

CHAPTER - VII

PAST SYSTEM OF MANAGEMENT

INTRODUCTION

7.1 FORMATION OF MARAYOOR SANDAL DIVISION

To combat the large scale illicit felling and smuggling of sandal wood trees from the Sandal Reserves, Govt. decided to upgrade the Marayoor Range of Munnar Division into a new Division named Marayoor Sandal Division with Headquarters at Marayoor as per GO (MS) No: 67/2005 Forest dated 08/06/2005. The Division consists of two Ranges (1) Marayoor Range with Headquarters at Marayoor (2) Kanthalloor Range with Headquarters at Kanthalloor

7.2. GENERAL HISTORY OF THE FORESTS

7.2.1 Past History: The tropical climate with heavy and evenly distributed rainfall, afford an optimum condition for vegetative growth. Local hill men practiced the system of hill cultivation and the people migrated from the plains also followed suit. While hill men confined their activities to the more inaccessible areas, the people who migrated from midland cleared the peripheral Forests and started cultivation.

Prior to the formation of Travancore - Cochin State in 1949 the forest of this Division was in Travancore state. In the former Princely state of Travancore, Muvattupuzha Division was constituted in July 1946, by bifurcating the erstwhile Northern Division into Malayattoor Division and Muvattupuzha Division. Thodupuzha Range was separated from Kottayam Division and added to Muvattupuzha Division. The head quarter of Muvattupuzha Division was at Muvattupuzha. It was shifted to Kodanad in March 1950. Muvattupuzha and Malayattoor Divisions were amalgamated and a new Division called Malayattoor Division with headquarters at Kodanad was formed in the same year. Subsequently, Malayattoor Division was again bifurcated and Munnar Division was carved out as per G.O (MS) No. 1011/62/Agri dated 05/06/1962 with effect from 01/04/1963. The Eastern portion of Malayattoor Division was thus bifurcated to form the new Munnar Division. The head quarters of Munnar Division was at Mattupetty and later in 1970 it was shifted to Devikulam. Rest of the erstwhile Malayattoor Division was again divided into Malayattoor and Kothamangalam Division during the formation of High Range Circle in 1981 as per GO (MS) No. 197/81 Forest dated 31/07/81. By the formation of High Range Circle, the Munnar Division

had no territorial changes. But the number of Ranges in this Division was increased to five from the original three. Adimaly Range was bifurcated forming Adimaly and Neriamangalam Ranges for administrative convenience and effective protection. Another Range namely the Munnar Range covering mainly the Anamudi reserve was also created. The headquarters of Neriamangalam Range is at Neriamangalam and that of Munnar is at Munnar.

Painted Rock Shelters of Marayur: *There are three rock shelters at different sites of the Anjanad viz., Koodakkad, Pallanad and Champakkaci, otherwise christened as Ezhuthala, obviously meaning the cave of pictures, Attala and PurachiAla - all under the jurisdiction of the Marayur Panchayat. Geomorphologically, the Koodakadu site is surrounded by titled and fractured formations. The Koodakkad shelter is (77° 05' E and 10° 15' N) at an elevation of about 3280 feet MSL, on the foot hills of the high ranges locally known as Ezhuthupara. The Pallanad shelter is (77° 05' E and 10° 00' N) at an elevation of about 5,500 feet M.S.L and the Champakkad shelter (78° 00' E and 12° 35' N) at about 2000 feet MSL. The petroglyphs at the Koodakkad site are depicted on a solitary tall granite boulder with a wider concavity. All the paintings are within the concavity that has given the rock the shape of a serpent hood towering to a height of 12 metres and almost three fourth of the stone, with a width of 10 metres. The paintings occupy almost three-fourth of the concavity. The entire surface is covered by paintings and engravings of horse, bull, elephants with and without mahouts, seated saint like human beings with arms raised, impressions of palm, seemingly auspicious symbols, ritual dancers and ceremonial scenes. The colours used are red-ochre, grey, pinkish buff, saffron and brownish yellows as in the case of the rock paintings elsewhere. Cattle, antelope, elephant riders, three human figures and a prominent bull going upward in opposite directions are the major paintings to be noted. The most significant of all is the picture of a tiger-like animal in the innermost layer of the' superimposition. Four prominent styles of paintings are visible in Marayur. The standing human figures have got close resemblance with that of the proto Egyptian pictures as well as those of the Middle East. The Marayur Cave Paintings are comparable with the sites mentioned in the Stone Age Paintings of India. The uppermost and the earliest bison like animals (gaur), the animal gallery of bull, horse, antelope etc. the large human beings and the cluster of white paintings depicting social life, duels, elephant rider form the prominent styles of the Koodakkad paintings. The depiction of animals, combat, dancing figures, and men and women at work constitutes some of the most striking portrayals in the rock shelter. The animals are depicted in moving, jumping and grazing moods besides standing as objects of hunting. The depiction has got sublime accuracy, naturalism, vigour and know-how about animal body. Their realism is laudable.*

Unlike the first shelter, the petroglyphs in the second shelter (Pallanad) are paintings solely in white and on the ceiling. The petroglyph in the second shelter is like that of an opened mouth of a giant lizard creeping. The depictions are all in white pigment and they include human figures in

different postures suggestive of domestic activities and probably rituals. This rock shelter has the largest number of rock paintings that come about 400. The main portrayals are: human figures, elephants with and without riders/mahouts, birds, acrobatics, combat scenes, symbol, boat like symbols, geometrical designs - rectangles and triangles, suspected letters and sense more visible superimposed styles, lizards, other reptiles, and trees. They are painted asymmetrically.

The third rock shelter (Champakkad), located on an elevated terrain and facing the northwards adjacent to the river Chinnar, is a big hall in the interior, spacious enough to accommodate at least 10 families. This rock shelter is the largest by area-wise. The petrographs are on the sidewalls of the shelter whose inner surface is divided into two rooms with much fallen debris. From the base, the height is of 100 metres and measures 30 feet at the opening and is about 50 feet deep. The main portrayals are: human and animal figures in white lime-like pigment. The paintings are small in size about 9" to 12" in height. They are in white pigment. The rock is sedimentary schist type.

Among the depictions in the hood stone concavity of the first shelter the most prominent is that of the cattle group - a long-horned humped bull with three cows, if not more. The earliest layer visible in the whole complex is that of the cattle depiction which is partly superimposed by the human figures. The hump, long horns, hind limbs and the genital organ are clear in the case of the bull whose other parts are superimposed by the right hand of one of the human figures. Heads and frontal limbs of the cows are lost beneath the biggest human figure at the waist of which some portion of a cow is visible. Morphologically and stylistically the bull with the bulbar end of the male organ resembles the bulls in the Neolithic/Iron Age petrographs of South India and Sri Lanka. The back of a horse appears between the right shoulder and head of a human figure. The cattle and horse seem to be in the same stratum, but the colour of the latter is pinkish brown, distinguished from the red-ochre and yellowish brown of the former. A horse, perhaps the most exquisitely depicted piece, whose whole body except the tailed back is superimposed by a huge human figure with wavy lines all over, is also suggestive of Iron Age interpolation. An elephant with an armed rider in the periphery of the concavity is obviously an Iron Age addition. There are differences of opinion about the identification of figures in terms of cultural strata and their relative dating. S.P Thampi ascribes the antelope, cattle and horse to the Mesolithic, roughly dating back to about 7000 B.C., the human figures to the Chalcolithic, of about 2000 B.C and the armed rider on the elephant to early historic, of about 300 B.C. Absence of evidences precludes the possibility of postulating a Chalcolithic phase in Kerala. The wavy lines remind us of the ceramic decorative quite common in red slipped and russet coated wares of Iron Age and this cultural association of the design could be taken as a clue to tentatively date the human figures. The depictions have been assumed to be of the time span of Mesolithic - Neolithic - Iron Age sequence.

In the second shelter at Pallanad, apart from the Mesolithic type of paintings, the most prominent depiction is that of boats which are suggestive of ancient marine or navigational activities. There are symbolic and ideographic representations too. Just as in the case of many other cave sites elsewhere in the Country, the Marayur shelter has also yielded microlithic tools, reinforcing the Mesolithic affinity of the petrographs. Along with the surface collection of the microlithic tools, ground nodules of red ochre in hematite quite common in Prehistoric Rock Art sites as the raw material for wall paintings, were discovered. Similarly bone pieces of animals and cattle, probably used as the painting sticks, and were also discovered from the first cave

Dolmens and Cists Structurally, the dolmens constitute a variant of cists, but the only distinction is that the dolmens are above the ground, whereas the cists are mostly buried. The dolmens and cists have one or more chambers formed by dressed granite slabs (orthostat). In some of the cists and dolmens, one of the side-slabs has a circular opening known as 'porthole'. In a few cases the portholes are 'u' shaped, cut from the top of the slab (Krishna Iyer 1967). The dolmens and cists are found normally in the granite belts especially in the high ranges with a relatively higher frequency, but they are found in the rocky tables of the plains also. Porkkalam in the Trissur District and Marayur and Anjanad in the Idukki District can be cited as representative examples for the dolmens in the plains and high ranges respectively. Porkkalam, famous for its huge dolmens, is probably the most extensively excavated megalithic site of Kerala. In fact, it is a site of multiple types such as porthole cists with stone circles, rock-cut caves and urns. The dolmens in the Anjanad they are found the Reserve and Structure Katukkutty on the crest of a hill. The dolmens there are with orthostats and a cover slab. One dolmen at Katukkutty is reported to be of three orthostats. The flooring of the dolmens is paved with stone slabs. The stone blocks used these monuments were made of unhewn rock (Krishna Iyer, 1967). At some sites dolmens are found singly and at others, in groups enclosed by a cairn-circle or an enclosure of dry-masonry wall comprising several courses, packed by cairns (Tampi 1983:76-77). All the excavated dolmens have yielded the usual megalithic burial goods. Dolmens have been reported on top of rocky tablelands without any burial remains at a few localities in the hill regions (Krishna Iyer 1967). In such cases the size of the dolmens is found comparatively smaller. At a few places they are found as scattered and at some places they indicate a pattern of assemblage. The cluster of small dolmens found on a rocky table at Palappilly in the Trissur District is indicative of their alignment in a circular fashion.

7.3 PAST SYSTEM OF MANAGEMENT

Till the end of the 18th Century, the Forests of Travancore were not subjected to any systematic management. The first reliable information regarding the working of Forests is by M/s Ward & Connor, who were engaged in the survey of the British India from 1817 to 1820. They published their experiences in the form of a book "Memoir of the survey of Travancore" in which they observed that, in the earlier days it had been the practice to rent each river bank for its timber apparently for teak and it had almost depleted the Forests as it was found very difficult to obtain large sized teak except from the interior. At the time of their visit to Travancore, they found that the Government has then introduced a new system by which the timber was to be worked down by the State. This service was entrusted with Captain Robert Gordon of Bombay Engineers who held the post of commercial agent at Alleppy. Besides attending to his duties he was appointed as the Conservator of Forests and was given additional charge of collection of Cardamom from gardens in the hills and the sale of collected timber. Teak was the only monopoly timber held by the state.

