

CHAPTER – 3

PROTECTION & WATER CONSERVATION WORKING CIRCLE

(Extent 6260.094 ha)

3.1 CONSTITUTION OF THE WORKING CIRCLE

This working circle consists of the entire Sandal Reserves, Vested Forest, Proposed Reserves, Ecologically Fragile Lands and plantations of Marayoor Division. Extent of this Working Circle is 6260.094 ha.

3.2 THE STATE OF FORESTS

3.2.1 Condition of Forest: The entire forest area of Marayoor Division falls on the Eastern slope of the Western Ghats. Different types of Forests present in this Division are subjected to severe biotic damage resulting in their degradation and thus leading to diminished ecological value and economic importance. The natural Forests in the plan area are under the influence of adverse factors like illicit felling, sandal smuggling, firewood collection, annual fire and grazing. The grasslands and shola Forests having the ecological status of climatic climax form of vegetation are either invaded by pulpwood plantations or facing degradation due to annual unmanaged fires and grazing.

3.2.2 Causes of Degradation: The causes of degradation of forest can be attributed mainly to the following reasons.

1. Occurrence of illicit cutting of trees, annual fires, grazing, encroachment, ganja cultivation, etc.
2. Over exploitation and unscientific collection of forest resources like bamboo, medicinal plants and other NWFP.
3. Invasion of exotic weeds like lantana, eupatorium and parthinium.
4. Soil erosion due to degradation of forests owing to heavy biotic pressure especially on fringe areas.
5. Conversion of high altitude grasslands into pulpwood plantations of wattle.

6. Lack of awareness regarding the finiteness of forest resources among the people.

3.2.3 Impacts of Degradation: In addition to the well-known impacts of degradation such as soil erosion, loss of bio-diversity, reduction in rainfall, drying up of rivers and streams, flood, land slides etc., the following specific phenomena are also noticed:-

1. Loss of soil fertility
2. Water scarcity and severe drought in summer
3. Lack of regeneration and change in the forest composition and structure.
4. Increase in human-animal conflict
5. Decreased availability of NWFP in providing livelihood security to tribes and other fringe communities.

3.2.4 Major Parameters Determining Forest Degradation: The Kerala Forest Research Institute has published a report regarding “survey and establishment of monitoring system for the degraded forests of Kerala”. This study was sponsored by the KFP. As per the study certain parameters have been identified which determine the severity of forest degradation individually or in combination, as given below in **Table No. 28**.

Table – 28 – Major Parameters Determining Forest Degradation

SI No.	Parameters	Degraded	Not degraded
1	Proximity to habitation	< 5Km	> 5 Km
2	Continuity of Forests patches	Discontinuous	Continuous
3	Forest patch size	< 100 ha	> 100 ha
4	Crown density	< 0.40	>0.40
5	Formation of gully	High	Low
6	Established seedlings	Low < 40 %	High > 40 %
7	Established pole crop	Low < 40 %	High > 40 %
8	Presence of indicator plant species (this include Eupatorium, Tall grass, lemon grass, Citronella, Pennisetum panicum, Mikania)	High (Covering more than 60 % of the area)	Low (Covering less than 40 % of the area)

These parameters are easy tools to identify degraded forests for various restoration treatments.

3.3 OBJECTIVES OF MANAGEMENT

An integrated approach to conserve water and soil by direct and indirect methods is envisaged. As water is life and rivers and streams are the arteries of the forest, a holistic approach is needed for the protection and conservation of soil and moisture: -

The main objectives are –

1. To protect and arrest the degradation of existing forests.
2. To preserve the forests for soil and moisture conservation.
3. To improve the water retention capacity of micro watersheds of this rain shadow area.
4. Ecorestoration in wattle plantation area.

3.4. PROTECTION OF EXISTING FORESTS

Though the existing policy of the Government does not suggest conversion of any more natural Forests for non Forestry purposes, the chances of encroachment of forest persist against which protection machinery has to be further strengthened. Total length of the forest boundary in Marayoor Division is 55 Km, out of which natural features constitute 27 Km. where consolidation of boundary is not necessary. The remaining boundary consolidation in 20 Km has already been completed. Balance 8 Km of boundary has to be consolidated

The Divisional Forest Officer shall fix annual target for each Range Officer for refixing and consolidating the boundary in their jurisdiction by constructing a fixed number of Cairns every year. Theerthamala, Chempattikudi, Sushani, Kulachivayal etc are the tribal settlements which require boundary consolidation.

Most of the cairns had been constructed 15 to 20 years back and a good number of them are seriously damaged. Damaged cairns are present in station areas of Vannanthura 50 numbers, Kanthalloor 100 numbers, Marayoor 50 numbers and Nachivayal 50 numbers.

Construction of Kayyalas (jungle stone wall) along the boundaries connecting the cairns to cairns would reduce the chance of encroachment in future. It is proposed to construct 5 Km in Koodakkadu area of Marayoor Range and 5 Km in Vannanthura, Theerthalar area of Kanthalloor Range.

Planting of agave/jetropha in two to five rows along the boundary will reduce the spreading of fire and will act as a physical barrier (vegetation fence). It is proposed to plant agave species in station areas of Vannanthura 2 Km, Kanthalloor 5 Km, Marayoor 5 Km, Nachivayal 5 Km along the boundary.

Prescriptions

1. The boundary consolidation has to be done around the settlements in the Marayoor Sandal Division area. Boundary of each settlement has to be demarcated and consolidated with permanent cairns.

