ANNUAL REPORT

1987-'88

kerala forest research institute

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April 1987 March 1988

Kerala Forest Research Institute
Peechi, Trichur 680 653, Kerala

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1. INTRODUCTION

The year 1987-88 was notable for the development of a large number of interdisciplinary projects, many of them sponsored by external agencies. During the year the Institute received a grant of Rs. 58.83 lakhs from the State Government and Rs. 17.5 lakhs from other agencies against specific research projects (IDRC, FAO, Department of Environment, Govt. of India, and Kerala Forest Department).

The Governing Body met twice during the year - in August 1987 and February 1988, and the Executive Committee met 8 times.

2. INFRASTRUCTURE

Library

During the year, 249 books and 445 reprints/photocopies were acquired in the library. The number of journals subscribed were 230. Computerised databases were developed for Forest Entomology literature in India, complete list of KFRI publications and mailing list of KFRI publications, using the CDS/ISIS software package.

Campus development

Although plans were prepared for a Research Scholars' Hostel at Peechi, no progress could be made in construction, due to paucity of funds. Progress in construction of the Teak Research Centre at Nilambur was also negligible.

At Peechi a 20 x 20m plot of *Hopea parviflora* was raised. At Nilambur, in addition to maintaining previously laid out trial plots and germplasm banks, new small plots (0.005 to 0.01 ha) of nine tree species (eg. rosewood, toon, mahagony and *Mesopsis*) were laid out and maintained with location sketches and other details.

Research facilities and equipments

Construction of a mist chamber at Peechi campus for studies on vegetative plant propagation was taken up and most of the works were completed

during the year. Annual maintenance of buildings were carried out at Peechi and Nilambur. No major scientific equipments were procured due to financial constraints.

Infrastructure development suffered heavily due to lack of sufficient funds.

3. HUMAN RESOURCES

As on 31 March 1988 there were 151 regular employees - 47 scientific and 10 technical and the rest administrative and supporting (See Appendix 1). The following persons were appointed in the Institute during the period.

Shri. K. A. Gopalan, Office Assistant	— on 20.05.1987
Shri. Kurien Mathew, Driver	— on 18.06.1987
Kum. M. P. Sujatha, Scientist E, Soil Science	— on 11.12.1987
Dr. Jose Kallarackal, Scientist C, Physiology	— on 14.12.1987
Shri. P. Aravindakshan, Dy. Registrar (Fin.)	— on 15.01.1988

Shri. M. Muhammad Usman, who was holding the post of Registrar on deputation from the Govt. of Kerala, left the Institute on 18.04.1987 to take up the post of Registrar, Kerala Agricultural University. Shri. P. K. Balan, Deputy Registrar (Fin.) was promoted and posted as Registrar by the Executive Committee in accordance with the KFRI recruitment rules.

Two garden workers were employed on service conditions similar to that of the Farm Workers of the Kerala Government. During the year the Engineer Mr. K. R. Mukundan was given compulsory retirement and one of the Overseers, Mr. U. Y. John was dismissed., on disciplinary grounds.

Mr. Mathew P. Koshy, Genetics Division, Mr. T. Surendran, Physiology Division and Dr. R. C. Pandalai, Silviculture Division rejoined the Institute after training.

The following scientific staff were deputed for training.

Mr. U. Nadakumar Silviculture Divison	— Continuation of training in SFS College, Coimbatore.
Mr. Samuel Rajasekhar Silviculture	— Recruited to the Institute in March 87 and sent for training to SFS College, Coimbatore on a stipend.
Mr. E. A. Jayson	— Deputed to Wildlife Institute of India, Dehra Dun for a nine month Diploma Course in Wildlife Management.

Dr. A. R. R. Menon Ecology Division	—	Deputed to Indian Institute of Remote Sensing, Dehra Dun for a 10 month Post graduate Diploma Course in Remote Sensing.

4. RESEARCH

At the beginning of the year there were 42 ongoing research projects. Twenty one new research projects were taken up during the year and four research projects were completed and the final reports brought out. Work on several other projects were completed and preparation of reports was initiated. A statement on the status of research projects is given below.

No. of ongoing research projects as on 1-4-1987	—	42
New projects taken up in 1987-88	—	21
Total		63
No. of reports published/submitted to sponsor	—	4
No. of projects terminated	—	4
No. of Research Reports under preparation	—	18
No. of ongoing projects as on 31-3-1988	—	37
Total		63
Total No. of externally sponsored projects	—	15

During the year, 35 research papers were published in journals or proceedings and 13 were communicated for publication. Brief details of research activities are given below.

4.1 Brief details of completed projects

4.1.1. Biology and control of insect pests of fast-growing hardwood species' Final Report of Research Project Entom 05/77. KFRI Res. Report 51. (KSS Nair and George Mathew)

A study was made of insect pest problems in plantations of *Albizia falcataria* and *Gmelina arborea* in Kerala and their control.

Twenty-five species of insects were found associated with *A. falcataria*, of which all except four were new records for this tree in India. With some expections, most of them were minor pests. The bagworm, *Pteroma plagiophleps* Hamp. (Lepidoptera, Psychidae) known as an occasional minor pest of the tamarind tree, was the most serious pest. Outbreaks occurred in some plantations which led to total defoliation in patches leading to large-scale tree mortality (up to 22% in one plantation) and growth retardation. The biology of this little-known species, its seasonal incidence, host range and distribution

in Kerala are reported. It has now spread to *Delonix regia* planted as avenue trees throughout Kerala. The importance of several natural mortality factors including insect parasitoides and disease organisms have been recognized, but their quantitative impact needs to be investigated further. For emergency control, several insecticides were tested and the most effective ones determined. Caterpillars of the pierid butterfly *Eurema blanda silhetana* caused occasional localised defoliation in young stand and scolytid beetle *Xyleborus fornicatus* bored into the stem of the live saplings. The latter is recognized as a potential pest, particularly in poorer sites where the sapling are under physiological stress.

Thirty-four species of insects were found associated with *Gmelina arborea*, of which all except five were recorded on this tree for the first time in India. The insect complex included leaf feeders, sap suckers and live tree borers, but only the following are considered important. The tingitid bug, *Tingis beesoni* erupted into outbreaks in young plantations and caused defoliation, leading to die-back of terminal shoot. Young plantations were also affected by the scolytid borer, *X. fornicatus*, as in the case of *A. falcataria*. The leaf and shoot webbing caterpillar, *Epiplema fulvilinea* caused moderately high defoliation on some occasions. The defoliating beetle, *Calopepla leyana*, recognized as a major pest elsewhere in India was present in small numbers but outbreaks were not noticed. The above four species are recognized as potentially serious pests; but their full impact can be judged only when more extensive plantations are raised.

4.1.2. Foliar analysis in *Eucalyptus tereticornis* and *E. grandis* to assess soil test methods for nitrogen, phosphorus and potassium. KFRI Research Report No. 53. (S. Sankar, MV. Mary and TG. Alexander).

Although plantations of eucalypts occupy over 35,000 ha in Kerala, no studies have been conducted so far to explore the possibilities of nutrient management for increasing productivity. In this study the foliar levels of nitrogen, phosphorus and pottassium of *E. tereticornis* and *E. grandis* were analysed in relation to the content of these elements in the soil.

Field work was carried out in Kondazhi (1977, *E. tereticornis* plantation, Trichur Division) and Muthanga (1980, *E. grandis* plantation, Kozhikode Forest Division). Soils were collected from pits (0-20, 20-40 and 40-60 cm layers) and the foliage was sampled thrice (April 1983, September 1983 and March 1984). Analysis of N, P and K in soil and plant were carried out following standard procedures.

Soils in both *E. tereticornis* and *E. grandis* plantations contained low levels of N03-N and extractale P while the content of K was moderately high. The same trend was observed in foliar concentrations of these elements.

Sampling season did not have an impact on foliar levels of N, P and K. Fully expanded leaves were found to be reliable material for foliar analysis. The markedly low concentrations of N and P in the soil as well as plant material suggest that productivity can be improved by soil management.