Shortly after in 1813 Colonel U.V. Munro was appointed as the first independent Conservator of Forests. Besides the charge of Forests he had also the duty of commercial agent at Alleppy. During his period teak extraction was confined to Periyar and Achankoil riverbanks.

In 1818 an attempt was made as per his instruction to restock the depleted teak Forests by dibbling of teak seeds throughout the Reserve. In 1835 departmental system for monopoly trees, the permit system for jungle wood trees and contract system for firewood and the Minor Forest Produce extraction were introduced.

Mr. U. V. Munro died in 1844 and Mr. West was his successor for the next 8 years. After Mr. West, Mr. Kohlhof was the Conservator for 12 years. After the period of Mr. Kohlhof, Mr. Vernede took charge as Conservator of Forests of Travancore on 15th August 1864. During his period many regulations were imposed and rules were introduced. Special plans relating to the Forests were made and the Regulation III of 1080 (The Cochin Forest Act) was changed in 1905 on the lines of Madras Forest Act of 1902. Teak, Rosewood, Ebony and Sandalwood were monopolized. Marking of trees before felling was started in 1865. The felling of teak, black wood and jungle wood below 12 ½-inch quarter girth were prohibited. The preparation of Working Plans were suggested and the forests were divided into territorial Divisions and entrusted to qualified hands.

In 1865 the first teak plantation was raised successfully at Vembooram in Malayattoor Division. On 30th January, 1866 an order was issued for stopping the felling of teak, rosewood, ebony and all trees in the river banks. From 1867 onwards the systematic planting of teak was started in

Malayattoor and Konny Divisions. In 1868 Mr. Thomas, Assistant Conservator of Forests who was previously in the British Forest Service was put in charge of teak plantations of Konny.

In 1869 the first cardamom gardens were started in the neighborhood area of Konni under the supervision of forest staff.

A proclamation was issued on 18th October-1869 prohibiting shooting of Elephants.

In 1870, rules were made to allow the people to cultivate in Government land i.e. grassland, reed area, marshy land etc without permission of the Government.

In 1870 extraction of teak under the contract system was stopped and the Government started the extraction. The trees above 15" girth were felled.

In 1870 on April 15th rules were issued allowing cultivation in hill area.

In 1883, a forest commission was appointed for processing suggestions for the better management of forest, destroyed due to the heavy and indiscriminate fellings coupled with uncontrolled shifting cultivation. This Commission recommended the abolition of seigniorage system and substitution of depot system for the sale of timber. This Commission also drew a draft of an Act on the lines of Madras Forest Act of 1882. The first Forest Act was passed in 1887 (Regulation IV of 1063 M.E/1887 A.D.) and the first reserve to be constituted was the Malayattoor Reserve which was settled in the year 1895 (1070 M.E.).

On 14th June 1891 Mr. T. F. Bourdilluon succeeded Mr. Vernede as Conservator of Forests, Travancore and continued for 27 years. A complete reorganization of the forest department was done on the lines of British Forest Administration. The whole forest in the state was divided into four Divisions, Divisions into Ranges and Ranges into Sections and Beats. The emoluments to the staff were increased. Vast areas were brought under teak plantations in Konny, Aryankavu and Malayattoor.

A beginning was made for the exploitation and protection of the forests with the promulgation of the Travancore Forest Act 1887 and the constitution of the Malayattoor Reserve in 1895. As a first step in this direction, one Inspector and six guards were appointed to protect the forest, regulate the fellings and collect the revenue from this newly constituted Malayattoor Reserve.

In the year 1910 the first Working Plan for the Malayattoor Reserve was prepared, its author being unknown. Though it is called a Preliminary

Working Plan Report, its introduction marked the first attempt for regulating the Forest exploitation, and for the systematic administration. It dealt with the Division of the Forest area in certain localities into coupe or blocks fixing the year in which the annual felling were to be carried out without mentioning the obtainable quantity of timber from fellings. Thus the Plan was mostly revenue-conscious. In 1915, Mr. M.Velu Pillai prepared another Working Plan for Malayattoor Reserve and some other Reserves falling within the purview of the present Malayattoor Division.

Sri.Dhannushkodi Pillai prepared the Working Plan for this Division for one year for the period 1921–22. Sri.T.P.Viswanathan prepared the first basic Working Plan for the period 1963-72. After this period Sri.James Varghese prepared the present Working Plan for the period 1972-73 to 1981-82.

7.4. HISTORY OF SANDAL

Sandal is said to have been introduced to Marayoor by local people **(Appendix-XXXIV)**. In the beginning the villagers made free use of the sandal wood on religious and festival occasions, and for the cremation of important personalities. People used to send good sized pieces to the Poonjar Chief as the Sandalwood areas were originally under his control. In due course of its cultivation, Sandal got naturalized in Marayoor and the neighboring villages. In 1075 M.E (1899-1900) all the land came under the jurisdiction of the Government of Travancore and consequently the Forest Department took its control and management. Thereafter, Sandal area over 409 acres was declared as sandal reserve. During the period of Mr.Vernede, Sandal trees growing on private lands were reserved for their protection. In the early years, exploitation was done by Government agency and the collection was confined only to the dead and dying trees, old stumps and roots, top broken, wind fallen etc. To meet the increasing demand from the market, in 1902, a few mature and over mature sound trees were also extracted. But the Mysore and Sathyamangalam Sandal wood fetched more attractive prices than the Marayoor Sandal because of the poor dressing and cleaning of Sandal wood in Marayoor. In an attempt to artificially regenerate sandalwood, in the year 1901, an experimental plantation was raised in Nachivayal by planting in pits. But the exact location of the plantation could not be ascertained. After five years another small area in the reserve No.51 was cleared and the sandal seeds and the seeds of *Pavetta indica* were put in specially prepared pits. The area was maintained by removing the climbers and the miscellaneous tree growth interfering with the normal growth of the sandal plant. It was fenced for protection from grazing. The result was encouraging.

7.5. PREVIOUS WORKING PLAN, PRESCRIPTION, IMPLEMENTATION AND RESULTS

7.5.1 Preliminary Working Plan for Marayoor Sandal Wood by M. P. Jacob (1911-12): In 1087 M.E (1911-1912) Sri M.P Jacob prepared the First Working Plan for the Sandal Reserve. This was called the “Preliminary Working Plan -Marayoor Sandalwood”. According to this Plan, the whole area was to be gone over every year for a period of seven years. He prescribed the exploitable girth of 36 inches for the sandal trees inside the Reserve and 30 inches for the trees in Unreserved lands and the removal of 50 green trees per year in the reserve. Later Sri. Thanu Pillai reduced the exploitable girth to 33 inches for inside Reserve Forests and the number to 25 per year. He divided the whole area into 7 annual coupes and provided the prescription, for felling, conversion, cleaning of the sandal wood and seed dibbling. During his plan period, some areas of the Reserve were barbed-wire fenced and cutting and lopping of miscellaneous trees were done in favour of Sandal trees. In 1942 Sri. Sreekanda Pillai prepared the Working Plan for the Sandal wood Reserve but this was overlapped by the Working Plan of Sri T. P. Viswanathan for the then Malayattoor Division.

7.5.2 Working Plan Prepared By Mr. Dhannushkodi Pillai in 1921-22: The Forests were brought under the systematic and scientific working with the introduction of the detailed Working Plan prepared by Mr. Dhannukodi Pillai in 1921-1922 (1097M.E). He divided the forest area into coupes, fixed a felling cycle of 20 years, suggested selection felling of mature and over mature trees and fixed the yield at 50% of the enumerated exploitable trees. He emphasized that the over mature, dead defective; dying trees and those of the higher girth which would not stand till the time of next felling should be removed. He suggested to retain the vigorous exploitable trees standing on exposed ridges and banks. In each coupe enumeration was carried out and the number of exploitable trees was determined. History shows that the prescription were not implemented and followed properly and the tree extraction was guided and regulated by demands of the market and the working convenience.

7.5.3 Working Plan By Sri T. P. Viswanathan (1951-52 to 1966-67): The Working Plan of Sri T. P Viswanathan was for the period from 1951-52 to 1966 to 1967. The Conversion Working Circle, the Red Gum Working Circle and the Sandal Working Circle were the important Working Circles constituted by him.

Considering the necessity and importance of long fiber raw material for the pulpwood industries, Pine plantations were raised on experimental basis in certain clear-felled areas in Pampadumshola and in revenue grass lands in Choondal locality. These plantations were raised out side the prescription of the Working Plan. Similarly some Wattle plantations were also raised in the clear felled areas of Pampadumshola and Mannavan Shola areas.

Intensive exploitation of the bamboo occurring in the area was prescribed. The Sandal Working Circle included the whole of the Sandal Reserve of the Division covering an area of 3809 acres (1542 ha) falling into three felling series, viz, the Nachivayal (609 acres), the Marayoor (1120) and the Karayoor (208) felling series. Extraction of dead trees with a three year felling cycle was prescribed. Since artificial regeneration was extremely expensive and the past attempt did not produce any encouraging result, reliance was placed mainly on the natural regeneration. The existing growing stock was tended regularly. The sandal areas were tended following the removal of dead trees as prescribed in each coupe.

7.5.4 Working Plan by Sri James Varghese (1972-73 to 1981-82): He prepared the first Working Plan for the composite Munnar Division for a period of 10 year from 1972-73 to 1981-82 with the following general objectives.

- 1) To make the maximum use of the land available with the Forest department and take the maximum yield from them by increasing the value of the Forest aiming at a progressive yield.
- 2) To provide raw materials to the existing and new industries adjacent to this area.
- 3) To protect the steep hills and catchment areas of several dams in this region and ensure perennial and maximum water flow in the rivers which feed several Hydal schemes.
- 4) To exploit the evergreen, semi evergreen and deciduous Forests and to replace the degraded natural Forests by artificial planting of valuable species.
- 5) To achieve these valuable objectives of management he divided the entire area into 10-Working Circles viz., Sandalwood Working Circle, Pine Plantation Working Circle, Eucalyptus Working Circle, Wattle Plantation Working Circle, Devikulam Fuel Plantation Working Circle, Teak and Miscellaneous Working Circle, Selection Working Circle, Reed Working Circle, MFP Working Circle and Protection Working Circle.

1. Sandal Working Circle: All the Sandalwood Reserves of this Division were covered in this working circle extending over an area of 1542 ha. The special objectives of management were (1) to extract the dead trees in the Sandal Reserves and the Reserve Lands and (2) to grow the maximum stock of Sandal in the reserves by aiding natural regeneration supplemented by artificial means. The Working Circle was divided into Marayoor (453 ha), Nachivayal–Karayoor (464 ha) and Vannanmthura (625 ha) felling series.

