CHAPTER - I

BASIS OF PROPOSALS

Our National Forest Policy 1998, formulated four years before the Earth summit held at Rio de Janeiro, Brazil in 1992, embodies many of the highlights which have been repeatedly emphasised in the Rio de Janeiro Principles. The policy is strongly oriented towards conservation as the main strategy for sustaining and strengthening the ecological role of Forests. National Forest Policy suggest to treat the forests first, as an ecological necessity, second as a source of goods for the use by local stakeholders and only thirdly as a source of wood and other commercial forest produce for the industries and non local users. In fact, the 1988 forest policy envisages "ensuring environmental stability, the maintenance of ecological balance including the atmospheric equilibrium, which is vital for the sustenance of all life forms, human, animal and plant. The derivation of economic benefits must be sub-ordinate to this principal aim".

The National Forest Policy of 1998 of Government of India suggested certain guidelines for the future management of forests. The shift from use-oriented management to conservation-oriented management has given a totally different perspective to the principles of forest management. Though, forests have been recognised as global resource in terms of ecological values and bio-diversity, dependence of communities on forest for their sustenance has led to the recognition of their undisputed role in conservation. Therefore, their participation has been recognized as an integral part of forest management. It is thus of great importance that forests are managed for achieving optimum productivity on a sustainable basis. For scientific and intensive management of existing natural forests and plantations, these principles have been adopted in the present Working Plan.

Government of Kerala, in tune with the principles contained in the National Forest Policy, 1988 laid down the following objectives for forest management in the State as per Order G.O.(MS)No.3/1998/F&WLD dated 7-1-1998.

- To conserve forests for prosperity, in particular with regard to bio-diversity, soil, water and historical, cultural, religious and aesthetic values.

- To increase tree cover and productivity of natural forests and forest plantations to meet the needs of present and future generations for forest products and services.

- To improve the standard of living of tribes and other forest dependent communities.

1. Objectives of Management:

- To conserve and protect the biodiversity of forests, wildlife habitations, eco-restoration of the degraded natural forests on watershed basis. So that, these assets will continue to fully serve the ecological functions

- To maximise the production potential of plantations, by intensive scientific management and also to manage the Bamboo, Reeds and Rattan areas in the natural forests for sustained yield.

- To ensure sustainability of NTFP with the participation of the forest dependent communities includes tribes and ensure sustainable livelihood.

1.1 Management Strategy:

- In order to accomplish the above objectives, following strategies are proposed.

- The existing Forests will be protected against various threat factors and Eco-restoration will be effected in the degraded forest areas by means of appropriate treatments.

- Harvest of teak plantations on attaining maturity during the plan period in a sustainable manner. Technology advancement in the field of plantation forestry will be the tool for attaining high productivity in the plantations.

- Reserve enhancement operations will be taken up in the Bamboo, Reed and Rattan areas. Sustainable harvest of bamboo will be done in a systematic way.

- Enriching the NTFP resource and its sustainable harvesting. Protection and conservation of forests with the active involvement of the forest dependent communities.

- Special habitat improvement activities will be taken up for the rich wildlife diversity in the division.

1.2. Working Circles and their Constitution:

In order to achieve the above objectives, the following Working Circles are constituted for the purpose of management.

- Plantation Working Circle

- Protection and Watershed Management Working Circle

- Bamboo, Reed and cane Working Circle
- Non-Timber Forest produce & Tribal Welfare Working Circle
- Wildlife and Bio-diversity Conservation Working Circle
- PFM and Eco-tourism Working Circle
- Miscellaneous prescriptions

1.3. Period of the Plan:

The Plan covers a period of ten years from 2011-12 to 2019-20. The revision of this plan should begin in 2020-21 as preparation takes two years, approval and finalisation may take another six months.

1.4. Distribution of forest areas:

The forests of this Division are identified for the proposed Working Circles as above. The details are provided in the table below.

Table - 25 - Constitution of Working Circles

Working Circles	Extent (ha)	Distribution	Purpose
Plantation WC	1088.0161	All the planted area with different species under different schemes.	Scientific management, regulation of yield and to increase productivity.
Protection Cum Improvement WC	41729.88	All the forest areas of this Division excluding the leased out areas, areas diverted for non-forestry purpose and non-revertible forest areas.	To protect the Forests against the prevailing threat factors and for Eco-restoration of the degraded forest areas.
Bamboo, Reeds and Cane WC	41729.88	All the forest areas of this Division excluding the leased out areas, areas diverted for non-forestry purpose and non-revertible forest areas.	Enrichment of Bamboo, Reed and cane growing stock in the Forests and for their sustainable harvest.
Non-Wood Forest Produce & Tribal Development Working Circle	41729.88	All the forest areas of this Division excluding the leased out areas, areas diverted for non-forestry purpose and non-revertible forest areas.	To conserve and to improve the sustainability of NTFP and their value addition. To involve forest dependent communities in the protection of Forests as well as to improve the source of their livelihood and standard of living.
Wildlife and biodiversity Conservation WC	42242.91	All the forest areas of this Division including the plantations, leased out areas, areas diverted for non-forestry purpose and non-revertible forest areas.	To protect the diversity of Wildlife in the Division by habitat improvement activities.
PFM and Ecotourism WC	41729.88	The entire Reserve and Plantation areas of the Division, non-forest fringe areas and spots of Ecotourism importance.	To involve forest dependent communities in the protection and restoration of Forests and to encourage ecotourism.

CHAPTER - II

PLANTATION WORKING CIRCLE

2. General Constitution:

This Working Circle shall include all the plantations in the Division with a total extent of 1088.0161 ha.

The Plantation Working Circle covers all the Teak Plantations, Pulpwood Plantations including Acacia and Eucalyptus Plantations, Cashew Plantations and Miscellaneous Plantations coming under the territorial jurisdiction of Mannarkkad Forest Division. As the compartment system was not adopted or practised in this region for managing forestry operations in the past, this tract is not divided into compartments, sub-compartments or blocks. Hence, each range is considered as a unit for taking up forestry operations. Range wise list of the plantations with their extent is furnished in **Appendix - XIX.**

Table - 26 - Abstract of Plantations in Mannarkkad Division

Sl. No	Plantations	Extent (ha)			Total
		Mannarkkad Range	Attappady Range	Agali Range	
1	Teak	223.2766	181.2779	-	404.5545
2	Acacia (Pulpwood)	10.5654	314-8000	153.9698	164.5352
3	Eucalyptus (Pulpwood)	-	55.4882	58.4277	143.9159
4	Cashew	152.7115	-	-	152.7115
5	Miscellaneous	43.3332	14.9377	164.0281	222.2990
6	Social Forestry Plantations	-	268.2900	-	268.290
Total		**429.8867**	**251.7038**	**406.4256**	**1088.0161**

2.1. Objectives:

To increase the production potential of plantations by intensive scientific management using appropriate silvicultural techniques and improve the site.

2.2. Teak Plantations: (404.5545 ha):

2.2.1. General Constitution:

Teak Plantations raised in Mannarkkad Division were classified into Mannarkkad Teak felling series and Gottiyarkandi teak felling series in the previous Working Plan. Mannarkkad teak felling series include Panakkadan area 232.41 ha, Thathengalam area 21.42 ha, Karappadam 25 ha and Kandamangalam area 25 ha Stock in Karappadam and Kandamangalam area is poor and presently, the area is transferred to buffer zone of Silent valley National Park. Though, there are teak plantations raised in

combination with species like Elavu (*Bombax ceiba*), Ailanthus (*Ailanthus triphysa*), Nasakam (*Evodia lumu ankenda)* etc of varying extent ranging from 0.2 to 4 ha, the results were not encouraging and hence these mixed plantations are included in teak felling series.

Teak plantations are generally classified into two series viz. Panakkadan series and Pottikkal series. Panakkadan series are not up to the mark when compared to Pottikkal series as already reported in the previous working plan. The area is highly infested with weeds and natural growth. Some plantations have dominance of miscellaneous growth over teak. Stocking in Thathengalam plantation is fairly good and have a site quality between second and third.

Gottiyarkandy teak felling series included Pottikkal area (184.62 ha), Chindakki area (16.90 ha), Panthanthode area (104.05 ha), Thadikundu area (153.21 ha), Gottiyarkandy area (156.85 ha) and Mukkali-Venga area (177.00 ha). Pottikkal area has fairly good stock of plantations in the entire division. Some plantations are over-stocked due to the absence of timely thinning. Soft wood plantations raised in small extent along with teak plantations are also treated under teak felling series for easy management purpose. Elavu trees have attained maximum growth but removal of softwood trees alone is a cumbersome process and hence recommended to remove along with the thinning of teak as per schedule.

Chindakki, Thadikundu, Panthanthode and Mukkali-Venga areas have been transferred to Silent Valley National Park as part of the constitution of buffer zone. Gottiyarkandy having an extent of 156.85 ha is totally a failure, only about 10 ha area of teak is left without any tending works. Teak is not suitable in this area where as bamboo has good growth, Suitable prescriptions are recommended in the following paras.

2.2.2. Character of Vegetation:

Teak plantations raised in Panakkadan area were badly affected with the growth of miscellaneous species dominating the area. Miscellaneous species generally found are Pala, Angily, Irul, Veeti, Ilavu, Poovam, Sindhooram, Maruthu etc. Heavy infestations of lantana and climbers have adversely affected the growth of teak in most places. Plantations are prone to soil erosion with the formation of gullies, with the result, huge quantities of fertile soil is lost, thus decreasing the planting area under teak. Cattle trampling makes soil hard and compact rendering them incapable of retaining sub-soil moisture resulting in increased surface run off. Some of the younger plantations raised in Panakkadan series in Mannarkkad range have medium growth but they are in abandoned stage for want of maintenance.

2.2.3. Analysis and valuation of crop:

Mannarkkad Division comprises the reserve portions of former Mannarkkad Territorial ranges, Vested Forests of Thenkara and Agali Ranges of former Palakkad Special Division. Planting of teak in Mannarkkad area started as early as 1934 with total area of 400 ha brought under teak. The largest teak plantation in the Division is one at Gottiyarkandy raised in 1981 with total extent of 156.85 ha but it is a failure.

Table - 27 Quality Class wise Stock Calculation of Teak Plantations

Sl. No	Name of Plantation	Quality (ha)				Misc & Others	Total Area (ha)	Quantity (M^3)
		I	II	III	IV			
Range: Mannarkkad								
1	1950 Panakkadan	-	0.47	0.77	-	-	1.24	108.90
2	1952 Panakkadan	0.40	1.52	1.17	-	-	3.08	296.67
3	1953 Panakkadan	0.69	0.85	0.27	0.21	1.60	3.62	208.51
4	1954 Panakkadan	0.95	1.41	0.58	0.90	0.46	4.29	364.31
5	1955 Panakkadan	-	0.48	1.37	1.20	0.66	3.72	229.68
6	1956 Panakkadan	-	0.57	0.79	1.25	0.76	3.38	196.25
7	1957 Panakkadan	-	0.81	2.62	0.71	0.33	4.48	333.44
9	1958 Panakkadan	0.45	0.79	1.51	0.79	0.53	4.07	305.98
8	1959 Panakkadan	-	1.57	0.33	4.23	1.35	7.48	436.72
9	1960 Panakkadan	1.82	2.33	1.49	1.21	0.50	7.35	330.60
10	1961 Panakkadan	-	5.14	4.18	4.36	5.00	18.68	555.11
11	1962 Panakkadan	3.26	3.51	4.47	3.37	2.88	17.49	667.39
12	1963 Panakkadan	1.74	6.02	3.34	1.90	4.07	17.06	604.20
13	1964 Panakkadan	2.71	5.93	5.91	1.17	0.60	16.32	744.14
14	1965 Panakkadan	-	-	6.90	7.74	0.58	15.21	508.04
15	1966 Panakkadan	3.44	4.70	2.83	6.27	1.24	18.47	759.54
16	1968 Panakkadan	2.92	2.65	-	-	-	5.57	322.11
17	1976 Panakkadan	-	3.21	3.59	3.49	0.87	11.16	204.29
18	2003 Panakkadan	-	-	9.94	2.04	1.69	13.66	-
19	2004 Panakkadan	4.87	11.92	4.31	6.06	-	27.16	-
20	2005 Panakkadan	-	0.53	0.21	0.97	-	1.71	-
21	2006 Panakkadan	-	0.90	1.97	1.63	0.26	4.74	-
22	2007 Panakkadan	-	1.14	1.00	0.86	-	3.01	-
23	2009 Panakkadan	1.38	0.86	1.31	0.96	-	4.51	-
24	TP Vettilachola	-	1.20	-	-	-	1.20	29.96
25	TP Thathengalam	-	0.45	0.51	0.44	0.08	1.48	55.80
26	TP Thekkinthitta	0.69	0.23	0.12	0.14	-	1.17	130.35
27	TP Kacheriparambu	1.22	0.39	0.14	0.12	0.11	1.98	107.95
Range : Attappadi Range								
1	1951 Pottikkal	-	0.43	-	-	0.22	0.65	43.10
2	1952 Pottikkal	0.32	0.38	0.16		0.28	1.14	92.88
3	1953 Pottikkal	0.52	0.60	-	-	0.58	1.70	127.70
4	1954 Pottikkal	1.73	2.13	-	-	0.35	4.21	438.53
5	1955 Pottikkal	1.73	1.53	2.48	1.20	0.56	7.51	649.10
6	1956 Pottikkal	-	4.39	3.45		0.91	8.75	715.07
7	1957 Pottikkal	0.61	1.17	1.35	0.53	0.54	4.20	336.10
9	1958 Pottikkal	-	1.16	1.32	0.89	0.60	3.98	275.92
8	1959 Pottikkal	1.01	2.47	1.88	2.57	0.70	8.63	683.00
9	1960 Pottikkal	-	6.11	3.82	4.46	4.70	19.08	1183.89
10	1961 Pottikkal	1.33	5.00	3.83	2.03	2.57	14.77	550.81
11	1962 Pottikkal	2.21	5.99	1.79	3.27	1.66	14.92	612.89
12	1963 Pottikkal	2.52	4.00	6.09	0.82	-	13.42	631.42
13	1965 Pottikkal	-	4.69	2.07	7.80	1.48	16.03	550.96
14	1966 Pottikkal	-	2.30	3.76	6.18	3.21	15.44	450.48
15	1966 Pottikkal	0.76	0.88	1.39	1.53	0.79	5.36	194.98
16	1967 Pottikkal	1.04	3.27	3.45	1.65	1.32	10.73	418.35
17	1967 Pottikkal	-	0.87	0.90	-	0.88	2.65	79.18
18	1968 Pottikkal	-	-	3.80	5.17	2.26	11.23	307.20
19	1968 Pottikkal	0.04	0.96	1.04	-	1.69	3.73	92.48
20	1983 Pottikkal	-	2.30	3.76	6.18	0.93	13.17	225.24
Total		**40.35**	**110.18**	**107.96**	**96.33**	**49.77**	**404.55**	**16159.23**
Average Value (in Crores of Rs.)						**49.60**		

The teak plantations of above five years of age were divided into one square chain plots and the height of the dominant tree in each Sq. Chain plot is measured as top height. Site quality maps are prepared based on the above data. The stock percentage and extent according to the site quality are mapped through quality class mapping. 5% enumeration was taken to assess the growing stock of the plantations and derive suitable prescriptions. This was done by cutting baseline and taking strips at every 4th, 8th, 12th, 16th chains and so on. Later, every 5th, 10th, 15th, and 20th square chains were enumerated. Regeneration status was also assessed by taking sample plots for assessing the growth of miscellaneous species in the plantations. Thus, by incorporating the above details, stock maps are prepared. The quality class maps are compiled and attached to this Plan in Vol. II. The quality class maps convey extent under each quality and stock percentage pertaining to each teak stand.

2.2.4. Selection of Area:

The schedule of operation for the plan period is based on the age of plantations. All operations should be completed on time and the preliminary operations should start well in advance. A marginal belt of minimum 20 m width should be left along the banks of the rivers, width of the belt can be altered depending on the locality. The Divisional Forest Officer should closely monitor the field work by frequent field inspections. The importance of locality factors and other silvicultural needs should be considered while selecting the species for replacement. Trained and experienced Forester should do the supervision and execution of the works.

2.2.5. Method of treatment:

Silvicultural System - The silvicultural system proposed for managing the plantations is final felling on rotation, artificial regeneration of pure teak and clear felling the poorly stocked and matured plantations and replanting with teak. Since mono-cropping is adversely affecting the site quality, planting miscellaneous species along with teak has to be encouraged to gradually replace the teak.

The Choice of Species - Genetically superior seeds should be used for planting. Teak (*Tectona grandis*) will be used to regenerate final felled areas, it is easier to establish the plantations using stumps or root trainer seedlings. This indigenous species is sure to establish and grow well in this tract. Its regeneration is easy and cheap. The future prospect of teak is bright as it is certain that teak will retain its pride of place among timbers.

2.2.6. Rotation Age:

The rotation age for teak plantations is prescribed at 60 years as per the Working Plan by Shri. A. Ramankutty (2001 to 2011). The rotation for teak was reduced to 60 years as per Government Order G.O (Rt) 525/93/Forest&Wildlife Department dated 04-12-1993 by the Government of Kerala is appended in **Appendix- XX.** Therefore, it is prescribed to continue 60 years rotation during the current plan period also.

2.2.7. Regulation of yield:

The general site quality ranges between II to IV with the major portions has II/III. The teak plantations are to be harvested on reaching rotation age. Twenty Four plantations are available for final felling during this plan period in Mannarkkad and Attappady Ranges. The expected yield of timber and firewood from the above plantations are available in the statement of anticipated stock from teak plantations as per All India Yield Table. The figure was arrived at by 5% sample -enumeration. The figure must be compared with the actual out turn obtained at the time of the final felling and percentage of difference must be noted in the Division Journal. These figures can be considered while assessing the growing stock of the remaining plantations at the time of revision of the plan. Details of the anticipated stock in Teak Plantations are given in **Appendix - XXI.**

Table- 28 Number of trees/ha to be retained after thinning as per Yield Table (F.R.I)

Thinning	Site Quality of Plantation						
	I	I/II	II	II/III	III	III/IV	IV
5th Year	1250	1250	1250	1250	1250	1400	1750
10th Year	505	580	694	802	956	1107	1367
15th Year	315	372	452	538	643	776	990
20th Year	185	232	281	348	425	544	687
30th year	128	155	192	245	309	390	533
40th year	88	106	128	160	160	274	371

2.2.8. Harvesting:

The plantation should be surveyed and demarcated to consolidate the boundary. The trees and other vegetation, to a width of one chain on either side of the perennial water sources shall be retained while clear felling. It is also proposed that important miscellaneous species like Rosewood, sandal, Ebony and fruit bearing trees are to be retained. The timber and firewood is harvested from the plantations by way of:

1. Harvesting by clear felling the teak at rotation age.
2. Harvesting by clearing the poorly stocked and low quality plantations.
3. Harvesting the teak trees by thinning and collection of wind fallen trees.

2.2.9. Thinning:

Thinning is a Silvicultural operation aiming to reduce root-shoot competition. Since teak being a light demander, thinning will ensure its health vigour and stability. Thinning is defined as a felling made in an immature stand for the purpose of improving the growth and form of the trees that remain without permanently breaking the canopy.

Thinning is the most important work in teak plantation requiring special attention of an experienced and responsible officer of the controlling staff.

There are two systems in thinning i.e crown and ordinary thinning. Ordinary thinning is applied to teak. In ordinary thinning, the method adopted is removal of inferior individuals of a crop starting from suppressed class followed by dominated and lastly some of the dominants. This is applied to regular crops. Trees are classified into crown class as detailed below to facilitate thinning.

It is prescribed to follow the existing thinning cycle of 5th year (Mechanical), 10th year (1st Silvicultural), 15th year (2nd Silvicultural) 20th year (3rd Silvicultural), 30th year (Penultimate) and 40th (Final thinning) during this plan also. During the 1st mechanical thinning, the alternate diagonal rows should be removed, which would give an even spacing of 2.8m × 2.8m, the alternate planting rows should never be removed, which will lead to an irregular spacing of 2m × 4m.

The prescriptions for thinning are guided by general principles. Since the growth and stock in many of the plantations are not satisfactory, the thinning should be carried out with much caution. Mechanical thinning can be carried out only if the area satisfies two conditions viz (a) the area should be fully stocked and (b) the canopy is close enough in the year intended for thinning. If the plantation is not uniformly stocked, mechanical thinning may be taken up in fully stocked areas only. In the balance area, selective removal can be done, if required.

During the Silvicultural thinning, 'C' grade thinning shall be resorted to in the plantations of site quality IV and above. The teak trees to be removed in the order of preference are (1) Dead, dying and diseased (2) Elephant damaged (3) Top broken (4) Suppressed (5) malformed (6) Infested with stem borers and loranthus.

2.2.10. Dominant Trees (D):

All trees, which form the uppermost, leaf canopy and having their leading shoots free, are dominant trees. These may be sub-divided according to the position and relative freedom of their crowns into the following.

Pre-dominant: Comprising of the tallest trees, which determine the general, top level of the canopy and are free from vertical competition.

Co-dominant: Comprising the rest of dominants falling short of an average about 5/6th of the average height.

Suppressed trees: Trees which reach only 1/2 to 5/8 of the height of the best trees with their leading shoots definitely overtopped by their neighbour or at least shaded on all sides by them.

Dead and Moribund: This class includes bent over and badly leaning trees of the whip type.

Diseased trees: Trees, which are infected with parasites to such an extent that their growth is seriously infected or they are a danger to their neighbours (Symbol K is suggestive of canker). They may be dominant or dominated and suppressed.

Reproduction and Regeneration: Over mature (the symbol-V is suggestive of veterans)

2.2.11. Thinning Intensity:

Ordinary thinning has five intensities. A, B, C, D & E. The first two i.e. A & B are very light, hardly affecting the dominants, C-grade is heavy thinning exerting its influence very perceptibly. The D-grade is very heavy. The important feature is that it takes into account some of the dominants and these are removed by providing no lasting gap in the canopy. E-grade thinning is the heaviest thinning that can be done in a crop without making permanent gaps and is chiefly used for research purposes. The classification of thinning (ordinary thinning) is given below.

Light thinning (A-grade): This is limited to the removal of dead, dying, diseased and suppressed trees ie. Classes V, IV & III. This grade is of no practical use, but forms a convenient initial stage, especially in comparative research on to the effect of thinning on increment.

Moderate thinning (B-grade): This consists of advance removal of defective dominant stems and whips, branchy advance growth which it is impracticable or not desirable to prune or lop, may also be taken. This grade is also of little use in ordinary practice having little influence on the increment of the remaining stems.

Heavy thinning (C-grade): This consists of further removal of the remaining dominant stems such as the defective co-dominants that can be removed without making lasting gaps in the canopy. C-grade is the standard grade in vogue for yield table computation.

Very heavy thinning (D-grade): The distinguishing feature of this grade is that it also takes some of the good dominants, subject to the same conditions of not making any lasting break in the canopy. Trees selected for removal are such that the remaining crop consists as far as possible of trees with good boles and crowns, well and evenly distributed over the area with room for further development.

Very heavy thinning (E-grade): This is about the heaviest thinning that can be done in a crop without making permanent gaps in the canopy. More dominant stems are removed in this thinning.

Considering the quality of teak plantations, C grade thinning is prescribed for all teak plantations.

The Range Officer and Divisional Forest Officer shall inspect the plantation proposed for thinning before taking up the work. In few plantations stocking is poor hence, a regular thinning may not be required in such plantations. However, climber cutting, loranthus cutting and such other cultural operations can be taken up along with hygienic felling operations. The number of stems to be removed has to be decided after assessing the average stocking prescribed for that age and quality. It would, therefore be necessary that the Divisional Forest Officer should inspect the plantations during the year prior to that in which the thinning has been prescribed and decide whether any change in the schedule is necessary.

As each thinning is done silviculturally, except the first thinning, the stocking will be reduced to the number of stems required, according to the All India yield Table, for an average between which the thinning is done and that when the next thinning is due. In the final thinning, the stocking will be reduced to the number of stems required at rotation age, plus an extra 20% if required. The best guide to obtain the correct stock at each thinning is the consideration of espacement.

2.2.12. Procedure for thinning:

The aim of silvicultural thinning is to ensure more timber production of good quality. To achieve this objective the operation should be done with great caution. During the operation, only the required number of stems of very good quality should be retained. Heavy openings in the canopy should be avoided. Where there is miscellaneous growth, always preference should be given to teak. In places where there is poor stocking, miscellaneous species of comparatively good economic value should be retained.

The Divisional Forest Officer should measure the height and diameter of 100 dominant trees and compute the average.

While conducting this exercise he should measure the espacement of trees in sample plots also and record at random. The quality class of the plantation should then be recorded with reference to the yield table.

A clear weeding and climber cutting carried out wherever necessary. Valuable naturally grown species such as Rosewood, Ebony, Sandal, fruit bearing trees etc are to be retained. Thinning should be carried out continuously without creating permanent openings in the canopy.

All works connected with thinning should be done departmentally. Thinned materials may be classified as per the existing classification. Trained Forester may be entrusted with the task of classification. The temporary depot if found necessary, may be opened outside the plantation. However, it is advisable to handover the produce to Timber Sales Division, wherever possible.

2.2.13. Demarcation:

It is recommended to survey and demarcate the plantations that are due for final felling, one year in advance. Temporary cairns or survey stones should be erected on the boundaries and cleared to a width of 5 meters.

2.2.14. Marking:

The healthy and promising trees with better girth, top heights, crown and bole form should be retained. Maximum care should be taken to prevent any wide opening in the canopy while marking for thinning. Judicious and exhaustive marking of trees should be ensured by the Divisional Forest Officer. The Form II register will be maintained as per code provisions. Two blazes are to be given, one at breast height (BH) and the other at base with chisel numbering from 2nd Silvicultural thinning onwards. Marking will be done by the Forester. Forester can use field measurement book (Form No: 84 of Forest Code) and the recording in the field book should be transferred to Form-II kept in the Range office, before the marking list is furnished to the Divisional Forest Officer. After completing the marking register, the Forester submits it to the Range officer with three copies of marking list. Range Officer in turn will check measure and send the list to the Divisional Forest Officer. The Range Officer will check at least 25 per cent and the Divisional Forest Officer 10 per cent of the marking and satisfy the exhaustiveness and accuracy of the marking. The Divisional Forest Officer will make arrangement for extraction of timber if he is satisfied with the demarcation and marking.

It is not desirable to go for marking the trees in the field before fixing the number of trees to be removed. It would be easy always to remember the espacement to be given. Marking should be done in such a way that each tree is removed from the next one at the espacement computed either as per age/quality or diameter/quality. The spacing can be checked frequently either by pacing or by measuring the distance between trees, as often as necessary.

The teak trees retained at each thinning should be freed from climbers. One or two climber cutting may be necessary during the intermediary period of final thinning to final felling.

Schedule of operation prescribing thinning and final felling during the plan period is given below.

Table - 29 - Schedule of Final Felling and Thinning

Sl. No	Plantation	Area (ha)	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
Mannarkkad Range													
1	1950 Panakkadan	1.24	F*										
2	1952 Panakkadan	3.11	F*										
3	1953 Panakkadan	3.66		F									
4	1954 Panakkadan	4.29			F								
5	1955 Panakkadan	3.72				F							
6	1956 Panakkadan	3.38					F						
7	1957 Panakkadan	4.48						F					
8	1958 Panakkadan	4.07							F				
9	1959 Panakkadan	9.30								F			
10	1960 Panakkadan	7.35									F		
11	1961 Panakkadan	16.40										F	
12	1962 Panakkadan	17.49											F
13	1963 Panakkadan	17.06	S5*										
14	1964 Panakkadan	16.32	S5*										
15	1965 Panakkadan	15.22	S5*										
16	1966 Panakkadan	19.74	S5*										
17	1968 Panakkadan	5.57	S5*										
18	1976 Panakkadan	11.16	S4*										
19	2003 Panakkadan	13.66		S1					S2				
20	2004 Panakkadan	27.16			S1					S2			
21	2005 Panakkadan	1.70				S1					S2		
22	2006 Panakkadan	4.76					S1					S2	
23	2007 Panakkadan	3.01	M					S1					S2
24	2009 Panakkadan	4.51			M					S1			
25	Thekkinthitta TP	1.17		F									
26	TFSKacheri Parambu	1.09											
27	1952 Pottikkal	1.14	F										
Attappady Range													
1	1953 Pottikkal	1.70		F									
2	1954 Pottikkal	4.21			F								
3	1955 Pottikkal	7.51				F							

Sl. No	Plantation	Area (ha)	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
4	1956 Pottikkal	8.75					F						
5	1957 Pottikkal	4.19						F					
6	1958 Pottikkal	3.98							F				
7	1959 Pottikkal	8.63								F			
8	1960 Pottikkal	19.08									F		
9	1961 Pottikkal	14.77										F	
10	1962 Pottikkal	14.92										F	
11	1963 Pottikkal	13.41	S5*										
12	1965 Pottikkal	16.03	S5*										
13	1966 Pottikkal - Bit I	15.44	S5*										
14	1966 Pottikkal - Bit II	5.35	S5*										
15	1967 Pottikkal- Bit I	10.73	S5*										
16	1967 Pottikkal- Bit II	2.65	S5*										
17	1968 Pottikkal- Bit I	11.24	S5*										
18	1968 Pottikkal- Bit II	3.73	S5*										
19	1983Pottikkal	13.17		S4									

F- Final Felling (60th Year), M-Mechanical Thinning (5 years), S1-1st Silvicultural Thinning (10 years)
S2-IInd Silvicultural Thinning(15 years), S3-IIIrd Silvicultural Thinning(20 Years),S4-Penultimate Thinning(20 Years), S5-Final Thinning(40 Years), *. Arrear Operations

2.2.15. Felling and Logging:

The felling, conversion classification and transportation are carried out either by tenderer or by the department. It is desirable to execute these works departmentally, if not possible, the tender should be invited only after completion of marking.

- Planting being a seasonal work, utmost care should be taken to clear the site well in advance of the monsoons.
- Whether the Contractor/Convenor is in a position to arrange for sufficient labour as per the requirements of the work, before commencement of work is to be considered.
- The area should be well protected from fire and theft by engaging Watchers and fire tracing the boundaries.

Each plantation should be exclusively under the charge of a Forester for effective supervision of felling. Close supervision during the time of logging will enhance the progress of work. The Range Officer should inspect the coupe frequently. He should submit the inspection note to the Divisional Forest Officer stating the progress of work. The Divisional Forest Officer will inspect the work in the field once in a month. He should also prepare an inspection note. The felling is done with saw and as close to the ground as possible. This will reduce the loss due to cutting by axe; cross cutting will be done only with saw. The Forester in charge of felling will mark the points for cross cutting with economic considerations.

Felling and conversion of the trees should be given due importance. The chisel marking at the base is mandatory for the

department extraction for spot inspection and verification. Conversion is aimed at better marketing and optimum volume. The felled logs shall be dragged from site only after the logs are registered in stock register in Form III and after verification by the Divisional Forest Officer, along with corresponding entries in Form II. The Chief Conservator of Forests will decide the dumping site, if required in case of any practical difficulties are met with for transporting to regular sales depots.

Table - 30 - Classification of Teak Poles

Class	Girth at 3m from butt end (cm)	Length	Quality
1 A	65 to 76	Above 12 m	Fairly straight and sound
B	--do	9 m to 12 m	-- do--
C	-- do --	Up to 9 m	--do--
D	--do--	Any length	Defective as crooked
II A	53 to 64	Above 12m	Fairly straight and sound
B	53 to 64	9 to 12 m	Fairly straight and sound
C	53 to 64	Up to 9m	Fairly straight and sound
D	53 to 64	Any Length	Fairly straight and sound
III	41 to 52	Any Length	Fairly straight and sound
IV	26 to 40	Any Length	Fairly straight and sound
V	25 Cm and below	Any Length	Fairly straight and sound

Poles below 25 cm girth, which are not fairly good are classified as Kappukals.

Firewood: All Pieces below in length but not fit for billets. The billets that aredefective can be used as firewood.

Teak: All pieces below 1m but not fit for billets

Rosewood: All pieces below 1 m length but not fit for billets

Table - 31 - Classification of Teak Timber

Classification of Timber		
A. Teak		
1	Short length logs	Above 1 m to below 2.5 m in length
2	Lengthy Logs	2.5 m to below 7.3 m in length (inclusive both ends)
3	Long lengthy logs	Above 7.3 m in length
B. Rosewood		
1	Short length logs	1 m to below 2.5 m in length
2	Lengthy Logs	2.5 m and above in length (inclusive both ends)
C. Jungle Wood		
1	Lengthy Logs	Above 1 m in length
Girth Classification		
A.Teak		
1	Export	Of and above 185 cm middle girth
2	I Class	Of and above 150 cm up to 184 cm middle girth
3	II Class	Of and above100 cm up to 149 cm middle girth
4	III Class	Of and above 76cm up to 99 cm middle girth
5	IV Class	Of and above 60 cm up to 75 cm middle girth
6	Teakwood below Specification	Below 60 cm middle girth
B.Rosewood		
1	Export	Of and above 185 cm middle girth

2	I Class	Of and above 185 cm middle girth
3	II Class	Of and above125 cm up to 184 cm middle girth
4	III Class	Of and above 75cm up to 124 cm middle girth
5	IV Class	Of and above60 cm up to 74 cm middle girth
6	Rosewood below specification	Below 60 cm middle girth
C. Junglewood		
1	I Class	Of and above 125 cm middle girth
2	II Class	Logs up to 124 cm girth in middle
Quality Class for Timber Logs		
A. Teak and Rose Wood		
1	A Class	Logs straight and sound without any defects
2	B Class	Fairly straight and sound logs
3	C Class	Defective and crooked logs
B. Jungle Wood		
1	A Class	Straight and sound logs
2	B Class	Defective logs

Poles below 25 cm girth, which are not fairly good, classified as Kappukals.

Firewood: The billets that are defective can be used as firewood.

Teak: All pieces below 1m length but not fit for billets

Rosewood: All pieces below 1m length but not fit for billets

2.2.16. Classification of timber for jungle wood:

A separate classification is followed in the case of timbers other than teak and softwood.

(i) Girth classification of timber:

1st class: of and above 125 cm mid girth

IInd Class: Logs upto 124cm midgirth.

(ii) Length classification or grading of timber:

Lengthy Logs: Above 1m in length

(iii) Quality Class for timber logs:

A Class: Straight and sound logs

B Class: Defective logs.

(iv) Billets:

I. Billets export size
II. Billets 1A, 1B, 1C
III. Billets IIA, IIB, IIC
IV. Billets IIIA, IIIB, IIIC
V. Billets IVA, IVB, IVC

(v) Firewood:

All pieces below 1m length but not fit for billets

2.2.17. Disposal and Marketing of the Produce:

The produce obtained from thinning and final felling are to be disposed as per the existing government norms. The teak timber and timber from other depot delivery species obtained during final felling are presently transported to depots of Timber Sales Division in Palakkad. The poles, billets, jungle wood, firewood and other miscellaneous timber obtained are sold in dumping depots.

2.2.18. Site Specific Operations:

A site specific plan (SSP) for a period of 5 years should be prepared and got approved by the Chief Conservator of Forests before the start of the operations.

2.2.19. Site Quality:

Areas yielding timber less than 50 m^3/ha on final felling may be classified as poor sites.

2.2.20. Soil Management:

Soil analysis is to be done before hand and based on the results, treatments to be prescribed. A fertilization schedule is to be developed keeping in mind the nutrient deficiencies. Gully Plugging with stones and if need arises with vegetative hedges before planting. Taking platforms (60cm×60cm×30cm at cutting end on inward slope) for moisture conservation around the seedlings, maintenance of the platforms during second and third years. Proper soil working to be done for the seedlings during first year, soil working to the backward plants (if any) during the second and third years.

2.2.21. Weed Management:

Table - 32 - Prescriptions for weeding in teak plantations:

1st year	Spade weeding May-June for stump planting, July –August for root trainer and three knife weedings (Aug-Sept, Oct-Nov & January)
2nd year	4 Knife Weeding (May-June, Aug, Oct & Dec)
3rd year	3 Knife Weeding (May-June, Aug-Sept & Nov)
4th year	One knife weeding and climber cutting during Aug-Sept
5th Year	One knife weeding and climber cutting during Aug-Sept (Required only if the mechanical thinning is not taken up)

2.2.22. Timely Operations:

SSP to prescribe the schedule and timing of operations. The area is to be left fallow for the year if delay occurs in completion of the extraction works, the pre-planting and planting activities to be done in the next year. Stump planting in April-May is suggested. Casualty replacement with root trainer seedlings during June to August. Planting by root trainer seedlings also can be taken up during June-July, Causality replacement during Aug-Sept on rainy days. Adequate labour force to camp within the plantation and carry out the operations on a round the year basis.

2.2.23. Spacing:

2m×2m spacing is suggested. Fungicide treatment and rooting hormone to stumps required before planting.

2.2.24. Formation of Nursery:

Nursery for stumps: Standard beds of 12m×1.2m×0.3m may be formed either close to the planting site or at easily accessible site. The site may be cleared of leaves and other slashes. As teak is a light demander, care should be taken to select appropriate site for nursery. Soil should be dug to a depth of 30cm, the stones and roots removed allowed to weather. Ash and sand is to be added if the soil is clayey to avoid water logging. The beds are to be formed by the end of March or early April. Sides of the beds may be made firm. Bamboo thatties are preferable. Half a meter space may be left in between beds for proper drainage and allowing free passage for inspection and for carrying out weeding whenever necessary. Five beds per hectare are required to produce good quality stumps for original planting as well as casuality replacement. Seed rate is four kg per bed. Seeds filled in gunny bags and immersed in water for two days before sowing will give better and faster germination. The seeds are spread evenly on the surface of the bed during pre-monsoon showers. About 1 cm thick soil is spread over the bed with a covering of straw or *Emblica* or *Albizzia* leaves over it. The nursery should be properly weeded and kept clean. The seedlings are to be thinned when over crowding is noticed. Stumps are prepared just before planting, for which ten to eleven months old seedlings are used. Optimum sized seedlings may be carefully uprooted by hand. Length of the stump should be 20cm. Seedlings that are too small or too large should not be utilized for preparing stumps. The knives used for the purpose should be sharp and the cuts at both ends should be slanting. Bark should not be damaged while removing the lateral roots.

Root Trainer Nursery: Root trainer seedlings are presently produced at the central nursery at Nilambur, Nilambur North Division. Teak seeds are collected from the recognised seed stands of the department. Seeds are then graded according to the

physical characteristics. After grading, seeds are pre-treated by alternate soaking and drying for 3 days. Seeds are soaked in water at night and dried in the sun on subsequent day. Pre-treated seeds are put on standard nursery beds for pre-germination. Based on germination, culling is done in such a way that the very early and late germinated ones are discarded. The germination takes about 15 days in seedbeds. The germinating seeds with 4 small leaves are put in Root trainer containers. Potting media used is comprised of forest soil, sand, compost, burnt rice husk in the proportion of 70, 15, 10 and 5 per cent respectively. Seedlings are kept in shade house for 15 days and transferred for hardening, where they are kept for 40 days. After proper culling at this stage, seedlings of about 20cm height are transported to field for out planting. March is ideal for starting of the nursery activities so that the seedlings will be ready for planting by June. The root trainer containers currently in use are of size 150 cc.

2.2.25. Planting Activities:

The preliminary operations such as clearing and cleaning the site should be completed well before April. Aligning and staking at an espacement of 2m × 2m for planting stumps and 2.5m × 2.5m for root trainer seedlings can be done during April. After completing the aligning and staking, pitting can be commenced for planting of root trainer seedlings. The pits may be of $45cm^3$ size. The pitting should be completed well before June. This will ensure the withering of soil.

2.2.26. Preparation of Stumps:

One year old seedlings having 1-2 cm diameter at collar region is ideally suited. The bed may be watered for easy uprooting of the seedlings. Promising seedlings of medium growth, good in vigour and free from diseases are only to be uprooted. The shoot portion is cut at 2 cm above collar and the root portion at 20 cm below the collar. All lateral roots should be trimmed off.

2.4.27. Planting of Stumps:

Stump planting is best after pre-monsoon showers. The stumps so prepared are planted in crow-bar holes. The planting is done in straight line in accordance with alignment. The stumps are inserted in the hole leaving the portion above the collar on surface of earth and hole is packed tight with soil without leaving any air cavity near the root to avoid decay. The stakes may be kept near the plant point in a slanting position. This will help in identifying the plants as well as planted area.

Stumps are planted during pre-monsoon showers immediately after a few showers to facilitate to make crow-bar holes. Stumps should be prepared one or two days before

planting. Planting stumps in crow bar holes and consolidate the soil around the stump by crowbar so that the stump is firmly fixed leaving the tip of the stump flush with the ground level. Care should be taken to avoid water logging around the stumps. When stumps are planted for causality replacement during rains, the tip of the stumps should be kept slightly projected. Planting should be constantly supervised by experienced field staff and checked by Range Officer and Divisional Forest Officer regularly.

Care should be taken till the stumps are established. Stumps will sprout in 2 to 4 weeks, if planted during pre-monsoon showers and suppression of weeds and grass should be avoided in initial stages by clearing weeds around the seedlings.

Casualties should be replaced till the end of August to get full stocking. Here basketted seedlings or root trainer seedlings may be used to get uniformity in growth with the earlier planted stumps and assured establishment. Casualty replacement may be resorted to the 2nd year with basketted seedlings or root trainer seedlings in case there are large blanks. Fertilizers shall be applied depending on the site conditions, based on soil analysis, especially in 2nd rotation crops in two split doses in the 1st year, thereafter once in a year up to 5th year. Organic manure can be applied in pits.

2.2.27. Comparision of Root trainer seedlings and stumps:

The comparative study conducted in 2004 in Teak Plantation raised in Thiruvizhamkunnu with respect to the growth of teak seedlings raised in the root trainer and stump planted showed marked difference in girth and height of plants. The GBH of Root trainer seedlings showed 28.43% more growth when compared to stump planted seedlings (32.97 cm growth in root trainer seedlings and 25.67 cm growth in stump planted seedlings).