4.1.3. Comparison of wilt-diseased and non-diseased (overaged) coconut stem with respect to their utilization potential. Final Report of Research Project Wood 08/84 (R. Gnanaharan).

Project has been completed and report submitted to the sponsoring agency, the Coconut Development Board. Sailent features of the results are given below.

Root-wilt disease affects the sawn timber output. When height was adjusted (by ANACOV techniques), it was found that non-diseased over-mature palm had an average output of 0.16 m^3 and wilt-diseased over-mature palm, 0.12 m^3. Outer zone specimens from basal and middle positions of the palm do not differ in density significantly. There was no significant difference in volumetric shrinkage either due to disease or age.

In general, wilt disease did not have any adverse effect on strength properties. However, where stiffness is critical, stem wood from over-mature palms only will be suitable. Over-mature palms compare quite well with other structural timbers like teak, anjily, jack, etc.

Coconut stem wood produces charcoal of adequate heating value (about 3900 cal/g). An yield of 25 to 28% charcoal with fixed carbon content of about 70% was obtained by employing portable type "Tongan Kiln".

4.1.4. Impact of selection felling in a forest ecosystem in Kerala. Final Report of Research Project Ecol 06/83. (K. Balasubramanyan).

The report has been prepared and sent to the Dept. of Environment, Govt. of India. The salient features of the findings are as follows :

There is a marked increase in the minimum and maximum atmospheric temperatures due to selective logging, the increase ranging to about 7°C. The mean relative humidity showed a difference of about 22%. The minimum soil temperature showed an increase of 6°C and the maximum increased by 4.3°C between worked and unworked areas. The incidence of light in different strata also showed remarkable difference between worked and unworked areas. An example, at the ground level at 8 AM the difference was of the order of 3100 Lux while at 10, 20 and 30m. levels it was 10447, 48305 and 68749 Lux, respectively.

Natural regeneration of the desired species in selectively logged area was very poor and this can be attributed to drastic changes in the microclimatic conditions; viz., soil and atmospheric temperature, relative humidity and increased light availability at various levels. Due to the tall nature of the trees and their large spreading crowns logging damages due to selection felling was heavy. Nearly half of the damages could be ascribed to crown damage. Unscientific road alignment and elephant dragging also cause damage. Potential trees for subsequent felling cycles were often damaged. Even if six trees per hectare as prescribed in the Working Plan is adhered to the opening created is estimated to be about 68 per cent.

4.2. Details of projects completed and reports under preparation

DIVISIONAL PROJECTS

4.2.1. Botany Division

Bot. 02/79 : Establishment of an orchidarium in the Institute

Principal Investigator	:	N. Sasidharan
Associates	:	VPK Nambiar
	:	C. Renuka
Date of Commencement	:	February 1979
Date of completion	:	January 1984

The orchid collection was further enriched by adding 9 species from Kuruva Island, Wynand, and Forests of Trichur : *Acrides crispum, Bulbophyllum neilgherrense, Nervilia* sp., *Liparis frazeri, Trias stocksii, Oberonia thwaitesii, O. iridifolia* var. *denticulata, Dendrobium macrostachyum* and *Oberonia* sp.

4.2.2. Ecology Division

Ecol 04/80 : Phenological studies in representative evergreen forests of Kerala

Principal Investigator	:	K. Balasubramanyan
Date of commencement	:	April 1980
Date of completion	:	May 1984

The report is under preparation

4.2.3. Entomology Division

Entom 12/83 : Search for natural resistance to the insect *Hyblaea puera* in teak.

Principal Investigator	:	KSS Nair
Associates	:	Mathew P. Koshy
	:	VV Sudheendrakumar
	:	K. Mohanadas
	:	RV Varma
	:	George Mathew

Date of commencement : April 1983
Date of completion : December 1986

Experimental work was completed and report is in preparation.

Entom 13/84 : Biology and ecology of teak trunk borer, *Cossus cadambae* Moore and its control.

Principal Investigator : George Mathew
Date of commencement : October 1984
Date of completion : September 1987

Experimental work was completed except for some follow-up observations. Part of the report was being prepared.

4.2.4. Genetics Division

Nil

4.2.5. Management Division

Econ 02/82 : A socio-economic study of farm forestry with special reference to Kerala

Principal Investigator : CTS Nair
Associates : CN Krishnankutty
: Mammen Chundamannil
: AR Rajan
Date of commencement : April 1982
Date of completion : September 1984

Work under the project was completed and data were tabulated.

Econ 06/85 : Techno-economic study of the sawmilling industry in Kerala.

Principal Investigator : PK Muraleedharan
Associate : KM Bhat
Date of commencement : April 1985
Date of completion : April 1986

Work under this project was completed and the report is in preparation.

4.2.6. Pathology Division

Pathol F02/79 : Epidemiology and control of diseases in Eucalyptus caused by *Cylindrocladium* spp. in Kerala.

Principal Investigator : JK Sharma
Associate : C Mohanan
Date of commencement : January 1979
Date of completion : January 1983

Writing up of the project report was initiated in March 1987. Writing continued but the progress was slow as the statistical analysis done earlier was not found adequate and more analysis had to be carried out. The following chapters have been completed and finalized : (1) Prevalent species of *Cylindrocladium* in Kerala and their distribution, (2) Epidemiological studies *Cylindrocladium* leaf blight. (3) Relative susceptibility of eucalypt provenances to three *Cylindrocladium* spp. (4) Pathogenic variability in five isolates of *C. quinqueseptatum*. (5) Variability in cultural characters and growth of *C. quinqueseptatum* isolates.

Pathol NF05/84 : Control of teak mistletoe through trunk injection of chemicals.

Principal Investigator	:	M Balasundaran
Associate	:	MI Mohamed Ali
Date of commencement	:	January 1984
Date of completion	:	December 1986

The draft report was completed.

4.2.7. Plant Physiology Division

Nil

4.2.8. Silviculture Division

Silvi 01/79 : Silviculture and management of fast growing indigenous hardwood species with multiple end uses.

Principal Investigator	:	CS Venkatesh
Associate	:	KC Chacko
Date of commencement	:	January 1977
Date of completion	:	January 1982

Silvi 02/77 : Study of afforestation techniques in grasslands of Kerala

Principal Investigator	:	VPK Nambiar
Associates	:	KC Chacko
	:	N Sasidharan
	:	Thomas P Thomas
Date of commencement	:	January 1977
Date of completion	:	December 1982

Draft report prepared.

Silvi 04/81 : Studies on utilisation of stump as planting material for raising plantations of *Eucalyptus tereticornis*

Principal Investigator	:	E Muhammed

Associates	: KC Chacko : T Surendran : VV Sudheendrakumar : C Mohanan
Date of commencement	: July 1981
Date of completion	: June 1984

Work on the final report is in progress.

Silvi 05/81 : Studies on the effect of slash burning on planting site for teak

Principal Investigator	: E Muhammed
Associates	: KC Chacko : Satish Williams : S Sankar : RC Pandalai : UN Nandakumar
Date of commencement	: October 1981
Date of completion	: September 1985

Analysis of data and writing up of the final report is in progress.

Silvi 06/81 : Estimation of quantity of *Eucalyptus* seeds for sowing in nurseries

Principal Investigator	: E Muhammed
Associates	: KC Chacko : RC Pandalai : UN Nandakumar
Date of commencement	: October 1981
Date of completion	: September 1983

No progress was made during the period.

4.2.9. Soil Science Division

Nil

4.2.10. Wildlife Biology Division

Wild 04/83 : Ecology and behaviour of the Malabar Giant Squirrel.

Investigator	: KK Ramachandran
Date of commencement	: January 1983
Date of completion	: April 1985

Final report was submitted to the Editorial Committee and comments obtained. Corrections are being incorporated.

Wild 05/85 : Habitat utilization by large mammals in Parambikulam Wildlife Sanctuary.

Principal Investigator : P Vijayakumaran Nair

Date of commencement : April 1983
Date of completion : September 1985

Final report submitted to Editorial Committee and comments obtained. Corrections are being incorporated.

Wild 06/84 : Movement pattern of Asiatic elephant, *Elephas maximus* in Parambikulam Wildlife Sanctuary.

