* Lindl.
733	*Flickingera macraei* (Lindl.) Seidenf.
734	*Geodorum densiflorum* (Lam.) Schltr.
735	*Habenaria crinifera* Wt.
736	*H.digitata* Lindl.
737	*H.longicorniculata* Grah.
738	*H.longicornu* Lindl
739	*H.ovalifolia* Wt.
740	*H.plantaginea* Lindl.
741	*Liparis nervosa* (Thunb.) Lindl.
742	*L.viridiflora* (Bl) Lindl
743	*Luisia birchea* Bl
744	*L.evangelinae* Blatt & Mc Cann
745	*L.zeylanica* Lindl.
746	*L. elliptica* Wight
747	*Nervilia aragoana* Gaud
748	*Oberonia brachyphylla* Blatt. & McCann
749	*O.brunoniana* Wt.
750	*O.denticulate* Wt.
751	*O.santapui* Kapad
752	*Pecteilis gigantean* (J.E.Sm.) Rafin
753	*Peristylus densus* (Lindl.) Sant. & Kapad
754	*P.plantagineus* Lindl.
755	*Pholidota imbricata* Hook.
756	*Polystachya concreta* (Jacq.) Garey & Sweet

757	*Rhynchostylis retusa* (Lindl.) Bl
758	*Sirhookera latifolia* (Wt.) O.Ktze
759	*Smithsonia maculata* (Retz.) Sald.
760	*Trias stocksii* Benth ex Hook .f.
761	*Vanda tessellata* (Roxb.) Hook ex G.Don
762	*V.testacea* (Lindl.) Reinchb. F.
763	*Vanilla wightiana* Lindl.ex.Hook.f.
764	*Zeuxine longgilabris* benth.ex Hook .f.
	PANDANACEAE
765	*Pandanus tectorius* Soland
	POACEAE / GRAMINEAE
766	*Agrostis peninsularis* Hook.f.
767	*Alloteropsis cimicina* (L.) Stapf.
768	*Apocopis courtallumensis* (Steud.) Henr.
769	*Arthraxon lancifolius* (Trim.) Hochst.
770	*Arundinella leptochloa* (Nees *ex* Steud.) Hook .f.
771	*A.purpurea* Hochst. *ex* Steud.
772	*Bambusa bambos* (Linn.) Voss.
773	*Brachiaria miliformis* (J. Persl. *ex* Persl) A. Chase
774	*Capillipedium huegelii* (Hack.) Stapf
775	*Chrysopogon aciculatus* (Retz.) Trim.
776	*C.zeylanicus* (Nees) Thw.
777	*Cymbopogon flexuosus* (Nees ex Steud) Wats.
778	*Cynodon dactylon* (Linn.) Pers.
779	*Cyrotococcum oxyphyllum* (steud.)Stapf.
780	*Dactyloctenium aegyptium* (Linn.) P. Beauv.
781	*Dimeria ornithopoda* Trim.
782	*Echinochloa colonum* (Linn.) Link.
783	*Eleusine indica* (Linn.) Gaertn
784	*Eragrostis japonica* (Thunb.) Trim.
785	*E.tenella* (linn.) Beauv. *ex* Roem & Schult.
786	*E.unioloides* (Retz.) Nees ex Steud.
787	*Eulalia phaeothrix* (Hack) O.Ktze.
788	*Garnotia tenella* (Arn. *ex* Miq.) Janowsky
789	*Heteropogon contortus* (Linn.) P. Beauv. *ex* Roem. & Schult
790	*Indocloa oligantha* (Hocsht.) Bor
791	*Isachne setosa* Fischer
792	*Ischaemum indicum* (Houtt.) Merr.
793	*I.nilgiricum* Hack
794	*I.rangacharianum* Fischer
795	*Jansenella griggithiana* (Muell.) Bor.
796	*Ochalandra travancorica* (Bedd.) Benth. *ex* Gamble
797	*Oplismenus compositus* (Linn.) P.Beavu.
798	*Oryza granulata* Nees & Arn. *ex* Watt.
799	*Paspalidium flavidum* (Retz.) A.Camus
800	*Paspalum scorbiculatum* Linn.
801	*Perotis indica* (Linn.) O.Ktze
802	*Pennisetum polystachyon* (Linn.) Schult.
803	*Pseudanthistria umbelata* (Hack.) Hook. F.
804	*Rottboellia exaltata* Linn. F.
805	*Sacciolepis indica* (Linn.) A. Chase
806	*Setaria pallidafusca* (Schum.) Stapf & C.E.Hubb.
807	*Spodiopogon rhizophorus* (Steud.) Pilger
808	*Themeda quadrivalvis* (Linn.) O. Ktze.
809	*T.triandra* Forsck

	XYRIDACEAE
810	*Xyris pauciflora* Willd.
	ZINGIBERACEAE
811	*Alpinia galanga (*Linn.) Sw.
812	*A.malaccensis* (Burm.f.) Rosc.
813	*Amomum microstephanum* Baker
814	*A.muricatum* Bedd.
815	*Boesenbergia rotunda* (L.) Mansfield.
816	*Costus speciosus* (Koenig) Sm.
817	*Curcuma ecalcarata* Sivar. & Indubalacha.
818	*C.vamana* Sabu & Mangaly
819	*C.zedoaria* (Christm.) Rosc.
820	*Elettaria cardmomum* (Linn.) Mat.
821	*Globba maranthina* Linn.
822	*G.ophioglossa* Wt.
823	*Zingiber cernum* Dalz
	GNETACEAE
824	*Gnetum edule* (Willd.) Bl.