The root trainer seedlings perform better with respect to height growth also in comparison to the stumps. The root trainer seedlings showed 24.36% more growth in height when compared to stumps. Hence, it is more advisable to plant root trainer seedlings rather than stumps. Stumps are easy to handle, plant in crow-bar hole, higher survival rate than root trainer seedlings. But the root trainers have better root growth, which provide initial boost for establishing easily; they are bulky in nature and hence difficult to transport in hilly terrain and also to handle while planting. Root trainer seedlings normally produced homogenous planting stock in about 45 days. It was observed that root trainer plants were healthier with better collar girth than the stumps. Root trainer technology gives better growth and high percentage of survival. Large number of seedlings can be raised in less area.

Hence, it is prescribed to use any of the two methods depending upon the site factors.

2.2.28. Maintenance of Plantations:

1. Frequency and number of weeding may be decided by the Divisional Forest Officer after field inspection.
2. Scrapping or removing weeds around the plants once or twice to avoid suppression.
3. Fertilizer application in split doses based on the result of soil testing.
4. Fire protection and protection from grazing
5. Causality replacement.

2.2.28. Second Year:

1. Weeding, the number and frequency may be decided by the Divisional Forest Officer after field inspection.
2. Scrapping or removing weeds around the plants once.
3. Fertilizer application in split doses
4. Fire protection and protection from grazing
5. Casualty replacement with basketted or root trainer seedlings.

2.2.29. Third Year:

1. Weeding as per local conditions
2. Fertilizer may be applied judiciously to backward plants
3. Fire protection and protection from grazing.

2.2.30. Fourth Year:

1. Weeding, as decided by the Divisional Forest Officer after field inspection.
2. Fertilizer may be applied judiciously based on the need.
3. Fire protection and protection from grazing

2.2.31. Fifth Year:

1. Weeding, the number and frequency may be decided by the Divisional Forest Officer after field inspection.
2. Fertilizer may be applied judiciously after testing the soil.
3. Fire protection and protection from soil

Timely annual maintenance during the initial stages is vital for success of the plantation. Department maintenance of younger plantations should be done timely and regularly. According to the site conditions and growth rate, the maintenance may be extended up to 5 years instead of 3 years, as practiced now. A minimum of 3 weedings besides the one done before aligning and staking during first year, 3 weedings each during the 2nd and 3rd

year subject to alterations by the Divisional Forest Officer are recommended. Similarly, the fourth and fifth year maintenances shall be carried out based on the necessity.

Table - 33 - Schedule of Regeneration in Mannarkkad Division

Sl.No	Year	Plantation	Extent(ha)
Mannarkkad Range			
1	2013	1950, Panakkadan	1.2435
2	2013	1952, Panakkadan	3.1106
3	2013	1953, Panakkadan	3.6613
4	2014	1954, Panakkadan	4.2934
5	2015	1955, Panakkadan	3.7169
6	2016	1956, Panakkadan	3.3838
7	2017	1957, Panakkadan	4.4757
8	2018	1958, Panakkadan	4.0691
9	2019	1959, Panakkadan	9.3019
10	2020	1960, Panakkadan	7.3462
11	2021	1961, Panakkadan	16.4016
12	2022	1962, Panakkadan	17.4925
Attappady Range			
1	2013	1952, Pottikkal	1.1391
2	2013	1953, Pottikkal	1.7018
3	2014	1954, Pottikkal	4.2108
4	2015	1955, Pottikkal	7.5095
5	2016	1956, Pottikkal	8.7504
6	2017	1957, Pottikkal	4.1988
7	2018	1958, Pottikkal	3.9781
8	2019	1959, Pottikkal	8.6289
9	2020	1960, Pottikkal	19.0847
10	2021	1961, Pottikkal	14.7662
11	2021	1962, Pottikkal	14.9174

2.2.32. Quality of operations recommended:

One Forester and two Forest Guards should be assigned the supervision duties for each plantation. It would be better if the staff also camps within the plantation at least on rotation basis. A group of labourers must camp with in the area in sheds and carry out various activities during the first 4 or 5 years. This would provide the required protection to the plantations from wildlife, fire and others besides ensuring timely execution of operations.

Normally, additional labour force will be required only during the slash felling –first burning –heaping and re-burning operations, spade weeding, making of platforms and the soil working during the 1st year, maintenance of platforms during the 2nd and 3rd years. The additional labour force for these operations shall be arranged in time.

2.2.33. Pests and Diseases:

The main pest in younger teak plantation is stem borer. To alleviate the problem, effective weeding during the initial 4 or 5 years and mild burning of the area in 4th and 5th year is

suggested. The staff and labourer camping in the plantation are to be trained to diagnose and effectively check the spread of stem borer infestation.

2.2.34. Biotic interference:

- Ø Mazdoors should camp inside the plantation erecting sheds at strategic positions for preventing elephant damage.
- Ø Use of country made crackers to deter the elephants.
- Ø Small kerosene lamps may be put around the plantations; the light may deter the elephant from entering the plantations.
- Ø Cattle grazing to be prevented during the first 2 or 3 years.

2.2.34. Soil and Moisture Conservation:

Soil and water conservation measures such as gully plugging, contour bunding, contour trenching, and mulch crops etc are to be implemented in this working circle also as prescribed under the protection and improvement working circle. In order to increase the productivity of the soil, site and plantations some steps are essential to achieve this goal. In sites, where the land is sloppy, the slash can be collected and heaped along the contours so that they will act as contour bunds, regulating and easing the runoff and preventing soil wash. Soil and water harvesting measures like gully plugging, erection of checkdams, contour bunds, terracing etc which reduce the surface run-off and reduce soil loss are to be attempted before the onset of monsoon. Once the soil is built up, its moisture absorption and retention capacity increases. This will help in the accumulation of humus and nutrients and increase the biomass ultimately increase the productivity.

2.2.35. Teak Plantations with abundant Natural Growth:

Natural growth should be retained along the banks of rivers and tributaries to a width of 20 m on either side. This area should be excluded from subsequent planting, the existing miscellaneous growth and natural regeneration should be protected, which can develop into natural riverine vegetation offering immense ecological benefits. The miscellaneous growth and natural regeneration existing in rocky areas and patches with low soil depth should be retained and protected. Marshy patches with miscellaneous growth occurring in some teak plantations at Pottikkal area in Attappady Range should be protected by harvesting teak alone. The plantations with more than 50% of miscellaneous growth are recommended for harvesting teak alone and the area should be planted with locally available predominant species thus reverting the area into natural Forests. The names of

these plantations are to be removed from the list of plantations in the next revision.

It is proposed to carry out planting either by stumps or root- trainer, whichever is suitable and convenient for the site can be followed. If it is stump planting, it is suggested to start in April - May months and in case of root trainer, it can be undertaken during June-July months.

The plantations where soil and moisture conservation works are essential are identified in the field and noted against each plantation as prescriptions in the **Appendix- XXII.**

2.2.36. Controls:

Control on Working Plan prescriptions has to be effected by maintaining records on prescriptions and results on actual execution of the works. The plantation and Nursery journals are to be maintained properly. The details regarding the thinning and other cultural operations are to be essentially recorded in the pages set apart for the purpose in the concerned plantation journal. The details about marking, actual yield obtained, working cost, price fetched should be clearly recorded. If any deviation from Working Plan prescriptions has occurred the circumstances for such deviation are also to be recorded. Plantation journals are to be maintained and all relevant details regarding growth data, maintenance works carried out, weather conditions, fire incidences, yield etc are to be recorded.

2.3. Cashew Plantations (152.7115 ha):

2.3.1. General:

Cashew (*Anacardium occidentale*) belongs to the family *Anacardiaceae*, an indigenous species of the Caribbean Region. It is grown as an exotic in India and other parts of the world outside its natural habitat under tropical conditions. It is extensively cultivated in South India. The Portuguese introduced this species in the northern part of Kerala. It was initially cultivated to check the soil erosion as a wasteland crop. Cashew timber is used for packing cases and pulpwood. It is grown on sandy, laterite soil of warm tropical climate conditions up to 600-700 metres above MSL. The productivity of cashew plantations is very low due to poor planting stock, mortality of trees and inadequate maintenance operations. Further, cultivation of cashew is not in conformity with the National Forest Policy and hence it is proposed to gradually reduce the area under cashew in the Division.

Mannarkkad Division has 263.31 ha of cashew plantation planted between 1956 and 1957. Only Mannarkkad Range has

cashew plantation, mainly due to the presence of laterite soil in the area. Plantations raised during the years 1956, 1957 and 1958 comprising of 93.19 ha were poorly stocked, and hence recommended for planting miscellaneous species in the previous plan itself. Similarly, the cashew plantation at Mulakuvellam, 13.069 ha were under stocked and prescribed for planting suitable species. The plantations which are still yielding are taken under this plan for further maintenance and collection of yield. The management of cashew plantations is usually not satisfactory. Cashew cannot be left unattended as in case of other forestry species. Regular tending, manuring, canopy regulation and pest control are required for better yield. Hence, it is prescribed that the maintenance work be carried out regularly as prescribed in the package of practices. List of cashew plantations in the Division is given below:

Table - 34 - Cashew Plantations in Mannarkkad Division

Sl. No	Plantation	Area (ha)
1	1956 Cashew, Mulakuvellam	45.0255
2	1957 Cashew, Mulakuvellam	12.9267
3	1958 Cashew, Kanjiramkunnu	16.1747
4	1974 Cashew, Bunglakunnu /Thiruvizhamkunnu	1.3749
5	1976 Cashew, Thiruvizhamkunnu (Panakkadan)	2.2056
6	1981 and 1986 Cahsew, Thathengalam	39.3502
7	1995 Cashew, Kanjiramkunnu	11.9984
8	1996 Cashew, Kanjiramkunnu	23.6555
	Total	**152.7115**

The main reason for poor yield is due to poor quality planting stock and tea mosquito bug (*Helopeltis antonii).* It attacks the buds and flowers interfering with fruit setting.

2.3.2. Constitution:

The plantation working circle includes all the cashew plantations in the Division. No proposals are made for raising additional cashew plantations in this plan period. The existing *Acacia* and *Eucalyptus* Plantations of this Division comprises the pulpwood component of this Working Circle.

2.3.3. Analysis and Valuation of the Crop:

Random Sample enumeration was carried out in each plantation by taking small plots from representative areas and found that the present stocking is below 50%.

2.3.4. Method of Treatment:

Silvicultural System: Extraction of mature plantations on reaching the rotation age of 40 years followed by replanting the felled areas with appropriate species after site species matching. In plantations where stock of cashew is less than 70% and gaps

are existing, pulpwood Species like *Acacia auriculiformis, Acacia mangium, Eucalyptus* etc shall be inter-planted.

Choice of Species: Cashew shall be replaced with appropriate species that are suitable for the site such as *Casuarina equisetifolia, Acacia auriculiformis, Acacia mangium* etc.

Rotation: Rotation is fixed at 40 years. In general, there is a decline in yield of cashew.

Harvesting: The right of collection of usufructs from each cashew plantation is at present sold in public auction by the Divisional Forest Officer based on prior approval of the Chief Conservator of Forests. The practice may be continued during the plan period also.

Tending Operations: Tending operations will be carried out every 4th year. Annual weeding may be done in plantations if found profitable before auctioning the annual yield, so that better price will be fetched for the crop.

Soil and Water Conservation: In plantations with sloppy terrain, the soil and water conservation measures like terracing or trenching along the contour may be taken.

Fire protection: Fire protection, provision of watcher, maintenance of plantation and control journals are to be maintained as prescribed under teak plantations.

The plantations raised in 1956, 1957, 1958 at Kanjiramkunnu and Mulakuvellam are more than 40 years old, most of the trees are dead and branches started pruning naturally due to the attack of trunk borer. Some of the areas under these plantations were already augmented with miscellaneous species and grafted cashew seedlings during 1995-96 and 1999. Major portion of the areas under these plantations were already converted into Misc. Plantation.

2.3.5. Prescriptions for Cashew:

The yield from cashew plantation is very poor in terms of usufructs. Hence, it is prescribed that the lease right of collection of usufructs from each cashew plantation, shall continue as sold in public auction by the Divisional Forest Officer based on prior approval of the Chief Conservator of Forests. The practice may be continued till the yield is ceased. Cashew being a horticultural crop requires constant maintenance. Basic minimum requirements of weeding and tending will be done for increasing the productivity.

The condition of the existing cashew plantations is not promising. The yield is very low when compared to the yield of private holdings and firms like Plantation Corporation of Kerala, owing to genetically inferior planting stock and poor maintenance

and after care. All the cashew plantations have profuse growth of miscellaneous species and hence these shall be gradually reverted back to form natural forest. The gaps shall be augmented with miscellaneous species. As the existing plantations are not promising and the present stocking is poor, it is prescribed that the existing plantations be phased out in course of time. Hence, it is prescribed to harvest till the revenue decreases and the plantations may be left open to the local people to collect it as NTFP.

2.4. Pulpwood Plantations (308.4511 ha):

2.4.1. General:

Acacia auriculiformis and Eucalyptus are the main species under in pulpwood plantations. Social Forestry Wing raised most of these plantations in barren vested forest bits. Eucalyptus shall be felled as per prevailing coppice system for 3 rotations and thereafter replanted with genetically superior improved planting stock of the same species. Acacia shall be regenerated with high yielding varieties raised as root trainer seedling.

2.4.2. Constitution of the area:

The existing Acacia and eucalyptus plantation of this division comprise the pulpwood component of this working circle. Soil conservation works shall be done wherever necessary along with replanting. List of Acacia and Eucalyptus plantations as follows:

Table - 35 - List of Acacia and Eucalyptus Plantations

Sl. No	Year	Species	Locality	Area (ha)	Expected Volume of Timber (MT)
1. Mannarkkad Range					
1	1983	Acacia (Sf)	Thathengalam	6.3863	159.66
2	1983	Acacia (Sf)	Thathengalam	4.1791	104.48
Total				**10.5654**	**264.14**
2. Agali Range					
1	1998	Acacia	Kallamala	15.7282	393.205
2	1998	Acacia	Onthumala bit I	18.7916	469.79
3	1998	Acacia	Sholayur	5.2927	132.3175
4	1998	Acacia	Odappotty	4.8794	121.985
5	1999	Acacia	Kurathikallu	10.0122	250.305
6	2002	Acacia	Kalkkandi	0.4415	11.0375
7	2002	Acacia	Manjachola	18.6755	466.8875
8	2003	Acacia	Kollenkadavu	15.8782	396.955
9	2003	Acacia	Kallamala east	5.2007	130.0175
10	2003	Acacia	Poravalavu	20.4444	511.11
11	2004	Acacia	Cholakkad	9.2811	232.0275
12	2004	Acacia	Chinnaparambu bitI	4.6906	117.265
13	2004	Acacia	Chinnaparambu bitII	1.9868	49.67
14	2005	Acacia	Manthampotti	5.4845	137.1125
15	2005	Acacia	Onthumala bit II	4.5352	113.38
16	2005	Acacia	Thoova	10.7076	267.69
17	2007	Acacia	Kakkupady	1.9396	48.49
Total				**153.9698**	**3849.245**

Sl. No	Year	Species	Locality	Area (ha)	Expected Volume of Timber (MT)
1	2004	Eucalyptus	Thachamala	22.7449	363.92
2	2005	Eucalyptus	Thoova	11.6176	185.76
3	2005	Eucalyptus	Thoova	54.0652	865.04
Total				**88.4277**	**1414.84**
3. Attappady Range					
1	1997	Eucalyptus	Chalayur	55.4882	887.81
Total				**55.4882**	**887.81**
Grant Total				**308.4511**	**6416.035**

2.4.3. Analysis and Valuation of Crop:

The pulpwood plantations existing in this division are not fully stocked especially the eucalyptus plantations. This is due to mismanagement and biotic interference like firewood collection, fire and grazing.

2.4.4. Method of Treatment:

Raising pulpwood plantations with artificial regeneration and management with modern scientific principles are proposed.

2.4.5. Choice of species:

Suitable site matching species shall be selected especially for replanting the existing eucalyptus plantations

Table - 36 - Schedule of Felling of Pulpwood Plantations

Sl. No.	Plantation	Area (ha)	Year Proposed
1	2002, Acacia, Kalkandy	0.4415	2012-13
2	2002, Acacia, Manjachola	18.6755	2012-13
3	2003, Acacia, Kollankadavu	15.8782	2012-13
4	2003, Acacia, Paravalavu	20.4444	2012-13
5	2003, Acacia, Kallamala	5.2007	2012-13
6	2004, Acacia, Cholakkad	9.2811	2013-14
7	2004, Acacia, Chinna parambu Bit-I Bit-II	4.6906 1.9868	2013-14 2013-14
8	2005, Acacia, Manthanpotty	5.4845	2013-14
9	2007, Acacia, Kakkuppady	1.9396	2015-16
10	1998, Acacia, Sholayur	5.2927	2011-12
11	2003, Acacia, Thoova	10.7076	2011-12
14	2004, Eucalyptus, Thachamala	22.7449	2011-12
15	2005, Eucalyptus, Thoova	11.6176	2014-15
16	2005, Eucalyptus, Thoova	54.0652	2014-15
Total		**188.4509**	

2.4.6. Demarcation: The plantations due for clear felling are to be surveyed and demarcated in advance. The yields of the plantations are to be assessed one year prior to allotment for extraction.

2.4.7. Nursery stock: Root trainer seedlings of high yield varieties are to be obtained from Central Nursery at Nilambur.

2.4.8. Planting Programmes: The seedlings shall be planted at 2m × 2m spacing in 30 to 45cm^3 pits depending on the site conditions.

2.4.9. First year operations:

1. Three to four weeding
2. Casualty replacement
3. Soil working
4. Fire protection
5. Engaging mazdoors for protection

2.4.10. Subsequent maintenance works:

The plantation should be maintained at least for four years and necessary cultural operations are to be carried out including manuring.

2.4.11. Prescriptions:

The existing pulpwood plantations and newly raised plantations are to be extracted as they attain rotation age of six years for Acacia and eight years for Eucalyptus. Failed plantations with good stock of miscellaneous species are to be reverted back to form natural Forests. Clear felling with artificial regeneration with miscellaneous species is prescribed in the pulpwood plantations of this division, on attaining rotation age. First felling is proposed in the first year of the working plan itself. Gaps found after felling are to be augmented with same species till third rotation and replace with indigenous species suitable to the site.

2.5. Miscellaneous Plantations (222.299 ha):

A large number of miscellaneous plantations were raised in Mannarkkad Division. Miscellaneous plantations include medicinal, cane, rosewood, bamboo plantations, HMS Plots and Research Plots. The details of miscellaneous plantations are given below.

Table - 37 - List of Miscellaneous Plantations in Mannarkkad

Sl. No.	Location	Extent	Stock position (%)
1	2001, Panakkadan	1.7083	< 40
2	1998, Medicinal Plantation Anamooli	3.7056	40 to 60
3	2006 Medicinal Vettilachola	2.9241	< 40
4	1996, Cane Plantation, manthanpotty	12.3973	40 to 60
5	Bamboo Plantations Thoducap	22.5979	40 to 60
6	1987 Agave, Pudur	9.6373	40 to 60
7	1987 Cassia, Kunnanchala	5.3004	< 40
8	1992, Sambacode	23.9793	< 40

Sl. No.	Location	Extent	Stock position (%)
9	1998, Mixed Methottam Bit-I & II	21.4289	<40
10	1998, Cassia, Kulukkur	5.7408	40 to 60
11	1995 Keeripathi bit I & II	20.4514	< 40
12	2004 MPCA Sambarcode	7.1611	< 40
13	1995 Watershed & 1998 Mixed Kulukkur	85.2666	< 40
Total		**222.299**	

2.5.1. Prescriptions:

All treatment areas and miscellaneous plantations of the division as per the above list are recommended to be retained as such and protected against fire so that the areas will revert to their original status as natural Forests, supported by the natural regeneration of native species. If the areas can be fire protected and kept free from grazing and illicit firewood collection, residual growth from the initial planting and natural regeneration will give adequate soil cover and establish itself over a period of time. Hence, all these areas under miscellaneous plantations as well as areas treated by social forestry wing are recommended for reversion to natural Forests by deleting them from the list of plantations.

2.6. Medicinal Plantation:

Two medicinal plantations have been raised in Mannarkkad Division. They are:

2006 Medicinal Plantation, Kundanatty (Vettilachola) - 2.9241 ha

1998 Medicinal Plantation, Anamooly - 3.7056 ha

The 2006 Medicinal plantation at Kundanatty (Vettilachola) with an extent of 2.9214 ha was raised under the Centrally Sponsored Scheme (MFP) in Vettilachola Malavaram. Basketted seedlings of medicinal trees and herbs were procured from the medicinal garden owned by Kottakkal Arya vaidya sala, planted in the gaps of natural Forests. The species planted were *Grewia tiliaefolia, Ocimum tenvifolium, Vitex negundo, Bixa ovellana, Calamus spp, Hopea parviflora, Adhathoda vasica, Pongamia pinnata, Holarrhena pubescens, Ficus racemosa, Bridelia crenulata, Wrightia tinctoria, Piper nigrum, Saraca asoka, Piper longum, Aegle marmelos, Gmelina arborea, Phyllanthus emblica, Albizzia odorattissima, Nerium Sp.* etc.

The stock was 40 % during the preparation of current working plan but the area is covered with undergrowth and nothing remains, hence it is prescribed to treat it as natural Forests.

The medicinal plantation at Anamooly raised in 3.7056 ha area have attained the desired results. The species planted were *Aegle marmelos* (Koovalam), *Caesalpinia sappans* (Pathimugam)

Saraca asoka (Asokam), *Punica granatum* (Mathalam), *Phyllanthus emblica* (Nelli), *Pongamia Pinnata* (Ungu), *Acacia catcheu* (Karivelam) etc. Most of the above species have established. *Caesalpinia sappans* have grown matured and started decaying, hence extraction has to be done immediately. *Aegle marmelos*, *Phyllanthus emblica, Acacia catechu* has grown into trees. The area lacks maintenance.

2.6.1. Prescriptions:

It is prescribed to maintain a medicinal garden with name boards depicting the scientific names and its uses, to help the student community. Since the area lie adjoining to the main road of Mannarkkad-Anakkatty Road, the plantation should be converted into a model medicinal garden to attract the scientific aspirants. The plantation boundaries are not properly demarcated in many cases. This will create difficult situations when the plantations are subjected to various operations and treatments. Teak plantations subjected to final felling have to be clearly demarcated from the adjacent ones, for which demarcation of boundaries has to be done in all such cases.

2.7. Heterogenous Mixed Seeding Plots (262 ha):

The heterogenous mixed seeding plots (HMS) in Mannarkkad Forest Division was established during the period from 1990 to 1993 over an area of 262 ha.These areas have developed into a good vegetal cover and became natural forests. These plots were raised mainly in degraded areas for eco-restoration purposes. The area has improved and developed into natural Forests. These plots shall be deleted from the list of plantations and the area treated as natural Forests.

2.7.1. Prescriptions:

The degraded areas of natural Forests were treated by way of profuse mixed seeding under the Western Ghat Development Programme during 1990-93 to develop the degraded, poorly stocked and less valuable Forests. Since, natural regeneration of local species have grown in abundance than the ones that were planted, protection from fire and grazing be given to encourage the growth of the natural regeneration and no other maintenance is proposed.

2.8. Research Plots:

Research Wing of the Department had taken plots at five locations under Mannarkkad Division for research purposes. Most of the plots were raised during 1993, 94 and 1998; Evergreen observation plot at Muthikulam (25 ha) is to be demarcated properly and date collected should be made use of.

Similarly, the Dry Zone afforestation plot of (25 ha) at Boothivazhi raised during 1993-94 under the scheme Dry Zone afforestation trial with the following species such as *Acacia nilotica*, *Tamarindus indica*, S*yzygium cumini*, *Azadirachta indica*, Subabul etc. The site identified is fully covered with weed growth of lantana and thorny species;

The other three plots viz.1993-94 HMS plot, Kandakkamala (25 ha), 1998 Jatropha plot, Boothivazhi (5 ha) and 1993-94, 1994-95 watershed management plot (50 ha) had already transformed to natural forest. It is prescribed that all the five plots given below may be reverted back to natural Forests and shall be deleted from the list of plantations.

1. Evergreen Observation Plot, Muthikulam (25 ha)
2. 1993-94 Dry Zone afforestation plot, Boothivazhi (25 ha)
3. 1993-94 HMS plot, Kandakkamala (27.5 ha)
4. 1998 Jatropha plot, Boothivazhi (5 ha)
5. 1993-94 and 1994-95 Watershed management plot (50 ha)

2.8.1. Prescription:

Among the five research plots mentioned in the previous plan, only two plots namely 1993 Dry Zone Afforestation Plot at Boothivazhy (25ha) and 1998 Jatropha Plot, Boothivazhy (5ha) exist, remaining plots are not identifiable due to heavy weed growth and lack of maintenance. In the plots maintained by research wing, only *Acacia nilotica* and Subabul exist whereas other species failed to survive in the area. Hence, it is recommended to revert all these plots except the evergreen observation plot at Muthikulam (25ha) back as natural Forests and delete their names from the list of plantations.

2.9. Bamboo Plantations (22.6 ha):

Bamboo raised in Mannarkkad Division consists of mainly two species viz. *Dendrocalamus strictus* and *Bamboosa arundinaceae*. Bamboo was raised at Thodukappukunnu in an area of 22.5979 ha It has good stock and has an aesthetic value to the passerby. The area lies by the side of Perinthalmanna–Palakkad road at the entrance of Mannarkkad Division boundary. The area is presently used for dumping chicken waste, and highly vulnerable to fire. The area is suitable for takling under ecotourism project to render adequate protection.

2006 Bamboo Plantation raised by a VSS in 7 ha area is lying totally neglected, full of thorny bushes as heavy weed growth. The area has changed and hence proposed to revert back to natural forest.

Bamboo plantation raised in 2006 at Goolikkadavu of Agali Range has survival of 60-70% and grown along with Miscellaneous species. Sandal regeneration is noted in the area. Regeneration and enumeration of Sandal was also conducted and found to be abundant. Sufficient protection is required to protect the sandal from illicit removal. Growth of bamboo acts as a host for Sandal and hence it has to be protected.

Bamboo planted at Mulakuvellam over an extent of 8.3582 ha is *Dendrocalamus strictus*. It has established well and has a stock of more than 50%. Since the plantation lie as an isolated bit surrounded by settlements, chances of fire occurrence are more. The area shall be protected from fire and illicit collection.

2.10. Cane Plantation (12.4 ha):

Cane plantation raised at Manthanpotty during 1996 in 12.3973 ha area was the only plantation that has medium stock and abundant regeneration. The area should be protected from theft as it lies by the side of Mannarkkad-Mukkali Road. Canes have grown to a height of around 20 metres is seen by the side of streams originating from Manthanpotty.

It is prescribed to maintain and protect the plantation from illicit collection and fire.

2.11. Social Forestry Plantation:

Social Forestry Wing has taken compensatory afforestation plantations in Mannarkkad Divison, dry zone afforestation and compensatory afforestation are the two schemes through which majority of the plantations were raised. Most of the plantations have failed and very few plantations have stock up to 40%. Dry zone species raised are *Cassia siamea, Emblica officianalis, Azadirachta indica, Tamarindus indica, Acacia catechu* etc. Acacia was tried along with Neem, *Cassia siamea,* Cashew in Attappady range. But present stock is hardly 20%. Similarly, plantations of Silver oak, Wattle, Casuarinas, *Acacia nilotica,* Matti, etc in area like Elachi vazhi, Thoova, Cheerakkadav areas of Attappady Range are a failure.

2.11.1. Prescriptions:

Social Forestry plantations of the division are recommended to be retained as such and protected against fire so that the areas will revert to their original status as natural Forests, supported by the natural regeneration of native species. If the areas can be fire protected and kept free from grazing and illicit firewood collection, residual growth from the initial planting and natural regeneration will give adequate soil cover and establish itself over a period of time. Hence the areas treated by

social forestry wing are recommended for reversion to natural forests by deleting them from the list of plantations.

2.12. Failed Plantations:

The reasons attributed to the failure of majority of plantations in Agali and Attappady Ranges are poor site selection, uncertainity of weather, uncontrolled grazing and collection of fire wood coupled with untimely planting. Poor quality of planting stock and lack of proper supervision also contributed their share for the failure. Majority of the areas were unsuitable for planting on a large scale. There had been no timely maintenance operations.

2.12.1. Prescription:

It is advisable to leave the area as such and allow the natural growth to cover the area. Newly raised plantations should be maintained atleast for five years as in the case of plantations raised by AHADS instead of maintaining for three years. Hence, it is recommended to revert all these plantations to natural forest and delete their names from the list of plantations. A list of such failed plantations is furnished in table below.

Table - 38 - List of Failed Plantations

Sl. No.	Plantation	Extent (ha)	Remarks
Attappady Range			
1	1984, Teak Plantation, Gottiyarkandy	130.44	Stock of less than 10%,
Mannarkkad Range			
1	1946, Panakkadan-Evodia, Elavu	0.40	Miscellaneous growth dominates.
2	1947, Panakkadan-Evodia	2.43	Only misc. spp are seen
3	1952, Panakkadan-Evodia	0.40	Poor stock
4	1952- Panakkadan-Matti	2.17	Poor stock
5	1953, Elavu	0.60	Poor stock
6	1954, Elavu, Mahagani	0.40	Poor stock
7	1979, Mankada malavaram-Eucalyptus, Cashew	50.00	No stock
8	1981, Thathengalam-Euclayptus, Cashew	31.86	Cashew exist sporadically
9	1982, Thiruvizhamkunnu-Eucalyptus cashew, Casuarina	15.80	Cashew exist rarely full of local spp.
10	1986, Thathengalam-Cashew, Acacia	15.00	Full of natural regeneration
11	1986, Thathengalam – Cashew, Matti	20.00	Only misc growth
12	1989, Panakkadan-Casuarina	1.27	Few casuarina exist
Agali Range			
1	1962, Muthikulam-Eucalyptus	4.047	Miscellaneous growth no Eucalyptus seen
2	1963, Muthikulam-Eucalyptus	4.047	Miscellaneous growth exist and no Eucalyptus seen
3	1964, Muthikulam-Eucalyptus	4.047	Miscellaneous growth exist and no Eucalyptus seen
4	1976, Thachamala- Eucalyptus	46.00	Miscellaneous growth exist and no Eucalyptus seen
5	1978, Thoova- Eucalyptus	70.00	Miscellaneous growth exist and no Eucalyptus seen
6	1981, Thoova- Eucalyptus	29.00	Miscellaneous growth exist and no Eucalyptus seen
7	1983, Muthikulam, Eucalyptus	30.520	Miscellaneous growth exist and no seen
8	1986, Muthikulam, Eucalyptus	5.50	Few Eucalyptus grown sparsely and miscellaneous growth occupies the major portion
9	1987, Muthikulam, Eucalyptus	45.00	Few Eucalyptus grown sparsely and miscellaneous growth occupies the major portion
Total		**378.49**	

2.13. Transferred Plantations:

The table below shows a list of plantations that are transferred to Silent Valley National Park consequent to declaration of Buffer Zone.

Table - 39 - Plantations transferred to Silent Valley Buffer Zone

Sl. No	Plantations	Extent (ha)
Teak Plantations		
Mannarkkad Range		
1	1981, Karapadam-Pothuvapadam	25.00
2	1984, Thathengalam	21.42
3	1984, Kandamangalam-Pothuvapadam	25.00
Attappady Range		
1	1934, Chindakki	4.05
2	1935, Chindakki	4.75
3	1947, Pathenthodu	8.90
4	1970, Thadikundu	32.21
5	1971, 72 Thadikundu	34.00
6	1973, Thadikundu	41.00
7	1974, Thadikundu	23.00
8	1975, Thadikundu	23.00
9	1957, Ex-owners Plantation in Keeripara	177.00
10	1962, Panthanthodu	95.15
Rosewood Plantations		
Attappady Range		
1	1974, Panthanthodu	1.00
2	1975, Panthanthodu	2.00
3	1976-84, Panthanthodu	42.00
Miscellaneous Plantations		
Attappady Range		
1	1987, Chindakki (Bamboo)	12.00
2	1987, Anavai (Coffee)	14.67
3	1983, Anavai (Coffee)	10.00
4	1983, Anavai (Misc)	1.95
5	1992, Keeripara (Bamboo)	30.00
6	1995, Chindakki (Pepper)	15.00
7	1935, Chindakki (Teak, Rosewood, Venga)	4.05
8	1936, Chindakki (Teak, Rosewood)	4.05
9	1962 Pathanthodu (Teak, Bamboo, /Evodia)	50.15
Eucalyptus Plantations		
Attappady Range		
1	1967, Panthanthodu	50.39
2	1982, Panthanthodu	7.50
3	1983, Anavai	2.00
Total		**261.24**

2.13.1. Prescription:

The management of these plantations will be carried out as per the prescriptions of Management Plan of the Park. They are deleted from the list of plantations of Mannarkad Division.

CHAPTER – III

PROTECTION CUM WATERSHED MANAGEMENT WORKING CIRCLE

3.1. General Constitution of the Working Circle:

This Working Circle includes all the forest areas excluding the area of tribal settlements, leased out forest lands and non-revertible forest lands of the Division. This Circle overlaps with all other working circles except NTFP and Tribal Development Working Circle. In the previous Working Plan, this Working Circle was Protection Cum Improvement Working Circle but in order to give adequate importance to the water conservation measures, it has been renamed as Protection cum watershed Development Working Circle emphasising due importance to watershed developments.

The forests of this Division is broadly classified under five catchments viz. Bhavani Puzha, Siruvanipuzha, Kunthipuzha, Kanjirapuzha and Nellipuzha watersheds. Denudation and consequent degradation due to biotic pressures like uncontrolled grazing, annual fires, removal of ground vegetation etc have exposed the soil resulting in accelerated run-off and soil erosion. All these have adversely affected ground water re-charge and reduced the mean water flow in the rivers. The accelerated run-offs have increased the flow in the rivers during rains. Flash floods and land slides cause considerable damage to life and property.

Watershed is a manageable hydrological unit. Management inputs based on watershed principles involve besides other aspects, improvement of soil, conservation and judicious utilisation of the life supporting natural resources of water and soil.

3.2. Objectives:

An integrated approach to water and soil are envisaged. As water is life, rivers are the arteries of every organism; a holistic approach is needed on the issue. Objects of management are aimed to achieve the following:

* To improve the water retention capacity of the eco-system to enhance ecological and economic value of Forests
* To prevent loss due to calamities like land slides, drought and flood
* To protect and arrest the degradation of the Forests
* To maintain long-term productivity of watersheds

Protection cum Watershed development includes various activities related to protection of forest and overall development of watersheds. The main factors affecting protection of Forests are classified based on the threats caused to the environment. They are encroachment, ganja cultivation, degradation, sandal smuggling etc. each factors are dealt separately in the following paragraphs.

3.3. Encroachments:

Encroachment is a serious problem in Mannarkkad division, a vast extent of forest land is under this threat. Boundaries in many areas are still pending consolidation, mainly due to litigation and also remoteness of the areas. Encroachments of forestlands are identified under two categories Viz. encroachments prior to 01-01-1977 and encroachment post 01-01-1977. Encroachment prior to 01-01-1977 is likely to be regularised as per the policy decision of the Government whereas post 01-01-1977 are to be evicted.

The encroachment after 01-0-1-1977 is approximately 1639 ha and most of the cases are reported from Kurukkankundu area in Kallamala village under Agali Range. Government had decided to regularise the encroachment prior to 01-01-1977 after the joint verification by forest and revenue department. Accordingly, 465 cases were identified with name, survey number, extent and village. Details of the joint verification are given in Table below:

Table - 40 - Joint verification (Prior 01-01-1977)

Total application for joint verification		Total area jointly verified		Balance area to be jointly verified		Area identified as occupation prior to 1/1/77 during joint verification	
No.of plots	Extent (ha)	No.of plots	Extent (ha)	No.of Plots	Extent (ha)	No.of plots	Extent (ha)
1870	1086.2653	1296	597.4151	574	488.8502	81	39.4399

Similarly detailed list of post 01-01-1977 encroachment is given in table below:

Table - 41 - Details of Joint Verification (Post 01-01-1977)

Total application for joint verification		Total area jointly verified		Balance area to be jointly verified		Area identified as post 1/1/77 during joint verification		Post 1/1/1977 not involved in joint verification	
No.of plots	Extent (ha)	No.of plots	Extent (ha)	No.of plots	Extent (ha)	No.of plots	Extent (ha)	No.of plots	Extent (ha)
1870	1086.2653	1296	597.4151	574	488.8502	1215	557.9752	3628	2142.35

As per joint verification, out of 1870 plots (1086.2653 ha) applied, 1296 plots (597.4151 ha) were verified and 81 plots (39.4399 ha) were identified as occupation prior to 01-01-1977

and 1215 plots (557.9752 ha) as post 01-01-1977. Eviction was conducted in six cases and 8.0032 ha area was evicted as on 31-10-2011. List of persons encroached after 01-01-1977 is furnished in **Appendix XXIII.**

3.4. Boundary Consolidation:

Boundary consolidation has to be given prime importance to prevent encroachment. Survey of forest boundaries is still pending in some areas of the division due to stiff resistance from the encroachers. Immediate action is required to complete the boundary consolidation to ensure the protection of the remaining Forests. Delay in consolidation lead to loss of more forest land by way of encroachment. Hence, urgent steps should be taken to consolidate the boundary with top priority. Damaged cairns should also be repaired along with the fixation of the boundary.

Mannarkkad Division has a total outer boundary of 272.72 km, inter-division boundaries with Silent Valley National Park 52.05 km, Palakkad Division 53.82 km, Nilambur South Division 47.83 km and inter-state boundary of 101 km. As part of the boundary consolidation, 15,500 permanent cairns were constructed during the plan period. Besides the inter-state and inter-division boundaries, there are vested Forests bits of 27,172 ha lying scattered inside the division limit, which are to be consolidated, hence, a time-frame is to be fixed for consolidation of the forest boundaries to protect the land from encroachment.

3.5. Prescriptions:

It is proposed to plant suitable species like Agave, *Caryota urens*, bamboo, *Glyricidia maculata* etc along the boundary @10 km every year. This can also be adopted in between plantations to identify as well as act as barriers against fire.

It is prescribed to consolidate the entire boundary with in first half of the plan period.

Construction of Kayyalas (jungle stone walls) along the boundaries may also be resorted to. Kayyala or stone wall will play an effective role in Protection, control erosion, grazing, fire etc.

It is proposed that remaining length of approximately 150 km should be demarcated within the 1st half of the plan period at the rate of 25 km/year from 2011 to 2015 subsequently, general maintenance of the boundary should be attended to on yearly basis. The outer boundary especially the inter-state boundary should be cleared annually. All the boundaries of tribal settlements should be duly surveyed or boundary demarcated to prevent further encroachment.

3.6. Degradation:

Vast area of natural forests in Mannarkkad Division had been decimated due to biotic factors, like grazing, fire, encroachment, felling etc. Attappady, Agali areas of Mannarkkad Division have transformed into a dry zone due to destruction of Forests over the years. Attappady area, being a tribal belt, all government agencies pump in more funds for the betterment of tribals. Some agencies supply cattle to tribals as a source of livelihood, whereas agencies like AHADS afforest the area for eco-restoration which appeare to be contradictory. Degradation has brought in adverse impacts on the capacity of the forest soil to hold rain water and as a result, streams and waterholes in the forest dry up shortly after the rainy season. The wildlife have to travel long distances in search of food and water. During the process, they happen to intersect the human habitations damaging the crops. The rivers, streams, and streamlet, that serve as veins of agriculture dry up by mid summer putting lakhs of people under stress.

Encroachment of forest in different areas of the division, most of which had to be regularised by the governments. There are Acts and rules to curb encroachment and prevent plundering of forest wealth. Further loss of forest area has to be prevented by strengthening the protection measures.

The causes of degradation of Forests in the division have been described in detail in Part I of this plan. The faulty management practices in the past, threat factors such as fire, illicit felling, ganja cultivation, unregulated collection of forest produces, invasion of weeds, absence of natural regeneration, soil erosion etc still continue to accelerate the process of degradation. For further prevention of degradation of Forests and eco-restoration of already degraded forest areas, the prevailing threat factors should cease to continue. AHADS had an important role in eco-restoration of the area by raising plantations in degraded patches, soil and water conservation measures, tribal development, and improvement of infrastructure facilities etc. details of their achievement in the field of forestry, tribal welfare, water conservation etc are dealt under the topic 'AHADS' in this working circle itself.

Though a large number of miscellaneous plantations have been raised, most of them became failure. Among the plantations, Acacia and Eucalyptus survived in some areas but in majority of the areas, these species could not get established. Among the miscellaneous plantations, a variety of species like *Acacia nilotica, Ailanthus triphysa, Dalbergia latiflolia, Swietenia mahagony, Bamboosa Bamboo, Grewilia robusta, Tamarindus indica, Phyllanthus emblica, Agave Americana* etc were tried but failed. The reasons were poor site selection, vagaries of weather,

uncontrolled grazing, collection of firewood coupled with untimely planting, poor quality planting stock, fire occurrence and lack of proper supervision. Majority of the area were unsuitable for planting on a large scale. There have been no timely maintenance operations. It is best to leave the area as such. If the areas can be fire protected, kept free from grazing and illicit firewood collection, residual growth from the initial planting and natural regeneration will give adequate soil cover and establish over a period of time.

3.7. Prescriptions:

Miscellaneous species suitable to the locality, preferably indigenous species can be planted for afforestation and eco-restoration of area as per the methods followed by AHADS.

Before planting, reasons for the failure of plantation have to be evaluated and the suitability of site assessed.

Success story of AHADS plantation model can be adopted

A Site Specific Plan (SSP) is mandatory for every bit of Plantation to be raised in the field with due concurrence of the CCF concerned, prepared by the Range Officer under the guidance of DFO.

Maintenance of control form is essential with field sketch, vegetation status and physical configuration of the land.

3.6. Watershed Management:

3.6.1. Introduction:

During the past five decades, there has been a great pressure on the forest land as well as forest produces of Kerala. The increase in population and initiation of major development works paved way for encroachments and large scale deforestation in Kerala. The man-induced/ made activities having an adverse affect on the land, water and biomass of forest areas include grazing, forest fire (man made), indiscriminate collection of minor forest produces, encroachments, firewood collection, felling of trees, construction activities, Pilgrimage etc. animals also at times contribute to the destruction of the forest eco-system.