Principal Investigator : PS Easa

Date of commencement : July 1984
Date of completion : January 1987

Draft report was prepared.

4.2.11. Wood Science Division

Nil

INTER/MULTI DISCIPLINARY PROJECTS

Ecol 01/79 : Preparation of soil-cum-vegetation map of the forests of Trichur Division

Principal Investigator : K. Balasubramanyan
Associates : ARR Menon
: Thomas P Thomas
: S Sankar
: MV Mary
: M Balagopalan
: TG Alexander

Date of commencement : January 1980
Date of completion : December 1983

Sectional reports on, properties of soils (profiles and pits) in the natural forests and plantations of Trichur Forest Division. 35p. (mimeo) were prepared, Preparation of forest vegetation map of Trichur Forest Division is in progress.

Silvi 07/81 : Establishment of a bambooteaux in the Institute

Principal Investigator : KC Chacko
Associates : T Surendran
: N Gopalakrishnan Nair

Date of commencement : October 1981
Date of completion : September 1986

The Bambooteaux was maintained. Following species were additionally collected and maintained in the nursery for planting out :

Bambusa ventricosa, *Melocanna bambusoides*, *Oxytenanthera stoksii*, *Bambusa tulda*, *Dendrocalamus hamiltonii*, *Phyllostachys pubescence* and *Bambusa* sps. (from Arunachal Pradesh).

4.3 On - going Projects

DIVISIONAL PROJECTS

4.3.1. Botany Division

Bot 04/82 : Establishment of a herbarium in the Institute

Investigator : N Sasidharan
Date of commencement : October 1982

Made several trips to the forests of Trichur and Parambikulam and collected 420 species. A total of 175 specimens were incorporated into the herbarium. Acronym 'KFRI' has been assigned to the Institute herbarium and will be included in the forthcoming edition of Index Herbarium.

Bot 07/85 : A study of the tree legumes endemic to Western Ghats of Kerala

Investigator : N Gopalakrishnan Nair
Date of commencement : October 1985
Date of completion : September 1988

Extensive exploration trips to relocate the endemic legumes were undertaken. Four species of *Humboldtia* could be collected from the southern region. *Sialium travancoricum*, a rare and large tree, was relocated from the Ponmudi-Kallar zone. Seeds of three variants of *Kingiodendron pinnatum* were collected and germinated and about 150 seedlings were bagged. Seeds of two species of *Humboldtia* and *Ormosia travancorica* were collected and seedlings raised.

Bot 08/85 : Distribution of important forest tree species in Kerala (Southern Circle)

Investigator : N Gopalakrishnan Nair
Date of commencement : October 1985
Date of completion : September 1988

Extensive field trips were conducted and [illegible] species were collected. Seeds of 15 species were collected and germination trials undertaken. Seedlings of *Gluta travancoria*, *Poeciloneuron indicum*, *Calophyllum elatum*, *Clausena Indica*, *Dicspyros* spp., etc. were grown in polythene bags.

Components of inter / multidisciplinary projects

Gen 03/85 : Species diversity, status of endemic and species of economic importance in Pooyamkutty Hydroelectric Project area (KKN Nair)

KFRI 108/87 : Ecological studies on reeds (MS Mukesh Kumar)

KFRI 109/87 : Taxonomy and collection of rattans (C Renuka)

KFRI 114/87 : Botanical studies and arboretum of selected indigenous species (KKN Nair)

KFRI 117/87 : Regeneration studies on some important trees of the moist deciduous forests of Kerala (N Sasidharan)

4.3.2. Ecology Division

Ecol 07/86 : Vegetation analysis and mapping of Parambikulam Wildlife Sanctuary

Investigator : ARR Menon

Date of commencement : April 1986

Date of completion : March 1988

Three field trips were undertaken to Parambikulam to complete the vegetation data. Data on plantations in the area were also collected and plantation map of the area was prepared. Analysis of vegetation is in progress. Vegetation mapping of five out of the eight grids have been completed.

Components of inter/multidisciplinary projects

Gen 03/85 : Existing vegetational types and estimation of loss in vegetational cover due to submersion (K Balasubramanyan)

KFRI 114/87 : Ecological studies on selected indigenous species (ARR Menon)

KFRI 117/87 : Regeneration studies in moist deciduous forests (K Swarupanandan)

KFRI 121/87 : Establishment of permanent sample plots and long term monitoring of ecological processes (K Balasubramanyan and K Swarupanandan)

4.3.3. Entomology Division

KFRI 101/87 : Development of a management strategy for the teak defoliator, *Hyblaea puera*

Principal Investigator	: KSS Nair
Associates	: VV Sudheendrakumar
	: K Mohanadas
	: KC Chacko
	: MS Jayaraman
Date of commencement	: April 1987
Date of completion	: March 1992

Studies on various aspects were carried out as follows :

Life-table studies and natural enemy potential : In three permanent sample plots established in the 1974 plantations at Kariem-Muriem, continuous weekly sampling of insect populations was carried out. When necessary, sampling is carried out at closer intervals and in temporary mobile plots to record the fate of an infesting population.

Reproductive behaviour and role of pheromones: These studies are being undertaken to gather basic data on reproductive behaviour and to elucidate the role of pheromones in *H. puera*. A steady culture of *H. puera* is maintained either on teak leaf or in an artificial diet. The pupae were sexed and kept separately for the emergence of virgin moths. The behaviour of these moths were studied. Over 200 pairs of adult moths were directly observed to collect data on mating behaviour with regard to time of mating, age of mate, oviposition and fedundity. Lab reared males and females obtained from pupae maintained in the lab did not respond to each other untill they were at least 48 h old. However, in the case of adults emerged from field collected pupae, mating was observed after 24 h of emergence. Precopulatory behaviour was conspicuous in males. Mating took place during early morning hours, i.e. between 3.00 to 5.00 AM. Female mated only once during the life whereas the males mated with several virgin females. Mated females laid their first batch of fertile eggs in less than 24 h.

Field evaluation of phenological resistance: Eight early flushing clones were selected from the Nilambur area, grafts prepared and planted out in small blocks of 50 trees each to test their performance with respect to escape from defoliation.

Patterns and causes of outbreaks: Spatial distribution of infestation during the early buildup phase of defoliation was mapped in plantations at Nilambur. The limited data gathered indicated small and localised but sudden build-up in widely separated plantation sites during the pre-monsoon season; and sub-

sequent spread of infestation over extensive areas. Various aspects of the genesis of epidemics are being studied. A project proposal was submitted to U. S. India Co-operative Science Programme to seek financial and technical support for mathematical modelling of population dynamics of *H. cuera*.

KFRI 103/87 Spatial and temporal distribution of *Ailanthus* pests *Eligma narcissus* and *Atteva fabriciella*.

Investigator	:	RV Varma
Date of commencement	:	April 1987
Date of completion	:	March 1990

The project was commenced in April 1987. Suitable experimental areas were identified in the Kothamangalam Division - one at Thattekkad and another at Mullaringad. Regular sampling of larvae and pupae were carried out in the intensive study area at Thattekkad. In addition, isolated trees of *Ailanthus* on either sides of a strip of road at Thattekkad were also kept under observation at regular intervals. Various mortality factors were also monitored. In addition to natural enemies reported earlier, two bugs - a pentatomid *(Cantheconidea furcellata)* and a reduvid *(Panthous bimaculatus)* were found to feed on the pests. Of these, *P. bimaculatus* was a more effective predator of *E. narcissus*.

Detailed investigations have also been undertaken to study the impact of *Atteva* feeding on the growth of *Ailanthus*. This field experiment was laid out in a badly infested plantation at Erumeli (Karikattoor) during February 1988 and the work is progressing.

KFRI 105/87: Studies on the lepidopteran fauna of Silent Valley.

Investigator	:	George Mathew
Date of commencement	:	April 1987
Date of completion	:	March 1990

Work under this project was initiated in January 1988. Basic infrastructural facilities were arranged at the study area. Collection of moths and butterflies is being carried out by setting up light traps, by rearing larvae collected from the field or by sweeping with a hand net. Taxonomic studies on a few butterflies and moths collected from the area are in progress.

