annual report
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TABLE OF CONTENTS

1. INTRODUCTION

The year 1985-86 was an important year in the history of the development of the Institute as it marked the completion of a decade since its establishment. Research activities were expanded considerably keeping in view the needs of the forestry sector in the State. Close liaison was maintained with the State Forest Department, and extension activities were strengthened to solve forestry problems faced by various agencies within and outside the State. A review panel appointed by the Governing Body undertook a detailed scrutiny of the functioning of the Institute during the last five years.

Hitherto progress of research activities was being presented Divisionwise. With the increasing complexity of the problems, considerable emphasis is being given to a multidisciplinary approach to research. To focus attention on applied aspects, the format of this report has been modified and progress in tackling specific areas or problems is presented instead of divisionwise reports.

2. RESEARCH ACTIVITIES

In view of the importance of plantation forestry, considerable attention was paid to problems pertaining to man-made forests, particularly of teak and eucalypt. Problems related to management of natural forests, ecology and management of bamboos, canes and other indigenous species, wildlife management, wood utilisation, etc. were also tackled. Progress of the various research projects is summarised below, giving important conclusions emerging from completed projects.

2. 1. PLANTATION FORESTRY

2. 1. 1. Projects completed during the year

(i) Studies on the seasonal incidence of defoliators and the effect of defoliation on volume increment of teak. Entom 02/77.

The project was initiated mainly to quantify the effect of defoliation on the growth of teak.

The seasonal incidence of defoliation and its effect on growth of teak plantations were studied at Nilambur, Kerala. Experimental plots established in

a 4-year old Plantation were either given selective protection against the two dominant defoliators or left unprotected, over a period of 5 years. The defoliation trend was studied by fortnightly visual scoring. Measurements made on trees felled during the first and second mechanical thinnings were used to establish empirical mathematical relationship between GBH and height on one hand and volume on the other. Using this relationship, the volumes of the experimental trees were determined at the beginning and end of the experiment. Increments were compared using statistical methods in which the initial volume and the number of neighbours of each tree were used as covariates.

Among the two well known pests, viz. *Hyblaea puera* and *Eutectona machaeralis* the latter was present in small numbers almost throughout the growth season, but defoliation caused by it was (1) infrequent over years, (2) generally of low intensity, and (3) occurred late in the season when the leaves were old and rate of growth was low. Defoliation by *H. puera*, on the other hand, was a regular annual feature, with one or two waves of epidemic defoliations between late April and July, followed in some years by another lighter defoliation between August and October. In this study some new insights were gained on the population dynamics of this insect. Circumstantial, but conclusive evidence indicated short-range migration of *Hyblaea* moths which necessitate a complete rethinking on the approaches to the control of this insect. A new model of the population dynamics of this insect is proposed. If some steps of the proposed model are confirmed by further study, simple methods could be devised to manage the pest by regulating the early build-up phase.

The most serious impact of defoliation was loss of volume increment, although in 2 to 4-year-old saplings, defoliation was sometimes followed by die-back of the leading shoot, which in rare cases led to forking. *E machaeralis* had no significant impact on increment, but *H. puera* caused loss of 44% of the potential increment in volume during the experimental period. When the gain due to protection is expressed as percentage increase over the normally realized unprotected yield, it amounted to 80%. The general applicability of this estimate and its practical significance are discussed. It is concluded that because of changes in stand dynamics brought about by improved growth, it is not possible to quantify the benefit in terms of volume gain for the entire rotation, until adequate models of stand dynamics have been developed. However, the study showed that the benefits are so large that attention must now be focussed on development of suitable methods of protection, rather than more precise estimation of the benefits. Control of *H. puera* is worthwhile, but control

of *E. machaeralis* is not. Protection during the early years will be more beneficia because of the greater absolute increment.

(ii) studies on the natural enemies of teak pests, *Hyblaea puera* and *Eutectona machaeralis*, Entom 10/83

The project was undertaken to gather information on the major natural enemies of teak pests in order to identify potential biocontrol agents. The study was conducted in three plantation sites at Nilambur, during April 1985.

The following natural enemies were found on *H. puera:* five parasites, viz., *Brachymera lasus. Palexorista solennis, Sympiesis* sp. and two species of unidentified ichneumonid wasps; two insect predators, viz., *Cantheconidea furcellata* and *Parena nigrolineata;* four species of birds, viz., *Corvus macrorhynchos* (Jungle Crow), *Acridotherus tristis* (Common Mynah), *Dicrurus adsimilis* (Black Drongo) and *Turdoides striatus* (Jungle Babbler): and a species of bacterial pathogen, *Enterobacter aerogenes*. Among these, the parasite *Sympiesis* sp., and the bacteria are new records on *H. puera*.

Most parasites were found infesting the larval stages of the pest. *P. solennis* was the only parasite consistantly recorded from all the study sites during the peak pest infestation period. The overall percentage parasitism due to all parasites ranged from 0 to 28 in 1983 and 0 to 26 in 1984, but during the first epidemic of the pest in each year parasitism was very low or almost absent.

Five species of parasites recorded on *E. machaeralis* include *Apanteles* sp. *Brachymeria hime atteviae, Phanerotama hendecasisella* and two species of unidentified ichneumonid wasps.

The insect parasites *Sympiesis* sp. and *Palexorista solennis* and the bacterial pathogen appear promising for management of *Hyblaea,* but more detailed studies are necessary to standardise the methods.

(iii) Disease survey in nurseries and plantations of forest tree species grown in Kerala - Pathol.01/79

Disease forms an important factor contributing to the low productivity of forest plantations in the state. Under this project a detailed survey was undertaken with the objective of identifying the most important diseases, the causative organisms and their epidemiology.

From *Tectona grandis, Bomabx ceiba, Ailanthus triphysa, Gmelina arborea, Dalbergia latifolia, Ochroma Pyramidale* and *Eucalyptus* spp. a total of 65

pathogenic and 13 other diseases (unknown etiology, non-infectious and phanerogamic parasite) were recorded. With these diseases altogether 88 pathogens were associated, of which 64 are new host records including seven new species (viz. *Pseudoepicoccum tectonae* and *Phomopsis varisporum* on *T. grandis*, *Meliola ailanthi on A. triphysa*, *Griphosphaeria gmelina* on *G. arborea*, *Physalospora dalbergiae* on *D. latifolia* and *Cytospora eucalypti* and *Velsa eucalyepticola* on *Eucalyptus* spp.) while 29 are first record from India.

Tectona grandis had fifteen diseases, two in nursery and fourteen in plantations, one being common to both. Ten organisms were associated with these diseases, mostly causing foliar damage. Six Pathogens are new host record and four first record from India. None of the two diseases in nurseries were serious whereas in plantations die-back caused by insect-fungus complex and a phaenrogamic parasite, *Dendrophthoe falcata* were serious diseases capable of causing large-scale destruction. Three diseases viz. pink disease (*Corticium salmonicolor*), Phomopsis leaf spot and a disease of unknown etiology appeared to have potential to become serious.

In *Bombax ceiba* there were eight diseases, four in nursery and six in plantations, two were common to both Four pathogens are new host records. Collar rot and seedling blight were the severe diseases causing appreciable loss to stocking. None of the plantation diseases were found to be serious except *Myrothecium* leaf spot which in certain humid areas could pose some problem due to extensive premature defoliation.

Ailanthus triphysa had a total of nine diseases of which eight were in nursery and four in plantations ; three were common to both. All the eight pathogens are new host record while two were first record from India. Among relatively large number of seedling diseases, two, viz. collar rot and seedling blight were very widespread and damaging as they resulted in large scale mortality. In plantations though none of the diseases were very serious, three, viz. Botryodiplodia stem canker, pink disease and shot-hole were potentially serious, especially the former two, which killed the affected trees in certain localities.

There were ten diseases in G *arborea*, three in nursery and eight in plantations; one was common to both. All the ten pathogens associated with these diseases are new host records while three are recorded for the first time from India. In nurseries only seedling blight was of serious consequences though stem infection (*Phoma nebulosa*) also appeared to be potentially serious

in certain localities. In plantations a die-back disease caused by *Griphosphaeria gmelinae* was the major disease as it resulted in heavy mortality.

In Dalbergia latifolia none of the four diseases of foliage recorded were of serious nature. Leaf spots caused by Physalospora and *Colletotrichum* are new diseases while for leaf rust and *phyllachora* leafspot. *D. latifolia* is a new host.

Only two diseases were recorded in plantation of *O. pyramidale* and none in the nursery. One of the diseases, die-back, resulting in large-scale mortality, was caused by two pathogens, *Calonectria rigidiuscula* and *Fusarium moniliforme*, the former being the first record from India.

Eucalyptus spp. recorded the highest number of 30 diseases, 13 in nursery and 21 in plantations; four were common to both. Of the 46 pathogens associated with these diseases 30 are new host record and 18 first record for India. In nurseries, damping-off, seedling blight and leaf and shoot blights were serious seedling diseases affecting the nursery stock considerably, especially in high rainfall areas. In plantations, pink disease and leaf and shoot blights (*Cylindrocladium* spp.) were the major limiting factors during the first one to three years of establishment. A number of provenances of various species of *Eucalyptus* screened against pink disease following toxin bio-assay revealed variation in susceptibility between species and within provenances of a species. Other potentially serious diseases were web blight (*Rhizoctonia solani*) in nursery and stem cankers caused by *Cryphonectria cubensis* and *Cytospora eucalypticola* (both recorded for the first time from India) which can result heavy mortality.

Control measures for 18 seedling diseases of various tree species were worked out and field tested for the efficacy of the fungicide and its dosage.

(iv) Seasonal incidence and possible control of important insect pests in plantations of *Ailanthus triphysa* - Entom 09/83.

The project was initiated in April 1983 and completed in September 1985.

Two insects, viz. *Atteva fabriciella* (Lepidoptera: Yponomeutidae) and *Eligma narcissus* (Lepidoptera: Noctuidae) are known to cause damage to *Ailanthus* spp. The seasonal incidence and ecology of these pests were studied in a 2-year old *A. triphysa* plantation at Pothuchadi in Peechi Range to develop suitable control measures.

A. fabriciella larvae that fed on the terminal portion of the shoots caused death of terminal buds and formation of epicormic branches in many saplings. *E. narcissus* larvae fed on young as well as mature leaves and often caused total defoliation in nurseries and young plantations. Reflushing usually occured in about two weeks.

General observations in Kerala showed that nurseries and young plantations suffer most damage, older plantations being usually free of pest attack. The two common species of *Ailanthus* planted in Kerala viz. *A. triphysa* and *A. excelsa* were both found susceptible to both the pests. *Quassia indica*, a shrub of the family Simaroubaceae was found to support *A. fabriciella*: this is the first time that an alternative host is reported for this insect.

Monthly observation in the study plots showed that *A. fabriciella* was present throughout the year with peak populations in different months in different years. Within the study area seasonal occurrence of *E. narcissus* was erratic. General observations in other areas revealed prevalence of both species in other periods of the year.

For both species many mortality factors were found to operate under field conditions. They included an egg predator, (*Crematogaster perelegans*), a larval parasite, *Sarcophaga* sp. a fungal pathogen, *Bacillus firmus* for *E. narcissus* and the larval parasites *Brachymeria hime atteviae* and *Hexamermis* sp. (Nematode) for *A. fabriciella*. The fungus, *P. farinosus* and the bacterium *B. firmus* are being reported from *E. narcissus for* the first time. This is also the first report of the bacterium, *B. firmus* as an insect pathogen.

Laboratory studies were undertaken to test the pathogenicity of the above microbial pathogens against both the pests. When larvae were sprayed with a fungal spore suspension of *P. farinosus* nearly 100% mortality was obtained in 48 hours for both *E. narcissus* and *A. fabriciella*. Infected larvae showed profuse growth of fungal mycelia on the body surface. The pathogenicity of the bacterium was tested by feeding test larvae on leaves treated with a bacterial suspension. *E. narcissus* larvae stopped feeding by 18-24 h. and 80 - 100% mortality occured in 72 hrs but on *A. fabriciella* no pathogenicity was observed.

Selected insecticides, viz. quinalphos (Ekalus), monocrotophos (Nuvacron) and cypermethrin (Cymbush) were screened in the laboratory as well as under field conditions. All of them gave satisfactory control of both the pests.

(v) Physical properties of soils in relation to eucalypt growth. Soils 09/82.

Meagre data exist in Kerala on the physical parameters of soils and their relation to eucalypt growth. Literature points to the influence of depth of soil, texture, structure, stoniness, bulk density, permeability, aeration, infiltration, and water-holding capacity on tree growth Present project aims at an indepth elaboration of soil physical properties and their relation to height growth of *Eucalyptus tereticornis* and *E. grandis* in one site each. Kondazhi in Trichur and Muthanga in Kozhikode Forest Divisions were the respective study areas. Four plots, 10 x 10 m for Kondazhi and 12.5 x 12 5 m for,Muthanga, within a radius of 500 m were demarcated and 0-20, 20-40 and 40-60 cm depths were sampled from three pits in each plot. Top height and girth (gbh) of 5-7 trees were measured.