Marayoor Range : 1200 cairns

Kanthalloor Range : 400 cairns

Consolidation to be carried out 200 cairns per year in Marayoor and 100 per year in Kanthalloor Range

- 2 The entire boundary of proposed Reserves and Sandal Reserves are to be consolidated before the end of the plan period 200 numbers of cairns can be constructed along the boundary.
3. Damaged cairns in plan area need renovation urgently.
4. Construction of jungle stone wall (kayyala) from cairns to cairns in areas prone to encroachment.
5. Planting of Agave/Jetropha along the boundary in 3 to 5 rows in areas prone to encroachment and fire.

3.5 ECORESTORATION OF DEGRADED FORESTS ON WATERSHED BASIS

A study by CWRDM, Kozhikode shows that surface run off in the streams from dense catchment areas is less than that of the exposed and exploited catchment area during rainy season. In Marayoor Division the network of streams join the river Pambaar. The land area which contributes water to a particular river or stream is called water shed. It is a manageable hydrological unit. The Marayoor Sandal Division contributes water to Pambaar River and hence these areas are under Pambaar water shed.

These macro watersheds are identified based on topography, irrespective of nature of land use, and each catchment is identified and divided into micro watersheds. The micro watersheds identified in Marayoor Division are described in **Chapter 1 of Part-I**.

The grassland- shola ecosystem found in high altitudes of this Division has been recognized as the most important vegetation type that maintains stream flow as the rain collected by shallow grassland soil is drained to the deep declivity of shola Forest which maintains a perennial water flow from it. **Table No. 29** gives details of streams and brookes originating from plan area.

Table – 29 – Details of streams and Thodu

Marayoor Range		Kanthalloor Range	
Sl. No	River Name	Sl. No	River Name
1	Pambbar River	1	Mannvanchola aar
2	Kambilipara thodu	2	Paripetty thodu
3	Kadavala thodu	3	Kunjukumbala aar
4	Selakudala thodu	4	Koolipetty aar
5	Iduppukallu thodu	5	Keezhpanam thodu
6	Oonjampara thodu	6	Palathaar thodu
7	Panayoda thodu	7	Theerthamala aar
8	Pambakada thodu	8	Poonkadavu thodu
9	Karimutti river	9	Thalakundu aar
10	Puravayal thodu	10	Muttivayal aar
11	Nagamala thodu	11	Kanthalloor thodu
12	Kadalavara thodu	12	Karayoor thodu
13	Kanyamkadavu thodu	13	Poravayal thodu
14	Karimutty thodu	14	Kazuthyurunda thodu.
15	Adani thodu		
16	Thulasimantha thodu		
17	Uppukuzhi thodu		
18	Kammalan kudi thodu		
19	Alampetty thodu		

3.5.1 Restoration of Degraded Forest area on Watershed basis: Threat factors such as fire, illicit felling and unregulated collection of NWFP etc. still continue to accelerate the process of degradation. For prevention of degradation and for eco-restoration of already degraded area, these biotic factors are to be prevented. Once such factors are reduced/eliminated, the natural regeneration is expected to improve and as a result the vegetation would tend to regain its original status. For easy tackling of the watershed areas all the major watersheds have been divided in to micro watersheds having natural boundaries. It is presumed that 50 percent of the area of the micro watershed may not require any treatment except protection from fire and biotic interference. Treatments are not required in areas treated as ANR, RDF and RRB under KFP earlier. Details of area treated under KFP are given in **Table No. 20.**

3.5.2 Identification of sites for treatment: The degraded forests, for management intervention will be taken up on micro water shed basis. Plan area belongs to water sheds area of Pambar. Details of micro watersheds falling in Marayoor Sandal Division with watershed code No. etc have been furnished in **Table - 4 of Chapter – 1, Part - I** of this Plan. A map showing the Forest type in Plan area prepared by the GIS of the Forest Department shows that, nearly 20% of the Natural Forests areas (Approximately 1300 ha) are degraded in the above watershed area of plan area. List showing extent of degraded area available in each micro watershed is given in **Table No. 30.** During the past 10 years 570.38 Ha. has been undergone various treatments like RDF, RRB, ANR and for activities enriching the growth of sandal. It is proposed to conduct treatment in an area of 650 Ha. (Marayoor 300 ha Kanthalloor 350 ha) during the plan period.

CWRDM has conducted a study in Vattavada watershed area for preparing a typical master plan for integrated development of the water shed. Details of the study report has given in **Chapter -7 Part –I.** As per their study report it was understood that increasing surface water source, ground water resource and land resources are essential for development of a watershed. In order to conducting eco restoration works for over coming degradation instead of tackling the area in single compact unit, treatment of each micro watershed is suggested. The treatments have to be continued up to 5 years for ensuring the development of area. The schedule of activities to be done in each water shed is given in **Appendix – LIX.**

Table – 30 – Details of Micro Watershed in Marayoor Division

Marayoor Range

Sl. No	Station	micro watershed	Extent (Km ²)	Extent of forest area (Km ²)	Treatment required (ha)	Nature of area	Proposed area (Ha)	Activities required				
								ANR/ RDF (ha)	SMC GP	Cont. Bund (M)	Trench (M ³)	Fire protection (ha)
1	Marayoor	16P21a	12.9708	9.00	100	Koodakadu proposed reserve. Grassland alternate with shola patches. Wind is very high. Fire protection, soil conservation etc are required.	20	20	150 M ³	500	500	20
2	Marayoor	15P19d	4.93324	1.50	50	Area is spreaded in SR-51, Koodakadu proposed reserve, SR-52 and 54. Rocky area and highly susceptible for soil erosion. Agave planting, gully plugging, enrichment planting etc are suggested.	50	50, Agave 30 ha	300 M ³	750	500	50
3	Marayoor	15P19a	2.3343	2.3343	100	Area covered koodakadu Proposed Reserve area, part of SR-52, SR-54 and the whole area of NSR-I. Area degraded due to fire and soil erosion. Rocky area is also present. Fire protection, planting of agave, gully plugging etc are suggested.	50	50 Agave 10 ha	300 M ³	500	500	50
4	Nachivayal	15P19b	20.2961	20.296	100	Koodakadu proposed reserve area. Grassland area alternate with shola patches. Fire occurring area. Since it is highly susceptible to fire protection is suggested.	25	25	100 M ³	500	250	25