He prescribed the silvicultural removal of dead and uprooted trees from the Sandal Reserve, unreserves and green trees from the purampok and private lands according to necessity. Since the attempts in the past for supplementing the natural regeneration by, canopy manipulation, dibbling seeds and stump planting were not successful, due to uncontrolled grazing, he proposed barbed wire fencing around the Sandal regeneration against the cattle damage. It was suggested to fell all the broad crowned miscellaneous trees to remove overhead shade to the Sandal plants and to induce root suckers by wounding the roots of sandal trees by digging shallow contour staggered trenches or by general soil working.

A five year felling cycle was prescribed, so that the entire area could be covered twice during the Working Plan.

2. Wattle Plantation Working Circle: Wattle (*Acacia mollissima*) is a species, which can be raised in the first instance and still easier in the subsequent rotation periods since it regenerates well both from root suckers and seed. Wattle is a good seed producer. It thrives well in poor soil at an elevation of 1500 m or more where other species do not grow well. The details of the plantations raised during the plan period are given in **table No. 28**.

3. Minor Forest produce working circle: The objectives of this working circle was to extract and utilize the large quantities of miscellaneous Forest produce available in the forest of the Division. This was an overlapping working circle and it covered the entire Working Plan area.

4. Protection working circle: All areas except those dealt with in the above working circles came under this working circle. The main objectives of this working circle was to preserve the tree growth in the upper slopes of steep hills for soil and water conservation purposes.

7.5.5 Period 1982-83 to 1996-97: During the period from 1982-83 to 1996-97 the Division functioned only as per the approved annual plan of operations.

7.6 MANAGEMENT PLAN FOR THE PERIOD FROM 1997-98 TO 1999-2000

Management Plan for the year 1997-2000 was approved by the Chief Conservator of Forests Bangalore with ref No: F(C) A/11.6/72/Misc dated 13/02/98 and 02/02/99. The main objectives are given below.

1. To restore to the extent possible the original characteristics of the natural Forests.
2. To manage the catchment areas so as to improve the hydrological parameters of various river systems.

3. To manage the areas on sustained basis especially with reference to collection of bamboos, reeds and minor Forest Produce.
4. To improve the productivity of plantations by adopting scientific management practices so as to meet the wood and firewood demands of the locals and also the raw material demands of the Forest based industries.
5. To protect and conserve the wildlife as an important part of Forest ecosystem by means of participation of local communities especially Forest dwellers (tribes).
6. To undertake welfare measures for the tribals living in and around the Forests.
7. To ensure proper regeneration and establishment of sandal in the sandal reserves of the Division.

7.6.1 Prescriptions for Plantations

1. Wattle plantations: The rotation fixed for the wattle was 8 years. The adopted silviculture system is clear felling with natural regeneration and to assist with augmentation wherever it is required. 52 plantations were proposed for extraction during the Plan period.

Result: Extraction was not done during the Plan period due to scarcity of demand for wattle bark within the state and from the neighboring states.

2. Non-wood Forest Produce: The right of collection of NWFP is granted to tribal co-operative societies as identified by Kerala State SC/ST federation.

Result: Number of items have been identified out of which 27 items were collected during the plan period.

3. Management of natural Forest and Eco restoration of degraded Forest: Proposals were given to manage different types of forests i.e Ever green, Semi ever green and Deciduous forests of lower hills, montane shola Forest, grass lands of High Ranges and Dry deciduous sandal wood Forest of Anjanad tract based on the intensity of degradation. It was classified into less degraded, moderately degraded and highly degraded.

Result: Eco restoration treatment plots were taken during the Plan period. Special practices were formulated for eco restoration works under Kerala Forestry Project, which was implemented from the year 1997-2000. Under this programme the degraded areas were identified and suitable site specific treatments were undertaken. The areas were classified on the degree of degradation and separate treatment packages were implemented i.e assisting

natural regeneration (ANR), restoration of degraded Forest (RDF I & II) and protection of bamboos (RRB). The details are given in the **Table No. 20**.

Table – 20 – Treatment Areas under Kerala Forestry Project in Division

Sl.No	Range	Locality	Year	Extent	watershed & Extent
List of Treatment Areas (RRB) Taken Under KFP					
1	Marayoor	Theerthalar	2003	21.25 Ha	Theerthalar. Block V
Details of Treatment areas (ANR) taken under KFP					
1	Marayoor	Theerthalar	2003	55.50 Ha	Theerthalar. BI IV 106 Ha
2	Marayoor	Kamalankudy	2003	36.75Ha	Karpoorakudy 71.75 Ha
3	Marayoor	Vengapara	2003	89.00 Ha	Karpoorakudy 112.25 Ha
4	Marayoor	Kavakudy	2003	60.75 Ha	Kavakudy 178 Ha
5	Marayoor	Karpoorakudy	2003	65.00 Ha	Karpoorakudy 94 Ha
Details of Treatment areas (RDF) taken under KFP					
1	Marayoor	Teerthalar	2003	15.00	Theerthalar. BI VI 15 Ha

4. Shola Forest: In Marayoor Division the shola patches interspersed with high elevation grass lands form a unique ecosystem which is rich in biodiversity but very vulnerable to the threats of annual fire, soil erosion, grazing and firewood collection. Due to biotic and a biotic interferences, it shows high degree of degradation, which has been observed to be irreversible.

It was proposed to restore the degraded patches of shola by conducting fire protection and soil and moisture conservation works.

5. Tribal development: Proposals were made in the Plan for the uplift of the hill men residing in the forest. The tribals residing in Marayoor Sandal Division area are Mudhuvas and Hilpulayas. It has been proposed to change the mode of cultivation along modern lines. Proposals were also given to make the tribals to participate in Forest development and protection activities through participatory forest management.

Result: Tribal Vana Samrakshana Samithies were formed in all settlements and they participated in the collection of NWFP, its management and the protection of forest area etc.

6. Fire protection: The proposal for fire protection is given in the Plan for overcoming damages caused by fire. Since the shola forest is interspersed with the grassland, fire in the grassland sweeps down to shola resulting in their degradation. It also causes damage to plantations. In the proposal, the entire area has been divided into various blocks of 500 to 1000 ha. To each of such fire blocks measures for engaging of fire protection mazdoors,

construction of sheds for their stay, construction of fire watch towers etc were proposed.

Result: Fire protection works like preparation of fire line, engaging of fire mazdoors were done during Plan period.

7. Management of sandal wood Forest: The total area of Sandal Reserves in Marayoor Division is 1542 ha. The yearly extraction of dead and wind fallen trees is proposed in the Management Plan. The silviculture system proposed is inducing natural regeneration supplemented with planting. The natural regeneration is induced by injuring the roots to produce root suckers.

Result: Extraction of dead and wind fallen sandal trees was done during the plan period. 723 numbers of trees were extracted during 1997, 524 numbers during 1998 and 3070 numbers during 1999. Details of extraction during the Plan period are given in **Appendix-XXXV** Sandal augmentation works were done at Kovilkadavu in an extent of 14 Ha during 1998. During 1999 augmentation works were done in three plots at Koodakkadu proposed Reserve in plot No. 1 in 50 Ha, 30 Ha each in plots IInd and IIIrd Details of augmentation works done during the period is given in **Appendix-XXXVI**.

7.7. WORKING PLAN FOR THE PERIOD UP TO 2000-01, 2001-02

The Working Plan for the period 1994-95 to 2003-04 had been prepared and preliminary discussion was held on 06/01/1999 in the office of Chief Conservator of Forests, Trivandrum and as per the suggestions of the committee a revised draft Working Plan was prepared and sent to the Regional Chief Conservator of Forests, Southern Zone vide reference 1318/B1/98 F&WLD dated 16/02/2000. The revised Working Plan was discussed by Conservator of Forests with Chief Conservator of Forests (Planning) on 06/04/2000 at Forest Head Quarters, Trivandrum and certain omissions therein were pointed out. The modified draft was examined by the Zonal Chief Conservator of Forests in the light of the additional information furnished by the Chief Conservator of Forests (Planning) and also with reference to provisions of Forest Conservation Act 1980 and National Forest Policy 1988. Certain additional clarification was sought from the State by the Regional Chief Conservator of Forests vide reference No. F(C) A/11.6/72/Misc dated 20/07/2000. The State Govt. gave the additional information and requested that the Working Plan may be approved for the period up to 2001-02 and as per this letter, the Regional Chief Conservator of Forests approved the Working Plan of Munnar Forest Division for the period up to 2001-02 under Section '2' of Forest Conservation Act 1980 with direction to revise the Working Plan for Munnar and with instruction that the Preliminary Working Plan report to be sent in due course of time for discussion in the meeting of the Committee constituted by the State Govt. so

that the Working Plan could be finalized by 31.03.2002 positively. The following are the prescriptions for 2001-02.

7.7.1 Prescription

1. Prescription has been given for extracting the wattle plantations proposed as per the Working Plan. It is mentioned that the plantations were due for felling during 94-95, 96-97, 98-99 and the felling of plantations due in 1995-96 has already been extracted in the past.

Result: - The extraction work of Wattle has been carried out in 1991 to 96 and no extraction has been done after this period for want of demand for wattle bark.

2. Approval was given for collecting dead, uprooted and spike disease affected sandal wood trees as proposed with direction to verify the marked trees by Deputy Conservator of Forests/Assistant Conservator of Forests as per the instructions issued by the Principal Chief Conservator of Kerala.

Result: - 966 number trees were marked, verified and extracted during plan period. The **Appendix-XXXV** shows the details of sandal collected and quantity after the conversion.

3. The established miscellaneous growth in the softwood plantations of Eucalyptus, Wattle, and Pine plantations may be retained during the time of harvest. The clear felling in area having more than 25 degree slope and along the bank of river/stream should not be undertaken.
4. The prescription was also given to complete the boundary demarcation before 31st October and for finalizing the steps for the reserve notification of the two reserves mentioned in the Para 321 of Working Plan. Direction has also been given for strictly regulating the felling of trees as per the order **WA.No.314/1995in OP No.1026/1994.**

Direction was also given for finalizing the steps for preparing of new Working Plan before 31/03/2002 and for taking care for ensuring that no non Forestry activities are permitted/taken up in Forest area in violation of the provisions of Forest Conservation act 1980. Instructions have also been given for strictly following the provisions of Conservation Act and guidelines there under while implementing the Working Plan.

7.8. SANDAL MANAGEMENT PLAN FOR THE PERIOD 2003-04

Since the period of the Working Plan had expired on 31/03/2002, a separate, Management Plan was prepared for Sandal Forests in Marayoor which was approved by the central Govt. vide reference No.F(c)A/11.6/72 Misc. dated 08/12/2004.