Natural calamities like land slides also are harmful to the system. These activities in turn accelerate the rate of soil erosion and also bring about changes in soil characteristics. There has been substantial change in the hydrology and sediment transport phenomenon in this region. There were frequent floods and debris flow. The rate of recharge of ground water affected as also soil moisture levels. The impact of these changes started spreading to adjacent areas. In this background, the necessity to introduce soil

and water conservation measures in the degraded patches of the forest was recognised. The present exercise is to suggest appropriate treatment of the plots already identified as degraded.

3.6.2. Watershed Management Concept:

The management of watershed aims at soil and water conservation for which land is used within its capabilities and treated according to its needs. The major objectives of watershed management are:

- To protect the land against all forms of soil deterioration
- To rebuild eroded and depleted soils
- To built-up soil fertility
- To stabilise critical run-off and sediment producing areas
- To conserve water
- To provided needed drainage
- To reduce flood and landslides

3.6.3. Implementation of watershed concept:

Mannarkkad Division comprises of mainly six forest types of vegetation namely West Coast Tropical Evergreen Forest, West Coast Semi Evergreen Forests, Southern Moist Mixed Deciduous Forests, Southern Tropical Dry Deciduous Forests, Southern Montane Wet Temperate Forests and Southern Euphorbia Scrub. A manageable hydrological unit is called 'watershed'. It involves better sustained forest management, aiming at improvement of soil, judicious utilization of life supporting natural resources and putting check on all harmful activities that pave the way for ecological imbalance.

West Coast Tropical Evergreen Forests is seen in Muthikulam of Agali Range, part of Attappady Block I, to V of Attappady Range covering an area of 8000 ha. The annual rainfall above 3000 mm and mean annual temperature is below 27^0 C.

West Coast Semi Evergreen Forests is seen in Attappady Block I, Thudukki, Mukklai Venga, Pathenthode, Ummanarimala, Manthanpotti areas of this Division between an elevation of 250m and 600m above MSL.

Southern Moist Mixed Deciduous Forest is seen in Attappady Valley, Kanakkadan RF and in VF of Thathengalam, Paruthimala, Vettilachola, Kellallor, Aralikkonam and both banks of Varahapallam River.

Southern Tropical Dry Deciduous Forests is confined to rain shadow regions of Attappady east areas like Aralikkonam, Mulli, Thoova. It is an open forest with trees about 15m to 20m height.

Southern Montane Wet Temperate Forests characterised by stunted branch of natural trees found in Attappady Block I to V where rainfall is above 3000mm per annum. This type of forest is found in Attappady Reserve Block I to V where rainfall is above 3000mm per annum.

Southern Euphorbia scrub type of forest is found in the higher reaches of Southern Tropical Dry Deciduous Forests especially in the eastern portion around Mulli and Thoova forests. Hence, Mannarkkad Division has a representation of all main types of forest vegetation.

Watershed treatment depends on the type of vegetation it deserves. Natural Evergreen Forests absorb rainwater and enhance filtration of rain water, maintaining climatic climax type of vegetation and allowing the progression of vegetal system, wherever degraded the succession is of paramount importance, as evergreen Forests are considered to be in total equilibrium with nature.

In the previous working plan, the forest areas of the division are broadly divided into four zones. Viz: Attappady Dry Zone, Mannarkkad Zone, Kanjirapuzha Zone, Muthikulam Evergreen Zone.

Attappady Dry Zone covers major portion of Attappady Valley include highly denuded areas with rocky portion, sparse vegetation consisting of thorny shrubs, bushes and deciduous species indicate the degree of degradation. Being rain shadow region with rainfall 700 mm and temperature of above 40^0 c during April-May months.

3.6.4. Mannarkkad Zone:

Includes forest areas of Mannarkkad, Thiruvizhamkunnu forest stations of Mannarkkad Range. The Forests support Dry Deciduous type of vegetation with teak, cashew and miscellaneous species plantations and portions of vested Forests.

3.6.5. Kanjirapuzha Zone:

Comprised of forests coming under the jurisdiction of Polukkayam Forest Station in Mannarkkad Range. Forests under this Zone support mainly moist deciduous and semi-evergreen type of vegetation with some patches of evergreen Forests.

3.6.6. Muthikulam Zone:

Comprises of evergreen forests and high sholas included in Attappady Block VI of Singapara forest station and adjoining evergreen patches in Sholayur Forest Station. By maintaining the zonations described above, the division is classified under five major watersheds based on the catchments namely Bhavani, Siruvani, Kanjirapuzha, Nellipuzha and Kunthipuzha watersheds. These watersheds cover all the RF, VF and revenue lands under Mannarkkad Division.

Table – 42 - List of Watersheds in Mannarkkad Division

Sl. No	Watershed	Area (ha)			
		RF	VF	Revenue Land	Total
1	Bhavani	8077.14	8865.95	16,509.88	33,452.97
2	Siruvani	6385.95	6515.07	10,708.89	23,609.91
3	Kanjirapuzha	-	5509.28	10,981.57	16,490.85
4	Nellipuzha	-	4575.71	11,446.87	16022.58
5	Kunthipuzha	610.13	1703.68	15,302.09	17615.90
	Total	**15073.22**	**27169.69**	**64,949.30**	**107192.20**

3.6.7. Bhavani Watershed (33,452.97 ha):

Boundaries:

North: Nilgiri District, Tamilnadu

East: Coimbatore District, Tamilnadu

South: Kanjirapuzha Watershed and Nellipuzha Watershed

West: Bufferzone of Silent Valley National Park.

Bhavani watershed comprises of four types of Forests namely Wet Evergreen, Semi Evergreen, Moist deciduous and Southern Euphorbia Scrub type. Bhavani River originates from the Kuntha Reserve Forests of Tamilnadu, passes through the Attappady Reserves and takes a U-turn at Mukkali and flows down towards East. The main rivers joining Bhavani River are Varahapallam, Yemmari and Kokkuvenipallam rivers. The catchment area has all extremes of vegetation ranging from dense thick vegetation to dry area. The general terrain of this water shed is undulating. The elevation at the highest point is 2299 m above MSL at Buthinari Betta, which is situated in the North-West boundary.

Bhavani Watershed spresds in both Attappady and Agali Ranges. It has 8077.14 ha of RF, 8865.95ha of VF along with Revenue area of 16,509.88 ha Attappady Block I RF with an extent of 5925 ha area is transferred to Silent Valley National Park for formation of buffer zone. Bhavani River is the life line of Attappady Valley and hence soil and water conservation measures

have immense significance in improving the status of vegetation, livelihood of people who depend on Bhavani Watershed and cultivation of crops.

AHADS have implemented the water conservation measures in Attappady Valley covering an area of 745 Km^2 by dividing the whole Attappady and Agali areas into 146 micro watersheds. Out of this, 93 micro watersheds have habitation, hence User Associations (UA's) were constituted democratically. The activities include afforestation, biomass development, soil and water conservation and watershed resource development by ensuring watershed based governance of resources.

Soil and Moisture Conservation Works completed on 9300 ha area of forest land by taking 6.60 lakhs staggered trenches, 8013 gully plugs, 279 km DLT works. Regeneration works carried out in 11837.91 ha of forest land, Avenue plantations on 33 km road. Water resources development activities like protection of springs, open wells, rainwater harvesting and gravity irrigation system and irrigation channels are constructed and maintained.

3.6.8. Siruvani Watershed (23,609.91 ha):

Boundaries:

North: Bhavani Watershed

East: Coimbatore District of Tamilnadu

South: Palakkad Taluk

West: Kanjirapuzha watershed

The main drainage of this watershed is Siruvani river, which originates from Attappady RF and flows north wards, its tributaries are Pambar, Pathiar and Kodungarapallam. This watershed stretches both in Agali and Attappady ranges and falls in the villages of Kottathara, Sholayur, part of Palakkayam, part of Kallamala and part of Agali villages. Out of the total area of 23,609.91 ha 6385.95 ha are RF, 6515.07 ha are VF and 10,708.89 ha are revenue land.

Attappady Block VI RF has a luxuriant growth of wet evergreen Forests, bamboo Forests, reed brakes and shola Forests and grass land. It is west coast tropical evergreen type of Forests in its optimum form of development between 750 to 1100 m elevation. The catchment receives more than 2000 mm rainfall and a short dry period of three months or less. These Forests have more rainfall than in plains due to the relief against monsoon winds, reduction in the length of dry season due to convection currents and night condensation almost through out the year.

Muthikulam natural forest, a typical evergreen forest is located at the southern end of Attappady. Floristic analysis of this natural forest indicated the occurrence of a total of 42 tree species belonging to 25 families. It is evident from the structural analysis that this forest is very dense as indicated by high-density values. Siruvani dam located in the watershed is known for its purity and it is the life line of the people of Coimbatore district. Major chunk of the water is used for drinking purpose only.

3.6.9. Kanjirapuzha Watershed (16,490.85 ha):-

Boundaries:

North: Bhavani Watershed

East: Siruvani Watershed

South: Ottappalam and Palakkad Taluks

West: Nellipuzha Watershed

The main river in this watershed is Kanjirapuzha; it takes its origin from the dense mixed jungle between Kumbanmala, Pattiyamukkammela and mudukurissi plain and flows due SouthWest through Kundampoti. There are a number of rivulets joining this river. Thuppanadu puzha and Ambankkadavu thodu are its tributaries which finally join Kanjirapuzha A dam has been constructed at Kanjirapuzha About one-third area of this watershed is covered with dense mixed jungle and some open scrub. The area is having very steep slopes and rocky patches. The highest peak is Elival mala with an elevation of 2066 m above MSL. The lower slopes are covered with dense mixed jungle and the upper mountain slopes covered with shrubs.

Kanjira puzha watershed covers part of Agali range and part of Mannarkkad Range and stretches over the villages of Karimba I, Karimba II, Karakurissi, Thachampara, Pottasseri I, Pottasseri II and part of Palakkayam and Kallamala. There are no RF in this watershed. VF cover an area of 5509.28 ha and the remaining 10,981.57 ha area is revenue land.

In Kanjirapuzha watershed, there is no RF, only VF lying as isolated patches of hillocks called “malavaram”, Puzhikunnu mala, Chullippara mala are seen which do not have any dense vegetation. These hill ranges are not having any streams or rivulets flowing downwards. These hills will be drier and highly fire prone due to the nature of vegetation. Soil and moisture conservation measures are very essential in these areas to change the nature of vegetation as well as to improve the soil status of the area.

3.6.10. Nellipuzha Watershed (16022.58 ha):

Boundaries:

North: Bhavani Watershed
East: Kanjirapuzha Watershed
South: Ottappalam Taluk
West: Kunthipuzha Watershed.

Nellipuzha is the major water source, originating from Kallumala, flows southwest and nourished by the tributary Ambankadavuthodu. Kundampotti river is also flowing through this watershed in South-west direction and joins Kunthipuzha outside this watershed.

Dense Forests are seen in the hills, the upper reaches are covered with shrubs. Major area of this watershed is with settlers and the vast extent of forest patches were already converted into agricultural land. Plantain, coconut, arecanut and rubber are being raised in the area. The steep slopes of Urulan kunnu, Panthenthode, Pangode areas were totally converted into farm lands, hence the watershed lacks any water resources.

Nellipuzha watershed spread over three ranges namely Attappady, Agali and Mannarkkad. Watershed includes villages of Mannarkkad, Thenkara, Palakkayam (Part), Kallamala (part) and Kumaramputhur (part). Out of a total area of 16022.58 ha, VF comprises of 4575.71ha and the balance area of 11,446.87 ha are revenue land. There are no RF in this watershed.

3.6.11. Kunthipuzha Watershed (17615.90 ha):

Boundaries:

North: Silent valley
East: Nellipuzha Watershed
South: Ottappalam Taluk
West: Perinthalmanna Taluk

Kunthipuzha watershed is situated in Mannarkkad Range. The villages coming under this watershed is Payyanedom, Kottopadam I, II, III, Alanallur I, II, III, Thachanattukkara I, II, and part of Kumaramputhur. Out of a total area 17615.90 ha, 610.13 ha are RF, 1703.68 ha are VF and 15,302.09 ha are revenue land.

Kunthipuzha is the main river in this watershed, it originates from Valakkad in the Silent Valley and flows southwards, nourished by the tributaries namely Kundanchalapuzha, Karingthodu, Malarayanthodu, Kummattanthodu and Ariyoor thodu. The other major river is Palakkazhipuzha and its tributaries are Vehekkayamthodu and Alanallur thodu.

The Panakkadan teak series are under this watershed and some cashew plantations are also situated in this watershed. VF portion of Karappadam, Poduvappadam areas were transferred to Silent valley National Park as buffer zone.

3.6.12. Main objectives:

The main objectives of this working circle is to promote conservation of biodiversity and arrest the degradation of forest lands by increasing the vegetal cover coupled with soil and moisture conservation measures.

The undisturbed or less disturbed natural forests would constitute conservation areas where management is aimed at conservation of biodiversity. In natural Forests, the strategy should be based on catchment area basis for development of full spectrum of forest products, including NTFP and also on the sustainable availability of other natural resources like water. Improvement of productivity should be achieved through better management and maintenance of natural vegetation, enrichment planting with special emphasis on indigenous species of local utility and introducing soil and moisture conservation measures.

3.6.13. Analysis and Valuation of Crop:

In Mannarkkad division, RF, VF and revenue lands coming under its jurisdiction are brought under five catchments mentioned above. Out of the five watersheds, Bhavani and Siruvani catchments are having forest areas with good growth of trees and the remaining three consists of VF areas supporting sparse vegetation. All the watersheds except Bhavani and Shiruvani form major tributaries to Bharathapuzha

3.6.14. Division of Watershed into Micro Watersheds:

A micro watershed having clear natural boundary should be selected for the purpose. The areas having preponderance of wastelands, degraded Forests, shortage of drinking water, low level of employment shall be given priority. As far as possible previously untreated areas should be selected.

3.6.15. Extent of Micro Watershed:

500 to 600 ha to be selected preferably near habitations so that they could also be involved in planning process and benefits of treatment accrue to them.

3.6.16. Strategic Planning for a Watershed:

For each micro watershed, there will be a strategic plan including details about the watershed, problems, strategies to improve, participation of local communities, division of areas into

different units based on the approved criteria, maps, treatment plan etc, the strategic plan is to serve as a basis for preparation of operational plans (SSP's), which will follow the guidelines already issued for different treatments, like ANR, RDF, RRB etc. The strategic plan will be approved after conducting detailed Participatory Rural Appraisal (PRA) involving members of Panchayat/NGO's and local people. Perambulation of the site to be done by Forester and Forest Guards in charge of the area. The Deputy Ranger, Range Officer and the Divisional Forest Officer will also perambulate the area and finalize the proposal. The Chief Conservator of Forests will finally approve the strategic plan after inspection.

3.6.17. Strategic Plan should include monitoring indicators:

The objectives focused on conservation of bio-diversity, upgrading and utilization of natural endowments, namely land, water and vegetation in a harmonious and integrated manner, protection of steep slopes and catchment areas of streams, reservoirs to prevent soil erosion, recharging of ground water and recycling of domestic consumption, increasing employment potential, improving the stock of indigenous and commercially important species.

3.6.18. Divisions in the Micro Watershed:

The entire watershed would be divided into a number of blocks based on the criteria for various treatments like ANR. RDF, RRB etc. the areas where no treatments are required will also be shown as separate blocks. Each block will be considered as a separate area for preparation of SSP's and estimates. Similarly, a single block should not exceed an area of 100 ha Preparation of SSP for each block will be done as per existing instructions. The blocks, where no treatments are proposed will be generally protected from fire.

3.6.19. Monitoring indicators and Documentation:

For each watershed, a set of monitoring indicators will be developed while preparing the strategic plan and base line data collected. This will be in addition to the indicators for each block and incorporated in the concerned SSP. In addition to the journal maintained for each SSP, there will be area based treatment journal for the watershed. This should include the following

- Name of Officer/Staff in charge of the area
- Location map and Survey sketch
- Boundary description
- Brief history of the area

First year maintenance (Name of work, starting and completing, quantity, expenditure etc), second year, third year, fourth year and fifth year.

- Inspection notes by Range Officers and higher officials
- Observations
- Participation of local people

A committee consisting of representatives from local people, NGO's and local Panchayat should be formed to associate with the management of the watershed. General protection of the watershed and fire protection should be entrusted o the local people.

3.6.20. Prescriptions:

Soil and Water Conservation Measures:

There are several measures which can be suitably used for soil and water conservation in a watershed, especially with an aim to prevent soil erosion. The important principle to be kept in view while planning measures for proper conservation and utilization of water are:

i. Increasing the time of percolation and thereby allowing more water to be absorbed and held in soil profile.

ii. Intercepting a long slope into several short ones so as to maintain less than a critical velocity for the runoff water and

iii. Protection against damage owing to excessive run off

iv. The measures for controlling soil erosion are based on either of the two broad general principles

v. Stabilization of soil to make it more stable and non-erodent and

vi. Reduction of the erosive forces, especially the eroding action of water.

Gully Control Measures:

Gully erosion generally starts as small rills and gradually develops into deeper crevices. Ravines are a form of extensive gully erosion. Gully erosion not only damages the land resources but also contributes to larger amount of sediment load to river systems. Stabilization of gullies through vegetation is a difficult task when the gullies have to be used for conveying run-off,

especially during the commencement of plantations. In such cases, mechanical measures have to be adopted. Such protective measures need be only temporary. Therefore, temporary structures are designed to:

- Retard the flow of water
- Reduce the channel erosion
- Retain some quantities of sediment and moisture to establish vegetation.
- The advantages are:
- These structures are cheap as compared to permanent ones.
- Locally available material can be used and
- Much technical skill is not needed

Among the five watersheds identified, AHADS had tackled almost all areas with forest as well as revenue land under Bhavani watershed with various soil conservation measures and water resource development. Hence, it is proposed to undertake soil and moisture conservation measures in newly proposed plantations and treatment areas where AHADS had not treated. Soil and moisture conservation practices suitable for Forests under dry condition like Attappady are as follows:

Construction of Gully Plugs:

- Gully plugs are to be constructed starting from top proceeding to bottom
- Crest level (water flowing level) of the second gully plug should at least be in line (or below) with the bottom level of the gully plug above.
- As far as possible, narrow cross sections of the gully should be selected for constructing gully plugs to reduce construction cost.

Gully plugs should be at a spacing of every 50 m Jungle stone gully plugs of width and height 1m (maximum height of gully plug should not exceed 1.2m) with spill way and apron for smooth flow of peak run-off. Foundation of gully plug should be 30 cm if bottom is firm and 50 cm otherwise. As far as possible dig a percolation pit above the gully plug and put the earth behind the structure to support it. This will facilitate the gullying to act as a water harvesting structure.

If the plantations site is of newly planted seedlings, dig a trench of size 2m × 0.5m × 0.5m just 0.5m above the seedlings and put the earth excavated down the seedling to make a honey comb like structure. Water harvested in the trenches above will seep into the root zone of the growing plant.

Trenches and Pits:

Trenches are constructed along the contour lines forming embankments (bunds) on the downhill side of the trenches with material taken out of them. Trenches and pits break velocity of run-off. Rainwater percolates through the soil slowly and moves down. These structures can be used for all slopes in both high rainfall and low rainfall conditions and also varying soil types and depths.

Contour trenches are excavated at suitable vertical intervals depending upon the slope of the land and the cross-sections are designed to collect and convey the run-off expected from the inter-space between the successive trenches and this determines the size of the trench. General recommended size of the trench is 100 cm length, 100 cm top width, 50 cm bottom width and depth of 50 cm. About 150 such trenches can be taken in one hectare of land. These trenches and pits will get filled up gradually and therefore, may have to be re-trenched every year or once in two years.

Check dams:

Check dams of a maximum height of 1.5 m is proposed. Spill ways are provided to avoid over topping during high flows. Keying of the check dams into the side and floor of the gully greatly improves its stability.

Construction of check dams of average length of 10 m, height of 3 m, top width of 0.90 m and bottom width of 2 m. As far as possible, locally available materials are recommended for construction purposes. Low cost *insitu* conservation measures like contour trenches and pits have been recommended in almost all the plots as they are found effective in arresting soil erosion, enhancing ground water recharge and natural regeneration of local species. Engineering measures have been recommended in areas where natural/vegetal measures are not suitable.

Loose Rock Check dams:

Construction of loose rock checkdams begin by sloping back the top of the banks. A trench is then dug across the stream floor and into the banks. Large rocks are placed in the trench to form the toe of the structure. The dam is built upward from this. Rocks smaller than 100 mm diameter should not be used as these

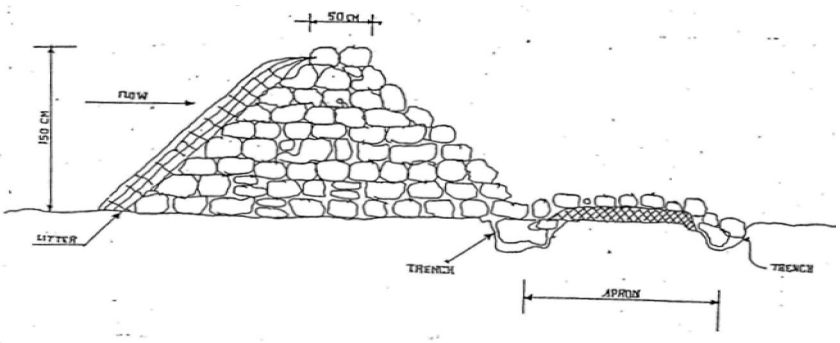
will be quickly washed out. But dams made of large rocks alone will leave large voids in the structure, allowing water jets which will weaken the dam

A second trench should be made to mark the downstream end of the apron and filled with heavy rock. A 100 mm thick layer of litter, such as leaves, straw or fine twigs is laid on the floor of the apron and covered with a solid pavement of rock. A thick layer of litter is also placed on the up stream face of the dam. This will trap the sediments and fine particles and develop as an impervious layer to obstruct seepage.

These loose rock check dams are recommended in all the watersheds where ever the location is suitable and necessitate its requirement. Model sketch of the loose rock check dam is given below

Figure No.1

Loose rock check dam



3.6.21. Treatment for Teak and Miscellaneous Plantations:

Teak being a good timber species it is widely cultivated in plantations. It fetches major share of the revenue. However, the growth in second rotation areas is seen very poor mainly due to poor soil conditions and soil moisture. Proper soil and moisture conservation measures are the only solution to enhance the biomass content of teak plantations.

Making platforms / terraces along the contour 1.5m length, 1.2m width and 0.3m height at cutting side at 3m × 3m spacing. The standard practice of taking 50m^3/ha is also recommended for teak plantations which will take care of additional trenching / pitting required for the plots.

3.7. Attappady Hill Area Development Society (AHADS):

Attepady Hill Area Development Society has done extensive eco restoration works in the region since 2000. Main thrust being soil water conservation as a prelude to vegetation improvement of the area for improved income generation of the local population coupled with health and education packages.

3.7.1. Characteristics of the project:

- Ø Intensive peoples participation in project planning and implementation
- Ø Good representation of women and tribals in people's institution (PI)
- Ø Watershed based resource management with participatory planning, implementation, monitoring and evaluation through PI's.
- Ø Equitable and transparent implementation arrangements delivering development benefits to deserving people
- Ø Multi-disciplinary team concept for field implementation

3.7.2. Implementation through People's Institutions:

Participatory approach is followed in the implementation of projects where in involvement of the real end-users are ensured right from the planning through implementation. Local people, functioning under various People's Institutions(PI's) Plan and implement different components of the project, AHADS supports them with financial and technical resources and facilitates investments in a transparent and participatory manner. Following grass root level people's institutions created.

i. User Associations (UA's): Beneficiary of a micro watershed form User Associations with 9 members Executive Committee with minimum 5 woman and 4 tribals, which execute all works pertaining to the micro watershed. 93 users Associations are formed in 93 micro watersheds out of 146 micro-watersheds in the project area.

ii. Ooru Vikasana Samithies (OVS): Executive Committee consisting of 13 members (with minimum 6 women) are constituted to take up development works in and around tribal settlements. 166 Committees are formed out of total 187 hamlets of Attappady.

iii. Joint Forest Management Committee (JFMC): Committees for taking up afforestation and protection works in the state forest lands. There are 54 JFMc's under the project, which have been

federated as 16 Vanasamrakshana Samithies (VSS) under Mannarkkad Forest Development Agency (FDA).

iv. Thaikula Sangam (TKS-Mother's Group): These groups of tribal women have emerged as a result of their empowerment as a social corrective force. These groups are constituted in each tribal hamlet to fight against the social evils like alcoholism, drugs etc and registered as a society. Groups are constituted with 12 member's executive committee.

v. Income Generation Activity Group (IGA): 220 groups with 12 to 15 members. These groups are meant to take up sustainable income generation activities through promotion of micro-credit among members in the project area. These groups function as self-help groups.

3.7.3. Afforestation and forest protection works in State forest lands:

- Forest regeneration works completed on 11,837.91 ha of forest land includes 3776.25 ha of forest plantations and 8061.66 ha of natural regeneration
- 2.26 km forest fencing completed
- 782.31 km fire protection line maintained
- Soil and moisture conservation works completed on 9300 ha of forest land (6.60 Lakhs staggered trenches, 8013 gully plugs, 279 Km DLT works)
- Avenue plantations completed on 33 km road length.
- 4.08 millions seedlings raised by the Peoples Institutions (PI's) for the afforestation works.
- 3700 units of energy conservation devices and alternate energy systems have been popularised.

3.7.4. Special Focus on Tribal Welfare:

The project implementation is planned in such a way that project benefits directly reached the tribal communities. In Attappady, 41% of the total population is tribal. It is note worthy that 60% of the project benefits reach the tribes. The activities such as Total Hamlet Development Programme (THDP), Environmental Literacy Programme and the construction of the community resource centre are exclusively for the development of tribal population. These programmes along with the construction of access roads to hamlets and other hamlet development programmes are implemented by the Ooru Vikasana Samithies (OVS) themselves.

3.7.5. Kurumba Devlopment Package:

The forest dwelling Kurumbas of Attappady have a unique ethnic and socio-ecological milieu that demands a special treatment of this community under the eco-restoration project. Living in inaccessible areas, close to the nature having been deprived of many basic amenities and traditional rights, the Kurumba Communities were leading the most unsustainable life styles through shifting cultivation practices. Developmental activities for this area are designed considering the harmony between human and environmental factors.

- Tribal Hamlet Development Programme started at Mele Anavai, Thazhe Anavai, Murugula, Kinattukara, Kadugamanna, Mele Boothayar and Pazhayur hamlets.
- Footpath laid between Anavai and Kadukamanna hamlets.
- Suspension bridge to Kadukamanna renovated.
- Environmental literacy classes in Kurumba language started in all the above mentioned hamlets.
- Anganwadi and committee offices function at Anavai, Kadugamanna and Kinatukkara hamlets.
- For economic sustenance, 2025 coconut, 6000 arecanut, 13000 coffee, 750 Gardenia seedlings, 15625 Nos pepper vines distributed.

3.7.6. Promoting Bio-diversity Studies:

Attappady block, being part of Nilgiri Biosphere Reserve has rich flora and fauna. The assessment of bio-diversity requires measurement of diversity indices, which is possible only when some quantitative values are ascribed to them compared over a period of time. Six research projects on biodiversity have been awarded to the following institutes.

I. Study on Inventory of the biodiversity of Attappady with GIS aid by Salim Ali centre for Ornithology and Natural History (SACON).

II. Study on “Structural analysis of plant diversity of natural and protected areas of Attappady” by Kerala Agricultural University.

III. Study on “Plant-bird interaction with special references to identification bird attracting plants for afforestation of Attappady Valley, Kerala” by SACON.

IV. Study on: Establishment of seed production systems for NTFP's of Attappady Hills" by institute of Forest Genetics and Tree breeding".

V. Tribal indigenous knowledge systems and practices in livestock based livelihood by Kerala Agricultural University.

VI. Adoption of microbian inoculants technology in the farming system of tribal population of Attappady by Kerala Agricultural University.

3.7.7. Infrastructure Development:

i. Chavadiyur Bridge:

The Bhavani River divides Agali Grama Panchayat from Pudur Grama Panchayat. During rainy seasons, the river comes in flood. Pudur remained cut off from the mainland during rainy season causing immense hardships to the people. As a part of social commitment, a bridge at Chavadiyoor connecting Agali and Pudur Grama Panchayats across Bhavani river was constructed under the project. The bridge was constructed at a cost of Rs.3.57 crores for a length of 135 metres and width 7.5 metre and ingurated on 02-08-2008.

ii. Community Resource Centre:

Inorder to create public space for meetings cultural activities, training classes etc community resource centes were constructed in 84 hamlets.

iii. Health and Education:

- 40 bedded hospital building was constructed for community Health Centre, Agali
- Government Ayurveda Hospital at Karundikkal
- Lab Equipments to Kottathara Tribal Speciality Hospital
- Laboratory equipments to Government Tribal Schools.
- Drinking water facilities at PHC, Anakkatty, Kottethara Hospitals.
- Agali drinking water scheme.
- Infrastructure Development like bridge, ropeway, stage, roads, buildings Community Resource Centres (CRC i)

3.7. 8. Conclusion:

The eco-restoration project has generated a massive people's movement for demand driven development and shifted development discourse towards people centric, transparent and accountable implementation of development programmes. The eastern and part of the northern Attappady Hills; which falls in a rain shadow region, now sports a green look with regeneration of Forests and recharging of streams and ponds. To arrest the environmental disaster, the central government sanctioned Rs.219 crore eco-restoration projects with Japanese aid and established AHADS to implement it. The 10 year project got further extension, considering the pendency of some components. AHADS helped in regenerating the forest cover in large areas of eastern Attappady and recharging dried up streams and ponds. Watershed based soil and water conservation activities regenerated the vegetation in the area and rejuvenated the water resources. The improved ground water regime is gradually increasing the greenery of the area.

3.8. Sandal Regeneration in Mannarkkad Division:

3.8.1. Introduction:

Sandal wood is the fragrant heartwood of the species "*Santalum album*". The essential oil is extracted from its heartwood known as Sandal oil. Sandal belonging to the family santalaceae is a semi parasite, having a wide range of host plants mainly, dry deciduous species. The tree grows at altitudes upto 1200 m above MSL. It attains a height of 10 to 15 m and average girth of 100 cm at BH. The tree is believed to attain full maturity within 100 years. Attappady have dense growth of Sandal with profuse regeneration coming underneath. The climatic and edaphic factors are suitable for the growth of Sandal and hence protection from illicit felling and grazing is the only solution for its sustainable growth and development.

3.8.2. Distribution of Sandal:

The distribution of sandal trees is not uniform in all the areas of Attappady region. It is concentrated in dry zones viz: Mallikathottam, Thachamala, Marappalam, Goolikadavu, Moochikadavu, Cheerakkadavu, Pattanakkallu, Mele-mulli and moist deciduous region of Panakkadan area. The sandal trees are half cut by the smugglers to check the presence of heart wood and wide scale damages are made to the existing trees.

3.8.3. Growing stock Assessment:

Total enumeration was done for assessing the growing stock of the sandal trees of Attappady Range sandal trees above

15 cm GBH are enumerated. It gives an indication of the distribution of Sandal trees and other miscellaneous trees in the area. The result of the enumeration shows that the number of sandal above 30cm in BH is 2011 nos.

3.8.4. Problems affecting Sandal regeneration:

Weeds: Lantana with its gregarious and bushy nature is the major weed present in the sandal areas. Sandal that germinate and grow with in the bushes will get natural protection from the graziers. Once the bushes are destroyed, either due to fire or other causes such as drought, the young regeneration of sandal gets affected and dies. The negative aspect of this weed is that it entangles and suppresses the further growth of the seedlings. Hence lantana is a good nurse but a poor host.

Grazing: Cattle rearing is the main occupation of tribals in Attappady. People residing in and around Attappady area rear cattle and goat as their main sources of income. These animals are let loose in the open. The uncontrolled grazing and lopping to feed goats have caused heavy damages to younger regeneration. Since the forest paches are lying intermingled with private habitations the grazing intensity is high.

Annual Fires: Fire is one of the major limiting factors in the regeneration of sandal. Man-made fires cause more damages to the growth and development of sandal regeneration.

3.8.5. Objectives of Management:

The sandal areas of Attappady, Agali have to be protected to produce good quality Sandal wood. The degrading factors like grazing, fire, illicit felling, weed growth etc have to be controlled for protecting the regeneration. For the regeneration and survival of sandal trees and its associates, eco-restoration activities and protection of the area are essential. Smuggling of sandal wood from this area is also a socio-economic problem. Since the unemployed local people and tribals are being lured by the sandal mafia, it is necessary to wear them away from the clutches of the mafia. The major objectives of management are:

a) To protect and manage existing sandal tracts and sandal trees

b) To increase the growing stock of sandal trees

c) To adopt participatory protection strategy

d) To encourage sandal cultivation in private holdings

e) To adopt efficient marketing strategy for sandal

3.8.6. Tending Operations:

Intensive tending at seedling stage is not essential as Sandal is known to push through heavy lantana and other miscellaneous growth without any external assistance. When it reaches sapling stage, help is given by providing overhead light. Hence the tending operations are aimed at giving enough lateral shade during the early stage and plenty of overhead light after the sapling stage. Climber cutting is being done at all stages of growth

3.8.8. Regeneration of Sandal:

The following factors play an important role in the successful regeneration and establishment of sandal seedlings whether by artificial means or natural.

- Seedlings are sensitive to drought and readily get killed due to sudden exposure to sun.
- Seedlings need lateral shade but are intolerant of low over head cover in the first year. Hence, the seedlings have to free during the rains. If not they may die due to damping off as a result of excess moisture.
- They are sensitive to water logging and rot in cold wet soil.
- Grows in all kinds of soil like sand, clay, laterite, loam and black cotton even in very poor and rocky soils except in water logged situations.
- They thrive well in very dry and wet areas ranging from a minimum of 500mm to over 3000mm, rainfall and temperature 50^0 to 95^0 F.
- Capable of reproducing itself very profusely provided there are no unfavourable biotic factors.
- Root suckers are freely produced when the roots are exposed or cut through or when the parent tree is felled.
- The tree is extremely sensitive to fire and killed or badly injured and rendered unsound.
- The tree is readily browsed by goats, other cattle and wildlife especially during dry seasons.

3.8.9. Natural Regeneration:

Sandal trees start yielding fruit from the third to fourth year. Normally, tree flowers and produces fruit twice a year (September-October, March- April). It is capable of regenerating profusely. It will come up in all types of soil and better in well-

drained red loams and laterites. The dispersal of seeds is by birds which eat the fleshy coat of the fruits leaving the hard seed to germinate. Favourable moisture conditions, availability of adequate shade upto one year and sufficient light afterwards and protection from fire and grazing will help the survival of sandal seedlings.

3.8.10. Artificial Regeneration:

The enumeration in sandal areas reveals that the average number of seedlings/saplings per ha is very low. The result of regeneration survey conducted in various Sandal Reserves is dono. It shows that regeneration and establishment of sandal is much low. Hence artificial regeneration is required for restocking the area. Sandal can be artificially regenerated by various methods.

3.8.11. Collection of seeds:

It is desirable to obtain seeds from superior mother plants having better germination and survival %, hence it is better to collect from fully matured trees i.e. trees above 20 years age. The fruits are collected from the mother trees as soon as they are fallen. They are soaked in water and rubbed to remove the pulp. The de-pulped seeds are washed and dried in shade and stored in gunny bags after treating with organic mercuric fungicide. The freshly collected seeds are dormant for a period of two months and viable up to 9 months. Approximately 6,000 seeds make one Kg. The production of seeds during Sep-Oct is comparatively in larger quantity than that of the season in Mar-Apr due to the end of drought season.

3.8.12. Pre-treatment of seeds:

Pre-treatment is conducted by soaking of seeds in 0.05 % Gibberellic acid overnight. It will give uniform germination of 80-85 % in 30 days.

3.8.13. Sowing of seeds on mounds of trenches:

For conserving the rain water for survival of the seedlings, construction of staggered trenches is suggested. The sowing of seeds can be done on the mound of the trench along with the seeds of host Plants. The loosening of soil will help the speedy establishment of the seedlings. In steep areas, shallow pits are dug along the contour and seeds may be dibbled on the mound of the trench. In areas without host Plants, it should be born in mind that hosts are highly influential in conferring relative resistance against spike disease. For Example, *Strychnos nuxvomica* (Kanjiram), *Pongamia glabra* (Ungu), *Azadirachta indica* (neem), *Cassia Siamea* (Manja Konna) provide high resistance power to the dependent sandal trees, *Accacia*

planiferms, Albizzia ferrugenia are also found to be good hosts. Among these some of the trees are leguminous and with thorns which protect sandal.

Some of the trees have thin perforated canopy. The regeneration areas should be maintained properly by weeding as and when required till the young seedlings/root suckers establish and grow well at least for a period of 4 years as Sandal is an extremely slow – growing hardwood species.

3.8.14. Dibbling of Seeds:

In areas where adequate sandal trees are absent, dibbling of sandal seeds can be done. The pretreated seeds may be dibbled after the clearing of ground and soil racking 1 m^2 or 2 m^2 apart and the sown seeds should be covered with a thin layer of soil. This work may be done immediately after the beginning of rainy season. Not less than 0.5 kg of seeds shall be sown in 1 ha plot. About 5-10 seeds shall be dibbled per spot. To keep account of the sowing spots pegs numbered with paint shall be used. For dibbling the sandal seeds below thorny Plants a fork shall be used to lift drooping branches so that the mazdoors can freely approach the base of the Plant.

3.8.15. Raising of Seedlings in Poly bags:

One to two and half year old sandal seedlings with stem size of pencil thickness along with host plants may be planted in the field. Preferably 120 polythene bags must be raised to get 100 good seedlings of sandal i.e. about 20% in excess has to be raised giving margin for casuality. Mother bed of sandal may be raised at least 2 or 3 months ahead of mother bed of host Plant. Mother bed of sandal may be of pure river sand without silt. It has to be raised at least 20 cm to 30 cm above the ground level and sides supported with bamboo thatties. Fungicides such as *Fytolon or Furadon* may be mixed with soil. One and a half to two kgs of seeds should be spread uniformly over the bed. It is better to soak the seeds for 24 hrs in lime water prior to sowing. Pretreatment with 0.05 % Gibberellic acid will quicken the germination. The seeds are to be covered with river sand of its thickness. Heavy watering should never be done. It will cause the dampness of the seedlings. If the beds are in open ground light shade may be given at the height of 1.5 – 2 m. Germination will start after 15-20 days. When profuse germination is noticed the direct cover over the bed may be partly removed. When the seedlings come out and cotyledons have not spread that is when it is in the form of a needle it is fit for pricking out in the containers. As it is the optimum size or time for pricking out there should not be any delay. Once the cotyledons spread out the survival percentage after transplanting with such seedlings will be very low. The germination of sandal will not be uniform and it will extend up to

3 to 4 months. Hence the operation of pricking out can neither be delayed nor be done in bulk. One will have to be vigilant to keep the containers ready for pricking out and transplanting daily as and when suitable sized seedlings of sandal are emerging and this should be a daily routine. These seedlings of sandal and host also shall be planted in the holes made in the container and compacted by using a small stick, without injuring the tender roots.

Host seedling shall be raised 10 to 15 days in the container and kept ready to prick out close to the stem of the parasite. In such cases the sandal seedling may be in contact with the base of the host Plant to develop the haustoria early and easily. Pricking out of sandal may be preferably on the shaded side of the host that is generally on the Northeast. After pricking out with the host Plant, it should be arranged under the shade and after that about 3 gm *Furadan* may be sprinkled around the base of seedlings. The shade may not be too thick. As it requires diffused light only a pandal has to be raised in an open ground so as to provide partial shade. Containers of 1000 to 2000 plants have to be arranged in a bed. The young seedlings need lateral shade too. Hence in addition to the 'pandal' fence with brushwood to a height of 1 to 1.5 m may be raised around. During 132 rainy days top shade may be shifted since dripping of rain water may increase dampness and kill the sandal seedlings. Once the host Plants grow fairly tall to provide lateral and top shade the artificially raised shade pandals on the top has to be removed since excess of shade will harm the seedlings.

3.8.16. Watering:

Regulated watering with rose can alone should be done and excess watering should never be done. On no occasion the container should become slushy or water logged. Once the stem develops brown bark, watering can be done both in the morning and evening. This will be necessary only in hot climate and dry regions.

3.8.17. Method of Planting:

Since the regeneration work is done in natural forest with trees, alignment and espacement are not suggested. $60cm^3$ pits are suggested for Planting. The stumps of *Lantana, Acacia intia* etc should be uprooted around the Planting spot in a diameter of 1 to 2 m, for avoiding immediate suppression. In other areas uprooting of the other stumps should be avoided since the sandal needs host Plants in later periods.

Planting should be done in May-June immediately after the pre-monsoon. No Planting should be done after June, which may cause damping off. Taller and healthy seedlings of at least 75

cm height, 2 to 2.5 year of age shall be planted out in pits. Host Plants shall also be planted in the same pit. Casualty replacement can be done whenever required.

Two weedings are suggested after Planting i.e one in August-September and after that in November-December. A mazdoor may be engaged for an extent of 10-15 ha as watch and ward for protecting the Plants from grazing, other biotic interference, removal of climbers, for trimming the side branches of Planted host Plants whenever suppression occurs and for lopping the branches of adjacent trees. Fire protection work should be done during the fire season.

3.8.18. Vegetative Propagation:

Most suitable methods for vegetative propagation are

1. Root suckers
2. Side grafting or cleft grafting

1. Root suckers: Breaking of roots induces sleeping vegetative buds to regenerate. Construction of staggered trenches in sandal wood Reserves cause the breaking of the root portion resulting in regeneration of sandal and conservation of soil and moisture which will enhance chances of establishment of the regenerated seedlings. Root suckers from the mother trees can be collected and pricked out in to filled bags. These polythene bags will be kept in glass houses under controlled conditions. Root setting hormones may be applied for getting seedlings from this root portion.