Gravel, sand, silt and clay contents are reported as percentages of the whole soil (gravel + sand + silt + clay = 100) and interpretations are better with this approach than the conventional method of sand + silt + clay = 100. Soil data are being discussed for 0-20, 20-40 and 40-60 cm depths and for 0-60 by summation. Among the properties, gravel is the most and particle density the least variable. Sand, silt and clay contents are highly variable whereas water-holding capacity, pore space and bulk density are intermediate. Intercorrelation of properties bring out consistency in the data. In Kondazhi, significant correlation exists for gravel, sand, silt, clay, bulk density, pore space, and water-holding capacity with tree height; however, it is only for gravel and sand in Muthanga. Correlation is consistent for gravel and sand in both sites. Principal component analysis reveals that a large part of the variation in height is explainable by the first and second components. Gravel, sand and water-holding capacity stand out among the physical properties and these appear to influence the height growth of eucalypts in Kondazhi and Muthanga sites.

2.1.2 Ongoing Projects

(i) Studies on the physiology of vegetative propagation of important timber species by rooting stem cuttings. Physiol 01/79.

The main objectives are to study the rooting behaviour of the stem cuttings of economically important timber species, to study the efficacy of different growth regulating substances on induction of roots in stem cuttings, to study the effect of girdling and pinching on root initiation of cuttings and to find out the optimal conditions for the induction of roots on stem cuttings for vegetative propagation.

Work under this project has been completed and the report is under preparation. The salient observations are given below. Propagation trials were conducted using branch cuttings of ten species viz. *Tectona grandis*, *Gmelina arborea*, *Leucaena leucocephala*, *Hopea parviflora*, *Sweitenia macrophylla*, *Melia dubia*, *Xylia xylocarpa*, *Casuarina equisetifolia*, *Acacia mangium* and *Haldina cordifolia*. Two concentrations (10 and 100 ppm) of five growth regulating substances (GRS) viz. indole acetic acid (IAA), indole butyric acid (IBA), naphthalene acetic acid (NAA), coumarin and boric acid (BA) were used for treating cuttings. Treatment was given by dipping the basal portion of the cuttings in aqueous solution of a GRS for a period of 24 hours. Fresh material from the first seven species was collected every month and the treatments were repeated to find out the seasonal effect on rooting. Only limited trials were carried out with the latter three species.

Of the ten species *Leucaena leucocephala*, *Casuarina equisetifolia*, *Gmelina arborea*, *Acacia mangium* and *Tectona grandis* could be propagated by cuttings. Cuttings of *Melia dubia* and *Swietenia macrophylla* although rooted once during the trial period, the percentage of rooting was very poor (10%); *Hopea parviflora*, *Xylia xylocarpa* and *Haldina cordifolia* did not give positive response to any of the treatments. Generally, treatment with growth regulating substances was effective on induction of rooting in cuttings. Season also had a pronounced role on root induction. The best treatment and favourable month for maximum rooting varied with species. Furthermore, the treatments which induced maximum percentage of rooting were not best with regard to other growth parameters observed such as number and length of roots and number and height of sprouts. Of the seven species which responded to treatments the most easily rooted species were *Leucaena leucocephala* and *Casuarina equisetifolia* followed by *Gmelina arborea*, *Acacia mangium* and *Tectona grandis*.

(ii) Studies on the physiology of flowering in teak and eucalypts. Physiol 03/79.

The main objectives of the study are (i) to induce flowering in profusion before the stage of naturel flowering and (ii) to study the effect of various growth regulating substances. The following works were undertaken during the year.

Teak: Of about 900 sprouted grafts, 576 belonging to six different clones were selected and outplanted in an expreimental plot during June-July 1985. Treatment of sprouted grafts with CCC (Chloroethyl trimethyl ammonium

chloride) 500 and 1000 ppm, TIBA (2, 3, 5 triiodo benzoic acid) 100 and 200 ppm, ethrel (2-chloro ethyl phosphoric acid) 1000 and 3000 ppm, KNO_3 (Potassium nitrate) 1 & 2 % and GA_4 (Gibberellin 4) 10 and 50 ppm was initiated during December and is being repeated at monthly intervals. Observation on growth and other morphological changes in the plants were recorded.

In another experiment sixty sprouted grafts belonging to four different clones, maintained in polybags, were treated with CCC (1000 ppm) TIBA (2000 ppm) Ethrel (3000 ppm) KNO_3 (20%) and GA_4 (50ppm) alone and in combination with bark ringing during March 1986 Observations on morphological changes were recorded.

Chemical analysis to find out the changes occuring during different stages of development of inflorescence in teak was initiated.

Eucalypts: One year old potted plants of *E. tereticornis* were treated with CCC (500 and 1000 ppm) TIBA (100 and 200 ppm) (Ethreal (1000, 3000, 10,000 and 20,000 ppm) and Potassium nitrate (1 & 2%) by foliar spray. Another set of two year old plants was treated with CCC (500 and 1000 ppm) and ethrel (1000 and 3000 ppm) under field conditions. Treatments were repeated at monthly intervals and observations on growth and other morphological changes recorded. Higher concentration of ethrel (10, 000 and 20, 000 ppm) was toxic and caused drying up of apices and scorching of leaves. But these plants after two months developed profuse lateral shoots with abnormal smaller leaves. Almost all the axillaray buds developed to small lateral shoots. Plants treated with 3000 ppm of ethrel also showed the loss of apical dominance and profuse lateral shoot formation.

(iii) Search for natural resistance to the insect pest *Hyblaea puera* in teak- Entom 12/83.

The main objective of the project is to identify teak trees resistant to the defoliator *Hyblaea puera*, if any, so that they could be utilised for breeding resistance against the pest as a component of integrated pest management. Work carried out on the project during the year is summarised below.

Earlier results showed that some early flushing trees escaped defoliation under natural conditions. While it became apparent that this 'resistance' was due to phenological differences, clones of selected trees were raised for more rigorous testing. Twelve such clones selected from different areas

were planted inside a field cage at Peechi in a statistically designed plan for tests during the 1986 flushing season.

Methods were also developed for rearing *H. puera* in an artificial diet in the laboratory. In addition to permitting for screening for resistance, the facility of maintaining the insect continuously in the laboratory is expected to promote research on many other aspects of this seasonal pest.

(iv) Biology and ecology of the teak trunk borer *Cossus cadambae* Moore and its possible control. Entom 13 84.

This project was initiated in October 1984 and is scheduled for completion in September 1987. The objective include study of the biology and distribution of *Cossus cadambae*, the factors that lead to infestation of teak plantations and development of a strategy for management of the pest.

The infestation was found mostly in mature plantations. Eggs are laid in groups in crevices in the bark. They hatch in 20-22 days and the larvae generally get established in the axils of side branches or in callus tissue formed over injured bark. Larva initially feeds on the bark and subsequently bore into the wood. The larval stage lasts for about 7 months. Pupation occurs in the soil inside a cocoon made of silken fibres and sand particles spun together. The moths emerge in about 11-13 days; they are light brown in colour and measure about 5.2 cm in wing span. Under field conditions, the generations are continuous with overlapping generations. In light traps, the largest number of moths were recorded during May to November after which the population declined.

A study on the distribution of this insect in teak plantations in Kerala is in progress. Varying levels of infestation was recorded at Konni, Ranni, Chalakudy, Trichur, Nemmara and Parambikulam. Infestation was mostly confined to teak, but a few instances of attack were found on *Grewia tiliifolia* and *Terminalia bellerica*.

Two species of wood peckers and another unidentified bird were found to feed on the larvae of *C. cadambae* under natural conditions. In the field as well as in the laboratory, some fungal and bacterial pathogens were found on this insect. The organisms have been isolated and identified and their pathogenicity is being tested.

(v) Epidemiology of *Cylindrocladium* associated with *Eucalyptus* leaf blight and its control using soil fumigants and systemic fungicides. Pathol F.02/79.

The main objectives of the project are (i) to identify the prevalent species of *Cylindrocladium* and their distribution (ii) the host-pathogen relationships, mode of infection, survival capability and genetic variability and (iii) diurnal and seasonal variation in the incidence of conidia and its relation to disease severity and climate.

Work under this project was completed. The raw data were processed and organized into tables for statistical analysis. The analysis for most of the laboratory and nursery trials was completed. Relevant literature for the review was gathered. The salient points emerged from the data analysed are summarised below.

In vitro germination of conidia of *Cylindrocladium quinqueseptatum* began after 5 h of incubation at 20, 25 and 30°C and completed within 8 h; no germination occurred at 10 and 15°C. The optimum temperature for germination was 25°C, which is the average temperature encountered during the rainy season in Kerala. Penetration of leaves by germ tubes usually occurred directly through the epidermis and rarely through the stomata. In younger leaves the penetration was noticed within 5 h while in older ones it took 5-6 h. At the infection site necrotic lesion developed within 12 h. Five isolates of *C. quinqueseptatum*, which showed morphological differences, also indicated statistically significant differences in their requirements of various carbon and nitrogen sources. The strain differences in these isolates were further indicated in inoculation trials on a set of differential comprising 13 eucalypts. The results showed statistically significant differential interaction between the isolates and eucalypts indicating vertical resistance in eucalypts to *C. quinqueseptatum*. This also confirmed the existence of genetically different strains in this pathogen.

(vi) Diseases of *Albizia falcataria* in Kerala and their possible control measures. Pathol F 03/82

The objectives of the study are (i) to prepare a checklist of prevalent diseases of *A. falcataria* in nurseries and plantations (ii) to assess the seriousness of the disease problem and (iii) to suggest chemical control measures for important diseases.

Experimental work was completed and data statistically analysed. Preparation of the project report is in progress. Highlights of the findings are given below.

The survey conducted in seven representative and other plantations of different age groups as well as numerous nurseries recorded a total of five

diseases. In nurseries only two diseases viz. web blight and seedling wilt were observed of which web blight was common and it caused considerable mortality of seedlings if appeared within a month of emergence; seedlings 3-month-old resisted the infection. Two aerial strains of *Rhizoctonia solani*, which varied in aggressiveness were found associated with web blight. Studies on incidence and spread of web blight in relation to age of seedlings, inoculum density and two isolates of *R. solani* indicated that isolate 783 was more aggressive than isolate 766 as it caused high mortality within a short period; 60-days-old seedlings were more susceptible than 75-days-old. Of the 13 fungicides evaluated *in vitro* against two isolates of *R. solani*, Bavistin and Terrachlor Super-X gave the maximum inhibition. However, *in vivo* only Bavistin 0.1% a. i., applied before transplanting the seedlings, controlled the disease caused by both the isolates. Fungicides applied after the appearance of the disease were not effective. Terrachlor Super-X could not control the disease at any stage.

Of the three diseases *Botryodiplodia* die-back, *Phomopsis* shoot die-back and bacterial wilt) recorded in plantations, only *Botryodiplodia* die back caused by *B. theobromae* was the most serious disease prevalant throughout the State. Large-scale mortality of trees due to this disease was recorded at Nangchee and Kattilappara (Thenmala For. Div.) and Kollathirumedu (Vazhachal For. Div.)- Manifestation of the disease was mainly through bark injuries caused by fire and animals. *Phomopsis* shoot die back, reported from plantations affected by fire and bacterial wilt only from one plantation at Thundathil, were not common.

Progress of the disease recorded at six monthly intervals in a special plot at Kattilappara indicate that the disease spread from tree to tree. The disease severity remained constant at moderately severe level while the incidence declined from 94.3% in June 1983 to 69.82% in May 1985. However, the mortality of the affected trees increased from 8.83% to 30.3% during the same period.

(vii) Root nodulation potentialities of *Leucaena leucocephala* in Kerala. Pathol NF 04/82.

The objective of the study is the acquisition and isolation of suitable rhizobial strains and to investigate their effectiveness. The work has been completed and the report is under preparation. Some of the important conclusions are given below.

Pelleting *Leucaena* seeds with Rhizobium improved weight of fresh nodules as well as biomass of seedlings. Isolates collected from Kerala soils (Nilambur, Nandiyode and Trivandrum) were found equally effective as the best exotic isolates suitable for nodulation.

The effect of pH on nodulation and biomass of seedlings of *Leucaena leucocephala* was found to be quite significant. The low pH had deleterious effect not only on nodulation but also on growth and establishment of the plants. Among the six rhizobium isolates selected RCR 3817, an exotic isolate, obtained from Rothamsted collection of rhizobium gave the maximum nodulation and the biomass at pH 5.7 and above. This was followed by TAL 582 at pH below 5.7. Among the Kerala isolates Nilambur isolate was most promising both at acidic and alkaline levels.

(viii) Control of teak mistletoe through trunk injection of chemicals. Pathol NF 05/84.

This is a follow up project undertaken with the objective of finding out suitable chemicals for killing mistletoe and to standardise their dose and the time of application. Progress of work during the year is summarised.

Infusion of glyphosate, delchlor and atrazine in an 18-year-old teak plantation at Machad Range, infested with mistletoes did not give any encouraging results. Also, the adjuvants did not enhance the activity of these herbicides. However, Sencor (metribuzin) gave better results when adjuvants were added. Sencor was infused into parasite-infested trees in various concentrations ranging from 0.025% (a. i.) to 0.5% (a. i.). Each concentration of Sencor was dissolved in 100, 300 & 500 ml of water to ascertain the optimum dose depending upon the size of the parasite-infested trees. A dosage of 300 ml of Sencor containing 0-025% to 0.25% (a. i.) gave most promising results. Observations are being continued to find out the delayed phytotoxicity, if any in the host tree.