APPENDIX – IX

CHECKLIST OF FAUNA IN VAZHACHAL FOREST DIVISION

Mammals

Sl. No	Common name	Scientific name	Family
1	Lion-tailed Macaque	*Macaca silenus* Linnaeus	Cercopithecidae
2	Bonnet macaque	*Macaca radiata* Geoffroy	Cercopithecidae
3	Nilgiri Langur	*Trachypithecus johnii* J.Fischer	Cercopithecidae
4	Asian Elephant	*Elephas maximus* Linnaeus	Elephantidae
5	Gaur	*Bos gaurus* H.Smith	Bovidae
6	Sambar Deer	*Cervus unicolor* Kerr	Cervidae
7	Chital or Spotted Deer	*Axix axis*	Cervidae
8	Barking Deer	*Muntiacus muntjak* Zimmermann	Cervidae
9	Mouse Deer	*Moschiola meminna* Erxleben	Tragulidae
10	Wild Boar	*Sus scrofa* Linnaeus	Suidae
11	Malabar Giant Squirrel	*Ratufa indica* Erxleben	Sciuridae
12	Large Brown Flying Squirrel	*Petaurista petaurista* Pallas	Sciuridae
13	Indian Porcupine	*Hystrix indica* Kerr	Hystricidae
14	Small Indian Civet	*Viverricula indica* Desmarest	Viverridae
15	Common Palm Civet	*Paradoxurus hermaphrodites* Pallas	Viverridae
16	Sloth Bear	*Melursus ursinus* Shaw	Ursidae
17	Tiger	*Panthera tigris* Linnaeus	Felidae
18	Leopard	*Panthera pardus* Linnaeus	Felidae
19	Jungle Cat	*Felis chaus* Guldenstaedt	Felidae
20	Wild Dog	*Cuon alpinus* Pallas	Canidae
21	Nilgiri Tahr	*Hemitragus hylocrius* Ogilby	Bovidae
22	Common Indian Field Mouse	*Mus booduga* Gray	Muridae
23	Fishing Cat	*Prionailurus viverrinus* Bennett	Felidae
24	Common Mongoose	*Herpestes edwardsii* Geoffroy	Herpestidae
25	Layard's Palm Squirrel	*Funambulus layardi* Blyth	Sciuridae
26	Indian pangolin	*Manis crassicaudata* Gray	Mantidae

Reptiles

Sl. No	Common name	Scientific name	Family
1	Indian Pond Terrapin	*Melanochelys trijuga*	Emydidae
2	Travancore tortoise	*Indotestudo forstenii* Schlegel & Muller	Testudinidae
3	Land Tortoise	*Geochelone elegans* Schoepff	Testudinidae
4	Common Garden Lizard	*Calotes versicolor* Daudin	Agamidae
5	Forest Calotes	*Calotes rouxi* Dum & Bibr	Agamidae
6	Common Skink	*Mabuya carinata* Schneider	Scincidae
7	Flying Lizard	*Draco dussumieri* Dum&Bibr.	Agamidae
8	Monitor lizard	*Varanus bengalensis* Schneider	Varanidae
9	Spotted Tree Lizard	*Calotes elliotti* Gunther	Agamidae
10	Common Worm/Snake	*Rhamphotyphlops braminus* Daudin	Typhlopidae
11	Indian Python	*Python molurus* Linnaeus	Boidae
12	Bronze-headed Whip Snake	*Ahaetulla perroteti* Dum & Bibr	Colubridae
13	Gunther's Whip Snake	*Ahaetulla dispar* Gunter	Colubridae
14	Common Krait	*Bungarus caeruleus* Schneider	Elapidae
15	Russels Viper	*Vipera russelli* shaw	Viperidae
16	Malabar Pit Viper	*Trimeresurus malabaricus* Jerdon	Viperidae
17	Bamboo Pit Viper	*Trimeresurus gramineus* Shaw	Viperidae
18	Common Indian Bronzeback	*Dendrelaphis tristis*	Colubridae
19	Indian Cobra	*Naja naja* Linne	Elapidae
20	Striped Small-headed Snake	*Xylophis stenorhynchus* Gunther	Colubridae
21	Large scaled Pit Viper	*Trimeresurus macrolepis*	Viperidae
22	Hump nosed Pit Viper	*Hypnale hypnale* Merrem	Viperidae
23	Forest cane turtle	*Vijayachelys silvatica*	Testudinidae

Amphibians

Sl. No	Common name	Scientific name	Family
1	Ornate Narrow-mouthed Frog	*Microhyla ornata*	Microhylidae
2	Common Indian Toad	*Duttaphrynus melanostictus* Schneider	Bufonidae
3	Southern Hill Toad	*Bufo microtympanum* Boulenger	Bufonidae
4	Short-webbed Frog	*Limnonectes brevipalmatus*	Bufonidae
5	Narrow Mouthed Frog	*Microhyla rubra*	Mycrohylidae
6	Common Frog	*Rana hexadactyla*	Ranidae
7	Fungoid frog	*Rana malabarica*	Ranidae
8	Brownzed frog	*Rana temporalis*	Ranidae
9	Beddome's Leaping Frog	*Indirana beddomii*	Petropedetidae
10	Malabar Flying Frog	*Rhacophorus malabaricus* Jerdon	Rhacophoridae
11	Large Wrinkled Frog	*Nyctibatrachus major*	Nyctibatrachidae
12	White-nosed bush frog	*Philautus leucorhnus*	Rhacophoridae
13	Beddome's Frog	*Rana beddomii* Gunther	Ranidae
14	Brown Tropical Frog	*Micrixalus fuscus* Boulenger	Micrixalidae
15	Indian Bull Frog	*Hoplobatrachus tigerinus*	Dicroglossidae
16	Green Frog	*Euphlyctis hexadactylus* Lesson	Dicroglossidae
17		*Fejervarya nilagirica*	Dicroglossidae
18	Common Tree frog	*Polypedatus maculates*	Rhacophoridae
19	Indian Paddy field frog	*Linnonectus liannocaris*	Dicroglossidae
20	Sharp nosed bull frog	*Philautus nasutus* Gray	Rhacophoridae