7.8.1 Prescription for 2003 - 04

Extraction of Sandal: - Prescriptions were given for the extraction of dead and wind fallen trees to avoid smuggling, loss due to fire etc. Timely extraction will also reduce the deterioration of the sandalwood and increase the revenue for Government. Result Out of the 1033 number of sandal trees marked from 8 sandal reserves, 109 number of trees were extracted, 7783Kg of sandal wood was collected during the period 2003-04 and 2004-05. The details regarding the No. of trees marked, quantity collected, are given in **Appendix-XXXV**.

7.8.2 Regeneration of Sandal Reserve area: Even though the regeneration activities were carried out in Sandal Reserves by inducing root suckers, the same were not successful due to cattle grazing in these areas. Hence cattle proof fencing was done in heavy grazing areas. It is prescribed to take at least 10 year care for the establishment of seedlings. Proposal is given in the Management Plan for seed dibbling in small bed at an espacement of 2.5 x 2.5 m and watering till the establishment of seedlings. The proposal was approved for taking 10 Ha. in every year and the financial forecast for formation and subsequent maintenance were approved. The list of places where augmentation works were done is given in **Appendix-XXXVI**.

7.8.3 Management of Sandalwood area: Proposals were given for taking urgent steps for the Reserve notification of the proposed Koodakkadu and Theerthalar Proposed Reserves. In the approved proposal, provisions are given for establishing the participatory forest management by involving the locals in the protection of sandalwoods. The involvement of Marayoor, Karayoor and Nachivayal VSS in protection activities is result of this.

7.9. MANAGEMENT PLAN FOR 2003-04 AND 2004-05

In the Management Plan for the period 03-04, 04-05, importance was given to improvement and conservation of plantations and the prescriptions based on National Forest Policy.

Marayoor Division has an extent of 367.02 ha. Wattle plantation which was not at all extracted due to lack of demand for wattle.

For meeting the shortage of raw materials for HNL, The Government of Kerala has allotted 5,600 Ha of plantation area from various Divisions as the captive plantations as per order GO (MS) No. 42/93/ F&WLD Dt. 11/06/93. In the allotted 2,600 Ha from erstwhile Munnar Division, *Eucalyptus grandis* was raised in only 1427 ha. The balance land was not suitable for raising plantations out of which an extent of 18.2 Ha. of above plantation area is coming in Marayoor Sandal Division. For meeting the short fall, an additional extent of 392 Ha land in Munnar Division was again allotted vide order No. GO (MS) No. 51/01/F&WLD. Dt. 21/07/2000. Out of 392Ha, 341 ha mature wattle plantation, and is prescribed for extraction of the same and replant the area with *Eucalyptus grandis* by HNL for improving the productivity.

It was also proposed to extract the mature *Eucalyptus* plantations for meeting the need of pulpwood and to realize maximum revenue. The proposed Plan was approved by the regional Chief Conservator of Forests, Bangalore as per the order with reference No.F(c)A/116/72/Misc.dt. 19/03/2004.

7.9.1 Objectives of Management

1. To extract the wattle plantation allotted to HNL Ltd for captive plantation.
2. To manage the plantations scientifically to increase the productivity to meet the raw materials requirement of pulpwood industries.
3. To extract the matured *Eucalyptus grandis* plantations to ensure the sustained productivity of pulpwood plantations.
4. To realize maximum revenue from the existing plantations in consistence with the National Forest Policy 1988.

7.9.2 Prescriptions for Wattle Plantations: The wattle plantations were raised in grassland area. The proposal was to harvest in time and replant with *Eucalyptus grandis*. 1959 Mannavan shola, 1962 Kanthalloor, 1963 Kanthalloor, 1964 Kanthalloor, 1965 Iddalimotta are the plantations allotted to HNL for raising captive plantations which were proposed for planting during 2002. Among the allotted 341Ha of matured wattle plantation to HNL, it was proposed to extract an extent of 80Ha during 2003-04 and 138Ha during 2004-05 and to replant with *Eucalyptus grandis*.

Result: - The artificial tannin is replacing the natural tannin and there was no demand for Wattle bark in the market. The only pulpwood industry having demand of wattle wood is HNL. Due to scarcity of demand for wattle bark the extraction had not been done during the period.

7.10. MANAGEMENT PLAN BY SRI. RAJAN SEHGAL (2004-05 TO 2005-06)

There was no approved Working Plan during the period 2004 and this situation necessitated preparation of Management Plan for the smooth functioning of the Division. Sri. Rajan Sehgal Deputy Conservator of Forests, Munnar prepared a Management Plan for Munnar Division for the period from 2004-05 to 2005-06. It was revised by his successor Sri. Justin Mohan DCF for the period 2006-07. The object of the proposals in the Management Plan was to improve the existing plantations in better manner as far as possible and leave the natural forest with least disturbance.

The objectives of management

1. To extract the over mature/mature Eucalyptus, Wattle, Pine and Alnus plantations and to augment/replant the area with pulpwood seedlings wherever required.
2. To manage the plantations scientifically to increase the productivity, to meet the raw material requirements of pulpwood industries.

Main prescriptions for 2004-2005 and 2005-06

1. Management prescriptions for Wattle plantations
2. Regeneration prescriptions.

7.10.1 Management of Pulpwood plantations: Among the over matured plantations of Wattle 216.48 ha. was proposed to extract during 2004-05 and 155.50 Ha during 2005-06.

Result: The wattle plantation in the erstwhile Munnar Division area has not under gone any extraction since 1996 for want of demand for the Wattle bark.

7.10.2 Proposal for regeneration: It was proposed to conduct the regeneration works in the extracted area of wattle with clonal seedlings of Eucalyptus grandis for increasing the productivity.

Result: Extraction works have not been not done during the plan period and hence no regeneration activities.

7.11. EXTRACTION OF SANDAL STUMPS

There was large scale smuggling of sandalwood from the Reserves of Marayoor during 2001-05 period. Enumeration of stumps available in the field was assessed and its verification was done by the Forest Vigilance Wing

during 2005. Details regarding the availability of stumps in each sandal reserve, and the financial forecast for the extraction are given in Table No. 26. The extraction of stumps have been started from the sandal wood Reserve area since 2004 as per the guide lines issued by the Conservator of Forests High Range Circle and as per the Govt. order GO (MS) N0. 54/04/F&WLD dated 22/12/2004. In addition to the existing conditions for the extraction of sandalwood in Forest Code, this order contains detailed guidelines regarding extraction. Copy of the order is appended in **Appendix-XXXVII**. As per this order 913 stumps have been collected from different sandal reserves and the same have been sold. The details regarding the collection of stumps, quantity obtained, amount fetched in public auction are given below.

Table – 21 – Details of Extraction of stumps

Reserve	No of Roots extracted	Quantity (kg)
Nachivayal I SR	496	6074
52 Sandal Reserve	216	2774
Karayoor I SR	115	1930
Pallanadu VF	86	1182
Total	913	11960

Revenue received for the sale of the above sandalwood is given below.

Sale Value	294.41 lakhs
FDT 5%	014.72 lakhs
Vat 12.50%	038.64 lakhs
Total	347.77 lakhs

Balance of 6487 stumps in is available for extraction in various sandal reservs. Details regarding stumps in various reserves and the expected revenue is given in **Table No. 22**

Table – 22 – Details of Enumerated stumps from various Reserves

Range	Reserve	Total Stumps	Extracted	To be extracted
Marayoor	52 SR	600	216	384
	54 SR	200		200

Range	Reserve	Total Stumps	Extracted	To be extracted
	Nachivayal I SR	1700	496	1204
	Nachivayal II SR	1200		1200
	Vested Forest	400	86	314
Kanthallor	Karayoor I SR	500	115	385
	Karayoor II SR	1000		1000
	Vannanthura I SR	600		600
	Vannanthura II SR	1200		1200
	Total	7400	913	6487

Revenue	
Total stumps to be extracted	6,500 Nos
Approximate Qty of Sandal wood	100 MT
Price of 1 MT of Sandal wood including VAT, FDT etc.	30 lakhs
Total revenue anticipated	3,000 lakhs
Expenditure	
Cost of extraction of 1 MT	1 lakh
Cost of extraction 100 MT	400 lakh
Regeneration and land management proposed	25 lakhs
Total expenditure	125 lakhs
Net Revenue	2875 lakhs

7.12. ACCOUNTING OF SANDAL TREES

All the sandalwood trees having GBH 30 cms and above were numbered. The first numbering was done in 2001. This was repeated again during 2004 and 2005. As per G.O. (MS) No. 54/2004/ F&WLD dated 22/12/2004, fresh numbering was done after dividing the whole sandal Forests in to small coupes. The copy of GO is attached as **Appendix-XXXVIII**. A statement showing the details of enumeration done in the past is given in **Table No. 23**.

Table – 23 – Details of Enumeration of Sandal trees

Sl. No	Sandal Reserve	No. of Sandal trees enumerated			
		During 10/01	During 7/04	During 2/05	During 2008
1	Nachivayal I	22879	20305	20187	21575
2	Nachivayal II	10157	7848	7732	6764
3	Sandal Reserve 52	6904	7165	7148	4826
4	Sandal Reserve 54	1918	1987	1969	1820
5	Sandal Reserve 51	972	0	0	0
6	Vested Forest Pallanadu	795	540	522	533
7	Karayoor I	5203	5319	5267	3099
8	Karayoor II	8718	8183	8156	7765
9	Vannanthura I	2267	2163	2149	2177
10	Vannanthura II	5614	4741	4716	7431
	Total	65427	58251	57846	55990

7.13 COLLECTION OF SANDALWOOD FROM PRIVATE AND REVENUE LAND

Sandalwood from private lands are collected departmentally and sold in auction. The concerned Government orders regarding sharing of auction price and the rules regarding mode of extraction are given in **Appendix-XXXIX**. Large scale smuggling from homesteads and Government Revenue land had taken place during 2004-05. Forest Act is not applicable for booking cases of felling of sandal trees from private and Revenue Land. For preventing pilferage, proposal for cutting green sandal trees beyond the girth 30 cm was mooted by senior Police Officers. Accordingly Government directed the Department to submit a proposal. The proposal was submitted by the Department for seeking approval from Government of India under Forest Conservation Act 1980. Copy of letter from Principal Secretary of Govt. to Chief Conservator of Forests is given as **Appendix-XL**.

7.14. PROTECTION OF SANDAL RESERVES BY CHAIN-LINK FENCING

Increase in organized smuggling of sandal wood from Sandal Reserves has become a great concern. Wide spread allegations against the Forest Department and its inability to protect the sandal trees of high economical and environmental value were raised by NGOs and Environmentalists. Huge cry to protect sandal trees gave rise to a public rally “Chandana Samrakshana Rally” at Marayoor organised by NGOs, Environmentalists, Tribal Organisations etc. The Government of Kerala decided to protect the sandal trees at any cost. It was decided to protect the Sandal Reserve Blocks by erecting Chainlink fence. Construction of Chain – link fence using 125 mm mesh and 50 x 50 mm anglairs around Sandal Forest in Marayoor Division for effective protection commenced in 2005 This 3.3 m tall fencing can prevent easy passage of smugglers to sandal forest and will check grazing. Fencing has been completed around Nachivayal block I, and II, Pallanad Vested Forests, Karayoor II and and partially at Karayoor sandal R F I and partially at Karayoor RF II. An approximate peripheral length of 10 Km has to be completed around Karaoor Sandal Reserve I. A few sandal trees are standing out side the chain linked fencing in Nachivayal. As these trees are extremely vulnerable to theft, a proposal has been made by the department for getting permission for extracting these green trees standing outside the chain link fencing.