Sl. No	Station	micro watershed	Extent (Km ²)	Extent of forest area (Km ²)	Treatment required (ha)	Nature of area	Proposed area (Ha)	Activities required				
								ANR/ RDF (ha)	SMC GP	Cont. Bund (M)	Trench (M ³)	Fire protection (ha)
5	Nachivayal	15P20a	3.657	3.657	50	Rocky and fire affecting area. Soil erosion is more	30	30 Agave 10 ha	200 M ³	200	500	30
6	Nachivayal	15P17a	5.423	3.250	75	Part of Koodakadu proposed Reserves and Pallanadu R F. Highly degraded and regeneration sandal is less. Proposed Reserve and VF can augment with sandal and other local species	50	50	250 M ³	600	200	50
7	Nachivayal	15P18a	6.753	6.200	150	Area is coming in NSR-I and Koodakadu proposed Reserves. Both are highly degraded. Enrichment planting of sandal and associates can be done in this area. Augmentation of bamboo, construction of check dam, soil and moisture conservation works etc are suggested.	75	75	400 M ³	500	500	25
	Total						300	300	1700 M ³	3550	2950	250

Kanthalloor Range

Sl. No	Station	micro watershed	Extent (Km ²)	Extent of forest area (Km ²)	Treatment required (ha)	Nature of area	Proposed area (Ha)	Activities required				
								ANR/ RDF (ha)	SMC GP	Cont. Bund (M)	Trench (M ³)	Fire protection (ha)
8	Kanthalloor	16P16a	6.6559	0.200	10	Theerthalar proposed Reserve area. Augmentation of sandal	10	10	50 M ³	200	200	10
9	Kanthalloor	159a	2.437	0.800	40	Part of Theerthalar proposed Reserve and whole portion of Pallanadu vested forest. Highly degraded area. Enrichment planting of sandal, SMC structures like gully plugging, staggered trenches etc are suggested.	20	20	50 M ³	500	500	20
10	Kanthalloor	15P8a	2.777	0.800	50	Theerthalar proposed Reserve area. Highly degraded. Planting of sandal seedlings and associates soil and moisture conservation works are suggested.	30	25	200 M ³	300	500	25
11	Kanthalloor	15P7c	11.935	8.000	150	Area is coming Theerthalar proposed Reserve. Regeneration is less. Highly eroded area. Augmentation of sandal and other trees species, fire protection and soil conservation works Terracing Chempattikudy, Theerthamalakudy etc are suggested.	75	50	300 M ³	500	1000	50

Sl. No	Station	micro watershed	Extent (Km ²)	Extent of forest area (Km ²)	Treatment required (ha)	Nature of area	Proposed area (Ha)	Activities required				
								ANR/ RDF (ha)	SMC GP	Cont. Bund (M)	Trench (M ³)	Fire protection (ha)
12	Kanthalloor	15P7b	5.7947	4.000	80	The micro watershed area is coming in Theerthalar proposed Resave area. Watershed area is highly degraded due to heavy soil erosion, grazing and fire. Augmentation of sandal, fire protection, Terracing are suggested	50	50	300 M ³	500	500	50
13	Kanthalloor	15P6a	3.992	0.750	30	This watershed area is coming under part of Karayoor SR-I. Boarder area is fenced. Regeneration is very less suggestion for conducting augmentation works and soil conservation.	20	20	200 M ³	500	500	20
14	Kanthalloor	15P5a	1.3724	0.500	50	Part of KSR-I and whole portion of KSR-II coming in this area. Chainlink fencing is present. Area degraded regeneration of sandal is very less. Enrichment planting of sandal and associate species, soil and moisture conservation works etc are proposed.	25	25	200 M ³	500	500	25
15	Vannanthura	15P4c	3.992	0.400	30	This micro plan area covers an appx extent 40 ha in Vannanthura Sandal Reserve. Degraded, Enrich planting of sandal and associate species fire	10	10	150 M ³	500	600	10

Sl. No	Station	micro watershed	Extent (Km ²)	Extent of forest area (Km ²)	Treatment required (ha)	Nature of area	Proposed area (Ha)	Activities required				
								ANR/ RDF (ha)	SMC GP	Cont. Bund (M)	Trench (M ³)	Fire protection (ha)
						protection, soil and moisture conservation works etc are suggested.						
16	Vannanthura	15P4b		0.600	50	This area is extended in Vannanthura Sandal Reserve - I & II. Regeneration of sandal is very less in this area. Soil conservation works, fire protection, enrichment planting etc are suggested for treatment of the area.	30	20	200 M ³	500	500	20
17	Vannanthura	15P4a	4.0429	2.000	75	This area is in Vannanthura SR-II area. Regeneration is very less. Soil erosion is more. Soil conservation works enrichment planting, fire protection etc are suggested.	50	50	300 M ³	500	500	50
18	Vannanthura	15P3a	6.6659	1.520	50	Part of Vannanthura-II is coming in the watershed area. Soil conservation works, augmentation of sandal and associated specie etc are suggested	20	20	150 M ³	500	500	20
19	Vannanthura	15P2a	9.313	0.150	15	This mirco watershed in Vannanthura -II. Soil conservation work, sandal augmentation etc are suggested.	10	10	100 M ³	500	500	10
	Total						350	310	2200 M³	5500	6300	310

3.5.3 Criteria for selection of various Treatments: The type of treatments required for various sites depend up on the crown density, degree of regeneration etc. If the crown density is more than 0.4, protection measures like soil and moisture conservation works are only required and if the crown density is less than 0.4 with good natural regeneration, measures like fire protection, protection from grazing and illicit activities, soil and moisture conservation works, seeding with local tree species etc shall be done. Selective weeding around the naturally coming seedlings shall also be done for overcoming the suppression from obnoxious weeds like Lantana, Eupatorium etc. No native species will be disturbed in the name of weeding. As far as possible, high altitude shola ecosystem should not be subjected to the treatments.