Birds

Sl.No	Common name	Scientific name
1	Pond heron	*Ardeola grayii*
2	Little egret	*Egretta garzetta*
3	Blackwinged kite	*Elanus caeruleus*
4	Crested goshawk	*Pernis ptilothynchus*
5	Shikra	*Accipter badius*
6	Crested goshawk	*Accipter nisus*
7	Crested hawk eagle	*Spizaetus nirrhatus*
8	Black Eagle	*Ictinaetus malayensis*
9	Lesser serpent eagle	*Spilornis cheela*
10	Indian kestrel	*Falco tinnunculus subsp*
11	Red spurfowl	*Galloperdix spadicea*
12	Grey jungle fowl	*Gallus sonneratii*
13	Greyfronted green pigeon	*Treron pompadora*
14	Green pigeon	*Treron pheoenicoptera*
15	Imperial green pigeon	*Ducula aenea*
16	Jerdon's Imperial pigeon	*Ducula badia*
17	Nilgiri wood pigeon	*Columba elphinstonii*
18	Indian spotted dove	*Streptopelia chinensis*
19	Indian emerald dove	*Chalcophaps indica*
20	Blossomheaded parakeet	*Pstittacula cyanocephala*
21	Bluewinged parakeet	*Psittacula columbodies*
22	Indian loriquet	*Loriculus vernalis*
23	Common hawk cuckoo	*Cuculuus varius*
24	Indian cuckoo	*Cuculus micropterus*
25	Indian baybanded cuckoo	*Cacomantis sonneratii*
26	Indian plaintive cuckoo	*Cacomantis merulinus*
27	Coucal/crow pheasant	*Centropus sinensis*
28	Pennisular sacops owl	*Otus scops subsp*
29	Indian collared scops owl	*Otus bakkamoena*
30	Forest eagle owl	*Bubo nipalensis*
31	Barred jungle owlet	*Glaucidium radiatum*
32	Brown hawk-owl	*Ninox scutulata*
33	Indian ediblenst swiflet	*Collocalia unicolor*
34	Brownthroated Spinetail Swift	*Chaetura gigantean*
35	Whiterumped spinetail Swift	*Chaetura syvatica*
36	Indian alpine swift	*Apus melba*
37	Indian house swift	*Apus affinis*
38	Crested tree swift	*Hemiprocne longipennis*
39	Malabar trogon	*Harpectes fasciatus subsp*
40	Whitebreasted kingfisher	*Halcyon smyrnensis*
41	Chestnutheaded bee-eater	*Merops supperciliosus*
42	Small green bee-eater	*Merops orientalis*
43	Indian roller	*Coracias benghalensis*
44	Ceylon hoopoe	*Upupa epops subsp*
45	Malabar grey hornbill	*Tockus griseus*
46	Great Indian hornbill	*Buceros bicornis*
47	Small green barbet	*Megalaima viridis*

48	Crimsonthroated barbet	*Megalaima rubrucapilla*
49	Crimsonbreasted barbet	*Megalaima haemacephala*
50	Rufous woodpecker	*Micropternus brachurus*
51	Little scalybellied green woodpecker	*Picus myremecophoneus*
52	Indian small yellownaped woodpecker	*Picus cholorolophus*
53	Malabar goldenbacked woodpecker	*Dinopium benghalense*
54	Malabar golden backed woodpecker	*Dinopium javanense*
55	Indian great black woodpecker	*Dryocopus javensis*
56	Yellowfornted pied woodpecker	*Picoides mehrattensis*
57	Kerala pigmy woodpecker	*Picoides nanus subsp*
58	Heartspotted woodpecker	*Hemicircus canente*
59	Larger goldenbacked woodpecker	*Chrysocolaptes lucides*
60	Indian pitta	*Pita branchyura*
61	Common swallow	*Hirundo rustica subsp*
62	Indian redrumped swallow	*Hrundo daurica subsp*
63	Brown shrike	*Lanius cristatus*
64	Indian golden oriole	*Oriolus oriolus*
65	Blacknaped oriole	*Oriolus chinensis*
66	Indian backheaded oriole	*Oriolus xanthornuns*
67	Southern black drongo	*Dicrurus adsmilis subsp*
68	Indian grey drongo	*Dircurrus leucophaeus*
69	Bronzed drongo	*Dicrurus aeneus*
70	Haircrested drongo	*Dircrurus hottentotus*
71	Large racket-tailed drongo	*Dircrurs paradiseus*
72	Ashy swallow shrike	*Artamus fuscus*
73	Whiteheaded myna	*Sturnus malabaricus subsp*
74	Indian myna	*Acridotheres tristis*
75	Hill myna	*Gracula religiosa*
76	Kerala tree pie	*Dendrocitta vagabunda subsp*
77	Whitebellied tree pie	*Dendrocitta leucogastra*
78	Indian jumagle crow	*Corvus macrohynchosa*
79	Malabar woodshrike	*Tephrodornis gularis*
80	Common woodshrike	*Tephrodornis pondicerianus*
81	Indian large cuckoo shrike	*Coracine novaehollandiae*
82	Blackheaded cuckoo shrike	*Coracine melanoptera*
83	Orange minivet	*Pericrocotus Flammeus*
84	Small minivet	*Pericrocotus cinnamoneus*
85	Ceylon iora	*Aegithina tiphia subsp*
86	Goldfronted chloropsis	*Chloropsis aurifrons*
87	Jerdon's chloropsis	*Choloropsis cochinchinensis*
88	Fairy bluebird	*Irena puella*
89	Greyheaded bulbul	*Pycnonotus priocephalus*
90	Rubythroated bulbul	*Pycnonotus melanicterus*
91	Redwhiskered bulbul	*Pycnonotus jocosus*
92	Redvented bulbul	*Pycnonotus cafer*
93	Yellowbrowned bulbul	*Hypsipetes madagascariensis*
94	Black bulbul	*Hypsipetes madagascariensis*
95	Pennisular spotted babbler	*Pellorneum ruficeps*
96	Kerala scimitar babbler	*Pomatorhinus schisticeps subsp*
97	Blackheaded babbler	*Rhopocichla atriceps*
98	Rufous babbler	*Turdoides subrufus*

99	Malabar jungle babbler	*Turdodies subrufus*
100	Wynad laughing thrush	*Garrulax deleserti*
101	Nilgiri quaker babbler	*Alcippe poioicephala subsp*
102	Brown flycatcher	*Muscipa latirostris*
103	Brownbreadsted flycatcher	*Muscicapa mutti*
104	Rufoustailed flycatcher	*Muscicapa rufocauda*
105	Eastern redbreated flycatcher	*Muscicapa parva subsp*
106	Whitebellied blue flycatcher	*Muscicapa pallipes*
107	Bluethroated flycatcher	*Muscicapa parva subsp*
108	Tickell's blue flycatcher	*Muscicapa tickelliae*
109	Nildiri verditer flycatcher	*Muscicapa alibicaudata*
110	Greyheaded flycatcher	*Culicicapa ceylonensis subsp*
111	Penninsular paradise flycatcher	*Terpsiphone paradisi subsp*
112	Franklin's ashy grey wren warbler	*Monarcha azurea*
113	Indian tailobird	*Prinia hodgsonii*
114	Blyth's reed warber	*Orthotomus sutotius*
115	Greenish leaf warbler	*Acrocephalus dumetorum*
116	Large crowned leaf warbler	*Phylloscopus trochioides*
117	Indian bluecat	*Phylloscopus occipitalis*
118	Indian magpie robin	*Erithacus brunneus*
119	Blackbacked Indian robin	*Copsychus saularis*
120	Blueheaded rock thrush	*Monticola cinclorhynchus*
121	Malabar whistling thrush	*Myiophoneua horsfieldii*
122	Whitethroated ground thrush	*Zoothera citrina subsp*
123	Nilgiri blackbird	*Turdus merula subsp*
124	Indian grey tit	*Parus major*
125	Yllow cheeked tit	*parus xanthogenys subsp*
126	Velvetfronted nuthatch	*Sitta frontalis*
127	Forest wagtail	*Motocilla indica*
128	Grey wagtail	*Motacilla caspica*
129	Thickbilled flowerpecker	*Dicaeum agile*
130	Tickell's flowerpecker	*Dicaeum erythrorhynchos*
131	Nilgiri flowerpecker	*Dicaeum concolor*
132	Purplerumped sunbird	*Neetarinia zeylonica*
133	Small sunbird	*Neetarinia minima*
134	Maroonbreasted sunbird	*Nectarinia lotenia*
135	Indian purple sunbird	*Neetarinia asiatica*
136	Little spiderhunter	*Arachnothera longirostris*
137	Nilgiri white-eye	*Zosterops palpebrosa subsp*
138	Rosefinch	*Carpodacus erythrinus subsp*

