annual report
1982-'83

kerala forest
research institute

ANNUAL REPORT

April 1982 March 1983

kerala forest research institute

Peechi, Trichur 680 653, Kerala

INTRODUCTION

The organisation of laboratories with equipment and other facilities for research investigations, was continued. Senior Scientists with supporting staff were positioned in most of the Divisions and research activities were intensified. Nine research projects, viz

1 Investigations on the possibility of vegetative propagation of bamboos and reeds by stem cuttings.

2 Eco-taxonomic study of the seedling of commercially important tree species of Kerala and preparation of a key for their identification.

3 Studies on the seasonal incidence of teak defoliators and the effect of defoliation on volume increment of teak.

4 Preliminary investigations on the biology and control of beetles damaging stored reed.

5 Studies on the host-parasite relationship of phanerogamic parasite (s) on teak.

6 Silviculture and management of fast-growing indigenous hardwood species with multiple end uses.

7 Study of afforestation techniques in grasslands of Kerala.

8 Influence of site factors in *Bombax ceiba* plantations, and

9 Cultural practices for managing soil erosion in forest plantations: State-of- knowledge report.

Initiated during earlier years were completed and final reports were either published or processed for publications. An information bulletin on "How to establish seed orchards of teak (*Tectona grandis* L. f)" was published both in English and Malayalam. Scientific papers were contributed to Journals, National and International Seminars, Symposia etc Field studies were augmented and several experimental plots were established in forest areas. More projects relevant to scientific forestry management were identified and preliminary exploratory studies were taken up.

The development of residential complex received greater attention and 10 more quarters in the campus were allotted to the staff for occupation.

GOVERNING BODY

The Governing Body constituted in Order M.S. No. 11/81/Plg. dated 24.3.1981 by the Government of Kerala continued during the year. The Governing Body consist of the following members:

Ex-officio:

1. Minister for Forests (Kerala) .. Chairman
2. Chairman, State Committee on Science & Technology (Kerala) ... Vice-Chairman
3. Inspector General of Forests, Government of India, New Delhi.
4. Commissioner for Economic Development & Special Secretary to Government of Kerala Planning & Economic Affairs Department.
5. Chief Conservator of Forests, Kerala.
6. Vice-Chancellor, Kerala Agricultural University.
7. Director, Kerala Forest Research Institute.

Scientists:

8. Shri K K. Nair
   Managing Director,
   Kerala Wood Industries Ltd., Calicut.
9. Shri Hari Singh,
   Rtd. Inspector General of Forests, Bangalore.
10. Prof. YML Sharma
    International Forestry Consultant Bangalore.
11. Shri JC Varmah,
    Ex-President,
    Forest Research Institute & Colleges, Dehra Dun.

Representative of forest-based industry:

12. Shri A. K. Kaderkutty,
    Managing Director,
    Western India Plywoods Ltd., Baliapattam.

The Governing Body met twice during the year.

EXECUTIVE COMMITTEE

The Executive Committee consisting of the following members continued during the year.

1. Chairman,
   State Committee on Science & Technology (Kerala)
2. Commissioner for Economic Development & Special Secretary to Government of Kerala, Planning & Economic Affairs Department, Chairman
3. Chief Conservator of Forests, Kerala.
4. Shri K K Nair,
   Managing Director,
   Kerala Wood Industries Ltd., Calicut.

5. Shri A K Kaderkutty,
Managing Director,
Western India Plywoods Ltd., Baliapattam.

6. Director, Kerala Forest Research Institute.

The Executive Committee met on three occasions.

CAMPUS DEVELOPMENT

The Institute campus is located at Peechi in 28.174 ha. of forest land leased out by the Kerala Forest Department for a period of 99 years. The construction of laboratory blocks, library and administration building was completed in the previous years.

The work of construction of auditorium with water tank on top of it, entrusted to the Kerala State Construction Corporation for execution, is in progress. The structural part of the work is over. The work on acoustic arrangement and other fittings within the auditorium remain to be done. This work is being arranged by the Corporation.

The construction of 16 Nos. of Type I quarters, 20 Nos. of Type II quarters and 13 Nos. of Type III quarters in the campus at Peechi uudertaken by the Corporation was over and the quarters were allotted for occupation. The construction of two more Type III quarters is almost completed. This will be allotted for occupation soon. The Corporation has been entrusted with the work of construction of 10 more numbers of Type I quarters at Peechi and the work is in good progress.

WATER SUPPLY TO THE INSTITUTE CAMPUS

The work of permanent water supply system to the campus at Peechi entrusted to the Kerala Public Health Engineering Department is in progress. The work of construction of purification plant is under execution now. The work such as construction of infiltration well-cum-pump house, pumping main, erection of pump set and receiving chamber have already been completed. The Institute is already making use of the system. Water from the well is pumped to temporary water tanks erected on the hill top and supplied to the quarters, laboratory etc. through the distribution lines already laid.

ESTABLISHMENT OF SUB CENTRES

The Institute has developed a Sub-Centre at Nilambur in 43.358 ha. of forest land leased out by the Kerala Forest Department for 99 years. An office-cum-laboratory building, staff quarters and a rest house have already been constructed there. There is proposal to construct a Type I quarter there and the Kerala State Construction Corporation has been approached to take up the work. Necessary experimental plots are being developed on a phased manner.

The Expert Committee appointed by the Government of Kerala to examine the question of locating the Institute had recommended establishment of a Sub-Centre at Thekkady. This recommendation was accepted by the Government and an area of 1.5 ha. of land was leased out to the Institute. Since a suitable site could not be got allotted from the Forest Department, the development of Sub-Centre could not be taken up. The question of developing the Sub-Centre at Thekkady was considered again at a high level meeting convened by the Commissioner for Economic Development, Government of Kerala, in July 1982. The Government directed the Institute to select a new location for the Sub-Centre for wild life studies and suggested Parambikulam as an alternate location. This question was considered by the Executive Committee and it was decided that the proposal for opening a Sub-Centre at Parambikulam might be considered after sometime.

TEAK MUSEUM AND STUDY CENTRE

The work of construction of Teak Museum and Study Centre is proposed to be entrusted to the Kerala State Construction Corporation. The Corporation has already agreed to undertake the work. They have requested the Institute to supply good quality teakwood required for windows, doors, panelling etc. As directed by the Governing Body, the Kerala Government have already been approached for the free supply of timber. As soon as orders are received for the supply of timber free of cost, necessary agreement will be executed with the Corporation for commencing construction work.

STAFF

The staff in position as on 31.3.1983 is shown in Appendix I.

Dr. PM Ganapathy, Director, after seeking voluntary retirement from the Indian Forest Service, left the Institute in June 1982. The Government appointed Dr. CTS Nair, Forest Economist of the Institute, to hold charge of the post of the Director. Subsequently Dr. S Kedharnath was appointed as Director of the Institute and he joined in October 1982.

The post of Statistician and Plant Physiologist could not be filled up yet for want of suitable persons. Action was initiated to identify suitable persons on personal contact for appointment against these positions.

The post of Geneticist also fell vacant, when Dr. CS Venkatesh, who was on deputation from the Forest Research Institute & Colleges, Dehra Dun, went back to his parent Institution in November 1982. The Institute had selected a person for the post. Though offer of appointment was sent to him (He is working in Canada), he has not joined so far.

Shri M. Muhammed Usman, Additional Secretary to Government of Kerala, continued as Registrar of the Institute.

FINANCE

The budget for 1982-83 approved by the Governing Body was for Rs 65 lakhs. The provision made for research projects financed by external agencies in the Budget Estimate for 1982-83 was Rs. 2.65 lakhs. The Government released Rs. 44.25 lakhs during the period under report. The year started with a cash balance of Rs. 6.40 lakhs. The expenditure incurred was Rs. 45.61 lakhs. The cash balance at the close of the year was Rs. 5.04 lakhs.

M/s. Joseph & Joseph, Trichur, audited the accounts of the Institute for the year. The audited statement of accounts is in Appendix II.

REVIEW COMMITTEE

The Review Committee report was considered by the Governing Body in May 1982.

LIBRARY

Acquisition of Documents

The details of books and other documents acquired in the library during the year are as furnished below:

Item	Nos. acquired during the year	Total acquisition
Books	686	8,380
Photocopies	180	861
Reprints	395	2,837
Journals	20	232
Back volumes	192	940
TOTAL:	1,453	13,250

Documentation Work

The catalogue of journal holdings in the library as on June 1981 was published. A classified catalogue of reprints available in the library will be published soon. The release of Fortnightly KFRI library News release continued during the year. The following bibliographies were compiled:

i) Forestry for Food
ii) Bison/Gaur
iii) Charcal production/consumption in India.
iv) Social Forestry with particular reference to India.
v) Medicinal Plants

vi) Elephant

vii) Tiger

Viii) Rattan

RESEARCH

During the year, final reports of the following projects were published as KFRI Research Reports:

1	Entom. 06/1979	Investigation on the possibility of non-insecticidal control of termites.
2	Soils. 05/1981	Cultural practices for managing soil erosion in forest plantation: State - of - knowledge report.
3	Wood. 03/1979	Preservative treatment of rubber wood *(Hevea braziliensis)*.
4	Wood. 04/1980	Protection of fibrous raw material in storage against deterioration by biological organisms.

The following projects were completed and reports are under preparation or being processed for publication:

1	Physiol. 02/1979	Investigations on the possibility of vegetative propagation of bamboos and reeds by stem cuttings.
2	Ecol. 03/1979	Eco-taxonomic study of the seedling of commercially important tree species of Kerala and preparation of a key for their identification.
3	Entom. 02/1977	Studies on the seasonal incidence of teak defoliators and the effect of defoliation on volume increment of teak.
4	Entom. 04/1979	Preliminary investigations on the biology and control of beetles damaging stored reed.
5	Pathol (NF) 01/1979	Studies on the host-parasite relationship of phanerogamic parasite (s) on teak.
6	Silvi. 01/1977	Silviculture and management of fastgrowing indigenous hardwood species with multiple end uses.
7	Silvi. 02/1977	Study of afforestation techniques in grasslands of Kerala.
8	Soils. 04/1979	Influence of site factors in *Bombax ceiba* plantations.

An information bulletin entitled "How to establish seed orchards of teak (*Tectona grandis L.f)*" was published both in English and Malayalam.

Scientific papers on results of some of our findings of academic interest were published in Journals.

Progress achieved in respect of various projects undertaken is summarized below:

BOTANY (PHYSIOLOGY)

Physiol. 01/1979: Studies on the physiology of vegetative propagation of important timber species by rooting stem cuttings.

This project has been initiated with the objective of studying the rooting behaviour of stem cuttings of economically important timber species, and the effect of different growth regulators on induction of roots.

Experiments were continued at Nilambur Sub Centre with stem cuttings of *Tectona grandis, Swietenia macrophylla, Xylia Xylocarpa, Hopea parviflora, Melia composita* and *Gmelina arborea*. *Tectona grandis* cuttings showed very good sprouting and callusing, but rooting percentage obtained was low. Maximum percentage of sprouting and callusing was observed during the months of March and April. *Gmelina arborea* stem cuttings, collected from different provenances' collection at Chempankolli Gmelina plot, gave good sprouting and rooting. *Melia composita* responded to the treatments with very low percentage of sprouting and rooting. However, good percentage of callusing was observed in treated cuttings compared to untreated cuttings of this species. *Hopea Parviflora, Swietenia macrophylla* and *Xylia Xylocarpa* cuttings showed considerably low percentage sprouting and rooting responses. At Peechi, trials were conducted using stem cuttings of *Tectona grandis* which were ringed one month prior to extraction and treatment. These cuttings showed better sprouting response. Trials in these aspects like ringing and callusing prior to growth regulator treatments are continuing.

Physiol. 02/1979: Investigations on the possibility of vegetative propagation of bamboos and reeds by stem cuttings.

Bamboos and reeds are important sources of raw material for the pulp and paper industry. Traditional cottage industries such as basket making, mat making etc. depend on bamboos and reeds. As flowering and fruiting takes place at long time intervals, it is necessary to resort to vegetative propagation. This project was initiated to investigate the possibilities of rooting stem cuttings of bamboos and reeds using auxinic and non-auxinic growth regulators.