2. Side/Cleft grafting: For grafting the scions are collected from the upper part of the tree showing vigorous growth. The scions must be 15-25cm long and of 6-12 mm diametre. It shall not have flower buds but dormant vegetative buds preferably. The scions may be kept in moist and cool place until grafting is done. The side grafting /cleft grafting may be carried out depending upon the size of the root stock. Side grafting shall be attempted if the diameter of the root stock is bigger than the scions.

3.8.19. Augmentation in Sandal Reserves:

Sufficient regeneration is not taking place in the natural area of sandal due to heavy weed growth of lantana and other weeds, biotic factors like fire, severe grazing etc. Augmentation plots had been raised for enhancing the growth of natural seedlings. Artificial regeneration like Planting of basketed seedlings, trenches for sprouting of root suckers etc were done. Fire tracing, barbed wire fencing and strip weeding also have been done in these areas.

3.8.20. Host Plants:

It is found that once the sandal seedlings get established and start growing; most of the host Plants disappear gradually and probably this might be due to the parasitic effect of sandal seedling on host. This might even be one of the reasons for the failure of Sandal Plantation when sandal seedlings are raised in places where proper uprootal or weeding of other species had been done prior to planting. By means of complete uprootal the survival of the tree species becomes difficult and the land becomes devoid of any host species, other than the seedlings raised in container along with the raised sandal seedlings. Once the host plants get killed for want of other plants in the vicinity, the sandal seedling do not thrive well. However this requires a detailed study. The suitable host plants are *Albizzia lebbeck. Albizzia odoratissima, Wrightia tinctoria, Cassia auriculata, Alangium lamarcae, A. concinna, Vitex negundo, Dendrocalamus strictus, Bambusa aurandinacea, Azadiracta indica, Accacia suma, Zizyphas oenoplia, Dalbergia sissoo, Acaccia intia* etc.

3.8.21. Felling:

The marked tree will be uprooted by digging around them so as to secure all the main roots that contain heartwood. It is easier to do the uprooting during the wet weather. On the fall of a tree, the minor branches and small roots that do not contain heartwood will be lopped.

All the main branches must be sawn off from the stem. Sawing must be done flush with the stem so that the stem is free from basal ends of branches. Each branch will bear the number of tree and its own serial number. The root portion will also be separated from the stem and if the main root carries a number of big sized side roots, the later should be sawn off neatly and given the serial number as in the case of branches. All the sawing severing of branches and roots shall be done in the forest only if it would be inconvenient to transport the entire tree as such to the Depot. If that can be done without difficulty, the billeting will be done only at the depot.

3.8.22. Protection problems in Sandal area:

Attappady and Agali Ranges have abundant sandal regeneration. Mannarkkad Range also has an isolated bit where profuse sandal regeneration exists. Since Attappady and Agali Range lie adjacent to Tamilnadu and the said sandal Mafia has origination in Mannarkkad area, establishment of sandal growth is highly cumbersome and challenging as it has to overcome strong threats from the local as well as from the adjoining state, Tribals and unemployed youth are mainly attracted to the sandal smuggling as it fetches good amount.

It is observed that most of the saplings and pole stage crops are being half cut at the bottom portion to check the presence of heart wood. Though the presence of heart wood is known from overall appearance, it has become a tendency among the smugglers to cut the stem and verify the core portion. This has damaged poles and affects further growth, cattle grazing and lopping of sandal tree tops are another serious problem faced in the establishment of sandal regeneration. Sandal areas are easily accessible as it is surrounded by habitations.

3.8.23. Prescriptions:

a. Construction of camping shed with transportation & communication facilities: Sandal regeneration mainly exists in areas under Puthur Station of Attappady Range, Sholayur and Ommala stations of Agali Range and Thiruvizhamkunnu station of Mannarkkad Range. Many of the areas are more than 5 km away from the concerned station or its out posts, hence it is suggested to construct watch tower/camping shed with sufficient watchers and staff with mobile phones. Presence of staff and watchers in the camping place and frequent patrolling would help in protection; Mele Mulli, Puliyapathy are more than 20 km away from their respective stations.

Provision of staff and sufficient number of watchers with all infrastructures are necessary for protection of sandal, Watch tower/camping shed of low cost can be built with ankles and metal sheets with elephant proof trench is suggested in the following area

Table - 43 - Details of Campsheds required for protection of Sandal area

Sl.No	Location	Station & Range	Distance from Station (km)
1	Mallikkathottam	Pudur, Attappady	4
2	Moolakombu	Pudur, Attappady	6
3	Parappanthara	Pudur, Attappady	12
4	Mulli	Pudur, Attappady	20
5	Cheerakkadavu	Pudur, Attappady	8
6	Pattanakkallu	Pudur, Attappady	8
7	Puliyapathy	Sholayur, Agali	20
8	Thacha mala	Ommala, Agali	6 from outpost

It is prescribed to construct watch towers and observation posts at sensitive locations where ever required. Eight locations are suggested during the plan period with centralized stations have wireless systems and powerful binoculars.

b. Training: Frequent training to staff for creating awareness among people is highly essential to ensure sandal protection. The staff should be given proper training in scientific investigation and charging of cases. They should also be given constant updating in forest laws and latest orders and rules in force.

c. Strengthening VSS activities: For preventing smuggling of sandal wood, adequate measures have to be taken for providing gainful employment to local people and tribals who are lured by the mafia. For gaining the confidance of tribals and local people steps are to be taken for implementation of forestry schemes actively through participation of local communities.

It must be clearly understood that long term protection and management of sandal Forests is possible only by taking the local people into confidence. For establishing and maintaining good relationship with local communities, tenure of not less than 3 years is prescribed for the staff engaged in VSS activities.

d. Block level protection units: Block and protection unit is to be introduced for effective protection. Six blocks of 100 hectares each are formed to manage 590.3493 ha of sandal regeneration area. Each block is under the charge of a Forester, 3-4 Forest Guards and 4-8 watchers. The presence of staff and watchers should be available in blocks/ protection units for 24 hours in a day and 7 days in a week. More number of staff and watchers should be deployed during night. Annual plans regarding engaging of protection watchers in each block shall be prepared every year and should be included in the protection strategy.

e. Day and Night Patrolling: Patrolling in sensitive points, smuggling routes and along the borders shall be strengthened. A system for day patrolling shall be developed and put in practice.

f. Maintenance of Roads and Trek paths: In order to facilitate easy movement in the Forests and to help protection, the existing roads and trek paths are to be maintained annually. New trek paths should be constructed wherever required.

g. Purchase of Arms and Ammunition: Sandal smugglers are well equipped with arms and ammunition hence, the staff engaged should be provided with arms and ammunition for their safety.

h. Provision of Camping materials: The staff engaged in sandal protection stay in camp sheds during night, hence it is necessary to provide camping equipments such as sleeping bags, rain coats, pull over, torches, binoculars, mobile phones etc.

i. Procurement Vehicles: New vehicles with communication facilities are to be procured for effective protection.

j. Intelligence Gathering: Strengthening of present intelligence network both within and outside the state is highly essential. Intelligence gatherers should be suitably rewarded and their identity protected.

k. Installation of Chain linked fencing: Fencing of areas using 125 mm GI wire mesh and 50 × 50mm angles can be undertaken gradually during the plan period. Fencing can protect the sandal regeneration from cattle grazing and smuggling. While erecting chain linked fencing, the aspect of Wildlife habitats and movement of large mammals shall also be taken in to consideration. Regular movement paths of large mammals shall not be blocked.

l. Enumeration of Sandal Trees: All the sandal trees having GBH 30 cms and above have been numbered in 2011. fresh numbering of sandal have been done after drawing a base line of 90 cm width through its lengthiest portion and cutting the base line at odd numbers viz. 1, 3, 5, 7 and 50 cm for drawing strips of 90 cm width on either sides and gap between two strips is 40 m. Total enumeration is carried out in alternate strips which shall cover the entire area. These were classified as seedlings, saplings, poles and trees above 30 cm GBH. Details of sandal enumeration held upto 31-12-2011 is furnished in Table below it is suggested to do this exercise once in 3 years and update the data on sandal growing stock.

Table - 44 - Sandal Regeneration in Mannarkkad Division

Sl. No	Location	Range	Station	Extent (ha)	Seedlings (No)	Saplings (No)	Poles (No)	> 30 cm at BH (No)
1	Mallikathottam	Attappadi	Puthur	36.7590	2174	2835	1818	56
2	Moolakompu	Attappadi	Puthur	18.0000	7867	6056	5134	125
3	Parappanthara	Attappadi	Puthur	77.0000	1092	2705	1897	72
4	Mulli (Cholamannu)	Attappadi	Puthur	15.1000	3127	2403	1769	0
5	Mulli (Gundukalmala)	Attappadi	Puthur	39.7000	7422	5964	4029	26
6	Vannikkad	Attappadi	Puthur	5.0000	71	217	19	0
7	Cheerakadavu	Attappadi	Puthur	49.0900	1188	298	350	36
8	Pattanakkallu	Attappadi	Puthur	106.0000	1795	1843	3612	48
9	Moochikadavu	Agali	Sholayur	63.0208	3436	3474	8088	464
10	Puliyappathi	Agali	Sholayur	36.6200	2850	2199	3414	130
11	Marappalam	Agali	Sholayur	55.2000	1701	1475	5444	489
12	Goolikkadavu	Agali	Ommala	40.0800	10120	12121	11904	511
13	Thachamala	Agali	Ommala	21.5095	3122	1586	1174	12
14	Puttanikkad	Mannarkkad	Thiruvizham kunnu	27.2700	150	80	111	42
TOTAL				**590.3493**	**46115**	**43256**	**48763**	**2011**

m. Regeneration Survey: Along with enumeration of sandal, regeneration survey has to be conducted for assessing the regeneration status. Establishment of seedlings, saplings and poles are to be enumerated. Present regeneration survey shows that percentage of regeneration is high. Suitable site improvement activities such as soil and moisture conservation, nutrient enrichment etc may be done for enhancing the natural regeneration and survival of established seedlings.

n. Weeding, Protection from grazing and fire: The removal of weed growth through strip weeding will enable the germination of sandal seed and subsequent establishment of the seedlings. Hence, it is prescribed to conduct weeding before the flowering of weeds. Steps may be taken for protection of areas from the

damages of fire by suitable methods like construction of fire line, engaging of firewatchers etc.

3.9. Ganja Cultivation and its eradication:

Ganja cultivation is one of the major problems in Mannarkkad Division. Out of three ranges, Attappady is highly prone to Ganja cultivation. Attappady area is most susceptible to Ganja Cultivation because of its geographical factors like climate and rainfall. The forest areas bordering Kerala and Tamilnadu in the Attappady and Nilgiri Hills are in difficult terrain, most suited for Ganja cultivation. People especially from high ranges of Idukki, Devikulam, Marayoor and Chalakkudy lure the tribals of Attappady for Ganja cultivation. They offer arrack and money in return for their services. Frequent raids are the only solution to eradicate Ganja from the area.

3.9.1. Prescriptions:

- Frequent raid is the only possible solution for eradication of Ganja once for all.
- Rapid Action Force (RAF) formed during 2004-05 period may be revived with new task of eradicating Ganja and protecting Sandal regeneration.
- Open out station camps at vulnerable areas for taking stock of the situation and enhance suitable preventive measures. Camping staff may be provided all facilities for their protection and effective performance of duties.
- Deployment of adequate watchers especially who had previous knowledge of routes and areas or who had served in AHADS may be utilized.

Ganja eradication should find a permanent place in the Annual plan of operations with sufficient funds to ensure that the eradication programme is not affected. Ganja eradicated areas are to be afforested with suitable miscellaneous species with the participation of tribal community through tribal VSS.

CHAPTER - IV

BAMBOO, REED AND CANE WORKING CIRCLE

4.1. General:

Kerala was known to be the land of bamboos, reeds and canes and these were extensively used in the house construction, furniture making, cottage industries etc. Apart from Forests bamboos were available in plenty in homesteads, wastelands, streams and riverbanks. Twenty two species of bamboo and two varieties belonging to six genera are recorded as native of Kerala. These include *Bambusa, Dendrocalamus, Pseudoxytenanthera, Schizostachyum, Sinarundinaria* and *Ochlandra*. Majority of bamboos in Kerala are found at an elevation of 50-150 m above MSL.

The species belonging to genera such as *Ochlandra, Bambusa* and *Dendrocalamus* are seen extensively growing in large forest areas as bamboo brakes and reed brakes. The species like *Bambusa bamboo* and *Dendrocalamus strictus* are adapted to dry plains and hilly tracts. Their distribution is abundant in the moist deciduous Forests. *Bambusa bamboo* is generally found at an elevation between 50 m-1000 m and distributed throughout Kerala. *Dendrocalamus strictus* is distributed in the Forests of Attappady at an altitude of 150-750 m above MSL.

Ochlandra travancorica and O. *reedii* or simply reeds is a species of bamboo found abundantly in the Forests of Kerala. Bamboo mats woven from reeds is very popular in the state and so is bamboo ply, the resin bonded bamboo mats, which are a good substitute for wood/plywood based applications. Since the plant propagates rapidly and the collection method is selective felling, the ecological balance is not disturbed even if reeds are cut in large numbers. As a natural renewable resource, bamboo is regaining its popularity in the modern world.

4.2. Character of the Vegetation:

Bamboosa arundinaceae and *Dendrocalamus strictus* are the main species found in Mannarkkad Division. *Bamboosa arundinaceae* occur in drier tracts and *Dendrocalamus* is confined to moist areas. The reeds seen in Mannarkkad Division are mainly *Ochlandra reedi*i and *Ochalandra travancorica* in evergreen and semi-evergreen forests. Commonly found canes are *Calamus reedii, Calamus tennur* and *Calamus travancorica*

Table - 45 - Distribution of Bamboos and Reeds

Sl. No	Species	Local Name	Altitude (m)
1	*Bamboosa bamboo*	Mula, Illy	40-1000
2	*Bamboosa giganteus*	Para mula	400-700

Sl. No	Species	Local Name	Altitude (m)
3	*Dendrocalamus strictus*	Kellanmula	5-800
4	*Ochlandra beddomei*	Eetta	400-600
5	*Ochlandra ebracteata*	Velleetta	400-70
6	*Ochlandra Kerelensis*	Eetta	600-800

4.3. Objects of Management:

- Ø To conserve the existing growing area from conversion or destruction
- Ø To improve and increase the productivity to ensure continued supply to industrial units and working communities
- Ø To ensure systematic and scientific extraction and effective management
- Ø Enhancement of resources through promotion of bamboo augmentation in forest areas and waste lands
- Ø Promotion of bamboo cultivation in private lands as a commercial crop
- Ø Improvement of bamboo productivity by use of scientific management practices

Use of bamboo for environmental protection, greening up of degraded lands and other diversified activities such as watershed protection, greening up of degraded lands and river banks

4.4. General Constitution of the Working Circle:

4.4.1. Bamboos: This Working Circle constitutes all the bamboo bearing areas of the division. The main bamboo bearing areas in the division are Manjkandy, Gottiyarkandy in Attappady Range; Verikakkadavu, Goolikkadavu in Agali Range and Vakkodan Malavaram, Karimba, Thiruvizhamkunnu areas in Mannarkkad Range.

There are more than 1250 species of Bamboo under 75 genera in the world. India perhaps has the world's richest source of Bamboo. It has about 130 spp. occurring over an area of 10.03 million ha, this is about 12.8 % of the total forest area of the country and represents 20 % of World's production.

Even a large culm of 35 metres height attains its full height in 2-4 months. Then the culm tissues harden, the internodes become hollow and branches with leaves are formed in the upper part. In some species like Giant Bamboo, the sheath covered shoots emerge from the soil at the rate of 4 cm/hr. So rapid is the growth on moist warm mornings that one can actually hear the shoots grow.

Clump and Culm: Most Bamboo species of commercial importance form culms. The new seedlings produce rhizomes that in turn produce clumps. New rhizomes develop from the previous rhizomes. In India, new culms generally appear during the rainy season. Culms are tender during the growing period. They grow tough in the second year and are mature in the third year. At the age of 3 years they acquire full density and strength. After this age, they started changing colour.

Rhizomes: Rhizomes generally grow at an upward inclined angle. The angle of incline depends on the species and conditions of soil. During this period of growth, any exposure to sunlight stops the rhizome development. Rhizomes may develop in any direction and the culms may appear anywhere in the clump.

Flowering: Most of the woody bamboos flower and seed after an exclusive vegetative growth for a species specific supra annual intervals ranging between 3 and 120 years. There are three types of flowering.

1. Those which flower gregariously and periodically

2. Those which flower irregularly

3. Those which flower annually

In gregarious flowering, all members of a cohort (Plants from seeds of common origin) enter the reproductive phase approximately, at the same time and after flowering and seeding the parents 'die en masse'. This death of the bamboo parents used to be given more importance, probably because of their long intermast period and arborescent habits.

In sporadic flowering, members of a cohort enter the reproduction phase at different or irregular intervals and after flowering (and seeding) the parents do not die but revert to vegetative growth. Some species like Indocalamus wightiana, Bambusa atra and Ochlandra scriptoria flower annually. This peculiar flowering behaviour in bamboos has resulted in a poor understanding of their inter-relationships besides making difficult the perennial raising of plantations using seeds.

Method of Treatment: Extraction of bamboos on large scale for industrial purpose is not recommended. Bamboo dominant forest areas of the division comprises of 142 ha in Mannarkkad Range, 452 ha in Attappady Range and 191 ha in Agali Range totalling 785 ha in Mannarkkad Division. For the purpose of felling and management, the entire area is treated as one felling series. A quantity of not more than 1/3 yield is recommended for extraction. This is recommended once in three years and limited to 2000 MT only.

Computation of Yield: Bamboo culms become mature for use in 3 years when the industrial clump from rhizome origin or seed origin gets established in about 1 year. The total number of utilizable bamboos available in respective felling series does not include broken, malformed, deceased and otherwise unsuitable culms. About 2/3 of the growing stock can be taken as yield considering the regeneration status of bamboos in the division.

Felling Cycle: Felling of bamboo is prescribed once in 3 years only. The total quantity is fixed as 2000 MT for 3 years. Felling should be regulated accordingly.

Felling Rules for Bamboo: The following rules should be strictly followed while felling bamboos

i. No culms of the current year shall be cut. All culms less than one year and at least six older Culms shall be left unfelled in each clump.

ii. Culms more than two years may be felled if the clump has more than six mature culms. Older culms unfelled shall be evenly distributed over the clump.

iii. Clumps with less than six mature culms shall not be felled.

iv. Culms shall be cut clean and as low as possible but not below the first node from the ground level.

v. No culms shall be removed with rhizome.

vi. All dead culms should be extracted and also the mal-formed and top-broken ones, if their removal will not be detrimental to the clump.

vii. Culms should be removed from the center towards the periphery by cutting in from the side opposite to where maximum numbers of new shoots are developing. This should result in a more or less horseshoe shape.

viii. In flowered areas, no felling will be done before the flowering is complete and seeds have sown themselves on the ground i.e., felling shall be done only the next year.

ix. In such flowered areas the entire clump is to be clear felled.

x. Remnants of felling should not be left on the clump or along roadsides.

xi. These shall be removed close to streams and left so as to reduce fire hazard.

xii. No felling shall be done on very steep hillsides where felling or extraction of bamboos will accelerate soil erosion or cause other ecological loss.

xiii. Felling shall be done systematically by dividing each coupe into small blocks or strips and working one strip at a time. Work shall be started from the farthest end and continued towards the roadside.

Cultural operations: The clumps should be cleared by removing the dead and decaying materials and cutting climbers. All the debris and slashes should be collected and stacked along the contours.

Annual fire accelerates the depletion of bamboo and reed resources. Fire prone bamboo areas should be protected from fire damage. The areas of bamboo working circle being part of the catchments, they are to be protected by appropriate soil and water conservation measures as prescribed under Protection Working Circle.

Regeneration: Artificial regeneration of bamboos is recommended in natural Forests wherever the stock is poor. Rhizome planting is ideal in bamboo worked coupes to augment the area. River bank stabilization is suggested with planting of bamboos. Intensive regeneration activities are required to arrest further depletion of growing stock.

Kerala Bamboo Mission: The State Bamboo Mission was constituted in November 2003 with the broad aim of marshalling the scattered resources of the state and adopting a focused approach to revitalize the bamboo sector thereby promoting value addition, enhancing income generation and alleviating poverty. The main activities are

- Promoting cultivation of bamboo and cane
- Promoting upgradation of skills of craftsman and artisans through training
- Promoting development of new products and innovative designs and usages
- Promoting research in the bamboo sector to bring in new technologies, higher levels of mechanisation and better value realization

Tapping the IT strengths of the State for creating a network / linkage of service providers, experts, research institutions, commercial operators and Government bodies to provide access to information on markets and technologies for the benefit of bamboo cultivators and artisans.

By these the mission intends to secure the foundation of sustainable bamboo based economy providing livelihood and economic security to artisans, craftsmen, planters and industrial workers through a broad based association linking Government NGO's SHG's and local bodies.

Management Prescribed:

Dressing of bamboo clumps is essential for sustaining the production since the congestion of culms is known to affect the production of new shoots badly. Bamboos mature within three years and hence a felling/dressing cycle of three years is prescribed.

Yield: The yearly availability of bamboos as per estimation of KFRI is 17200 MT in the Division. Considering the present rate of extraction, the availability in a three year felling cycle, and that all the areas are not accessible for the extraction, taking a conservative approach 1/8 of the recruitment quantity is prescribed to be harvested

Mannarkkad Range 500 MT

Attappady Range 2000 MT

Agali Range 2000 MT

The flowering cycle reported for *Bambusa spp* is 30-35 yr (Seethalakshmy and Mukesh Kumar, 1998). In case of flowering, the extraction of the fully flowered quantity can be carried out when the seed fall is over and after the rainy season.

Supervision: Adequate and strict supervision is necessary to ensure that the felling rules are scrupulously followed. It will be advisable to have staff who are well-versed with the area are given the supervision duty.

Regeneration: Effective protection from grazing and fire after the flowering and seed dispersal for a period of three years is recommended to ensure establishment of young bamboo regeneration. No dormancy has been reported for the dispersed seeds.

For artificial regeneration, seeds gathered by clearing and sweeping the ground below the flowered clumps, can be sown in nursery beds during March to May. In one kg, there will be 75,000 - 1,05,000 seeds (Sen Gupta, 1936) and the germination percentage is 90 to 100%(Luna, 1996). From one kilogram of seeds, about 55,000 seedlings can be produced. The seeds are sown in nursery beds and watered daily for a week and later, on alternate or once in three days. Partial shading of nursery beds

can improve establishment and growth of seedlings. Growth rate of culms varies depending on the area of planting, which also affect the length of internode. It is suggested to undertake bamboo planting in moist deciduous Forests with scanty bamboo occurrences in a phased manner. Planting of poly bag seedlings in a 30cm × 30cm × 30cm pit formed in the middle of a platform of 1m × 1m with 30cm at the cutting end is advisable. The spacing can be 6m × 6m to 8m × 8m. No other site clearance or weeding is required. The platform can be maintained prior to the onset of south west monsoon during the second year.

4.4.2. Reeds and its prescriptions:

The species found in the division are Ochlandra tranvancorica (Eetta). The reed management will be in tune with the State Reed Management plan. The members of 34 tribal settlements will be allowed to collect reeds free of cost for their bonafide domestic and agriculture purposes. In the previous Working Plan, though the prescription was not to allott reed extraction for industrial purpose, was deviated from the prescription by allotting 784200 Nos reeds to M/S.HNL. Hence, it is strictly prescribed to allot the working community especially the Kavaras and SC community, who depend on reeds for their livelihood, can be given permits for collection of reeds for their bonafided use. The same shall be communicated to the APCCF (Prot) for information.

Felling Rules for Collection of Reeds:

1. No culms less than two years will be cut.

2. There shall be one full inter node with septa intact above ground level after felling.

3. All new culms and not less than one fourth of the old culms will be left in the clump.

4. No clump shall be clear felled.

5. The extraction of the culms shall be done from the side opposite to that where maximum fresh culms are emerging.

6. All utilisable length shall be collected and no wastage left at site or over the clump obstructing fresh growth.

7. Felling shall not be done on very steep slopes, generally all ecological principles of soil, water and plant and wildlife conservation should be followed.

8. Reeds shall not be worked commercially in June, July and August, as it is the regeneration period. But an exception

may be made in the case of legal head load collectors who collect for their cottage unit.

9. 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.

10. Each clump should be cleaned by removing the debris, fallen top etc. after felling.

11. Each annual coupe should be worked and completed systematically.

12. All dead and mal-formed culms, irrespective of size and age should be removed.

13. No damage should be inflicted on the young shoots, buds and other culms that are retained in the clump.

Regeneration:

Artificial regeneration of reeds as constituent of eco-restoration works by planting in natural Forests along stream banks and in moist areas is proposed in this plan period. Strict adherence to the felling rules and proper fire protection is to be ensured.

4.4.2. Canes:

No commercial cane extraction is prescribed in this plan. Out of 14 species of canes found in Kerala, 5 species namely *Calamus delessertianus, Calamus hookerianus, Calamus thwiitessi, Calamus travancoricus* are predominantly growing in this Division.

Raising Cane Plantation:

The planting site should be selected in natural evergreen and semi-evergreen Forests depending on the species. Select an area where the forest floor is rich in humus and having moderate number of trees. Canes need the trees for support and shade and at the same time, require canopy opening for more sunlight.

Species Selection:

All the cane species growing in Kerala Forests are commercially important. Out of the 14 known species, two are single stemmed while others are clump forming. Since different species show preference to a particular altitudinal range, natural occurrence of a cane species should be considered for the suitability in raising plantations.

Preparation of planting material:

Collection of Fruits: The best months for collection of ripe fruits are April-May. Only ripe fruits should be collected since they only give good germination percent. The check for ripeness, press the fruits in between fingers. If the scaly cover is easily detached, the fruits are ripe enough for collection. Seeds should be kept moist since seed moisture content of about 40% is essential to maintain seed viability. It is advisable to plant them as soon as they are collected.

Extraction of seeds: To ensure a good germination, it is necessary to remove the outer scaly cover, the inner fleshy layer forms the seed. The scaly cover can be removed by crushing the fruits with hands or by pounding them gently in a mortar with a wooden mallet as done for de-husking paddy. Then soak the seeds in water for about 48 hours to induce fermentation of the fleshy layer. Remove the fleshy part of the seed by rubbing with hands and collect the clean seeds settled at the bottom of the vessel. These seeds can be stored for a week, but care should be taken to keep the seeds moist, as dry seeds fail to germinate.

Fungicidal treatment: Before sowing, treat the seeds with any one of the fungicides-Captan 75 WP, Thiram 75 WP or Bavistin 50 WP to prevent any fungal infection. Before fungicidal treatment air dry the seeds for 30 minutes. Take 1 kg of seeds in a container and add 3 gm of any one of the fungicides and shake well so that each seed gets the powdery coating.

Nursery Techniques: Keep the treated seeds in moist saw dust in a polythene bag for about two weeks till the seeds start germinating. Sprinkle water over the saw dust when the upper layer gets dry. The process will help to hasten the germination.

The nursery site should be selected near a perennial water source. Nursery must be partially shaded, with a thatch of palm leaves or coir mat as cane seedlings need shade for their initial growth. It is better to sow the germinated seeds in polythene containers of 15 × 20 cm size filled with a mixture of forest top soil and sand in the ratio 3:1. Arrange the polythene containers in the nursery over a black polythene sheet spread over the soil, so that the growing roots do not penetrate the ground. Transfer the saw dust with the seeds from the polythene bag to a shallow tray. Plant the just germinated seeds in the polythene containers already arranged in the nursery. Alternately, the germinated seeds can also be sown in nursery beds and later pricked out into the containers. Maintain the nursery for a year and out plant in the following rainy season, June-July.

Planting:

Site Preparation: The site should be prepared for planting in the dry season. Plant the seedlings in line, the rows preferably running from east to west. The planting lanes of two metre wide are taken 8m apart from each other. Remove only the undergrowth from the planting lane alone and the area between two planting lanes should be kept undisturbed.

Out Planting: During rainy season, June-July, the seedlings can be out-planted. Take pits of 30 cm^3 size at a distance of 2-4 m on one side of the cleared path. Planting the seedlings along one side of the path helps the canes to climb the trees of that side earlier and this will leave a wider inspection path on the other side. The planting distance depends on the nature of the cane. Plant the seedlings after removing the polythene container without disturbing the soil around the roots in such a manner that the root collar is at level with the ground surface. Care is to be taken to ensure that the seedlings are not planted too deeply as this would delay the production of suckers.

Cultural Operations:

i. Brushing and mulching:

After the seedlings are established, brushing and mulching of the soil around the clump once in six months will encourage the growth of seedlings

ii. Weeding:

As and when necessary, line weeding should be carried out for 2 years. Once established, rattans require less care and maintenance. The seedlings will be in the rosette stage(without stem formation) for the first three years. In the fourth year, stem formation begins and the plants will increase in height gaining 1 to 1.5 m length per year. First harvesting can be done after 8 to 10 years of planting. Extraction of canes should not be done during this plan period. Artificial regeneration of canes is prescribed in a phased manner in the selected natural patches.

CHAPTER -V

NON-TIMBER FOREST PRODUCE & TRIBAL WELFARE WORKING CIRCLE

5.1. Non-Timber Forest Produce (NTFP):

Non-Timber Forest produces (NTFP) include all forest products other than timber and firewood of both plant and animal origin, occurring naturally or sometimes as augmentation in Forests. As compared to animal products like ivory, honey, wax, lac, horns, musk etc plant products natural and man-made are much diversified depending upon the availability of forest types and species grown in man-made Forests and also the extent of forest in a given area or region. NTFP is an output from the forest without disturbing the eco-system. As we are passing through an era of conservation, it is right time to manage the produce and revenue from NTFP so that the reduction in revenue from timber could be compensated.

5.1.1. Objectives of Management:

1. To manage the Non-wood Forest Produce on a sustainable basis,

2. To integrate the developmental activities for the welfare of tribes to improve their standard of living

3. To develop and adopt a package of scientific practices for sustainable extraction and usage of medicinal plants.

4. To ensure holistic development and welfare of tribes of the region.

5.1.2. Division of the Area:

Entire forest area of the Division excluding tribal settlements and area leased to PCK and Private plantations are included in this circle. The area is divided into three working units, covering one forest Range each namely Mannarkkad, Attappady and Agali.

5.1.3. Constitution:

All the forest areas under the jurisdiction of Mannarkkad Forest Division are brought under this working circle. It is overlapping with all other Working Circles and the area of the Working Circle will be the total area of Mannarkkad Division.

NTFP plant species are being over-exploited from the Forests to meet the market demand which has resulted in depletion of this resource. Hence it necessitates sustained utilisation and conservation of NTFP plant resources. Sustainable management of this natural resource requires authentic information on the identity of species, demand and supply, regeneration, scientific harvesting and processing techniques.

Protection and improvement of the natural habitats of NTFP species is essential to ensure continued availability of NTFP, apart from their 'ex-situ' conservation and establishment of plantations either within or outside the forest areas to supplement the yield from natural Forests.

There is a need to conserve these species to posterity. Plants yielding NTFP form part of the floral diversity and hence conserving the natural flora is the means to protect NTFP spp. Taking stock of the present availability and resource status of the plants and products, identification of species which deserves protection and propagation, delimitation of habitat of NTFP plant for overall conservation, formulating non-destructive methods of harvest and sustainable utilization and evolving methods for regeneration are certain aspects which deserve immediate attention to ensure the continued availability of products and benefits from this group of plants in future.

At present, NTFP are procured and marketed through Kerala State SC and ST Federation, based at Thiruvananthapuram. Kurumba Tribal Society of Chindakki No.P-650. Attappady Range and Sholayur Girijan Co-operative Society of Sholayur No.P-496 in Agali Range are the two tribal societies engaged in collecting NTFP from the entire Mannarkkad Division. Kurumba Tribal Society collects NTFP from Attappady and Mannarkkad Ranges where as Sholayur Society collects from Agali Range. These societies mainly collect the following NTFP's from the areas under Mannarkkad and Silent Valley Divisions. Kungilium collected from *Boswellia serrata*, Nannari (*Hemidesmus indicus*), Amal Pori (*Rauvolfia serpeitina*), Chinikka (*Acacia sinuata*), Kakkum kaya(*Entada rheedi*),Kurumthotti (*Sida rhombifollia*), Chundaveru (*Solanum Violaccum*), Orila (*Desmodium gangeticum*), Karimkurinji (*Nilgirianthus ciliatus*), Pathiripoov (*Myristica malabarica*) Kattuthippali (*Piper longum*), Nelli (*Phyllanthus emblica*), Kadokka (*Terminalia chebula*), Kalpasam (*Nervilia aragoana*), Cheruthekkuveru (*Callicarpa tomentosa*), Kattu kurumulagu (*Piper nigrum*), Anathippali (*Raphidophora pertusa*), Padakizhangu (*Cyclea peltata*), Uruvanji (*Sapindus emarginatus*), Honey and wax.

The above NTFP are collected from Tribes of respective ranges, who are also members of tribal co-operative societies for which they are paid an amount in proportion to their collection, based on market rates by the societies. The procurement price for

each item, month of collection, selling rate for each item collected from tribal societies for the past 10 years and the abstract is furnished in Table below. Detailed procurement list and selling rates of each item by the tribal societies during the previous Plan period is furnished below.

Table - 46 - Procurement and sale of NTFPs by SC/ ST Federation

Sl. No.	Species	Quantity (kg)	Purchase Value (Rs)	Sale Value (Rs)
1	Kunkilliam	20699	7,12,349	9,59,450
2	Wax	385	28,689	9,187
3	Honey	12235	10,46,315	13,17,008
4	Nannari	202	51,440	14,945
5	Kudampuli	33	1,018	1,224
6	Amalpori	11	773	1,036
7	Cheenikkai	183768	26,79,409	32,34,856
8	Athi Tripalli	5346	2,28,695	3,06,610
9	Pada Kizhangu	15003	17,17,391	23,26,116
10	Kurunthotti Pacha	3874	46,037	47,803
11	Chunda Pacha	39916	4,65,884	9,78,260
12	Orila Pacha	20595	2,20,027	2,32,385
13	Kattutrippalli Pacha	21	75	0.00
14	Orila Dry	2704	35,792	61,000
15	Chunda Dry	8771	1,04,784	1,57,887
16	Moovila Dry	289	4,335	7,514
17	Kurunthotti Dry	1126	19,914	24,713
18	Nellikka-Pacha	200	900	1,100
19	Nannari-Dry	83	6,852	14,370.50
20	Pathiripoovu	1267	12,339	8,369.00
21	Urinchikka	30	150	180.00
22	Avanakku	107	749	982
23	Karinkurinji	36949	3,06,828	4,52,236
24	MakkumKai	969	3,322	6,931
25	Kunkilliam-White	17	340	604
26	Cheruthekku	8264	99,333	1,97,757
27	Kadukka	2	8	20
28	Kalpamsham	10	594	0.00
29	Chunankan	5963	53,667	77,519
30	Karimkurinji-Dry	7640	61,120	1,06,960
31	Kattumulakinthandu	20599	2,36,458	4,89,443
32	Cheruthekku Dry	182	2,548	4,550
TOTAL		**396126**	**81,48,137**	**1,10,41,018**

Various medicinal plants collected by the tribals and gathered by the federation are listed below and a detailed note about each of them is given in detail in part I of the plan under flora and faunal diversity.

(i). Kungilium (*Boswellia serrata*)
(ii). Nannari (*Hemidesmus indicus*)
(iii). Amalpori (*Rauwolfia serpentina*)
(iv). Chinikka (*Accacia sinuata*)
(v). Kakkumkya (*Entada rheedi*)
(vi). Kurumthotti (*Sidra rhombifolia*)
(vii). Chundaveru (*Solanum violaceum*)

(vii). Orila (*Desmodium gangelicum*)
(ix). Karimkurinji (*Nilgirianthus ciliatus*)
(x). Pathiri Poov (*Myristica malabarica*)
(xi). Kattuthippali (*Piper longum*)
(xii). Nelli (*Phyllanthus emblica*)
(xiii). Kadukka (*Terminalia chebula*)
(xiv). Kalpasam (*Nervilia aragoana*)
(xv). Cheruthekku veru (*Callicarpa tomentosa*)
(xvi). Kattu Kurumulagu (*Piper nigrum*)
(xvii). Ana Thippali (*Raphidophora pertusa*)
(xviii). Padakizzhangu (*Cyclea peltata*)
(xix). Uruvanchi (*Sapindus emarginatus*)
(xx). Honey
(xxi). Wax

5.1.4. Mode of Transactions:

Tribal Societies based at Chindakki sell the NTFPs through the Federation office at Thrissur. Federation invite tender/auction for the items and quantities reported by the tribal societies and sell the produce from Thrissur office. The successful bidder collects the produce from various outlets/depots opened under Tribal Society of Attappady. The outlets/depots are opened and managed by depot managers for easy procurement of produce collected locally. Tribals bring the produce and sell it to the local depots. Poor tribes are cheated at this stage. Societies are not aware of the prices actually given to the tribals for the produce. At this juncture, tribal VSS can play an active role and save the tribals from exploitation. Initially, tribal VSS should closely link or tie up with tribal societies for getting the price and know the market situations. It is always better to sell the produce through the federation in order to avoid the exploitation in the market. Since they are accountable to the apex bodies, transactions will be transparent. This procedure can be tried on an experimental basis by registering tribal VSS with tribal Co-operative Societies in the region, thereby ensuring that they get reasonable prices for the produce they collect from the field.

Awareness programmes have to be conducted through VSS for its members (tribals who are engaged in collection of NTFP's) in sustainable harvesting of the produce. Scientific methods have to be adopted for collecting the produce from the field, so as to ensure that no serious damages/injuries are made to the host plant/tree. Suitable incentives have to be paid to the members during lean season by modifying the microplans of tribal VSS. Initial support can be provided by the department to the tribal VSS to overcome the problems for the first three years and later they will have to find the source of income themselves with the ways and means suggested earlier.

Medicinal plants are being over exploited and their availability is deminishing day by day. Conservation and sustainable utilisation of medicinal plants must necessarily involve long term strategy. Protection, preservation, maintenance, characterisation, evaluation, cultivation and sustainable utilisation are the main ingredients.

The scheduled tribes and other Traditional Forest Dwellers (Recognition of forest Rights) Act, 2006 recognises the right of tribals to collect the NTFP's with all legal protection. Section 3(1)(c) clearly defines that "the right of ownership, access to collect, use and dispose of minor forest produce which has been traditionally collected within or outside village boundaries." Section 3(1)(i) specifies the right to protect, regenerate or conserve or manage any community forest resource which they have been traditionally protecting and conserving for sustainable use"

The Act envisages the right of collection permitted exclusively to the tribals or traditional dwellers of the forest area and hence only the tribal VSS constituted for the purpose are empowered to collect the NTFPs from Forest.

The Government G.O (Rt) No: 40/2001/F&WLD (G) Department dated 02-02-2001 clearly stated the objectives for constituting Tribal VSS and Management of Non Wood Forest Produce. Tribal VSS is mainly constituted to enlist the participation of tribal communities living in the forest area for sustainable management of Non Wood Forest Produce (NTFP) and protection of rights to utilise the indigenous knowledge of tribal communities as far as possible. Based on the Government order and provisions of the Forest Rights Act, 2006, suitable steps can be taken to constitute Tribal VSS's to ensure that their basic livelihood problems are solved and to protect them from exploitation.

5.1.5. Prescriptions:

- Awareness programme has to be conducted among tribals to educate them about the non destructive methods of collecting NTFP so as to ensure lasting supply of the produce

- Frequent monitoring of the collection and ensuring reasonable rates for their produce to avoid exploitation.

- Separate scheme should be evolved for conservation of NTFP and their marketing in appropriate time to realise maximum price.

- Steps should be taken for value addition of the products

- Ø There should be adequate storing facility to keep the products without sacrificing the quality during glut season for marketing in appropriate times to get maximum revenue.

- Ø An inventory of all the non-timber forest produce yielding plants of Kerala is highly essential to know the distribution of different species for identifying in situ Conservation areas and also to decide on ex-situ conservation strategies to be followed for different rare or threatened species.

5.2. Tribal Welfare:

5.2.1. A Brief Profile of Attappady and its Adivasis:

Location and Landscape: Attappady lies in between 10" 55' to 11" 15' N Latitude, 76" 45' E Longitude. Attappady is an approximately 750 km^2 east slopping plateau in the North-Western corner of Mannarkad taluk in Palakkad district of Kerala. To its north is Nilgiris district and east Coimbatore of Tamilnadu. To the southwest and northwest, Palakkad district of Kerala borders Attappady. Attappady is essentially a plateau at an approximate elevation of 500 m above the sea level, which is dissected by Bhavani, Siruvani and Kodungarapallam rivers in to a series of valleys [Nair 2002]. The recent extensive and intensive human manipulations have accelerated the degradational changes in plant communities. All the higher ridges have Sub-Temperate Montane Evergreen Forests and Wet Temperate grasslands above 1600m. Below 1600m until about 900m above mean sea level and in sheltered valleys receiving more than 1800 mm of rainfall annually, typical evergreen Forests, which are also called rainForests, occur. Silent Valley and Attappady reserve forest have extensive areas of this type of forest. Most of the remaining areas of Attappady used to be covered by Semi Evergreen Forests. Areas with less moisture retaining soils and with regenerating vegetation had Moist Deciduous Forests. Except in Reserved Forests, most of the uncultivated, but previously forested areas of Attappady retain only scrub vegetation at present. Some ridge tops subjected to regular annual fires have denuded in the eastern and the western parts of Attappady.

The Adivasis were dependent on forest resources for their livelihood. As a result of inflow of settler population and establishment of government institutions they have become less self-reliant as they depend upon the settlers for their livelihood. As part of government's forest conservation measures their dependency on forest for their life has reduced. Among the adivasis of Attappady, the social relations and economic conditions and health status are better in case of Kurumbas. Linguistic differences notwithstanding, the different Adivasi tribes of Irulas, Mudugas and Kurumbas had many commonalities. They

engaged in collecting forest resources like honey, food and other minor forest produces. Slowly they shifted to agricultural activities and animal husbandry.