A severe leaf blight of *Dendrophthoe falcata*, the mistletoe attacking teak was found to be caused by *Colletotrichum gloeosporioides*. Experiments to ascertain its potential as a biological control agent against *D. falcata* are continuing.

(ix) Evaluation of microbial pathogens for bio-control of insect pests of *Ailanthus* and teak-Pathol NF. 06/86.

The objectives of the project are (i) to identify microbial agents infecting insect pests of *Ailanthus* and teak and to establish their pathogenicity, (ii) to study

the effect of factors such as light, temperature and pH on the growth of the pathogens and the synergistic effect of the most effective pathogen and (iii) to investigate the mode of action and suitability of selected microbes in the field.

A gram positive, sporulating bacterium, *Bacillus firmus* was isolated from diseased larvae of *Eligma narcissus*. The pathogenicity of the isolate was confirmed. In addition, some gram negative bacteria were also isolated from dead *Hyblaea* larvae from field as well as those reared in the laboratory. The morphological details of these isolates were studied and sent for identification. Detailed investigations on the role of micro-organisms on other pests are being carried out.

(x) Studies on the effect of slash buring on planting site for teak Silvi 05/81.

The project was initiated with the objective of finding out whether slash burning is necessary at all and to evolve a practice of slash burning which is acceptable with respect to (a) rate of growth (b) soil properties and (c) weed growth.

Observations on growth (with respect to height and girth) and survival have been made. Analysis of date is in progress.

(xi) Possibility of employing polyurethane form nursery technique for various important forest species. Silvi 08/84

The objective is to investigate the suitability of polyurethane foam nursery technique for various species of forestry importance and to standardise nursery practices.

Experiments have been conducted in the case of *Anthocephalus chinensis*, *Eucalyptus camaldulensis* and *Casuarina equisetifolia*. Further trials are in progress.

(xii) Foliar analysis in *Eucalyptus tereticornis* and *E. grandis* to assess soil test methods for nitrogen, phosphorus and potassium. Soils 08/82.

Evaluation of nitrogen, phosphorus and potassium levels in leaves to assess the requirsments of eucalypts for these nutrients and correlation of tree nutrients content with that of the soil are the main objectives of the study.

Two study sites, one in 1977 *E. tereticornis* and the other in 1980 *E. grandis* plantation, were selected. Soil sampling consited of 12 soil pits in each site with 0—20, 20—40 and 40—60 cm depths of sampling; plant

samples were taken during three seasons. Analysis of soil and plant samples for nitrogen, phosphorous and potassium have been completed. The report is under preparation.

(xiii) Soils in teak plantations of different site quality — Soils 10/84.

The project was under taken with the objective of identifying the integrative characteristics that determine site productivity in respect of teak plantations.

Transects for study were laid out in teak plantations in Thenmala, konni, Malayattoor, Nilambur, Chethleth and Begur, and these transects covered a range of site qualities. Soil sampling has been completed in all the transects. Analyses of physical properties like bulk density gravel and sand silt and clay have been completed.

(xiv) Physical and chemical properties of soils in *Albizia falcataria* plantations. Soils 11/84.

The objective of the study is to characterise the soil, especially with reference to the physical and chemical properties, in albizia plantations.

Study areas were selected in *Albizia falcataria* plantations at Arippa in Trivandrum Forest Division and Vazhachal in Vazhachal Forest Division, both plantations established in 1977. 20 plots of 10 x 10 m were selected randomly in each area, one plot in every hectare and at each plot, samples were taken from 0—20, 20—40 and 40—60cm layers of a soil pit.The height and girth measurements of 10 trees around the soil pit were also recorded. Altogether 20 x 2 = 40 soil pits, hence 40 x 3 = 120 samples and 20 x 2 = 40 core surface samples for bulk density determination were collected. Soil samples were processed; bulk density percentage of gravel, particle size separates, pH, soil organic carbon, exchangeable bases, exchange acidity and soil organic matter fractions were determined.

(xv) Effect of varying soil moisture and bulk density on root growth of teak, eucalypt and albizia seedlings. · Soils 13/84.

The objective of the project is the determination of root dry matter yields of teak, eucalypt and albizia seedlings raised in pot culture under varying moisture and bulk density.

Trials were conducted to standardise the mettodology by which soil can be compacted in concrete pots (35 cm height x 26 cm diameter). A soil press was fabricated for this purpose. Side by side seedlings of eucalypts and albizia were raised in PVC pots (15 cm might x 7 cm diameter) in soil

compacted to three levels of bulk densities — 1.2, 1.5 and 1.7 g/cm^3 replicated 4 times, harvested and dry matter production of root and shoot determined. Teak, eucalypts and albizia seedlings raised in polypots were transplanted in the concrete pots adjusted to bulk densities 1.1, 1.4 and 1.6 g/cm^3. Nine replications were provided. The preliminary trials in the PVC pots gave the indications that growth and dry matter production of eucalypts and albizia seedlings decreased with increasing bulk densities, though there was not much difference between the second and third treatments.

(xvi) *Ex-situ* decomposition of leaf litters of teak, eucalypt and albizia' Soils 14/84.

The objective is to stduy the decomposition and incorporation of leaf litters of teak, eucalypt and albizia in plantation. soils under controlled conditions and to study the microflora involved in decomposition.

Freshly fallen leaf litters of *Eucalyptus tereticornis, Albzia falcataria* and *Tectona grandis* were collected from different plantations, air - dried and stored Measured quantities of litter were then incubated under lab conditions and outdoors in nylon mesh begs. Beginning May '85 samples were drawn 8 times from litter incubated in the lab and outdoors. 'weight loss was determined and microbial activity in litter measured each time. Microorganisms such as fungi, bacteria and actinomycetes associated with the decomposition of litter were isolated and enumerated. The identity of fungi was attempted. Organic carbon added to the soil during decomposition process was also determind.

Observations on weight loss of litter can be summarised as follows. Under lab conditions, after an year of incubation when 67% of *Albizia* litter decomposed, the decay rate in teak litter was 81% and Eucalyptus 55%. Outdoors, weight loss of *Albizia* litter was 70%, teak litter 89% and *Eucalyptus* 55%. The observations hither to show that *Eucalyptus* litter decomposes relatively slowly.

2.2 STUDIES ON NATURAL FORESTS

Natural forests, in particular the evergreen and semi-evergreen forests are managed under a polycyclic selection system in Kerala. Silvicultural systems adopted are largely based on thumb rules and not formulated on the basis of detailed ecological studies. In view of the growing importance of the natural forests to provide a variety of benefits, both direct and indirect, projects have been initiated to study different aspects of their biology and ecology.

2.2.1 Completed projects

(i) Species relation studies in moist deciduous forests of Trichur Forest Division. Ecol 05/32.

The project has been completed and the findings are summarised below.

More than 200 localities in Trichur divisionwere visited and vegetational data of 165 selected localities were analysed for structural studies. The plant communities and their successional status (Maturity Index) in different localities were also worked out. The Maturity Index studies reveal that most of the stands selected are moderately Mature with respect to their successful status. The phytosociological analysis leading to stand similarity, continum index, etc. were also done to assess the overall nature of the 'releve'. The Species Distribution Index, the Composite Index like IVI etc. of the vegetation are also incorporated. The quadrat data supplemented will give more useful information regarding the structure and status of the vegetation in general and species in particular. This can be used as a data bank for the area.

The general trend of the species with respect to mutual association has been worked out. Species have been categorized into different groups based on the nature of association. Selection of species for the plantation trials have also been indicated from the positively associated group of species. The species are further grouped into 'medium ranked group', 'character species group', 'secondary species group' etc. based on their association trend. A detailed list of species with positive associations have been incorporated.

To supplement the study, vegetation man at the scale of 1:50,000 has also been appended.

(ii) A field key to the identification of indigenous aborescent species of Kerala. Ecol 02/79.

All the previous treatments on the Kerala trees are largely based on generative characters. But, the specimens collected may not always be with generative organs (flowers and fruits). Because of this, experimental and field biologists are often put to difficulties in their identification. Never the less, identification at sight, in the field is often necessary for many practical purposes. For this an artificial key based on vegetative characters is desirable, besides descriptive floras based mainly on generative characters. To meet this need, the project was undertaken with the aimof generating a convenient key.

A checklist of the dicotyledonous tree species with a minimum of 10 m height, indigenous to the Kerala forests (341 spp.) was prepared from the regional floras. Based on field observations and studies made in the Institute Herbarium, Madras Herbarium (MH) and Central National Herbarium (CAL), a cardex set for characteristics of species was prepared. From this an artificial serial key based on vegetative characters has been compiled.

A systematic compilation of the cardex data in the alphabetic sequence of binomials is given at the end, for convenience. Nomenclaturally correct and taxonomically accepted binomials, whenever available the hasionym, the names given in Bourdillon's "The Forest Trees of Travancore" (1908) and Gamble and Fischer's "Flora of the Prescidency of Madras" (1915-1935), correct citations, the commonest Malayalam names, family name, detailed annotations of the vegetative characters, a synopsis of the generatjve characters, ecological details and distribution within the natural forests of the Kerala State are furnished. Indices of binomials and Malayalam names are also appended.

(iii) A study of the seedlings of some commercially important trees of Kerala. Ecol 03/79

Seedlings of fifty commercially important tree species of Kerala forests were studied. Seedlings used for the study were of nursery origin, raised from the seeds of identified mother trees, or collected from natural forests. Morphology of the seedlings were studied under a stereomicroscope at low magnifications. Descriptions of the seedlings and necessary drawings, are provided so as to facilitate easy identification. Based on the study, an artificial key for the fifty species, to distinguish from one another, is also provided.

(iv) Distribution of importent forest tree species in Kerala (Central Circle). Bot 03/80.

The project has been completed. Occurrence and distribution of one hundred and eight tree species in the forests in central circle are given based on field observation and herbarium studies. Due to biotic factors large stretches of forests in the circle have become dispersed groups of 'islands' and many species are threatened with extinction. Regeneration of some of the species, including endemics, is good and they can be utilised for afforestation programmes and enrichment planting.

2.2.2. Ongoing projects

(i) A study of insect pest incidence in natural forests Entom 11/83.

The main objective of the project is to test the assumption that pest outbreaks do not occur in natural forests as compared to plantations. The study is also expected to yield information usful for pest management in man-made forests through an understanding of control mechanisms that operate in natural forests.

Field work on the project has been completed and data are being analysed.

(ii) Nutrient partitioning in an evergreen forest ecosystem. Soils 12/84.

The objective of the study is to establish the nitrogen, phosphorous, potassium, calcium and magnesium distribution pattern in an evergreen ecosystem.

Investigations are being carried out in an evergreen forest at Pothumala of Nelliampathy. A plot of 50 × 50 cm has been demarcated and enumeration has been carried out. Estimation of standing biomass and litter biomass has been completed. Samples have been collected for analysis.

(iii) Preparation of a soil-cum-vegetation map of the forests of Trichur Division. Ecol 01/76.

Soil analysis has been completed in respect of 367 samples collected from 89 soil pits and 16 profiles. Vegetational study has also been completed. The report is under preparation

(iv) Phenological studies in representative evergreen forests of Kerala Ecol 04/80.

Analysis of data in respect of most of the localities has been completed.

(v) Impact of selection felling in a forest ecosystem in Kerala. Ecol 06/83.

The objective of the study is to examine the effect of the present system of selective felling in the evergreen forests particularly with reference to changes in environmental factors and their possible onsequences on regeneration. Data on logging demages, microclimatic factors like relative humidity, atmospheric temperature, soil temperature and light intensity and status of regeneration were gathered.

(vi) Nursery technique for selected evergreen species of Kerala. Silvi 09/85.

This project was formulated to assess the quantity of seed required for nurseries, to standardize the nursery techniques and to improve the growth vigour in the nurseries to produce tall plants in a short time. It is felt that planting of tall plants in the gaps of evergreen forests will help in combating competition from grasses and other rank growth.

The project commenced in July 1985 and the observations were commenced with *Hopea parviflora*. Non-availability of good seeds was a constraint with other species. In 1986, *Mimusops elengi* was also taken up. The nursery stock was improved by application of fertilizers. As per present indications, *Hopea* raised in sunken beds with addition of fertilizers are almost double the size of the plants (untreated) – height more than one meter.

2.3 STUDIES ON INDIGENOUS SPECIES (INCLUDING BAMBOOS AND CANES)

Studies on some of the indigenous species which are of considerable economic importance were continued during the year. Progress in this respect is detailed below.

2. 3. 1. Completed projects

(i) Investigations on the possibility of vegetative propagation of bamboos and reeds by rooting stem cuttings. Physiol 02/79.