3.5.3.1 Assisted Natural Regeneration (ANR): This type of treatment is applicable in the area where there is insufficient regeneration. Various cultural operations like weeding of gregarious growth of Lantana, Eupatorium, soil working, sowing seeds of locally available tree species etc can be done in this area for promoting the natural regeneration. Natural regeneration is to be assisted in areas having more than 600 seedlings of local species per hectare. The points mentioned below show the criteria for selection of the area under the treatment ANR.

3.5.3.2 Criteria for site selection for ANR:

Crown density should be between 0.4 and 0.7.

The areas which have importance for healthy catchment to ensure water regime and sites, expected to respond favourably to soil and water conservation measures.

The areas should be rich in bio-diversity but the degradation is due to soil erosion, fire and past forest operations.

Areas supporting natural regeneration of an average of more than 600 seedlings/Ha with occasional small poor or blank patches require tending.

The areas with less biotic interference like collection of NWFP, firewood, fodder, green manure etc.

In areas with limited weed growth in small gaps, the weeds can be removed for assisting the growth of natural seedlings. Every year an approximate extent of 40 ha can be treated under this scheme during the plan period.

3.5.3.3 Treatments proposed: Stock mapping of the area is to be done after the survey and demarcation. Based on the stock analysis treatment map,

which have to be prepared for guiding the site specific operation. It should contain the details about the soil and moisture conservation works like gully plugging, contour bunds, staggered trenches etc, the tending operations like weeding, sowing of seeds of native species and details regarding the sowing and planting in the area.

SSP shall be prepared which reveals the sequence of operations to be carried out. The treatment plan will be prepared by the Range officer under the guidance of the Divisional Forest Officer and has to be approved by the Conservator of forests before sanctioning of the estimate.

3.5.4 Restoration of Degraded Forest (RDF): This type of treatment is aimed at improving the growing stock of a locality in addition to improving the ecological services. The activities proposed under this type of treatment are planting of tree species, tending of natural seedlings, sowing of native species etc depending on the need which will be taken up along with other works. Priority has to be given for the regeneration of sandal seedlings. Preference will be given to soil binding species like bamboo, vetiver, grass etc for controlling soil erosion. The works include planting to improve growing stock, planting soil binding species like bamboos etc in the river or stream bank and contour terracing to prevent the surface run off. The Range Officer will submit the proposal in the form of SSP with field data and after the inspection by the Divisional Forest Officer it will be sent to the Conservator of Forests for approval. The plan will be approved after the inspection by the Conservator.

Depending upon the number of seedlings available per hectare the treatment required can be divided into RDF I & II. If the number of seedlings per hectare is between 300-600, such areas are categorized as RDF I and if the number per hectare is less than 300 such areas are categorized as RDF II.

Table – 31 – Criteria for selection of area

Sl.No	Criteria	RDF I	RDF II
1	Crown density	0.1-0.4	0.0-0.1/failed Plantations
2	Regeneration status (Seedlings/ha.)	300 – 600 established seedlings	Less than 300 nos for plantations.
3	Occurrence and size of gaps	Small, few	Large may small gaps
4	Weeds and grasses	Invasion not well established	Invasion of weeds/grasses well established
5	Human interference	Moderate	Heavy

Sl.No	Criteria	RDF I	RDF II
6	Stage succession	Pioneer and colonizers present. Succession on way and possible to assist by artificial or natural means.	Succession failed, requiring intensive interventions. Not applicable for degraded plantations.
7	Soil types	Not much degraded, responding to soil/moisture conservation	Degraded requiring intensive site treatment for improvement of soil quality.

3.5.4.1 Treatments Proposed: The nature of treatment RDF I & II depends on the extent of degradation. Survey, demarcation, stock mapping, and preparation of treatment plan etc are the pre requisites. Choice of species for planting in RDF I & II areas should be based on site species matching; while in RDF I area, the stage of succession and structure of communities will suggest the species for planting, preferably with fast growing pioneer species to cover the site, or other native species which the site could support and decide the status of the vegetation, the most suited silvicultural practices in conjunction with artificial planting of seedlings or by seeding of indigenous species. Soil and moisture conservation works should precede planting operations depending on the necessity.

3.5.4.2 Strategic Planning of Water shed: For each micro water shed there will be a strategic plan which will view general details about the watershed, the problems of the water shed, the strategy to improve the watershed, the participation of local communities, the division of areas for different treatments based on the approved criteria, maps, treatment plan etc. The strategic plan is to serve as a basis for preparation of operational plans (SSPs) which will follow the guidelines already issued for different treatments like ANR, RDF, RRB, and Plantations etc. The strategic plan will be prepared after conducting detailed Participatory Rural Appraisal involving members of the Panchayat/NGOs/local people. Perambulation of the site is to be done by the Forester and Forest Guards in charge of the area. The Deputy Range Officer, Range Officer and the Divisional Forest Officer will also perambulate the area and finalize the proposal. The Conservator of Forests will approve the strategic plan after his personal inspection.