They had an economic system that was blended with the 'ecology' and nature around them. Land and other items were never seen as a commodity. Every Ooru had a council of moopans (elders) who were vested with the responsibility of guiding the members of the hamlets. The Ooru Moopan is the chief and he is assisted by other members of the council of moopans designated as Vandari, Kuruthala, and Mannookaran. Significant among the cultural activities of Adivasis, the folk songs and dances were considered to be part of their expressions. Adivasis also had their own forms of 'natakams' and 'koothus'. They also had mastery over many ethnic wind and percussion instruments like ‘para, thak peek, mangai, theral’ etc. The migration of the 'mainstream' Tamilians and Malayalis into the area in search of agricultural land began in the early 20th century and increased in the mid 21st century. The settlers emerged as major economic and the only political power within two decades of their settlement and presently outnumber the Adivasis. They managed to take land on lease from the Jenmi and later started claiming ownership of the land. This has deprived the Adivasis from their livelyhood.

Adivasis were following shifting cultivation. Irrigation was not part of their practice. Monoculture is not a preferred agriculture practice among them. They were sowing about thirteen varieties of seeds on slashed and burnt lands and using the piece of land till it yields. Harvesting of the yield is done as and when different crops mature throughout the year. They abandon that land after three years. Adivasis were practicing community agriculture. The community agriculture was called “Kambalam”. Men and women prepare the land collectively and sharing the yields. As in all other walks of life, the practice of agriculture too accompanied with dances, songs and playing of musical instruments. Participation in the Kambalam was voluntary. Alongside community agriculture there were also family agriculture, practices. In family agriculture, families or group of families participate. Allocation of land for agriculture purpose is done by the council of moopans headed by Ooru moopan. The Ooru moopan collects tax in return to be paid to the Jenmi. Among moopans the most reverred is the mannookaran. Mannookaran is the ritual head of agricultural practices of hamlets. Mannookaran is also considered as an expert in soil and agricultural practices. It was believed that with the loss of sanctity of mannookaran the land would stop yielding. Mannookaran decides the cultivability of a land, sows the first seed, and initiates the first harvest. Mannookaran's wife is responsible for the food preparation from the first yield. The mannookaran loses his sacredness when he gives up ethical way of life (neethi and nen) as it is conventionally followed. The mannookaran never

attends death rituals, as it was believed that participating in death rituals pollutes him. With the government takeover of the forestlands, government's wild life protection initiatives, settler inflow, establishment of governmental bureaucracy, familiarity with the settler practice of commercial agriculture, deforestation, soil erosion, displacement demanded by the 'development' and so on the traditional practices gradually became irrelevant and the adivasis were reduced to daily wage labourers depending on settler entrepreneurs. Documented property rights, their new labour status, establishment of money economy, decline of the traditional community governance by the elders, loss of traditional agriculture, introduction of arrack into their culture, the settlement of the outsider combined with ecological degradation has resulted in decline of their life style. The net effect of the changes is that, women lost grip on property rights, neither men nor women have to be dependent on each other as they work as labourers for the outside settlers. This has diluted the necessity for 'ena" relationship as well as that of the strong community relationships. The parent children relationship had become very different from the past. In the past, the family as a unit was collectively working towards food production and gathering. In the present life pattern, it is a rare occasion that all the family members sitting and conversing together. In most of the families, the mid teen age children became labourers whereas in some other families children stay at residential tribal schools. In either of the case, the bondage between children and parents is fast declining. Children earn money independent of their parents and hence for them there is no necessity to be guided by their parents. Everything happened so sudden to the adivasis, before they take stock of things in their life, life simply escaped their purview and took its own turn making drastic changes in their familial relationship with the changes brought with the settlement of outsiders and other events they had hardly any control over. As a result, the familial and community relationships are devastated and their life has become something very unfamiliar and uncertain to themselves.

The collected life experiences show the general trend in the adivasi community that, as children, they are neglected, at their teen age they enter into a weak conjugal relation, with childbirth they grow their children with meagre support from their husbands and other relatives only to be deserted at a later stage. The story of the men is also not very different. In the past as well as in these days the formal marriages are rare. Boys and girls, start living together when they find suitable partners. To start living with a girl, in earlier days the boy had to work for the parent of the girl for about a year. This is called *penvevela*. The boy has to pay '*Penvela*.' The boy had to pay the 'bride price' to her parents. To day, the custom is fast fading. The term *Penvela* literally means, "girl-work." It is the labour performed to get a girl as spouse. With the performance of *Penvela*, the boy convinced

the parents of the girl and the girl herself that he is capable of providing her a secured life. Some boys started demanding dowry. *Penvela* is not practiced these days. In the past, during *Penvela,* it was common that the pair eloped and stayed at the forest for days together. This was called '*kalavu*.' Usually the elopement is legitimated and they were allowed to live together. If parents of the girls are impressed by the boy who performs *Penvela*, the girls are given to boys in a ceremony arranged for this or asked to live with him. The consents of the girl mattered less. In the past as well as these days, the boy sets a house after he had found a girl. Earlier, there was no scarcity of land and neither there were land documents. The children settle near the house of either of the parents, mostly near the parents of the boy's house. As land has become a documented property the freedom to set a house at the place of preference could no longer be exercised. These days it is usual that the girl goes and stays with her spouse at a place owned by the boy's family. As law prevents the tribal lands from being sold to non-tribal, and also because tribal people are not usually that wealthy enough to buy land, girls do not enjoy their parental property, even though it can be given to her as per documents. Her brothers will usually enjoy her land. The adivasi society is gradually inventing patriarchical norms. For example, dowry that had never been heard among the adivasis is gradually emerging as a custom. The adivasi women say that present men unlike the men of older generation are less involved in household works. Child rearing, bread winning, family maintenance and household jobs are becoming women's sole responsibility. As most of the men are alcoholic, they even abuse their wives. Today, it is common that both men and women suspect their spouse of illicit extra marital relations and this has become a major reason for household feuds. This was not the case with the older generations. In contrast to the marital relationships of the younger generations, even today the elderly people of the adivasis can be seen always with each other's company either at home or at outside. They were always together even in their young age. Today, this can be rarely seen. Women and men go to work at different places and come back home only in the evening. Generally, by the time the men come home they are drunk. They do not share all the information with each other. Men and women have many things to hide from each other. For example, women hide the amount of money with her because, if it were told, the man would take it from her. Similarly, men have many common things they do with their workmates and others they meet at their workplace. This has distanced the spouses from each other. They know less of each other and they fight. Decades of encounter with the settlers and the interference of government mechanism in Attappady resulted in ecologically denuded situation and the social, cultural and economic impoverishment of adivasis. The combined effect of ecological denudation and impoverishment is hunger, ill health, malnutrition and the loss of community life.

Attappady block consists of three 'grama panchayats' namely Agali, Pudur and Sholayoor. The Irulas, Mudugas and Kurumbas are three groups of 'tribal' communities living in this region. Irulas live at relatively low lands, Mudugas at mid lands and Kurumbas at the high lands. The high lands are mostly forest area. Of the three, Irulas are closer to the mainstream and the Kurumbas are distant from the mainstream. All the three groups are integrated into the money economy and settled in hamlets. Of three, the forest dwelling Kurumbas appear to be healthier and happiest. Moopan of Kurumba hamlets command more respect than those of Irulas and Mudugas. All these groups live in nuclear families. Of the three, Irulas have a few people in government jobs, Mudugas have fewer and Kurumbas usually do not prefer government jobs, democratically elected leaders come mostly from Irulas.

Health: The commonly prevailing ailments are fever, diarrhoea, anaemia, worm infestation, dental diseases, Rheumatoid arthritis, tuberculosis, leprosy, and diseases related to thyroid glands. Most of the diseases prevailing here are direct consequence of malnutrition, alcoholism, excessive use of tobacco and usage of un-potable water. The block panchayat project report of 1997-2002 states that among the 'illiterates' of Attapaddy the Infant Mortality rate is 132/1000. Among Kurumbas the infant mortality rate is as high as 280/1000.

Literacy and Education: The literacy rate among adivasis is low. With the new syllabus, the children are expected to make projects based on audio visual and newspaper reports. As the children have no easy access to the audio visual as well as visual media, and also due to the marginalised socio economic background, they find it difficult to continue their education. However children in the residential schools are better, as they are not severely limited by the socio economic background of their parents. As the adivasis of Attappady are comparatively more marginalised than Malayarayas of ldukki and Pathanamthitta, Kurichiyars and Kurumars of Wyanad, they loose out the benefits from the positive discrimination strategies of the governments to the better off among the adivasis.

Development: Attappady is notoriously known for failed high-expenditure development projects and subsequent studies probing into the possible reasons for the failure. There had been several tribal development, irrigation, eco-restoration, agriculture, animal husbandry, fisheries, diary, sericulture, forestry, soil conservation, watershed management projects sponsored by the government and non-governmental agencies. Invariably all of them met with failures in achieving the results set by themselves. The saga of failures still continues. Corruption, insincerity, lack of relevance, poor planning, poor understanding of the ecology and the conditions of people and the very internal bias of

developmentalism, formal party politics and bureaucratic mechanism could be pointed out as the reasons for these continuing failures(GOK 2003:, 3-4; IRTC 1988;, Menon 1982;, Vijayanand 1997;, KFRI 1980;, BES 1977, IRTC 1998). The decentralization initiatives after 73rd and 74th constitutional amendments presently being carried out are propagated to bring changes in the lives of the adivasis by the government machineries. Most of the developmental projects claim that they exist there for the restoration of ecology, management of watershed, improvement of drinking water availability, improvement of health and nutrition among the adivasis, facilitate the hamlet based community organization, strengthen grassroot democracy, bring about participatory spirit etc. Looking back into their history, one would not find they were ever poor in these respects and rather poverty in these respects was introduced into their life and into the region through the development projects and the government schemes.

The community organisation pattern among the adivasis has greatly changed. The traditional Moopan do not have so much of command over people as in earlier days. Secondly, they had never been governing or managing communities as the modern governments or bureaucracies do. It is arrogant and demeaning to assume a village extension officer to be made a decision making partner with the moopan even if we go along with the logic with which moopan are taken to be the leaders of the adjvasis. It is obvious that the studies of this sort could not even understand the ground realities of the projects meant for adivasis for their own benefits [(GOK, 2001) (GOK 2003:3)] The 'Government Order' issued in May 2003 points out: In spite of the high human development in Kerala and its features of equity, most of the tribal communities have continued to be outliers always subject to the danger of being pushed further away from the development process. A quick analysis of the tribal situation in the State reveals the following features.

- Extreme poverty deprivation and vulnerability to exploitation.
- Extremely low levels of social and political empowerment.
- Rapid marginalization due to unfair, unequal and exploitative relations of production and exchange between tribal communities and others.
- Low access to entitlements
- Practically zero participation in development matters with no autonomy in any form of decision-making.

- Abnormally huge siphoning off of developmental resources and benefits meant for tribal people by middlemen.
- Poor human development with low literacy and access to health care.
- Rapid alienation of assets like land
- Alarming depletion of social capital especially traditional forms of organization and leadership.
- Quick deterioration of traditional knowledge systems and cultural attainments.
- Fast increasing tendency to use tribal people as cat's-paw in criminal activities like illicit distillation, cultivation of narcotic plants, stealing of forest wealth etc.
- High levels of exploitation of women by outsiders.
- Weak delivery system of public services
- Dependency inducing developmental programmes relying on distribution of benefits rather than building up of capabilities.
- Implementation of ad hoc and stereotyped developmental progammes in the absence of proper planning.
- Weak monitoring systems.

To prepare for the Praxis intervention, the research team undertook field survey with Kurumbas, Mudugas, and lrulas at Attappady and with Kuruchiar, Thean Kurumars, Urali Kurumars, Adiyars and Paniyars of Wyanad in randomly selected hamlets. In interacting with the adivasis, the researchers were reminded almost every moment that they asked wrong questions in trying to understand the adivasis. For example, at Nakkupathi Ooru, an 'Irula' hamlet at Agali, Attappady, when a question such as 'what is that they think the reason for their poverty' was asked, after talking to them for an hour, an old man among them calmly answered in his language, without any passion that *"We are not poor. We are the original inhabitants of this place (Adivas,). You made us poor."* There were inhibitions among the members of the group as their voices being recorded. They also expressed their displeasure of being addressed 'poor.' At Thirunelly (in Wyanad District of Kerala), the research team was walking aside an 'Urali Kurumar' household. There they saw a very old man sitting on his buttocks folding his legs and his face on his knees. He was unable to lift his head, as his neck was not strong enough to support his head. His face was full of wrinkles and surrounded with yellowish white beard. He may be around 90 year old. He was sitting on the

veranda of his house. While passing, they just enquired his well-being and asked him to compare the life these days with that of his younger days. He did not answer for a moment. He looked at their face for a few minutes and looked at their feet. Pointing at their footwear, he recollected, and said, In my younger days, I remember, even the British officials if they wanted to pass by our households, keep their footwear there (showing a place about ten meters from the location where the researchers were standing). Then he paused for a few minutes and continued with his feeble voice folding his hands as a sign of respect (probably he considered them to be the welfare bureaucrats) showing the partly tiled and partly thatched construction of his house, "Can you help me if there is government support in repairing the roof?" He was silent once again. He was coughing and looking down. The moment of the fieldwork experience with the people located in the economically impoverished, culturally de-capitalised, socially maintain joint families, that is, families of sons staying with their parents till they get an opportunity to build a new house. The adivasis of Attappady are economically, socially and culturally impoverished. Their economic poverty is indicated by their poor income [GOK, 2003] disproportionate to their requirement, social poverty is indicated by not having a socially honoured community status of influential leaders, highly placed entrepreneurs or senior bureaucrats among them. The survey conducted among adivasis of Attappady shows that the average family income of adivasis of Attappady is ranging from Rs 1000 to 2000. The adivasi families at Attappady usually do not have persons holding jobs of regular income. The adivasi community of Attappady does not have political or community leaders of high social stature. The local politicians from the adivasi community at Attappady expressed their concern of being treated as the bonded labourers of the mainstream political parties. A Bureaucrat, writing on the formal politics at Attappady comments, The Attappady experience shows that it is difficult for the elected tribals who constitute 45% of the panchayat membership to resist the pulls of cooperation and seek grass-root level mobilisation. In spite of their numerical strength, they serve the dominant interests by allowing themselves to be manipulated. (Vijayanand 1997; IRTC 1998)

5.2.2. General:

Scheduled Tribes are an integral part of forest ecosystem. Any development of the Forests will be complete only with the improved living conditions of tribals. The main tribal communities living inside Forests are Irular, Mudugar, Kurumbar, Kadar and Kattunaikkar. The hill men enjoy the right of collection of NTFP and are engaged in forestry works also. The details of hillmen settlements in the forests of the Division, their location, population, etc are furnished in Table below:

Table - 47 - List of Tribal Settlements in Mannarkkad Division

Sl. No	Settlements	No.of Families	Tribe	Panchayat	Male	Female	Total
1	Muthikkulam	38	Muduga	Sholayur	62	56	118
2	Pothuppady	6	Muduga	Thenkara	11	12	23
3	Karadippara	9	Muduga	Thenkara	18	10	28
4	Onthumala	6	Muduga	Agali	9	10	19
5	Paravalavu	9	Muduga	Agali	18	10	28
6	Mele Abbannur	29	Muduga	Padavayal	59	47	106
7	Chenthumbi	16	Irula	Puthur	24	22	46
8	Pankanaripallam	15	Irula	Puthur	24	22	46
9	Murugala	11	Kurumba	Padavayal	26	24	50
10	Kinattukara	9	Kurumba	Padavayal	20	16	36
11	Kadukumanna	50	Kurumba	Padavayal	102	97	199
12	Mele Thudukki	72	Kurumba	Padavayal	151	147	298
13	Galazi	12	Kurumba	Padavayal	24	26	50
14	Kurukathikallu	47	Kurumba	Padavayal	76	73	149
15	Gottiyarkandi	57	Kurumba	Padavayal	107	92	199
16	Thazhe Bhoothar	32	Kurumba	Puthur	30	26	56
17	Mele Bhoothar	37	Kurumba	Puthur	45	44	89
18	Edavani	30	Kurumba	Puthur	96	60	156
19	Ooradam	14	Kurumba	Puthur	26	19	45
20	Pottikkal	28	Irula	Sholayur	37	57	94
21	Thazhe Abbannur	60	Mudugar	Padavayal	118	112	230
22	Karappadam	4	Kattunaikan	Kumaramputhu	6	4	10
23	Narukkumchola	4	Mudugar	Kanjirapuzha	4	6	10
24	Pampanthode	65	Mudugar	Kanjirapuzha	99	91	190
25	Pangode	14	Mudugar	Kanjirapuzha	24	16	40
26	Maruthankode	17	Kattunaickan	Kumaranputhur	29	28	57
27	Vakkodan	18	Mudugar	Thachampara	32	27	59
28	Achilatty	23	Mudugar	Thachampara	47	35	82
29	Vettilachola	61	Mudugar	Thachampara	100	96	196
30	Vellathode	35	Mudugar	Kanhirapuzha	99	91	190
31	Anakkaranam	18	Mudugar	Kanhirapuzha	34	24	58
32	Vakkode	25	Mudugar	Karimba	45	39	84
33	Palavalavu	9	Mudugar	Thenkkara	18	10	28
34	Hanumanthan Moola	11	Mudugar	Thenkkara	22	18	40

5.2.3. Background:

Attappady, known for tribals, were the majority of population till 1961. But by 1971, due to mass influx of settlers form Kerala and Tamilnadu, the population scale tilted in favour of non-tribals. Now, tribals constitute only 44% of the population in Attappady. According to 2001 census, the total population of Attappady was 66,171, which includes 27,121 (41%) scheduled Tribes and 3024 (4.5%) scheduled castes. The Scheduled Tribes belong to the Dravidians clans of Irula, Muduga and Kurumba. Out of the total population of 66,171, 55% is contributed by general category. Tribals constitute a majority of the population upto 1961, but are now in minority, since settlers from outside have outnumbered them.

The tribes of Attappady have a rich cultural heritage consisting of their belief, practices, songs, dances, and indigenous wisdom. They have a traditional system to maintain the social order to each hamlet in harmony with natural resources and

society. The Oorumoopan is chief of the society, Kuruthali, a ministerial position, Bhandari, the treasurer and Mannukkaran, who determines the sowing season, management of crops, handling indigenous medicines etc. occupy next position in the social hierarchy. Although they are significantly diluted, the traditional social hierarchies are still maintained in most of the tribal settlements.

Attappady, the only tribal block in Kerala with large extent of waste land in the state has historically experienced several ecological degradation. The progressive loss of water and vegetation resulted in the expansion of wastelands and become evident in all classes of lands viz: Private agricultural holdings, the tribal and government lands, the river banks, wet lands and common lands. The wide spread ecological degradation consequently affected livelihood security of the people of Attappady adversely, especially the tribal population. The beginning of the 1990's presented Attappady with absolute backwardness and poverty with more than 80% living below poverty. Attappady was then associated with administrative apathy, rampant child labour, labour migration to the plains of Tamilnadu and Kerala, diseases and hunger.

From being more than 91% of the total population in 1951, the tribals have been reduced to a minority in a matter of 50 to 60 years time. The non-tribal population has increased considerably. This demographic process in Attappady Valley played a crucial role in impacting the tribal culture, economy, social institutions, land holdings, agriculture and power dynamics, which have been in general disadvantageous to the tribal population.

5.2.4. Tribal Communities of Mannarkkad Division:

There are mainly five tribal groups in Mannarkkad Division. They are Irula, Muduga, Kurumba, Kadar and Kattunaikkar. Among the tribal groups first three groups are based in Attappady region and the last two are located in Mannarkkad area. Details of each community are furnished hereunder.

Irula: Irula are numerically dominant and relatively advanced among the three tribal groups in Attappady. They mostly inhabit the eastern half of the Attappady valley and are found residing in 144 settlements, distributed over all the three panchayats of Attappady. They were formerly shifting cultivators, but due to land alienation, they now practice settled agriculture. At present, those who possess small plots of land near their hamlets perform dry land agriculture, mainly cotton and indigenous grains. They depend more upon the farms of adjacent settlers for unemployment and their major source of income is wage labour.

Muduga: Muduga are the second largest tribal community in Attappady, covering 24 hamlets. Most of the Muduga hamlets are settled in the Western Attappady mostly in the proximity of Bhavani River. It is believed that the Muduga were the original inhabitants of Coimbatore plains and later moved westward due to the prosecution and exploitation by more dominant communities. They are dry land farmers, sowing crops such as ragi, thuvara, chama etc. They have more contact with the migrated settlers from the plains of Tamilnadu and Kerala. Literacy rate of Muduga is relatively higher among the tribals. The growing contact between Muduga and settlers has influenced their culture.

Kurumbar: The Kurumbar are considered as the earliest tribal inhabitants of Attappady residing in 19 settlements. When the Badugas started colonizing the Nilgiris, these people moved down to the Attappady Valley. They are the smallest among the three tribal groups of Attappady. After an initial period of nomadic life, they must have taken up shifting cultivation, their main occupations being hunting and gathering. Once their hamlets were distributed in the valleys adjoining Bhavani River and its tributary Varagar Pallam. However, all these people have their settlements inside the forest, and until recently they had hardly any contact with the outside world, not even with Irular and Mudugar. They maintain a community life by sharing labour and food with other in the common issues affecting the settlements. Due to the low literacy rate and development, Kurumbas are considered as the most primitive tribal group in Attappady.

Kadar and Kattunaikkar: Kadar and Kattunaikkar are the other protective tribal groups in Attappady. Kattu naikkars are commonly seen in Kottopadam, Alanallur and Kumaramputhur panchayats under Mannarkkad Range.

5.2.5. Agencies Created for Tribal Development:

Integrated Tribal Development Project (I.T.D.P), Attappady:

Integrated Tribal Development Project in Attappady is the nodal agency in the area for tribal development activities in Attappady. Mainly, it has two fold functions – first as the agency to implement covering the areas of economic development, education, social upliftment, cultural promotion. The second being the function as Block Panchayat which also implement Rural Development Programme. ITDP, Attappady is jointly constituted by scheduled Tribes Development Department and Rural Development Department. Most of the development Schemes formulated by the centre and state governments are implemented through ITDP, Attappady.

Attappady Co-op Farming Society:

Attappady Co-op Farming Society came into existence in 1975. It has four Co-op farms. First is at Chindakki (283.43 ha area) and 100 families are engaged, Karuvara (141.47 ha area) with 50 families, Pothuppady (377.89 ha area) with 150 families and Varadimala (290 ha area) with 120 families. Attappady Co-op Farming Society runs a high school at Chindakki. Performance of the school in the field of academics and sports are commendable.

Vattulukky Girijan Co-op Farming Society:

This society is a creation of Government by providing 478 ha Vested Forest land lying in Sholayur Gama Panchayat in 1980 with 147 tribal members. The society houses 75 families situated at farm land.

Attappady Tribal Handicrafts Indistrial Co-op Society:

This Society came into being in 1974 with 147 tribal members. The society is at Boothivazhy. It has a warehouse and workshop in 33 cents of land provided by the government.

Kurumba Scheduled Tribes Service Co-op Society, Chindakki:

Kurumbas are the most primitive among the tribal communities in Attappady. The society started functioning in 1976 with its headquarters at Chindakki. Kurumba tribes residing at 16 settlements in Pudur Panchayat is the area of the society. There are 630 members in the society. Collection of agricultural produces of Kurumbas and its marketing, collection of minor forest produce like honey, medicinal plants, herbs, wax etc from Mannarkkad and Attappady forest ranges and marketing through Kerala State SC and ST Development Co-op Federation are the main functions of the society.

AHADS:

Attappady Hill Area Development Society (AHADS), an autonomous institution under the Local Self Government Department, Government of Kerala was started with major objectives such as ecological restoration of Attappady and promotion of sustainable livelihood options for the local people, with special emphasis on tribal population. AHADS came into existence on 31st October 1995 with a project outlay of Rs. 219.31 crores with the implementation of the project, wage rate has been enhanced from Rs.50/- to Rs. 125/-, starvation deaths stopped due to year long employment, malnutrition cases decreased, employment generation increased, labour migration reduced, child labour came down drastically. They created 93 User Associations (UA's), 166 Ooru Vikasana Samithies (OV's), 54 Joint

Forest Management Committee (JFMC's) III Thaikulams (TKs), 198, Income Generation Activity Groups (IGA Groups). Thus they found solutions to the socio-economic crisis of inhabitants of Attappady. More details about AHADS are dealt under Protection cum Improvement Working Circle.

Implementation of MGNREGS:

The Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS), the Central Scheme helped more and more tribal people taking the plough again by creating a fertile field for revival of agriculture. Many years ago, a majority of the 30,000 strong tribal population left agriculture as a means of livelihood. Many had lost their lands, those who still owned land had inadequate means to cultivate it. Absence of irrigation and marketing facilities further worsened the matters. The result was malnutrition and starvation in the hills, now, with the job scheme allowing employment of tribal labourers in farmlands, green shoots of agricultural recovery are springing up. Of the 13000 acres of uncultivated land, 5500 acres belongs to the tribals. In the financial year 2010-11, 273 tribal families took up cultivation on 352 acres of land. Thus, MGNREGS is acting both as food security and a poverty alleviation scheme in Attappady, ensuring employment and helping convert bare land into farm lands.

5.2.6. Problems faced by the Tribals:

The tribal population living within the forest areas face many problems like lack of employment, threatening by wild animals, degradation of local habitat, limited alternative sources of income, poor marketing facilities, health care, lack of infrastructural facilities, poor planting system and other social problems.

Lack of employment: Reduction in felling and timber operation limits the livelihood options. There is no source of regular income. The work out turn of tribals in forestry work is also poor. As a result, the more efficient work force gets employment. There exists a need to institutionalize a system that ensures regular employment to at least one member of each family so that they are ensured basic living conditions.

Threat of Wild Animals: The tribals residing in the forest are exposed to threats of crop destruction by wild animals and at times threat to life. There is urgent need to protect the hamlets from the threat of wildlife and offer prompt relief for damage to life, property and crops.

Degradation of local habitats: With the reduction in rainfall, the water and the soil is easily lost from the forest floor. Most of the water is lost as run-off, removing the soil nutrients and top

soil leading to reduction in yield. Effective measures are required on a war-footing to stop the process of degradation in the tribal hamlets and improve the water regimes. This will improve the productivity and result in the economic improvement of the tribals.

Poor planting System: The tribals use poor planting stock and hence poor yield. If high yielding varieties are made available, the excess production can be marketted for additional income.

Poor marketting facilities: The NTFP and other produce have great potential for income generation but suffer from inefficient collection and processing of produce. Urgent need exists to streamline systems so that better prices are obtained and the same reach the tribals.

Health care: Periodic health camps are to be conducted so that the health problems are attended. Awareness and training programmes are also to be arranged.

Infrastructure: Safe drinking water, houses, roads, electricity, transportation and other communication facilities are required to improve the standard of living.

Social Problems: In many areas, tribals fall prey to local evils like Ganja cultivation, Illicit brewing and Poaching. Better livelihood options can stem the rot that has set in.

5.2.7. Activities Proposed:

Agriculture / Horticulture:

i. Strengthening of agricultural practices on tribal land with following inputs-
ii. Training tribal farmers cum demonstration.
iii. Distribution of seeds of high yielding varieties and fertilizers.
iv. Taking up fruit and vegetable cultivation on tribal land.
v. Land development activities.
vi. Assistance for cultivating lands restored to them.

Watershed Development / Soil and Moisture Conservation:

i. Management of micro watershed involving tribal land, including construction of checkdams, diversion channels, water harvesting structures, open wells.
ii. Supply of poultry units/ duck units etc to tribals families
iii. Scientific collection, processing and marketing.
iv. Formation and strengthening of self Help Groups (SHG)

Implementation of Scheme:

As an institutional frame work for implementing schemes, with peoples participation, Forest Department already have forums like Vana Samrakshana Samithies (VSS's) and Eco-Development Committees(EDC's) under Forest Development Agency (FDA), Mannarkkad. It is proposed to have a uniform institutional frame work with uniform structure, rules and nomenclature for implementation of various schemes. Each hamlet will have an Oorukoottam. All adults above 18 years age shall be the members of the co-operative. All the works through this scheme shall be undertaken through such tribal co-operatives or Oorukoottams.

A microplan will be prepared in consultation with Oorukoottams/VSS/EDC following the participatory approach. The Forest Department will implement the technical portion and shall employ the tribals for the labour component of the work as far as possible. The VSS's will be responsible for monitoring the support of the members and for conduct of various programmes and distribution of benefit among the beneficiaries.

Components of the Microplan:

i. At least 50% of the volume of the works such as raising nurseries, plantations, plantation maintenance, firelines, and other timber operations is to be exclusively given to tribals. They can carryout the works through Tribal VSS.
ii. Streamline NTFP collection with effective check and control will lead to the sustainable availability of the produce and fair price.
iii. Provide power fencing, elephant proof trench, payment of compensation for loss of crops, loss of life and injuries etc.
iv. Construct checkdams, wells, diversion channels, water harvesting structure etc.
v. Supply high yielding varieties, agricultural equipments and ancillaries, fertilizers, mini kits etc.
vi. Provide alternative source of income, supply of bee-hives, poultry, duck units, mushroom cultivation, vegetable growing, floriculture, Eco-tourism etc.
vii. Provide training in carpentry, welding, painting, tailoring, cooking and catering etc according to their taste and interest.
viii. Strengthening of value addition and marketing.
ix. Repair to dwelling houses, providing drinking water facilities, electricity, road connectivities etc.

Monitoring and Evaluation:

Regular system of reporting the ongoing monitoring and evaluation will be conducted by the Forest and Scheduled Tribe

Development Departments through VSS's and other specially arranged officials.

Financial Outlay:

The scheme proposed is for the sustainable development of the forest dwelling tribes and it is a long term programme. As an initial step, the scheme can be implemented for the 1st five years with annual plan outlay duly approved by the forest department. The source of fund can be channelled from NAP fund through FDA and finally VSS's or Oorukoottams.

Kurumba Package:

Forest Department has formulated different schemes for development of tribals living inside forest. A kurumba package was developed by the FDA, Mannarkkad by constituting the tribals of 16 Kurumba hamlets. Since the period of AHADS ended by March 2012, the tribal youths who had actively involved in different activities are jobless and they have to be accommodated in the mainstream to divert them from going to illegal activities. Detailed discussions in this regard was held with the participation of tribals, AHADS, Industries, Education, Health, Tribal and Forest departments to evolve a suitable strategy in the form of a microplan. The tribal areas include the hamlets of Mannarkkad Division as well as Silent Valley Division.

Microplans were prepared for the overall development in the field of agriculture, forest, labour, drinking water, energy, economy culture, education health etc. Provisions for annual plan were also included in the microplan to enable them to under take agriculture or any other occupation. Emphasis are being given for food security along with raising cultivation in their own lands, protect forest from further degradation, conserve the endemic, endangered medicinal plants and herbs, conserve biodiversity, scientific and sustainable harvest of NTFP's are the different thrust areas.

Kurumba tribals, mostly under Mannarkkad Division were previously engaged in Ganja cultivation. Outsiders, especially the people from Idukki area were mainly engaged in Ganja cultivation with the help of Kurumba Tribals. Continuous raids helped to a certain extent to eradicate Ganja cultivation. Hence, suitable measures have to be undertaken to engage the tribals in developmental activities. The objectives behind the formulation of Kurumba package are to ensure food security to the kurumba tribals, and alleviation of poverty, besides attaining self sufficiency in all areas.

There are 16 Kurumba hamlets lying scattered. Out of these, 12 hamlets namely Kadukamanna, Ooradam, Edavany,

ThazheBoothayar, Mele Boothayar, Pazhayoor, Kurukathikkallu, Gottiyarkandy, Galasy, Mele Thudukki, Murugala and Kanattukkara come under Attappady Range of Mannarkkad Division. Thazhe Thudukki, Anavai, Thadikundu and Palappada are under Bhavanai Range of Silent Valley Division. Altogether, there are 488 families with total population of 2099, males 544, females 531 and children 1024. As already stated in the earlier paragraphs, Kurumbas are the most down trodden tribe in Mannarkkad Division with no proper source of income. Many of them turned to Ganja cultivation due to poverty and starvation. This resulted in malnutrition and poor health. Diseases among them are very common. Prior to large scale Ganja cultivation, they had good relation with department but somehow it got spoilt. The only way to save them from the grips of illegal activities is to bring them under joint Forest Management Committees and actively involve them for their upliftment and overall development.

Table - 48 - Demographic details of Kurumbas

Sl. No	Hamlet	Extent (ha)	Families (No)	Agriculture raised
1	Kadukamanna	185	41	Paddy, Ragi, Thuvara. Kaduku, Maize, Plantain
2	Ooradam	10	15	Ragi, Thuvara, Cheera, Maize
3	Edavani	25	31	Paddy, Ragi, thuvara, Cheera, Maize
4	Thazha Boothayar	20	40	Paddy, Ragi, thuvara, Cheera, Coconu, Arecanut
5	Mele Boothayar	60	23	Paddy, Ragi, thuvara, Cheera, Coconu, Arecanut
6	Pazhayoor	50	18	Ragi, Thuvara, Maize, Cashew, Coconut etc
7	Kurukathikallu	85	33	Ragi, Cheera, Maize, Plantain, Coconut
8	Gottiyarkandi	104	56	Ragi, Cheera, Maize, Plantain
9	Galazi	15	12	Ragi, Cheera, Maize, Plantain
10	MeleThudukki	60	32	Ragi, Thuvara, Cheera, Maize
11	Thazhe thudukki	58.2	40	Plantain, Ragi, Maize, Cheera
12	Murugula	25	9	Ragi, Thuvara, Maize, Pepper.
13	Kinattukkara	20	18	Plantain, Ragi, Maize, Cheera
14	Anavai	168.8	86	Ragi, Arecanut, Amara, Kaduku
15	Thadikundu	89.3	30	Ragi, Arecanut, Amara, Kaduku
16	Palappada	14.4	4	Chama, Amara, Cheera, Thuvara, Ragi

Kurumba package envisages short term objectives for a period of 5 years to achieve overall development in the field of agriculture, forest and biodiversity, basic amenities of local people by striving towards social, cultural, financial and health development. For achieving the above objectives a micro plan has been prepared for 5 years by the FDA, Mannarkkad. The activities have been classified into different sectors namely, agriculture,

forestry, soil and moisture conservation, NTFP, electricity, drinking water, education, health etc.

Agricultural Sector: Kurumbas mainly raise agricultural crops like Cheera, Thuvara, Amara, Chama, Ragi depending on rainfall. They are used to shifting cultivation. They shift after a period of two or three years. Wildlife cause extensive damages to their crops and hence protection of crop is essential. They have to be trained in raising cash crops other than seasonal crops for better return.

Solar Power Fencing: Hamlets are generally situated at elevated points and they cultivate land around their hamlets. Solar power fencing is essential for each hamlet to protect their crop from Wildlife damages. Power fencing is erected, block wise hence, it can be shifted to other block as such when they intend to shift their cultivation. Its maintenance is entrusted with the hamlet. They have proposed Rs. 1.50 lakhs towards establishment cost for one km.

They have also proposed for vegetative fencing with sharp thorny species as a support to solar fencing, so that their hamlet as well as farm land can be protected effectively. It is proposed that planting of 5000 seedlings with a cost of Rs. 1 lakh to cover one block.

Providing hybrid seeds and its production: Tribals are to be provided with hybrid seeds of their crops and made to practice improved modern methods of agriculture in order to enhance the yield.

Training to raise horticultural crops: Most of the tribals inside forest were growing horticultural crops like Carrot, Beetroot, Beans, Potato, Cabbage, Cauly flower etc in their hamlets. The climate is suitable for raising such crops and they have to be trained to undertake modern farming techniques without affecting the traditional method of cultivation

Introduction of Organic farming and Modern farming equipments: Tribals normally follow organic farming without applying pesticides and fertilizers. As the inputs are costlier, they perform organic cultivation only. They have to be trained to continue organic methods and market the products they produce. Some eco-shops are suggested to market. Use of modern implements would help them to improve the cultivation.

Forestry Sector:

Afforestation: Department has initiated a massive drive for eradication of Ganja and reduced the menace to a great extent. Large Ganja eradicated areas are without any cultivation, hence it has to be re afforested. Restoration of degraded areas and without

affecting the wildlife habitat suitable measures can be taken to regain the status of land.

Increase the availability of Medicinal Plants: Since tribals collect NTFP from forest areas, they are familiar with medicinal plants and its distribution. The species with medicinal value are to be produced abundantly in the NAP areas to reduce the pressure on forest.

Prevention of Fire: Man made fires are common rather than natural fire. Proper awareness programmes have to be adopted among the tribals to prevent fire occurrence. Formation of fire gangs, fire observation towers, communication facilities etc would help to reduce fire incidences.

Interference of external forces: Tribal colonies are always subjected to exploitation. Outsiders frequently visit the colonies and induce them to cultivate Ganja, illicit brewing, poaching, smuggling of forest produce etc. They use tribal knowledge for unsocial activities. Tribals should be provided identity cards through the department so that outsiders could be identified easily. Formation of tribal VSS and Ooru Vikasana Samithies constituted should be empowered to prevent the external agencies spoiling them. Joint inspection and surprise visits could reduce the interferences.

Soil & Moisture Conservation Sector:

Check dam construction:

In order to protect the water sources as well as irrigating the cultivated lands around the hamlet, checkdams are proposed to be constructed at an elevated land with low cost and it can also be used for water supply to houses of the colony. Check dam is of earthen dam model with available resources at a cost of Rs.2.95 lakhs per structure.

Prevention of soil erosion:

Soil erosion pose a great threat to the landscape of Attappady valley due to unscientific agricultural practices, sand mining, quarrying etc. gullies and rills have changed to ravines due to heavy down flow of water. AHADS, the organization constituted for restoration of ecological degradation, had undertaken several measures like gully plugging, vegetative bunding, check dams etc. Their models are recommended for implementing in the field. Contour trenches, vegetative bunding, Gully plugging, Contour planting etc will help to improve the soil status and reduce erosion. Planting of bamboo, reeds and rattans in gully plugged areas will increase the soil binding capacity and improve the percolation.

NTFP Sector:

Establishment of Micro Forest Enterprises:

Tribals collect various NTFP's from forest and market through federation. They get nominal price for the produce they collect. Most of the products are seasonal, value addition is essential to fetch better prices. Establishment of micro units in the accessible area where electricity, water and transport facilities are available, they would be benefited. Processing of each product requires technical knowledge, storage facilities, manpower etc.

Water and Electricity:

Water and electricity are the basic requirement for a better living. Since most of the tribal hamlets are very interior, electric lines are to be drawn for long distances and same is the case with water supply also. Facilities for tapping water from natural sources, electricity from solar energy are more feasible at present, hence sufficient funding have to be made for meeting the basic necessities.

Socio-cultural programmes:

Tribals normally, do not take part in the activities of the main stream people. They remain isolated in socio-cultural fields. They have their traditional cultural programmes and hence their activities have to be promoted. Reading rooms, community hall, formation of cultural forums etc will benefit them to improve Socio-cultural status.

Education:

Most of the tribals are illiterate. New generations lack facilities for continuing the education. As soon as they complete the primary education, they stop and look for traditional jobs. They have to reach towns for higher education. At least facilities upto higher secondary education is to be provided in the viscinity. Most of the primary schools in tribal areas do not have adequate staff and is managed by single teacher; sufficient staff with infrastructure is necessary to provide good education.

Health:

Tribals were known for good health and vigour and resistance to diseases. At present they are weak and most of them are disease-ridden due to the lack of quality food and timely treatment. Since they are familiar with traditional medicines, it has to be developed and their knowledge should be utilized for the common welfare of tribals. Planting of medicinal trees and its uses should be imparted to new generation.

5.2.8. Implemenatation of the scheduled tribes & traditional forest dwellers (recognition of rights) act, 2006:

Introduction:

The Scheduled Tribes & Traditional Forest Dewellers (Recognition of Rights) Act, 2006 recognises the forest rights and occupation in forest land. The rights of residing in the forests for generations, but whose rights could not be recorded. The rights of forest dwelling scheduled Tribe also include the responsibilities and authority for sustainable use, conservation of biodiversity and maintenance of ecological balance and thereby strengthening the conservation regime of the Forests while ensuring livelihood and of security of the forest dwelling tribes and traditional forest dwellers.

Since the forest rights on ancestral lands and their habitat were not adequately recognised at the time of consolidation of state Forests during the colonial period as well as in independent India resulting in historical injustice to the forest dwelling Scheduled Tribes and other Traditional forest dwellers who are integral to the very survival and sustainability of the forest eco-system.

Before the implementation of the Act, it is essential to know the aim, the terms and sections used in the Act, which may come across frequently.

The act aims to recognize and vest the forest rights and occupation in forest land of forest dwelling tribes and other traditional forest dwellers.

The President's assent was received on 29th December, 2006 and the Scheduled Tribes and other Traditional Forest dwellers (Recognition of Forest Rights) Act, 2006 was notified on 2nd January, 2007.

The Act recognises 12 specific rights as per Section: 3 as under:

1. Right to hold and live in the forest of individuals or communities for self cultivation or livelihood.
2. Community rights
3. Rights of ownership to collect, use and dispose Minor Forest Produce which has been traditionally collected.
4. Other community rights such as fishing and grazing.
5. Community tenures of habitat.
6. Rights over disputed lands
7. Rights for conversion of pattas, leases or grants titles.

8. Rights for conversion of forest villages to revenue villages.
9. Right to conserve, protect and regenerate or manage community Forests which they have been traditionally doing for sustainable use.
10. Right to access to bio-diversity and community right to intellectual property right and traditional knowledge.
11. Any other traditional right customarily enjoyed
12. Right to *insitu* rehabilitation including right to alternative land in case they have been illegally evicted or displaced without compensation prior to the 13th day of December, 2005.

Section 3 (2) has provisions for speeding up the prior approval of the Central Government under the Forest Conservation Act, 1980 in specified cases of providing facilities managed by government subject to the condition that the area of forest land diverted for non-forest purpose not exceed 1 Ha, the number of trees to be felled do not exceed 75 Nos and the same is cleared by the Grama Sabha.

Section 4(2) has provisions for resulting tribals having rights in critical wildlife habitats subject to fulfilment of certain conditions.

The rights are extended to forest dwelling scheduled Tribes, and other traditional forest dwellers who have occupied forest land before 13th December 2005.