Rooting experiments with culm cuttings of Bamboos and Reeds were completed at Nilambur Sub-Centre and at Peechi. Observations were made and data collection completed. The data are being analysed.

To study the sprouting/rooting behaviour and other responses of flowered *Bambusa arundinacea* culm cuttings, a series of experiments were started at Peechi Parental clumps

both flowered and non-flowered, from ten different locations were selected and culm cuttings were collected from these clumps at different stages of flowering period. Two noded cuttings were treated with different growth regulating substances and were planted in nursery beds horizontally. Another set of single noded cuttings were treated and planted in earthernware pots filled with forest soil. Culm cuttings from flowered bamboo clumps sprouted profusely and produced inflorescence. The sprouting percentage was higher when compared to the sprouting response of the non-flowered culm cuttings.

The project has been completed and the report is under preparation.

Physiol. 03/1979: Studies on the Physiology of induction of flowers in teak and eucalypts.

The objectives of the study are (a) to induce flowering in profusion before the stage of natural flowering and (b) to study the effect of certain growth regulators and physical treatments like girdling, pinching etc. on growth and development of young seedlings.

Seedlings of *Eucalyptus tereticornis* were raised and kept in polythene bags for treatment studies. Some of the chemicals required for flower induction studies are being procured. Steps are being taken to locate areas in the field to conduct flower induction studies on saplings of teak and Eucalyptus of different age groups.

BOTANY (TAXONOMY)

Bot. 01/1979: Study on medicinal Plants of Kerala forests

The project involves (a) the listing of medicinal plants, (b) habitat studies of some selected medicinal plants, (c) collection and display of samples of raw materials used in medicines, (d) organising a live collection of medicinal plants and (e) building up of a herbarium of medicinal plants.

Additional informations relating to several medicinal species procured from various sources are being incorporated in the report on medicinal plants. Based on the results obtained from preliminary experimental trials, propagation of *Ipomaea mauritiana*, *Plumbago indica*, *Hemidesmus indicus* and *Alpinia galanga* has been undertaken.

Additions are being made to the raw material and live collections of medicinal species. The existing medicinal plant herbarium is being enriched by fresh collections.

Bot. 02/1979: Establishment of an orchidarium in the Institute

This project has been initiated with the objective of collecting and identifying orchids of Kerala forests and growing them in the Institute Campus.

Orchid collections were made from Devicolam, Ezhimalai, Peermedu, Manantoddy, Chandanathode, Sholayar, Vazhachal, Nelliampathy and Parambikulam. A few species of orchids were collected from Shillong and Tippi orchid stations. All these collections are organised in the temporary orchid shed. Among these there are few reportedly endangered species. Some of the precious collections are gradually dwindling down

not being able to compete with the extreme heat. A few forms which have established and flowered were photographed. Herbarium sheets are prepared for all collections made.

Bot. 03/1980: Distribution of important forest tree species in Kerala (Central Circle)

A knowledge of the distribution of important forest tree species in the different forest ranges will be of considerable value in the preparation of working plans. This project is aimed at the collection of data on the distribution of important forest tree species of central circle, and to resolve the nomenclatural problems.

Collections of tree species have been made from Pattikkad, Sholayar, Vazhachal and Palappilli. Herbarium sheets were prepared. Some of the specimens were identified by referring to Herbarium of Botanical Survey of India, Coimbatore. Some of the tree species are propagated in the garden at Peechi.

Bot. 04/1982: Establishment of a herbarium in the Institute

The project aims at building up and maintaining a herbarium of all flowering plant species found in Kerala forests.

The organisation of a herbarium in the Institute was being continued from 1979 onwards. At present the collection numbers more than 3000 specimens belonging to 185 families. About 2400 specimens have been accessioned. Additions are being made by incorporating fresh collections.

Bot. 05/1982: Morphological, anatomical and physical properties of Calamus spp. of Kerala forests.

The object of the project is to prepare a key for the indentification of the species, to investigate anatomical and physical characteristics of the various species and to maintain a live collection in the Institute campus.

Species of *Calamus* were collected from Nelliampathi, Dhoni, Achencoil, Aryankavu, Thenmalai, Senthuruny, Peermedu and Parambikulam. The herbarium sheets have been prepared. The species are being identified. Materials for anatomical studies have also been processed.

Other activities

A high altitude experimental medicinal plant garden has been organised at Devicolam with the help of the Kerala Forest Department.

ECOLOGY

Ecol. 01/1979: Preparation of a soil-cum-vegetation map of the forests of Trichur Division

The main objectives of this project are:

a) Mapping of forest soil types

b) Mapping the present stage of natural as well as transformed vegetation types

and

c) Standardisation of nomenclature of various forest types.

The preliminary reconnaissance of the forests in Trichur Division was continued. During the period data on floristic composition, the frequency, abundance and density of the species were gathered from 171 localities. It may be necessary to cover approximately another fifty sites. The areas visited were mostly from Peechi, Pattikkad and Machad Ranges. Since Wadakkancherry Range consists mostly of plantations field work there is proposed to be done at the end.

A map of 1 : 50,000 was prepared as per the boundary description of 1980 incorporating forest types, physiographic features, and other important features. Twenty bit maps of 1: 11667 (6 cm = 1 km) were also prepared for every five minutes interval. The status of the localities with reference to biotic interferences were also gathered.

The relevant soil studies will be taken up shortly.

Ecol. 02/1979: A field key to the identification of indigenous arborescent species of Kerala based on ecotaxonomic features

The project aims at the preparation of a key to facilitate easy identification of arborescent species in the field.

In Kerala there are about 560 species which are over 10 m. of height of which about 125 species have the potential for commercial exploitation.

The project is being taken up in two phases. The first phase of preparation of a field key for about 125 commercially important species has been completed. This will be published soon.

Under the second phase, vegetative characters which are stable and can have diagnostic value will be identified for the remaining species.

Ecol. 03/1979: Eco-taxonomic study of the seedlings of commercially important species of Kerala and preparation of a key for their identification

Identification of seedlings are of paramount importance in natural regeneration operations, where species selection has to be made. Hence the main objective of the project is to facilitate an easy identification in the field. Seedling collections in and

around Sholayar, Chandanathodu, Peechi were made. Prominent characters taxonomic value like cotyledonory shape, size, structure, venation, vernation; presence or absence of scales; presence or absence of petioles; laminar shape, margin, venation; relationship between epi and hypocotyle; stipular features; presence or absence of indumentum and other ecological features like habitat, soil type, altitude, associated species were gathered for about 50 species. This information in respect of 25 more species is being gathered.

The work under the project has been completed and the report is under preparation.

Ecol. 04/1980: Phenological studies in representative evergreen forests in Kerala

The main objectives of the study are:

a) to determine the frequency and the peak season for flowering, fruiting and defoliation of principal arborescent species.

b) to correlate this data with the locai climate.

and

c) to quantify the total production of flowers, fruits and leaflitter. Th data generated from this study would be useful in understanding the autecology of the species and in the management of evergreen forests.

Monthly collection of litter from Sholayar, Chandanathode and Idukki continued. Analysis of data will be taken up during the rainy seasons of 1983.

Ecol. 05/1982: Species relation studies in moist deciduous forests of Trichur Division

The main objective of the project is to work out the rate of mutual species relations in the area as observed in natural condition.

Data for species relationship were gathered from 171 localities in Peechi, Pattikkad and Machad Ranges.

ECONOMICS

Econ. 02/1982: A Socio-economic study of farm forestry in Kerala

The study aims to identify the social and economic factors that influence the cultivation of non-conventional tree crops in the farm lands and home-steads in Kerala. Most of the preliminary works connected with the project were completed during the year. A number of households in Trichur and Palghat Districts were visited to collect preliminary information on land use, socio-economic status etc. The response of households to the prelliminary questionnaire was also tested. A tentative sampling frame has also been completed.

Although the project was submitted for financial assistance to the National Bank for Agricultural and Rural Development, so far no information is available as regards the likelihood of obtaining such assistance. In the orginal proposal, the objective was to carry out household sample survey in all the major agro-climatic regions in the State. If financial support is not available from the NABARD, the study will be limited to selected villages in Trichur District. House hold survey for the project has not yet commenced.

Econ. 03/1982: Rural Institutions for Development of Appropriate Forestry Enterprises: A Case Study of Collection Processing and Marketing of Reeds in Kerala

The study is sponsored by the FAO to enable the preparation of conceptual framework and guidelines for development of appropriate forestry activities. Institutions such as Kerala State Bamboo Corporation, Harijan Co-operative Societies, and Handicraft Societies which use reeds as a raw material were visited and details were collected on the economics of their activities, performance in relation to the objectives. A survey of the reed workers involved in basket and mat weaving was undertaken to asses their socio-economic background. Based on the data collected a draft report was submitted to the FAO. The FAO has approved the draft and the final report is under preparation. Findings of the study are briefly summarised below.

Institutions such as Co-operative Societies and the State owned Bamboo Corporation were set up with the social objective of enhancing the income accruing to traditional workers by eliminating intermediaries. Production of baskets and mats require little capital input and is appropriate to the resource endowments of household producers. Internal organisation of the Institutions involved in the various activities has been studied focussing attention on workers' involvement in decision-making. Irrespective of the structure, actual involvement of workers in decision-making is limited. Performance of the institutions under these conditions becomes primarily dependent on the commitment and ability of the leadership. An analysis of the interaction between society, institutions and technology indicates that reliance on market signals for decision-making would, in due course, compel institution to deviate from their initial objectives and a tendency towards adoption of inappropriate technologies develops.

Econ. 04/1982: Studies on Intensive Multiple Use forest Management in the Tropics: Tropical Rain Forests and Teak plantations in Kerala

This also is a project sponsored by the FAO as part of their programme to carry out case studies in representative tropical forest regions. A number of field trips were undertaken to Ranni, Konni, Thenmala and Punalur forest divisions and data was collected on management prescriptions, actual operations carried out, technical, institutional and financial constraints etc. Information on past systems of management was collected from earlier working plants, working schemes, administration reports, division journals etc.

During September 1982 a trip was made to Rome to finalise a format for writing up the report, in consultation with the FAO officials. The draft report is under preparation and is expected to be ready shortly.

ENTOMOLOGY

Entom. 02/1977: Studies on the seasonal incidence of teak defoliators and the effect of defoliation on volume increment of teak

Although defoliator attack in teak plantations is common, it is necessary to gather data on increment loss in order to decide whether any control measures are required, and whether the additional cost involved can be justified in terms of the volume gains. This project was taken up to determine the effect of insect defoliation on wood volume increment of teak in order to assess possible economic loss and to study the ecology and seasonal incidence of the skeletonizer-defoliator complex, *pyrausta machaeralis* and *Hyblaea puera*, with a view to develop population mangement techniques.

Observations were continued in the 12 experimental plots laid out at Karulai to study the effect of insect defoliation on teak increment. As in previous years, the unprotected plots suffered heavy defoliation. In some of the plots prophylatic applications of insecticide were made to control the damage. Final growth measurements were taken in December 1982, thus completing the experimental part of the project. Preliminary analysis of the results have shown that there is significant loss of increment due to insect defoliation. The exact quantum of loss can be assessed only after the data has been analysed statistically, which work is now in progress.

The project is completed and the report is under preparation.

Entom. 04/1979: Preliminary investigations on the biology and control of beetles damaging stored reed

This project aims at studying the biology and seasonal population trends of Dinoderus beetles under laboratory condition and screening various insecticides under laboratory conditions for control of the insect.

Experimental work on this project has been completed. In field experiments laid out in the HPC storage yard at Vellore, no major insect attack was noticed. Between stacks treated with BHC and boric acid, the latter treatment was found to be better. Experiments carried out to determine the effect of cutting season on susceptibility to insect attack showed that reeds cut in certain months were not attacked. However, there was considerable discrepancy in the results and the data need critical analysis. Laboratory studies on the effectiveness of various insecticides have shown that the synthetic pyrethroids and organophosphates were more effective than organochlorine, except BHC. As expected, boric acid-borax had little contact toxicity since its effectiveness is mainly due to stomach poisoning.

The project is completed and the final report is under preparation.