Based on the interaction with stakeholders, suggestions on entry point activities will be made, so as to reduce pressure on the Forests. Suggestions for closing the area for collection of NWFPs for commercial purposes will also be made, except where socio-economic causes are involved such as collection of bamboos and reeds by the workers under Kerala State Bamboo

Corporation. In such cases collection must be done strictly observing the scientific principles.

3.5.5 Site Specific Plan (SSP): The Range officer will prepare the SSP under the supervision of the Divisional Forest Officer and the Conservator of Forests will approve it. For the preparation of SSP the area will be surveyed and stock mapped. Based on the stock analysis treatment maps will be prepared incorporating the features of the terrain and other relevant details. The following informations are to be incorporated while preparing the SSP.

1. Survey sketch of the treatment area with field book.
2. General information viz. physiography, geology, climate etc.
3. A status report discussing the level of degradation, type and composition of crop, species diversity, number and extent of open patches, regeneration status, status of slopes, intensity of soil erosion, types of erosion, level of biotic interference, major weeds, causes of degradation etc.
4. Stock map of the area.
5. Regeneration survey details, with analysis of result.
6. Causes of degradation.
7. A comprehensive treatment report with detailed suggestions to address the identified causes of degradation.
8. A treatment map prepared based on the treatment plan.
9. If artificial regeneration is a component of treatment, the details of planting stock are to be furnished.
10. Proposals for special conservation of rare or endangered species, if any, in the treatment area.
11. With regard to fringe areas, the result of Participatory Rural Appraisal, and suggestions to reduce the dependency of the stakeholders on the treatment area.
12. Availability of labour force, institutional arrangements.
13. Monitoring indicators.
14. Financial forecast.
15. Photographs of the degraded forest area before treatment.

3.5.6 Implementation: The treatment will be carried out as per the approved prescriptions in the SSP. The prescriptions are generally for the conservation of soil and moisture, fire protection in the treatment area, eradication of weeds and supplementing natural regeneration by ANR, RDF I and RDF II.

3.5.7 Maintaining of Treatment Journal: A journal shall be maintained containing all relevant details regarding the area. A copy of the survey sketch with field book, treatment map in which the locations of the gullies, streams and other physical structures are to be pasted in the journal. The details regarding the sample plots are also furnished in the treatment journal. The areas where weedings required have to be surveyed and a survey sketch also incorporated with the journal. The sample plot data will be maintained properly. Measurements are taken periodically for assessing the natural regeneration and growth of planted seedlings. Details of all treatments will be recorded periodically to evaluate the effect of treatment. The details of works done and the expenditure incurred every year also will be furnished in the treatment journal. The degraded forest areas will normally be maintained for a period of five years.

Prescription

Eco-restoration works like RDF/ANR shall be done as per approved SSP only on watershed basis. The proposed sites and schedule for year wise treatment are given in **Appendix- LIX**.

3.6 SOIL AND MOISTURE CONSERVATION

During the rains 10 – 20 % water will percolate into the ground and the remaining will runoff reaching streams, rivers and finally end up in the Ocean. Obstruction of the runoff water to facilitate its percolation into the ground is the objective of water harvesting structures. The vegetation cover increases the organic content of the soil, which in turn increase infiltration and storage capacity. The leaf litter reduces the erosion and increases infiltration by slowing down runoff. The flow of water from dense Forest catchments is less when compared to the exposed catchments during rainy season. The prescriptions for soil and water conservation are aimed at the over all development of the area.

Various methods are available to recharge the water table by increasing the rate of infiltration. The artificial recharge will be achieved by obstructing the flow of water. The following methods can be adopted.

3.6.1 Gully Plugging: These are structures constructed across the rills, gullies and ravines to obstruct the flow of water. Gullies are formed in forest areas due to washing of thin soil cover along with ground flora and leaf litter.

Treatment of gullies will be started from the uphill side. Big stones should be put in bottom layers and also on top to prevent them from being dislodged or carried away by the water current, by careful packing. Blocking of permanent stream is not Gully Plugging. Streams can be trained and direction regulated by strengthening stream banks.

After filling the foundation up to 20cm depth and laying stones in the first layer, a step of 0.15 meters may be left on the down stream side without deviating from the curve. In the successive layers steps are left so as to reduce top width gradually. Thickness of apron packing should not be less than 0.45 meters and gully sides above the apron have to be protected with stone pitching to a height of at least 0.3 meters above the anticipated maximum water level to prevent side scours being formed by the falling water. The stone filling should go up to 0.3 to 0.6 meters into the stable portion of the gully side to prevent end cutting. In the center of the dam portion, sufficient water way should be provided to facilitate overflow. The structure should form an arch with convex side facing the up hill. Depending on steepness and run off volume, in general the top width should be kept to the essential minimum required (say 60-90cm).

Instead of dry rubble, gabionic structures can be used for gully plugging in highly eroded areas. It could be done in the places where there is soil erosion and slope is very steep and should be attempted only in gullies and never in natural streams.

3.6.2 Gully plugging with brushwood: Certain gullies can also be plugged by means of brushwood and posts. This sort of structure can also be used within a series of structures while tackling severe gullies for reducing the cost factor. Small jungle wood posts can be collected from the top ends and residues available in the extracted plantations and piled into the soil at definite intervals in two or more rows. Then brush wood or branch wood with leaves is put in below and these will get filled up with washed off soil and get compact. Care should be taken to avoid cutting natural seedlings and poles. These structures can be taken up in lower slope area where the terrain is near flat. Name of places which require gully plugging are at Nachivayal – II, Kandathilchola, Thenmalachola, Pothadi, Mattumontha, Inchaparathodu, Kammalamkudy, Vengaparakudy, Kuthukallukudy, Ambalapara, Sevakkudy, Palakkadanchola, Chempattykudy, Periyachola, Anjanattupara, Theerthamala, Karayoor and Thodavattichola. Details regarding quantity are given in **Appendix – LIX**.