Commercially important bamboos and bamboo reeds of Kerala viz. *Bambusa arundinacea, Dendrocalamus strictus, Ochlandra travancorica, O. scriptoria* and an introduced species *Bambusa balcooa* were successfully propagated vegetatively through culm cuttings. The rooting and sprouting responses were significantly enhanced by the application of one of the suitable growth regulating substances (GRS) indole acetic acid (IAA), indole butyric acid (IBA), napthalene acetic acid (NAA), coumarin or boric acid (BA). Although some cuttings rooted without GRS treatment the development of roots and sprouts was relatively poor. In all the species culm cutting extracted and treated during summar months (February to May) gave better response than in other months. This could be correlated well with high temperature and low precipitation prevailing during this period. The treatment to obtain maximum rooting and sprouting respo-nses varied with species. IBA or NAA 100 ppm during March was the most promising treatment for *B. arundinacea* while NAA 100 pmm during February to March was the best for *D. strictus*. The most effective treatment(s) for *O. scriptoria* was IBA 100 ppm in March and for *n. travancorica* NAA 100 ppm ro coumarm 10 ppm in April.

(ii) Studies on the spike disease of sandal. Pathol NF 03/80.

Sandal spike disease was first observed in the Reserve 51 of Marayoor forest range, Munnar forest division, during June 1980. More than 50 percent of the sandal trees in this reserve had been found to be affected with the disease. Rate of disease spread in two disease monitoring blocks, calculated in terms of apparent infection rate was 0.030 and 0.066 per unit per month. *Zizyphus oenoplia, Stachytarpheta* sp. and *Jasminum rigidum* showing witches' -broom symptoms found in several places in the reserve were suspected to be the collateral hosts of the pathogen.

Histopathological studies, using aniline blue and Hoechst 33258 gave evidence on the occurrence of MLO in the diseased phloem tissues. The technique

could be used as an easy method of disease detection. Electrophysiological studies using Shigomater indicated a positive correletion between severity of the disease and electrical resistance of inner bark in diseased trees. Though TEM studies showed large number of MLOs in the phloem tissues, attempts to culture the organisms *in vitro* were not successful. *Redarator bimaculatus* was identified as an insect vector of spike disease through disease transmission studies and by the presence of MLO in the tissues of intestine and salivary glands of the insects fed on spiked sandal and in the phloem tissues of plants infected through the vector.

Infusion of aqueous solution of 500 mg of tetracycline antibiotics dissolved in 500 ml of water in spiked trees gave remission of disease symptoms lasting for three to five months. Repeated infusion of tetracycline HCl in alternate months for an year did not give complete recovery. Higher doses of tetracyclines ie. 2 to 8g/tree prolonged the remission period up to seven to eight months. Infusion of tetracycline at 12g/tree was found phytotoxic. Combinations of different tetracyclines did not give any additional improvement of antibiotic action. Digitonin and 2-1, guanidinododecane acetate also gave temporary remission of disease symptoms. But cephalexin did not give any result.

2.3.2 Ongoing projects

(i) Morphological, anatomical and physical properties of *Calamus* spp. of Kerala forests Bot 05/82.

The objectives of the project are (i) to prepare a key for the identification of *Calamus* spp. based on morphological and anatomical characteristics, (ii) to study the basic density variation along the stem and (iii) to maintain a live collection in the Institute campus.

A total of 10 species of *Calamus* could be collected from the Kerala forests of which 4 are unreported. Reported species are *C. thwaitesii*, *C. hookerianus*, *C. pseudo-tenuis*, *C. gamblei*, *C. rotang* and *C. travancoricus*. Of the unreported ones, the species collected from Dhoni near palghat was a new one which is named as *C. dransfieldii* Renuka sp. nov. Another species, *C. matzianus* Schlecht collected from Nilambur is a new record to Kerala.

Out of the 10 species, 8 are found below 900 m. while the remaining two, *C. pseudo-tenuis* and *C. gamblei* prefer altitudes above 700 m.

Seedlings of *C. thwitesii* *C. hookerianus* and *C. pseudo-tenuis* have been outplanted.

(ii) Preservation of *Dalbergia* L.f. in Kerala by establishment of a germ plasm bank. Bot 06/83

The objectives of this project are (i) collection of herbarium materials and propagules of all species of *Dalbergia* in Kerala, (ii) identification of various species under the genus, (iii) raising a live collection of the genus, (iv) preparation of a taxonomic account with dichotomous keys and illustrated desorintions and (v) preparation of distribution maps for various species in the state.

Collection of various species of the genus *Dalbergia* in flowering and fruiting stages, to facilitate taxonomic study and to raise live-collections was done. Three more species were collected and their live-collections established. So far, a total of 13 species have been collected and their live-collections established. Search conducted to locate species *D. travancorioa, D. acaciifolia, D. congesta* and *D. championii* was not successful. Illustrations and distribution maps fo all the 19 taxa reported in the State have been prepared. Preparation fo the taxonomic account of the genus is in progress.

(iii) A study of the tree legumes endemic to Western Ghats of Kerala. Bot 07/85.

The objectives of the project are (i) to bring out botanical data on tree legumes of Western Ghats, (ii) to collect material for future research work and (iii) to collect propagules for trials.

Field trips were and taken in the southern region of Western Ghats to relate to the endemic legumes. Herbarium materials of the following species have been collected: *Humboldtia bourdillonii* in *H. vahliana* Wt., *H. unijuge* Bedd., *Ormosia travancorica* Bedd., *Dalbergia sissoides* Carh ex Lt. & Arn, *Cynometra bourdillonii* Gamble and *C. travancorica* Bedd, of which *H. unijuga* and *C. bourdilonii* are of recent collections.

2.4. WILDLIFE MANAGEMENT

Studies on the following projects were continued.

(i) Ecology and behaviour of Malabar Giant Squirrel. Wild 04/83.

The data collected was coded and analysed for time activity budgets. Thc frequency and size class of trees of different species in the intensive study area was tabulated. The phenology of fruiting of selected tree species were analysed for food availability.

Data analysis for food availability shows an interesting pattern. In all months except August the giant squirrel depends on seed/fruit and flower of trees of the study area. In the month of August the animal fed mostly on the bark and leaves of *Lagerstroemia microcarpa* and *Grewia tillifolia*. There was no instance of caching (= hoarding) observed in this squirrel.

This animal's distribution in the less disturbed natural forest explains that their occurrence in the wild is only possible with the conservation of the natural habitat where the canopy continuity is maintained and where there is sufficient food throughout the season. Three generations of the known squirrel was followed and social interactions recorded.

The analysis of data and preparation of report is in progress.

(ii) Habitat utilization by large mammals in teak plantations and natural forests. Wild 05/83.

Data collection from the transects in different age plantations have been completed. The data has been coded and entered in computer. The analysis is in progress. Feeding trials on captive elephants, sambar and spotted deer were carried out to determine the importance of different species to the animals. The platations seem to have different plant combinations and animal occupancy at different ages.

(iii) Movement pattern of Asiatic Elephant, *Elephas maximus* in Parambikulam Wildlife Sanctuary. Wild 06/84.

The project was started in September 1984. A herd of eleven individuals consisting of different age and sex classes were followed in summer and rainy seasons. The routes taken by the herd were plotted on a map. The animals were found to confine themselves in and around the lake area in summer and started moving to far off areas with the onset of rains.

Another herd of 11 elephants was selected in February, 1986 and they are being followed regularly.

2.5 Wood Utilisation:

2.5.1. Completed projects

(i) Natural durability of commercial timbers of Kerala with reference to decay. Wood 05/80.

Natural durability of five timber species of Kerala, namely, *Mesua nagassarium, Hopea parviflora. Vateria indica, Vepris bilocularis* and *Vitex altissima* was studied adopting accelerated laboratory soil-block test method. *Bombax ceiba* was used as reference timber. Test fungi included three brown rotters and six white rotters (two species were represented by two strains). Fungi were screened for their virulence and the following virulent ones, namely, *Lenzites trabea, Polyporus palustris* (brown rotters), *P. hirsutus. P. sanguineus* and *P. versicolor* (white rotters) were used in the further study.

Wood of *M. nagessarium*, *H. parviflora* and *V. altissima* lost less than 10 percent weight when exposed to any, test fungus and these timber species are grouped under 'highly resistant'. Wood of *V. indica* was 'resistant' against all the fungi, even though it was rated as non-durable by the graveyard stake test. *V. bilocularis* was highly resistant against *L. trabea* but in general, it is only moderately resistant.

Significant inverse correlation between density and percentage weight loss was found in the case of *H. parviflora* and *V. bilocularis*. However, this relationship was either poor or not consistent in the case of other timber species.

Among the brown-rot fungi, *P. palustris* was the most virulent and among the white-rot fungi, *P. versicolor*. These two fungi could be used as representative test fungi.

(ii) Wood and bark properties of branches of selected tree species growing in Kerala. Wood 06/82.

In the present system of logging and timber utilisation, branches remain as the major unutilised reserves of the industry. With a view to evaluating raw material quality of branches in relation to those of stem wood propertiee of eleven selected timber species were studied The properties examined ars density of wood and bark, percentage of bark and heart wood, proportion of wood components, viz. fibres, vessels, rays and parenchyma, and fibre length. The timbers studied are benteak, cashew, coraltree, dhamen, dillenia, nurjan, irul, kindal, padri, rubber wood and teak.

No statistically significant difference is found between branches and stem either in wood and bark density or in percentage of fibres, vesseles, rays and parenchyma of majority of the species. The average percentage of bark is significantly greater in branches than in stem. It ranges from 10.3 (in benteak) to 28.9 (in cashew) in branches as against 4.8 to 16.2 in stem. Heartwood percentage is considerably lover in the branches. On an average, branch fibre length is 12 percent lower than stem fibre length. Mostly, wood density and bark percentage are higher at the top, while the heartwood percentage and fibre length are greater at the bottom of branches and stem. The coefficients of variation and analysis of variance reveal that with a few exceptions, the variability of these properties among branches and stem is not large. Branch diameter is an important quality parameter as it is correlated with bark and heartwood percentage, fibre length and wood and bark density of certain species. The results of this study suggest that branches can be an additional source of raw material for pulp, paper and board industries.

The among-species comparison, based on statistical test shows that (i) coral tree is low-density (400kg/m^3) timber; cashew comes under moderately low-density (400-500 kg/m^3) hardwood and rest of the species are medium density (550-750 kg/m^3) hardwoods, irul being the heaviest timber, (2) With average fibre length below 1 mm cashew is a short-fibered hardwood. Dillenia, with average fibre length of 2.7 mm can be included under long-fibred species and rest of the species come under the hardwoods of medium-sized fibres (average fibre length of 1.0-1.5 mm). *Dillenia* is therefore, of particular interest to the paper industry in meeting the long-fibre needs.

2. 5. 2. Ungoing Projects

(i) Comparison of wilt diseased and non-diseased (overaged) coconut stem with respect to their utilisation potential. Wood 08/84.

The objectives are (i) to generate basic information on physical and mechanical properties of wilt-diseased and non-diseased coconut stem wood, (ii) to determine sawn timber out put and, (iii) to evaluate charcoal production by portable unit.

Linear regression equations on the relationship between height and sawn timber output were arrived at for both non-diseased senile palms and wilt-diseased palms of all age groups.

Stem wood density of palms increased with age. However, outer zone specimens from basal and middle portions of the palms did not differ in density significantly. The volumetric shrinkage of coconut palms was determined to be 9.6 percent and the fibre saturation point, 23.3. percent.

(ii) Sapstain fungi of some commerrially important timbers and their chemical control. Pathol F 04/86.

The important objectives of the study are: (i) To identify fungi causing sapstain in timbers of *Ailanthus triphysa, Albizia falcataria, Alstonia scholaris, Anacardium occidentale, Bombax ceiba, Hevea brasiliensis, Macaranga peltata and Mangifera indica.*, and (ii) Laboratory evaluation of chemicals for possible control of sapstain fungi.

Preliminary information on the loss of timber due to sapstain, in relation to a particular season was gathered from some of the saw mills, timber depots, match factories, plywood and packing case manufacturing companies in and around Trichur. Samples of stained wood of each species were collected. Repeated isolations were done from the samples and the fungal isolates were maintained in potato dextrose agar for further studies.

(iii) Techno-economic study of sawmilling industry in Kerala. Econ 06/1985.

The main objectives of the study are: (i) to examine the structure and working of sawmilling industry with particular reference to its linkages with wood production and end uses of wood and (ii) to study the technological aspects of processing and the response of the industry to the decline in availability of wood.

The duration of the project is one year starting from April 1985 The work such as review of literature and preparation and testing of questionnaire was carried out in the first half of the period. Also, attempts were made to gather information on wood consumption and number of saw mills in Kerala from secondary sources such as Directorte of Economics and Statisties, State Planning Board, Small Industries Service Institute, etc.

The study is mainly based on primary data collected from a sample of saw mills. Saw mills are distributed in all the districts in the State. However 80 percent is concentrated in 8 districts such as Ernakulam, Trichur, Calicut Cannanore, Palghat, Malappuram, Kottayam and Quilon. 165 saw mills have been drawn randomly from the above 8 districts and information has been collected by convassing the schedules by visiting each selected saw mill. Till March 1986, data have been collected from 150 saw mills.

2.6 FOREST RESOURCE MANAGEMENT

2. 6. 1. Completed Projects

(i) Analysis of factors influencing timber prices in Kerala. Stat 05/79.

The report on the project has been prepared and the salient information is summarised below.