Components of inter/multidisciplinary projects

Pathol 06/86 : Entomological aspect of insect pathogens for biocontrol (RV Varma, VV Sudheendrakumar)

KFRI 114/87 : Pest problem of indigenous species and control (George Mathew)

4.3.4. Genetics Division

KFRI 115/87 : Genetic improvement of *Ailanthus triphysa*

Investigator : EP Indira
Date of commencement : July 1987
Date of completion : June 1996

Older plantations and natural forest were surveyed at Kannoth, Kottiyur, Kurichiat, Peruvannamuzhy and Nilambur and plus trees were selected. Due to poor seed year, seeds could not be collected except from two trees. Studies on breeding system were initiated.

Components of multidisciplinary projects

KFRI 104/87 : Genetic improvement of eucalypts through selection (EP Indira)

KFRI 108/87 : Germ plasm collection of bamboos and seeds (MP Koshy)

4.3.5. Management Division

Econ 05/84 : History of forest management in Kerala

Principal Investigator : CTS Nair
Associate : Mammen Chundamannil
Date of commencement : October 1984
Date of completion : March 1987

Work on the project during the year was mostly confined to reference work using the material available in KFRI Library. Field trips were made for data collection on trends in forest land use in Malayattur and Munnar Divisions.

Stat 02/77 : A data bank for the forestry sector in Kerala

Principal investigator : K Jayaraman
Associate : CN Krishnankutty
Date of commencement : January 1977
Date of completion : Continuous

The data compiled from the annual administration reports of the Kerala Forest Department on area, production, revenue and expenditure with respect to the forests in Kerala pertaining to the period 1956-57 to 1984-85 were stored. Statistics on age and species war area under various forest plantations as on March 1985 (collected from the different Forest Divisions), data on annual rainfall at different rain gauge stations for the period 1964-75 to

1984-85 (gathered from KSEB), yield from experimental plots tested till 1986 (collected from various Forest Range Offices) are also available. Efforts are underway to create a computerised database and utilise the information in all possible ways.

Stat 06/84 : Statistical techniques in forestry research in Kerala

Principal investigator	:	K Jayaraman
Associate	:	P Rugmini
Date of commencement	:	October 1984
Date of completion	:	September 1987

This is an investigation on forest research methodology. The nature of forest research is examined and the current methods of research evaluated. Applications for recent statistical techniques forestry research have been identified. Systems analysis has been found one of the most potential tools in forest research and forestry.

KFRI 119/87 : Demand and supply of wood in Kerala and their future trends

Principal Investigator	:	CN Krishnankutty
Date of commencement	:	October 1987
Date of completion	:	September 1989

A sample survey is being conducted to assess the growing stock of tree crops in homesteads and consumption of timbers and firewood by the household sector in Kerala. Work pertaining to 9 out of 30 villages selected was completed. Data pertaining to the quantity of wood used by industries in the organised sector were gathered from the Annual Survey of Industries-schedules of the Directorate of Economics and Statistics. The survey, collection of secondary data, compilation etc. are in progress.

Components of inter/multidisciplinary projects

Gen 03/85 : Human impact studies in Pooyamkutty Project area (CTS Nair and Mammen Chundamannil)

KFRI 108/87 : Market studies of bamboos and reeds (CN Krishnankutty)

KFRI 109/87 : Inventory methods of rattan resources in Kerala (K Jayaraman)

KFRI 116/87 : Human ecology and socio-economic interactions in tribal communities of Attappadi (PK Muraleedharan)

KFRI 121/87 : Statistical aspects of establishment of permanent sample plots in Silent Valley (K Jayarman)

4.3.6. Pathology Division

Pathol F04/86 : Sapstain fungi of some commercially important timbers and their chemical control

Principal Investigator : EJ Maria Florence
Date of commencement : January 1986
Date of completion : December 1988

Stained wood samples were collected from wood based industries at various intervals and causal organisms were isolated. Artificial inoculation tests were carried out for 50 fungal isolates. An experiment was initiated to study the effect of *Botryodiplodia theobromae* on weight lose in *Hevea brasiliensis*. *Ailanthus triphysa* and *Bombax ceiba*. Monthly observations are continuing. In a preliminary experiment a bacterium found as a contaminant was tested for its antagonistic property against several staining fungi as well as wood surface moulds in the laboratory. Moisture content of different freshly felled timber species was determined to correlate its significance in infection. Taxonomic characters of 51 fungal isolates were studied and sent to CAB International Mycological Institute, for authentic identification. A total of 250 stock cultures were subcultured at quarterly intervals.

KFRI 106/87 : Decay in standing trees in natural forests

Principal Investigator : C Mohanan
Date of commencement : April 1987
Date of completion : March 1992

Prevalence of wood decay was recorded from five sample plots (25 x 25 m) in different sub-coupes at SFC (1985) Aramba, Achenkoil. Data on decay indicators, their number, position, gbh, height, etc., from 118 marked trees, scattered in 9-sub-coupes (45.45 ha) at Aramba before and after felling and from 93 marked trees in SFC XIV (1987) Chalakkayam were collected. Observations on electrical resistance of decayed trees (50 trees) were recorded using Shigometer (needle probe) from the SFC (1987) Chalakkayam. Wood decay samples were collected from felling sites (Aramba SFC, Gurunathan-mannu SFC, Chalakkayam SFC) and isolations microorganisms attempted.

KFRI 110/87 : Diseases of bamboos, reeds and canes in Kerala.

Principal Investigator : C Mohanan
Date of commencement : April 1987
Date of completion : March 1990

A reconnaissance was conducted in bamboo, reed and cane growing areas in the State and representative areas in different forest circles were

selected for recording the disease data. From selected areas data were collected on the occurrence and severity of disease. Disease incidence was also recorded in various bamboo nurseries. From diseased specimens isolates of the causal organisms were made and cultural and morphological details of 39 fungal isolates were studied. Pathogenicity trials with one bacterium (possibly *Pseudomonas*) causing seedling rhizome rot and *Rhizoctonia solani* causing seedling stem and leaf infection were conducted and positive results obtained. Seed mycoflora associated with the stored seeds of *Bambusa arundinaceae* was studied employing standard techniques.

Components of inter/multidisciplinary projects

Pathol NF06/86 : Evaluation of Microbial pathogens for bio-control against insect pests of *Ailanthus* and teak (MI Mohamed Ali)

Soils 14/04 : Ex-situ decomposition of leaf litters of teak, *Eucalyptus* and *Albizia* (KV Sankaran)

KFRI 104/87 : Screening and field performance of eucalypts for resistance to pink disease and Cylindrocladium leaf blight (JK Sharma, M. Balasundran and EJ Maria Florence)

KFRI 109/87 : Protective measures against pathogenic fungi to preserve post-harvest rattans (C. Mohanan)

KFRI 114/87 : Disease problems of indigenous species (MI Mohamed Ali)

4.3.7. Physiology Division

Components of inter/multidisciplinary projects

KFRI 104/87 : Clonal propagation of eucalypts by rooting of juvenile stem cuttings (T. Surendran)

KFRI 108/87 : Development of suitable propagation techniques for bamboos (KK Seethalakshmi)

KFRI 109/87 : Development of suitable techniques for propagation of rattans (KK Seethalakshmi)

4.3.8. Silviculture Division

Silvi 08/84 : Polyurethane foam sheet for raising forest tree seedlings

Principal Investigator : KC Chacko
Associate : RC Pandalai

Date of commencement : July 1984
Date of completion : December 1986

Trials were conducted with *Lagerstromia microcarpa*, *Haldina cordifolia* and *Anogeissus latifolia*. Performance of *Haldina cordifolia* on foam was not satisfactory.

KFRI 120/87 : Afforestation trials in Attappady

Principal Investigator : KC Chacko
Associate : RC Pandalai
Date of commencement : August 1987
Date of completion : July 1990

About 7 ha of degraded vested forest land at Mully was identified for field trials. A nursery for raising planting stock was started close to the proposed planting site. Seeds of the following species were procured and seedlings raised - *Acacia planifrons, Albizia amara, Albizia lebbek, Hardwickia binata, Holoptelia integrifolia, Pterocarpus santalinus, Tamarindus indica, Anacardium occidentale* and *Ailanthus excelsa*.