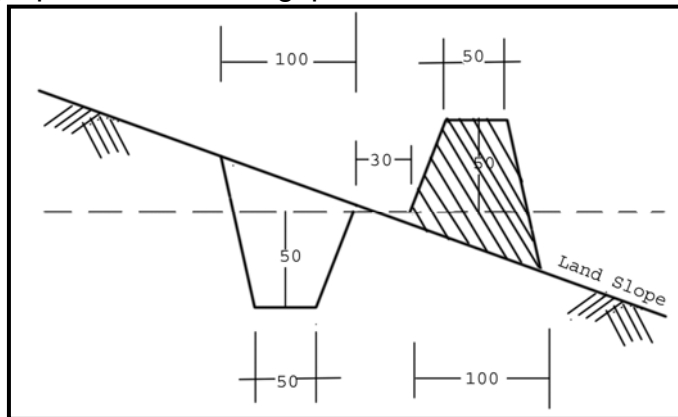
3.6.3 Check Dams: Check dams are generally constructed with concrete, RR masonry across the perennial streams or gullies for storing water. It will attract wild life also during dry season. It cuts off the runoff velocity and reduces erosive activity. The water stored improves the soil moisture of the adjoining areas and allows percolation to recharge the aquifers and improve water table. Care should be taken not to inundate swamp vegetation and

vayals by impounding water. Proposed sites for construction of check dam are at Koodakkadu thodu in Nagamala, Thodathattichola, Pothadi, Kammalamkudy, Illikkadu and Chundukandu. If any more suitable sites are available those may be considered.

3.6.4 Contour Trenches: Contour trenches are water harvesting structures constructed along the contour in the degraded and barren areas in a continuous or staggered manner. Trenches are recommended for areas of lesser slope in both Ranges. The Divisional Forest Officer has to use his discretion in fixing the interval and number of pits per hectare. The scooped up soil can act as bunds and these can be stabilized by planting grass or live hedges of agave plants. Name of places which required staggered trenching are Kammalamkudy, Karpurakudy, Vengaparakudy, Nellipettikudy, Kuthukallukudy etc in Marayoor Range and Soossannakudy, Theerthamalakudy etc in Kanthalloor Range. A quantity of 3000 m³ is proposed for Marayoor Range and 1000 m³ for Kanthalloor Range. Detail is given in **Appendix - LX**.

Prescriptions

The eco restoration works proposed are Soil Conservation works like Gully Plugging, Trenching, Check dam, water holes etc. The places which require eco restoration and Soil Conservation are Koodakkadu, Vannanthura sandal Reserve I&II, Nachiayal II, Karayoor, Theerthamala, Kudathilchola, Thenmalachola, Pothadi, Mattumontha, Eenjanpara thode, Vengapara kudi, Kuthukallu kudi, ambalapara, Sekharkudi and Palakkadanchola. The whole soil conservation works shall be carried out in microwatershed basis. Name of ecorestoration works to be done in each watershed is given in **Table No. 30**.



- 1) Gully plugging shall be carried out in identified sites.
- 2) Check dams shall be constructed at proposed sites in both Ranges.
- 3) Contour Trenching may be done at Kammalamkudy, Karpoorakudy, Vengaparakudy, Nellipettikudy, Kuthukallukudy in Marayoor Range and at Soossannakudy, Theerthamalakudy in Kanthalloor Range.

Above mentioned soil conservation works may be taken up in other places if found necessary as per approved SSP.

3.7 FIRE MANAGEMENT

The management of forest fires assumes great importance as forest fires cause damage to biodiversity and productivity of the forestland. The chances of forest fire are more in this Division due to the presence of grasslands and disturbed moist deciduous forests. The damage caused due to fire, though on a smaller intensity, is hard to quantify. Young recruits never get established due to annual fire. Extension and awareness activities shall be conducted among the locals and the tribals residing inside the forest. Often forest fires are not reported. Even if reported, the losses are underestimated. Forest Department often fails to project the actual loss caused due to forest fire. This often hinders Government from giving sufficient funds to prevent Forest Fires. The protective staff should be properly guided to report incidence of fire promptly.

3.7.1 Fire Protection: The period between Januarys and May is the fire season of this Division. Biotic interferences from tribal settlements and regularized encroachments, hunting, careless collection of NWFP, etc. are the major causes of Forest Fires.

3.7.2 Effects of fire: A very detailed discussion is beyond the scope of this Plan. Only a brief mention is made about the aspects of fire that could be beneficial and those that are detrimental.

Beneficial effects

- 1 Fire is very useful in habitat manipulation for specific objectives in Wildlife Management.
2. Fire releases nutrients faster from debris.
3. Soil borne pathogens are reduced.
4. Increased availability of palatable grass and forage for herbivores.
5. Early burning can be used as a tool for preventing disastrous fire occurrences.
6. Controlled fire burns off accumulated litter there by reducing the possibility of disastrous 'late fires'.

Deleterious effects

1. Regeneration is killed leading to retrogression and depletion of Forests.
2. Organic matter and leaf litter are consumed, thus reducing productivity of soil.
3. By opening up of forest and removal of leaf litter, run off increases reducing percolation and leads to reduction in summer stream flow and increased surface fertile soil wash.
4. A fire weakens and injures trees making them susceptible to decay and disease thus leading to reduction in stand productivity.
5. Fire harms base of standing trees which are the most valuable part of bole reducing timber value and also in some cases making them unsuitable for veneering.
6. Soil properties are influenced deleteriously.
7. Beneficial soil microorganisms are killed.
8. Some soil borne pathogens could be induced to increase activity.
9. Directly harmful to small wild life.