Average annual prices for 8 species for the period 1956-57 to 1981-82 were estimated from the data collected from the records of the Forest Department. The species considered a were Anjily (*Artocarpus hirsutus*) Chadachy (*Grewia tiliifolia*), Irul (Xylia xylocarpa), Maruthu (*Terminalia paniculata*), Teak (*Tectona grandis*), Thembavu (*Terminalia crenulate*), Vengai (*Pterocarpus marsupium*) and Venteak (*Lagerstoemia microcarpa*). Five-year moving averages, based on real prices obtained by deflating the current prices using wholesale price indices, were utilised to identify the trend. From the analysis it could be seen that prices of all species had increased over the whole period. The period upto 1976–77 was characterised by stable prices and the increase was marginal. A sharp increase in prices for all species was noticed during the period from 1976-77 onwards.

Both changes in supply and demand seem to influence the prices. The average annual supply of timber has declined to 69 percent between the periods 1968-69 to 1976-77 and 1977-78 to 1981-82. While supply has declined internal demand has increased, primarily due to growth of the construction activity as indicated by the increase in the number of buildings. Price expectation during sales to consumers seems to be an important factor that determines bid prices. Price expectation, however, depends upon anticipated demand and expected supply. During the period from 1976-77 onwards, not only that demand has increased but also supply has declined, and both have cumulatively contributed to a rapid price increase.

On the basis of the circle-wise real prices of timber for the priod 1975-76 to 1981-82, it could be observed that for certain species the prices were consistently high in some circles for most of the years while for some others, such a consistent trend was not noticeable. Local preferences developed over time, availability etc. seem to be the most important factors affecting such regional variation in prices.

(ii) Forest management systems in the tropical mixed forests of india. Econ 06/84.

Final report on the project has been prepared and submitted to FAO, the sponsor of the study. Summary of the findings is given below.

The tropical mixed forests of india form an important natural resource providing a variety of goods and services. Depending upon the vegetation characteristics and the prevailing socio-economic conditions these forests are managed under different silvicultural systems. An analysis of various systems in vogue indicate considerable divergences between theory and practice. What is actually followed seldom resemble what is described in silvicultural text books.

Selection, shelterwood and eoppice systems rely entirely on natural regeneration. Although overtime clearfelling followed by artifical regeneration is increasing in importance, as such natural forests supply most of the wood requirements. A detailed study of the management practices indicates the limitations of present approaches. In most cases regeneration has been neglected, seriously undermining sustainable production of goods and services Fire, grazing and other biotic factors have further complicated the situation accelerating the degradation process. The low growing stock and poor increment in indian forests are attributable to this.

Developments in biological and technical sciences have not significantly influenced the Management of natural forests. Institutional changes in forest administration have been marginal and policing of forest property continues to

be the main function. Establishment of forest development corporations have not improved natural management as they have mostly concentrated clearfelling and artificial regeneration with profitability as main objective.

Given the low growing stock, uncertainty of natural regeneration and severe biotic pressures, natural management has serious limitations in fulfilling the various social needs. Intensively managed plantations raised on the extensive barren and degraded land alone can reduce the pressure on natural forests, and thus facilitating their sustainable management.

2. 6. 2. Ongoing projects

(i) A data bank for the foresiry sector in Kerala Stat 02/77.

The project had the objective of compiling the data pertaining to the forestry and allied activities in the state. The data available in the administration reports of the Kerala Forest Department on area under forest out-turn of timber, revenue, expenditure, timber transaction through depots and breaches of forest regulations for the period since 1956-57 were compiled. Trend analysis is in progress.

Data on age and species wise area under plantations in each Range were obtained from twenty one out of twenty six divisions in the state.

Information on yield and factors associated with yield of Eucalypts plantations are being obtained from plantaion journals maintained at the Range Offices. Nine out of thirteen divisions have been covered so far.

(ii) Statistical techniques in forestry research and forestry. Stat 06/84.

The project was initiated with the objective of finding application for the recent statistical techiniques in forestry research and forestry. The first phase was a review of the recent developments in the field. Attempts to develop appropriate statistical techniques whereever needed are in progress.

(iii) A socio-economic study of farm forestry in Kerala. Econ 02/82.

Analysis of the data collected during sample survey is in progress. Programmes for analyses have been prepared and the entire data have been computerised for easy retrieval and analysise.

(iv) History of forest maniagement in Kerala. Econ 05/1984.

Data on wood production, investment on various forestry activities, revenue, growth in area under pantations and such other details have been collected. Analysis on the general trends in relation to forest land use is in progress.

(v) Long term environmental and ecological studies of Pooyamkutty hydroelectric project - Western Ghats of Kerala - Preconstruction stage analysis. Gen 03/85.

A major part of the submergible area has been perambulated and information has been gathered on the existing land use pattern. Salient details on locality factors, tree cover, wildlife, human interference etc. have been collected adopting a grid system. Extensive botanical collections have been made from the submergible ares of the Pooyamkutty dam. Information has been gathered on forest management practices in the area, particularly the collection of reeds by the Hindustan Newsprint Unit and traditional workers engaged in mat and basket weaving.

3. EXTENSISON ACTIVITIES

Scientists from the Institute were consulted by the Forest Department and other agencies and the Institute responded to the practical problems. Considerable time was devoted to extension activities. The following main problems were investigated and suitable recommendations given.

3.1. Soil problems

(i) Mortality of Matty (*Ailanthus triphysa*) seedlings at Vaikom nursery.

Effect of fire on soil properties at Kulamavu.

Soil study in Wynad forest division.

Wilting of casuarina saplings in Kasaragod.

3.2. Insect problems

Tree species and location	Problem caused by
Ailanthus triphysa at Mullaringad Kothamangalam) and Adimaly (Malayattur Div.)	*Atteva fabriciella* and *Eligma narcissus*
Bamboo nursery at Chulli (Athirappally)	Grasshopper
Bamboo secondary nursery at Wadasserikara	*White grubs*
Bamboo nursery at Kannoth, Wynad	Cutworms
Albizia falcataria at Karavaloor (Anchal)	*Eurema blanda silhetana*
Acacia auriculiformis at Vazhachal	Grass hoppers/cut worms
Swietenia macrophylta at Kannoth	*Hypsipyla robusta*
Eucalyptus grandis at Valayanikulam (Munnar Div)	*Sahyadrassus malabaricus*
Teak nursery at Padikappus (Munnar Div)	White grub

3. 3. Disease problems

Disease/cause diagnosed	Locality
Cylindrocladum ef blighlt	Attappara, Pachakanam
Stunting of *Acacia auriculiformis* seedlings - excessive use of urea and stem infection	Kollathirumadu
Cylindrocladium leaf blight	Kothamangalam
Botryodiplodia root infection of teak	Murinakal, Agricultural Dept. Kottayam
Bacterial wilt of teak seedlings	SF, Ponthenpuzha and Panakkachira Kottayam
Pink disease of *E. tereticornis*	KFDC, Punnala Punalur
Bacterial wilt of *Casuarina* seedlings	SF, Kasaragod
Die-back, Ascomycete infection on stem	Kuthuparamba
Bacterial wilt of teak saplings	Chalakudy
Pink disease of *Pterocarpus santalinus*	Palappilly Kodanad Range
Fusarium wilt of pine	Kulamavu, Fire Training Centre & Peermade Research Range
Pink disease of teak	Pattikkad
Insect-fungus complex-death of *Cedrella toona*	Dandeli, Karnataka
Over-crowding-yellowing	Adirappally
Unknown etiology-death of 2-year-old plants occurred 3-4 months ago	SF Plantation VSSC, Trivandrum
Collar rot of *Ailanthus & Casuarina* seedlings	SF, Perumbavoor

3.4. Wood identification / preservation

Wood samples received from public and private organisations were identified.

Prophylactic treatment of rubber wood planks and billets was demonstrated to M/s Harrisons Malayalam Ltd. and technical details on the preservative treatment were supplied to various firms.

Technical details on behaviour of wood under compression at freezing temperatures, preservative treatment of wood, etc. were given to M/s Uhde India Ltd.

Information on utilisation of coconut wood, calorific value of different fuelwood species, etc. was given to different firms.

4. PUBLICATIONS

The following research reports and papers were published during the year.

4.1. Research Reports:

Alexander, T. G. and Thomas P. Thomas 1985. Physical properties of Soils in relation to eucalypt growth. Final Rep. Res. Proj. Soils 09/1982. 11pp.

Bhat, K. M., Bhat, K. V. and Dhamodaran, T. K. 1985. Wood and bark properties of branches of selected tree species growing in Kerala. Final Rep. Res. Proj. Wood 06/1982. 34 pp.

Balasubramanyan, K., Swarupanandan, K. and Sasidharan, N. 1985. Field key to the identification of indigenous arborescent species of Kerala forests. Final Rep Res. Proj. Ecol 02/1979. 175 pp.

Balasubramanyan, K. and Swarupanandan, K. 1986 A Study of the seedlings of some commercially important trees of Kerala. Final Rep Res. Proj. Ecol 03/1979. 64 pp

Balasundaran, M., Nazma and Gnanaharan, R. 1985. Natural durability of commercial timbers of Kerala with reference to decay. Final Rep. Res. Proj. Wood 05/1980. 15pp.

Gopalakrishnan Nair, N. and Sasidharan, N. 1985. Distribution of important forest tree species in Kerala (Central Circle). Final Rep. Res. Proj. Bot 03/1980. 31pp.

Ghosh, S. K., Balasundaran M. and Mohammed Ali, M. I. Studies on the spike disease of sandal. Final Rep. Res. Proj. Pathol (NF) 03/1980. 56 pp.

Krishnankutty, C. N., Rugmini, P. and Rajan, A. R, 1985. Analysis of factors influencing timber prices in Kerala. Final Rep. Res. Proj. Stat 05/1979. 25 pp.

Menon, A. R. R. and Balasubramanyan, K. 1985. Species relation studies in moist deciduous forests of Trichur forest Division (Kerala). Final Rep. Res. Proj. Ecol 05/1987. 194 pp.

Nair, K. S. S., Sudheendrakumar, V. V., Varma, R. V. and Chacko, K. C. 1985. Studies on the seasonal incidence of defoliators and the effect of defoliation on volume increment of teak. Final Rep. Res. Proj. Entom 02/1977. 78 pp.

Sharma, J. K., Mohanan, C. and Maria Florence, E. J. 1985. Disease survey in nurseries and plantations of forest tree species grown in Kerala. Final Rep. Res. Proj. Pathol (F) 01/1979. 268 pp.

Sudheendrakumar, V. V. 1986. Studies on the natural enemies of teak pests *Hyblaea puera* and *Eutectona machaeralis*. Final Rep. Res. Proj. Entom 10/1983. 23 pp.

Surendran, T. and Seethalakshmi, K. K. 1985. Investigations on the possibility of vegetative propagation of bamboos and reeds by rooting stem cuttings. Final Rep. Res. Proj. Physiol 02, 1979. 47 pp.

Varma, R. V. 1986. Seasonal incidence and possible control of important insect pests in plantation of *Ailanthus triphysa*. Final Rep. Res. Proj. Entom 09/1983. 42 pp.

4.2. Papers:

Balasundaran, M. and Ghosh, S. K. 1986. Mistletoe problem of trees in India. *In* Vistas in plant pathology, Eds. Varma, A. and Verma J. P, pp. 205-219. Malhotra Publishing House, New Delhi.

Balasundaran, M., Nazma and Gnanaharan, R. 1985. Wood of *Mesua nagassarium* (Burm. f.) Kosterm - its natural resistance to decay fungi. Material und Organismen 20: 215-220.

Bhat K. M. 1985. Properties of selected less - known tropical hardwoods. J. Indian Acad. Wood Sci. 16: 26-35.

Gnanaharan, R. and Dhamodaran, T. K. 1985. Suitability of some tropical hardwoods for cement bonded wood-wool board manufacture. Holzforschung 39: 337-340.

Gnanaharan, R., Dhamodaran, T. K. and Thulasidas, P K. 1985. Sawn timber output from wilt – diseased and non-diseased coconut palms. Indian Coconut Journal 16 (2): 6-12.

Gnanaharan, R., Dhamodaran, T K. and Thulasidas, P. K. 1986. Physical properties of stem wood of wilt-diseased and nondiseased coconut palms. Indian Coconut journal 16 (10) : 10–15

Gnanaharan, R., Sudheendrakumar, V. V. and Nair, K. S. S. 1985. Protection of cashew wood in storage against insect borers. Material und Organismen 20: 65-74.

Maria Florence, E. J., Sharma, J. K., Sankaran, K V. and Mohanan, C. 1985. Some diseases of forest tree seedlings in India caused by *Sclerotium rolfsii* and *Rhizoctonia solani*. Eur J. For. Path. 15: 187-190.

Mohanan, C , and Sharma, J K 1985. Shot-hole disease of *Terminalia paniculata* caused by *Cylindrocladium quinqueseptatum* – a new record. Eur. J. For. Path 15: 157-159.

Mohanan, C. and Sharma, J. K. 1985 *Cylindrocladium* causing seedling diseases of *Eucalyptus* in Kerala, India. Trans. Br. Mycol. Soc. 84 (3): 538.