Components of inter/multidisciplinary projects

KFRI 101/87 : Silviculture aspects of teak defoliator management (KC Chacko and MS Jayaraman)

KFRI 104/87 : Nursery and planting practices for increased production of pulpwood in eucalypt plantations (KC Chacko and RC Pandalai)

KFRI 108/87 : Establishment of bamboo plantations in the State (KC Chacko)

4.3.9. Soil Science Division

Soils 11/84 : Physical and chemical properties of soils in *Albizia* plantations

Principal Investigator : M Balagopalan
Date of commencement : April 1984
Date of completion : December 1987

Wet digestion of 120 soil samples for determination of nitrogen, phosphorus and potassium. Assay of nitrogen, phosphorus and potassium. Collation of data and statistical analysis.

Soils 12/84 : Nutrient partitioning in an evergreen ecosystem

Principal Investigator : S Sankar
Date of commencement : July 1984
Date of completion : December 1987

Completion of biomass estimation, sampling and leaf analysis for nitrogen, phosphorus, potassium, calcium and magnesium. Calculation of nutrient content in each compartment. Soil analysis for nitrogen, phosphorus, potassium, calcium and magnesium.

Soils 13/84 : Effect of varying soil moisture and bulk density on root growth of teak, eucalypt and *Albizia* seedlings

Principal Investigator : Thomas P Thomas
Date of commencement : July 1984
Date of completion : December 1987

Completion of experiments. Collation of data and statistical analysis. Writing of report in progress.

KFRI 102/87 : Soil technology packages for enhancing productivity in teak plantations of Kerala

Principal Investigator : TG Alexander
Date of commencement : April 1987
Date of completion : March 1992

Detailed study is intended in Nilambur Division. Ten transects, Vattikkal, Kariem-Muriem (2), Panayamkod, Walluvasseri, Panappuzha, Cherupuzha, Nellikkutha, Elencheri and Mundakkadav were selected. From each transect of 500m length, five 0-68 cm soil pits were taken to represent different slope positions. One composite sample of 0-60 cm depth was obtained from each pit. Completed sample processing.

KFRI 107/87 : Soil-plant community relationships in Silent Valley

Principal Investigator : M Balagopalan
Date of commencement : August 1989
Date of completion : July 1989

Reconnaissance in Silent Valley for different tree communities. Selected Cullenia - Palaquium at Aruvampara, Poeciloneuron - Reed at Cheriyawalakkad and Calophyllum - Reed community at Poovanchola. Five sample plots, each of 50 x 50m are intended for each community. Composite 0-20, 20-40 and 40-60 cm samples of three 0-60 cm soil pits were taken from each plot.

Components of inter/multidisciplinary projects

Gan 03/05 : Long term environmental and ecological studies of Pooyamkutty hydroelectric project-preconstruction stage analysis (S Sankar)

Soils 14/84 : Ex-situ decomposition of leaf litters of teak, eucalypts and *Albizia* (MV Mary).

KFRI 116/87 : Human ecology and socio-economic interactions in tribal communities of Attappadi (S Sankar).

KFRI 108/87 : Fertiliser trials in bamboo plantation (Thomas P Thomas)

4.3.10. Wildlife Biology Division

KFRI 111/87 : Ecology and behaviour of sambar deer, *Cervus unicolor* in Parambikulam Wildlife Sanctuary.

Principal Investigator : PS Easa
Date of commencement : April 1987
Date of completion : March 1990

Field trips were conducted one week in a month. Observations were made for the physical changes such as antler shedding and occurrence of sore patch. Continuous observations were also made for food and feeding habits and social behaviour. Arrangements were made to tranquilise sambar deer for ear tagging.

KFRI 112/87 : Feeding and ranging patterns of lion-tailed Macaque (*Macaca silenus*) in Silent Valley

Investigator : K K Ramachandran
Date of commencement : August 1987
Date of completion : July 1989

Intensive perambulation was carried out in the areas namely Aruvampara, Kattuvaramudi, Kattimudi, Kummattanthodu, Panthanthodu, Ponnamala and Nilikkal in and around Silent Valley National Park. During the period not less than six lion-tailed macaque troops were identified with a total number of individuals sighted to be about 80. Exact troop composition and various sex and age classes could not be categorised due to poor visibility condition, rough nature of the terrain and for want of suitable equipment. Approximate number of individuals in the troop and the presence of females with young ones assisted in identifying different troops. Successive sighting locations of the troop and its ranging to different areas are being monitored. The food items of the lion-tailed macaque troop is also observed and identified.

KFRI 118/87 : Community ecology of birds in Silent Valley

Investigator : EA Jayson
Date of commencement : August 1987
Date of completion : July 1989

As the investigator was deputed for training in the Wildlife Institute of India, Dehra Dun during this period work could not be initiated.

Components of inter/multidisciplinary projects

Gen 03/85 : Wildlife studies in Pooyamkutty hydroelectric project area (P Vijayakumaran Nair).

4.3.11. Wood Science Division

Wood 07/82 : Establishment of Xylarium

Principal Investigator : KM Bhat
Date of commencement : April 1982
Date of completion : March 1987

A total of 49 wood specimens were identified and labelled. Slides were prepared for 64 species. The work is in progress.

KFRI 113/87: Wood properties of some less-known tree species of Kerala.

Principal Investigator : KM Bhat
Date of commencement : April 1987
Date of completion : March 1990

Wood samples were collected from 10 less-known timbers (*Aglaia barberi, Drypetes elata, Evodia lunu-ankedia, Flacourtia* sp., *Polyalthia coffeoides, Knema attenuata, Anacolosa* sp., *Vepris bilocularis, Eugenea* sp. and one unidentified timber) for anatomical studies. Preparation of microslides completed for 7 of the above. Observations are in progress.

Components of inter/multidisciplinary projects

KFRI 108/87: Preservative treatments and physical and mechanical properties of bamboos (R Gnanaharan).

KFRI 109/87: Morphological, Anatomical, Physical, chemical and mechanical properties of canes (KM Bhat).

KFRI 114/87: Utilization aspects of indigenous species (KV Bhat)

INTER/MULTIDISCIPLINARY PROJECTS

Soils 14/84: Ex-situ decomposition of leaf litters of teak, eucalypt and *Albizia*.

Principal Investigator : MV Mary
Associate : KV Sankaran
Date of commencement : July 1984
Date of completion : December 1987

Studies on decomposition of leaf litters of *Tectona grandis, Eucalyptus tereticornis* and *Albizia falcataria* using mesh bag technique under laboratory conditions and outdoors continued. Major fungal genera isolated from decomposing litters were *Aspergillus, Penicillium, Robillarda, Doliomyces, Trichoderma, Phoma, Curvularia* and *Fusarium*. Determination of weight loss of litters and estimation of CO_2 evolved are in progress.

Pathol NF06/86: Evaluation of microbial pathogens for biocontrol of insect pests of teak and *Ailanthus*.

Principal Investigator	: MI Mohamed Ali
Associates	: RV Varma VV Sudheendrakumar
Date of commencement	: January 1986
Date of completion	: December 1988

Teak pests: Laboratory studies on nuclear polyhedral virus (NPV) bioassay carried out for *Hyballaea puera* indicated that a dosage of 14.6×104 PIB ml-1 was active and death of treated larvae occurred after 72 h. NPV exposed to UV radiation (approximately 2850 Ao) for 30 min did not reduce the infectivity. Similarly, heating of PIBs at 40oC for 7 days also did not affect the infectivity. An imprint technique using cellotape was standardised to study the PIB on leaf surface. A survey was made in selected teak plantations to assess the natural NPV infection of *Hyblaea*.

Bacillus cereus was isolated from *Hyblaea* larvae from Nilambur. Pathogenicity of *Beauveria bassiana* on *S. malabaricus* was confirmed.