Butterflies

Sl.No	Scientific name	Family
1	*Troides minos* Cram	Papilionidae
2	*Graphium sarpedon teredon* Feld.	Papilionidae
3	*Papilio budha* Westwood	Papilionidae
4	*Pachliopta aristolochiae* Fb	Papilionidae
5	*Papilio helenus* Lin	Papilionidae
6	*Papilo crino* Fb.	Papilionidae
7	*Papilo demoleus* Lin	Papilionidae
8	*Papilo pandiyana* Moore	Papilionidae
9	*Papilio dravidarum*	Papilionidae
10	*Papilio polymnestor*	Papilionidae
11	*Papilio polytes polytes*	Papilionidae
12	*Papilio clytia clytia*	Papilionidae
13	*Papilio liomedon*	Papilionidae
14	*Pachliopta hector*	Papilionidae
15	*Graphium doson eleius*	Papilionidae
16	*Graphium sarpedon teredon*	Papilionidae
17	*Pachliopta pandiyana*	Papilionidae
18	*Appias libythea* Fb.	Pieridae
19	*Appias lyncida* Cram.	Pieridae
20	*Appias paulina* Feld.	Pieridae
21	*Catopsilia pomona* Fb.	Pieridae
22	*Catopsilia pyranthe* Lin.	Pieridae
23	*Clotis amata amata* Fb	Pieridae
24	*Cepora nerissa phryne*	Pieridae
25	*Anapheis aurota*	Pieridae
26	*Delias eucharis* Drury	Pieridae
27	*Eurema blanda* Boisd.	Pieridae
28	*Eurema hecabe* Lin.	Pieridae
29	*Eurema laeta* Boisd.	Pieridae
30	*Appias lyncida latifascia*	Pieridae
31	*Appias albina darada*	Pieridae
32	*Leptosia nina* Fb.	Pieridae
33	*Ixias Marianne* Cram.	Pieridae
34	*Colotis eucharis eucharis*	Pieridae
35	*Colotis danae danae*	Pieridae
36	*Appias indira shiva*	Pieridae
37	*Eurema brigitta rubella*	Pieridae
38	*Caleta caleta decidia*	Lycaenidae
39	*Discolampa ethion vavasanus*	Lycaenidae
40	*Pseudozizeeria maha ossa*	Lycaenidae
41	*Arhopala pseudocentaurus* Doubleday	Lycaenidae
42	*Castalius rosimon* Fb.,	Lycaenidae
43	*Cheritra freja* Fb.	Lycaenidae
44	*Chilades pandava* Horsfield	Lycaenidae
45	*Lampides boeticus* linne	Lycaenidae
46	*Spindasis vulcanus vulcanus* Fb.	Lycaenidae
47	*Loxura atymus* Carm.	Lycaenidae

48	*Tajuria cippus* Fb.	Lycaenidae
49	*Megisba malaya* Moore	Lycaenidae
50	*Curetis thetis* Drury	Lycaenidae
51	*Curetis* sp.	Lycaenidae
52	*Chilades pandava* Horsfield	Lycaenidae
53	*Jamides electo* Field	Lycaenidae
54	*Pieris canidia canis*	Lycaenidae
55	*Ixias pyrene sesia*	Lycaenidae
56	*Ixias marianne*	Lycaenidae
57	*Ariadne merione Cram*	Nymphalidae
58	*Cirrochora thaia Fb.*	Nymphalidae
59	*Cupha erymanthis Drury.*	Nymphalidae
60	*Euthalia garuda* Moore	Nymphalidae
61	*Euthalia lubentina* Cram.	Nymphalidae
62	*Hypolimnas bolina* Lin.	Nymphalidae
63	*Hypolimnas misippus* Lin.	Nymphalidae
64	*Junonia atlites* Lin	Nymphalidae
65	*Junonia hierta* Fb.	Nymphalidae
66	*Junonia almana almana* Lin.	Nymphalidae
67	*Junonia iphita* Cram	Nymphalidae
68	*Neptis hylas* Moore	Nymphalidae
69	*Phalanta phalantha* Drury.	Nymphalidae
70	*Vanessa indica* Frushstorfer	Nymphalidae
71	*Eupolea Sylvester coreta*	Nymphalidae
72	*Euploea core core*	Nymphalidae
73	*Melanitis zitenius gokala*	Nymphalidae
74	*Lethe europa ragalva*	Nymphalidae
75	*Lethe drypetis todara*	Nymphalidae
76	*Lethe rohira neelgheriensis*	Nymphalidae
77	*Mycalesis anaxias anaxias*	Nymphalidae
78	*Mycalesis anaxias anaxias*	Nymphalidae
79	*Mycalesis mineus polydecta*	Nymphalidae
80	*Mycalesis oculus*	Nymphalidae
81	*Zipoetis saitis*	Nymphalidae
82	*Charaxes solon solon*	Nymphalidae
83	*Acraea violae*	Nymphalidae
84	*Hasora chromus chromus*	Hesperiidae
85	*Badamia exclamationis*	Hesperiidae
86	*Elymnias caudate* Butler	Satyridae
87	*Melanitis leda* Lin.	Satyridae
88	*Mycalesis anaxias* Hewit	Satyridae
89	*Zipoetis saitis* Hewit	Satyridae
90	*Lethe drypetis* Moore	Satyridae
91	*Mycalesis mineus polydecta* Cram.	Satyridae
92	*Ypthima sp.*	Satyridae

APPENDIX-X

Important medicinal plants, its local name and indigenous uses by Kadar tribes.