Entom. 05/1977: Biology and control of insect pests of fast-growing hard wood species

An understanding of the biology and ecology of insect pests of fast-growing hardwoods is necessary to assess the significance of damage and to develop suitable pest management techniques. This project has been initiated with the above objective.

Observations were continued on the bagworm *Pteroma plagiophleps* attacking *Albizia falcataria*. It was noted that the pests continued to spread extensively along roadside *Delonix regia*. Among several insecticides tested against the insect, Ekalux was found to be the most effective.

Other activities

The Division investigated instances of insect damage reported to the Institute from the Forest Department and other agencies and rendered advice on methods of control. These included termite attack of eucalypt species at Mananthody and Mullaringad Ranges, at Vythiri (for South Wynad Girijan Joint Farming Co-operative Society) and at Pozhuthana (for Achoor Estate), of *Delonix regia* at Vellikulangara Range; Caterpillar *(Eligma narcissus)* damage of *Ailanthus triphysa* at Vadasseri *(Ranni)* and Peechi Ranges; *Sahyadrassus malabaricus* damage of eucalypt species at Peermed Range; *Hyblaea* damage of teak nursery at Aryankavu (Thenmala) Range; and Caterpillar *(Catopsila pyranthe)* damage of *Cassia fistula* at Pattikkad Range. In addition to the above extension services, observations were continued on the large scale demonstration plot for termite control in *Eucalyptus* at Mavinhalla. About ten percent of the seedlings were damaged by termites in the untreated area and less than one percent in the area treated according to our specifications. The incidence was low compared to that in many other previous experiments, but it was clearly demonstrated that the recommended treatment is effective in large-scale operations. The observations have been completed and the report is under preparation.

GENETICS

Genet. 01/1979: Genetic improvement of teak in Kerala

Improving the genetic quality of seeds used for raising plantation in the State will have a marked influence on enhancing the quality and quantity of timber output. This project aims at enhancing the supply of quality seeds by establishment of seed orchards and carrying out progeny trials.

Prebudded plus tree container plants were prepared in nurseries at Nilambur, Peechi and Arippa and duly established in additional seed orchards – a 20-clone seeds orchard at Palappally near Trichur in Central Kerala and a 25-clone seed orchard at Arippa near Trivandrum in Southern Kerala. In both the orchards, randomized polycross designs were adopted with 8 x 8 m. quincuncial spacing. Selection of new plus trees and their registration continued. Data on height, girth, clear bole, crown form etc. of the plus trees were collected and a plus tree register was compiled. The final report of the project is prepared and will be published shortly.

An information bulletin entitled "How to Establish Seed Orchards of Teak" was published both in English and Malayalam.

Genet. 02/1979: Improvement of eucalypts by selection and interspecific hybridization

The project was initiated with the objective of genetic improvement of eucalypts through hybridization.

As earlier attempts for interspecific hybridization between *Eucalyptus deglupta* and *E. grandis* were not successful, it is proposed to intensify work on the selection of disease resistant trees from the plantations of *E. grandis* and progeny testing for evaluating their resistance.

Genet. 03/1979: Genetic improvement of important matchwood species Ailanthus triphysa and Bombax ceiba

Ailanthus triphysa and *Bombax ceiba* are two important mathchwood species in the State. Genetic improvement could considerably enhance tha yield and will be helpful in reducing the rotation. The project was taken up with the above objective.

Different techniques of vegetative propagation were attempted in *Ailanthus triphysa*. 14 plus trees were located at different parts of Kerala and seeds were collected from these trees and also from other trees in order to lay out a progeny trial.

Seeds of five high seed yielding clones of *Bombax ceiba* viz. H, I, J, K and L from Campierganj seed orchard , U. P., were obtained and sown in nursery beds at Nilambur Sub Centre. The progenies are proposed to be planted out in the field for progeny test. Seeds from individual trees were also collected from different localities in Kerala to lay out a progeny-cum-provenance trial.

Genet. 04/1979: Provenance trial and floral biological studies of Gmelina arborea Roxb

Gmelina arborea is an important indigenous hardwood species with multiple end uses. Several provenances which differ in growth and overall performance exist. This project aims at the isolation of the provenance most suitable for the conditions in Kerala.

Regular height and diameter measurements were continued in the provenance trials of *Gmelina arborea* at Nilambur. Floral biological studies were continued in the species. Selfing and cross pollination were done and in both cases fruit setting have been obtained.

Genet. 05/1982: Management practices for teak seed orchards

The project is aimed at evolving a package of practices for management of teak seed orchards.

The Institute has already established seed orchards at Nilambur, Palappally, and Arippa. Management operations like weeding, pruning, irrigation, protection etc. were carried out in these seed orchards. Soil analysis will be carried out and appropriate doses of fertilisers (NPK) will be applied.

PLANT PATHOLOGY (FUNGAL DISEASES)

Pathol. (F) 01/1979: Survey of representative plantations in the State for leaf, stem and root diseases of forest trees and assessment of level of infection

The project has been taken up with the objective of preparing a checklist of pathogens responsible for causing various diseases in plantations of eucalypt, teak, balsa, rosewood, *Gmelina arborea*, *Bombax ceiba* and *Ailanthus triphysa*, and to assess the level of infection of major diseases.

During the reporting period third and final observation on the occurrence of various diseases and their level of infection was completed, in all the plantations. Few new diseases were recorded from all the tree species under study. Taxonomical characters of 63 isolates and 26 herbarium specimens were studied and referred to Commonwealth Mycological Institute, U. K., for authentic identification. Authentic identification of a total of 58 fungal isolates, 2 bacterial isolates and 21 herbarium specimens were received from CMI.

Field Studies

i) Incidence and spread of *Cryphonectria cubensis* were studied in 4 plots, each of 400 trees, in *E. grandis* plantation (1977) at Muthanga, S. Battery. Distribution map of the disease clearly indicated tree to tree spread of the pathogen; 60% of the trees were found to be affected. Disease specimens have been deposited in CMI herbarium.

ii) Observations on the incidence of *Corticium salmonicolor* on *E. grandis* were recorded in two plots at Noolpuzha. This is the first record of outbreak of pink disease in *E. grandis* in Kerala. Isolate from *E. grandis* differ from that of *E. tereticornis*.

iii) Pathogenecity tests of *Colletotrichum gloesporoides* (shot-hole of Ailanthus), *Endothia gyrosa* (stem canker of *E. grandis*), *Marasmiellus ignobilis* (soft rot of *Tectona grandis*), *Sclerotium rolfsii* (leaf infection of *T. grandis*), *Coniella fragariae* (leaf spot of *E. grandis*), *Cylindrocladium camelliae* (root-rot and leaf and shoot blighf of cashew) and *Calonectria rigidiuscula* and *Fusarium moniliformae* var. *subglutinance* (die-back of balsa) were conducted and positive results obtained.

iv) A chemical control trial against *C. salmonicolor* was conducted at Kothamangalam. Affected plants in 1 ha. were treated with a new formulation of calixin in latex (brush-on-formulation). The reproductive stages of the fungus were studied and photographs taken.

Laboratory studies:

i) Different fungicides were evaluated for their efficacy against *Botryodiplodia theobromae*, *Cryphonectria gyrosa*, *phaeoseptoria eucalypti* and *Rhizoctonia solani*.

ii) Effect of seedling density, inoculum potential and different moisture regimes (water potential) and some fungicides on the development of damping-off caused by *R. solani* was studied. Vitavax, MEMC and Captan were found to be most effective.

iii) To find out a suitable medium, growth of *E. gyrosa* was studied in 8 different media.

iv) Disease free seedlings of *Eucalyptus* spp. (total 49 types) belonging to different provenances were raised in a nursery.

v) A toxin bio-assay technique for testing relative susceptibility of various eucalypt species (raised in the nursery) to *C. salmonicolor* (CS) was standeardised. Toxin from *E. grandis* (Eg) and *E. tereticornis* (Et) isolates was purified. So far 23 different eucalypts have been tested against both the toxins; Et toxin is more virulent than Eg. Differential reactions to both the toxins are found among species and provences. The Cs toxin is characterized as a host-specific toxin.

vi) Height measurement of container seedlings belonging to different eucalypts were taken.

vii) Sub-culturing of old cultures is done every three months.

Pathol. (F) 02/1979: Epidemiology of Cylindrocladium associated with Eucalyptus leaf blight and its control using soil fumigants and systemic fungicides

The important objectives of the study are to identify (1) the prevalent species of *Cyliudrocladium* in Kerala and its distribution (2) the host-pathogen relationships, mode of infection' survival capability and genetical variability in the pathogen (3) the diurnal and seasonal variations in the incidence of conidia and its relation to disease severity and climate and (4) to identify appropriate chemical control methods.

Laboratory studies:

i) Six fungicides were screened against *Cylindrocladium camelliae* employing "soil method"; only Bavistin was found to be effective at 0.05% (a. i.).

ii) A detached leaf technique for retaining the "greenness" was standardized. Of IAA, IBA, Kinetin, GA and Benzimidazole, only latter at 5 ppm was found to be most suitable as eucalypt leaves could be incubated for more than 90 days without any sign of senescence.

iii) Employing detached leaf as well as mass inoculation techniques forty-nine eucalypts, 2 *Pinus* spp. and 2 *Acassia* spp were screened against *C. quinqueseptatum* and *C. clavatum*. Statistical analysis of the data show differential interaction between host and both the species of *Cylindrocladium*.

iv) Eleven fungicides were evaluated for their efficacy against *Rhizoctonia solani*.

v) The effect of some of the promissing fungicides against *R. solani* was studied in an experiment employing different seedling density, varied inoculum potential and water potential. Vitavax, Captan and MEMC were found to be the most effective fungicides.

Field studies.

i) Second chemical control trial at Chandanathode was concluded. *E. grandis* seedlings from some of the best treatments and directly sown in containers were outplanted (1.25 ha.) at Vattappoil.

ii) An *E. tereticornis* (1980) plantation was selected at Kothamangalam for aerobiological studies of *Cylindrocladium*. One spore trap was installed and exposed tapes are being collected at weekly intervals and slides prepared.

iii) For third and final chemical control trial a nursery of *E. grandis* was raised at Chandanathode. For experiments are in progress to standardize:

a) mode and numbar of application of effective fungicides for controlling *Rhizoctonia*, *Pythium* and *Cylindrocladium*.

b) Seedling density in relation to prickable seedlings: observations are being recorded at weekly intervals;

c) quantity of seeds to be sown in relation to viability and number of prickable seedlings, observations are recorded at weekly intervals.

d) type of shade, watering frequency and seedling density in relation to disease development; root: shoot ratio is being recorded at weekly intervals; regular observations on disease incidence and pathogens associated with them as well as microclimatic conditions temperature (max. and min.), RH, soil temperature and soil water potential are being recorded.

Pathol. (F) 03/1982: Diseases of Albizia falcataria in Kerala and their possible control measures

The project has been taken up with the objective of preparing a checklist of prevalent diseases of *Albizia* in nurseries and plantations, assessing the level of infection of seriuus diseases and to suggest control measures for diseases of major concern.

Field studies.

i) During the reporting period 13 plantations of *A. falcataria* of different age groups were surveyed for the occurrence of various diseases. Observation plots were selected and paint marked in 7 plantations. A preliminary survey showed that die-back, stem canker *(Phomopsis mendad, Hypoxylon* sp. *B. theobromae)* and pink diseases (*corticium salmonicolor*) are prevalent in most of the plantations. Three nurseries were surveyed and observations recorded; Web blight caused by *R. solani* was prevalent in all the nurseries. Other leaf spot diseases were also recorded.

ii) Pathogenicity of *P. mendax* was tested at Kulathirumade.

Laboratory studies:

i) Pathogenicity trials of two isolates of *R. solani* were completed using two inoculum concentrations and three different age of seedlings of *Albizia*.

ii) Pathogenicity trials of *Robillarda sessilis*, causing a leaf spot of *Alibizia* was carried out.

iii) Morphological characters of various organisms isolated from diseased specimens were studied and referred to CMI.

iv) A preliminary experiment was conducted to find out strain differences within *Phomopsis mendax* and its relation to development of fruiting bodies.