Nair, K. S. S. 1985. Role of behavioural studies in the development of management strategies for forest insect pests. Proc. Indian Acad. Sci. (Anim. Sci.) 94 (3): 341-350.

Nair, K. S. S. and Sudheendrakumar, V. V. 1985. The teak defoliator, *Hyblaea puera*: Defoliation dynamics and evidence for short range migration of moths. Proc. Indian Acad. Sci. (Anim. Sci.) 95 (1): 7-21.

Nair, K. S. S. and Varma, R. V. 1985. Some ecological aspects of the termite problem in young eucalypt plantations in Kerala, India. Forest Ecol. & Management 12: 287 - 303.

Nair, C. T. S. 1986. Bamboo - based industry in Kerala State, India. *In* Appropriate Forest Industries. FAO Forestry Paper 68. pp. 99-109, FAO, Rome.

Sharma, J, K., Mohanan, C. and Maria Florence, E. J. 1985. Occurrence of Cryphonectria canker disease of *Eucalyptus* in Kerala, India. Ann. Appl. Biol. 106: 265-276.

5. PARTICIPATION IN SEMINARS, WORKSHOPS, ETC.

5. 1 Seminars, Workshops, etc, attended by KFRI staff

During the year the Institute staff attended the following seminars/ workshop.

1 Dr. R Gnanaharan attended the National workshop on wood processing at Calcutta on 8-10 April 1985.

2 Dr. K. K. N. Nair attended a seminar on the Ecorestoration of Sasthamkottah Lake at Quilon on 5-6 July, 1985 and presented a paper 'Ecorestoration in and around Sasthamkottah Lake.'

3 Dr. T. G. Alexander, under the sponsorship of East-West Centre/Environment and Policy Institute, Hawaii, participated in the Regional Workshop on the roles of agroforestry in site protection and amelioration held at the Institute of Forest Conservation, Los Banos, Philippines from 4-10 September, 1985 and presented a paper "Taungya and soil management during establishment phase of forest plantations in Kerala."

4 Dr. George Mathew attended the All India Workshop-cum Training on Pheromones and Pest Control held at University of Agricultural Sciences, Bangalore, from 23 to 29th September, 1985.

5 Dr. K. S. S. Nair, Dr. George Mathew and Dr. V. V. Sudheendrakumar attended the National Seminar on Entomophagus insects and other arthropods, held at Calicut on 9-11 October, 1985. Dr. Nair presented a paper entitled 'Migration mechanism of parasite evasion.' Dr. Mathew presented a paper entitled 'Natural enemies of some timber borers in Kerala and their possible role in regulating pests incidence'. Dr. Sudheendrakumar presented a paper entitled 'The role of parasites in regulating populations of *Hyblaea puera* in teak plantations.'

6 Shri. M. I. Mohammed Ali attended the 8th IUFRO Mycoplasma Conference, held at Indian National Science Academy, New Delhi from 13-15 December, 1985 and presented three papers, entitled : 'Studies on little leaf disease of eucalypts' by M. Balasundaran, M. I. Mohammed Ali and S. K. Ghosh, 'Association of sandal spike MLO with the insect vector, *Redarator bimaculatus* Dist. by M. Balasundaran, M. I. Mohammed Ali, S. K. Ghosh and V. Sundararaman and 'Association of mycoplasma-like bodies in the insect transmitted spike disease of sandal' by M. I. Mohammed Ali, M. Balasundaran and S. K. Ghosh.

7 Sri. K. Shanmuganathan and Dr. J. K. Sharma attended a meeting of Southern Regional Silviculturists and Forest Research Workers' Conference at Bangalore from 1-4 January, 1986.

8 Dr. R. Gnanaharan attended the Workshop on Building Materials, their availability, production and use at Trivandrum on 24 January, 1986 and presented a paper entitled 'Application of wood and wood products for building construction.'

9 Dr. R. V. Varma and Dr. George Mathew attended a symposium on insect physiology, ecology and behaviour held at Trivandrum on 18-20 February, 1986. Dr. Varma presented a paper entitled 'Seasonal occurrence and factors regulating the populations of major pests of Ailanthus' and Dr. George Mathew presented a paper entitled 'Some aspects of the biology and ecology of the teak carpenter worm *Cossus Cadambae*.'

5.2 KFRI Seminar : The following seminars were organised at the Institute during the year.

Dr. P. V. Nair	:	Visual aids in publications and seminars (29 April 1985)
Dr. K. S. S. Nair	:	Insect sex pheromones – A new tool for manipulating pest populations (6 May 1985)
Dr. T. G. Alexander	:	Conservation-oriented soil management in forest plantations (20 May 1985)
Smt. E. J. Maria Florence	:	Sap stain fungi (3 June 1985)
Dr. K. Jayaraman	:	Forest stand modelling and simulation (1 July 1985)
Shri K. Shanmuganathan	:	Sea turtle conservation in India (29 July 1985)
Dr. S. Kedharnath	:	Exotics (12 Aug. 1985)
Dr. William Bentley	:	Problem-solving in forestry research (13 Aug. 1985)
Sri. P. K. Muraleedharan	:	Some aspects of valuation of teak plantations in Kerala (19 Aug. 1985)
Dr. K. K. Seethalakshmi	:	Role of gibberellins in flowering (16 Sept. 1985)

Sri. M. I. Mohammed Ali	:	Pesticide residues (14 Oct. 1985)
Dr. P. V. Nair	:	Remote sensing (28 Oct. 1985)
Smt. E. P. Indira	:	Breeding systems and their importance in forest genetics (4 Nov. 1985)
Dr. S. Sankar	:	Social and environmental aspects of Social Forestry Projects (18 Nov. 1985)
Sri. Mammen C.	:	Review of plantation forestry in Kerala (16 Dec. 1985)
Dr. K. V. Bhat	:	Decorative characteristics of wood (30 Dec. 1985)
Sri K. Mohanadas	:	Insects of medical importance (27 Jan. 1987)
Prof. P. S. Ramakrishnan	:	Man in the humid tropics (4 Feb. 1986)
Prof. M. A. Rao	:	High altitude flora of the Himalayas (4 Feb. 1986)

6. INFRASTRUCTURE

6. 1. Library

6. 1. 1. Acquisition of documents

Details of the various documents acquired in the library during 1985-86 are furnished below.

Sl. No.	Items	Nos. acq.	Total of each item as on 31st March '86
1.	Books (including books received as gift)	416	9847
2.	Reprints	539	4763
3.	Photocopies	103	1283
4.	Journals (current subscriptions)	2	236
5.	Backvolumes	200	1640
		1260	17769

6. 1. 2. Documentation

All the documents acquired during the year were processed and made available for reference. The library continued the system of issuing the

library News Release which helps to bring to the notice of researchers new additions to the library. The reprographic facility was enhanced by procuring an automatic plain paper copier.

6. 2. Buildings: (1) Construction of the following buildings were completed during the year.

1. Director's Bungalow KFRI Campus
2. Construction of 10 type II quarters KFRI Campus
3. Construction of Duplex type, type I quarters, Nilambur Sub Centre
4. Construction of Orchid House, KFRI Campus.

work on permanent water supply to the sub centre campus in progressing.

(ii) Although the construction of the Teak Museum and Study Centre was scheduled to be completed by December 1985, work could not be completed due to paucity of funds. The frame structure, including casting the concrete roof has been completed.

7. FINANCE:

The budget for 1985-86 approved by the Governing Body was Rs. 87.75 lakhs. The Government released only Rs. 55 lakhs during the year. For want of funds, an amount of Rs. 11.57 lakhs remain unpaid to contractors and other agencies towards the expenditure on civil works.

Appendix I

GOVERNING BODY

The Governing Body constituted as per Government Order M. S. No. 11 81/Plg dated 24.3.1981 continued during the year. The Governing Body consists of the following members.

1. Shri K. P. Nooruddin — : Chairman
   Minister for Forests
   Government of Kerala
   Govt. Secretariat
   Trivandrum.

2. Dr. S. Vasudev — : Vice Chairman
   Chairman
   State Committee on Science,
   Technology & Environment
   Trivandrum.

3.	Secretary to Govt. of Kerala Dept. of Planning & Economic Affairs Govt. Secretariat Trivandrum.	:	Member
4.	Secretary to Government Finance Department Govt. Secretariat Trivandrum.	:	"
5.	Vice-Chancellor Kerala Agricultural University Mannuthy.	:	"
6.	Chief Conservator of Forests, Kerala Trivandrum.	:	"
7.	The Inspector General of Forests Ministry of Agriculture Dept. of Agriculture & Co-operation Krishi Bhavan New. Delhi.	:	"
8.	Director Kerala Forest Research Institute Peechi.	:	"
9.	Shri. J. C. Varmah "Shivdham" 194-E, Rajpur Road P O. Rajpnr Dehra Dun (U. P) Pin: 248009.	:	"
10.	Shri Hari Singh Rtd. I. G. of Forests No.48, First Cross HAL Stage. III Bangalore.	:	"
11.	Shri K. K. Nair Rtd. Chief Conservator of Forests Komath House Cannanore Road Calicut.	:	"

12. Prof. Y. M. L. Sharma : Member
International Forestry Consultant
171- VI Cross
Gandhinagar
Bangalore-9.

13. Shri A. K. Kaderkutty : ,,
Managing Director
Western India Plywoods Ltd.,
BALIAPATTOM P. O.
Cannanore.

Appendix II

EXECUTIVE COMMITTEE

The Executive Committee consists of the following persons.

1. Dr. S. Vasudev : Chairman
Chairman
State Committee on Science,
Technology & Environment
Trivandrum.

2. Secretary to Govt. of Kerala : Member
Dept. of Planning & Economic Affairs
Govt. Secretariat
Trivandrum.

3. Chief Conservator of Forests, : ,,
Kerala
Trivandrum. : ,,

4. Director : ,,
Kerala Forest Research Institute,
Peechi.

5. Shri K.K. Nair : ,,
Rtd. Chief Conservator of Forests
Komath House
Cannanore Road
Calicut.

6. Shri A. K. Kaderkutty
Managing Director
Western India Plywoods Ltd.,
BALIAPATTOM P.O.
Cannanore

STAFF AS ON 31-3-1986

Dr. S. Kedharnath, FNA, FASc. : Director

Administration

1.	Shri M. Muhammed Usman	Registrar
2.	,, C. D. Johny	Dy. Registrar (Admn)
3.	,, P. K. Balan	Dy. Registrar (Fin.)
4.	,, P. Achuthankutty	P. A. to Director
5.	,, N. V. Narayanan Elayath	Internal Auditor
6.	,, M. K. Aravindakshan	Office Assistant
7.	,, M. S. Sukumaran	,,
8.	,, V. K. Mohanan	,,
9.	Smt. K. M. Suseela	,,
10.	Shri E. V. Eshac	,,
11.	,, K. K. Thomas	,,
12.	,, P. V. Sankaranunni	,,
13.	Smt. M. Kamalamma	,,
14.	Shri T. J. Alfred Headisjis	,,
15.	Smt. Mary Kuruvilla	Stenographer
16.	Shri P. M. Venugopalan	Receptionist
17.	,, T. Chandran	Typist
18.	,, P. Mohandas	Driver
19.	,, K. Chandran	,,
20.	,, K. R. George	Attender
21.	,, P. V. Subramanian	,,
22.	,, P. S. Raman	,,
23.	,, M. B. Dasan	,,
24.	Smt. S. Sobhana Amma	,,
		Stenographer (Joined on 7-8-85)

Engineering

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

34.	Shri K. Dhorairaj	Driver
35.	,, V. D. Johny	,,
36.	,, K. Vijayan	,,
37.	,, S. Shahul Hameed	Attender
38.	,, B. P. Sreedharan	Watcher (Joined on 24-7-85)
39.	,, K. Said Mohammed	,,
40.	,, P. M. Vasu	,,
41.	,, V. N. Balakrishnan	,,
42.	,, K. C. Subramanian	,,
43.	,, A. C. Antony	Cleaner
44.	,, C. K. Vincent	Pump Operator / plumber
45.	,, K. C. Subramanian	(Joined on 22-7-'85)
46.	,, D. Skariah	(Joined on 10-3-86)
47.	,, K. M. Velayudhan	Full-time Sweeper
		,,
48.	Smt. V. M. Amminy	
49.	,, K. D. Chinnamma	

Library

50.	Shri K. Ravindran	Librarian
51.	,, K. Sankara Pillai	Asst. Librarian
52.	,, Subash Kuriakose	Artist Photographer
53.	Smt. N. Sarojam	Library Asst.
54.	Shri K. H. Hussain	,,
55.	Smt. K. N. Rajamma	Office Asst.
56.	Shri V. Asokan	Typist
57.	,, C. A. Jose	Binder
58.	,, V. S. Neelakandan	Attender
59.	,, K. K. Ahamed	,,

Botany (Physiology)

60.	Dr. K. K. Seethalakshmi	Scientist Grade D
61.	Shri T. Surendran	,,
62.	,, C. K. Soman	Field Asst.
63.	Shri. P. A. Sankarankutty	Attender
64.	Smt. D. Sumangala Amma	Stenographer
		(Joined on 19-4-85)

Botany (Taxonomy)