Sl. No	Botanical name	Family	Local name	Parts used	Uses
1	*Arbus precatorius* Linn.	Fabaceae	Kunni	Leaf	The fresh leaves are applied over the swellings with warmed coconut oil for pain
2	*Adenia hondala* Wilde	Passifloraceae	Palmuthukku	Tuber	Tuber is used as body stimulant and for lactation
3	*Ageratina adenophora* King & Robins	Asteraceae	Venappacha	Leaf & stem	Crushed tender leaves and stem are applied for cuts, body pain and allergy caused by *Dendrocnide sinuate*
4	*Alstonia venenata* R. Br.	Apocynaceae	Analivegham	Bark	Tablets made from the paste of stem bark are taken with cow's urine for the treatment of snakebite. For better results against highly poisonous snakes, the above preparation in combination with *Aristolochia tagala* Cham. (Karalakam-whole plant), *Peucedanum anamalayensis*, Thottea siliquosa, etc. are used. The stem bark paste from each plant has to be stored as tablets separately. Mixing of tablets with cow's urine is done only at the time of usage
5	*Angiopteris evecta* Hoffm.	Angiopteridaceae	Kidang	Persisting leaf trace	Paste made from the persisting leaf trace on the stem is used

					against knee and elbow joint pain
6	*Arisaema tortuosum* Schott.	Araceae	Nagathaali	Corm	Flour made from the dried corm is taken internally against worms and diarrhoea
7	*Biophytum reinwardtii* Klotzch	Oxalidaceae	Mukkutti	Whole plant	Paste prepared from whole plant is used for dysentery
8	*Bridelia scandens* Willd.	Euphorbiaceae	Kottakam, Venga	Stem bark & leaf	Dried stem bark and leaves mixed with turmeric and coconut oil are used for wounds. Root paste in rice bran water is applied to remove wound scars
9	*Bulbophyllum neilgherrense* Wight	Orchidaceae	Cherumaravaha	Whole plant	Crushed plant is taken internally for scabies
10	*Centella asiatica* Urban	Apiaceae	Kudavan	Whole plant	Juice extracted from the plant is used for dysentery especially in children
11	*Clausena anisata* Hook.f.ex Benth.	Rutaceae	Kattuveppu	Leaf	Leaves boiled in water are used as a mosquito repellent
12	*Coscinium fenestratum* Colebr.	Menispermaceae	Manjavally, Maramanjal	Mature stem	Mature stem cuttings boiled in water are taken internally against jaundice and joint pain
13	*Curcuma pseudomontana* Grah.	Zingiberaceae	Manjakoova	Rhizome	Juice prepared from the rhizome is used against stomachache
14	*Cyclea peltata* Hook.f. & Thoms.	Menispermaceae	Karinthaali	Tuber	Crushed tubers are taken internally for stomach pain and bleeding
15	*Dioscorea bulbifera* Linn.	Dioscoriaceae	Kattukachil	Bulbils	Paste prepared from the bulbils is used for beestings
16	*Dracaena terniflora* Roxb.	Agavaceae	Manjakkantham	Root & fruit	Roots boiled with rice are

					taken internally for jaundice. Fruits boiled in coconut oil are used against headache
17	*Dynaria quercifolia* Smith	Polypodiaceae	Oolayali	Whole plant	Plant juice is used for the treatment of vomiting
18	*Entada rheedei* Spreng.	Fabaceae	Makkum kaya/Kakkum kaya	Seed	Juice extracted from the seeds is used for dysentery especially for children
19	*Eupatoium triplinervium* Vahl.	Asteraceae	Ayyampacha	Leaf	Crushed tender leaves are applied on cuts
20	*Ganoderma lucidum* Karst	Polyporaceae	Marakkoon	Plant body	Fruiting body crushed over rock surface is applied for headache
21	*Harpullia arborea* Radlk.	Sapindaceae	Puzhukkolli	Stem bark	Powder of stem bark mixed in water is a to prevent leech
22	*Hedychium flavescens* Carey ex Rosc.	Zingiberaceae	Aanachukku	Rhizome & leaf	Crushed rhizome and leaves boiled in water taken internally against diarrhoea
23	*Hydrocotyle javanica* Thunb.	Apiaceae	Kodavan	Whole plant	Juice extracted from the whole plant is taken internally for loose motion especially in children
24	*Leea indica* Merr.	Leeaceae	Njezhu	Stem bark	Mature stem bark is used for treating wounds
25	*Mimosa pudica* Linn.	Mimosaceae	Thottalvaadi	Whole plant	Whole plant crushed along with *Phyllantamarus* and roasted with duck egg is internally against jaundice
26	*Naravelia zeylanica* DC.	Ranunculaceae	Vathakkodi	Whole plant	Crushed whole plant is inhaled for quick from cough and cold
27	*Nervilia aragoana* Gaud.	Orchidaceae	Kamala	Whole plant	Whole plant paste is used

					against menstrual problems
28	*Ochlandra scriptoria* Fischer	Poaceae	Eetta	Sheathing scales	Dried sheathing scale on the stem bark is for wounds
29	*Peucedanum anamallayense* Cl.	Apiaceae	Padamchurukki	Whole plant	Whole plant paste along with cow's urine effective against snakebite
30	*Phyllanthus amarus* Schum. & Thonn.	Euphorbiaceae	Kizharnelli	Whole plant	Whole plant crushed in milk is used for jaundice
31	*Pittosporum tetraspermum* Wight & Arn.	Pittosporaceae	Analivegam	Stembark	Paste made from stem bark is dried as tab Tablets are taken internally against snake after mixing with cow's urine. For better against highly poisonous snakes wither the above plant alone or in combination with *Aristolochia tagala* (Whole plant), *Peucea anamalayensis*, *Thottea siliquosa*, etc. are Stem bark paste from each plant is stored tablets separately. Mixing of tablets with urine is done only at the time of usage
32	*Pterocarpus marsupium* Roxb.	Fabaceae	Venga	Heart wood, bark & pulp	Pulp obtained from the bark is used against toothache. The bark and heart wood after boiling in water is used for bathing to body pain
33	*Rhaphidophora pertusa* Schott	Araceae	Annarakkannan vazhakka	Stem	Stem boiled in coconut oil is applied for earache
34	*Rotula aquatica* Lour.	Boraginaceae	Kallurvanchi	Root	Root juice is used for all types of urinary problems
35	*Scoparia dulcis* Linn.	Scrophulariaceae	Kallurukki	Whole plant	Juice from the whole plant is

					used against kidney stone
36	*Solanum Americanum* Mill.	Solanaceae	Chakkutti	Fruit	Mature fruits made in to paste are applied toothache
37	*Solanum viarum* Dunal	Solanaceae	Kattuvazhuthana	Fruits	Roasted fruits made in to paste are applied toothache
38	*Spilanthes ciliata* H.B. & K.	Asteraceae	Palluvethanchedi	Flower	Flowers are used for toothache
39	*Stephania japonica* Miers	Menispermaceae	Karinthaali	Tuber	Crushed tubers are taken internally for and sore
40	*Wrightia tinctoria* R. Br.	Apocynaceae	Ayyappala	Leaves	Crushed leaves dipped in coconut oil sunlight exposed for three days are applied for skin problems