Ailanthus pests: Paecilomyces fumaroseus and *P. farinosus* were isolated from infected pupae of *Eligma* from Kottappara, Ayyappankoil and Erumeli. Studies to ascertain minimum lethal concentration of *P. fumariseus* (1.9 × 106-103) for *Eligma* were undertaken. The experiment will be repeated. Aerospora studies were initiated in an *Ailanthus* plantation at Kottappara to study the seasonal incidence of *Paecilomyces*.

KFRI 117/87: Regeneration studies on some important trees of the moist deciduous forests of Kerala.

Principal Investigator	: K Swarupanandan
Associate	: N Sasidharan
Date of commencement	: August 1987
Date of completion	: July 1990

Moist deciduous forests of Trichur and Nenmara Forest Divisions and Parambikulam Wildlife Sanctuary were inspected for site selection. The latter two were found to be not fit to undertake the study and finally Trichur Forest Division was selected. Three localities, viz., Karadippara and Kalluchal (Peechi Range) and Kuthiran (Pattikkad Range) were chosen in this Division. Plots of 2.16 ha, 2.0 ha. and 0.7 ha were laid out in all the three areas respectively. Each of these plots were grided for 10 X 10 m. and permanently marked with numbered wooden pegs. Enumeration, numbering, girth measurement and grid plotting of these trees in each of these were done. A total of 175 trees

from Karadippara and Kalluchal were selected for phenological observations. Monthly records were made. Over 4000 recruits were tagged for demographic studies at Kalluchal.

Gen. 03/85: Long term environmental and ecological studies of Poovarnkutty hydroelectric project - preconstruction stage analysis.

Principal Investigator	:	Director, KFRI
Associates	:	K Balasubramanyam S Sankar P Vijayakumaran Nair Mammen Chundamannil
Date of commencement	:	November 1984
Date of completion	:	October 1988

Land use studies: Area under different land use categories was estimated.

Botanical studies - Species diversity, status of endemics and species of economic importance: Check-lists of the flora of Pindimedu dam catchment areas, and Anamalai-Manali region were prepared. Nomenclature corrections were done for various species in the checklist. The check-list is further supplemented with details collected from the field with regard to the availability and conservation status of the endemic and rare species in the study area. Data on the distribution pattern of about 350 species in the Pindimedu region and about 175 species in the Anamalai-Manali region were gathered to find out the percentage of endemism and to note the occurrence of phytogeographically important species in the area. Data on the economically important plants in the area are being collected.

Ecological studies - Existing vegetational types, estimation of loss in vegetational cover due to submersion: Field work was completed. Analysis of data is in progress.

Soil studies: Soil erosion and sediment load were monitored in selected locations in the study area. The data are being processed. Properties of soils in different ecosystems were determined.

Wildlife Studies: The status of wild animals and birds were recorded for the entire area by dividing it into one square kilometer grips and making field observations. Elephants and wild pigs were found to be common in the area. A total of 65 species of birds were recorded.

Human impact studies - Linkages between tribals and forests, deforestation and settlements, management of forests: The socioeconomic aspects of the people and resource in the project area was studied. Field work for the project is almost completed; 54 house-holds in the submergible area at

Kurathykudy, Metanappara and Anakulam areas were covered by a detailed socio-economic survey. The migration pattern of the tribal people as well as the settlements that have come up in the wake of lemon grass cultivation, grow-more-food schemes, reed working etc. and the development of accessibility in the project area has been examined.

KFRI 104/87: Tree improvement of *Eucalyptus* for disease resistance and higher productivity.

Principal Investigator & Coordinator	:	JK Sharma
Investigators	:	M Balasundaran
	:	EJ Maria Florence
	:	EP Indira
	:	T Surendran
	:	KM Bhat
	:	KC Chacko
	:	RC Pandalai
Date of commencement	:	April 1987
Date of completion	:	December 1995

Screening of eucalypts for resistance to pink disease and Cylindrocladium leaf blight.

Pink disease organism, *Corticium salmonicolor*, was isolated from various eucalypts and other host species. Cultures were grown in liquid media and attempts were made to refine further the toxinbioassay technique using seedling of *E. grandis* and *E. tereticornis*. The experiment is continuing.

Cylindrocladium spp. were isolated from several leaf specimens (75) collected from different localities of Kerala. Cultural characters and conidial morphology of some of the isolates were studied.

Prepared a note detailing the methodology for the selection of disease evading plus trees (DEPT), includidg a form for reporting DEPT in consultation with Genetics Division. Disease evading plus trees of eucalypts were selected in Peermedu, Wadakkancherry. *Corticium salmonicolor* was isolated from 15 diseased eucalypt specimens and cultures were maintained.

Genetic improvement of eucalypts through selection

As the first part of plus tree selection, a list of *E. grandis* and *E. tereticornis* plantations in Kerala raised by KFDC and Forest Department during 1977-'80 was collected. Surveyed the *Eucalyptus* plantation at Mullaringad and Kottappara to find out the feasibility of selecting disease evading plus

trees. Field trips were conducted to peerumedu, Ampua, Erumeli, Onthupacha, Begur, Manantoddy, Thamarasseri and Sultans Battery. Disease evading plus trees of *E. tereticornis* were selected from Kayampoovani, Wadakkanchery. Survey and selection of disease evading plus trees were done along with Scientist from Pathology Division.

Clonal propagation of eucalypts by rooting cuttings

To study the effect of time of felling on coppice growth, an experiment was designed and study initiated in two areas, Elanad (1978 *E. tereticornis*) and Noolpuzha (1978 *E. grandis*). Sixteen trees having a GBH of 30 cm or above for *E. tereticornis* and a GBH of 40cm or above for *E. grandis* were marked and felled monthly at both the experimental plots. The felling of trees was initiated in April 1987 at Elanad and was completed by March 1988. Similarly, the felling of *E. grandis* trees was started in September 1987 at Noolpuzha and is being continued.

Weekly observations on number of coppice produced on each stump, height and diameter measurements of the tallest shoot in a clump of coppice shoots were made by Investigators from Physiology, Pathology and Silviculture Divisions at both the locations regularly. Weekly recordings of these parameters for the initial eight weeks for stumps of each month of felling and thereafter monthly measurements for upto one year of coppice growth were made. These observations are being continued.

A plan of mist propagation unit (MPU) was finalised, necessary details were procured for various items to be used in the construction. The construction was supervised and closely watched by the Principal Investigator.

KFRI 108/87 : Silviculture, management and utilization of bamboo resources in Kerala

Project Leader	: Director, KFRI
Research Coordinator	: K Shanmuganathan
Investigators	: R Gnanaharan
	: MP Koshi
	: CN Krishnankutty
	: MS Muktesh Kumar
	: KK Seethalakshmi
	: Thomas P Thomas
Date of commencement	: April 1987
Date of completion	: March 1990

Market studies of bamboos and reeds to identify the nature of demand, sources of supply and prices

A market study on bamboo was taken up to identify the nature of demand, source of supply and the levels of prices. This involved assessing the growing stock of bamboo in homesteads, estimating the quantity of bamboo used for household agricultural purposes, estimating the quantity of bamboo used by household producers of bamboo mats, baskets etc., and collecting information on supply, demand and prices available at depots. A household survey is being conducted and the work pertaining to 9 out of 30 selected villages has been completed.

Development of suitable propagation techniques

To find out the effect of position of cutting on rooting in bamboos, an experiment was laid out at Nilambur with *Dendrocalamus strictus* during March 1987. The observations recorded on percentage of rooting and other growth parameters such as number and length of roots and shoots indicate that the response varies with regard to position. The rooted cuttings were polypotted and maintained in the nursery for field trials.

Introduction trials : Culm cuttings of about 10 bamboo species were collected from various localities as mentioned below. Treatment with NAA 100 ppm was given soon after collection and observations on rooting were taken after six months.

	SPECIES	LOCALITY
1	*Bambusa balcooa*	Dandeli
2	*B. pallida*	"
3	*B. tulda*	"
4	*B. ventricosa*	Calicut
5	*Dendrocalamus brandisii*	Dandeli
6	*D. hamiltoniana*	"
7	*D. longispathius*	"
8	*Oxytenanthera monostigma*	Kasaragode
9	*O. stoksii*	Dandeli
10	*Melocanna bambusoides*	

Except for *B. pallida* and *O. monostigma* rooting was observed for all other species.