Table – 24 – Details of chain link fence

SI No	Location	Length(m)	enclosures	Area (ha)	Details
1	NSR I	7788	One	145.441	1 Right for way
2	NSR II	5370	One	101.171	1 Right for way
3	Pallanadu VF	999	One	7.55	1 Right for way
4	KSR I	1252	One	120	1 Right for way
5	KSR II	97.24	One	97.248	Nil
	Total	18709		471.41	

7.15. HISTORY OF SANDAL SMUGGLING

The sudden escalation in sandal smuggling in Marayoor started from the private holdings which had a good number of sandal trees. As per rules and regulations laid down by the Government, the extraction of dead sandal trees form private lands was done by Forest Department. These extracted trees were transported to Government Sandalwood Depot, Marayoor, converted to marketable size and sold in auction by the Department. The payment to the

land owners were regulated by Government Order No. GO (MS) 126/73/AD Dated 03/04/1973 (**Appendix-XXXIX**). The land owners will be paid 70% of the auction amount leaving 30% to the Department. Their payments to the beneficiaries were taking place in a routine manner. The procedures were cumbersome as well as time consuming. Both the Revenue & Forest Departments were involved in the procedures of sandal extraction from private lands. Previously the Village Officer was competent to issue certificate of ownership of sandal trees to the patta holder. A new procedural frame work made the Tahsildar as the authority for issue of certificate of ownership. This was again revised and the authority to issue ownership certificate was vested with the Revenue Divisional Officer hence the common man had to 'follow the matter up' from the Village Office to Revenue Division Office. People had to move from Range Office to the Divisional Forest Office for getting the benefits of sale proceeds. Chief Conservator of Forests was to sanction the auction procedure. The procedural complexity along with the burden of protecting one's own sandal trees from being smuggled, gave local acceptance to the new option of selling the same to smugglers who offered quick cash. It first started from the dead trees and later, like wild fire spread across the entire length and breadth of the Anchanad valley. The live trees also followed the same paths. Soon the trees in private lands were almost completely exhausted. Gradually a well entrenched mafia took over the activity. When the availability of sandal trees in private lands were considerably reduced, the sandal mafia started operating in full swing in the Sandal Reserves intensifying smuggling.

The major factor that kick-started the felling spree during 2001-06 was the unprecedented increase in the price of sandalwood. In Tamil Nadu and Karnataka all the mature sandalwood available in the Forests were uprooted and kept in the sandal depots. Mature sandal trees were available only in Marayoor area. Hence scarcity was another factor for the phenomenal rise in sandal smuggling from Marayoor.

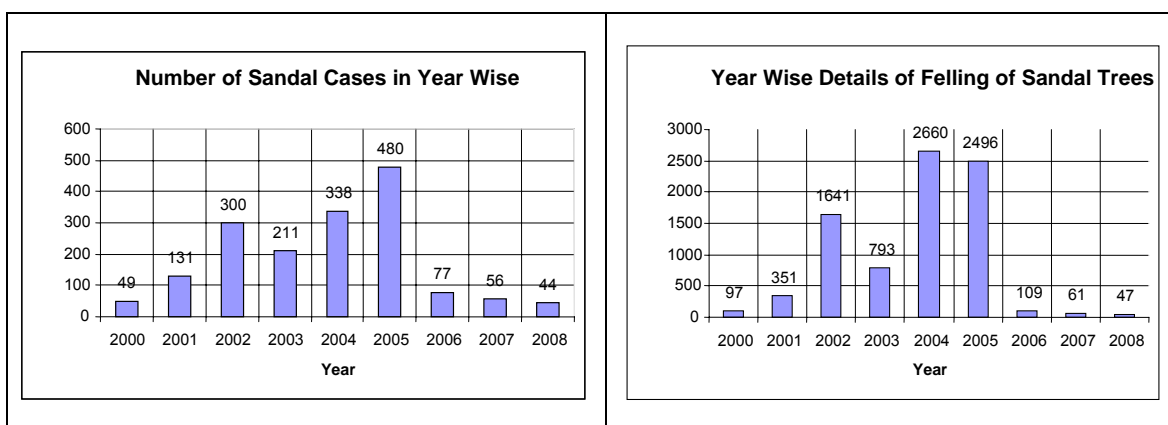
The sandalwood Reserves in Marayoor that are situated amidst human habitations with numerous paths and roads passing through them are easily accessible from all sides. Proximity to human habitations is another factor that aggravated the problem. Paradoxically, when sandal was being raised in Anchanad Valley as plantations, the taungya system involving local people was practiced for 'producing conditions conducive to the natural spread of sandal'.

A gang of smugglers could fell a sandal tree of 60 – 90 cm girth and remove its valuable portion having hardwood within a short period of 10 to 15 minutes. If successful, each one in the gang could get between Rs. 3000 – 8000 depending on the quantity smuggled. Thus the chances of earning easy money coupled with acute unemployment that is prevailing in tribal hamlets and local settlements, has also contributed to the current protection problems.

The table below shows the rate and quantum of sandalwood smuggled during the period from 2001 to 2008.

Table No – 25 – Year-wise Details of Sandal Offences (As on 30/11/08)

Year	No. of cases (sandal)	Tree felled
2000	49	97
2001	131	351
2002	300	1641
2003	211	793
2004	338	2660
2005	480	2496
2006	77	109
2007	56	61
2008	44	47



7.15.1 Strategies adopted to protect Sandalwood Trees

1. **Block and Protection Unit System:-** Immediately after the formation of Sandal Division on 18/07/05, the whole sandal Forest was divided into blocks and protection units and protection charge of each unit was entrusted to a team of staff and watchers. This system was found very useful. A detailed guideline regarding this strategy was prepared and communicated to the staff.
2. **Proper deployment of staff:-** Arrangement has been made for the staff and watchers for camping in camp sheds made in each protection unit/block during day and night. They were changed periodically. Eco-tourism programme has been designed so that the community participation is assured for sandal protection. The additional income by way of tourism activities provided an incentive to the community intensify protection.

3. **Intensive patrolling:-** Patrolling during day and night was intensified in Sandal Reserves and adjacent areas. Most of the sandal smuggling routes are passing through the Kerala Tamil Nadu border areas in Munnar Wildlife Division. Steps were taken for conducting frequent camps in such border areas to seal the routes. Such prominent sandal smuggling routes are given in **Appendix –XLI**.
4. **Strict vigil over Palapetty area:-** Palapetty in Kanthalloor Range area have good sandal stock with large size sandal trees. Frequent smuggling had taken place in this boarder area. Camping arrangements for staff equipped with arms and ammunition were made in the area.
5. **Interstate Officers Rapport:-** Good relations with the counter part officers viz Wildlife Warden Pollachi, Divisional Forest Officer Dindigal and Divisional Forest Officer Kodaikanal were maintained and improved which helped in getting important information on sandal smugglers and smuggling routes etc.
6. **Intelligence collection:-** Intelligence on sandal smuggling agents and operation at various levels was gathered. Informants were adequately rewarded. This has helped in establishing a network of intelligence gathering inside and outside the state leading to arrest of notorious sandal smugglers.
7. **Charging of the Cases:-** Number of cases has increased from 2000 onwards due to the increase in smuggling. Pending cases were charged and it helped in bringing the accused before Law and to award maximum punishment.
8. **Formation of more VSS:-** In some cases of smuggling of sandal, the connivances of some locals were reported. They have colluded with the sandal mafia for employment and for making quick money. For weaning away the local people from smuggling VSS have been formed in Marayoor area which has helped in improving the support of the local people in the protection of sandal trees. Its effect is still meagre and the existing VSSs have to be more activated and empowered.

7.16 SANDALWOOD FACTORIES

During 1989 - 1995 periods more than a dozen factories functioned in the Palakkad locality bordering with Tamil Nadu. It was a known fact that the sandal wood; the raw material for these factories have been smuggled out from Tamil Nadu area. Unable to control the illicit flow of sandalwood to Kerala, Government of Tamil Nadu has taken the strategy to salvage the remaining sandal trees from Reserve Forest areas. Sandal trees from Reserve Forests were felled and collected in Government Sandalwood Depots. This forced the sandalwood smugglers and factory owners to turn

their attention to Marayoor. Stringent measures were taken to prevent illicit fellings in Sandal Reserves and frequent raids were conducted in sandal wood factories. Actions were taken to shut down these illegal sandal oil extracting factories. This tempted sandal mafia to shut down most of the illegal sandal factories in Kerala. Some of them shifted their activities to Goa, Pondichery and Andhra Pradesh. Although the intensity of sandal smuggling has been reduced, the demand in market combined with various other factors, sandal wood smuggling is still continues from Marayoor Sandal Reserves.

7.17. SANDAL MONITORING CELL

As per the direction of H'nble High Court to Govt. of Kerala on basis of the judgment dated 27/06/2006 in O.P. No. 20858/01, WP (C) 25865/01, 16409/03, 6179/05 and 9607/05 for taking steps to carryout the suggestion to constitute a state level monitoring cell headed by Chief conservator of Forests (Vigilance), ant to officers of integrity and uprightness in sensitive places. The proposal for formation of monitoring cell was approved by the Govt. of Kerala as per Order GO (Rt) 419/06/F&WLD, Thiruvananthapuram dated 13/10/06. The copy of Government order is given in **Appendix- XLII**.

7.18. SPECIAL WORKS OF IMPROVEMENT TAKEN UP

7.18.1 Kerala Forestry Project : The World Bank aided Kerala Forestry Project was launched in the state in 1998-99 with the objectives 1) to promote conservation of bio-diversity and to arrest degradation of Forest areas so that these assets continue to fully serve their ecological functions, 2) to improve the sustainable production of both timber and non-timber Forest products in designated Forest lands and on farm lands, 3) and to improve the standard of living of local rural populations residing in and around Forest areas. To achieve the above objectives, the project had the following components.

1. Management of Less Disturbed Natural Forests:- ANR (Assisted Natural Regeneration) In reasonably but unevenly stocked Forests, frequently with insufficient natural regeneration, the project envisaged support for promoting or supplementing natural regeneration by means of planting seedlings/viable rootstock, or by sowing seeds of native species in gaps. Forest areas with more than 600 established seedlings per hectare and crown density of 0.4-0.7 was being treated under this component.

Treatments Proposed: - Soil/moisture conservation treatments like forming gully plugging, contour bunds, staggered trenches etc and regeneration treatments like tending natural regeneration/sowing seeds of native species.