APPENDIX-XI

Details of plantations after the expiry of the last Working Plan

The list of Teak plantation raised after the expiry of the last Working Plan (Sri. John Koilparambil's Working Plan)

Name of plantation	Year	Extend (ha.)	% Stock	Status Natural regeneration	Remarks
Athirapilly Range					
Athirapilly Teak plantation	1979	39.56	55	nil	Mikania infestation
Teak Plantation Oolassery	1979	11.26	60	nil	Mikania infestation
Teak Plantation Oolassery	1981	8.66	60	nil	Mikania infestation
Teak Plantation 15th block	1982	43.32	70	nil	Mikania infestation
Teak Plantation Oliveli	1984	85.16	55	moderate generation	Below 10 % slope
Teak Plantation Oolassery	1990	2.88	60	nil	Below 10 % slope
Teak Plantation Karadippara	1990	1.44	50	nil	Mikania infestation, Elephant attack
Teak Plantation Oolassery	1992	16.52	70	nil	Elephant attack, below 10% slope
Teak Plantation Chully	1994	94.69	60	nil	Elephant attack, below 10% slope
Teak Plantation Chully	1995	15.46	70	nil	Elephant attack, below 10% slope
Teak Plantation Chully	1996	8.86	80	nil	Below 10 % slope
Teak Plantation Vadamury	1997	66.67	80	nil	Mikania infestation, Elephant attack
Teak Plantation Vadamury	1998	28.46	60	nil	Mikania and grass infestation, elephant attack, growth is normal
Name of plantation	**Year**	**Extend (ha.)**	**% Stock**	**Status Natural regeneration**	**Remarks**
Vazhachal Range					
Teak Plantation Irimpupalam	1979	72.39	70	nil	Mikania and grass infestation, below 10% slope
Teak Plantation Panjanamkuthu	1980	30.1	50	present	stunted growth with miscellaneous natural growth of Macaranga,Xylia, etc. below 20% slope
Teak Plantation Irimpupalam	1982	43.1	70	present	Mikania infestation, biotic interference with below 10% slope
Teak Plantation Vazhachal	1990	10.8	80	present	Mikania and grass infestation, biotic interference with below 10% slope
Teak Plantation Panjanamkuthu	1990	4.48	70	present	grass infestation, biotic interference with below 10% slope
Teak Plantation Vazhachal	1990	15.94	60	present	growth is normal with Mikanea and grass infestation
Charpa Range					
Teak Plantation Charpa	1988	13.77	70	nil	Mikania and grass infestation, below 10% slope
Teak Plantation Charpa	1990	14.56	60	nil	Mikania and grass infestation,below 10% slope
Charpa	1992	40.11	60	nil	Mikania and grass infestation, below 10% slope

Teak Plantation Panjanamkuthu	1995	11.56	72	nil	Mikania and grass infestation,below 10% slope
Kollathirumedu Range					
Teak Plantation Kalakallu	1990	8.36	60	nil	Mikania and grass infestation,low height, below 10% slope
Teak Plantation Choozhimedu (Ist Bit	1990	6.84	60	moderate	Mikania ,poor growth, low height, below 10% slope
Teak Plantation Choozhimedu (Iind Bit	1990	7.32	60	moderate	Mikania ,poor growth, low height, below 10% slope
Teak Plantation Papra(Iiird Bit)	1990	2.67	60	moderate	Mikania ,poor growth, low height, below 10% slope
Teak Plantation Choozhimedu	1992	7.02	70	moderate	Mikania and grass infestation, elephant attack, below 20% slope
Name of plantation	**Year**	**Extend (ha.)**	**% Stock**	**Status Natural regeneration**	**Remarks**
Teak Plantation Kalakallu	1993	8	60	moderate	low height, animal attack, mikanea infestation, below 10 % slope
Teak Plantation Choozhimedu	1994	30	70	moderate	animal attack, mikanea infestation, below 20 % slope
Teak Plantation Watchmaram	1994	5.1	70	moderate	grass infestation, below 10% slope
Teak Plantation Thavalakuzippara	1995	11.3	60	moderate	animal attack, mikanea infestation, below 20 % slope
Teak Plantationchoozhimedu	1995	7.02	80	moderate	animal attack, below 20 % slope

The list of miscellaneous plantations raised after the (Shri. John Koilaparambil's Working Plan) expiry of last Working Plan

Name of plantation	Year	Extend (ha.)	% Stock	Status Natural regeneration	Remarks
Athirappilly Range					
Miscellaneous Plantation 15th Block	1959	72.68	40	nil	Poor stock, Elavu, low height, scattered, normal slope
Miscellaneous Plantation. Vadamury	1961	17.69	Teak-50, Elavu-20	nil	1 ha. Cane under planted in 1993, normal slope
Miscellaneous Plantation.15TH Block	1965	118.10	Teak-70, Elavu-40	nil	Animal attack, Mikania, below 10% slope
Miscellaneous Plantation.Oolassery	1973	46.84	45	moderate	Elephant attack , normal slope, Mikania infestation
Miscellaneous Plantation.Oolassery	1975	29.52	50	nil	Elephant attack , normal slope, Mikania infestation
Miscellaneous Plantation.Oolassery	1975	19.48	30	nil	To be felled and replanted
Miscellaneous Plantation.Oolassery	1976	17.62	50	nil	Elephant attack , normal slope
Miscellaneous Plantation.Karadipara	1978	14.48	30	nil	Eucalyptus scattered, poor growth, normal slope
Miscellaneous Plantation.Oolassery	1979	73.18	Teak-70, Elavu-20	present	slope below 20%
Miscellaneous Plantation. Oolassery	1979	56.12	Teak-65, Elavu-20	nil	Elavu Poor growth, low height,Mikania infestation,