Other activities

i) Observations were recorded on survival, growth and diseases if any of *E. tereticornis* raised from stumps at Nilambur. Some of the treatments, especially fungicides mixed with fertilizer were found to be good. In general more than 60% casualities were recorded due to drought.

ii) Twenty-one diseases problems in various host species were referred to this Division by Kerala Forest Department and Tamil Nadu Forest Department. Detailed studies were conducted and recommendation for the control of the disease was sent in Extension reports.

iii) Observations of the pathogenicity test of *Endothiella eugeniae* on clove were recorded in a plantation at Balamare (Nagercoil). Positive results were obtained. Appropriate control measures were recommended to the Tamil Nadu Forest Department.

PLANT PATHOLOGY (NON-FUNGAL DISEASES)

Pathol. (NF) 01/1979 : Studies on the host parasite relationship of phanerogamic parasite (s) on teak

Some of the phanerogamic parasites cause extensive damage to teak plantations in the State. Development of an effective and economic method for control of these parasites requires a thorough understanding of the host-parasite relationship, assessment of the loss, factors responsible for the spread and establishment of the parasites etc. This project has been initiated to study the above details.

Dendrophthoe falcata var. *Pubescens* Hook. f. of family Loranthaceae is the most common and harmful parasite attacking teak. Survey in teak plantations of various age groups in Nilambur Division revealed that most of the older plantations are seriously infested by the parasite and the average number of clumps per tree also increases with the

age of the tree. However, mortality is more in young plantations. The percentage of infestation is upto 93% in Nilambur Division. The parasite is more devastating in Northern and Central Circles. Before killing the host, the parasite severely reduces the growth rate of the teak. There is a diameter loss of 0.5 cm. Per tree/year in the case of parasite infested trees in 12 year (1971) teak plantation, and 0.13 cm. per tree/year in a 34 year (1949) plantation.

The parasite flowers profusely generally during December-March. Scant flowering is noticed during other months also By March-April plenty of attractive red fruits are formed.

Studies on the strength properties of parasite-attacked trees showed that the Modulus of rupture (MOR) and work to maximum load are significantly affected by the parasite attack.

A hyper-parasite, *Viscum capitellatum* Sm., was observed growing on the mistletoe in the teak plantations in Wadakkancherry Range. Some of the *D. falcata* clumps were found dried and dead due to the hyper-parasite, indicating that this could be one of the potential agents for eradication of teak mistletoe. Another potential agent for biological control is the caterpillar of a butterfly *Delias eucharis* Linn. Which is seen occasionally in teak plantations, feeding on the parasite leaves causing heavy defoliation and subsequent drying of the parasite clumps.

In the chemical control experiments, Sencor was found to be effective. Infusion of Sencor using tree injection technique developed in the division was repeated using various concentration of the chemical. 600 ml aqueous solution containing 0.05% a.i. showed selective killing of the parasite without harming the host. However, increased atmospheric temperature under drought conditions showed some harmful effect (scorching) on the young leaves of the host.

The project was initiated in January 1979 and terminated in January 1983. The project report is under preparation.

Pathol. (NF) 02/1979: Studies on the little leaf disease of eucalypts

The objectives of the study are (1) to find out the nature of causal agent of the disease and its mode of transmission, and (2) to develop a method of detection of diseased trees in the field.

Staining technique using flourescent stains such as Aniline blue showed typical golden green flourescence in the phloem region. Characteristic blue colouration in the phloem of the diseased plant was observed when stained with Diene's stain, which is specific for Mycoplasmas. These staining reactions could be used for the routine diagnosis of infected material.

Electron Microscopic examination also showed MLOs in a few phloem cells in very low concentration. Extensive Electron Microscopy has to be undertaken to fully understand the morphology and the nature of the causal agent.

Pathol. (NF) 03/1980: Studies on the spike disease of Sandal

This study aims at the isolation, characterisation and identification of the causal agent and at evolving possible control measures for the spike disease of sandal

While monitoring the spread of the spike disease at Marayoor (Marayoor Range, Munnar Division), it is found that the disease spread is at the rate of five trees per month in the western block and two trees per month in the eastern block.

Infusion of aqueous solution of Tetracycline hydrochloride using tree injection technique developed in the Division, gave temporary remission of the disease the important factors conditioning the period of remission being the intensity of the disease at the concentration of the Tetracynline used. An experiment is in progress to find out the effect of various tetracyclines, single and repeated infusions.

Histopathological studies using flourescent stain aniline blue showed more concentration of the fluorescent spots in the root than in stem or leaves indirectly indicating more concentration of pathogen in the root.

Pathol. (NF) 04/1982: Root nodulation potentialities of Leucaena leucocephala (Subabul) in Kerala.

The project has been taken up with the objective of acquiring and isolating suitable rhizobial strains and to investigate their effectiveness on the growth of *Leucaena leucocephala*.

Eighteen strains of *Rhizobium* sp. for *Leucaena* have been procured from various sources and a few isolates have been isolated locally. The cultures are maintained in the laboratory.

Studies on the evaluation of the strains for increasing the biomass as well as their acid tolerance is in progress.

Other activities

i) **Change of microflora due to the effect of slash burning on planting site for teak**

Soil samples collected from experimental plots of Silviculture Project 05/1981, before and after burning have been analysed for microbial count. Further collection of soil samples and analysis of the microflora is in progress.

ii) **Natural durability of commercial tibers of Kerala with reference to decay (Wood 05/1980)**

Ten wood rotting fungi have been used against samples of *Mesua nagassarium* an important wood species collected from evergreen forests. They could cause a weight loss ranging from 0.21% to 0.63% only whereas they caused 60% weight loss to *Bombax ceiba* (control). Eight more commercial timber species have been collected for evaluating them against rotting fungi, using the accelerated laboratory test:

SILVICULTURE

Silvi 01/1977: Silviculture and management of fast growing indigenous hardwood species with multiple end uses.

The important objectives of the project are:

a) to study natural variability and to locate good seed stands of *Gmelina arborea*, *Anthocephalus chinensis* and *Melia composita*.

b) to study seed viability and standardise nursery practices

and

c) to provide technical guidance to raise plantations.

The project has been completed and the report is being written up.

Silvi 02/1979: Study of afforestation techniques in grasslands of Kerala

The project aims to carry out field trials to identify commercially valuable species for afforestation of grasslands and to standardise the technique for raising plantations.

Regular observations with regard to species planted in the grasslands of Chandanathode were taken. Growth of *Casurina equisetifolia* and *Grevellia robust* were satisfactory. Two more species viz. *Pinus caribae* var. hondurensis (TPRC/17) and *Santalum album* were introduced during the current season (50 plants per replication and a total of 3 replicates for each species.). Species (Mainly grasses) were collected from grasslands for identification.

The project has been completed and the report is under preparation

Silvi.04/1981: Studies on stumps as planting material for Eucalyptus tereticornis plantations

Considering the cost involved in raising eucalypt plantations adopting the existing techniques, it was considered desirable to evolve simple and cheaper techniques. This project aims to explore the possibility of raising *E.tereticornis* plantations using stumps.

Observations with regard to survival, growth etc. were recorded in the trials laid out in 1981, at Nilambur. The results as on September 1982 (at the end of 15 months) are as under:

Length of root and shoot of the stumps:

Stumps with 15 cm. root and 5 cm. shoot length gave a survival of (28%) followed by that with 10 cm. root and 5 cm. shoot (24%). Stumps with 15 cm. root and 2.5 cm. shoot gave the minimum survival (10.7%).

Storage:

Storage of stumps under good shade covered with gunuy bag for 4 days gave maximum survival (49.3%), followed by that stored in pits for 11 days (43.3%). In the control the survival was only 2.7%.

Cut-end sealing:

Sealing the cut end of shoot with wax or coaltar did not have any advantage. On the other hand survival was poor in those cases as against control (28.0% and 16.7% as against 30% in the control).

Thickness of the stump:

Very thick stump (about 1.8 cm. shoot-end diameter and 1.2 cm. root-end diameter) registered poor survival as against thin ones (0.8 cm. shoot-end diameter and 0.4 cm. root-end diameter). It was 12.7% for the thick ones and 21.3% for the thin ones.

Season of planting and its effect on sprouting:

The planting done at the start of monsoon gave maximum sprouting (55%) as against that done in monsoon rains (26.7%).

A plot was laid out during the reporting season to find out the best season for planting stumps. The results 3 months after planting are as under:

Season of Planting and its effect on survival:

Planting in late May gave maximum survival (87.18%) as against poor survival for planting done in early May (8.55%) and late June (0.85%). Mid May planting also gave relatively good results (64.10%). There was moderately distributed rain after mid May.

Seedlings were raised in the nursery with the object of laying out further trials during the 1983 planting season.

Silvi. 05/1981: Studies on the effect of slash burning on planting site for teak

The study aims at finding out whether slash burning is a pre-requisite operation for raising plantations and to explore the feasibility of evolving an appropriate practice which will not be deterimental to the growth of plants and at the same time increase the output of firewood.

Teak stumps were planted in all the 18 plots. 19th plot was divided into 12 subplots and the treatments were done in the subplots also. Thereafter, plot 19 was left unplanted for studying the natural regeneration coming up there.

Average quantity of material that was salvaged per hectare in the teak final felling area (FFA) under study, was 20.1 stacks of Teak and 4.2 stacks of miscellaneous species which fetched Rs. 1,358-97 and Rs. 640-34 per hectare. The average number of trees per hectare felled was 102 teak and 6.8 miscellaneous species. Taungya lease amount in A, B, C were Rs 1,617/-, Rs. 868/-, Rs. 403/- respectively (per hectare.)

During first weeding, weed growth was more in treatment F (no burning). But the quantity of weed in all the treatments was almost equal at the time of third weeding. Yield of paddy was slightly more in unburnt area. Height of teak was more in treatment D

(usual slash burn + Taungya) followed by treatment E (reduced slash burn + No Taungya) In all the other treatments, it was almost same. Regular observations were continued.

In the auction held by the D.F.O., Nilambur, on 23-3-1983 for cultivation of second Taungya crop, it was seen that there was a definite possibility of the taungyadar raising paddy and topioca in the plots under trial. As this would upset the experimental pattern, the D.F.O was requested to cancel the auction and reauction it only for one crop viz. paddy. This was agreed upon.

Silvi. 06/1981: Estimation of quantity of eucalypt seeds for sowing in nurseries

At present the optimum quantity of eucalypt seeds to be sown in nurseries is not pre-determined and quantities varying from 30 gm. to 200 gm. is sown in standard beds. This is because the germinability and viability of seeds are not assessed before sowing. It is proposed to evolve a suitable method to determine the germinability and viability of seeds and pre-fix the quantity of seeds of *Eucalyptus tereticornis* and *E. grandis* to be sown in a standard bed.

A simple method for testing the viability of *E. tereticornis* and *E. grandis* seeds using polyurethane foam sheet as substrate was developed.

Trials were laid out at Nilambur Sub Centre nursery also with the object of correlating the germination percentage obtained during test with that of seedlings obtainable for potting.

Silvi. 07/1981: Establishment of a bambooteaux in the Institute:

The objectives are collection, identification and establishment of Indian species of bamboos.

An area of about one hectare was selected at Nilambur Sub Centre for establishment of ten species initially. Planting of the two local species *(D. strictus* and *B, arundinacea)* has been done (16 plants of each species in a block at an espacement of 7 m. x 7 m.).

The following species are being raised in the nursery for planting out in the coming rainy season.

1. *Bambusa vulgeris (yellow)*
2. *Bambusa polymorpha*
3. *Dendrocalamus giganteus*
4. *Thyrsostachys oliveri*
5. *Dendrocalamus longispathus*
6. *Dendrocalamus membranaceus*
7. *Dendrocalamus calostachysus*
8. *Ochlandra scriptoria*
9. *Ochlandra travancorica*

Other activities: *Leucaena leucocephala* manurial trial (Silvi/Soils/1981 Trial)

The study aims to find out the effect of lime-cowdung and Mussorie Phos on growth of *L. leucocephala*. A plot (3 replications, 5 treatments, 1 control, 32 plants in each treatment) of *L. leucocephala* was laid out in the Sub Centre at Nilambur. Regular observations were taken. Performance in terms of height growth for different treatments is as under:

Treatments	Ht. after 14 months
FYM-Farm yard manure 2Kg. per plant applied two months after planting.	328 cm.
MP 150-M. Phosphate 150 gm/plant	270 "
L 150-Lime 150 "	232 "
L 100- " 100 "	229 "
MP 100-M. Phosphate 100 "	215 "
C – Control	202 "

SOIL SCIENCE

Soils.04/1979: Influence of site factors in Bombax ceiba plantations

Generally, Bombax trees seem to get stunted in plantations and we do not know whether such stunting is due to site factors. This investigation has the objective to establish whether soil factors cause stunting of Bombax.