If artificial regeneration was necessary the same could be effected by planting normally not more than 100 seedlings per hectare. The location of planting should be specifically shown on the treatment map and demarcated separately in the field.

2. RRB: - The area under this component will be selected based on the degradation status of the reed, bamboo and cane brakes. Areas with poor clump development, invasion of Mikania, areas with depleted stock owing to over exploitation in the past, areas with less than 200 clumps/Ha. etc were selected for treatment.

Treatments proposed:- Undertake weeding and tending operations, preferably line weeding, intensive weeding of Mikania infested areas, dressing cleaning and hygienic operations of clumps, soil working, fire protection, soil and moisture conservation works, augmentation planting and tending operations. No harvesting will be done till the crop matures nor during the period of operations.

3. Rehabilitation of Degraded Forests (RDF):- About 20% of the Forests in the State have been classified as open or degraded Forests. These are classified into RDF-I, which supports 300-600 natural seedlings per hectare and RDF-II, supporting less than 300 natural seedlings. Apart from the regeneration status, the crown density also has to be taken into account for deciding degradation. The crown density prescribed for RDF-1 is 0.1 to 0.4 and for RDF-II is 0 to 0.1. In RDF-I areas the invasion of weeds will not be as established as in RDF-II areas. The objective of RDF-I treatment is eco restoration to normalcy, and that of RDF-II areas is restocking of degraded Forests and failed plantations.

Treatments Proposed

1. RDF 1:- Tending regeneration is the principal activity. Planting is to be done only in gaps. A site clearance was done in planting areas and skinning in grassy patches. Selective weeding was done to promote natural regeneration and also in areas to be planted. Fire protection, engaging of watch and ward, soil and moisture conservation works, moderate soil working and manuring were done.

2. RDF 2:- Planting is the principal activity. Provision for intensive cultivation. Slash felling and preparation of site before planting. Fire protection and watch and ward area essential. Soil working to be done wherever necessary. Skinning in grassy patches. Tending is a subsidiary activity. Choice of species for planting based on vegetation analysis data. While in RDF-I area, the stage of succession and structure and structure of communities will suggest the species for planting, in RDF-II areas, the extent of degradation of soil will be taken into consideration while selecting the species for planting, preferably with fast growing pioneer species to cover the site, or other native

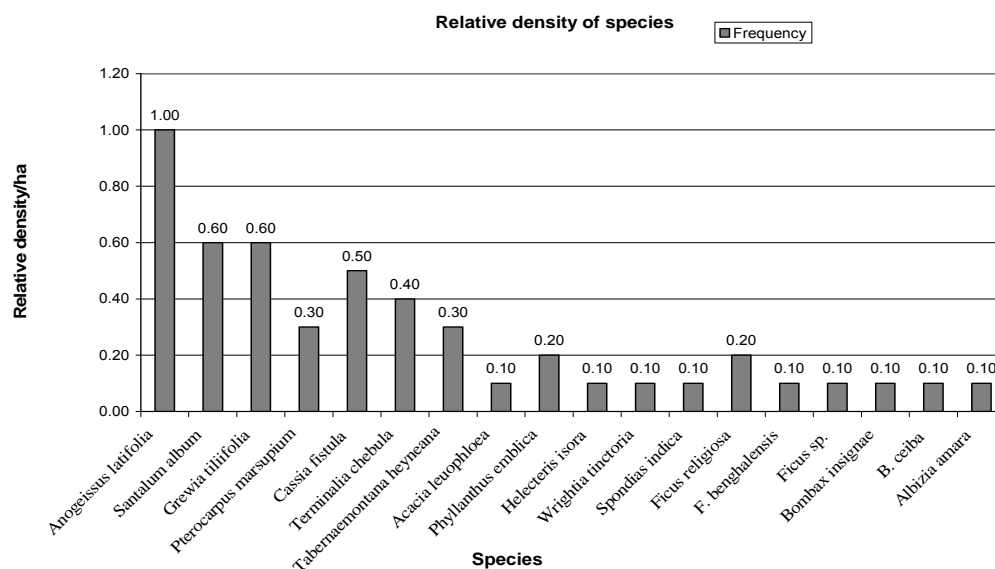
species which the site could support. For degraded plantations, the species will be selected based on the purpose for which the area is planted. Details of the activities done under KFP are given in **Table No. 20**.

7.19. PHYTOSOCIOLOGICAL STUDY IN NACHIVAYAL SANDAL RESERVE – II BY STUDENTS OF FORESTRY COLLEGE, MANNUTHY.

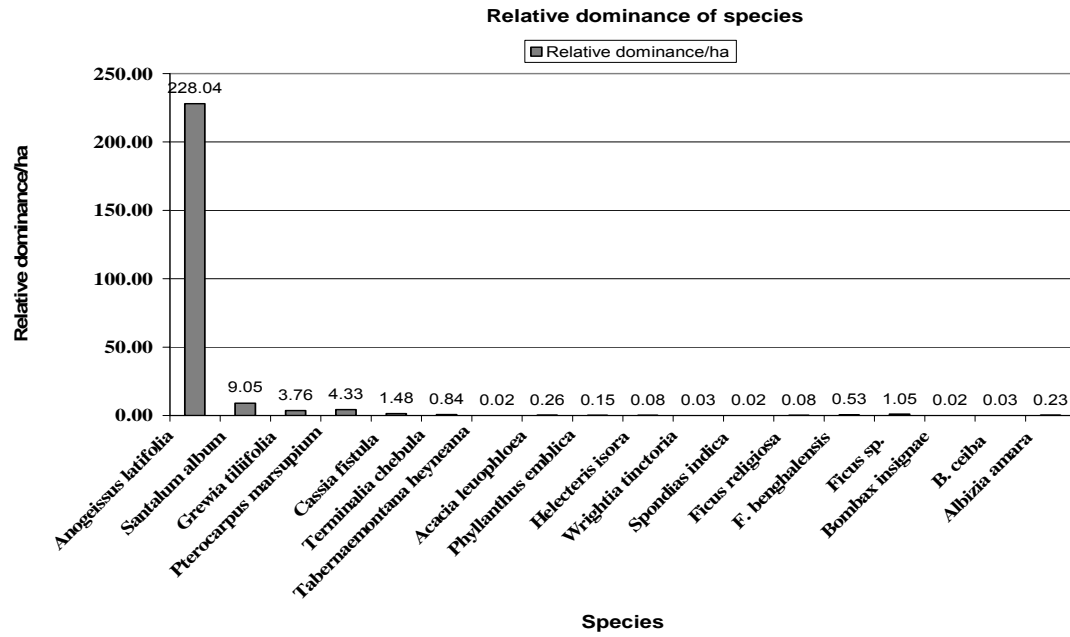
NSR 2 extends to 100 ha and the team had done a 1% sample survey to assess the diversity of the Sandalwood Reserve. Ten, 20 x 20 m plots on either side of the base line alternatively taken for survey. Complete enumeration of under growth in 20 x 20 m plot was done. (Usually sample plots of 1 x 1 m or 2 x 2 m is taken for survey. Here a complete enumeration to evaluate *Lantana* infestation was carried out. This was to study the impact of gregarious growth of *Lantana* in sandal regeneration

Result of the study: Among tree species *Anogeissus latifolia* (Vekkali, Mazhukanjiram) has highest relative density, followed by *Grewia*, and sandal. The forests have a high diversity index (0.73) w.r.t to tree species. Among undercover species *Lantana camera* has high relative density, relative frequency and abundance. Graphical representation on studies of Relative Density., Dominance, Frequency and Abundanacce of species and under growth is given below.