					normal slope
Miscellaneous Plantation.15Th Block	1980	151.24	Teak-60, Elavu-20	nil	Mikania infestation, Elavu Poor growth, slope below 10%
Name of plantation	**Year**	**Extend (ha.)**	**% Stock**	**Status Natural regeneration**	**Remarks**
Miscellaneous Plantation Athirappally	1991	15.40	40	nil	Elephant attack , normal slope,Mikania infestation
Miscellaneous Plantation Athirappally	1992	12.37	40	nil	Elephant attack , normal slope,Mikania infestation
Vazhachal Range					
Miscellaneous plantation. Pokalappara	1958	11.83	60	nil	Mikania infestation,Elavu Poor growth, normal slope
Miscellaneous plantation. Pokalappara	1959	15.36	60	nil	Normal slope,Mikania infestation, grass infestation
Miscellaneous plantation. Pokalappara	1960	17.12	70	nil	Mikania infestation, Elavu Poor growth, normal slope
Miscellaneous plantation. Pokalappara	1962	59.72	70	nil	Mikania infestation, normal slope
Miscellaneous plantation. Karadipara	1963	117.21	75	nil	Mikania and grass infestation, elephant attack, normal slope
Miscellaneous Plantation. Karadipara	1964	41.68	60	present	grass infestation, elephant attack, below 10 % slope
Miscellaneous plantation. Karadipara	1965	9.44	80	nil	grass infestation, elephant attack, below 10 % slope
Miscellaneous plantation. Karadipara	1966	10.40	70	nil	grass infestation, elephant attack, below 10 % slope
Miscellaneous plantation. Choozhinedu	1971	90.22	60	nil	Mikania and grass infestation, elephant attack, below 10% slope
Miscellaneous plantation. Karanthode	1972	19.22	50	present	grass infestation, elephant attack, below 10% slope
Miscellaneous pltn. Panjanamkuthu	1974	5.52	60	present	elephant attack, below 10% slope
Miscellaneous Plantation. Panjanamkuthu	1976	9.85	50	present	elephant attack, biotic interference, grass infestation, below 10% slope
Miscellaneous Plantation.Poringal	1988	8.00	80	present	Normal slope
Miscellaneous Plantation. Lakshmi	1991	16.28	40	present	Below 20% slope elephant attack, grass infestation
Miscellaneous Plantation. Pokalappara	1992	6.82	50	present	normal slope
Name of plantation	**Year**	**Extend (ha.)**	**% Stock**	**Status Natural regeneration**	**Remarks**
Miscellaneous Plantation. Mukkampuzha	1998	30.00	80	present	elephant attack, grass infestation, Below 10% slope
Miscellaneous Plantation. Karanthode	1999	30.00	50	present	elephant attack, grass infestation, Below 10% slope
Miscellaneous Plantation. Panjanamkuthu	1992	14.40	40	nil	grass infestation, animal, attack, below 10% slope

Miscellaneous Plantation. Charpa	1992	7.56	50	nil	Mikania infestation, animal, attack, below 10% slope
Miscellaneous Plantation. Orukomban	1991	57.80	50	nil	grass infestation, animal, attack, below 10% slope
Miscellaneous Plantation.Orukomban	1991	37.25	50	nil	grass infestation, animal, attack, below 10% slope
Albizia Plantation, Charpa	1973	4.48	10	nil	Albizzia scattered, poor stock, below 10% slope
Acacia Plantation, Karanthode	1988	66.28	10	nil	Planted by S.F. replanted as failed plantation
Bamboo Plantation, Karanthode	1972	18.88	60	nil	grass infestation, animal, attack, below 10% slope
Bamboo Plantation, Karanthode	1998	30.00	50	nil	grass infestation, animal, attack, below 10% slope
Bamboo Plantation, Nellapode	2000	10.25	60	nil	below 10% slope
Bamboo Plantation, Charpa	2000	2.75	50	nil	below 10% slope
Murukku Plantation, Karanthode	1972	30.30	30	nil	poor growth, below 10% slope
Murukku Plantation, Karanthode	1974	18.18	30	nil	poor growth, below 10% slope
Medicinal Plantation, Charpa	1998	11.50	50	nil	below 10% slope
Medicinal Plantation, Charpa	1999	6.50	50	nil	below 10% slope
Kollathirumedu Range					
Miscellaneous Plantation. Kollathirumedu	1981	26.20	20	Nil	Replanted As Failure Plantation, Poor Stock, Animal Attack, Grass Infestation, Below 10% Slope
Miscellaneous Plantation.Lakshmi	1999	12.00	50	Present	Elephant Attack, Grass Infestation, Below 10% Slope
Name of plantation	**Year**	**Extend (ha.)**	**% Stock**	**Status Natural regeneration**	**Remarks**
Eucalyptus Plantations	1970	154.39	Below 10%	Nil	Grass Covered, Clear Felled, Coppice Scattered
Eucalyptus Plantations	1972	14.45	Below 10%	Nil	
Eucalyptus Plantations	1974	42.72	Below 10%	Nil	
Albizia Plantation, Vazhachal	1977	8.61	Below 20%	Nil	Clear Felled, Teak Planted(1990)
Albizia Plantation, Lakshmi	1990	33.28	Below 20%	Nil	Animal Attack, Grass Infestation, Below 20% Slope
Elavu Plantation, Vazhachal	1956	34.35	Below 10%	Nil	Animal Attack, Scattered Elavu , Grass Infestation, Below 20% Slope
Elavu Plantation, Pokalappara	1957	28.06	Below 10%	Nil	
Grewia Plantation, Karadippara	1968	16.60	Below 10%	Nil	Elephant Attack, Grass Infestation, Below 10% Slope
Medicinal Plantation, Mukkumuzha	1996	30.00	60	Nil	Elephant Attack, Below 10% Slope
Medicinal Plantation, Mukkumuzha	1997	22.00	60	Nil	Elephant Attack, Below 10% Slope