Surface soil samples (163) were taken from plantations having stunted and nonstunted Bombax trees. At each sampling site, height and girth measurements of five dominant trees were also taken. Particle-size, pH, organic carbon, exchange acidity and exchangeable bases analyses were done on all samples. Analysis of data is over.

The report is under preparation.

Soils.05/1981: Cultural practices for managing soil erosion in forest plantations: A state-of knowledge report

Soil erosion is the detachment and transport of soil constituents by water, wind and gravity. It is a natural process that has existed throughout geological time, but lately human activities have accelerated this process. Although there is minimal erosion in natural forests, several factors such as lack of funds for erosion-control practices, intensification of silvicultural operations through reduction of rotation cycles and human disturbances in many forms promote erosion in forest plantations. This project was initiated for preparation of a state - of - knowledge report on cultural practices suitable for managing soil erosion in forest plantations, with particular reference to Kerala.

The project has been completed and the report published.

Prevention is better than cure approach is apt in lowinput forest plantations and here erosion management requires proper action at the proper time. Less expensive cultural practices are appropriate instead of costly mechanical ones such as terracing and contour bunding. As the time of worst vulnerability to erosion is during establishment stage when soil loss can be serious due to intensification of taungya operations, maintenance of cover by taungya crops, undergrowth, under crops or mulches is important. Contour planting of seedlings plus ridge and furrow system for tapioca planting can minimize erosion in forest plantations. Also, intercrops which provide good cover namely *Leucaena leucocephala*, *Calliandra calothyrsus* and *Acacia auriculiformis* may be tried during the post taungya period to mitigate deleterious effects of soil erosion.

Soils. 06/1981: Organic matter dynamics in teak and eucalypt plantations

Besides being a storehouse for several essential elements, organic matter has pronounced influence on the physical, chemical and biological activities in soil. This study aims at evaluating changes in the distribution of organic matter in teak and eucalypt plantations due to plantation activities.

Study areas were selected at Konni, Vazhachal and Nilambur for teak and Punalur and Wynad for eucalyptus. Soil sampling was done at 200m. intervals in a sequence of 3 Km. originating from natural forest and running through plantations. At every sampling site, samples from 0-20, 20–40 and 40-60 cm. were taken from a central pit and 15 surface samples (0–20 cm.) were taken within a radius of 10 m. from the pit. Sampling was completed in all the study areas (1,350 samples). Organic carbon analysis is over and data analysis is in progress.

Soils. 07/1981: Effect of Mussoorie Phos on the growth of eucplypt seedlings

As Mussoorie Phos is indigenously available, its use is being popularised in agriculture, horticulture and forest plantations. This project is to evaluate the effect of Mussoorie Phos on the growth of eucalypt seedlings.

Growth trials of *Eucalyptus tereticornis* were completed in plastic pots (1 Kg soil) containing soils from Thenmala, Alimukku, Muthanga and Thirunelli plantations for assaying Mussoorie Phos dosage. Detailed studies in cement pots (25 Kg soil) using from Peechi were completed. Four doses of Mussoorie Phos were tried in these pots: 50, 100, 150 and 200g at 10, 20 and 30 cm. depth. Field studies were begun at Arippa and Vellani areas.

Soils. 08/1982: Foliar analysis in Eucalyptus tereticornis and E. grandis to assess soil test methods for Nitrogen, Phosphorus and Potassium

Foliar analysis is a sensitive and practical method for studying mineral nutrition of trees. This investigation aims at evaluating foliar content of NPK in relation to soil test methods. The results would be useful in suggesting fertiliser requirements for eucalypt plantations.

Study sites were chosen in Kondazhi and Muthanga plantations. Leaf and soil sampling is in progress.

Soils. 09/1982: Physical properties of soils in realtion to eucalypt growth

As plantation activities are intensified to meet raw material shortage, the need for inputs like ameliorants and amendments arises. Soil physical properties in combination with chemical and biological properties determine the necessity for these inputs. This study aims to bring out the relationship between soil physical properties and growth of eucalypts.

Study sites were selected in Kondazhi and Muthanga plantations. Soils ampling is in progress.

Other activities:

The Division collaborated in Bot 01/1979, Ecol. 01/1979, Pathol (F) 02/1979, Silvi. 02/1977 and Silvi. 05/1981 project of Botany (Taxonomy), Ecology, Pathology (Fungal Diseases) and Silviculture Divisions.

Soil study in eucalypt plantations of Punalur Division

In response to a request from the Working Plan Officer, Punalur, the study of soils in eucalypt plantations of Anchal and Pathanapuram Ranges of Punalur Division was undertaken. Five soil profiles to a depth of 80-125 cm. and 108 composite surface samples (0-20 cm.) were taken from Anakkulam and Piravanthoor-Kadakkamon plantations. Particle-size, pH, organic carbon and cation exchange capacity analyses were completed. A write-up "Soils under eucalypts in Anchal and Pathanapuram Ranges of Punalur Forest Division" was handed over to the Working Plan Officer for inclusion in the Eucalyptus Working Circle.

Generally, rooting depth extends to 40-50 cm. The soils are loam to loamy sand in texture. Clay content increases with depth while that of sand decreases. The soils of Anakkulam plantations (Anchal Range) are coarser than those of Piravanthoor-Kadakkamon plantations (Pathanapuram Range). Soil reaction varies from medium to strongly acid. Organic carbon content is fairly high in both plantation areas and in all the profiles there is a sharp drop in carbon values in the subsurface horizons. Cation exchange capacity decreases with depth and its values are similar in Anakkulam and Piravanthoor–Kadakkamon plantations. Detailed field studies are necessary to ascertain the need for soil inputs such as fertilisers and other amendments.

Soil study in teak plantations of Konni Division

In response to a request from the Working Plan Officer, Konni, the study of soils in teak plantations of Konni, Naduvathumuzhi and Mannarappara Ranges of Konni Division was undertaken. Eight soil profiles to a depth of 80-120 cm. and 68 composite surface samples (0-20 cm.) were taken from 12 plantation tracts. Particle-size, pH, organic carbon, exchange acidity and exchangeable bases analyses were done. A write-up "Soils in teak plantations of Konni, Naduvathumuzhi and Mannarappara Ranges of Konni

Forest Division" was handed over to the Working Plan Officer for inclusion in the Teak Working Circle.

The data of eight soil profiles and 68 composite surface samples (0-20 cm.) from Mundomuzhi, Njalloor-Omayankuppa, Kummannoor, Kanjirappara, Kondodi-Uliyandu, Kadiyar, Pichandikkulam, Pothupara, Adukeera, Mannarappara-Thora, Chempanaruvi and Kaikunnam plantation tracts (2445 ha) reveal that fertility need not be a soil constraint in teak plantations. Terrain stratification into flat riverine, adjoining gently rolling and rolling to hilly type distant from the river course discloses locational limitations such as erosion hazard and poor water relations in plantations on steep slopes. Hence appropriate soil conservation measures may be required in such plantations. Further studies on soil capability in relation to teak growth parameters are essential to mitigate soil constraints, if any, in teak plantations for increasing productivity

STATISTICS

Stat 02/1977: A data bank for forestry sector in Kerala

The project was initiated with the objective of collection and compilation of data pertaining to forestry and allied activities in the State. This is a continuing project and at present emphasis is given to the collection of statistics pertaining to man made forests. During the year data regarding plantations of various species has been collected from the divisional forest offices. To finalise a reliable list, it is necessary to carry out field checks. Since the division staff was busy with project 05/1979, this could not be carried out.

Yield data pertaining to eucalypt plantations, has been collected from Trichur and Wynad divisions In addition information has been gathered on locality factors, planting technique etc. Before carrying out the analysis it is also necessary to find out the stocking. This information is yet to be gathered.

Stat.05/1979: Analysis of factors influencing timber prices in Kerala

The objective of the study is to identify the temporal and spatial variation in timber prices and to analyse the factors that tend to influence the pri ces. Data collected from the 16 major timber depots in the State was analysed, and the trend observed in the case of timber prices from Nedumgayam and Chalakkudy was confirmed. To examine whether the trend observed in the State is applicable to adjoining States also, price data was collected from Pollachi timber depot.

Detailed discussions were held with some of the timber traders at Trichur and Calicut to identify the factors that could possibly influence timber prices in Kerala. Since demand from adjoining States, particularly Tamil Nadu is said to be an important factor influencing prices, data on timber export from Kerala to Tamil Nadu was collected from major check posts such as Walayar and Arienkavu. To understand the possible changes in demand within the State data were collected on the increase in the number of wood based industrial units in major wood consuming centres. Further, information was also

collected on the growth of housing in selected Panchayats in Trichur District. Most of the information has been analysed. Additional information on timber export to adjoining States, internal consumption etc. has to be collected.

Other activities

The division also attended to the statistical analysis of data pertaining to the research projects undertaken in other divisions as indicated below.

1. Soils 04/1979 – Influence of site factors in *Bombax ceiba* plantations.
2. Soils 06/1980 – Organic matter dynamics in teak and eucalypt plantations.
3. Wood 06/1982 – Wood and bark properties of branches of selected tree species in Kerala.
4. Data analysis was done for the paper 'Effect of lime on the growth of Mahogany'.

WILDLIFE BIOLOGY

Wild 02/1977: An ecological study in Periyar Tiger Reserve with special reference to wildlife

Preparation of management plans for wildlife sanctuaries requires a thorough knowledge on the population status of different species etc. This project has been formulated to undertake such studies in the Periyar Tiger Reserve in Kerala.

This project has been completed and the report will be published soon.

There was no evidence for extensive migration of elephants as reported earlier There does not seem to be any dearth of fodder grass, whereas the number of fodder trees for elephants seems to be limited. The suggestion for management include redefining core area and active protection measures.

Wild. 03/1980 : Long term environmental and ecological impacts of multipurpose river valley projects - A comprehensive study in Western Ghats- Wildlife studeies

This project is taken up as a component of the major project to study the long term environmental impacts of multipurpose river valley projects and aims at identifying the direct and indirect effect of river valley schemes on wildlife. The study aims at identifying the structure of mammalian and avian community in disturbed and undisturbed ecosystems and to assess the behavioural changes, if any, consequent to habitat alterations.

Studies on animals in Idukki region were conducted and comparison is made with earlier study areas, Silent Valley and Periyar. Animal density in Idukki region is comparatively low. Details of elephant herds, bonnet macaque troops and wild dogs are being collected. The study so far conducted indicate that the damage to the area around the reservoir is more due to human occupation than by the physical process of

constructing the dam and impounding water. Quantitative and qualitative environmental impact assessment techniques are being used for objective comparison of the effect of the project on the surrounding areas.

The floristic composition and physiognomic studies were completed. Phenological studies in evergreen and moist deciduous forests are in progress. The micro climatic studies will be taken up shortly.

Project "Aspects of reproductive and lactational physiology of the Asian elephant, Elephas maximus (L)"

Two problems associated with increasing elephant populations in captivity have been noted:

a) infrequent reproduction
b) high mortality of calves given artificial milk feed in the first few months after birth.

Causes of infrequent breeding were assessed in five cows at Kodanad using indirect methods. Complete confinement to camps eliminated cycling in 3 of the five cows; one had cystic ovaries at the start of the experiment and one other showed signs of persistent *corpora lutea.* The study was concluded with successful induction of ovulation in two cows and method of diagnosing the estrus condition formatted.

To assess whether the composition of artificial milk is similar to that of natural milk, milk samples are being collected from 3 cows from birth to weaning of the calf. Some samples have been anailysed and the results are as follows: Lactose content of artificial feed is less than that available in natural milk. From birth onwards milk lactose rises sharply to 4 weeks and remains stable for 4-5 months after which it shows a steady decline. From 8-14 months *post partum* lactose content has been found to be similar to that of African elephants.