Rhizomes of *Thyrsoltochys oliverii* were collected from a private plantation at Palghat.

To study the effect of relative humidity on rooting of branch cuttings and nodal bud chips, a mist chamber is being constructed.

Seed stronge : Seeds of *Bambusa arundinacea* was collected from Parambikulam during May 1987. The seeds were air dried and stored under various conditions like refrigerator, deep freezer, in desiccator over CaC12 and room temperature. Percentage of germination and moisture content of the stored seeds are being determined at monthly intervals. Although flowering of *Oxytenanthera monostigma* occurred in Nilambur during March 1988 the seed set was very poor. Available seeds were collected and the seeds were stored in room temperature and refrigerator.

Establishment of a germ plasm collection of bamboos and reeds

A format was prepared with regard to data on germplasm collection. Collection trips were conducted in Vazhachal, Sholayar and Nilambur and bamboo specimens were collected. Collected bamboos planted in poly bags are kept in the Institute Campus.

Distribution and ecology of reeds

Seeds of two bamboo species. *Phyllostachys pubescence* and *Fargesia* sp. brought from China were germinated. Only 20 seedlings of the former survived and the survival rate of the latter was considerably low.

Extensive field trips were made and about 9 reed areas have been located in the state. Reeds collected are being maintained in the Institute campus. Herbarium specimens are also being maintained.

A permanent plot for the ecological studies has been established at Kollathirumedu for *Ochlandra travancorica*. One *Ochlandra* sp. was collected in flowers from Nilambur and Peruvannamuzhi.

Establishment of bamboo plantations in the state of Kerala (Bambusa arundinacea)

Planting stock (6, 12 and 24 months old seedlings of *Bambusa arundinaceae*) and experimental area (about 11 hectares) were arranged.

Development of simple and low cost preservative treatment and determination of physical and mechanical properties of bamboos.

Chemicals for preservative treatment were procured. Preservative treatment of *Bambusa arundinaceae* was carried out with different chemicals. The treated poles in round and half-split form have been kept in ground contact and quater-split reapers in out-of-ground contact respectively. Decay is being monitored visually and with shigometer.

KFRI 109 / 87 : Management and utilization of rattan resources in Kerala

Project Leader	:	Director, KFRI
Reserach co-ordinator	:	K M Bhat
Investigators	:	K M Bhat
	:	T K Dhamodaran
	:	K Jayaraman
	:	C Mohanan
	:	P K Muraleedharan
	:	CTS Nair
	:	UN Nandakumar
	:	C Renuka
	:	KK Seethalakshmi
Date of commencement	:	April 1987
Date of completion	:	March 1990

Establishment of a live-collection of different indigenous and exotic species

Two plots have been selected, one at Pattakarmon (Nilambur) and another at Ranimedu (Nelliampathy), for planting the cane seedlings raised in the Institute.

Field trips were conducted in the forests of Kerala and Tamil Nadu and cane specimens collected. Seeds collected were processed and seedlings raised. Germination trials of seeds of 10 species of *Calamus* obtained from Andamans, China, Malaysia and Thailand were carried out. Seeds from Andamans took almost one year to germinate, while others took up to 6 months.

Development of suitable propagation techniques

Suckers of *Calamus hookerianus* and *C. thwaitesii* were collected from Nelliampathy and Dhoni respectively. Treatments with naphthyl acetic acid (NAA) and indole butyric acid (IBA) were given for induction of rooting. Since soaking in aqueous solution for 24 hours poses practical problems, drenching the base with 10 ml of solution was adopted for suckers.

Seeds of following species were collected from Kerala and abroad and seedlings raised.

	RATTAN SPECIES	LOCALITY
1	*Calamus rotang*	Quilon
2	*C. pseudotenuis*	Peermedu
3	*C. hookerianus*	Achenkoil
4	*C. thwaitesii*	..
5	*C. trachycoleus*	Malaysia
6	*C. manan*	..
7	*C. thysanolepis*	China
8	*C. tetradactylus*	..
9	*C. simplicifolius*	..
10	*C. perigrinus*	Thailand
11	*Daemenorops margaritae*	China

The area for plantation trials was located at Ranimedu (Nelliampathy) and Pattakarimbu (Nilambur).

Morphological, anatomical, physical, chemical and mechanical properties of popular and lesser-known rattan species and improvement in harvesting and processing techniques.

Stem samples of six species were collected and physical properties are being determined. Anatomical work is in progress. A pilot survey was made in Kerala and the adjacent districts of Karnataka on harvesting system and processing techniques. Regional Technical Design Centre, Bangalore was consulted for fabrication of processing tools.

Technical and socio-economic analyses of harvesting and processing industry in Kerala

For generating preliminary information on cane processing industry, an extensive tour was conducted in Mangalore and Shimoga in Karnataka, Shenkottai in Tamil Nadu, and different districts in Kerala. Based on this, a detailed questionnaire was framed. Data collection is in progress.

Protective measures against pathogenic fungi in post-harvest rattans

Survey was conducted in rattan handling/exporting, furniture and basket making units in Kerala, Tamil Nadu and Karnataka and information was gathered on sources of supply, method of storage, preservation technique applied, per cent loss due to fungal staining and deterioration, etc. Decayed and stained (rattan) canes were collected from various units and isolation of causal organisms made.

A detailed investigation on the occurrence and exploitation of rattan (canes) in the sacred groves in Alleppy and Quilon districts.

KFRI 114/87: Studies on selected indigenous species for future plantation programmes in Kerala.

Principal Investigator & Coordinator	:	KKN Nair
Investigators	:	KC Chacko
	:	ARR Menon
	:	KV Bhat
	:	George Mathew
	:	MI Mohamed Ali
Date of commencement	:	April 1987
Date of completion	:	July 1992

Botanical studies and arboretum

Information on the phenology and distribution of each of the species in Kerala has been gathered on the six species selected for the study namely *Albizia odoratissima, Grewia tiliifolia, Lagerstroemia microcarpa, Haldina cordifolia Pterocarpus marsupium* and *Xylia xylocarpa*. Several field trips were conducted and, specimens and seed samples have been collected.

Silvicultural studies and plantation trials

Seeds of five species were collected and seedling raised for field planting.

Utilization aspects

Increment core samples from a total of 17 trees of *Albizia, Grewia, Lagerstroemia, Haldina* and *Pterocarpus* were collected from Vazhachal, Palappilly and Nenmara areas. Measurement of heartwood proportion and density was carried out.

Pest problems and control

Information on insects associated with the following indigenous trees viz. *Grewia tiliaefolia, Adina cardifolia, Albizia odoratissima, Lagerstroemia lanceolota, Pterocarpus marsupium* and *Xylia xylocarpa* is being gathered. Though a number of insects are associated with all the trees, no major pest problems have been noticed so far. The survey work is being continued.

Disease problems and control

Field trips to Thenmala, Trivandrum and Nenmara forest divisions were made and natural stands of indigenous species were visited for disease survey

and leaf spot disease of *Lagerstroemia lanceolata*, *Adina cordifolia* *Xylia xylocarpa* *Grewia tiliaefolia* collected and pathogens isolated. Work is being continued.

KFRI 116/87 : Human ecology and socio-economic interactions in tribal communities of Attappady

Investigators	: P K Muraleedharan
	: S Sankar
	: C T S Nair
Date of commencement	: August 1987
Date of completion	: July 1990

Three tribal settlements in Attappady were selected for detailed study. The study was initiated in Kezhe Thodukki settlement where the Kurumbas are inhabited. Direct and participatory observation is the method used for gathering information. Data collection in Thodukki is in progress.

KFRI 121/87 : Establishment of permanent sample plots for long term monitoring of ecological process

Investigators	: K Balasubramanyan
	: K Swarupanandan
	: K Jayaraman
Date of commencement	: August 1987
Date of completion	: July 1987

Field trips were undertaken, to New Amarambalam and Silent Valley. Suitable accessible areas were not available in New Amarambalam. In Silent Valley suitable undisturbed and disturbed evergreen forests and grasslands were located. Plots are to be laid out during the summer of 1988.