Medicinal Plantation,Pokalappara	1999	17.50	60	Nil	Normal Slope
Medicinal Plantation, Poringal	1999	3.25	60	Nil	Normal Slope
Charpa Range					
Miscellaneous Plantation. Charpa	1991	9.70	70	Nil	Below 10% Slope
Miscellaneous plantation. Panjanamkuthu	1991	23.30	60	Nil	Grass And Mikania Infestation, Below 10% Slope
Miscellaneous Plantation.	1991	13.76	50	Nil	Grass , Below 10% Slope
Miscellaneous Plantation.	1992	6.84	50	Nil	Grass , Below 10% Slope
Miscellaneous plantation. Kollathirumedu	1990	2.84	40	Moderate	Animal Attack, Below 10% Slope
Miscellaneous plantation. Choozhimedu	1991	30.77	40	Nil	Animal Attack, Grass Infestation, Below 20%
Miscellaneous plantation. Kollathirumedu	1992	4.02	20	Nil	Failed Plantation Replanted
Albizia Plantation ,	1972	4.50	30	Nil	Not Felled, Below 10 Slope
Albizia Plantation ,Karadippara	1989	19.65	40	Nil	Grass Infestation, Not Felled, Below 20% Slope
Albizia Plantation ,Kalakkallu	1990	15.53	60	Nil	Grass Infestation, Below 20% Slope
Name of plantation	**Year**	**Extend (ha.)**	**% Stock**	**Status Natural regeneration**	**Remarks**
Sesbania Plantation, Karadippara	1972	21.07	40	Nil	Grass Infestation, Not Felled, Below 20% Slope
Grevelia Plantation, Choozhimedu	1969	35.74	20	Nil	Poor Stock, Scattered Below 20 % Slope
Grevelia Plantation, Karadippara	1970	24.21	30	Nil	Poor Stock, Grass Infested, Scattered Below 10 % Slope
Sholayar Range					
Bamboo Plantation, Thavalakuzhippara	1987	53.00	50	Nil	Animal Attack, Grass Infestation, Below 10% Slop

Details of tending and harvesting operations after the expiry of last Working Plan

Name of Plantation	Extent	Operation Carried out	Year of operation
1977 Teak Plantation, Kollathirimedu	71.3376	1st mechanical Thinning	1988-89
1977 Teak Plantation, Vazhachal	145.00	2nd mechanical Thinning	1988-89
1979 Teak Plantation Vazhachal	59.38	1st Mechanical Thinning	1988-89
1982 Teak Plantation Vazhachal	43.10	1st Mechanical Thinning	1988-89
1977 T. P Vazhachal	14.28	1st Silvicultural Thinning	1992-93
1979 Teak Plantation Athirappily	129.30	1st Silvicultural Thinning	1993-94
1974 Teak Plantation Thadimudi	67.25	1st Silvicultural Thinning	1993-94
	48.96	2nd silvicultural Thinning	1993-94
1976 Softwood Plantation Kannankhuzhi	57.275	2nd Silvicultural Thinning	1993-94
1984 Teak Plantationolivel	85.156	1st Silvicultural Thinning	1995-96
1965 Teak Plantationathirappily	98.09	4th Silvicultural Thinning	1996-97
1958 Elavu Plantation Athirappily	27.1792	Final Felling	1996-97
1971 Teak +Elavu Plantation, Choozhimedu	49.62	3rd Silvicultural Thinning	1996-97
1964 Teak + Elavu Plantation, Vazhachal	41.68	4th Silvicultural Thinning	1996-97
1962 Teak + Elavu Plantation, Karadippara	59.95	3rd Silvicultural Thinning	1996-97
1963 Teak + Elavu Plantation, Karadippara	116.85	4th Silvicultural Thinning	1996-97

1965 Teak Plantation Kollathirumed		4th Silvicultural Thinning	1997-98
1961 Teak Plantation Kollathirumedu		4th Silvicultural Thinning	1997-98
1963 Teak Plantation Karadippara		4th Silvicultural Thinning	1997-98
1971 Teak Plantation Choozhimedu		3rd Silvicultural Thinning	1997-98
1962 Teak + Elavu Vazhachal		3rd Silvicultural Thinning	1997-98
1964 Teak + Elavu		3rd Silvicultural Thinning	1997-98
1976 T. P. Charpa	50.00	1st Mechanical Thinning	1988-89
1982 Teak Plantation Charpa	39.897	1st Mechanical Thinning	1988-89
1979 Teak Plantation Charpa	126.00	2nd Mechanical Thinning	1988-89
1960 Teak Plantation Athirappily	150.00	Bamboo Underplanting	1986
1963 Teak + Elavu Kollathirumedu	17.00	Bamboo Underplanting	1986
1962 Softwood Plantation,Vazhachal	35.00	Bamboo Underplanting	1986
1964 Teak Plantation Athirappily	71.00	Bamboo Underplanting	1987
1963 Soft Wood Plantation,Vazhachal	60.00	Bamboo Underplanting	1987
Name of Plantation	**Extent**	**Operation Carried out**	**Year of operation**
1967 Teak Plantation Chully	42.94	1st Silvicultural Thinning	1990-92
1974 Teak Plantation Ezhattumugham	0.90	1st Silvicultural Thinning	1990-91
1981 Teak Plantation Athirappilly	8.66	1stMechanicalThinning	1991-92
1978 Teak Plantation Athirappilly	114.84	2nd MechanicalThinning	1991-92
1984 Teak Plantation Athirappilly	85.156	1st Mechanical Thinning	1991-92
1976 Teak Plantation Athirappilly	84.07	2nd Mechanicalthinning	1991-92
1939-44 Teak PlantationAthirappilly	94.20	Final Thinning	1992-93
1971 Teak Plantation Athirapilly	108.46	2nd Silvicultural Thinning	1992-93
1977 Teak Plantation Athirapilly	156.20	1st Silvicultural Thinning	1992-93
1974 Teak Plantation Athirapilly	129.55	1st Silvicultural Thinning	1992-93
1973 Teak Plantation Athirapilly	9.75	1st Silvicultural Thinning	1992-93
1960 Teak Plantation Athirappally	174.035	3rd Silvicultural Thinning	1992-93
1961 TeakPlantation Athirappally	47.864	3rd Silvicultural Thinning	1992-93
1964 Teak Plantation Athirapilly	82.72	3rd Silvicultural Thinning	1992-93
1981 Teak Plantation Koilathirumedu		2nd Mechanical Thinning	1992-93
1974 Soft Wood Plantation, Charpa	75.00	1st Silvicultural Thinning	1992-93
Vazhachal			
1973 Teak Plantation, Rapra		3rd Silvicultural thinning	1997-98
1992 Miscellaneous Plantation, Charpa	9.70	Augmented with bamboo	1997-98

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 : .....

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*** : .....

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	

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		
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		

H. HEAD 1. BUCCAL & NASAL CAVITIES 2. TONGUE 3. BRAIN AND SPINAL CORD	
I. MUSCULATURE	
J. SKELETON	

V. SPECIMENS COLLECTED FOR LABORATORY DIAGNOSIS

1)..... 4).....

2)..... 5).....

3)..... 6).....

VI. PROVISIONAL DIAGNOSIS

VII. REMARKS

.....

.....

.....

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

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

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

.....

APPENDIX XV 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 : .....

.....

.....

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 :.....

APPENDIX XVII
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