Section 5 empowers the right holder to protect the wildlife, forest bio-diversity, and adjoining catchment area and water resources. The right holder is to ensure that the habitat is preserved from destructive practices affecting their cultural heritage and that the decisions taken in the Gramasabha to regulate access to community forest resources and stop any activity that adversely affects wild animals, forest and biodiversity.

The Forest Right, Act, 2006 and its rules formed in 2007 are sufficient enough to protect and recognize the rights and privileges of Tribals living inside forest areas. Based on the above Act and rules, action was initiated to implement the Act, but some hindrances are experienced during the implementation at the respective areas and they are furnished below:

As per the government order G.O(Ms)No. 62/2008/SCSTDD dated 03-06-2008, the SC/ST Department is the implementing department. Revenue, forest and local self governments have to give all the assistance in its implementation.

Election to Forest Rights Committee is from the Grama Sabha, which is Panchayat wards in Kerala, where in GramaSabha have the majority of non-tribals.

Only 20 settlements are situated inside forest areas. All other tribal settlements are in patta lands either outside or fringe of the forest areas. The tribals living in Pattaland also lodge claim for rights.

In Attappady, lot of patta land under tribals had been alienated by the tribes due to pressure from settlers and many complaints exist regarding outsiders enjoying tribal land.

Many settlers managed to grab the tribal land and most of them managed to make documents for the land. Most of the cultivable and fertile land having water availability is with the settlers now and the tribes are confined to dry and less fertile areas.

Many claims are for land inside forest for about 5 to 10 km away from the settlements they reside now. It is doubtful whether these tribes will cultivate in such poor sites.

Kurumba, the down trodden tribe, still practice shifting cultivation and they do not like to limit their rights for agriculture to 10 acres per family

The right to collect NTFP is presently with the Tribal societies and the VSS. When the Act is implemented, the Community Forest resources may over lap with the area protected by the VSS and there by a dispute on jurisdiction of collection of NTFP may occur in many places.

In many places in the division especially in Agali Range, Sholayur area, many tribals are residing in Patta lands, with very small holdings like 5 cents or so. This sort of very poor people may not get the benefits of right over forest land as per Act.

The Grama Sabha mentioned in the Act is the Gramasabha of the Panchayat Wards. The tribals will be a minority in the Gramasabha and it is likely that the interests of the tribals are not protected and encroachers may creep in as traditional forest dwellers.

The Divisions have identified vested forest lands proposed for Rehabilitating Landless tribals and Record of Rights (ROR) are being issued. An extent of 3555.73 ha land has been proposed from Vested Forests area for rehabilitation of landless tribals as on June, 2010 Record of rights were issued in 138 cases for an extent of 162.0127 ha out of the total extent of 3555.73 ha proposed. The hindrances cited above for the implementation of Forest Rights Act exist for suitable directions or clarifications and accordingly necessary amendments have to be made in the Act before implementing the same in the field. Mannarkkad Division had already identified the extent and location proposed for assigning to landless tribals as per the Act and it has to be implemented as and when the applications are received.

CHAPTER – VI

WILDLIFE AND BIO-DIVERSITY WORKING CIRCLE

6.1. Constitution of the Working Circle:

Wildlife and Bio-Diversity Working Circle covers the entire Reserve Forests, Vested Forests and plantations of the Division.Mannarkkad Division comprises of Attappady reserves and Panakkadan Reserve Forests with an extent of 15073 ha spread over in three ranges. Attappady reserves are classified into six blocks and Panakkadan reserves into three blocks. Panakkadan reserves constitutes only a small portion of 610 ha where as Attappady reserves comes to 14463 ha, out of which 10709ha reserve forests has been transferred to Silent Valley National Park as buffer area. Among the Attappady reserve Forests Attappady Bit VI reserve forest with an extent of 6385.95ha constitutes major portion which have immense importance with respect to biodiversity, different ecosystems, diversified forest types, with variety of mammals, reptiles, birds and butterflies. The above reserve lie contiguous with protected areas of Silent Valley National Park at several locationsexcept some portions of Kurukkankundu area and hence biological importance are more, which cannot be neglected.

My predecessor has not given much importance to the wildlife and biodiversity in the previous working plan of 2001-2011. It may be due to the lack of proper studies conducted by the experts in the field. Dr. Satish Chandran a leading environmentalist and scientist who had conducted detailed study on the urgent need to establish a “Biodiversity Conservation Area in the Palakkad Hills of Kerala” with due importance to the conservation of bio-diversity rich Muthikulam area of Mannarkkad Division. He has stressed the need for a scientifically sound long-term perspective plan for the biodiversity conservation of our state. Moreover, the international community had declared the year ‘2011’ as Biodiversity year which assume much significance. Similarly, the study on Western Ghats and its conservation is going on by the Committee headed by the eminent ecologist Shri. Madhav Gadgil, prioritising locations for adding to the protected Area Network need to be taken into account the biodiversity richness, ecosystem benefits as well as the severity of threats, each area is facing. Mannarkkad Division has boundary with protected areas of Silent Valley National Park in one side and the biodiversity rich Muthikulam area with vast potential on other side. Muthikulam–Siruvani areas, the undisturbed forest lie outside the Protected Area Network lying in the southern tip of Nilgiri Biosphere, the biodiversity of these areas is almost at par with the Silent Valley National Park, hence a Working Circle in the

name 'Wildlife and Bio-Diversity' is highly essential for evolving suitable strategies with a long term perspective for its conservation and habitat improvement.

6.2. Objectives:

- To conduct scientific study and understand the biodiversity value of Muthikulam and develop strategies and tactics for conservation and management
- To locate the areas of high biodiversity values, 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 biodiversity and genepool with active participation of local communities

6.3. Wild Fauna and Habitat:

Muthikulam is very rich in fauna which is constituted by a large variety of mammals, birds, reptiles, amphibians, aquatic fauna, butterflies and other insects as well as micro organisms. The Wild fauna includes mammals (23 species), Amphibians (21 spp), Birds (48 spp), Reptiles (52 spp) and Butterflies (84 spp).

6.3.1. Mammals:

Muthikulam along with the adjoining Palakkad Hills forms a very important refuge for Elephants (*Elephas maximus*), Apart from that other large mammals like Gaur (*Bos gaurus*), Wild boar (*Sus scrofa*), Sambar Deer (*Rusa unicolor*), Barking Deer (*Muntiacus muntjac*), Porcupine (*Hystrix Indica*) Pangolin (*Manis crassicaudata*), Mouse deer (*Tragulus memina*) are found. The large Carnivores present are Tiger (*Panthera tigiris*), Leopard (*Panthera pardus*), sloth bear (*Melursus ursinus*), wild dog (*Cuon alpinus*).

The small carnivores include jungle cat (*Felis chaus*), common mongoose (*Herpestes edwardsi*), strip-necked mongoose (*Herpestes vitticolis*). The arboreal mammals include the Malabar Giant Squirrel (*Ratufa Indica*), Nilgiri Langur (*Trachypithecus johnni*), Lion – tailed Macaque (*Macaca silenus*) Bonnet Macaque (*Macaca radiata*), Slender loris (*Loris lydekkerianus*) Dusky stripped Squirrel (*Funambulus sublineatus*) the first three being endemic to Western ghats.Nilgiri Tahr (*Hemitragus hylocrius*), the endangered and endemic caprine is found in the higher reaches of Elival Peak.

6.3.2. Reptiles:

There are 52 species of reptiles reported, belongs to the families Bata guridae, Agamidae, Gekkonidae, Scinicidae,Varamidae, Taphlopidae, Uropeltidae, Boidae, Elapidae and Viperidae, of which 18 species are endemic to Western Ghats (Balakrishnan,2007).

6.3.3. Birds:

The diversity of birds in the Muthikulam area are studied by Dr.Nameer et al (2007) and Lalitha et al (2007). Approximately, 158 bird species have been recorded from Muthikulam and Siruvani Forests. 48 species are listed from Muthikulam hills. The important birds are Nilgiri Laughing Thrush, Great pied Hornbill, Malabar Irogon, Paddy field pipit, House swallow, Black-napped Oriole, Crested Tree Swift, Wayanad Laughing thrush, Malabar Whistling Thrush, White-bellied short wing, Lesser Fish Eagle, Blue-capped Rock Thrush, Eurasian and Tytler's Leaf-Warbler. Details of bird study conducted by Shri.Nameer.P.O, Shri. Praveen.J, Shri. Uthaman.K.V during 2007 is elaborated in later paras.

6.3.4. Butterflies:

About 48 Butterflies are reported from the areas of Koodam, Poolapara, Muthikulam base camp, Pattiyar base camp and Muthikulam Reserve Forest Nympha lidae, Lycaenidae and Papilionidae are dominant families. The species like Troides minos cram, Graphium Sarpedon teredon feld, Pachliopta Pandiyana, Udarakasa, Pieris canidia canis, Lethe rohria, Hasora chromus, Lethe drypetis Moore and Zipoetis saitis etc are reported from Muthikulam Hills.

6.3.5. Amphibians:

Around 21 species of amphibians were identified, some of them are *Rane temporalis*, white-nosed bush frog, Philautus *leucorhnus*, Indian Paddy field frog, *Linnonectus liannocaris* Large wrinkled frog, *Nyeti batrachus* major and Bedomies Leaping frog were some significant species recorded from this area. The other amphibians such as Southern Hill toad-Bufo micro tympanum Boulenger, the threatened Red, the sharp nosed bull frog-*philautus nasutus* Gray, The Indian Bull frog *Hoplo batrachus tigerinus* Daudin etc are found in this region.

6.4. Importance and necessity:

Nature conservation in India on the initiative of the government has been mostly through farming legislation, establishing official machinery for enforcing protection measures

and creating a network of protected Areas. All these measures have been tremendously beneficial in safe guarding the rich natural heritage of the country, especially in the decades immediately after independence. But in these times of rapid change these measures are becoming inadequate to meet the environmental challenges in our over exploited and degraded biosphere. There has been an explosive growth in environmental studies and our understanding of the biosphere functions has undergone radical change. The vital modulatory role of natural ecosystem functioning for the continuity of human civilisation is no longer a debated point. Consequences of human activities in establishing the environmental equilibrium, especially issues such as ozone depletion and global warming are in everyone's prescriptions due to wide media coverage. Bio-diversity is no longer an esoteric scientific term but very much a part of our perception of our surroundings. But all those new scientific insights do not get assimilated into governmental policies and functioning nor do they motivate adequate response action. There is often a dangerous and costly time lag.

Many traditional, obsolete or inadequate attitudes persist in our approaches to nature conservation action. Our understanding of biodiversity most often reverts to wildlife emphasising the presence of large mammals and some birds. Our ecological sensitivities remain bound to the recreational potential of reservoirs and green backdrop scenery. Habitat management is totally lacking in our resource exploitation. There is inadequate data for any scientific management for sustainability of development. Nature conservation or habitat protection is limited to within the government Reserve Forest. Public participation in conservation is only a vague concept.

Kerala is rich in biodiversity. Apart from large mammals, birds or butterflies, we have to protect the unique ecosystems, habitats of exceptional geophysical significance (eg: critical watershed regulatory areas) and ecologically fragile areas which are the natural heritage of the state. But, practically most of such areas are outside the Protected Area Network. On the other hand, the current extend of protected areas include extensive man-manipulated and severely degraded habitats, areas under tremendous human exploitative pressure and so on. The high proportion of protected area coverage with in the total forest cover is often stated as the reason for the non-inclusion of many invaluable areas. The potential loss of revenue is another often stated argument for such exclusion. It is time that we take a critical factual analysis of our current protected Area Network and implement some corrective steps. .One extremely important tract needing immediate attention is the Palakkad Hills along the northern lip of the Palakkad Gap. This tract falls partly within the Palakkad District of Kerala and the Forests are within the Palakkad and Mannarkkad Forest Divisions.

6.5. An overview of the landscape:

The Western Ghats forms a very distinct bio-geographic province in Penisular India on the basis of distribution of plants and animals as well as due to physical environmental conditions deciding identities of ecosystems contained therein. The Western Ghats is a narrow, long coastal mountain ridge receiving very high rainfall on its western face. There are latitudinal as well as altitudinal and climatic gradients along and also across the Ghats creating a wide range of habitat conditions. The complex topography of the mountain chain results in a cluster of insular habitats, many of which harbour relict populations of biota of great evolutionary antiquity. Distribution of hill-stream fishes and amphibians indicate the presence of such island habitats. The geological stability and the long-enduring humid tropical climate have permitted evolutionary continuity resulting in a rich assemblage of bio-diversity hotspot, the Western Ghats still remain very inadequately surveyed and poorly protected to safe guard its unique assemblage of life forms.

Although, the Western Ghats is the most diagnostic landscape feature in peninsular India, it has very distinctive subunits along its length and breadth. One most obvious feature of this hill chain is the Palakkad Gap where there is a total discontinuity for the hills for a distance of about 45 Km north-south. The gap is located immediately to the south of the Niligiris and has very steep scarp faces along both the lips. The ridges constituting the northern lip are called the Palakkad Hills and the Southern tip is formed by the Nelliampathies. This topographic features i.e. the gap influences the weather and climate, ecosystems, drainage pattern, bio-geographic distribution, pattern of biodata and human civilisation, impact on the adjacent parts of the Ghats.

Assessing the conservation potential of the Palakkad Hills landscape sub unit in the context of Kerala Western Ghats.

There are nine significant sites in the Kerala Western Ghats with the potential for rich bio-diversity and representative natural ecosystems. From south to north they are:

i. Agasthyamalai Western Slopes
ii. Achenkovil Valley to the northern edge of Periyar Tiger Reserve
iii. Chinnar-Eravikulam Idamala valley tract
iv. Sholayur Valley –Parambikulam-Nelliampathy
v. Palakkad Hills
vi. Silent Valley – New Amarambalam forest tract
vii. Camel's hump mountains
viii. Western edge of Wayanad
ix. Aralam-Kottiyoor Forests

Of these nine sites, the smallest in extent is the Aralam – Kottiyoor forest tract. The most potential as well as vulnerable are the Palakkad Hills, Camels hump and the strip of forests along the western edge of Wayanad. These three tracts have very watershed value, have high elevation mountain vegetation, are least explored scientifically and are expected to have serious impact from global climate change by their location, they have bio-geographical significance also.

6.6. The Geographical and Ecological Uniqueness:

The Palakkad Hills fringes the 45 Km wide Palakkad Gap. The total discontinuity of hills along the Gap drastically modifies the weather and climate along the gap and on the adjacent hill areas. Geographic influence over rainfall is lacking over the gap. Continuous high velocity winds pass along the gap around the year. On either side of the gap, air compression creates abrasive hot air streams influencing vegetation in a drastic manner. For half the year the wind direction is from west to east and for the rest it is in the opposite direction. Atmospheric humidity, rainfall pattern and seasonality are drastically different along the gap on either side of it in comparison with all other parts of Kerala. The western slopes of Palakkad Hills receive more than 5000 mm of rainfall annually and such locations are actually hardly one or two kilometres away from the dry Coimbatore plains where the rainfall less than 900mm. This is true with Attappady Plateau located to the North where rainfall is less than 1200 mm.

The Palakkad Hills landscape sub unit does not have any tribal habitations within, except the Muthikulam tribal hamlet which has been located therein as part of the earlier water impoundment during the British period. There are a few tribal hamlets along the western fringe as well as the southern fringe most of which are relocated hamlets where the original settlement has been submerged under reservoirs or where the private Forests have been totally cleared and converted to non-forest land uses forcing the tribal communities to shift.

The increased number of rainy days, peak rainfall period during the years and atmospheric humidity fluctuations differ from other areas of the Western Ghats. This significantly affects the composition, structure and function of vegetation communities. Palakkad Hills has dozens of isolated peaks reaching above 1500 m and many reaching over 1800 m within its compact extent. The deep valleys separating the steep, narrow edges, scarp faces and rocky pinnacles provide a wide range of micro habitats which could influence the distribution of biodiversity, especially herbaceous plants and lower animals. Inspite of its potential, Muthikulam remains biologically one of the least known parts of the Kerala Western Ghats.

6.7. Biodiversity Significnace:

Tropical Forests are the Earth's biologically richest ecosystems and play vital roles in regional hydrology, carbon storage and the global climate. They are the home to 70 percent of the world's plants and animals –more than 13 million distinct species and 90 percent of invertebrates (Laurance 1999). The main reasons for the wide range decline in biodiversity are habitat alterations, increased rates of invasions of introduced non-native species, over-exploitation of the resources and other human – caused resilience and is an 'insurance policy' and safe guard against expected climate change impacts.

The Muthikulam-Siruvani a.rea is rich repository of a vast variety of flora and fauna and plays a very vital function in preserving the habitat of several threatened or endangered species. The forest area falls into four forest type Viz:-West Coast Tropical Forest, West Coast Semi Evergreen forest, Southern Montane Wet Temperate forest and Montane grass land. The altitude varies from 200 m to 2000 metres.

6.8. Biodiversity Values

6.8.1. Muthikulam Hills:

Phyto geographically, the vegetation structure of Muthikulam hills shows more affinities to that of tropical Asia and Sri Lanka, thereby suggesting the existence of land connections in the past. The rate of endemism is comparatively high with most species distributed throughout the Western Ghats. The comparison of floristic diversity of Silent Valley, Muthikulam and Nelliampathy Forests indicates that the flora of these areas is of very high Simpson's index above 0.87 with Silent Valley (0.94) and Muthikulam (0.93). The main species association in Muthikualm Forests is Myristica-Mesua-Aglaia and these three species constitute 50% of the tree species.

6.8.2. Lichens:

A total of 77 species of micro and macro lichens are reported from Muthikulam Hills (Kumar.M and Sequiera.S 1999, Easa 2003, kumar et al 2008) mainly from four major micro habitats Viz: tree trunk, rock, soil and canopy branches. The family parmeliaceae dominates with 23 species under eight genera followed by Usneaceae (11 species under one genus), Collemataceae (nine species under one genus). Among the host plants of lichens, Palaquium ellipticum supported the highest number of species followed by Litsea floribunda, Antidensma menasu and Poecilo neuron indicum. Host plants such as *Ardisia pauciflora, Cinnamomum malabatrum, Euonymus angulatus, Flacoutia Montana, Syzygium Cumini, Syzygium munronii* support a substantial number of macro lichens. The list of lichens is provided in the **Appendix-XXIV.**

6.8.3. Pteridophytes:

Eighty three species of Pteridophytes representing 28 families were recorded from this region which shows extreme variations in habits and habitats. The dominant families are *Thelypteridaceae* (13 Sps), followed by *Pteridaceal* (8Sps) and *Polypodaceae* (7 sps).

6.8.4. Angiosperms:

The floristic study reports 488 species of flowering plants, including 387 dicotyledonous, 101 monocotyledonous plants from Muthikulam hills, of which 99 are endemic to the Pensiluar India. The most dominant families are *Orchidaceae* (22 Sps), *Poaceal* (22 Sps) *Rubiaccae* (22 Sps), *Euphorbiaceae* (21 Sps), *Fabaccae* (17 Sps) *Lauvaceae* (17 Sps) and *Piperaceae* (14Sps) and the dominant genera are piper (9 Sps), *Impatiens* (7 Sps) *Ficus* (6 Sps) and *Syzigium* (5 Sps). The number of endemic species found in these Forests indicates the bio-geographic significane of the area. Many of the important species to the Western Ghats such as *Vateria macrocarpa*, *Holigarna arnottiana*, *Palaquium ellopticum*, *Cullenia exarillata*, *Myristica dactyloides*, *Mesua ferrea*, *Calophyllum elatum*, *Hopea ponga*, *Aglaia eleagnidea*, *Cinnamomum macrocarpum*, *Dysoxylum malabaricum*, *Diospyros bourdillonii* etc are found.

The rare and threatened species are Meliocope lunuankenda, Saprasma fragrans, Pleetranthus rivularis, Pogostemon gardneri, Garcinia tinctoria, Poeciloneuron indicum, Ophiorrhiza brunonis, Wendlandia notoniana, Piper galeatum, Piper argyrophyllum, Glochidion sisparense, Glochidion ellipticum, Liparis vividifolia, Ephemerantha macraci, Chrysoglossum maculatum, Dendrobium macro statchyum, Microstylis versicolor etc.

6.8.5. Faunal Wealth:

Matching the floral wealth, the faunal wealth in Muthikulam area also is endowed with fantastic diversity. Diversity of Wildlife is tremendous in case of mammals, birds, reptiles or amphibians. The common and rare mammals seen in this area include Nilgiri Tahr, Lion-tailed macaque, Bonnet macaque, Nilgiri langur, Elephant Gaur, Sambar deer, spotted deer, Barking deer, Mouse deer, Wild boar, Malabar giant squirrel, Nilgiri marten, Ruddy mongoose, Indian Civet, Sloth bear, Tiger, Leopard, Jungle cat and Wild dog.

The Nilgiri Tahr (*Nilgiritragus hylocrius*) an ungulate, endangered (Schedule-I-Wildlife Protection Act species) mountain goat, endemic to the Nilgiri Hills and the southern portion of the Western Ghats is reported from higher reaches of Elivalmala with around 60 individuals. Populations of these animals are small and isolated, making them vulnerable to local extinction.

A large population of sloth bears (*Melursus ursinus*), an endemic and vulnerable species (IUCN) of the Indian Sub-continent is also reported from Muthikulam. This species listed in Appendix-I of CITES and Schedule-I of W.P.A 1972 is found in a variety of habitats ranging from Wet Evergreen forest to Deciduous and degraded scrub Forests. Degradation of Forests due to over grazing, tree felling, fire, conversion and reclamation for other uses and over-extraction of forest resources appear to be occurring throughout bear ranges.

The Nilgiri langur (*Trachypithecus johnii*) an endemic to the Western Ghats, exists in almost all habitat. They are more abundant in the evergreen Forests of Muhtikulam hills. The species is endangered due to forest fragmentation and poaching for its fur and flesh.

Lion-tailed macaque is an endangered species (IUCN) listed in Schedule –I of WP Act, 1972. The distribution of this species is restricted to the tropical evergreen Forests of Kerala, Karnataka and Tamilnadu. The population in the Muthikulam area is reported to be severely fragmented and isolated due to conversion of medium elevation evergreen Forests into reservoirs and forestry and commercial plantations. 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*. The Conservation Status and checklist of Mammals, Reptiles and Amphibians are to be updated once in three years. The details of reptiles are given in **Appendix – XXV.**

Shri. Nameer and others (2007) studied the bird diversity of Siruvani and Muthikulam Hills and reported a total 158 species of which 14 species are endemic to the Western Ghats while nine belonging to the Red Data Book Species were also seen. Of the total 158 species, 48 species were recorded from Muthikulam hills only **(Appendix-XXVI).** All the 22 Western Ghats endemics found in Silent Valley National Park with the exception of Nilgiri Pipit were recorded in Siruvani-Muthikulam Forests. The important birds found in the area are *Phylloscopus tytleri* (Tytler's Leaf-Warbler) *Ficedule nigrorufa* (Black and Orange, fly catcher) *Garrulax Cachinnans* (Nilgiri Laughing thrush) *Columba elphinstonii* (Nilgiri Wood-Pigeon) and *Hieraaetus fasciatus* (Bonelli's Eagle) with regard to the diversity of birds in different locations, Kuravampady has the highest diversity, due to the mix of plantations and natural Forests leading to several ecotones.

The discovery of Nilgiri Laughing thrush in these hills is a landmark achievement in establishing the importance of these habitats. The threatened birds in the area are *Spizactus cirrhautus* (Changeable Hawk-Eagle) *Pycnonotus priocephalus* (Grey-headed Bulbul), *Myiophonus horsfieldii* (Malbar Whistling thrush), *Garrulax*

cachinnans (Nilgiri Laughing Thrush) and *phylloscopus tytleri* (Tytler's Leaf-Warbler). Considering the diversity and endemism of bird communities, Muthikulam-Siruvani Reserve forest areas were recently added to the Important Bird Area (IBA) category as per the Bird Life International Guidelines.

A total of 84 butterflies were recorded from the Evergreen and Semi evergreen Forests in Muthikulam area. Butterflies are dominant in the area of koodam, Poolappara, Muthikulam base camp. Pattiyar base camp is in Singapara Forests. The most abundant and commonly found family was Nymphalidae with its important genera such as cupha, Euthalia, Hypolimnas, Junonia, Lethe and Mycalesis. The rare species recorded were Malabar Banded Peacock, Southern Birdwing, Malabar Raven, Plains cupid and Yam fly. The pattern of butterfly diversity was similar to that of birds, more in evergreen Forests followed by deciduous Forests in Muthikulam Reserve Forest(3.48) followed by Mukkali(3.41) and Chindakki(3.13). A list of butterflies in the region is provided in **Appendix- XXVII.**

6.8.7. Medicinal Plants:

The Muthikulam area is home to diverse Wild aromatic and Medicinal plants. The Muduga tribes of this area have a rich ethnic knowledge of these plants. Gajathippali (*Balanaphora fungose Spp*), Thelli (*Canarium strictum*) Manjakoova (*Curcuma Zedoaria*) Cheenikka (*Acacia Sinuata*), Maravettikkuru (*Hydnocarpus pendandra*), Urunjikai (*Sapindus trifoliate*), Kallur vanchi (*Rotula acquatica*) Analivenga (*Pittosporum neilgherrense*) and Kattupavakka (*Momordica dioica*) are collected from the Forests.

6.9. Tribes:

Mudugas inhabit mostly the forest areas of South-Western foot hills and in the Southern Part of Attappady Valley. Though their main livelihood was collection of NTFP, they also practice small scale shifting cultivation and fishing. They also grow in small quantities of Amaranath, beans, maize, cucumber and plantains. Forest products like bamboo, reed, grass, vines, wood etc are used to manufacture household items like baskets, brooms, tools and for constructing huts. Gathering in the forest is of great importance both for means of obtaining food and also as a source of raw materials. The major portion of their diet comes from roots, tubers and green leaves. Mushrooms are highly desirable and are picked during rainy season. The roots of Noor Kizhangu (*Dioscorea pentaphylla*) Savel Kizhangu (*Aioscorea tomentosa*) and sole kizhangu (*Dioscorea Sp*) are the main tubers used by Mudugas.

6.10. Major threats to Bio-diversity of Muthikulam- Siruvani area:

Biodiversity is the foundation for the goods and services provided by ecosystems that are crucial for human survival and well being. Loss of bio-diversity has negative effects on several aspects affecting human life such as food and energy security and access to clean water and raw materials. Tourism, an important and fast growing industry in Asia is vulnerable to 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.

6.11. Factors affecting biodiversity:

- Forest degradation and removal of evergreen patches
- Infestation of noxious weeds and forest fire
- Illicit Ganja cultivation
- Degradation of watersheds
- Over exploitation of NTFP's including reeds, bamboos and medicinal plants

Muthikulam forms connectivity between Forests north of the Palakkad gap and Silent Valley. The major land use changes, encroachments, fire and forest degradation are major threats to the loss of connectivity between Attappady Block VI and Silent Valley Forests.

Annual fires are common in evergreen, semi-evergreen, deciduous Forests and plantations caused by hillmen for hunting game orgraziers for promoting collecting NTFP, by graziers for promoting a flush of young grass, by negligence by way farers.

The invasive alien species such as Eupatorium, Mikania and Lantanna are ready colonizers in disturbed areas and cause considerable ecological damage to 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.

The Muthikulam Forests adobes the habitats of many rare, endangered flora and fauna. The population of *Vateria marocarpa, Dipterocarpus bourdilonii, Dysoxylum malabaricus, Gluta travancoria* are restricted to small isolated pockets. The selective logging process in the past, caused reduction in population size of many tree species in the area. The alteration of habitats, hunting and poaching the wildlife cause damage to the

ecosystem by removing species key to the system's functioning. The loss of habitats, hunting, poaching are the main threats to the remnant's population of the Western Ghats, endemic and endangered fauna such as Lion-tailed macaque, spotted deer, Nilgiri Tahr etc in Muthikulam area.

6.12. Strategies to be adopted:

Various strategies have to be adopted to face the threats thatare likely to occur in the bio-diversity rich Muthikulam area. Since no scientific study has been conducted with respect to the macro and micro habitats of the diversified floral and faunal wealth, to suggest enumeration measures. In order to conserve the critical species, ecosystems and gene poles, a thorough and detailed study of the Endemic, Rare and Endangered species have to be conducted first. Secondly, the conservation measures to restore the area, protect the unique ecosystems and species – specific habitats. Establishment of wildlife corridors in order to facilitate the movement of wildlife by bridging the gap between Silent Valley National Park and Muthikulam area. Suitable methods have to be enhanced to reduce Man-Animal conflict, which is a permanent phenomenon that exists in territorial areas as well as protected areas. Lastly, establish models for cost effective afforestation, conversion of degraded plantations to natural Forests and sustainable utilization of NTFP.

Kerala Forest Research Institute, Peechi has conducted a study on the bio-diversity of Muthikulam area and suggested some strategies based on zone and theme, which can be followed for future management.

6.12.1. High Value Biodiversity Conservation Zone:

The natural patches in Karimala, Vellingirimala and Elival mala provide more or less continuous forest cover with different types Viz: Dense Ever green, Semi-evergreen with ***Cullenia exarillata, Mesua ferria - Palaquim ellipticum*** type vegetation structure. These Forests are very important as they are repositories of unique biodiversity (flora & fauna).

6.12.2. 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 information system.
- Identify corridors for movement of Wildlife.

6.12.3. Action Plan:

- The proposed area should be tackled only on scientific principles backed by sound research.
- 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.
- Any area may be restored with native species only.
- Tourism in the conservation zone is to be prohibited.

6.12.4. Rare, Endemic and Threatened Species:

- Identify and protect the endemic and threatened species and promote their recovery to enable population levels
- Develop *ex-situ* conservation and *in-situ* recovery plans

6.12.5. Unique Ecosystems and Species-Specific habitats:

- Identify and assess unique ecosystems and species-specific habitats
- Unique ecosystems such as grass lands, Shola patches, species-specific habitats of Nilgiri Tahr, Elephant, birds 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.

6.12.6. Wildlife Corridors:

- Identify map and document the existing and potential corridor for elephants and other larger mammals.
- Restore the connectivity between Muthikulam and Silent Valley.
- Conduct studies on Ecological, Socio-economic, land use pattern etc and assess the status of the corridors.

6.12.7. Theme Plans:

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

Habitat Management: In habitat management, importance is to be given to improve the habitat for flora and fauna. Following measures are recommended for habitat improvement.

Weed Eradication: Weeds like Mikinia, Lantana and Eupotorium should be removed by uprooting during monsoon in phased manner but continuously for three years, then alternate year, where ever needed.

Fire Control: Fire lines should be properly maintained. Clearing of grass and weeds for a width of 5.2m 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 grassland, shola forest and small evergreen patches. Fire lines should also be maintained along the roads.

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.

6.12.8. Infrastructure and communication Development:

In order to provide adequate protection to the bio-diversity and manage the conserved area, proper infrastructure and communication network are of great importance. Construct necessary buildings, acquire infrastructure and develop wireless network system.

6.12.9. Protection:

The main illegal activities are tree felling, unauthorised collection of NTFP's especially medicinal plants, poaching ganja cultivation, grazing etc. Stake holders should be motivated, trained in forest protection activities through VSS. Establishment of anti poaching camps, frequent monitoring and patrolling of the boundaries are essential to enhance the protection measures.

6.12.10. 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 live stock and extension awareness to owners.

6.12.11. Prescriptions:

The proximity to silent valley National Park and the presence of biodiversity rich Muthikulam-Siruvani area in Agali Range under gives much prominence to Mannarkkad Division. Some portions of Attappady Block I and part of Pannakkadan reserves were already transferred to Silent Valley National Park

for the creation of buffer zone. All the animals found in the Protected Area are found in Attappady reserves adjoining to Silent Valley National park and Muthikulam area.

It is prescribed to afford maximum protection to Wildlife, habitat improvement, monitoring their response to managerial interventions coupled with creating awareness in the local population about the importance of Wildlife in the ecosystem, need for its conservation etc.

Establish protection camps, as in the case of Silent Valley at vulnerable points especially in the areas susceptible to poaching. The scheduling of duties suggested is such that staff would have a fifteen days stay at protection camp followed by a five days break. They should be provided basic amenities in the camp with all infrastructures.

There were only few studies on Muthikulam Reserve Forests in the past conducted by different research institutions and NGO's. The main studies include floristic inventories by K.S.Manilal in 1988, Chand Basha conducted studies on ecology including different forest types in 1987. Nameer studied the bird-diversity of Siruvani and Muthikulam in 2007. There is a big gap in the knowledge of biodiversity resources of this forest reserve. No systematic studies were carried out about lower group of plant kingdom such as algale, liverworts and mosses. There is no information with regard to fish diversity, soil micro flora, aquatic micro organisms, and wild animal parasites. Information about the productivity of various habitats is lacking, detailed data on the extent of human pressure on the forest is also not available, hence all the above information are required for formulating conservation strategies in future.

Evolve a prospective, sound and significant conservation oriented management plan for protecting and enhancing the high biodiversity value of Muthikulam area. A capacity building exercise has to be implemented in the department to enable staff to rise to the current global demands on biodiversity, forest and to meet the challenges in future.

Muthikulam Reserve comprises thick evergreen Forests, sholas and reservoir bound by grasslands. At an elevation of 1000 metres, tourists are attracted not only to the rustic sylvan area with Muthikulam waterfalls but also to a very pleasant climate. At present department is conducting ecotourism at Muthikulam called by the name 'Siruvani Ecotourism' through a VSS comprising the tribals from the settlement. It is prescribed to follow the present ecotourism as such, so that the rich biodiversity area can be protected from outside interference.

Tribals are integral part of Forests and they depends forest on various resources and 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, hence tribals should be given priorities for their rights as envisaged in the Forest Rights Act, 2006.

Research on rare and endangered species as well as endemic plant species ***Vateria macrocarpa***, the flag ship of Muthikulam *Diospyros bourdilloni*, *Myristica dactloides*, *Dendrobium species*, Piper species etc. Mammals (Lion-tailed macaque, Nilgiri langur, Niligiri Tahr), Birds (Nilgiri Laughing thrush, Nilgiri wood Pigeon). Reptiles, 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 Lion-tailed macaque (LTM), population size, specific niches and nesting pattern of hornbills, habitat suitability, the movement pathway for elephant and tiger also have to be prioritised.

6.13. Montioring and Evaluation:

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 short comings and make corrective alterations, if necessary. Following factors are to be maintained and evaluated to enhance protection as well as conservation measures. Status of endangered and endemic species, collection of NWPF's, illegal hunting and poaching , weed eradication, fire control ,measures, wildlife health and veterinary care, tourism activities in neighbouring areas, watersheds, eco-development activities, forest offences and social welfare activities.

6.14. Man-Animal Conflict:

6.14.1. Introduction:

The Forests in Kerala are highly fragmented due to settlements and enclosures. Indiscriminate poaching of wild animals has come down since the enforcement of the wildlife protection Act, 1972. Consequent to this, incidence of crop damage by wild animals has increased in Kerala. Direct Man-Animal conflict include crop depredation, injuries, causalities, cattle lifting and damage to building and other properties. Increasing incidence of crop damages by wild animals has led to the use of several methods to protect crops in Wildlife areas. The methods employed for crop protection are guarding with ordinary

fencing, stonewall fencing, line crackers, chemicals, trenches and electric fencing are the major control measures in practice.

As the incidence of crop depredation by wild animals increases, so do the methods to protect crops in wildlife areas. These methods could be effective for a long or short term, depending on the animal as well as the method used. Several control measures are used under different conditions and most researchers agree that the use of electric fencing and trenches are the most effective. Various methods are adopted for tackling the crop raids by Wild animals at different t places. Thorny branches of Acacia are used as brushwood fences in Haryana and Madhyapradesh. Use of trained dogs to chase crop-raiding deer where as the use of big game repellent and soap to reduce crop damage by deer. The traditional methods deterring crop-raiding elephants such as fire, brush fences and sound making devices have generally failed.

6.14.2. Reasons for crop-damages:

Kerala state, which lies in the Southern part of the Western Ghats, is unique in environmental characteristics due to its geographical location between 8^0 18' and 12^0 48'N and between 74^0 52' and 77^0 22'E and topography. It is bounded on the eastern side by the Western Ghats ranges and to the west by the Arabian Sea. The state can be classified into three topographical regions, namely the coastal area, midlands and the highlands. The forest area lies mostly in the highlands. About 24% of the forest area lies with in the protected area network comprising of Wildlife sanctuaries and National Parks. The forest areas have been subjected to alterations of various degrees for agriculture, developmental programmes and settlements. Most of the forest areas have human habitations in the fringes and in some cases scattered settlements within. The majority of the settlements cultivate a variety of crops which are prone to damage by Wild animals. The agro based economy of Kerala depends a lot on cash crops such as coffee, pepper tea, cardamom and rubber, cultivated mostly in the highlands. The state has a good number of mammal species representing various texa, such as Elephant (*Elephas Maximus*), Gaur (*Bos gaurus*), Sambar (*Cervus unicolor*) spotted deer (*Axis axis*), Wild boar (*Sus scrofa)*, Porcupine (*Hystrix indica*) and Bonnet macaque (*Macaca radiata*).

6.14.3. Methods employed:

The study was carried out in ninety five territorial and Wildlife ranges under five forest circles. Of these, four were selected randomly from each of the forest circles. Agali and Attappady ranges of Mannarkkad division were also subjected to study. The settlements with intensive crop damage problems, one each in the enclosure and the periphery were chosen in each of

the selected forest ranges. These settlements were visited once and 1 km transects laid, stating from forest boundary. Plots of 10 Sq.m were laid at every 100 meters along transects.

For each study plot, details of crop species in the plot, number of damaged and undamaged crop plants, phenology, animal causing the damage, nature of damage and protection method employed at the time of visit, were recorded. Enquiries were also made with cultivators in the area to confirm the animal species involved in raiding and other details such as the time and date of the raids, care was taken to cover the areas within a single season and at the time of cultivation.

The damaged areas were visited and details like crop damages, animal species involved, type of control measures, including the cost and efficiency of the method used were recorded, sample plots of 10 Sq.m were laid to determine the efficiency of a method.

The extent of damage is assessed in two ways. The number of plots raided (area of 10 m^2) or the number of crops damaged. The formulas derived are given below:

$$\text{Percentage of plots raided} = \frac{\text{Number of plots damaged} \times 100}{\text{Total number of plots}}$$

6.14.4. Protection methods employed:

- The protection methods employed in different locations sampled are classified into five categories.
- Guarding with ordinary fencing and fencing by various materials combined with guarding
- Special protection crackers are used to scare away the animals
- Store wall fencing walls built around cultivated areas
- Chemical repellents
- Solar fencing around the cultivated area

The effectiveness of the methods employed varied according to the locations. Electric fencing, which was observed in the Northern Circle, was the most effective in the region. The Southern Circle employed a variety of protection methods, of which special protection followed by chemical repellents were the most effective.

Wildboar raided the most (52.5%) in guarded area with ordinary fence, followed by elephant (41%), crops raiding by other

species individually or in combination was less in guarded plots with ordinary fencing. Special protection method employed in the Southern Circle was not effective against wild boar. Stone wall fence was recorded in the High Range Circle, where all plots were damaged by Wild Boar was high (78%). In electric fenced areas, the percentage of plots damaged by elephants was high (55%) followed by elephant and wild boar combination (31%)

An attempt was made to analyse the effectiveness of various protection methods applied at locations on the periphery and in the enclosure. The percentage of plots raided by Wild animals was higher on the Periphery (43%) compared to those in the enclosures (37%) in the locations guarded with ordinary fencing.

6.14.5. Results:

The highest numbers of plots damaged were in the periphery of the forest followed by the enclosure. The high incidence of crop raiding on the periphery, as well as in the enclosures, indicates greater risk and high probability of crop raiding in area adjacent to wildlife habitat edges.

Effectiveness of various control measures has been one of the most important topics of debate in recent times. Control measures have been one of the most important topics of debate in recent times. Control measures of long-term and short-term effects have been employed worldwide. The efficiency of the methods is reported to vary, depending on several factors including the raiding animal.

Protection methods prevalent in different locations in Kerala and their effectives vary only to a lesser extent. However, the efficiency of the methods varies considerably with the raiding animals. This necessitates the development of new, innovative, eco-friendly, socially acceptable and cost effective long term solutions which are effective against most of the crop raiders.

6.14.6. Crop Protection Methods Suggested:

The farmers employ a variety of crop protection methods which can be classified as follows:

Guarding and Ordinary Fencing: In 45 settlements, crops were guarded at night from machans or platforms on top of rocks or trees. Wild animals were scared off by noisily beating on metal tins and by torch light and fire. This method requires vigilance throughout the night. In most places, firewood or old tyres are used to light fire at night. Electric bulbs are also installed in the field. Dogs are used to detect and chase off wild animals and to alert the guards.

Coloured cloth and plastic bags are tied to poles and scare crows used in the field to scare off raiding animals. When the wind blows, the sound of the plastic bags scares the raiders away. Arecanut or Palmyra sheaths are tied to the trees for the same purpose. Cacti are planted along the boundary of the crop field as deterernts. The field is surrounded with fences of thorny branches of bamboo, Acacia, Zizyphos to prevent the smaller mammals and cattle from getting in. Closely tied wooden poles act as a barrier to wild boar and deer. Such barriers are located in many places in Kerala. Four or six rows of metallic wires are stretched all along the boundary to keep out deer and wild boar. These are effective only to a certain extent as the animals may jump over the fence. Fences of 10-12 rows of barbed metallic wires are installed all along the boundaries of the field. The wire is fixed cross wise. The sound and light of crackers scare the animals away. Burning torches are thrown at the animal leading to injury, but this is not done at most places.

Stone Wall: Only two settlements had stone walls to protect crops. The wall was built with rough-cut pieces of rock and stone, held together with cement and was in wide at the base, 0.5 m on top and 2m high. There were several instances of gaur jumping over the brick wall in Marayur. Angle irons with barbed wire were often fixed on top all along the stone wall to prevent gaur from sealing the wall. In some places, farmers had made rubble walls to prevent gaur from sealing the wall. In some places, farmers had made rubble walls 1m high 0.5m wide without cement to keep out smaller mammals, but it was not effective against elephants.