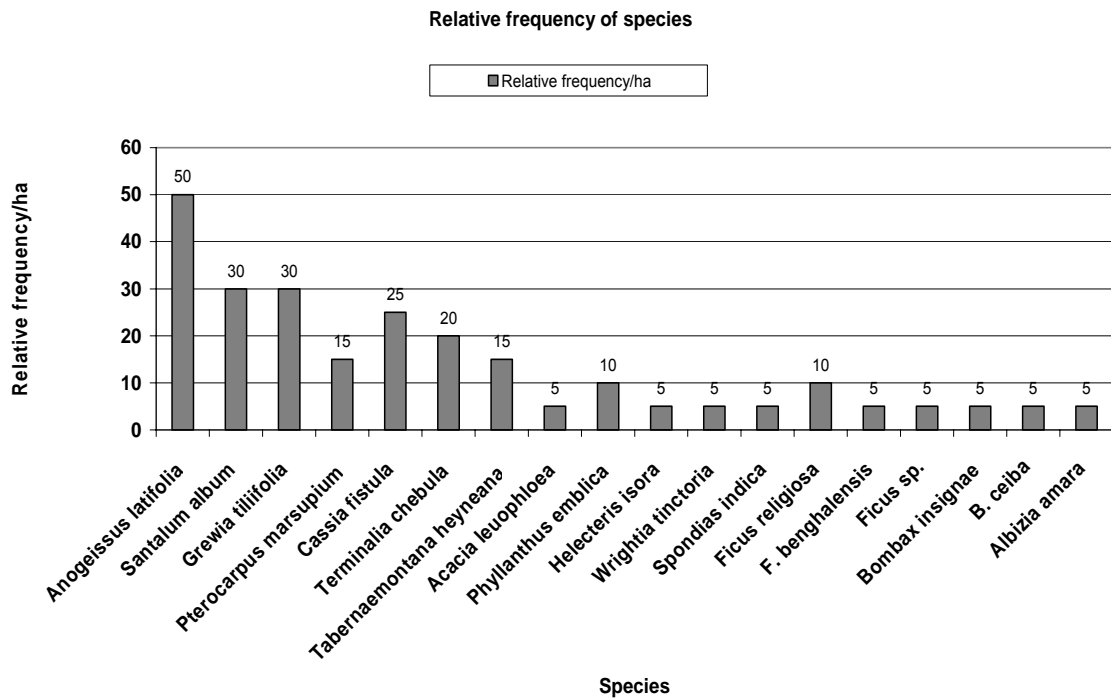
Graph No. 1



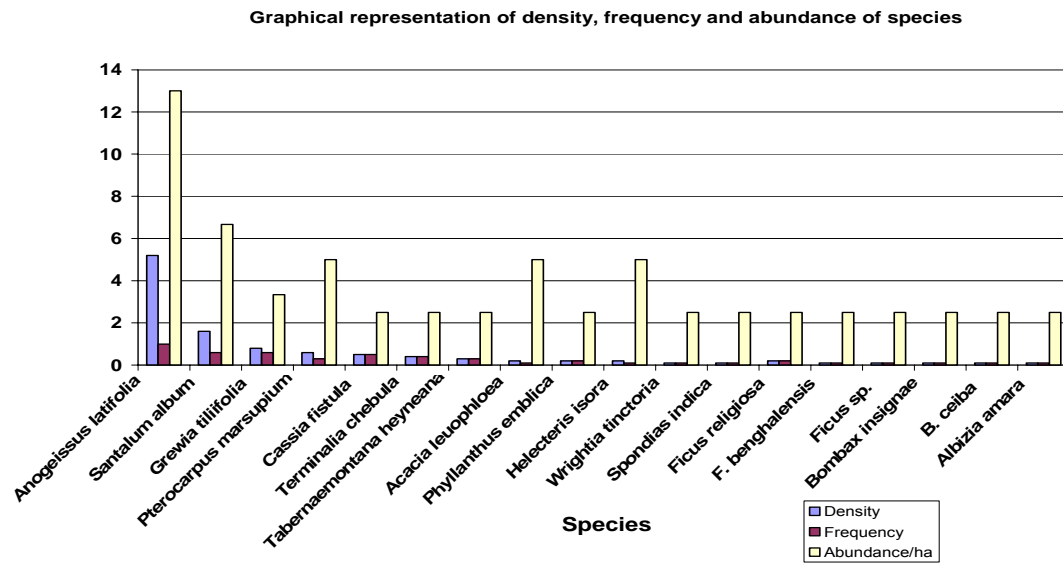
Graph No. 2



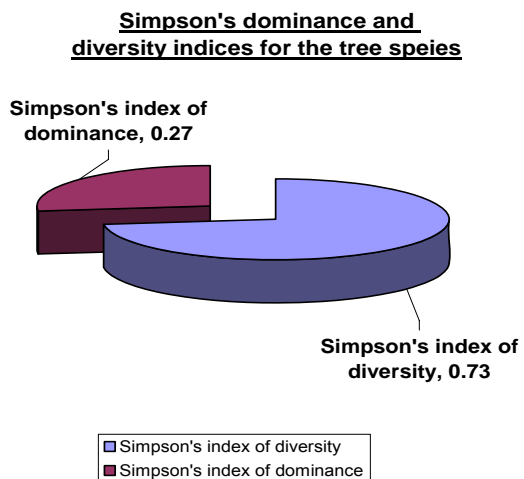
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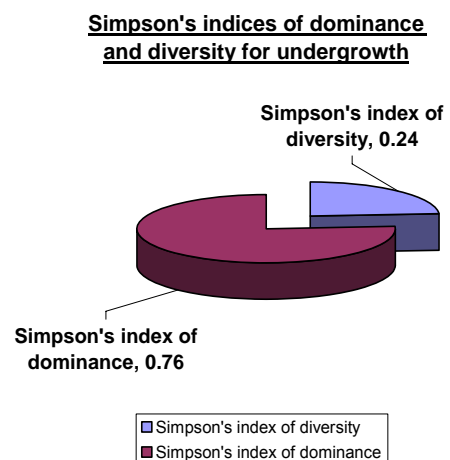
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Graph No. 5

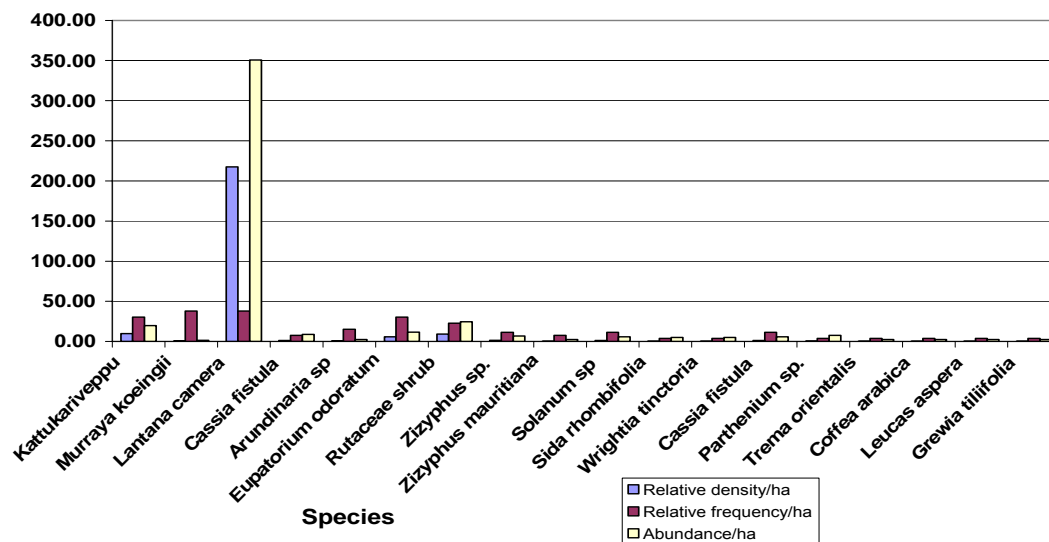


Graph No. 6

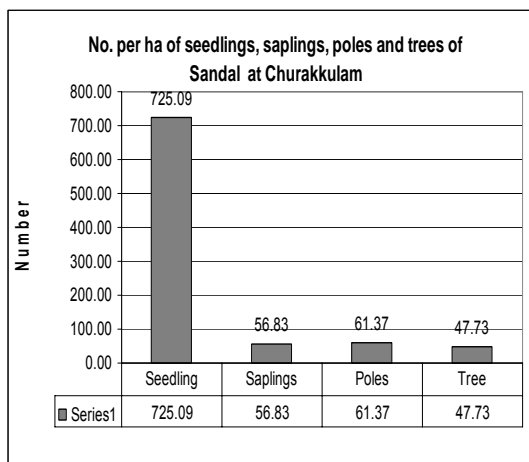


Graph No. 7

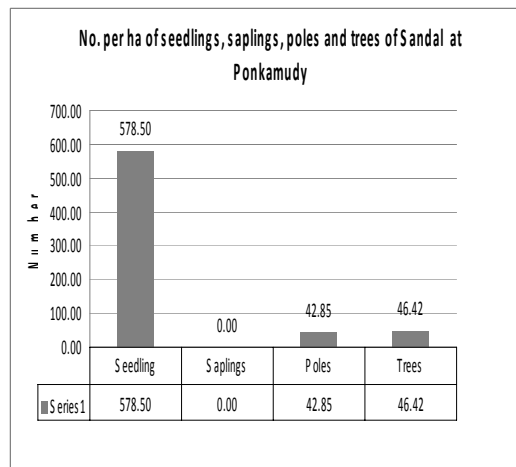
Graph showing relative density, relative frequency and abundance of undergrowth



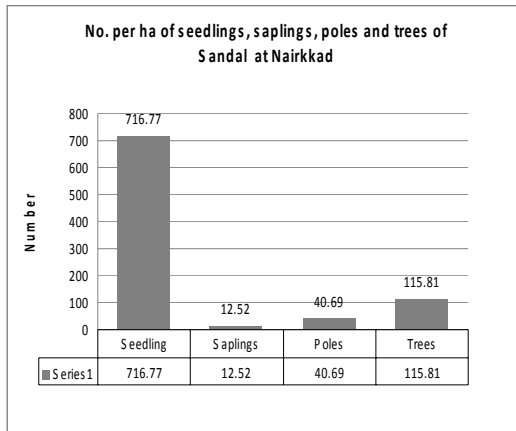
Graph No. 8



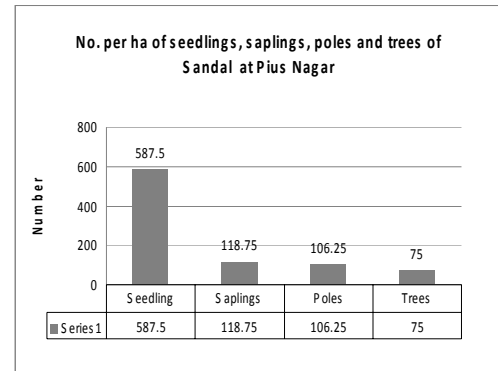
Graph No. 9



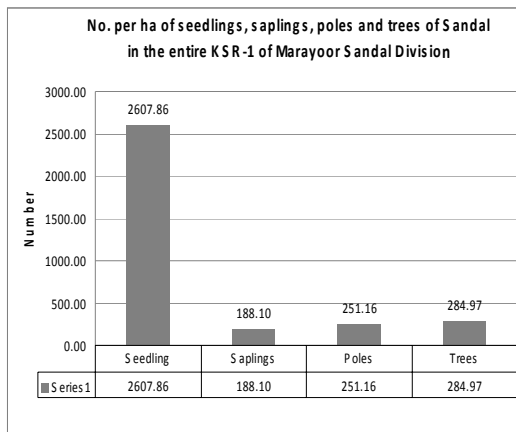
Graph No. 10



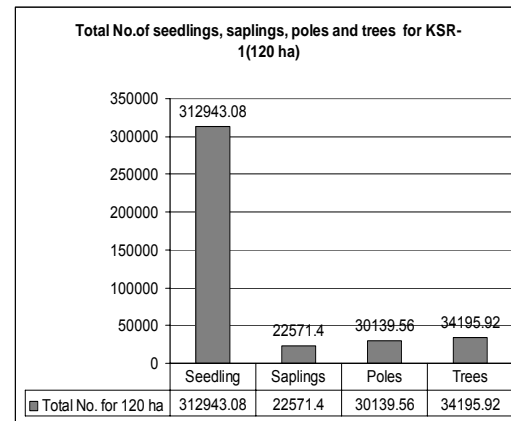
Graph No. 11



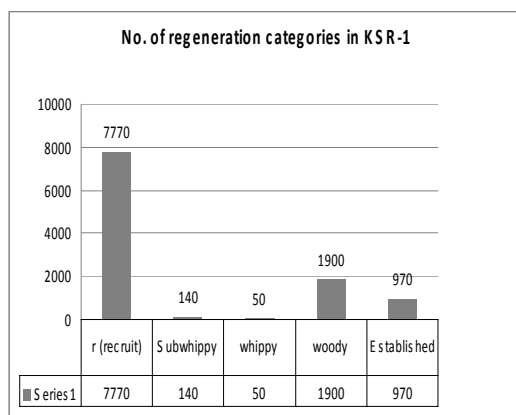
Graph No. 12



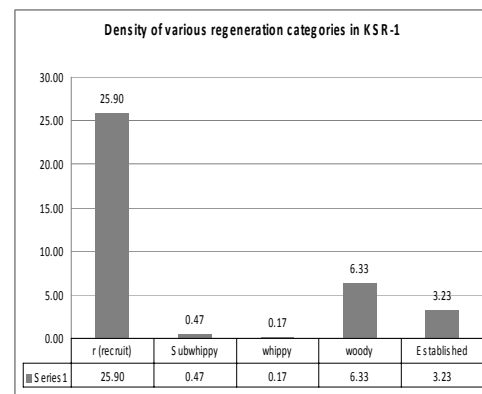
Graph No. 13



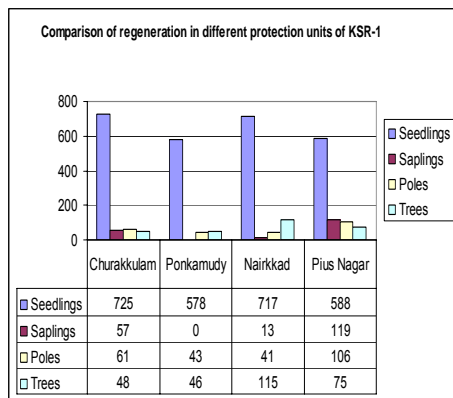
Graph No. 14



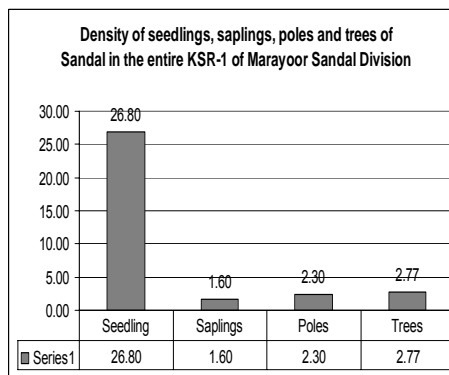
Graph No. 15



Graph No. 16



Graph No. 17



7.20 ACTIVITIES OF SILVICULTURAL REASERCH WING

1) Sandal seed production area, Marayoor

The Research Unit, Peerumedu is maintaining sandal seed production area in six plots at sandal Reserve in Nachivayal and Anikkampetti. An extent of 22.41 Ha. has been selected for this and the boundaries are demarcated by survey stones. Fire protection, weeding, etc are being done every year.