Fat contents of artificial feed compares within natural milk. However, it is unknown at this stage whether the fat composition is also comparable. As for African elephants, fat content shows an early exponential rise, followed by a slow one.

Milk protein rises continuously to about 8 months and remains stable thereafter. The artificial feed compares in content over the first 6 months, but is lower later in lactation when compared to natural milk. The composition of the protein is yet unkown.

The analyses of milk is still in progress.

WOOD SCIENCE

Wood.02/1979: Structural variability in the wood of Eucalyptus grandis and E. tereticornis in relation to age and locality

The objectives of this study are (a) to study some essential parameters determining pulping properties of eucalypt wood. (b) to study the magnitude of variation in the

structural characteristics of wood due to age and location and (c) to make attempts to study the incidence of kino veins and quantify the total phenols due to kino reins.

Preliminary data on fibre length, fibre diameter, lumen diameter and fibre wall thickness generated for *E. tereticornis* (7 yrs) were analysed and the results indicated that sampling size of the experiment was not adequate. The project is being modified.

Wood.03/1979: Preservative treatment of rubber wood (Hevea brasiliensis)

Rubber plantations in the State are an important source of wood, and the project has been takcn up to enhance the durability of rubber wood to facilitate its wider utilisation.

The project was completed and report published

Wood.04/1980: Protecting of fibrous raw material in storage against deterioration by biological organisms

Cashew wood and reed are important fibrous raw material used by the plup and paper industry in the State. To ensure an even supply of raw material, the manufacturing units have to store a large quantity of the material. During storage they are susceptible to insect and fungal attacks. The project was formulated with the objective of evolving appropriate treatments to minimise such damages

The project was completed and report published.

Wood, 05/1980: Natural durability of commercial timbers of Kerala with reference to decay

The objectives are to assess the resistance of commercial timbers of Kerala against decay by wood rotting fungi and rate these timbers into different durability classes

Samples from *Mesua nagassarium* were exposed to 10 wood rotting fungi. While the reference blocks of *Bombax ceiba* lost 60% of the original weight during a period of 18–25 weeks under these test fungi, there was only 0.21 to 0.63% weight loss for the test blocks of *M. nagassarium*. *M. nagassarium* will be classified as durable timber of class I.

Samples from nine species (14 trees) have been collected.

Wood.06/1982: Wood and bark properties of branches of selected tree species in Kerala

The objectives of this study are (a) to determine the physical properties such as basic density, moisture content and bark percentage of branches and to compare with those of stems, (b) to measure basic density and moisture content of bark and (c) to investigate the anatomical properties, viz., percentages of heartwood (if distinct) and different tissues (fibres, vessels, rays and parenchyma) and fibre dimensions.

Samples have been collected from stem and branches of 34 trees, comprising 9 species. Preliminary results indicate that, in general basic density of wood and bark, and

bark percentage are higher in branches than in stem; however, the fibre length is 20% shorter in branches than in stem.

Wood.07/1982: Establishment of Xylarium

The objectives are (a) identification and collection of wood samples and timber species of Kerala, (b) collection of voucher herbarium specimens and (c) preparation and collection of authentic slides of wood samples.

Wood samples of 6 species have been added to the Xylarium collection making a total of 56 species. Work on identification of wood samples and preparation of authentic slides is in progress.

Other activities

Seized scantlings (102 nos.) were identified for the Kerala Forest Department. Service was rendered to the Kerala Vigilance Department in the investigation of a criminal case.

Technical information was given to Evershine Packing Industries, Victory products, and Madura Coats Limited.

PARTICIPATION IN SYMPOSIA/CONFERENCES/SEMINARS

The Institute was represented by

1. Prof. V. P. K. Nambiar in the Ayurvedic Seminar at Kottakkal, Kerala (January 20, 1983).
2. Dr. K. Balasubramanyan and Dr. S. Sankar in the symposium on "Resources Survey of Land Use Planning and Environmental Conservation" at Dehra Dun (October 20-22, 1982).
3. Dr. A. R. R. Menon in the short Term Course on Landscape Planning and Environmental Conservation at School of Planning and Architecture, New Delhi (December 9 – 23, 1982).
4. Shri C. N. Krishnankutty in the seminar on "Data Base on Kerala's Economy" organised by the Directorate of Economics and Statistics, Government of Kerala, Trivandrum (January 27 – 28, 1983).
5. Dr. K. S. S. Nair and Shri V. V. Sudheendrakumar in the 11th Annual Conference of the Ethological Society of India at Calicut (May 3 – 5, 1982).
6. Dr. R. V. Varma in the International Study Workshop on "Termite Caste Differentiation" at Nairobi (November 7 - 12, 1982).
7. Dr. C. S. Venkatesh, Smt. K. K. Seethalakshmi Shri T. Surendran, Shri M. Balagopalan and Shri M. Balasundaram in the International Workshop on "Special Problems

in Physiological Investigations of Tree Crops" organised by the Rubber Research Institute of India, Kottayam (August 26 - 28, 1982).

8. Shri T. Surendran, Kum. M.V. Mary, Shri M. I. Mohammed Ali, Shri C. Mohanan and Smt. K. K. Seethalakshmi in the 5th Annual Symposium on "Plantation Crops" at Kasaragode (December 15 - 18, 1982).

9. Shri Thomas P. Thomas in the National Seminar on "Environmental Management" by the Government Engineering College, Trichur (March 3 – 4, 1983).

10. Shri E. A. Jayson in the All India Symposium on 'Wildlife Biology" organised by the Farook College at Farook (December 27 - 29, 1982).

11. Dr. J. K. Sharma in the symposium on "Fungi in Forest Eco-systems in connection with the 10th Annual Meeting of the Mycological Society of India at Sardar Patel University, Vallabh Vidya Nagar (December 6 - 7, 1982).

12. Dr. C. T. S. Nair in the seminar conducted by the Kerala Forest Department in connection with the Forest Convention 1983 at Calicut (February 11, 1983).

13. Dr. S. Kedharnath in the Technical Consultation meeting on "Wood Based Panels for Asia and Pacific Region" organised by FAO/UNDP Technical Consultation on Wood based panels at Delhi (January 13 – 17, 1983).

14. Dr. R. Gnanaharan in the ISTE Summer School on Optimal Management of Resources through utilisation of waste and replinishable materials at Government Engineering College, Trichur (April 27, 1982).

PAPERS PRESENTED AT SYMPOSIA/CONFERENCES/SEMINARS

1. Shri M. S. Mukteshkumar and Prof. V. P. K. Nambiar (with Prof. K. S. Manilal of Calicut University) – Floral Anatomy of *Burmannia championsii* Thw. (5th All India Botanical Conference, Rajkot).

2. Dr. K. Balasubramanyan - Need for a Clear Land Use Policy – A Case Study in Attappady, Palghat, District, Kerala (Symposium on Resources Survey of Land Use Planning and Environmental Conservation, Dehra Dun.).

3. Dr. C. T. S. Nair and Shri C. N. Krishnankutty – Forestry Planning in Kerala : Do we have Adequate Data (Seminar on Data Base of Kerala's Economy, Trivandrum).

4. Dr. R. V. Varma - Hormonal Mechanisms of Soldier Differentiation in *Postelecloro-termes nayara* (International Study Workshop on the Termite Caste Differentiation Nairobi).

5. Dr. C. S. Venkatesh, Smt. K. K. Seethalakshmi and Shri T. Surendran - *Promising new Techniques for Induction of rooting in Bamboos* (International Workshop on "Special problems in Physiological Investigations of Tree Crops", Kottayam).

6. Shri C. Mohanan and Dr. J. K. Sharma–A serious Disease of *Anacardium occidentale* L. Cast by *Cylindrocladium camelliae* and its possible control (Annual Symposium on "Plantation Crops" at Kasaragode).

7. Dr. S. Sankar – Soil Properties in different land use patterns in Plantations (Symposium on "Resources Survey of Land Use Planning and Environmental Conservation", Dehra Dun.)

PUBLICATIONS

1. Balagopalan M. and Alexander T. G., 1981 Shoot and root growth in *Eucalyptus tereticornis* seedlings. Indian J. Forestry 4 : 238.

2. Gnanaharan R. 1983. Preliminary note on the fungal problem of rubber wood (*Hevea brasiliensis*) International Research Group on Wood Preservation Document No.IRG/WP/3246. 7 pp.

3. Ghosh S. K., Balasundaram M. and Mohammed Ali M. I. Chemical Control of *Dendrophthoe falcata* on Teak through Trunk Injection. A preliminary field study. Current Science 51 (23) : 1119. 1982.

4. Ghosh S. K., 1982. Citrue Greening Under Field Conditions for Detection of Plant Disease. Raychaudhuri and Ahlawat (Ed.). Problems of Citrus Diseases in India. Surabhi Press and Publishers, Delhi. pp.37 – 43.

Appendix I

STAFF AS ON 31-3-1983

Dr. S. Kedharnath, FNA – Director

Administration

1.	Shri. M. Mohammed Usman	Registrar
2.	,, P. Viswanathan	Dy. Registrar (Admn.)
3.	,, P. K. Balan	Dy. Registrar (Fin)
4.	,, P. Achuthankutty	P. A. to Director
5.	,, M. K. Aravindakshan	Office Assistant
6.	,, M. S. Sukumaran	,,
7.	,, T. G. Ananthanarayanan	,,
8.	,, V. K. Mohan	,,
9.	Smt. K. M. Suseela	,,
10.	Shri. E. V. Eshac	,,
11.	,, K. K. Thomas	,,
12.	,, P. V. Sankaranunni	,,
13.	Smt. M. Kamalamma	Stenographer
14.	Shri. T. J. Alfred Hedisjis	,,
15.	Kum. V. Dhanalakshmi	Receptionist
16.	Smt. Mary Kuruvila	Typist
17.	Shri. P. M. Venugopalan	Driver
18.	,, T. Chandran	,,
19.	,, V. D. Johny	Attender
20.	,, K. V. Sidharthan	,,
21.	,, M. C. Reghunathan	,,
22.	,, C. Radhakrishnan	,,
23.	,, V. S. Neelakantan	,,
24.	,, K. R. Sevaraman	

Engineering

25.	Shri. K. R. Mukundan	Engineer
26.	Kum. V. K. Leela	Office Assistant
27.	Shri. P. R. Jose	Sergeant
28.	Shri. K. S. Gopalan	Overseer
29.	Shri. U. Y. John	Overseer
30.	,, P. P. Sunny	Skilled Maintenance Assistant
31.	Smt. T. V. Chandrika	Typist
32.	Shri. P. I. Madhavan	Driver
33.	,, K. Girijavallabhan	,,
34.	,, K. Dhorairaj	,,
35.	,, S. Shahul Hameed	,,
36.	,, P. Mohandas	

37.	,, K. Chandran	Attender
38.	,, M. K. Krishnankutty	Watcher
39.	,, P. M. Vasu	,,
40.	,, V. N. Balakrishnan	,,
41.	,, K. C. Subramanian	,,
42.	,, A. C. Antony	,,
43.	,, C. K. Vincent	Cleaner
44.	Smt. V. M. Amminy	Part-time Sweeper
45.	,, K. R. Omana	,,
46.	,, T. R. Chellamma	,,
47.	,, K. D. Chinnamma	,,
48.	,, K. Thankamani	,,
49.	,, K. K. Radha	,,
50.	,, V. K. Karthiayani	,,
51.	,, T. K. Vijayalakshmi	,,
52.	,, P. R. Madhavi	,,

Library

53.	Shri. K. Ravindran	Librarian
54.	,, K. Sankara Pillai	Assistant Librarian
55.	,, Subash Kuriakose	Artist Photographer
56.	Smt. N. Sarojam	Library Assistant
57.	Shri. K. H. Hussain	,,
58.	Smt. K. N. Rajamma	Office Assistant
59.	Shri. V. Ashokan	Typist
60.	,, C. A. Jose	Binder
61.	Shri. P V. Subramaniyan	Attender
62	Shri. K. R. George	,,

Botany (Physiology)

63.	Dr. K. K. Seethalakshmi	Research Assistant
64.	Shri. T. Surendran	,,
65.	,, C. K. Soman	Field Assistant
66.	,, C. V. Jose	Stenographer
67.	,, B. P. Sreedharan	Attender