Line Cracker: Line cracker is a special protection method recorded from four settlements. A metallic wire of small gauge is extended all around the field at a height of 0.5m high and one end of this line is tied to stone with crackers. When the animal touches the line, the device gets loose and the stone with the crackers hit another stone on the ground below the device and explode. The sound alerts the farmers and also deters the animal. The method is widely used throughout Kerala and is effective against most animals, especially elephants and Wildboars.

Chemicals: In three settlements, the farmers were using chemicals for protection. The smell of pesticide could repell the animal away from the field. It is effective against wild boar, but it was found to be effective only for a week. In some places Naphthalene and Phenol are used to repell elephants. Kerosene or Waste oil is poured along the possible entries of smaller animals such as porcupine, black-napped hare and mouse deer. Some tribes tie cloth soaked in kerosene to a pole and fix them in the field. Toilet or washing soap is kept in a coconut shell or tied to a stick and installed in the field. In the cold weather, the soap gets wet and its fragrance helps to keep smaller mammals away from the field. However, when this method was tried, the animals kept

away from the field only for a few days. Replacement after a short break had the same effect.

Trenches: Elephant proof trenches, 2m deep, 3m wide at the top, 1m at the bottom have been dug in Wayanad and found to be effective against elephant, guar and wild boar. Such trenches cost more and require annual maintenance. Trenches are not feasible in areas with loose soil and high rainfall.

Solar Fence: Solar fencing was recorded in only three settlements. The method is widely used the world over and is reported to be effective against most animals, depending on number of wires used. The solar power fences are normally 150 cm high, with 3 to 4 wires, 30 cm apart. They require good maintenance, vegetation in contact with the wires has to be removed. Further, though the fence was reported effective against elephants, tuskers reportedly use their tusks or poles to break the wires. More often, the fence acts as psychological barrier once the animal gets a shock from an encounter.

Evaluation: Most methods are not suitable against all the animals and those effective against a single animal, are not necessarily cost effective. The selection of a method would depend on the site, raiding animals and funds available. Evaluation of crop protection methods are furnished in the Table given below:

Table - 49 - Details of crop damages for the period 2001-02 to 2010-11

Period	No of Incidents	Crop		Amount Disbursed (Rs in lakhs)	
		Crop	Extent (ha)	Village	For death
2001-02	-			-	-
2002-03	-				
2003-04	-				
2004-05	59	Banana, Coconut, Arecanut, sugarcane, Black Gram	73.80	Kallamala, Padavayal, Paloor, Sholayur, Palakkayam, Puthur	2.58
2006-07	71	Banana, Coconut	148.69	Kottathara, Karimba, Padavayal, Paloor, Sholayur, Puthur, Palakkayam, Agali, Kottopadam	2.68
2007-08	45	Banana, Coconut, Arecanut, Tuber	71.57	Agali, Padavayal, Sholayur, Kottathara, Paloor.	1.07
2008-09	57	Banana, Coconut, Arecanut, Paddy	110.87	Sholayur, Alanaloor, Edathunattukara, Puthur, Agali.	1.5
2009-10	36	Banana, Coconut, Arecanut, Paddy	105.91	Sholayur, Padavayal, Kottathara, Karimba, Palakkayam, Agali	2.04
2010-11	96	Banana, Coconut, Arecanut, Paddy, tubers	221.96	Karimba, Thenkara, Sholayur, Padavayal, Kottathara, Alanaloor, Palakayam, Puthur, Edathunattukara, Agali	3.04

6.15.Man-animal conflict with special emphasis to Elephants:

6.15.1. Introduction:

Man-Animal conflict with special reference to elephants have to be dealt separately based on the wide scale damages to crop and human life caused by elephants are on increase since 2009-2010. The reasons for elephants entering in human habitation areas causing large scale damages to property and human life, measures for tackling this problem etc have to be subjected to a detailed study for further course of action. According to a study conducted KFRI, Peechi, it is reported that elephants kill about 100 to 200 people each year in India. Human deaths due to elephant injuries to human beings from wild animals are common. But no detailed study has been conducted so far in any of the divisions so as to formulate suitable guidelines to tackle the menace.

A study was conducted by Dr. E. A. Jayson and Shri. G. Christopher Division of Forest Ecology and Biodiversity Conservation, Kerala Forest Research Institute Peechi. They had made an attempt to investigate the human-elephant conflict in the Southern Western Ghats of India and possible measures needed for amelioration of the problem are also discussed. The study was mainly based on observational methods. Status of larger mammals and elephants were assessed by direct and indirect method.

Study revealed that crop depredation was mainly caused by seven species of animals to eighteen crops. Main crops destroyed were tapioca, plantain, coconut, paddy, tubers, Arecanut, rubber etc.

6.15.2. Mode of Damage:

The animals involved in crop damage were mainly lone males, in the case of elephants and most of the raids were at night. It was observed that more quantity of crop damaged, than, what was consumed by the animals. In the case of tapioca, tender shoots and tubers are preferred. Coconut was mainly damaged by elephant and was confined to the trees below 20 years. Trees below 10 years were pushed down and the central rachis and shoots were consumed. Plantains were also attacked by elephant and discarding the leaves, the central portion of the stem was consumed. Paddy was lost due to Wild boar and elephant. More waste was due to trampling and rolling by animals in the field. Elephant also destroyed paddy by tramping. Cashew trees and betel nut trees were not damaged by any of the animals. No distinct pattern was observed in crop raids. While damage by Wildlife boar was recorded through out the year, the attack from elephants was related to the species of crops cultivated. Whenever

palatable crops like plantain, coconut and arecanut were planted elephants attacked them.

6.15.3. Preventive measures for Crop damage:

Indigenous and modern methods were employed by the tribals and local people for the protection of crop. Thirteen indigenous preventive measures were identified among the tribals namely application of bar soap, Kerosene, human dummies, cloths, plastic bags and arecanut sheaths. Locally available materials like stone, bamboo, reed, poles and plant fibres are utilised for making traps.

6.15.4. Modern Methods:

Trenches, cracker lines, and live wire fencing are the modern methods applied by the tribals and local people for controlling the crop damage. In addition to this, electric fence with nergizer was also erected by the forest department to control the crop damage in some tribal settlements. Trenches proved effective for preventing crop damage but maintenance of trenches was laborious due to the loose soil structure and intermittent rainfall in all the months.

Cracker lines are a common method in which a bit of gun powder is packed in a paper and kept under a stone. When an animal touch the lead line from the cracker assembly, it triggered a mechanism by which the stone placed above the gun powder falls on it creating a load sound. This noise functioned as a warning sound to the watchers and as a threat to the marauding animals. One disadvantage is that as these lines provide only warning, people have to go to the field to drive away the animals.

Various preventive measures currently in practice and tried at several places are detailed in earlier paragraphs of this Working Circle.

6.15.5. Human Deaths by Elephants:

Many instances of attacks by Wild animals on people have become the subject for discussion recently. Main conflict of wild animals was with the local people. Regarding man-wildlife conflicts, tribals are experiencing only less of it, where as local people are severely affected. Always local people are more susceptible to attack while going inside forest for firewood collection or attending crops in the field. They rarely cared for the elephants and took least precautionary measures. Awareness of the dangers and programmes that are more educational should introduce for the local people to reduce human causalities.

Providing compensation is not a permanent solution to the problem. Adequate compensation was not given to the affected parties for crop damage. Human deaths and injuries caused by wild animals are suitably compensated in the division. Details of compensation paid during the plan period 2001-2011 are given in table:

Table - 50 - Human deaths/injuries and compensation paid

Year	No. of incidents	Wildlife attack			Compensation Paid (Rs)	
		Injured	Death	Village	For deaths	For injury
2001-02	-	-	-	-	-	
2002-03	1	-	1	Padavayal	20000	
2003-04	-	-	-	-	-	
2004-05	1	-	1	Kottathara	20000	
2005-06	1	-	1	Padavayal	50000	
2006-07	4	1	3	Pallur, Sholayur, Palakkayam	150000	1266
2007-08	8	5	3	Sholayur	150000	23000
2008-09	1	-	1	Sholayur	50000	
2009-10	2	-	2	Sholayur	150000	
2010-11	11	4	7	Karimba, Puthur, Sholayur, Pottassery	700000	5000

6.15.6. Prescriptions:

- Construct and maintain electric fences in problematic areas
- Local communities should be advised to avoid planting cash crops like plantains, coconut, pineapple and tapioca.
- Maintain the availability of drinking water in the forest areas during summer months either by constructing check dams or by providing artificial water holes.
- Forest fire should be prevented during summer months.

Many instances of attack by Wild animals on people were recorded during the period 2001-02 to 2010-2011. Among them, the prominent was man slaughter by elephants. A total of seven human deaths were recorded in eleven encounters during the period 2010-11 or incidents. Compensation to the tune of rune of rupees one lakh on an average was seen disbursed by the department. Elephants were involved in major cases. Injury to people by wild animals was normally reported from forest fringes. During the last decade, the human causalities due to wild elephants were on the increase. It is observed that generally, the villagers entering the forest to collect NTFP's, reed, firewood etc are more prone to attack. It is suggested that proper education of the local settlers about the behaviour of animals will reduce the conflict. Resetting of enclosures to outside areas may also solve problem to a certain extent.

It is observed that the crop damages are reported more from Agali, Padavayal, Sholayur, Kottathara and Palakkayam villages. The extent of damage is also increasing. The crops which are mainly susceptible to damages are plantain, coconut, sugarcane, Paddy, Arecanut and tubers. Palatable crops are damaged more. All the villages mentioned above are not situated near protected areas but the concentration of Wildlife are more in the Vested Forests and adjoining reserves. Compensation of the farmers are paid as per the norms and procedures issued by the Agricultural department and Forest department periodically. Generally, it is reported that the compensation amount disbursed for crop damages is meagre when compared to the cost of production and the efforts put in by the farmers. The amount has to be enhanced to actual cost incurred to farmers as the cost of production has increased. It is suggested to change the pattern of crops by changing from traditional/ seasonal crops to perennial crops. Careful selection of crops and planting strategy is necessary to reduce crop damages. Cultivation of crops like medicinal plants, rubber, non-palatable crops etc will reduce the problem and increase the income of the people, where as crops like plantains and coconut in monoculture will increase the crop damage.

CHAPTER – VII

PFM AND ECO-TOURISM WORKING CIRCLE

7.1 Introduction:

National Forest Policy of 1988 envisages conservation which includes preservation, maintenance, sustainable utilization, restoration and enhancement of the natural environment. Maintenance of environmental stability through preservation and where necessary restoration of the ecological balance that has been adversely disturbed by serious depletion of the forests of the Country. It also fully recognises the contribution of Forests in maintaining ecological processes and life support systems and preserving genetic diversity. Forests are regarded as a national asset to be protected and enhanced for the well-being of the people and nation. While emphasising the need to cover at least one third of the land area of the country with forest or tree cover, the policy recognised the need for greater involvement of local communities in the management of forest resources.

Government of India adopted the strategy of Joint Forest Management (JFM) to solve many of its problems related to deforestation, environmental degradation, and rural poverty. This concept essentially involves mobilising local people for group action in managing specific forest area adjacent to their villages or settlements and share responsibilities and benefits according to a well defined mutually agreed set of rules and regulations. As a legal back up to the policy, Government of India issued a circular on 1-06-1990 directing all state governments to accept this new strategy in principle and Government of Kerala accepted the participatory Forest Management (PFM) strategy by its order No: G.O(MS) 8/1998 dated 16-01-1998. The programmes are implemented by Vana Samrakshana Samithy (VSS) which is the user group. The forest Department will act as its facilitator. The VSS is a local level people's organization formed with the intention of implementing PFM programme. One VSS may represent a population of a geographical area of one or more Panchayat wards, micro watersheds, hamlets or settlements. A VSS can be constituted for a particular user group also. Detailed directions for selection of PFM areas, NGO, constitution of VSS, duties and responsibilities of VSS and KFD, preparation of microplan etc have been issued by the Kerala Forest Department from time-to-time.

7.2 Constitution of Working Circle:

The concept of PFM has emerged as an alternative for the traditional method of protecting Forests by forces and fences and to bring in community participation for the protection of Forests

against degradation and for the management of Forests for sustainable yields on which they subsist and thereby to improve their standard of living. It is intended to effect the management of NTFP by the VSS, representing the local communities especially the tribes. Apart from the management of NTFP, the VSS can involve into various other activities too like taking up the Eco-tourism activities, in the localities, tree planting forest protection etc. Therefore, the PFM and Eco-tourism Working Circle comprise the fringe areas of the reserve forests, degraded plantations etc. The additional area may be added in due course after improving the stocking of the present degraded area.

7.3 Objectives of Management:

Evolving programmes for promoting sustainable development to focus on sustainable livelihoods. The vast unemployment in the less developed countries provide the world with an extra ordinary opportunity for undertaking a massive global initiative for ecological restoration of the natural resource on which the poor depend for their very survival.

The conservation, management and development of Forests require the eradication of poverty. It must be recognised that economic security alone can form the basis of ecological security. With this background, the PFM and Ecotourism Working Circle is formed with the following objectives.

- To explore the potential of PFM
- Introduce sustainable NTFP harvesting practices to reverse the depletion of NTFP resources and to improve the living conditions of the stake holder communities.
- To make the level of dependency on forest of the stakeholder communities, environmentally viable
- Management of forest fires to effect forest protection
- Addressing the other threat factors responsible for the degradation of fringe area forests.
- Promoting Eco-tourism.

7.4 VSS in Mannarkkad Division

The first VSS was formed in November 2000. So far 27 VSS's have been registered in the Division of which 10 are functioning. The PFM is concentrated in the fringe areas, which were degraded in the past. The treatment of the forest under the PFM has shown varied degree of success. At present the VSS in the division are functioning effectively. In view of the alternate job opportunities generated by the implementation of activities envisaged in the microplans, the forest offences especially Ganja cultivation in Attappady Range have reduced to a certain extent. A few people engaged in the antisocial activities such as illicit brewing, Ganja cultivation in the forest areas have been brought

back to the main stream as a result of the PFM activities. In the initial stage, the financial support for the implementation of the PFM in state was through the World Bank aided Kerala Forestry Project. Since the Kerala Forestry project has expired, the financial support was made available through NAP, specially constituted for the purpose. However, the present challenge is how to make all the VSS's more sustainable. The answer lies in improving the capital value of the existing Forests, efficient utilisation of the resources available at their disposal, creation of artificial short rotation forestry crop having a mixture of NTFP including medicinal plants conservation and finding suitable markets for the value added forest produce.

7.5 Tribal VSS/AVSS:

The Government of Kerala vide G.O (Rt) No. 40/2001 F&WLD dated 02-02-2001 has issued general directions for the constitution of Tribal VSS with the following objectives.

- To enlist the participation of Tribal communities living in the forest area for sustainable management of Non –Timber Forest Produces and protection of rights for utilize the indigenous knowledge of Tribal communities as far as possible for the above purpose.

- To empower the tribal communities to take part confidently in the programme.

- To nurture the community collectiveness of the tribal people in order to help them solve their basic livelihood problems.

- To organise forest protection committees, Vanasamrakshana Samithies (VSS).

In the tribal VSS concept, the tribal communities will be recognised as responsible managers and custodians of Forests rather than being treated as petty collectors of forest products. The forestry activities envisaged to be taken up by the Tribal VSS are "Special protection programme for the rare and endangered NTFP species, Management of Gene Pool Conservation Zones and special enrichment programmes for regeneration of degraded forests.

Out of the total 27 VSS/AVSS formed under FDA, Mannarkkad, first 10 VSS's were formed between 2000 and 2004 and rest 17 VSS's were formed between 2008 and 2011. Although, they were formed in the year 2000, majority have started functioning from 2006-07.

7.6 Factors responsible for degradation of forests:

- Forest fires, mostly man made are more dangerous to forest and wildlife as it causes heavy damage to wildlife and ecosystem.
- Grazing by cattle and other animals.
- Illicit wood cutting for fuel and other uses.
- Natural calamities like land slide.
- Collection of sand from river belts.

7.7 Forest Development Agency (FDA):

The Ministry of Environment and Forest (MoEF) has implemented Centrally Assisted Schemes such as Integrated Afforestation and Eco-Development Project Scheme (IAEPS), Area Oriented Fuel wood and Fodder Project Scheme (AOFFPS), Non Timber Forest Produce (NTFP), Association of Scheduled Tribe and Rural Poor Scheme (ASTRP) for promoting afforestation in degraded Forests, adjoining lands, including lands adjoining National Parks and sanctuaries during the IXth Plan Period. The operational and functional profile of these schemes were subjected to reviews in consultation with the Forest Secretaries and Principal Chief Conservators of Forests during 2001, with a view to improve the implementation of these schemes. This resulted in the approval of FDA's by the MoEF on a pilot basis. Encouraged by the success of the pilot phase of the approach, the scheme titled National Afforestation Programme (NAP) has been approved by merger of the above mentioned four IXth Plan Centrally Sponsored Afforestation schemes. The Scheme would be implemented by involving three tier set up namely State Forest Development Agenciy (SFDA) as a nodal agent at the apex followed by Division level FDA and grass root level VSS or EDC.

In Mannarkkad Forest Division of Palakkad District, a project under the National Afforestation Programme for implementation by Mannarkkad FDA was sanctioned by MoEF (NAEB) during 2006 as per letter number No: MoEF (NAEB): 9-25/2006-B-IV dated 02-02-2006 to be implemented at a cost of Rs.57.32 lakhs from 2005-06 to 2006-07 (Xth Plan). The project area as per approved programme comprises of 770 ha of degraded forest land spread over 10 VSS's to be treated with Aided Natural Regeneration (ANR-300 ha), Artificial Regeneration (AR-60 ha), Bamboo Plantation (140 ha), Mixed Plantation of trees having MFP & Medicinal value (190 ha) and Regeneration of Perennial Herbs and shrubs of medicinal value (80 ha) for the period 2005-06 to 2006-07. As the sanction was received at the fag end of the financial year 2005-06, no works could be carried out during that year. The work commenced only during 2006-07.

During 2006-07, an area of 250 ha was planted (160 ha under ANR, 70 ha under Bamboo and 20 ha under perennial Herbs and shrubs, incurring a total expenditure of Rs.21.35 lakhs.

During 2007-08, an area of 326.40 ha was planted (263 ha) under ANR, 25.40 ha under Bamboo, 10 ha under cane and 28 ha under Perennial Herbs and shrubs, incurring a cost of Rs.17.84 Lakhs. The total physical achievement is 576.40 ha and the financial achievement is Rs. 39.19 Lakhs against the physical target of 635 ha and financial target of Rs. 64.93 lakhs. During the original project period Rs. 41.28 lakhs was released (First release Rs. 25 lakhs and second release Rs.16.28 lakhs) by the NAEB. During 2007-08, the release was Rs.22.63 lakhs. Thus a total amount of Rs. 63.91 lakhs was released by NAEB. Therefore, physical target achieved is nearly 90% and the financial target achieved is only about 60%.

Forest Development Agency (FDA) is mainly constituted to integrate and co-ordinate the administration and activities of village level forest committees (VFC's). FDA is headed by the Chief Conservator of Forests, Eastern Circle, Olavakkode, Palakkad, the Chairman of FDA. Divisional Forest Officer, Mannarkkad is the member-secretary cum Chief Executive Officer (CEO). The FDA has been registered as Federation of Village Forest Communities under Kerala Societies Registration Act on 26-10-2002 with Registration Number as C A-525/2002.

Table - 51 -VSS's Registered under FDA, Mannarkkad Division

Sl No	Range	VSS	Formation	Treatment Area (ha)	Station
1	Agali	Kallamala AVSS	2002	950	Ommala
2	Agali	Singappara AVSS	2002	1550	Singapara
3	Attappady	Dhanyam AVSS	2004	900	Mukkali
4	Attappady	Mele Chavadiyur AVSS	2004	900	Pudur
5	Attappady	Moolakombu AVSS	2002	180	Pudur
6	Mannarkkad	Achilatty VSS	2002	200	Palakkayam
7	Mannarkkad	Cherumala VSS	2000	300	Palakkayam
8	Mannarkkad	Kacheriparambu VSS	2002	300	Thiruvizham kunnu
9	Mannarkkad	Mankada VSS	2000	150	Palakkayam
10	Mannarkkad	Vettilachola VSS	2002	900	Palakkayam

7.8 National Afforestation Programme (NAP):

The National Afforestation Programme (NAP) is launched by the Ministry of Environment & Forests, Government of India, to closely interlink the approaches of integrated forest development and rural employment generation into a single umbrella scheme. The objective of NAP is to regenerate the Forests and neighbourhood areas with a view to enhancing availability of forestry resources to meet the livelihood requirements of forest dependent poor and marginalized communities who have very little physical assets of their own.

Guidelines are issued to further decentralise the project cycle management of the scheme with a view to expedite the fund transfer to the village level implementing organisation ie. the Joint Forest Management committees (JFMC's) and Eco-development Committees (EDC's) to embed the scheme in the overall forestry development programme of the state, to build capacity of the institutions and promote livelihoods of JFMC members by linking forest development to value addition and marketing of the products.

Table - 52 - Activities proposed under NAP

Outputs		Activities
A	Improved natural forest stock	Assisted natural regeneration (ANR) of degraded areas.
B	Increased and improved Forest Tree Cover (FTC)	i) Artificial Regeneration (AR) and enrichment planting. ii) Promotion of Non-Timber forest products (NTFP's).
C	Participatory Forest Management (PFM) initiated by supporting the immediate needs of fringe-community.	Entry Point Activities (EPA)
D	Increased Soil and Moisture conservation (SMC)	Biological SMC supplemented by physical SMC treatment as per local site condition.
E	Long-term participation of fringe community in forest management	i) Participatory micro-planning, implementation and monitoring of projects. ii) Flexible project design and cost norms.
F	Improved forest/tree productivity	Promotion and use of improved technologies and high quality planting materials.
G	Increased capacity of fringe-community and frontline staff to develop and manage natural resources.	Awareness generation, training and linkage with other institutions.
H	Enhanced opportunity for local forest based micro-enterprise	Value addition and marketing of forest produce from project area.
I	Review and independent monitoring processes	Bottom-up internal monitoring of projects and final evaluations of each project
J	Tree cover in non-forest areas promoted	i) Agro-forestry on shifting cultivation lands and other farm lands ii) Coastal shelter belt and tank foreshore plantations on public and private lands and rehabilitation of man groves and sacred groves.

7.8.1. Organisational set-up for implementation:

The scheme will be implemented by a three-tier institutional set-up namely state Forest Development Agency (SFDA) at the state level, Forest Development Agencies (FDA's) at the Forest Division Level and Joint Forest Management Committees (JFMC's) or Eco-development Committees (EDC's) at the village level.

7.8.2. State Forest Development Agency (SFDA):

Constituted at the state level, will be a registered society under the Societies Registration Act and function as a federation of Forest Development Agencies (FDA's)

7.8.3. Forest Development Agency (FDA):

Constituted at the territorial/wildlife forest division level will be a registered society under the Societies Registration Act and function as a federation of all JFMC's and EDC's in that forest division.

7.8.4. JFMC/EDC:

Constituted at the Village level. The composition and functions of the JFMC's or EDC's executing this scheme may be reconstituted to have minimum representation of the marginalized groups.

7.8.5. Area of Implementation:

The scheme will be implemented to regenerate, afforest or reforest degraded Forests and adjoining lands, under both public as well as private tenure. Due priority will be given to the treatment of problem, eco-sensitive, disaster prone areas such as coastal areas, mangroves, ravines, shifting cultivation areas, strips along public infrastructure etc.

7.8.6. Planning of the Project:

Joint Forest Management (JFM) will be the central and integral part of the projects under the scheme. Focused effort will be made at all levels for the constitution of JFMC in all potential forest fringe villages, awareness generation about JFM procedures and benefit sharing, PRA-based micro planning and its implementation, capacity building of JFMC members and participatory monitoring and evaluation.

7.8.7. Proposal:

An FDA may draw a 5 year perspective (5 year plan) and year-wise Annual plan of operation (APO) for treatment of the project areas in consultation with JFMC members. Due consideration of the existing and potential resources and constraints (financial, natural and human) will be taken into account for phasing and sizing of activities.

The proposals formulated by the FDA may be forwarded to SFDA, which in turn, will scrutinize and approve the proposals. The state will in turn submit statement of all approved FDA project proposals to the NAEB, which would approve the SFDA's plan for 5 years.

7.8.8. Micro Planning:

After the approval of SFDA's plan by the NAEB, FDA would undertake JFMC constitution/reconstitution and awareness raising activities, followed by detailed PRA-based micro planning in each project village. The micro planning will start with preparing base line information about the condition of the Forests under the charge of the JFMC. The micro plan would be an integrated plan for both village and forest development. Thus it will have two parts. a) Forest Development and b) Village Development. It will be in consonance with the broad prescriptions of the forest Working Plan of the area.

The village development part of the micro plan would take into account the ongoing and potential works that could be undertaken as part of the Entry Point Activity Component of the NAP Scheme.

7.8.9. Entry Point Acitivities:

During the preparation of microplans, the community would identify the Entry Point Activities (EPA) to be taken up during the project period and the mode of its maintenance. Creation of durable community assets to support improved livelihoods especially to the marginalized sections of the JFCM (Eg: landless, poor women, primitive tribes, scheduled caste etc) may be given preference. Details of EPA works undertaken shall be maintained at the FDA level.

7.8.10. Funding Procedure:

The scheme would be implemented as a centrally sponsored scheme with 100% central funding.

Table - 53 - Model cost norms of components under NAP Scheme

Sl.No	Component	Model Cost
(i)	a) Strengthening/Constitution of JFM b) Microplanning (per JFMC)	Rs.5000/- Rs. 5000/-
(ii)	Awareness generation	1% of the planting cost
(iii)	Micro planning	2% of the planting cost
(iv)	Planting/Regeneration	As per models
(v)	Fencing	5% of the planting cost
(vi)	Soil & Moisture Conservation	15% of the planting cost
(vii)	Entry Point Activities (per hectare)	R.4000/-
(viii)	Training & Capacity building	Rs.10 Lakh per FDA
(ix)	Value Addition and Marketing of Forest produce	Rs.20 lakh per FDA
(x)	Monitoring and Evaluation	2% of the planting cost
(xi)	Over heads	10% of the planting cost
(xii)	Treatment of problem lands	25% of the planting cost
(xiii)	Use of improved Technology	25% of the planting cost

* Plantation cost includes various plantations or regeneration models taken up under the scheme according to their model cost.

The cost of the component however, will be the proportion of the cost of artificial regeneration model of the project area even though any other plantation model is chosen by the FDA.

Table - 54 - Cost Norms for plantation models under NAP Scheme

Sl No	Model/Intervention	Unit cost/ha of plantation and maintenance
1	Aided Natural regeneration (200 plants/ha)	Rs.9750/-
2	Artificial Regeneration (1100 plants/ha)	Rs. 17,100/-
3	Pasture Development/Silvipasture/400 plants/ha)	Rs.11,100/-
4	Bamboo Plantation (625 plants/ha)	Rs.9300/-
5	Planting of canes (625 plants/ha)	Rs.11,100/-
6	Mixed plantations of trees having MFP and medicinal value (1100 plants/ha)	Rs.17,100/-
7	Regeneration of perennial herbs and shrubs of medicinal value (2000 plants/ha)	Rs.20,400/-

7.8.11. Training and Capacity building:

This component will aim at providing training to the members of FDA's, JFMC's and also to build their capacity through organizing linkages with programmes/Schemes of other departments/organisations in the public and private sector for the furtherance of the objectives of the scheme. Special focus will be given on the needs of the marginalized groups of the village community, the primitive tribal groups and traditional forest based artisans.

7.8.12. Value Addition and Marketting of Forest Produce:

This component will aim at providing support to the FDA's/JFMS's for taking up Small and Micro Forest Enterprises(SMFEs) based on value addition and marketing of the forest produce. The money would be deposited in the Village Development Fund (VDF), which each JFMC will establish, if not already established, at the start of the project and used as a revolving fund for undertaking SMFEs and also as a corpus for leveraging assistance from banks and other financial institutions. The micro-financing principles may be adopted for augmentation and use of the VDF.

7.8.13 Project Duration and Maintenance of Plantations:

Each FDA project may be up to 5 years duration, including 3 years of maintenance of the plantation with a provision that in case, the project period extends into the next Five Year Plan and the NAP Scheme is discontinued by the Central Government, the concerned State Government will provide funds to complete the project.

7.8.14. Monitoring and Evaluation:

Each project under the scheme will be monitored by the FDA, SFDA and Forest Department officials through field inspections. The Range Officer will undertake field checks of the works undertaken by the JFMC's and submit periodical reports to the Chief Executive Officer. The norms set out by the Forest Department for field inspection of department works by its officers will also apply to the FDA projects.

The FDA will maintain record of each NAP plantation plot so that sampling of the areas for monitoring of young plantations could be done in a more scientific manner. Such a record would be compatible to GIS analysis and obviate the occurrence of overlap or duplication of efforts of plantation.

Evaluation of each FDA project will be conducted twice during the project cycle. The first will be done in the 24-36 months of the project operation. The focus will be on assessment of the degree of people's participation in the functioning of JFCMC's. The second evaluation will be the Final evaluation of the project to be done after 3 years of the last stretch of the project. The final evaluation will focus on the quality of people's participation, success of regeneration, in terms of expansion and improvement in vegetation and poverty impacts of the project.

7.8.15. Objectives of the Project:

The main objectives of the project National Afforestation Programme (NAP) implemented through FDA, Mannarkkad are as follows:

- To arrest the trend of forest degradation due to the unsuitable removal of forest produce by dependent communities.
- To provide sustainable and assured employment opportunities to the tribal and weaker sections of the rural population
- To involve the forest dependent community in the execution of the programme.
- To create a funnel mechanism through which assistance under various schemes of the Ministry of Environment and Forest, Government of India and from other sources would flow.
- To ensure the flow of funds from other sources for development schemes in tribal settlements and area adjoining the forest villages through FDA.

- To create an effective mechanism in order to ensure that this medium is used to reach the beneficiaries by other Government Departments also.
- To liaison with other Government Agencies to develop and implement eco-friendly village development programmes.
- To provide effective monitoring, evaluation and supervision of the schemes implemented by member VSS/EDC's etc
- Sustainable development and management of forest resources
- Increase and / or improve forest and tree cover (FTC)
- Rehabilitation of degraded Forests and other areas by institutionalizing decentralized/participatory forest management and supplementing livelihoods improvement process.

7.8.16. Different Components of the Project – NAP:

Different components are envisaged to achieve the above objectives implemented through Participatory Forest Management (PFM)/ Vana Samrakshana Samithies (VSS).

Aided Natural Regeneration (ANR): Aided Natural Regeneration (ANR) is low intensity planting up to 200 plants/ha. The object is to fill the gaps which are existing in the degraded Forests. This planting is purely to supplement the existing vegetation. The goal is to achieve the full canopy closure and not just the protection of the planted seedlings. The planted seedlings as well as the naturally occurred seedlings in the treatment area need care and attention until they are well established. Planting and regeneration up to 200 plants will be taken as one hectare of ANR. The object is closure of forest canopy with minimum interventions. The intensity of weeding shall be limited to minimum. Removal of weeds is desirable only when they choke the growth of seedlings. The presence of weeds can act as a protection against grazing and destruction by animals. Weeds also protect seedlings from harsh weather conditions. Therefore removal of weeds shall be done with discretion.

Artificial Regeneration (AR): High intensity planting with an average of 1100 plants/Ha will be treated as one hectare of A.R. This is applicable in barren lands with sparse tree growth or in large expanses presently overgrown with noxious weeds. These weeds need to be removed before taking up the area for planting. Protect existing trees and established vegetation. The goal is to achieve full canopy closure.

Bamboo Plantation:

The species to be raised is Bamboosa Bamboos. The average number of seedlings per hectare will be 625. The existing natural vegetation will be retained.

Cane Plantation:

Cane is a climber and need supporting trees. The average intensity of the planting suggested is 625/Ha The objective is to grow canes in the wooded Forests and protection of these Forests. Planting and regeneration of 625 plants will be taken as one hectare of plantation for calculation purposes. This component can be taken up either under spatial planting or functional planting.

Mixed Plantations of trees having medicinal value: The treatment prescribed is same as in Artificial Regeneration.

Regeneration of Perennial Herbs & Shrubs of Medicinal Value: This component is a high density planting with 2000 seedlings per hectare and ideal for under planting in Forests where there are openings in ground vegetation.

7.9. Creation of Joint Forest Management Committees and Development Fund:

Ten Joint Forest Management Committees or VSS were functioning and opened bank accounts for all such committees. The core fund with the VSS is the Development fund.

7.9.1. Preparation of Micro Plan:

After conducting PRA exercise, the Range Officer concerned prepares the micro plan in Malayalam. Socio-economic mapping, resource mapping and similar assessments are being carried out during PRA exercise. Micro plans were prepared for all 10 VSS's. Before preparing micro plans, the VSS should be registered as a society under the Kerala Registration of Societies Act. This was essential for granting accreditation for JFMC committees.

7.9.2. Performance of VSS's since its inception:

In Mannarkkad Division, initially, two VSS's were formed in the year 2000 and later eight VSS's were formed during the period between 2002 and 2004 and their overall performance was not satisfactory. FDA was formed in the beginning of 2006 but the fund allotment was made and its utilization started in the end of the year 2006. Components like ANR, Bamboo, Regeneration of perennial herbs and cane were mainly implemented and its treatment areas are furnished in Table below. The total area treated under ANR is 452.9 ha, Bamboo 120.2 ha, Perennial herbs 65.87 ha and Cane 10 ha respectively.

Table - 55 - Area (ha) treated from 2005-06 to 2009-10

Treatment	2005-06	2006-07	2007-08	2008-09	2009-10	Total
ANR	10	146.3	184	82.6	30	452.9
Bamboo	7	83	17	9.2	4	120.2
Perr.Herbs	-	20	30	10	5.87	65.87
Cane	-	-	10	-	-	10

Physical and financial achievement of different components of NAP under FDA is given below

Table - 56 - Activities carried out under NAP

Sl. No	Name of VSS/AVSS	Year of Formation	Components implemented	Treatment Area (ha)	Period of Activities & Area treated (ha)				
					05-06	06-07	07-08	08-09	09-10
	Mannarkkad Range								
1	Mankada VSS	2000	ANR	150	10				
			Bamboo			7			
2	Cherumala VSS	2000	ANR	300					
			Bamboo			20			
3	Achilatty VSS	2002	ANR	200		7			
4	Vettilachola AVSS	2002	Cane	900					
5	Kacheriparambu VSS	2002	ANR	300					
	Agali Range								
1	Singapara AVSS	2002	ANR	1550					

In order to assess the success or achievement of VSS's performance, three factors are mainly considered. Firstly, the extent of area treated under various components and its survival percentage. Secondly, the effective utilization of fund and thereafter the fund saved and accounted under core fund of each VSS and thirdly, the impact created due to the formation of VSS in the concerned area. But on general assessment, the overall performances are not impressive; their interferences are strictly on the basis of allotment of money from the department. They don't have any contribution of their own for sustained income and development of the area.

7.9.3. Developmental Activities under taken through EPA's:

Entry point activity is one of the components under the constitution of PFM as a source of financial support for the afforestation programme carried out in the field. The fund under EPA is permitted based on afforesting the area per hectare. Once a VSS raise plantation in one hectare area, they are liable for an amount of Rs.4000/- as encouragement money. This amount can be utilised for the common benefit of the members of VSS as decided by the executive committee of the VSS. Similarly, the guidelines issued for calculating one hectare planting in the case of ANR is 100-200 plants/ha, AR it is 200-1100 plants/ha

Bamboo and cane plantation, 625 plants/ha, Regeneration of Perennial Herbs and Shrubs, it is 2000 plants/ha

Details furnished in the appendix prove that most of the VSS's has exceeded their allotment under EPA. EPA has benefitted the members of VSS and thereby helped to tide up their problems temporarily. Inspite of the contribution through EPA, members had not realised the necessity of VSS, to actively participate for the conservation of area and work for common benefit. As already explained above, all VSS's strive to achieve the estimate amount and not the benefit of VSS as a whole.

7.9.4. Collection of NTFP through VSS:

Non-Timber Forest Produce (NTFP) is being collected by the scheduled tribes vide Pattika Varga Sahakarana Sangam at Agali. They collected the MFP from tribes, for which they will be paid for the produce and society sell the produce either in the domestic market or outside for better price. Normally, the tribals are not benefitted by this mode of transaction. Society people reap the benfits and tribals are paid nominal amount for the collection of produce. As an alternative mechanism AVSS comprising of tribals alone can be tried as an experimental approach. There are several constraints in the collection, processing, marketing and profit sharing. Department assistance is essentially required to help from collection stage till disposal. In order to avoid the exploitation by collection agents, the NTFP collection can be entrusted to VSS. It can play a vital role in collection of NTFP through scientific methods to ensure sustainable yield and this matter is dealt in detail NTFP working Circle.

As per NAP guidelines issued by the MoEF it is stated that 20% value of usufructs from the forest area managed by VSS should be made available for them as Village Development Fund. They are entrusted with the authority to formulate rules and utilize the money for village development activities as decided by the VSS. Each Vss's shall constitute a village development fund and every member shall contribute a minimum amount of Rs.10/- month towards this fund. VSS and FDA will be authorised to receive donation into the Village Development Fund.

In order to make the VSS self-sustained for its effective functioning, formation of Self Help Groups(SHG) will be of immense help. This can generate self confidence, decision making ability, collective decision making, management of finance and credit, self-financing effort and community empowerment.

The amount allotted for EPA can be transferred to the operational fund in the beginning itself. This can be transferred to the core fund for transferring to the self-help groups on the basis of half yearly turn over. The labour contributed by the SHG can

be rewarded suitably and a portion of their income may be set aside by the SHG as an addition to their financial assets.

7.9.5. Scope for VSS to undertake development works:

The functioning of VSS's is limited to the execution of forestry works as per the estimates prepared and sanctioned like the manner, department works are carried out in the field. On doing so, the concept of the VSS itself is jeopardized. Instead of relying departmental works alone, they can look for other areas which will provide them monetarily benefitted. Some of the ways are preparation of organic, fertilizer, Bee keeping, raising of medicinal plants and perennial herbs required for the Ayurveda pharmaceutical companies, processing of honey and its marketing, manufacture of mineral water, wax, candles, balms, paper bags, umbrella making etc. All the above activities are recommended for VSS, subjected to amendment made in the bye-law

7.9.6. Prescriptions for VSS:

Considering the ample scope of VSS's, it is prescribed that for the welfare of the dependent communities, more areas facing degradation may be brought under the operation of VSS. It is recommended to go for degraded areas rather than treating ANR, cane and perennial herbs. Since, success stories are rare in components like ANR, Cane, Perennial herbs, it is prescribed that Non-revertible Forests (NRF) may be considered for the treatment of areas by VSS in future, so that natural Forests will be left undisturbed due to the implementation of certain components. Participatory Fire Management, Eco-tourism activities, Tree planting etc are some of the areas where VSS's would be able to play their role effectively.

This plan does not suggest the places for constitution of VSS's. It takes a few interactions with the local communities to decide as to whether a VSS will be newly constituted at a place or not. As such, the Range Officer's will suggest the places where new VSS's will be formed in all the three ranges. Besides 10 VSS's constituted earlier, 17 new VSS's formed as per the guidelines issued for FDA's requirement is suggested for the first half of the plan period and if the situation demands additional VSS's may be formed.

7.10. Eco-Tourism:

Eco-tourism is defined as a way of marketing the serene natural habitats as tourism product with an in-herent element of nature education. It is a new concept in tourism. It is a purposeful travel to natural areas to understand the cultural and natural history of environment, taking care not to alter the integrity of the ecosystem, while producing economic

opportunities that make conservation of natural resources beneficial to local people. It is also termed as nature-based tourism that involves education and interpretation of natural environment and is managed to be ecologically sustainable. This concept is gaining international importance and it is a fast growing component.

7.10.1. Objectives:

- To promote and propagate awareness about forests and wildlife among the public without affecting the protection and conservation aspects of forests.
- To improve the income of the local community by exploiting the tourism potential of the area.
- To protect the Forests from fire, encroachment and illegal activities.

7.10.2. Siruvani Eco-tourism:

In Mannarkkad Division, the lone ecotourism site identified is Siruvani eco-tourism. Siruvani lies 40Km away from Mannarkkad and 45 Kms from Palakkad. The main attraction is Siruvani dam, its water is known outside for its purity and freshness. It is the second fresh water dam in the world. There is a rest house built by the Britishers and known by the name 'Pattiar Bungalow" and has an age of approximately 100 years. Department has made it more innovative with tiled flooring and modern amenities. The rest house offers a beautiful landscape of tall mountains and Muthikulam waterfalls to the tourists who visit the place. Rest house is neatly furnished with two suites with all amenties. It is situated in a beautiful location with Panoramic view of Muthikulam reserve and water spread area of Siruvani dam on three sides. One can sight the wildlife like deer, wildgaur, elephant etc drinking water from the bungalow premises itself. The calm and serene nature of the area is the best attraction of the site.

The ecotourism project launched by the Mannarkkad Division is to conduct tourism without damaging the eco-system by permitting the tourists to visit upto Siruvani dam. The vehicles are parked in the forest station premises and two vehicles are arranged to take the tourists upto 'Keralamedu', the boundary location between Kerala and Tamilnadu. The vehicles ply through cool atmosphere of evergreen forests and watch wildlife like elephant, Wildgaur, Sambar deer etc, and the tourists will have an experience of being in the forest and its wilderness. Trekking is also permitted to those interested parties to walk through the permitted route and with the assistance of tribal eco-guides.

7.10.3. Facilities offered:

Two eight seator vehicles are provided for tourists to have a visit through evergreen forests and experience the wilderness of nature. Vehicles ply from Singapara Station to Keralamedu with a stretch of 12 km through the dense forests. An amount of Rs.50/- per person is charged for to and fro trip.