2) Sandal research plot in Karayoor in Sandal reserve block –II

With the objective to improving the natural stock of sandal by protection from biotic factors and to augment the natural stock by inducing regeneration by root suckers and to create awareness among the people about the need for protection of the highly dwindling sandal, they have selected an extent of 30 ha in block 2 of Karayoor Sandal Reserve. Trenches of size 1x1x0.2 meter were taken. Germinated and pretreated seeds were sown on the mounds of trenches. The process of regeneration study is in progress.

7.21 ACTIVITIES OF KERALA FOREST RESEARCH INSTITUTE

1. **Spike disease:** - Spike disease infected Sandal trees die within 2-3 years. KFRI had conducted research on this disease. This disease was detected by Dr. S. K. Ghosh and Dr. M. Balasundaran in Reserve 51 during the year 1980. The identity of the disease was confirmed through electron microscopic

observation of the pathogen known as phytoplasma in phloem tissues. An insect vector known as *Redarator bimaculatus* was found transferring the disease to healthy trees. By 1985 more than 50% of the trees in the original area of 382 ha of Reserve 51 were infected (Ghosh et al., 1985).

Studies done during 1996-2001, using biotechnological techniques could not identify spike disease resistant trees. PCR techniques and ELISA techniques were used for early detection of the pathogen in the plant tissues before heavy infestation. Tissue culture technique and vegetative propagation technique for sandal multiplication were developed. However, survival of the clonal plants was poor.

3. Planting of different Sandal provenances: - The research activities of planting 8 sandal provenances from Kamataka, Tamil Nadu, Madhya Pradesh and Orissa, Marayoor and Thrissur showed that growth, survival and establishment up to 2 years were highest for Marayoor seed source indicating the superiority of Marayoor provenance (Balasundaran, 2004). Modern molecular techniques can differentiate sandal logs from its adulterants such as African sandal (*Osyris* sp.) through DNA finger printing (Anupama and Balasundaran, 2008a), besides anatomical features. Difference in chemical properties of sandal oil components and African sandal oil components can be utilized for detection of sandal oil adulteration (Bhat et al., 2007).

4. Augmentation of sandal:- KFRI had conducted research works on different techniques to augment the natural regeneration of sandal for which studies were conducted in a 10 ha plot at Nachivaya¹ in Marayoor. Natural regeneration is practically impossible without providing protection to the young seedlings from browsing animals including rodents and domestic animals. Shade is an important factor controlling the growth and survival of seedlings. Seedlings require partial shade (50-25%) up to six months and 25% up to one year. There after the plants require good sunlight. The host plants casting shade over the young seedlings should be pruned suitably to regulate shade. Nevertheless, host plants are also necessary during the various growth stages of sandal. Sandal does not require host plants up to 2 months. There after, its roots search for host plant roots, and haustorial connection will be established for obtaining certain minerals and amino acids from host plants. Leguminous plants including cultivated plants are the favoured host plants at polybag stage while in the field; sandal roots establish connection between spreading roots of near by weeds to tiny roots of trees. In areas such as Marayoor, populated by browsing wild animals such as gaur, deer, etc. and domestic animals such as goats and cattle, protection of seedlings up to 3 m height are necessary. Growing seedlings by seed broadcasting in small raised beds or pits of size, 45 cm x 45 cm and protecting the growing seedlings using strong tree guards of chain linked fence will succeed in improving regeneration. (For brief description on sandal cultivation, see "Chandanam", an information bulletin in Malayalam by Anupama and Balasundaran, 2008 b).

5. Regeneration through root sucker:- Sandal regeneration can be augmented by inducing root sucker formation by digging trenches around trees. Sandal regenerate through root suckers arising from the exposed/injured roots. However, this method of regeneration in natural Forests is not recommended by KFRI because of the following reasons.

- i. The genotype of mother plants and root suckers will be the same thus adversely affecting genetic diversity of sandal in natural Forests.
- ii. Poor seed setting is noticed on sandal trees, forming patches of tree clusters. DNA studies showed that most of the trees of such clusters are of identical genotypes indicating possible regeneration through root suckers.
- iii. Pollination between such adjacent plants of same genotype results in inbreeding, and inbred seeds are presumed to be of inferior quality in the predominantly cross pollinated sandal.
- iv. Only very small percentage of the root suckers survives summer season; most of the root suckers perish at various stages of maturity. Growth of root sucker clusters is generally poor.
- v. Injured root system are infected by pathogens and decay causing microorganisms, and subsequently they become prone to attack by termites and other insect pests.

7.22 VATTAVADA MICRO WATERSHED – STUDY BY CWRDM

CWRDM has conducted a study at Vattavada micro watershed which has been selected for development by Govt. of Kerala during 1985. This report gives a master plan to develop the Vattavada watershed, based on a multidisciplinary concept involving disciplines like soil and water conservation, soil science, agronomy, geology, remote sensing and agricultural meteorology. The major thrust in the plan is on development of water and land resources, effective water management techniques and suitable cropping pattern.

Geology and Soil

The main rock type of the area is pink gneiss characterized by the presence of a good amount of the mineral feldspar. The rock exposures at Pazhathottam area is under the process of mechanical and chemical decomposition where as at Vattavada and other area, the rocks have already undergone physical weathering and high degree of chemical changes. Except quartz which is resistant to quick weathering process, all other minerals especially, feldspar have decomposed. The weathering in semi-arid conditions

has given rise to shallow sandy loam soils. The gradation in weathering from place to place to place indicates the extensive deforestation activities and the after effects of the same especially the direct interaction of water with soluble minerals of the gneissic rock of the area through space and time. This is evident from the large amount of lateritic and clay soils present in the area.

They conducted the study of soils collected from different profiles. Totally five profiles were collected along with samples from paddy and potato fields.

The soil from Pazhathottam area has high organic matter content especially in the surface horizons upto 60 cm and the organic carbon varies from 3 to 10 percent and it decreases rapidly down below. Unlike Pazhathottam, soils from Vattavada area has lower organic carbon and this is due to sandy loam nature of this soil. The soils of Pazhathottam has high water retention capacity possibly because of high organic matter and clay content. The available nitrogen content is very high in the surface layers in Pazhathottam profiles as compared to Vattavada where it is low to medium. The phosphorus concentration is fairly high in all the profiles studied. The K content is medium to high level especially in potato fields.

The water availability in micro water shed area has been studied. As per the estimation there is water surplus for 8 consecutive months starting from April – November and water deficit for the rest of 4 consecutive months December – March. Based on season wise distribution of rainfall, the study report had recommended to utilize the surface water resource by adopting soil and moisture conservation activities like construction of check dams, counter trenches, gully plugging etc.

Sl. No.	Crop/Total area	Slope(%)	Area(ha)	% Proportion under different slope units in a group
1	Paddy 411.24 (9.5)	25-35	143.45	35.0
		35-45	146.54	35.6
		45-58	121.25	29.4
2	Upland cultivation 915.85 (21.1)	25-35	394.04	43.0
		45-58	403.19	44.0
3	Waste land 1195.23 (27.6)	25-35	45.0	3.8
		35-45	458.03	38.3
		45-58	424.33	35.5
		758	267.9	22.4
4	Reserved forest 1807.54 (41.7)	25	204.62	11.3
		25-35	299.48	16.6
		45-58	909.47	50.3

Based on their study they have proved that development of surface water resource, ground water resource and land resource are essential for development of a watershed. Following are their recommendations.

- 1) For water resource development they have recommended to construct check dams in RR or Mud wall at convenient places.
- 2) Leveling of terraced land 1 to 2 % slope, and construction of puetoriccan terraces with vegetative barrier.
- 3) Reduction in the area under cultivation of paddy and introduction of ago-horticultural system in the upland and agro forestry in waste lands.
- 4) They have also recommended to bring with 10-15% slop under grass-legume.

7.23 PAST YIELD, REVENUE AND EXPENDITURE

In Marayoor Division there is no remarkable extent of pulpwood plantations. The whole Plan area is the Sandal Wood reserve. Hence the revenue obtained is from the auction sale of sandal wood. The delay and pendency in disposal of sandalwood cause the remarkable difference in revenue of every year. The **Table No. 26** shows the details of revenue after formation of this Division.

Table – 26 – Revenue during last 2 Years in Marayoor Division

Sl.No	Year	Revenue
1	2005-06	1622640
2	2006-07	2996770
3	2007-08	13716900

7.23.1 Expenditure: The Division had been regularly receiving fund from Plan and Non-Plan schemes. The yearly averages of funds received under Plan and Non-Plan schemes after the formation of the Division is Rs.15155926, Rs.9796908 respectively.

The allotment and expenditure detail of Marayoor Sandal Divisions from 2005-06 to 2007-08 is given in the **Table No. 27**.

Table – 27 – Budgetary Allocation after the formation of Marayoor Sandal Division

Sl. No	Year	Non-Plan (Rs)	Plan (Rs)	TSP (Rs)	SCP (Rs)	Revolving Fund (Rs)	Wildlife
1	2005-06	17820000	7882000				
2	2006-07	13639000	36966000				
3.	2007-08	18122000	21458000				

Expenditure after the formation of Marayoor Sandal Division

Sl.No	Year	Non-Plan (Rs)	Plan (Rs)	TSP (Rs)	SCP (Rs)	Revolving Fund (Rs)	Wildlife
1	2005-06	9015000	3873000				
2	2006-07	10578816	26438851				
3.	2007-08	14592485	21458000				