Botany (Taxonomy)

68.	Prof. V. P. K. Nambiar	Scientist
69.	Shri. N. Gopalakrishnan Nair	Scientist Grade D
70.	Dr. K. K. Narayanan Nair	,,
71.	,, N. Sasidharan	Research Assistant
72.	Dr. C. Renuka	,,
73.	Shri. M. S. Muktesh Kumar	,,
74.	,, K. K. Unni	Field Assistant
75.	,, T. Prabhakaran	Gardener
76.	,, M. A. Sankarankutty	Attender

110.	,, A S. Sreenivasan	Attender

Ecology

77.	Dr. K. Balasubramanian	Scientist Grade C
78.	Shri. K. Sworoopanandan	Research Assistant
79.	Dr. A. R. Ramachandra Menon	,,
80.	Shri. A. V. Velayudhan	Attender

Economics

81.	Dr. C. T. S. Nair	Forest Economist
82.	Shri. P. K. Muraleedharan	Research Assistant
83	,, Maman Chundamannil	,,

Entomology

84.	Dr. K. S. S. Nair	Scientist Grade C
85.	Dr. R. Venugopal Varma	Scientist Grade D
86.	Shri. George Mathew	Scientist Grade D
87.	Shri. V. V. Sudheendrakumar	Research Assistant (Nilambur)
88.	,, K. Mohanadas	Research Assistant
89.	,, P. Padmanabhan	Field Assistant
90.	Smt. K. Annapoorni	Stenographer
91.	Shri. P. S. Raman	Attender

Genetics

92.	Shri. Mathew P. Koshy	Research Assistant
93.	Smt. E. P. Indira	,,
94.	Shri. K. K. Ahammed	Attender

Pathology (Fungal Diseases)

95.	Dr. J. K. Sharma	Scientist Grade C
96.	Shri. C. Mohanan	Research Assistant
97.	Smt. E. J. Maria Florance	,,
98.	Dr. K. V. Sankaran	,,
99.	Shri. K. Yesodharan	Field Assistant
100.	,, E. P. Somasekharan Nair	Attender

Pathology (Non Fungal Diseases)

101.	Dr. S. K. Ghosh	Scientist Grade C
102.	Shri. M. Balasundaram	Research Assistant
103.	Shri. M. I. Mohammed Ali	,,
104.	,, M. B. Dasan	Attender

Silviculture

105.	Shri. E. Muhammad	Silviculturist
106.	Shri K. C. Chacko	Junior Silviculturist (Nilambur)
107	Shri. R. Chandrasekharan Pandalai	Research Assistant (Nilambur)
108.	,, Nandakumar U. Narath	Research Assistant
109.	,, M. Cherukunhan Nair	Attender (Nilambur)
110.	,, A S. Sreenivasan	Attender

111.	,, P. Avunni	Watcher (Nilambur)
112.	,, K. P. Balan	Cook-cum-Attendant (Nilambur)

Soil Science

113.	Dr. T. G. Alexander	Scientist Grade C
114	Dr. S. Sankar	Scientist Grade D
115.	Shri. M. Balagopalan	Research Assistant
116.	,, Thomas P. Thomas	,,
117.	Kum. M. V. Mary	,,
118.	Shri. E. T. Kuttykrishnan	Attender

Statistics

119.	Smt. P. Rugmini	Research Assistant
120.	Shri. C. N. Krishnankutty	,,
121.	,, A. R. Rajan	Field Assistant
122.	,, A. Ramakrishnan	Stenographer
123.	,, E. D. James Tidode	Typist
124.	,, K. S. Karunakaran	Attender

Wildlife Biology

125.	Dr. P. Vijayakumaran Nair	Scientist Grade D
126.	Dr. (Mrs) Rekha Sharma	Scientist
127.	Shri. P. S. Easa	Research Assistant
128.	,, K. K. Ramachandran	,,
129.	,, E. A. Jayson	,,
130.	,, M. C. Mohandas	Attender

Wood Science

131.	Dr. R. Gnanaharan	Scientist Grade C
132.	Dr. K. Mahabala Bhat	Scientist Grade D
133.	Dr. (Mrs) Nazma	Scientist Grade D
134.	Dr. K. Vishnu Bhat	Research Assistant
135.	Shri. T. K. Damodharan	,,
136.	,, P. A. Sankarankutty	Attender

General Project

137.	Shri. K. Sasidharan	Research Fellow
138.	,, K. K. Raveendran	,,
139.	,, S. Yatheesh	,,
140.	,, K. T. Philip	,,
141.	,, James Thomas	Field Assistant
142.	,, James Mathew	,,
143.	,, K. Vijayan	Driver
144.	,, K. Mohanan	Motor Boat Driver

Appendix II

Audited Statement of Accounts 1982-83

JOSEPH & JOSEPH
CHARTERED ACCOUNTANTS
P.C.V. Building, Rice Bazaar, Trichur-680 001

P. L. PAULOSE, F.C.A.
A. T. THOMAS, B.Sc., F.C.A.

Date: 7-10-1983

AUDITORS' REPORT

We have audited the accounts of the Kerala Forest Research Institute Society, Peechi, Trichur District for the year ended 31st March, 1983 with the books of accounts and other records maintained by the Institute and report that :-

(1) We have obtained all the information and explanations which to the best of our knowledge and belief were necessary for the purpose of our audit;

(2) The Balance Sheet and the Income and Expenditure Account dealt with by the report are in agreement with the books of accounts; and

(3) In our opinion and to the best of our information and according to the explanations contained in the notes, the accounts give a true and fair view:-

(a) in the case of the Balance Sheet of the state of affairs of the Institute as at 31st March, 1983 and,

(b) in the case of the Income and Expenditure account of the excess of expenditure over income for the year ended on that date.

For JOSEPH &JOSEPH
Chartered Accountants
Sd/-

P. L. Paulose, F. C. A.
Partner
CHARTERED ACCOUNTANTS.

THE KERALA FOREST RESEARCH INSTITUTE SOCIETY, PEECHI, TRICHUR (Dt.)

BALANCE SHEET AS AT 31 ST MARCH, 1983

	As per Schedule	Figures as at 31—3—1983	Figures as at 31—3—1982
LIABILITIES			
		Rs. P.	Rs. P.
GENERAL FUND	A	1,50,45,230.93	1,38,14,630.24
RESERVES & SURPLUS	B	1,09,703.68	1,09,703.68
CURRENT LIABILITIES & PROVISIONS	C	8,94,665.68	9,13,136.17
TOTAL:	Rs.	1,60,49,600.34	1,48,37,470.09
ASSETS			
FIXED ASSETS	D	60,75,017.33	58,86,414.15
CAPITAL WORK -IN-PROGRESS	E	73,29,421.57	61,44,921.69
CURRENT ASSETS, LOANS & ADVANCES	F	26,45,161.44	26,06,134.25
TOTAL :	Rs.	1,60,49,600.34	1,48,37,470.09

Note: Contingent Liability in respect of
L. C. for air-conditioner (s) ... Rs. 27,512.46

Signatures to balance sheet, Income and Expen liture Account and Schedules A to F form integral part of the accounts.

Resolved to adopt and pass the accounts of the Institute for the year 1982-83 as per the Statements appended and to send the same to M/s. Joseph & Joseph, Chartered Accountants, Trichur for audit and issue of audited statement of accounts.

Sd/-
CHAIRMAN
EXECUTIVE COMMITTEE

Sd/-
DIRECTOR
KERALA FOREST RESEARCH INSTITUTE

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31-3-1982

	31-3-1983 Rs. P.	31-3-1982 Rs. P.
INCOME		
Interest on Savings Bank A/c & F. D.	97,885.32	61,205.12
Service charge from research projects	1,02,894.00	87,572.00
Miscellaneous income	49,955.52	36,003.08
Provision for contribution to Employees Provident Fund written bank	26,640.00	——
Excess of Expenditure over Income	31,94,399.26	29,59,278.22
TOTAL Rs.	34,71,774.01	31,44,056.42
EXPENDITURE		
Salary and Allowance	17,23,905.13	13,73,456.40
Contribution to Employees provident Fund	1,02,947.00	79,519.00
Leave travel concession	3,002.00	6,292.20
Group gratuity assurance	26,476.81	39,505.72
Travelling expenses (including Rs. 16,855-87 to Governing Body members)	1,32,712.46	1,01,969.29
Medical reimbursement	38,761.97	25,579.25
Leave Salary & Pension contribution	17,660.00	19,916.35
Postage	11,622.45	33,583.30
Telephone Charges	27,335.45	8,591.90
Bank Charges	14.85	1,177.51
Rent	22,940.96	8,850.00
Printing & Stationery	53,683.95	40,238.38
Subscription to Journals & Periodicals	97,651.10	96,556.81
Repairs and Maintenance of Vehicles	2,20,848.11	2,29,578.44
Potting Shed	11,266.00	——
Repairs and Maintenance of Buildings and Equipments	50,183.81	1,16,251.94
Research expenses including Stores and Chemicals	2,84,030.19	3,25,139.81
	28,25,042.24	25,06,206.30
Advertisement charges	13,252.00	21,804.62
Staff Welfare expenses	4,829.40	11,682.52
Garden development expenses	11,773.63	7,753.41
Audit fees: For Audit	6,000.00	6,600.00
Professional charges	13,000.00	4,850.00
Electricity charges	20,661.25	17,859.30
Panchayat & Municipal property tax	13,259.16	6,941.16
Lease Rent of Land	2.00	2.00
Miscellaneous expenses	20,702.93	11,223.41
Depreciation on Fixed Assets	5,38,368.73	5,37,610.01
Campus Development	1,175.00	
Seminar & Symposia	3,707.67	11,523.69
TOTAL Rs.	34,71,774.01	1,44,056.42

SCHEDULES ATTACHED TO AND FORMING PART OF THE BALANCE SHEET
FOR THE FINANCIL YEAR 1982-1983

	Current year Figures Rs. P.	Previous year Figures Rs. P.
SCHEDULE-A		
General Fund:-		
Balance as per last Balance Sheet	1,38,14,630.24	1,10,45,164.86
Add: Grant received from Govt. of Kerala	44,25,000.00	57,23,743.60
	1,82,39,630.24	1,67,73,908.46
Less: Excess of Expenditure over Income	31,94,399.26	29,59,278.22
TOTAL Rs.	1,50,45,230.98	1,38,14,630.24
SCHEDULE-B		
Capital Reserve:-		
Surplus in grants received over the expenditure incurred, in respect of projects sponsored and financed by the following external agencies:-		
Federation of Indian Panel & Plywood Industries	3,183.51	3,183.51
Food & Agricultural Organisation	1,06,520.17	1,60,520.17
TOTAL Rs.	1,09,703.68	1,07,703.68
SCHEDULE-C		
Current Liabilities & Provisions:		
A. Current Liabilities:-		
Grant for Research project – in progress	6,58,444.10	7,01,844.10
Security Deposit from Customers	5,399.00	18,233.00
Other Liabilities	2,30,822.58	1,44,700.87
Letter of Credit		21,718.20
	8,91,665.68	8,86,496.17
B. PROVISIONS:-		
Employees Provident Fund		26,640.00
TOTAL: Rs.	8,94,665.68	9,13,136.17

	Current year Figures Rs. P.	Previous year Figures Rs. P.
SCHEDULE - D: (See separate sheet attached)		
SCHEDULE - F:		
CAPITAL WORK - IN - PROGRESS:		
Peechi Building - III Phase	73,16,307.44	61,31,807.56
Teak Museum	13,114.13	13,114.13
TOTAL: Rs.	73,29,421.57	61,44,921.69

SCHEDULE - F:

CURRENT ASSETS, LOANS & ADVANCES:

A. Current Assets:-			
1.	Research work - in - progress	9,02,111.39	7,93,080.15
2.	Stocks as per inventory taken, valued and certified by the Directors:-		
	a) Stock of Stationery	5,072.94	21,946.42
	b) Stores and Chemicals	35,393.54	38,351.26
	c) Cement	Nil	450.00
	d) Unused Stamp (previous year included in cash on hand)	978.00	
3.	a) Cash on hand	1,20,901.08	237.54
	b) With Scheduled Banks:-		
	i) In Savings Bank A/c	1,22,684.47	43,300.84
	ii) In Current Account	4,592.27	1,292.31
	iii) In Fixed Deposit (Being security for obtaining guarantee facility from S. B. T.)	15,000.00	30,000.00
	iv) Fixed Deposit with Sub - Treasury	1,09,700.00	1,09,700.00
	c) With Sub - Treasury - S. B.	8,217.89	5,13,948.34
	TOTAL: Rs.	13,24,651.58	15,52,306.86

	Current year Figures Rs. P.	Previous year Figures Rs. P.
B. LOANS & ADVANCES:-		
Advance Receivable in cash or in kind or for value to be received. (Unsecured Considered good)		
prepaid expenses	60,999.65	61,913.50
Advance for Capital Work - in - progress	10,34,763.00	9,31,500.00
Accrued Interest	1,03,687.85	51,455.17
Other Advances	1,15,259.36	2,03,158.72
Telephone Deposit	5,800.00	5,800.00
TOTAL: Rs.	13,20,509.86	12,53,827.39
SUMMARY (A & B):		
Current Assets	13,24,651.58	15,52,206.86
Loans & Advances	13,20,509.86	12,53,827.39
TOTAL: Rs.	26,45,161.44	28,06,134.25

SCHEDULE - G.