65.	Shri N. Gopalakrishnan Nair	Scientist Grade D
66.	Dr. K. K. Narayanan Nair	,,

67.	Shri N. Sasidharan	,,
68.	Dr. C. Renuka	,,
69.	Shri M. S. Muktesh Kumar	Scientist Grade E
70.	,, K. K. Unni	Field Asst.
71.	,, T. Prabhakaran	Gardener
72.	,, C. Radhakrishnan	Attender (Left on 29-11-85)

Ecology

73.	Dr. K. Balasubramanyan	Scientist Grade B
74.	Shri K. Sworrupanandhan	Scientist Grade D
75.	Dr. A. R. Ramachandra Menon	,,
76.	Shri P. K. Chandrasekhara Pillai	Field Asst.
77.	,, K. R. Sevaraman	Attender

Economics

78.	Dr. C. T. S. Nair	Forest Economist
79.	Shri P. K. Muraleedharan	Scientist Grade E
80.	,, Mammen Chundamannil	,,

Entomology

81.	Dr. K. S. S. Nair	Scientist Grade B
82.	Dr. R. Venugopal Varma	Scientist Grade D
83.	Dr. George Mathew	,,
84.	Shri V. V. Sudheendrakumar	Scientist Grade E
85.	,, K. Mohandas	Scientist Grade E
86.	,, P. Padmanabhan	Field Asst.
87.	Smt K Annapoorni	Stenographer
88.	Shri E. T. Kuttykrishnan	Attender

Genetics

89.	Shri Mathew P. Koshy	Scientist Grade D
90.	Smt. E. P. Indira	,,
91.	Shri K. K. Ramesh	Field Asst.
92.	,, A. S. Sreenivasan	Attender

Pathology (Fungal Diseases)

93.	Dr. J. K Sharma	Scientist Grade B
94.	Shri C. Mohanan	Scientist Grade D
95.	Smt. E. J. Maria Florence	Scientist Grade E

96.	Dr. K. V. Sankaran	Scientist Grade E
97.	Shri K. Yesodharan	Field Asst.
98.	,, M. A. Sankarankutty	Attender
Pathology (Non-Fungal Diseases)		
99.	Shri M. Balasundaran	Scientist Grade D
100.	,, M. I. Mohammed Ali	Scientist. Grade E
101.	,, M. C. Mohandas	Attender
Silviculture		
102.	Shri K. Shanmughanathan	Silviculturist (Joined on 4-3-85)
103	,, K. C. Chacko	Junior Silviculturist
104.	Dr. R. Chandrasekhara Pandalai	Scientist Grade E
105.	Shri Nandakumar U Narath	Scientist Grade E
106	,, M. Cherukunhan Nair	Attender (Nilambur)
107,	,, K. S. Karunakaran	Attender
108.	,, P. Avunni	Watcher (Nilambur)
109.	,, K. Mohanan	,,
110.	,, A. K. Sulaiman	Cook-cum Attendant
Soil Science		
111.	Dr. T. G. Alexander	Scientist Grade B
112.	Dr. S. Sankar	Scientist Grade D
113.	Shri M. Balagopalan	Scientist Grade D
114.	,, Thomas P. Thomas	Scientist Grade D
115.	Kum. M. V. Mary	Scientist Grade E
116.	Shri A. V. Velayudhan	Attender
Statistics		
117.	Dr. K. Jayaraman	Statistician
118.	Smt. P. Rugmini	Scientist Grade D
119.	Shri C. N. Krishnankutty	Scientist Grade E
120.	,, A. R. Rajan	Programmer
121.	,, A. Ramakrishnan	Stenographer
122.	,, E. O. James Tidode	Typist
123.	,, E. P. Somasekharan Nair	Attender

Wildlife Biology

124.	Dr. P. Vijayakumaran Nair	Scientist Grade D
125.	Shri K. K. Ramachandran	Scientist Grade D
126.	,, P. S. Easa	Scientist Grade E
127.	,, E. A. Jayson	Scientist Grade E
128.	,, K. V. Sidharthan	Attender

Wood Science

129.	Dr. R. Gnanaharan	Scientist Grade B
130.	Dr. K. Mahabala Bhat	Scientist Grade D
131.	Dr. K. Vishnu Bhat	Scientist Grade E
132.	Shri T. K. Dhamodaran	,,
133.	,, P. K. Thulasidas	Laboratory Asst.
134.	,, M. C. Reghunathan	Attender

Telephone : 22058
xxv/618 : Pazhayanadakkavu
TRICHUR—680 001.

R Rajan Associates
Chartered Accountants

AUDITOR'S REPORT

We have audited the accounts of the KERALA FOREST RESEARCH INSTITUTE SOCIETY, PEECHI, TRICHUR DISTRICT. for the year anded 31 st March 1986 with the Books of accounts and the records maintained by the institute and subject to facts contained in notes regarding.

1) Valuation of current assets loans and advances Note-No. 1.

2) Non capitalisation of IIIrd phase quarters (Note - No.2)

3) Providing same depreciation rates as in the previous year (Note-No.3)

4) Non adjustment of expenditure as reflected in the Bank statements (Note-No.5)

5) Adjustment of Bank interest (Note-No-6).

We report that-

a) 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.

b) The balance sheet and Income & Expenditure account dealt with by this report are in agreement with the books of account and

c) In our opinion and to the best of our information and according to the explanations given to us the accounts give a true and fair view.

i. In the case of Balance Sheet of the state of affairs of the Institute as at 31 st March, 1986.

ii. In the case of Income and Expenditure Account of the excess of expenditure over income for the year ended on that date.

For R. RAJAN ASSOCIATES
Sd/-
(C. K. VASUDEVAN)
Partner
CHARTERED ACCOUNTANTS

Place : Trichur
Date : 23-9-86

Notes attached to and forming part of the Balance Sheet as at 31st March, 1986

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 in the ordinary course of business.

2 In the case of type-III quarters even though the construction was completed and let out to the employees, the cost of coustruction is not capitalised in the absence of final bill of the contractors, namely Kerala State Construction Corporation. For the above reasons depreciation on these quarters has not been provided.

3 Depreciation has been calculated at the rates as applied during the previous year.

4 The previous year figures were regrouped/recast where ever necessary to suit current years lay out.

5 The following amounts has been debited by the Bank for which no corresponding entry has been passed in the institute books.

Slide cabinet	Rs.2,431.00
Commission	Rs. 58.00
	Rs.2,489.00

6 Interest of Rs.55,900.50 has been credited by the Bank (Rs.21,940/-interest on F.D). However in the Balance Sheet it is included under the head interest accrued instead of under Bank Balances.

Place : Trichur

Date : 23-9-86

For R. RAJAN ASSOCIATES

Sd/
(C.K.VASUDEVAN)

Partner
CHARTERED ACCOUNTANT

KERALA FOREST RESEARCH INSTITUTE SOCIETY, PEECHI. TRICHUR

Income & Expenditure Account for the year ended 31st March, 1986

	Current year Rs. ps.	Previous year Rs. ps.
INCOME		
Interest on Savings Bank A/c. & F. D.	44,953 45	80,035.90
Miscellansous Income as per Schedule-'G'	72,350.39	1,79,691.38
Excess of Expenditure over income.	46,45,660.69	41,28,097.76
Total	47,62,964.53	43 87,825.04
EXPENDITURE		
Salary & Allowances	27,98,538 04	21,63,371.26
Contribution Employees Provident Fund	1,68,101.00	1,35,876.00
Leave travel concession	1,270.00	15,686.30
Group Gratuity assurance.	30,658.63	23,577.86
Travelling Expenses (Including Rs. 26982. 75 to governing body members-previous year Rs. 16,517. 40).	1,29,653.75	1,04,706,24
Medical Reimoursement	34,727.99	47,045,99
Leave Salary & Pension contribution	3,949.00	16,428 00
Postage	15,904.10	14,588.05
Telephone charges (Including to Rs. 5800/- relating to previous year).	38,194.00	36,526.75
Bank Charges	20.25	111,00
Rent	7,600.00	11,550.00
Printing & Stationery	77,392.32	60,566.43
Subscription to Journals & periodicals.	2,19,568.58	1,31,756.99
Repairs & Maintenance of Vehicles	2,11,068.43	3,30,725.58
Potting shed	1,71,929.58	2,19,589.33
Consumables including stores & Chemicals	71,510.68	1,73,328.46
Repairs & Maintenance of Bldg. & Equipments	9,780.00	8,749.00
Advertisement charges	4,111.00	14,186.49
Staff Welfare Expenses(Uniform)	11,404.68	9,979.18
Garden Development Expenses	6,000.00	6,000.00
Audit fee (For Audit)	3,000.00	9,785.00
Professional charges (Legal Charges) C/o.	40,14,382.03	35,34,133.91

	Current Year		Previous Year	
	Rs.	Ps.	Rs.	Ps.
B/F	40,14,382.03		35,34,133 91	
Electricity charges	80,459.48		41,642.57	
Panchayat & Muncipal Property Taxes.	20,677.23		18,455.09	
Lease Rent of land	2.00		2.00	
Miscellaneous Expenses	9,516.95		34,485.05	
Depracation of fixed assets.	6,29,901.82		6,41,941.10	
Compus Development	2,111.37		1,528.89	
Seminar & Symbosia	5,913.65		70,976.58	
Interest income provided in excess during the preceeding year adjusted.	—		44,659.85	
Total	47,62,964.53		43,87'825.04	

As per our report of even date attached.
Place : TRICHUR
Date :

For R. RAJAN ASSOCIATES
Sd/-
C. K. VASUDEVAN
CHARTERED ACCOUNTANTS

THE KERALA FOREST RESEARCH INSTITUTE SOCIETY, PEECHI, TRICHUR

	Current year Rs.	Total Previous year Rs.
SCHEDULE — 'A'		
General Fund :		
Balance as per last balance sheet	1,90,40,597-18	1,70,84,625.50
Add: Grant Received from Government of Kerala	55,00,000.00	60,84,069.44
	2,45,40,597.18	2,31,68,694.94
Less: Excess of expenditure over Income	46,45,660.69	41,28,097.76
	1,98,94,936.49	1,90,40,597.18
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 and Plywood industries.	3,183.51	3,183.51
Food and Agricultural Organisation	1,06,520.17	1,06,520.17
	1,09,703.68	1,09,703.68
SCHEDULE — 'C'.		
Current Liabilities & Provisions:		
A) Current Liabilities :		
Grant for Research work in progress as per Schedule C (i)	18,33,337.15	16,87,866.35
Security deposit from contractors.	31,776.00	24,877.00
Other Liabilities as per Schedule e (ii).	2,69,396.96	2,28,261.21
	21,34,510.11	19,41,004.56

THE KERALA FOREST RESEARCH INSTITUTE, PEECHI, TRICHUR

SCHEDULE — 'D'