Trekking is permitted, consisting of ten members team and Rs.100/- is charged per person for one day. They will be accompanied by a tribal eco-guide to show the route and narrate the experience of nature

Table - 57 - Revenue from Siruvani Eco-tourism

Year	Details of Visitors		Total	Amount Collected(Rs)
	Gents	Ladies		
2009-10	4541 Nos	1037 Nos	5578	3,51,300
2010-11	4172 Nos	819 Nos	4991	3,53,500
2011-12	2176 Nos	528 Nos	2704	3,20,500

The rest house called by the name “Pattiar Bunglaw” offers two suites, well furnished, with all amenities to the tourists, who liked to camp in the area. The rest house has to book well in advance, especially in the peak season. An amount of Rs.1000/- is charged for two persons and single suite, Rs. 500/- is charged for additional person.

Besides the above, construction of watcher tower is under way for the tourists to stay open in the watch tower and experience the true nature.

7.10.4. Thodukappukunnu Ecotourism Site:

Thodukappukinnu eco-tourism site is a proposed site located at entrance of Mannarkkad Division limit and by the side of National Highway N.H.217 of Perinthalmanna-palakkad Road. The site is spread over an extent of 22.6432 ha planted exclusively with bamboo of three different species viz: *Bamboosa bamboo*, and *Dentrocalamus strictus*. These bamboos are planted during 1995-96. The area is surrounded by private settlements in the North, East and West and the main road in the south. Other species like Irul, Chadachi, Pezhu, Punna, Thanni, Arampuli, Vellanava, Venga, Kazhani, Maruthu, etc are grown in plenty.

Basis of Proposal: The proposed site is a Vested Forest bit retained after litigation in the Forest Tribunal and Hon’ble High Court. The area is highly prone to fire and susceptible for encroachment in future. It has been converted into a dumping yard for chicken waste and other non-degradable materials. The area is lying by the side of main road and hence the area is being used by miscreants for anti-social activities. In order to protect the area from anti social elements, it is proposed to conduct eco-

tourism by constituting a VSS, with the interested persons living in the locality.

Constitution of VSS: A VSS may be constituted with limited members for providing amenities to the travellers who had come all the way from airport at Karipur, Commercial Centre at Kozhikode to Mannrkkad or Palakkad. Arrangements are to be made for getting the travellers refreshed by providing toilet facilities, snack bar, trekking trail of one kilometre stretch and a parking area for the vehicles. Nominal fees are charged for parking the vehicles and toilet facilities; Snack bar provides drinking water (manufactured by VSS), tea/coffee, fruits and other snacks. Information centre furnish information related to the Silent Valley National Park, Siruvani ecotourism, Nelliyampathy, Parambikulam etc. Booklets of all ecotourism sites under the department can be given to travellers for information as well as booking. Trekking trail of one kilometre distance would help the interested persons to know more about nature, bamboos and other species and get themselves refreshed.

The site should be furnished with low cost Nirmithy model huts. The area has to be fenced in front with barbed wire fencing erected over a three feet stone wall with gate and other facilities. Trekking trail can be a pavement, made of boulders, and steps at intervals, would attract the people to walk through. The members of the VSS who attend the travellers should be trained to behave politely, impart knowledge about tourism sites and names of species found in the site etc. The nominal fee collected would be deposited with Division office account and the wages of members are paid from the fund so collected. The facilities required can be decided by the Divisional Forest Officer according to the need and necessity of the area.

CHAPTER – VIII

GENERAL FINANCIAL FORECAST

8.1. General Financial Forecast:

Table No.58 Anticipated Expenditure during the Plan Period

Amount Rs. in lakhs

Sl. No.	Particulars of Work	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
1	Timber operation & regeneration plantations	40	30	42	44	50	36	38	77	112	123	135
2	Soil& moisture conservation works	49	70	81	99	73	62	52	39	27	30	33
3	Maintenance of other plantations	36	40	43	47	50	55	60	63	66	73	80
4	Ganja eradication	37	40	43	47	49	52	55	57	60	66	73
5	Maintenance of Buildings, Roads, Trek Paths, etc	55	57	60	64	70	77	84	87	92	101	111
6	Compensation packages for cropdamages, Man-animal conflicts, etc	85	89	92	94	108	110	126	130	135	149	164
7	Fireprotection works	80	88	90	95	100	108	112	116	120	132	145
8	Boundary consolidation	30	36	42	44	48	15	10	8	5	6	7
9	PFM& Eco-tourism activities	132	145	147	150	157	160	163	165	173	190	209
10	Construction of new buildings, Office,Quarters, roads, etc	55	57	59	64	67	73	76	80	85	94	103
Total		**599**	**652**	**699**	**748**	**772**	**748**	**776**	**822**	**875**	**964**	**1090**

Table No.59 Anticipated Revenue during the Plan Period

Amount Rs. in lakhs

Sl. No	Particulars	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
1	Timber and Fire wood Teak	29	292	387	400	466	371	349	738	1262	1388	1527
2	Acacia	9	0	0	0	0	0	7	13	0	0	0
3	Eucalyptus	22	0	0	0	0	0	21	33	0	0	0
4	Eco-Tourism	0.8	1.3	2.2	3.7	6.1	10	16	27	45	45	45
5	Other sources	1.3	1.4	1.6	1.7	1.9	2.1	2.3	2.5	2.8	3	3
Total		**62.1**	**294.7**	**390.8**	**405.4**	**474**	**383.1**	**395.3**	**813.5**	**1309.8**	**1436.0**	**1575.0**

CHAPTER – IX

MISCELLANEOUS PRESCRIPTIONS

9.1. General Constitution:

Miscellaneous prescriptions are made to high light the activities that are not included in any of the working circles. The area taken under Ecologically Fragile Land (EFL) is not dealt under any Working Circles. Separate prescriptions are required to manage the land considering the site factors and legal matters. Most of the land taken under EFL under litigation in Forest Tribunal or High Court, hence uniform prescriptions as in the case of other working circles are not possible. Similarly, Fire incidence is not dealt in any of the earlier working circles; it has gained importance because of its danger that are likely to create in future, hence it is dealt separately with a management plan.

9.2. Vested Forests:

The Vested Forest areas were under the control of Palakkad special Division with effect from 10-05-1971, demarcated and surveyed during the period from 1974 to 1978, notified during 1977 to 1993. In the notifications, certain items were reported with difference in areas and descriptions. The survey sketches received from the survey department indicated extents that differ from those given in the notifications. Meanwhile, the erstwhile owners preferred petitions before the Forest Tribunals as per the Divisions in the Kerala Forest (Tribunal) Rules, 1972" to get the vested areas restored. In number of judgements, the bits were restored to the ex-owners, yet others are pending before various courts.

Mannarkkad Division has altogether 99 vested forest bits known by the name 'Malavarams' with 78 main items and 21 sub items as its parts. The above malavarams were notified in three stretches with same notifications No.1383/1977 with three different dates viz 18-03-1977, 29-07-1977 and 10-10-1979. On perusal of the above notifications, it is noted that almost 45 V.F.C. items are seen repeated with various survey numbers and extents, most of the survey sketches prepared by the survey department did not have the correct extent given in notification and they are preliminary. Because of the above reasons, vested Forests are subjected to encroachments and legal claims before the Forest Tribunal remain unending. Hence, it is proposed to constitute the Vested Forest areas, which do not have any legal claims pending, may be notified as 'Reserved Forests' as suggested by the Vested Forest Committee. Once the Vested

Forests are converted into a Reserved Forests, after examining all rights, concessions and issues, at least legal claims can be avoided and protect the remaining bits as pucca reserve forests. List of Vested Forest items with comparative study of different notifications are attached in **Appendix - III** already attached.

9.3. The Kerala Forest (Vesting & Management of Ecologically Fragile Land) Act, 2003:

9.3.1. Introduction:

On 27th July, 2000, the Governor of Kerala promulgated The Kerala Forest (Vesting & Management of Ecologically Fragile Lands) Ordinance, 2000 providing that ecologically fragile land shall vest in Government. The ordinance was repopulated on 27-01-2001with effect from 2nd June, 2000 and was subsequently replaced by the Kerala Forest (Vesting & Management of Ecologically Fragile Land Act, 2003.

9.3.2. Interpretation of the Act:

The object and reasons for EFL Act is very much important to understand the purpose of the Act reads as follows: "International Union of Conservation of Nature and Natural Resources"(IUCN) has declared the Western Ghats as one of the Biodiversity Hot spots in the world. As a signatory to the Convention of Biological Diversity (CBD), our Nation has the responsibility to conserve the biological resources for the sustained economic and social development of the society and for the maintenance of ecological stability.

It is evident from the preamble of the Act, the object and reasons appended to the Bill that the provisions for take over is to provide for *insitu* conservation. Accordingly 47 bits of varying extents ranging from 80 cents to 100 acres with a total extent of 720.04 ha were notified as EFL in Mannarkkad Division. Copy of the notified land with Survey number village, gazette no & date, locality, range and boundaries of the notified bit are appended as **Appendix - XXVIII.**

9.3.3. Prescriptions:

The Government has passed the EFL Act to bring the ecologically fragile lands under the ownership of the state and to ensure proper management of such lands with a view to maintain ecological balance and to conserve biodiversity for the welfare of the society and of the national at large. The lands taken under EFL Act are not uniform in nature. It varies upon the locality and hence uniform prescriptions are not suitable for EFL areas. Many EFL areas are under litigation in EFL Tribunals and Hon: High court. There are 16 EFL cases pending before the EFL Tribunal in

which DFO and Custodian of EFL are respondents besides the State of Kerala as the 1st respondent. Details of the EFL Cases Pending before EFL Tribunal are as follows.

Table - 60 - List of EFL Cases

Sl.No	Case. No.	Petitioner	Remarks
1	18/08	Bojan	OA Allowed
2	28/08	Sajan.K.John	For hearing
3	29/08	Sivanandan	Communication field
4	30/08	Rajeswary	OA Allowed
5	35/08	Jagadeesan	Call with IA
6	36/08	Sarojini	Call with IA
7	37/08	Sateeshan	Call with IA
8	38/08	Leela	Call with IA
9	39/08	Prejeesh	Call with IA
10	40/08	Sathyan	Call with IA
11	41/08	Praseena	Call with IA
12	42/08	Leela	Call with IA
13	43/08	Srikumaran	Call with IA
14	10/09	Nair Service Society	For Evidence
15	13/09	T.C.Joseph	For Evidence
16	31/09	Subrahmania Naikar	Objection filed
17	30/2010	Joseph& Others	For Objection and Hearing
18	31/2010	Mini & Others	For Objection and Hearing

Ecological significance varies upon land to land. Several factors related to ecological fragility viz. endemism, endangered species, wildlife corridors, Specialised Ecosystems, areas with intrinsically low resilience, sacred groves, frontier Forests, Steep slopes, grass lands, catchment area, High rainfall area etc have to be considered before suggesting any prescriptions. It is upto DFO to decide upon the activities suitable to the locality as and when the litigations are over and the area ultimately landed with the department.It is prescribed to afford adequate protection to EFL areas considering its fragility and ecology of the land.

9.4. Fire Management Plan:

The incidence of fire in the Forests is the single most dangerous factor for the destruction of forest areas all over the world. It is the most detrimental factor acting against the massive efforts of conservation of the forest department. The last fire occurrences in California, Amazon, Indonesia etc were the widely discussed fire hazards which removed thousands of square kilometres of invaluable forest lands from the surface of the earth that cannot be replaced by any conventional or scientific methods of man he achieved through the last many centuries. In India and especially in Kerala, the fire hazard is a major conundrum for the Foresters to tackle with.

Fires in the forest generally start from December continuing up to the month of May which is known as fire season. In interface of forests with the human interests in enclosures and among the peripheral dwellers has increased with the hike in the boundary length and these are some of the sources and may

constitute the basis for almost all the forest fires. Farming recapitalization, tribal settlements, encroachments in and around forest areas, Pilgrimage, tourist influx, illicit brewing, grazing, ganja cultivation, desertification etc and other forms of biotic pressure are the factors for forest fires.

9.4.1. Causes of fires:

The incidence of fire by natural means is comparatively very less. The fire hazard from high-tension lines passing through the forest areas is also less and so are the incidences from lightning. Most of the fires are not caused accidently but purposefully due to vested interests, carelessness, hostility or lack of proper awareness. The increase in flammable biomes, global warming, expansion of grass lands due to secondary succession etc are some other factors for fire. However the major causative factors are:

i. Landscape fragmentation and land cover change.
ii. Fires caused by trespassers and users of Forests by carelessly slinking the butts of burning cigarettes and matches on to the forest floor.
iii. Fires caused by campers in the forest who do not put out the camp fires that lit for cooking, before leaving
iv. Fire started by occupants adjacent and to forest when they burn slash for land clearing.
v. Fire caused by tribes and forest dwellers for burning vegetation for cultivation, collection of NTFP's or for hunting lesser animals etc.
vi. Fire caused by grazers and herdsman for getting new flesh of palatable fodder for their livestock.
vii. Fires caused by pilgrims, travellers, tourists etc.
viii. Fires caused by miscreants, engaged in illicit brewing, Ganja cultivation etc
ix. Fires caused by children for sports etc
x. Fires caused by unemployed youth to get employment as fire watchers.
xi. Fires caused wilfully by unwanted elements and hostile people.

9.4.2. Strategy for fire Planning:

Ø Since forest fire is a regular phenomenon in most of the forest areas every year, it is imperative to draw fire plans for each forest range and division to tackle the problem of forest fires.

- Ø The format discussed and finalised in various workshops should strictly be followed. This will facilitate incorporation of all necessary details and would be helpful in monitoring and evaluating the plans. Annual action plan should be prepared based on the strategic plan.
- Ø Planning should be proactive, rather than waiting for fires to occur, the concern should be for preventing fire. More emphasis should be given to development of a preventive strategy rather than control.
- Ø Planning should be done after prioritization having due regard to the resources available. Planning should be more intensive for areas, which are more fire prone
- Ø Where ever possible, participatory fire management strategy should be evolved based on the broader guidelines issued on this aspect. No plans will be approved without this component.
- Ø For prevention of fire and for minimizing fire damage, 'prescribed fires' should be planned and strategy laid out. Under an unwise rigidity regarding the width of firelines should be dispensed with and a need based strategy for this may be prescribed for different areas. Use of fire as management tool in protection and habitat management for wildlife is essential.
- Ø Command structure with unity of command should be specified for each strategy, illustration of this and positioning of equipment should be annexed to the plan for quick efficient and on the spot organisation of fire gangs.
- Ø Data should be gathered on the sources of secondary support such as the voluntary fire fighters, NGO's, Organisations, individual, students, teachers, nature covers etc.
- Ø Details of resources like man power, vehicles, wireless etc, should be made available.
- Ø Departments like Fire force, Meterology etc should be shown in Annexure to the plan to be tapped at local or state level during fire season.
- Ø Fire safety measures should be described in the plans and briefly on fire should essentially include briefing on fire safety also. Unsafe and caretess fire fighting strategy will not only be hazardous or even fatal to the men at the fire front, but also will impede their efficiency in fire situations resulting in more areas being consumed by fire. Some of the instructions to be given in this regard are
- Ø Wear non-synthetic clothes to cover the body so as to protect it from radiant and convection heat which usually keeps the fire fighter at bay.

- Ø The head gear and goggles to protect the head and eyes from radiant heat, flying embers and sparks.
- Ø Use footwear, preferably of leather, while working in fire burnt areas safely.
- Ø Carry enough quantity of water to guard against desiccation by heat
- Ø Keep a first-aid kit with the team while working to fight

Even though causalities of men during forest fires are rare in the Kerala situation, there are such reported cases in areas like Eravikulam where the raging and fast moving grass fires change speed and direction with the changes in wind. Therefore, in any fire situation, watch the fire intensity, spread and behaviour and plan for an escape route in case of danger.

- Ø Keep communication between fire fighters effectively while combating fire
- Ø Remember that the air near the floor is heavier, cooler and fresher.
- Ø In case the fire fighter is surrounded by fire, cutting off the escape route, shield the body with any non-conducting, non-burning material.

9.4.3. Guidelines/Instructions:

Experience on micro planning and Participatory Rural Appraisal (PRA) is essential. Key concept of the new technique is ensuring active participation of people in planning, implementation and management of programmes. There is no hard and fast rule as to the manner of participation by the people in forest fire control. However, the following are the general guidelines which can be used according to the circumstantial requirements.

9.4.4. Guidelines for Participatory Fire Protection by VSS/EDC:

i. It will be the responsibility of Divisional Forest Officer's and Range Officer's to organise VSS in preventing fire.

ii. Call general body of the VSS and explain the objectives of the department. To observe the year "Year of No Fires". Co-operation of local people (who are not members of VSS) also may be enlisted through Public meetings and publicity. Complete forest fire prevention shall be organized as a people's movement.

iii. Fire prevention strategy may be worked out in consultation with the VSS members. Opinion of all should be heard and consensus in methodology should be arrived at priority of locations to be protected from fire vis-à-vis probability of fire occurrence in such areas upto 20 years of age. Priority may start from youngest to oldest of the area.

iv. Locality specific strategy may be adopted which may include clearing of firelines or engaging fire protection watchers or both. Any other innovative strategy can also be experimented. However, the objective shall be to protect forest fire. There shall be a Fire Protection Committee in each VSS with all forest staff working in the respective forest station and at least 15 VSS members (minimum 50%women) as members. The committee shall meet at least once in every week and monitor the progress of fire prevention measures. Range office shall take adequate care to ensure that weekly meetings of fire protection committees are held. Minutes of these weekly meetings may be recorded and evaluated by the Divisional Forest Officer every fortnight.

v. "Fire Management Plan" may be prepared through the following steps.

vi. Organize a workshop of VSS/EDC members and forest personnel for preparing fire management plan.

vii. Discuss the protection issues related with forest fires.

viii. Prepare a map of the area to before protect and mark fire prone areas fire prevention strategy should be developed for all locations which are fire prone, even if no VSS is functioning there now. New VSS can be constituted in such locations.

ix. Discuss and document strength & opportunities of VSS in fire protection. Discuss and document weakness and threats of VSS in fire protection.

x. Prepare fire management strategy on the basis of strength, weakness, opportunities and threats of VSS and forest department.

xi. Chalk out site specific methods/techniques for fire protection.

xii. List out the role of Forest Department in Fire Protection

xiii. Prepare "Fire Management Plan", present it in the general body meeting of the VSS and get its approval Range Officer should get the Fire Management Plan approved by the general body of VSS and submit the same to Divisional Forest Officer who sanction it at the prevailing rates and subject to the availability of funds.

xiv. After approval of the plan.VSS will sign a Memorandum of Understanding (MOU) with the forest Department.

xv. Implementation of Fund:- The funds available under different budget heads shall be allotted to VSS.

xvi. Release of Fund

xvii. Protection Committee's meeting shall be conducted every week.

Please note that VSS's are only the agencies for implementing fire protection works as per the 'Fire Management Plan'. The MOU with VSS will not absolve our protective and executive staff from their primary duties and responsibilities with regard to fire protection.

A Circular No. E&TW 1-2002/2008 of the PCCF dated: 14-11-2008 was also issued for strict adherence during the fire season.

The fire protection measures to be adopted by the Forest Department during the fire season were discussed in detail during Senior Forest Officers. Meeting held on 10th November, 2008. The following decisions can be adopted on the basis of deliberations.

The forest officers are primarily responsible for effective implementation of fire management plans for protection of Forests from fire. The PFM institutions are to be effectively employed by them to achieve the desired objective.

The fire management shall be done in the following two ways.

1. By entrusting the work to the willing VSS's (willingness shall be ascertained in advance)
2. Where VSS's are not active or are not in a position, the work shall be executed departmentally

The following procedures shall be adopted for each of the above two methods.

9.4.5. Fire Management by VSS's:

Preparation of fire management plan can be done by VSS. The area under operation by each VSS shall be classified as follows:

- Highly Fire Prone area
- Medium fire prone area
- Least fire prone area

The general body of VSS's will draw the sketch of the forest areas and classify the forest areas as above and discuss the causes/sources of fire in each locality based on their local knowledge. The action plan to counter forest fire should keep in view the causes, and suggest preventive as well as containment measures. These can be

- Campaign children and youth of the locality can play a major role.
- Fire lines in essential localities and
- Stationing of fire control gangs for surveillance and fire fighting.

The general body will constitute a sub-group of VSS members for planning fire management. The Sub-group will take the initiative in preparing the plan. The plan signed by the sub-group, the President of VSS, Secretary of VSS, the station head, incorporating the conditions specified in this circular and approved by the Range officer, is approved fire management plan of the VSS. This constitutes the MOU.

Financial support for fire management activities will be as per the categorization mentioned above. This would mean that highly fire prone area will get the maximum amount, medium will get lesser amount and the least fire prone area will get still less.

The Range Officer will consolidate the fire management plans of the VSS's for the range and prepare Range Fire Management Plan.

The Divisional Forest Officer will approve the fire management plans submitted by Range Officers and ensure smooth flow of funds.

The responsibility of fire management in respect of younger plantations (upto 5 years) will vest with the department and therefore while preparing the fire management plan; such plantation may be excluded if necessary from the plan of VSS's.

The fire control gangs will maintain a diary of events pertaining to fire management activities as well as incidents of fire. The field officials of the department shall review the diary every day and issue necessary instruction.

The forest department will maintain the prescribed NMR in case of fire control gangs. The VSS's will deploy their members for fire protection activities and maintain their labour register.

Forest areas which are outside the management area of VSS shall be protected from fire by the Forest Department. In case the VSS's are weak or are not equipped enough, the forest department shall carry out fire management on its own.

The forest department shall maintain forest protection gangs of 10 to 15 watchers in each range, if required, with a view to supplementing the fire protection activities of VSS's. The services of the existing watchers can be utilized for the purpose.

The maintenance of roads for facilitating fire management shall be the responsibility of the department.

The time schedule may be maintained as follows:

Table - 61 - Fire Management Plan

Sl. No	Action	Time Schedule
1	Instructions by Divisional Forest Officer	Before 30th November
2	Submission of fire management plan by VSS's	By 10th December
3	Approval of management plan by Range Officer	By 15th December
4	Completion of fire lines	31st December
		10th January in case of delay in specific cases
		15th January for completion by VSS's
		After 15th January, departmental action for completion

The Divisional Forest Officer will review the implementation of the Fire Management Plan every month

The reasons for the incidents of fire if any will be evaluated by a team constituted for each division by the Chief Conservator of Forests. Its recommendations will be taken into account for improving the fire management strategy.

9.4.6. Fire Protection Activities in Mannarkkad Division:

Mannarkkad Division has reserve Forests of 150.7322 Sq km and Vested Forests of 271.7213 Sq Km. There are areas with average rainfall of 5000mm and at the same time area which receive scanty rainfall of less than 1000mm. Similarly, forest type also varies from Wet Evergreen type to Southern euphorbia scrub are also present. Though there are 11 VSS's formed prior to 2008 and another 14 VSS's formed later, they can be termed as still in infantry stage, hence the members of VSS's are interested only in field work rather protection of Forests in its true sense.

As per the Circular mentioned in the above para that fire protection has to be enforced in the field through VSS only unless they are inactive or not capable of doing the work. As far as Mannarkkad Division is concerned, there is no specific fire Management Plan as directed vide the Circular of PCCF. Hence, fire protection work are apportioned in the following manner vide the circular of PCCF. Hence, a portion of firelines are assigned to VSS's, some to JFMC's of AHADS, Fire Protection Committees constituted temporarily for the purpose of fire protection alone also get some work, balance works are executed through Convenor of the Department.

- The activities are classified accordingly
- Fire line creation'
- Engaging fire gangs and fire protection mazdoors
- Organizing campaigns against fire
- Creation of fire blocks for protection.

Details of fire lines created by VSS, department and by fire protection committees are furnished in **Appendix- XXIX.**

As per circular fire line works have to be carried out in the field through VSS unless they are unwilling to execute the work. Discussions held in all VSS's and a consensus had been arrived at before carrying out the work in the field. Besides the VSS's, department and FPC's AHADS had also under taken the fire protection works through their JFMC's for 160 Kms in Attappady Range and 30 kms in Agali Range. They had also utilized the fund from National Rural Employment Guarantee Scheme (NREGS) through their JFMC's for about 330 Kms in Agali Range 470 Km in Attappady Range. Though the fund is provided under NREGS, the technical sanction is accorded by the concerned Range Officers. Fire gangs are deployed under station level to meet emergency situations besides the employment of daily wages Watchers turned fire protection mazdoors. By all means, fire incidences can be tackled effectively with the above resources.

A fire protection strategy has been developed by dividing the total area into various blocks. Under teams constituted for fire protection activities. Each Station are divided into six to seven blocks entrusted with Forester/Forest Guard as team head to co-ordinate the fire protection activities.

9.4.7. Prescriptions:

- In the absence of institutional arrangements, a suitable fire management plan has to be prepared in the model shown above, to evolve strategies to meet the fire hazards.
- The model described above can be adopted for future fire management plans with strict adherence of directions in the circular of PCCF.
- The fire plan should be location specific identifying clear, measurable, cost effective, and achievable goals for each, specifying responsibilities as regard detection, communication, organisation and control of fire.
- Participatory fire management strategy should be evolved based on the broader guidelines issued on this aspect. No plans will be approved without this component in future.
- Fire Management Plan is mandatory for availability of fund from different heads; hence approval of fire plan is essential before sanctioning the fund.

9.5. Forest Management Information System (FMIS):

Development of FMIS is essential to make timely and pertinent information available for management decision-making. Effective use of information is critical for sustainable forest management. FMIS implementation may follow a four-pronged strategy

- Building up the capacity of staff to use and manage information facilitating the flow of information
- Mainstreaming the use of information Technology (IT) particularly database management systems, Geographic Information System (GIS) and internet connectivity and
- Increasing the availability of key reference data sets such as updated forest inventory.
- The FMIS will provide computers in the office and computer literacy to the staff and connect the various institutions in a network. The phased introduction of the technology is expected to address the following concerns
- Job specialisation because of frequent transfer, staff trained for a specific task is frequently assigned to other tasks

Streamlining of existing procedures: the automation of current information management procedures would only reinforce existing inefficiencies. At present FMIS is on experimental stage at Division level.

9.5.1. Modules of FMIS:

The following modules have so far been developed an installed in various offices.

i. Personnel Information System
ii. Store Tools Purchase
iii. Participatory Forest Management System
iv. Offence Information System
v. Court Case Monitoring System
vi. Natural Forest System
vii. Fire Management System
viii. Plantation Management System
ix. Social Forestry Projects Management System
x. Progress Reports Management System
xi. Research Project Management System
xii. Civil Infrastructure System
xiii. IRM & NTFP System
xiv. Sales Management System

Out of the above modules, Personnel Information System, STP, PFMS, Offence Information Systems, Fire Management System are developed and used in accounting.

9.6. Wind Fallen Trees:

Many commercially important timber species subjected to wind have been fallen and remains unretrieved. The dead standing timber and the wind fallen timber were being collected till 1997 from certain areas. Large scale annual collections can be a disturbance to the natural Forests and can lead to its degradation. On the other hand, leaving the economically important timber cause loss of revenue to Government, reduce timber supply in markets. The sizable quantity of dry timber lying in the most deciduous Forests is a potential fire hazard. Therefore, it is prescribed to collect the economically important wind fallen timber with least possible disturbance of Forests.

The collection will be limited to the accessible portions of the moist deciduous Forests only. No collection of wind fallen timber will be attempted in the evergreen and the semi-evergreen. The suggested species for collection are Rosewood, Teak, Vellakil (*Dysoxylem malabaricum*), Manjakadambu (*Adina cordifolia*), Kambakom (*Hopea parviflora*), Pulivaka (*Albizzia odorattissima*), Thembavu (*Terminalia crenulata*), Venga (*Pterocarpus marsupium*), Plavu (*Atrocarpus heterophyllus) Anjily (Artocarpus hirsutus),* Chadachi (*Grewia tiliaefolia),* Irul (*Xylia xylocarpa),* Maruthu (*Terminalia paniculata)* and Venteak (*Lagerstroemia macrocarpa).* The economically less important species will not be collected.

No dead standing tree will be collected. The wind fallen trees can be harvested every year from the plantations. In tune with the above, the general marking rules in the department shall be followed. New roads shall not be constructed for collection and transportation of wind fallen timbers.

9.7. Re-arrangement of boundaries:

Mannarkkad Division has three Ranges namely, Mannarkkad, Attappady and Agali. The territorial jurisdictions of Attappady and Agali Ranges lie North-South directions on either side of the Mannarkkad-Anakkatty road extends upto Anakkatty which has a distance of 35 km. The officials of both Ranges have to travel 35 km to cover their area which consum more time and fuel. It is suggested to think about re-defining the boundaries of Attappady and Agali Ranges to half of the above distance by re-arranging the jurisdiction limits either based on natural boundaries or revenue boundaries without effecting the fascilities enjoyed by the public now.

Similary, the administration of Singampara Forest Station vest with Agali Range for which, the Range Officer has to travel all the way from Mukkali, Mannarkkad to reach Singampara whereas the area lie adjoining to Mannarkkad Range area. Hence, it is suggested to include the administration of Singampara Station with Mannarkkad Range instead of Agali Range. In the same way, Mannarkkad forest station has its headquarters at Anamooly whereas its territorial jurisdiction extends beyond the jurisdiction limit of Palakkayam Station. Hence, it is suggested to refix the boundary limit of Mannarkkad and Palakkayam stations.

9.8. Human Resource Development:

Mannarkkad Division has staff strength of 3 Range Officers, 8 Deputy Rangers, 19 Foresters, 103 Forest Guards and 8 Reserve Watchers for protection of the field. The Division has to face problems like encroachment and protection as it borders with Tamil Nadu on two sides. Similary, Ganja eradication and sandal smugllings also pose a grave threat to protection. Division has at present only 6 Deputy Rangers, 16 Foresters, 94 Forest Guards and two Reserve Watchers.

The diversified activities especially for sandal protection, Ganja eradication etc warrants effective protection. Sanctioned staff strength has to be enhanced. It is proposed to increase the strength Foresters by 25 Nos., Forest Guards by 120 Nos. and Reserve Watchers by 15 Nos. for effective protection.

The following training requirements are identified for enhancing the knowledge, skill and attitude of the personnel. Role of computers in forestry and office administration for the ministerial staff is highly essential. Training on use of computers frequently to update the latest advancement in computer technology should be provided. Training on Participatory Forest Management, Watershed Management in degraded Forests, Wildlife Management and population estimations, EFL Acts and Rules, study tours to PFM areas, Sanctuaries and National Parks etc should be enhanced to improve the potential of staff.

9.9. Improving Amenities to Staff:

Staff working in stations packs sufficient amenities for stay and drinking water. They suggested the requirement staff quarters of vehicles, computer facility and camping equipments in common to all stations. Station buildings lack maintenance for the last few years and hence recommended for renovation or construction of new buildings according to the availability of fund. The requirement of staff is furnished below in Table.

Table - 62 - Details of Facilities Required in the Division

Sl. No	Range	Station	Facilities Required
1	Mannarkkad	Palakkayam	750 metre road tarring to station building Bore well at Injikunnu and Kalladikode camping sites.
		Anamooly	Change the sheet roof of checkpost building to tiled roof and water facility at checkpost building Furniture for station building.
		Thiruvizham kunnu	20 metres stations road to be tarred. Kacheri parambu-Puttanikkad road-3 Kms to be maintained Kacheriparambu-Mannathikottani Road to be maintained
2	Attappady	Mukkali	(i) Renovation of camp sheds at Thudukki, Kadukamanna with trench facility Thannichodu-Murugala, Chemmannur-Thannichodu, Pottikkal- Abbannur Roads to be maintained Murugala-Abbannur,Kadukamanna-Gottiyarkandy, Kadukamanna-Thudukki Trek paths to be maintained OP building at Thazhe Manjikandy
		Puthur	Camp sheds at Moolakombu, Mallikathottam, Mulli, Rajiv colony and Cheerakkadavu for sandal protection Maintenance of Edavani campshed and Road to Campshed Trek path maintenance to Edavani-Korakuntha-5Km, Kinakkara-Venthavatti-5Km, Choottara-Velatti-10 Km
3	Agali	Sholayur	Open well /Bore well at station premises Renovation of OP building at Nellipathy and new building at Sambarcode.
		Ommala	Open well/Bore well at station compound Maintenance of Thumbapara-Puliyara Road Watch tower at Goolikkadavu
		Singampara	Watch tower at Keralamedu Water tank facility at station compound Toilet facilities to tourists with VSS participation.

The requirement of facilities mentioned above may be provided during the plan period in a phased manner.

CHAPTER – X

SUMMARY OF PRESCRIPTIONS

10.1. Summary of Prescriptions:

I. Plantation Working Circle:

(a) Pure Teak Plantations:

i. The silvicultural system proposed is final felling on rotation of 60 years and replanting with teak.

ii. Thinning cycle proposed for pure teak plantations is first mechanical thinning at 5th year and silvicultural thinning at 10th, 15th, 20th, 30th, and 40th year.

iii. A clear weeding and climber cutting to be carried out wherever necessary before marking for thinning.

iv. Valuable naturally species such as Rosewood, Ebony, Sandal, fruit bearing trees etc are to be retained.

v. Replanting by using stump or root trainer seedlings and maintenance of the plantations for five years with adequate number of weedings.

(b) Teak Plantations with abundant Natural Growth:

i. There are three Plantations with more than 50% of miscellaneous growth. It is proposed to harvest teak alone and replant with locally available predominant miscellaneous species.

ii. The names of these plantations are to be removed from the list of plantations in the next revision.

(c) Pulpwood Plantations:

i. Rotation is six years for Acacia and eight years for Eucalyptus.

ii. Clear felling with artificial regeneration with miscellaneous species.

iii. Seven failed plantations namely 1998 Odampetty(5ha), 2002 Kalkandy(5ha), 2003 Kallamala(5ha), 2004 Chinnaparambu bit I & 2(6.6ha), 2005 Mangapotty(5.5ha) 2005 Ottumala(4.5ha), 2007, Kappupetty(2ha) with good stock of miscellaneous species are to be reverted back to natural forests.

(d). Cashew Plantations:

i. Cashew fruits are to be collected as NTFP and the gaps in the existing plantations are to be planted with miscellaneous local species.

(e). Miscellaneous Plantations:

i. These are the plantations created under various schemes by planting in the natural forests. They are full of miscellaneous growth and hence it is recommended to treat them as part of natural forests and delete their names from the list of plantations.

(f). Medicinal Plantation:

i. A medicinal plantation raised adjoining Mannarkkad-Anakkatty Road is to be maintained with boards depicting the scientific names and its uses.

(g). Heterogeneous Mixed Seeding Plots:

i. The degraded areas of natural Forests were treated by profuse mixed seeding under the Western Ghats Development Programme during 1990-93. Since, natural regeneration of local species has grown in abundance this plantation should be treated as natural forest and its name should be deleted from the list of plantations.

II. Protection & Improvement Working Circle:

i. It is proposed to plant suitable species like Agave, *Caryota urens*, bamboo, *Glyricidia maculata* etc along the boundary @10 km every year. This can also be adopted in boundaries of plantations to identify as well as act as barriers against fire.

ii. It is proposed that remaining length of approximately 150 km should be demarcated within the 1st half of the plan period at the rate of 25 km/year from 2011 to 2015. The boundary should be maintained once in two years.

iii. The outer boundary especially the inter-state boundary should be cleared annually.

iv. All the boundaries of tribal settlements should be surveyed and demarcated.

v. Soil and Water Conservation Measures such as gully plugging, check dams, rain water harvesting pits, contour

bunds and contour trenches are prescribed. Rough location is identified with instructions to the DFO for taking up the works depending on the funds available.

vi. It is proposed to treat the revenue land on watershed basis along with the treatment of forest areas.

vii. Construction of Camping shed with communication facilities at Sholayur and Ommala stations of Agali Range and Thiruvizhamkunnu station of Mannarkkad Range.

viii. Planting of miscellaneous species suitable to the locality, for afforestation and eco-restoration of area as per the methods followed by AHADS.

ix. Artificial regeneration with appropriate host and tending is proposed followed by proper enumeration and protection of existing growing stock.

x. A site specific plan (SSP) is mandatory for every bit of Plantation to be raised in the field with due concurrence of the CCF concerned, prepared by the Range Officer under the guidance of DFO.

xi. Vegetation status and physical configuration of the land.

xii. Frequent raid for eradication of Ganja and poaching.

xiii. Establishing camps at vulnerable areas as preventive measures. Camping staff may be provided all facilities for their protection and effective performance of duties.

xiv. Deployment of adequate watchers having previous knowledge of routes and areas.

xv. In the absence of institutional arrangements, a suitable fire management plan has to be prepared in the model shown above, to evolve strategies to meet the fire hazards.

xvi. Evolve an effective fire plan which is location specific identifying clear, measurable, cost effective, and achievable goals for each, specifying responsibilities as regard detection, communication, organisation and control of fire.

III. Bamboo, Reeds and Cane Working Circle:

i. Artificial regeneration of bamboo in natural forests with poor stocking.

ii. A maximum of 1000 nos. of bamboos can be collected and the area should be revisited once in 3 years.

iii. All river banks and boundaries should be planted with bamboo.

iv. Reed species *Ochlandra tranvancorica* (Eetta). The members of 34 tribal settlements will be allowed to collect reeds free of cost for their bonafide use.

v. Though there was a ban on commercial harvesting of reeds in the previous Working Plan it was violated by allotting 784200 nos. reeds to M/S.HNL.

vi. Cane planting technique is described in the text. Cane should be planted in the natural forests by taking up about 20 ha per year in this plan period.

IV. NTFP & Tribal Welfare Working Circle:

i. Conduct awareness programme among tribals to educate them about the non destructive methods of collecting NTFP.

ii. Frequent monitoring of the collection and ensuring reasonable rates for their produce.

iii. Evolve methods for processing and value addition of the NTFP.

iv. Create adequate storing facility maintaining the quality during glut season for marketing in lean season.

v. An inventory of all NTFP yielding plants of Kerala is essential to know the distribution of different species for identifying in situ Conservation areas and also to decide on ex-situ conservation strategies.

vi. Tribals should be given priorities for all works in the forestry sector.

vii. Educate tribals on their rights and responsibility to protect forests.

viii. Provide link between line departments in implementing various Tribal welfare activities such as housing, health, education etc.

ix. Complete the implementation of Forest Rights Act especially the community rights.

V. Wildlife & Bio Diversity Conservation Working Circle:

i. Research on habitat conservation of Rare, Endangered and endemic species such as *Vateria macrocarpa, Diospyros bourdilloni, Myristica dactloides*, *Dendrobium species*, Lion-tailed macaque, Nilgiri langur, Niligiri Tahr, Nilgiri Laughing thrush, Nilgiri wood Pigeon etc has to be sponsored to appropriate institutions and the practical findings to be adopted by the Department.

ii. Afford maximum protection to Wildlife, initiate habitat improvement, and monitor their response to managerial interventions.

iii. Create awareness among local people about the importance of wildlife in the ecosystem, need for conservation etc.

iv. Establish protection camps at points susceptible to poaching.

v. Initiate activities for capacity building to enable the staff for effective protection and conservation of forest and wildlife.

vi. Protect the shola patches as such by affording maximum protection.

vii. Provide water holes for wildlife at appropriate places especially during summer.

viii. Construct and maintain solar fence in problematic areas.

ix. Educate Local communities to avoid planting cash crops like plantains, coconut, pineapple and tapioca.

x. Forest fire should be prevented during summer months.

xi. Compensate the wildlife victims by timely payment of grants.

VI. PFM & Ecotourism Working Circle:

i. Strengthen the existing VSS by training them in different skills.

ii. Educate the members about the importance of ecology and environment for the survival of mankind.

iii. Allot the degraded areas in the fringes and failed plantations for afforestation through participatory mode.

iv. Timely release of their grants for work and entry point activities.

v. Ensure adequate representation of women and SC & ST participation in the afforestation activities.

vi. Involve the VSS in evolving the participatory fire management strategy.

vii. Enlist their support in protection of forest wealth.

viii. The existing Siruvani ecotourism centre should be managed through VSS only.

ix. Provide more visitor amenities in the above centre such as parking place, toilets, information centre et.

x. Provide brochures and pamphlets to the visitors on relevant information to educate them.

xi. Introduce computerized booking for better transparency.

xii. Provide uniform to the VSS members to lift their pride.

xiii. It is proposed to develop Thodukappukinnu eco- is a proposed tourism site located at entrance of Mannarkkad Division limit and by the side of National Highway N.H.217 of Perinthalmanna-Palakkad Road.

10.2. Miscellaneous Prescriptions:

i. The dead standing timber and the wind fallen timber were being collected till 1997 from certain areas. It is prescribed to collect the economically important wind fallen timber with least possible disturbance. The collection will be limited to the accessible portions of the moist deciduous forests only.

ii. Training on use of computers, Participatory Forest Management, Watershed Management in degraded forests, Wildlife Management and population estimations, EFL Acts and rules, study tours to PFM areas, Sanctuaries and National Parks, Man animal conflict resolution etc should be given to improve the efficiency of the staff.

iii. The territorial jurisdictions of Attappady and Agali Ranges lay North-South directions on either side of the Mannarkkad-Anakkatty road extend up to Anakkatty which has a distance of 35 km. The officials of both Ranges have to travel 35 km to cover their area which consume more time and fuel. Therefore it is prescribed to re-define the boundaries of Attappady and Agali Ranges to half of the above distance by re-arranging the jurisdiction limits either based on natural boundaries or revenue boundaries without affecting the facilities enjoyed by the public.

iv. Similarly, the administration of Singampara Forest Station vests with Agali Range for which, the Range Officer has to

travel all the way from Mukkali, Mannarkkad to reach Singampara whereas the area lie adjoining to Mannarkkad Range area. Hence, it is suggested to include the administration of Singampara Station with Mannarkkad Range instead of Agali Range. In the same way, Mannarkkad forest station has its headquarters at Anamooly whereas its territorial jurisdiction extends beyond the jurisdiction limit of Palakkayam Station. Hence, it is suggested to refix the boundary limits of Mannarkkad and Palakkayam stations.

v. There are 16 EFL cases pending before the EFL Tribunal in which DFO and Custodian of EFL are respondents besides the State of Kerala as the 1st respondent. Ecological significance varies upon land to land. Several factors related to ecological fragility viz. endemism, endangered species, wildlife corridors, Specialised Ecosystems, areas with intrinsically low resilience, sacred groves, frontier Forests, Steep slopes, grass lands, catchment area, High rainfall area etc have to be considered before suggesting any prescriptions.