MISCELLANEOUS INCOME:		
Application fees	635.00	1,380.00
House Rent recovered from Staff	25,927.20	11,090.25
Sale proceeds of tender documents	1,275.00	195.00
Cost of service book collected	72.20	53.20
Rest House rent recovered from third parties	2,694.75	2,034.50
Sundry	558.25	2,530.13
Hire Charges of Vehicles	18,793.12	18,720.00
TOTAL Rs.	49,955.52	36,003 08

GROUPINGS OF SCHEDULES

	31-3-1983 Rs. P.	31-3-1982 Rs. P.
GRANT FOR RESEARCH PROJECT-IN-PROGRESS:		
Grant from Forest Department	1,85,444.10	1,35,444.10
Grant from Govt. of India for MRV Project	2,50,000.00	2,50,000.00
Gwalior Rayons, Woods - 04	15,000.00	15,000.00
Advance from H.P.C.	8,000.00	8,000.00
Grant from Govt. of Kerala towards Teak Museum	2,00,000.00	2,00,000.00
Grant from Govt. of India for M.A.B. Project	Nil	93,400.00
TOTAL Rs.	6,58,444.10	7,01,844.10

	Current year Figures Rs. P.	Previous year Figures Rs. P.
ADVANCES FOR CAPITAL WORK-IN-PROGRESS:		
Kerala State Construction Corporation	1,03,263.00	Nil
Public Health Engineering Department (Government of Kerala)	9,31,500.00	9,31,500.00
TOTAL Rs.	10,34,763.00	9,31,500.00
PREPAID EXPENSES:		
Journal Subscription	58,400.00	53,112.27
Advance for Books and Microfilms	1,451.15	6,325.23
Insurance of Vehicles	1,148.50	2,476.00
TOTAL Rs.	60,999.65	61,913.50
RESEARCH WORK-IN-PROGRESS:		
Genetic improvement of Teak in Kerala	2,49,658.16	1,89,240.81
Thekkady Wild Life Project	3,47,956.15	2,88,358.68
Multi-Purpose River Valley Project	2,95,258.13	2,13,567.35
Woods (Gwalior Rayons)	3,801.91	3,801.91
Control of insects damaging stored reeds – Entom-04	5,234.79	4,711.40
F.A.O. Project – Econ-04	202.25	Nil
Man and Bio-Sphere Project	Nil	93,400.00
TOTAL Rs.	9,02,111.39	7,93,080.15

	31.3.1983 Rs. P.	31-3-1982 Rs. P.
OTHER ADVANCES		
T. A. Advance	14,266.00	2,081.75
Adavnce given to Institute Scientists for research worK	19,938.56	38,101.63
Trans Electrical, Cochin	6.00	6.00
Leave Salary Advance to deputationists	37,450.64	32,119.46
Leave Travel concession Advance	1,733.00	450.00
ASCU HICKSON. Culcutta (Treatment plant)	.....	1,07,333.75
INSDOC. Bangalore	1,135.90	1,038.90
Telephone Deposit	4,550.00	4,200.00
Deposit with K. S. E. B.	6,700.00	2,900.00
Deposit with I. O. C.	195.00	195.00
D. F. O. Nilambur	100.00	100.00
Chitra Sales Corporation, Trichur	840.00	740.00
D. F. O., Arunachal Pradesh	22.65	22.65
Private Trunk Call Charges	415.50	124.90
Central Transport of India, Calcutta	6,202.00	6,202.00
Chakkiat Agencies, Cochin	.....	329.50
M/s. C. P. N. Industries, New Delhi	1,926.00	1,926.00
Dy. Conservator of forest, Coimbatore	15.50	212.15
Macneil & Magor Limited, Cochin	400.00	400.00
Chhotalal Keshav-jee Shah & Sons, Bombay	.....	1,000.00
Festival Advance	3,590.00	3,675.00
Rent Advance to Smt. N. Sarojam, House-Owner, Director's Quarters	185.80	.....
L. I. C. Adavnace	23.21	.....
Bharat Pumps and Compressors, Allahabad	536.00	.....
M/s. Sartorius, West Germany	13,027.80	.....
M/s. Saraswathi Printers, Trichur	2,000 00	.....
TOTAL: Rs.	1,15,259.36	2,03,158.72

OTHER LIABILITIES:	31-3-1983 Rs. P.	31-3-1982 Rs P.
Salary payable	1,71,857.85	98,420.60
T.A. Payable	13,057.32	7,699.51
Medical reimbursement Payable	2,969.37	4,447.60
Advertisement charges Payable	.....	1,155.00
Rent Payable	450 00	300 00
Lease Rent Payable to Govt. of Kerala	12 00	10.00
C P.F. Collected not remitted	211.00	728.00
C.P.F. Loan collected not remitted	164.00	164.00
Electricity charges Payable	4,223.62	2,407.39
Audit fee Payable	12,000.00	6,000.00
Bank commission Payable	.....	35.95
Life Insurance contribution collected from staff	99 80	47.20
Caution Money deposit for library membership	150.00	150.00
Tax deducted at source:-		
Income-tax	2,691.00	4,051 00
Sales-tax	8.62	8.62
Suspense Account (Cement A/c)	20,556 00	18,750.00
Kerala Construction Corporation	.....	326.00
Leave Salary & Pension contribution Payable	359.00	.....
Telephone charges Payable	1,738.00	.....
Legal Fees	250 00	.....
Co-Operative Society recoveries pending remittance	25 00	.....
TOTAL Rs.	2,30,822.58	1,44,700.87

SCHEDULE D

SI.No.	DESCRIPTION OF ASSETS	Rate %	GROSS BLOCK As at 1-4-82	Additions	Sales	DEPRECIATION Total	Till 31-3-82	For the year	NET BLOCK Till 31-3-83	As at 31.3-82	As at 31.3-83
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
			Rs. P.	Rs. P.	Rs. P.	Rs. P.	Rs P.	Rs P.	Rs P.	Rs. P.	Rs. P.
1.	Building-Office	2.5	2650801.47	13950.98	.....	2664752.45	276011.62	59718.52	335730.14	2374789.85	2329042.31
2.	Compound Wall & Fencing	7.5	476032.22	103840.02	.....	579872.24	59214.74	39049.30	98264.04	416817.48	481608.20
3.	Nilambur Nursercy Fencing	10	12990.77	.....	.....	12990.77	6086.94	690.38	6777.32	6903.83	6213.45
4.	Roads	...	45668.41	107967.43	.....	153635.84	.....	.....	.....	45668.41	153635.84
5.	Well	...	26295.73	.....	.....	26295.73	.....	.....	.....	26295.73	26295.73
6.	Cycles	20	1034.63	.....	.....	1034.63	746.71	57.58	804.29	287.92	230.34
7.	Bus, Jeeps & Trailers	30	471388.44	.....	.....	471388.44	336025.02	40609.02	376634.04	135363.42	94754.40
8.	Boat	10	32219.81	.....	.....	32219.81	8246.75	2397.30	10644.05	23973.06	21575.76
9.	Cars & Motor Cycles	20	96577.26	.....	.....	96577.26	64437.15	6428.00	70865.15	32140.11	25712.11
10.	Electric Fittings	15	167763.20	116052.69	.....	283815.89	68210.93	32340.75	100551.68	99552.27	133264.21
11.	Motor Pump & Fittings	10	33290.10	.....	.....	33290.10	10859.52	2243.00	13102.52	22430.58	20187.58
12.	Motor spectro photometer	10	230113.83	.....	.....	230113.83	64046.60	16606.72	80653.32	166067.23	149460.51
13.	Microscopes	15	254534.93	3690.58	.....	258225.51	113985.44	21636.00	135621.44	140549.49	122604.07
14.	Research Equipments	10	1124416.75	63551.15	3604.40	1184363.50	269587.95	91477.55	361065.50	854828.80	823298.00
15.	Library Books	15	976405.50	116017.22	.....	1092422.72	451804.59	96092.71	547897.30	524600.91	544525.42
16.	Typewriters, Calculators & Duplicators	15	74724.88	1740.00	.....	76464.88	39019.19	5616.85	44636.04	35705.69	31828.84
17.	Furniture & Fittings	10	785028.90	86559.99	.....	871588.89	239802.07	63178.68	302980.75	545226.83	568608.14
18.	Refrigerators	10	52968.70	.....	.....	52968.70	15491.92	3747.68	19239.60	37476.78	33729.10
19.	Air Conditioners	15	40321.39	.....	.....	40321.39	11109.31	4381.81	15491.12	29212.08	24830.27
20.	Office Equipments	10	11520.77	.....	.....	11520.77	3722.09	779.87	4501.96	7798.68	7018.81
21.	Micro Computer	15	67833.98	.....	.....	67833.98	32424.21	5311.47	37735.68	35409.77	30098.30
22.	Research Binocular, Microscope	15	170209.01	.....	.....	170209.01	25531.85	21701.58	47233.43	144677.16	122975.58
23.	Insectorium	5	115367.88	.....	.....	115367.88	5758.39	5480.48	11238.87	109609.49	104129.01
24.	Aria Meter	10	78920.65	.....	.....	78920.65	7892.07	7102.85	14994.92	71028.58	63925.73
25.	Wood Seasoning Plant	10	.....	117206.25	.....	117206.25	.....	11720.63	11720.63	...	105485.62
	Total:		7996429.21	730576.31	3604.40	8723401.12	2110015.06	538368.73	2648383.79	5886414.15	6075017.33

SCHEDULE-G

Notes attached to and forming part of the Balance Sheet as at 31st March, 1983:-

1. In the opinion of the committee members, current assets, loans and advances have the value at which they are stated in the Balance Sheet if realised in the ordinary course of business.

2. No provision for income-Tax is made in the accounts as the Members of the Committee feel that the Institute will be granted exemption. Also there is no excess of income now. The requirement for obtaining exemption under section 10 of the Income-Tax Act, 1961 have been complied with and it is felt that the order granting the exemption will be received without delay

3. Service charges for research work in respect of research projects undertaken for Forest Department are calculated for each project at the rate of 2½% on salary, travelling allowance, medical reimbursement, leave salary and pension contribution and running and maintenance expenses of vehicles.

4. Amount relating to Government of India M. A. B. Project has been removed from both sides of the Balance Sheet as the work is completed and account settled.

5. In the opinion of the committee members it is no longer necessary to keep a provision for the Employees provident Fund. The provision made in the previous years is therefore written back and shown in the Income and Expanditure Account of the year.

6. The Construction of Type I and II quarters is completed and the quarters let out to employees. The cost of construction has not been capitalised, because the value could not be as certained as the final bill has not been settled with the contractors namely The Kerala State Construction Corporation. For the above reason depreciation on these quarters has not been calculated and debited to accounts. Estimated amount of depreciation is Rs. 71, 050/-.

7. The figures for the previous year have been re-grouped/ re-cost wherever necessary to suit current year's lay out.

For JOSEPH & JOSEPH,
Chartered Accountants,

Sd/-

P. L. Paulose,
Partner