Sl No.	DESCRIPTION OF ASSETS	Rate	GROSS BLOCK As at 01-04-1985	Additions	Sales	Total	DEPRECIATION Till 31-3-1985	For the year	Till 31-3-86	NET BLOCK As at 31-3-85	As at 31-3-86
			Rs. P.	Rs. P.	Rs. P.	Rs. P.	Rs. P	Rs. P.	Rs. P.	Rs. P.	Rs. P.
1	Building - Office	2.5	26,64,752.45	43,383 00	..	27,08,135.45	4,50,725.62	56,435.27	5.07,160.89	22,14,026.83	22,00.974.56
2	Building - Quarters Type I & II	2.5	28,27,005.13	...	...	28,27,005.13	70,675.12	68,908.25	1,39,583.37	27,56 330.01	26,87,421.76
3	Compound wall and Fencing.	7.5	5.79,872.24		...	5.79,872.24	1,67,796 22	30,905.70	1,98,701.92	4,12,076.02	3,81,170.32
4	Nilambur Nursery Fencing.	10	12,990.77	31,074.23	...	44,065.00	7,957.88	3,610 71	11,568.59	5,032.89	32,496.41
5	Roads	...	3,04,271.84		...	3,04,271.84	...	...	...	3,04,271.84	3,04,271 84
6	Well	...	26,295.73	...	..	26,295.73	...	...	...	26,295.73	26,295.73
7	Cycles	20	1,034.63	...	...	1,034 63	887.21	29.48	916.69	147.42	117.94
8	Bus, Jeeps & Trailers	30	4,71,388.44	...	...	4,71,388.44	4,24,958.78	13,928.90	4,38,887.68	46,429.66	32,500.76
9	Boat	10	32,219.81	...	...	32,219.81	14,743.45	1,747.63	16,491.08	17,476 36	15,728 73
10	Cars & Motorcycles	20	96,577.26	...	...	96,577 26	80,121.50	3,291.15	83,412 65	16,455.76	13,164.61
11	Electric fittings	15	3,20,688.53	43,094.54	...	3,63,783.07	1,59,455.00	30,649 21	1,90,104.21	1,61,233.53	1,73,678.86
12	Motor pumps & fittings	10	33,290.10	...	-	33,290.10	16,938.16	1,635.20	18,573 36	16,351.94	14,716 74
13	Motor Spectro Photo metre.	10	2,30,113 83	...	...	2,30,113.83	1 09,050.82	12,106 30	1,21,157.12	1,21,063 01	1.08.956,71
14	Micro Scopes	15	2,80,414.01	..	...	2.80,414.01	1,76,801 38	15,691.90	1,91,493.28	1,04,612.63	88,920 73
15	Laboratory Equipments	10	13,24,169.46	22,215.08	...	13,46,384.54	5,38,876.22	80,750.83	6,19,627.05	7,85,293 24	7,26,757.49
16	Library Books	15	13,37,577.69	1,08,277.76	...	14,45,855.45	7,54,015 74	1,03,775.96	8,57,791.70	5,83,561 95	5,88,063.75
17	Typewriters, Duplicators & Calculators	15	1,17,260 76	1,403.50	..	1,18,664.26	65,352.80	7,996.58	73,349.38	51,907.96	45,314.88
18	Furniture & Fittings	10	9,22,635 28	17,817.61	...	9,40 452.89	4,19,001 91	52,145.10	4,71,147.01	5,03,633 37	4.69,305.88
19	Refregerators	10	52,968.70	..	...	52,968.70	25,648.13	2,732.00	28,380.13	27,320.57	24,588 57
20	Air Conditioners	15	85,001.51	24.670.00	...	1,09,671.51	32,651.00	11,553.10	44,204.10	52,350.51	65,467.41
21	Office Equipments	10	11,520.77	3,175 00	...	14,695.77	5,835 53	886.00	6,721 53	5,685.24	7,974.24
22	Micro Computor	15	67,833.98	...	...	67,833.98	46,087.96	3,261.90	49,349 86	21,746.02	18 484 12
23	Research Binocular Microscope.	15	1,70,209.01	...	...	1,70,209.01	81,359.12	13,327.50	94,686.62	88,849.89	75,522.39
24	Insectorium	5	1,15,367.88	...	...	1,15-367.88	21,391.45	4,698 80	26,090.25	93,976 43	89.277 63
25	Area Metre	10	78,920.65	...	...	78,920.65	27,140.81	5,178.00	32,318.81	51,779.84	46,601.84
26	Wood Sea Zoning Plant	10	1,24,831.25	...	...	1,24,831.25	33,211.65	9,162 00	42,373.65	91,619.60	82,457 60
27	Electronic Balance	10	16,702.80	-	...	16,702.80	2,842.78	1,386.00	4,228.78	13,860.02	12,474.02
28	Potting shed	5	64,522.00	...	...	64,522.00	6,290 90	2,911.55	9,202.45	58,231.10	65,319.55
29	Utensils	10	16,368.74	...	...	16,368.74	2,051.56	1,431.70	3,483.26	14,317.18	12,885 48
30	Microstone Sharpener	10	69,692.04	---	...	69,692.04	6,969 20	6,272 30	13,241.50	62.722 84	56,450 54
31	Centrifuge	10	5,94,538.10	..	...	5,94,538.10	59,453 81	53,508 40	1,12,962.21	5,35,084.29	4,81,575.89
32	Shigo Metre	10	30,771.85	...	...	30,771.85	3,077.19	2,769.50	5,846 69	27,694.66	24,925.16
33	Computer	15	79,984.00	.	...	79,984.00	7,998 40	7,198,60	15,197.00	71,985.60	64,787.00
34	Photo Copier		...	1,33,441.95	...	1,33,441.95	.	20,016.30	20,016.30		1,13,425.65
	TOTAL	...	1,31,61,791.24	4,28,552.67	...	1,35,90,343.91	38,18,367.30	6.29,901.82	44,48,269.12	93,43,423.94	91,42,074.79

	Current year Rs	Previous year Rs
SCHEDULE 'E'		
Capital Work in Progress		
Peechi - Building III Phase and New 10 Nos, Type- II Quarters and Director's Quarters	77,07,728.24	65,12,908.24
Nilambur	3,97,636.00	2,86,396.00
Teak Museum	8,90,136 32	6,35,223.13
Total	89,95,500.56	74,34,527.37
SCHEDULE 'F'		
Current Assets Loans & Advances		
A. Current Assets		
1. Research Work in Progress As per Schedule - F (i)	13,22,753.45	12,31,788.78
2. Stocks as per inventory taken valued & certified by the Directors:		
a) Stock of stationery	24,102.15	16,423.54
b) Stores & Chemicals	25,368.94	37,731.20
c) Unused Stamps	428.55	692.15
3. a) Cash on hand	1,515.80	4,343.02
b) With Scheduled Bank	1,74,213.37	1,25,454.40
i) in savings bank a/c		
ii) in fixed deposit (being security for obtaining guarantee facility from SBI)	36,500.00	36,500.00
iii) Fixed deposit in sub-treasury	1,09,700.00	1,09,700.00
c) With sub-treasury S.B. a/c	2,35,307.57	6,52,054.94
Total	19,29,889.83	22,14,688.03

	Current year.	Previous year.
	Rs.	Rs.
B. Loans & Advances		
Advance receivable in cash or in kind or value to be received (Unsecured considered good)		
Prepaid expenses - As per Schedule F(ii)	86,498.00	1,19,507.63
Advances for Capital work in progress As per Schedule - F (iii)	17,89,793.00	17,74,430.00
Other advances as per Schedule- F (iv)	1,39,493.60	1,18,895.05
Telephone Deposit	—	5,800.00
Accrued interest	55,900.50	80,033.40
	20,71,685.10	20,98,666.08
Summary (A & B)		
Current assets	19,29,889.83	22,14,688.03
Loans & Advances	20,71,685.10	20,98,666.08
Total	40,01,574.93	43,13,354.11

SCHEDULE 'F' (i)

Research Work in Progress

C. S. I. R. collection of Pollen	11,496.91	2,458.06
Pooyamkutty Project	25,239.39	4,027.34
Assessment of consumption of Wood in Kerala (Social Forestry)	1,708.74	1,708.74
Cocunut develpment board - Wood - 08	30,077.70	17,087.90
Genetic Improvement of Teak in Kerala.	2,36,796.41	2,36,796.41
Tekkady wild Life Project	3,04,055.89	3,04,055.89
Woods-OH (Gwalior Rayons)	3,809.91	3,809.91
Multi-purpose River Valley Project	4,52,246.09	4,47,339.96
Control of insects damaging stored Reeds- Entom-04 (HPC)	6,831.79	6,831.79
FAO Project-ECON-03	2,399.10	2,399.10
FAO Project-ECON-04	10,183.43	10,183.43
C/O	10,84,845.36	10,36,698.53

	Current year Rs.	Previous year Rs
B/F	10,84,845.36	10,36,698.53
Preservation of Dalbargina Bots-06 Government of India Project.	14,462.84	9,487.63
Impact of selection felling in Forest Eco System in Kerala Western Ghats Ecol-90	2,16,868.15	1,85,602.62
Forest Management System in the tropical Mixed forests of India Econ-07.	6,577.10	—
Total	13,22,753.45	12,31,788.78

SCHEDULE 'F' (ii)

Prepaid Expenses

Journel Subscriptions	82,746.00	1,16,553.63
Insurance of Vehicles	3,752.00	2,954.00
Total	86,498 00	1,19,507.63

SCHEDULE 'F' (iii)

Advance for Capital Work in Progress

Kerala State construction Corporation.	58,293,00	3,42,930.00
Kerala Public Health Engineering Department.	17,31,500.00	14,31,500 00
Total	17,89,793.00	17,74,430.00

SCHEDULE 'F' (iv)

Other Advances

	6,385.00	5,725 00
T.A. Advance	12,296.20	14,081.55
Work-advance -given to institute scientists for research work.	—	9,672.50
Kerala Government (National Seminar)	20,851.20	21,393.60
Leave salary advance to deputationist	1,136 20	1,047.90
INSDOC Bangalore C/O	40,668.60	51,920.55

	Current year Rs	Previous year Rs.
B/F	40,668.60	51,920.55
Telephone Deposit	8,850.00	4,050.00
Deposit with K. S. E. B	22,529.00	20,765.00
Deposit with I. O. C.	195.00	195.00
Deposit with D. F. O Nilambur	100.00	100.00
Chithra Sales Corporation	840.00	840.00
Private Trunk Call Charges	—	517.50
M/s. Apte Amalgamation Ltd.	19,440.00	—
Rent Advance - Director Residence	—	5,000.00
Bharath Pumps and Compressors, Allahabad	—	536.00
P. S. Krishna Iyer	175.00	175.00
M/s. Labindra Service Thane	6,600.00	—
Director - Central Scientific Instruments.	140.00	140.00
Motorcycle Advance	18,719.00	25,176.00
Marriage Advance	8,126.00	6,008.00
L. I. C. Advance	—	1,910.00
M/s. H. C. L. Madras	285.00	—
C. W. R. D.M	—	1,386.00
M. A. Varkey	2,000.00	—
M/s. Verniculated Products, Madras	176.00	176.00
Festival advance	5,650.00	—
Advance for Training expenses to Dr. R. C. Pandalai.	5,000.00	—
Total	1,39,493.60	1,18,895.05

SCHEDULE — 'G'

Miscellaneous Income

Application fee	—	245.00
House Rent Recovery from staff	43,876.65	38,703.30
Sales proceeds of tender documents.	95.00	2,030.00
Rest House rent recovered from third parties.	2,782.60	3,251.10
Hire charges of Vehicles	21,488.98	24,307.87
National Seminar on Eucalyptus.	1,000.00	19,462.00
National Seminar on Western Ghats.	—	89,185.00
Sundry	3,107.26	2,507.11
Total	72,350.39	1,79,691.38

	Current year	Previous year
	Rs.	Rs.
SCHEDULE — 'G' (i).		
Grant for Research Work in Progress		
Kerala Forest Department	1,85,444.10	1,85,444.10
Government of India for M. R. V. Project	5,33,800.00	5,33,800.00
Gwalior Rayons — Wood — 04	15,000.00	15,000.00
Advance from H. P. C. Reeds	8,500.00	8,500.00
Grant from Government of Kerala towards Teak Museum	2,00,000.00	2,00,000.00
Grant from Government of India for preservation of Dalbargia-Bot-06	16,500.00	16,500 00
Grant from Government of India for impact of selection felling in forest Eco System-Ecol-06.	2,81,900.00	2,28,700.00
Grant from Food and Agricultural Organization-Econ-03 & Econ-04. (Rural institution for development of appropriate forestry enterprises and case study on multiple use of forest management in evergreen forests and teak plantations).	1,54,140.00	1,54,140.00
C. S. I. R. Collection of Pollen grains.	14,158.05	3,482.25
(Forest management Systems in the tropical mixed - forest of India)	47,400.00	—
FAO - Econ - 07	18,195.00	—
FAO - Econ - General	2,88,300.00	2,88,300.00
Pooyamkutty (Govt. of India) (General/03)	20,000.00	20,000.00
Grant from Social Forestry		
Grant from Cocunut development Board - Wood - 08.	50,000.00	34,000.00
Total	18,33,337.15	16,87,866.35

	Current year	Previous year
	Rs.	Rs.
SCHEDULE 'G' (ii)		
Other Liabilities		
Salary payable	2,38,261.30	1,63,978.10
T. A. Payable	11,300.80	10,463.10
Medical re-imbursement payable	1,926.60	4,572.76
Rent payable	—	1,000.00
Lease Rent payable to Govt. of Kerala.	18.00	16.00
G. P. F. subscription collected not remitted.	2,513.00	719.00
G. P. F Loan collected not remitted.	470.00	500.00
Electricity Charges payable	3,931.51	2,478.20
Audit fee payable	6,000.00	6,000 00
Life Insurance Premium collected from Staff.	412.40	487.30
Caution money deposit from library membership.	150.00	150.00
Income-tax collected and not remitted.	2,726.00	13,678.00
Sales-tax collected and not remitted.	5.50	—
Suspense Account (Cement)	—	20,556.00
Telephone charges payable	578.10	2,830.00
Co-operative society recoveries pending remittance	713.75	442.75
E. M. D of contractors	390.00	390 00
Total	2,69,396.96	2,28,261.21

THE KERALA FOREST RESEARCH INSTITUTE, PEECHI, TRICHUR

BALANCE SHEET AS AT 31st MARCH, 1986

LIABILITIES	As per Schedule	Current year Rs. Ps.	Previous year Rs. Ps
General Fund	'A'	1,98,94,936.49	1,90,40,597.18
Reserves & Surplus	'B'	1,09,703.68	1,09,703.68
Current Liabilities & Provisions.	'C'	21,34,510.11	19,41,004.56
TOTAL		2,21,39,150.28	2,10,91,305.42

ASSETS	As per Schedule	Current year Rs. Ps.	Previous year Rs. Ps.
Fixed Assets	'D'	91,42,074.79	93,43,423.94
Capital Work in progress	'E'	89,95,500.56	74,34,527.37
Current Assets, Loans and Advances.	'F'	40,01,574.93	43,13,354.11
TOTAL		2,21,39,150.28	2,10,91,305.42

Sd/-

CHAIRMAN
EXECUTIVE COMMITTEE

Sd/-

DIRECTOR
KERALA FOREST RESEARCH INSTITUTE SOCIETY

As per our report of even date attached.

For R. RAJAN ASSOCIATES

Sd/-

C. K. VASUDEVAN
PARTNER
CHARTERED ACCOUNTANTS

Place : TRICHUR

Date : 23-9-1986