Timely allocation of funds is crucial in carrying out fire protection measures. Adequate provision has to be made in the plan and budget for organizing more fire management committees.

The Forest Department has a strategy for fire management and participatory fire management. The fire Management Plans for Marayoor Sandal Division will be prepared as per the strategy evolved and implemented during the plan period itself. The fire plan has to be prepared by the Forest Range Officers and got approved by the Conservator of Forests.

3.7.3 Fire Management Plan: Fire Management Plans have to be prepared for each Division. Range should be treated as the unit for planning fire management. Maps in 1: 50,000 or larger showing all details required to prevent fire should be prepared.

The format discussed and finalized in various workshops in 1998-99 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.

- a. Planning should be proactive. Rather than waiting for fires to occur, the strategy should be for preventing fire. More emphasis should be on

development of a preventive strategy rather than control after occurrence.

- b. Planning should be location specific, measurable and cost effective.
- c. Planning should be prioritized based on availability of resources.
- d. Wherever possible, Participatory Fire Management strategy should be evolved.
- e. Data should be gathered on the source of secondary support such as the voluntary fire fighters, NGO's, etc.
- f. Details of the resources like man power, vehicles, wireless sets, etc. available with the other wings of the department should be listed. The facilities available with other departments like Fire Force, Meteorological department, etc. must be tapped during fire season.
- g. Fire safety measures to be adopted should be described in the Plans. Unsafe and careless fire fighting strategy will impede efficiency in fire situations resulting in more areas to be consumed by fire. Some of the instructions to be given in this regard are
 - 1. Wear cotton clothes to cover the body so as to protect it from radiant and convection heat, which usually keeps the fire fighter at bay.
 - 2. Wear headgear and goggles to protect the head and eyes from radiant heat, flying embers and sparks.
 - 3. Use footwear, preferably of leather, while fire fighting.
 - 4. Carry enough quantity of water to guard against desiccation by heat.
 - 5. Keep a First Aid Kit with the team while going to fight fire.
 - 6. Even though casualties of men during forest fires are rare in Kerala, there are such cases reported in Eravikulam where the raging and fast moving grass fires change speed and direction with the changes in wind direction. Therefore, in any fire situation, watch the fire intensity and plan for an escape route in case of danger.
 - 7. Keep communication effective between fire fighters while combating fire.
 - 8. Remember that the air near the forest floor is heavier, cooler and fresher.

9. In case the fire fighter is surrounded by fire, find out the escape route, and shield the body with any non-conducting, non-burning material.

Command structure with units of command will be specified for each strategy. Illustration of this and positioning of machinery, equipment and man power will be annexed to the plan for quick, efficient and on the spot organization of fire fighting teams. Data will be gathered on the source of secondary support such as voluntary fire fighters, NGOs, Organisations etc.

Command structures: Command structures are proposed at the following place in the Division.

Marayoor Range: Koodakkad, Pothady

Kanthalloor Range: Theerthala, Vannanthura

All the command structures as proposed above will be established during the first two years of the plan period. In addition to the above places command structures can be had in other places also if deemed necessary.

Fire-monitoring cells: Fire-monitoring cells will also be established during the fire season one each in every Range with a master unit at the Division Headquarters to coordinate and monitor the activities.

Important circulars: have been issued for prevention and management of forest fires. This has to be strictly followed. The copy of the recent circular is appended as **Appendix – LXI**.

3.7.4 Early burning: In order to avoid severe damage due to late fires, early burning in highly fire prone area is recommended. While doing early burns, the following procedures have to be adopted. Burning should be completed by the end of January when the vegetation is still green.

As far as possible engage Muduvan tribals as they are experts in this work. Burning has to be carried out early in the morning or late in the evening only. This is to avoid accidental spread of fire. Burning should be commenced from the top of a hill. Early burning should not be attempted on windy days.

Prescriptions

1. Fire management plan to be in place by January.
2. Participatory fire protection strategy shall be adopted wherever possible.
3. Fire tracing to be completed by 15th February.

4. Fire gangs to be established at recommended areas.
5. Circulars and guidelines issued from time to time by the Department shall be strictly followed.

3.8 PREVENTION OF GANJA CULTIVATION

Cultivation of Ganja is a major cause of forest destruction. The interior and inaccessible Forests that are normally undisturbed are selected and clear felled for carrying out Ganja cultivation. The activity is generally carried out by the settlers of Idukki District with the support of the tribals especially Muduvans who occupy the interior Forests. The cultivators are normally armed and stay inside the forests for about 6 months. During this period they engage in poaching, illicit felling and illicit brewing. The higher altitudes of Marayoor and Kanthaloor Ranges like Koodakkadu, Karpurakudi and Therthamala are some of the suitable locations for Ganja cultivations. In the process, they set fire to the forests. Details of ganja raid conducted in this Division are given as **Appendix – LXII**. This gives an idea about possible sites and intensity of such illicit activity. Ganja cultivation sites are difficult to locate because of relatively small size.

Prescriptions:

1. Intensive patrolling and regular monitoring camps shall be organised in Ganja prone areas.
2. Camp sheds in vulnerable areas shall be constructed and put to effective use.
3. Informants shall be rewarded.

3.9 MANAGEMENT OF WEEDS

Gregarious growth of exotic weeds like lantana, Mimosa invisa, mikania and eupatorium prevent the regeneration of natural seedlings and result in the degradation of the Forests. *Lantana camara* is an **invasive species** and has covered large areas in the plan area. It colonizes new areas when its seeds are dispersed by birds. Once it reaches an area, *L. camara* spreads quickly. It coppices so well, that efforts to eradicate it have completely failed. It is resistant to fire, and quickly grows in and colonizes burnt areas. It has become a serious obstacle to the natural regeneration of important native species including Sandal in Marayoor area. In greenhouses, *L. camara* is notorious for attracting whitefly. In the tropics and subtropics, whiteflies (Hemiptera: Aleyrodidae) have become one of the most serious

crop protection problems Feeding damage can cause economic losses, it is the ability of whiteflies to transmit or spread viruses that has had the widest impact on global food production.

Sandal seedlings require partial shade for at least six month. The sandal seedlings that grow with in the lantana bush get natural protection from grazing animals. Considering these aspects the weed management can be done by conducting strip weeding in an extent of 25-50 hectare every year in the Sandal Reserves during the plan period.

Prescriptions

Invasive alien species such as *Mimosa diplotricha*, *Mikania macarnta*, *Eupatorium* etc. shall be removed. As lantana bushes help in the regeneration of sandalwood, its growth shall be regulated.

3.10 CONTROL OF GRAZING

Grazing is another cause of degradation of Forests. The people residing adjacent to the Forests have the habit of keeping live stock which grazes in the adjoining Forest land. This will invite fire in dry season. Grazing should be totally stopped in sandal reserves as sandal seedlings are highly palatable. It will adversely affect the regeneration and survival of sandal seedlings. Steps should be taken for stopping the grazing totally in the plan area. Since the Sandal Reserves are located within the hillmen habituations, grazing intensity is very high in this part and has resulted in soil compactness.

Prescriptions

The institution of FDA and VSS shall co-ordinate with the local inhabitants proactively to promote stall feeding of cattle so that cattle movement in forest areas for grazing is kept under check.

3.11. ECO RESTORATION OF WATTLE PLANTATION AREA

A. Wattle: Wattle is an exotic, indigenous to Australia. The species planted are *Acacia mearnsii*, *Acacia decurrens* and *Acacia dealbata*. The wattles are growing so luxuriously that there is hardly a miscellaneous growth found in the plantations. Wild animals do not prefer wattle plantations. The wattles have invasive tendencies and spread into the nearby areas by seed and root suckers and therefore they are a potential threat to the grasslands and bio-diversity of the area. Ingression of wattles into the Eravikulam areas

is already a matter of concern. In short, these exotic species are nothing but a menace in the area.

There is only one miscellaneous plantation of Pulpwood species present in this Division. The species planted are of *Eucalyptus grandis*, *Acacia mearnsii* and *Grevilia robusta* in an extent 17.20 ha. at Kudakkadu and Nellipetty.

All the plantations are mature and ready for disposal. In the past the HNL used to lift the wood material for pulpwood purposes. But now they do not prefer wattle. So also there is no demand for wattle bark. However, it is learnt that there is demand from some private concerns.

Table – 32 – List of Plantations and Schedule of Extraction

Sl. No	Year	Range	Location	Extent (ha)	Schedule of extraction	
					Extent (ha)	Year of removal
1	1983	Marayoor	Koodakkadu	115.50	115.50	2010-11
2	1984	Marayoor	Koodakkadu	100.00	100.00	2011-12
3	1984	Marayoor	Pothady	275.5	100.00	2012-13
					100.00	2013-14
					75.50	2014-15
4	1986	Marayoor	Pothady	50.00	50.00	2015-16
5	1986	Marayoor	Chinna pothady	50.00	50.00	2015-16
8	1990	Marayoor	Nagamala	13.28	13.28	2016-17
9	1990	Marayoor	Pothady	26.56	26.56	2016-17
10	1990	Marayoor	Koodakkadu	29.60	29.60	2016-17
11	1991	Marayoor	Koodakkadu	66.48	66.48	2017-18
12	1992	Marayoor	Koodakkadu	52.70	52.70	2018-19
13	1995	Marayoor	Anchunadan para	20.00	87.20	2019-20
14	1995	Marayoor	Anchunadan para	15.00		
15	1995	Marayoor	Anchunadan para	35.00		
16	1987	Marayoor	Kudakkadu and Nellipetty	17.20		
			Total	866.82	866.82	

Prescriptions

Wattle and other species from the existing plantations shall be removed in a phased manner as per schedule and growth of shola species and climax grasses shall be encouraged.

3.12 FIREWOOD COLLECTION

Lemon grass oil is extracted in these areas in large quantities and the locals depend on firewood from the forests for distillation of lemon grass. The firewood required for this purpose is collected from the shola and the nearby forest areas.

prescriptions

- 1) The pressure of firewood collection can be reduced by raising fuel wood plantations in fringe areas of the Forests and in Non-Forest lands by VSS.
- 2) Technologies that reduce firewood consumption like solar cookers, smokeless Cholas and bio-gas plants shall be encouraged.
- 3) The materials collected from extraction of wattle plantations may be supplied to the tribals for bonafide use of lemon grass distillation etc. VSS can play a vital role in this activity.

3.13 SKILL UPGRADATION OF STAFF

For increasing the efficiency of staff, human resource development department has an important role. Since the role of Forest Management has shifted its focus from forest protection to conservation of biodiversity through participation, the related skills have to be developed among the department staff through training. The frontline staff should be thorough with the concept and practice of PFM, preparation of micro plan, conducting PRA, etc. Management of NWFP is another field where training is required. The field staff should also be trained in the use of equipments like GPS.