4.4. Research Projects terminated

The following projects were terminated due to formulation of more comprehensive new projects in the subject areas or due to lack of sufficient man power.

Genet 02/79 : Improvement of eucalypts by selection and interspecific hybridization.

Genet 03/79 : Genetic improvement of important matchwood species *Ailanthus triphysa* and *Bombax ceiba*.

Physiol 02/79: Studies on the physiology of induction of flowers in teak and eucalypts.

Silvi 09/85 : Nursery techniques for selected evergreen species of Kerala.

5. PUBLICATIONS

5.1. Research Reports

5.2.1 Published papers

1 Nair, KSS and George Mathew 1988. Biology and control of insect pests of fast-growing hardwood species. KFRI Research Report No. 51.

2 Sankar, S., M V Mary, and T G Alexander 1988. Foliar analysis in *Eucalyptus tereticornis* and *E. grandis* to assess soil test methods for nitrogen, phosphorus and potassium. KFRI Research Report No. 53.

3 Gnanaharan, R. 1988. Comparison of wilt diseased and nondiseased (overaged) coconut stem with respect to utilization potential. Final Report sent to sponsoring agency, Coconut Development Board.

4 Balasubramanyan, K. 1988. Impact of selection felling in a forest ecosystem in Kerala. Final Report sent to sponsoring agency, Department of Environment, Govt. of India.

5.2. Papers in journals and proceedings

5.2.1. Published papers

1 Alexander, TG. 1987. Taungya and soil management during the establishment phase of forest plantations in Kerala, India. In: Vergara NT & Briones ND (ed.) Agroforestry in the humid tropics: its protective and ameliorative roles to enhance productivity and sustainability. EAPI, East West Centre, Honolulu, & SEARCA, Los Banos, Philippines, p. 125-131.

2 Balasundaran, M. and Gnanaharan, R. 1986. Decay resistance of wood species belonging to Dipterocarpaceae. Materials und Organismen 21: 311-317.

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5.2.3. Miscellaneous publications

1 Balagopalan, M. 1987. Properties of soils in the natural forests and plantations of Trivandrum Forest Division. 92 p (mimeo). Report of the soil study done in connection with the preparation of Working Plan for Trivandrum Division.

2 Alexander, T. G. 1987. Soils of the Nilambur Subcentre Campus: an interpretative study. 70 p (mimeo).

3 Soil pit Sheets (278 SPSs & Appendix of 299 surface sample data based on studies in the Division of Soil Science from January 1977 to March 1988). 304 p (mimeo).

6. EXTENSION ACTIVITIES

Scientists in the Institute were actively involved in extension activities, particularly by way of rendering advice to the Forest Department and other agencies on various matters. Some of the important activities in this regard were as follows :

6.1 Botany Division

The plants in the Kuruva Island along the river Kabini, Wynad were collected and identified. A note on the vegetation of the Kuruva Island was prepared highlighting the salient features of the vegetation in association with Silviculture Division. Protective measures were also suggested to prevent further degradation.

Specimens referred to by the Forest Department, research scholars and Forestry students of the Kerala Agricultural University, (KAU) were identified.

Demonstration/class on the herbarium technique was given to two M. Sc. (Hort.) students of the KAU.

6.2 Genetics Division

A layout design was prepared for the Teak seed orchard established by the Forest Department in July 1987 at Kalluvettamkuzhy.

A radio talk by Smt. Indira E. P. was broadcast over AIR, Calicut on 'Acacia-vivadamuyarthiya maram' on November 2nd 1987.

6.3 Entomology Division

Instances of insect damage given below were investigated and advice on control suggested where necessary.

	Tree species	Problem caused by	Location
1	*Terminalia tomentosa*	In nurseries, attack by gall forming insects	Nilambur (Social Forestry, Valluvassery)
2	Cashew	Die-back of shoots due to fungus through injury caused by *Helopeltis antonii*	Chalakudy (Chettikulam)
3	Casuarina	Damage by the borer *Sahyadrassus malabricus*	Kasaragod, SF (Muliyar, Adoor & Mandakole)
4	*Tectona grandis*	White grub attack in nursery	Nilambur (Nellikutha)
5	Mahogany	Shoot borer, *Hypsipyla robusta*	Ranni (Valiyakavu)
6	*Acacia auriculiformis*	Sapling borer *Sahyadrassus malabaricus*	Perumbavoor (Social Forestry, Kollathirumedu)
7	*Dalbergia latifolia*	Caterpillars feeding on the leaves	Vazhachal (Vachumaram & Choozhimedu)
8	*Ailanthus triphysa*	*Eligma narcissus & Atteva fabriciella*	Chalakudy (Monadi)
9	*Acacia auriculiformis*	*Sahyadrassus malabaricus*	Trichur (SF, Kanakamuzhi)
10	Mahagony	Shoot borer, *Hypsipyla robusta*	Kottayam (Manipuzha & Karimpinthode)

6.4 Pathology Division

The following disease problems referred to the Division were investigated and findings along with remedial measures, if any, communicated to the Forest Department in Extension Reports.

	Tree species/ Substratum	Disease/cause diagnosed	Locality
1	*Acacia auriculiformis*	Wilting and drying up of plants - drought	Vadakkancherry
2	*Bambusa arundinacia*	Rhizome decay of seedlings	Kaliyar Kothamangalam
3	*Albizia falcataria*	Botryodiplodia die-back	Kottur, TVM
4	Cashew	Shoot die-back due to tea mosquito and *Colletotrichum*	Chettikulam (Chalakudy)
5	*Tectona grandis*	Microbial wood defects	KSWI, Nilambur
6	Mahogany seedlings *Ailanthus triphysa*	Scytalidium leaf infection	Nilambur
		Rhizoctonia solani	"
7	Growth of vegetation on buildings	—	Cochin Univ.
8	Report on *Calamus*	—	Asramam, Quilon
9	*Pinus oocarpa*	Root rot by *Fusarium*	Chandanathodu
10	*Casuarina equisetifolia*	Water logging-dying of trees	Azhikkal
11	*Albizia falcataria*	Fire damage	Punalur
12	*Tectona grandis*	Leaf and shoot blight due to *Phomopsis*	Vellikulangara
13	*Eucalyptus tereticornis*	Yellowing of leaves, leaf spots stem canker	Various localities of Punjab
14	*Dalbergia sissoo*	Root rot	"

6.5 Physiology Division

1 Seedlings of *B. arundinacea* and methodology for propagation of bamboos were given to Mr. Bennet who was interested in raising a private bamboo plantation near Trivandrum.

2 Mr. T. Surendran worked as a research advisor to Mr. V. Syam, M.Sc. Forestry student, Kerala Agricultural University for his M.Sc. (Forestry) dissertation programme since November 1987.

6.6 Silviculture Division

1 A note on Kuruva island in Wynad was prepared in association with Botany Division.

2 A report on the management of the catchment of Peppara dam was prepared for Govt. of Kerala.

3 A case of insect attack and growth retardation in plantations of *Ailanthus triphysa* in 3 localities in Kottayam Division referred by Mr. Lakhwinder Singh, IFS, Deputy Conservator of Forests, Kottayam. Recommendations were handed over to the Director for onward transmission. This investigation was done by the divisions of Entomology, Soil Science and Silviculture.

4 The failed plantations of KFDC in the Silent Valley area near Munnar were visited by the Scientists from the Divisions of Soil Science and Silviculture and recommendations were given for future management.

5 Details of *Ailanthus triphysa* and *Antiaris toxicaria* were provided to Chief Executive, Harrisons Malayalam Ltd.

6 Details on poplar cultivation were provided to Shri Somair Singh, Hyderabad.

7 Details on planting of teak were provided to Agricultural Officer - Chendamangalam.

8 A list of plantations of Trivandrum Forest Division was prepared with the help of the Programmer and sent to Shri K. P. Ouseph, IFS, Working Plan Officer, Quilon.

6.7 Soil Science Division

1 Soils of the natural forests and plantations of Trivandrum Forest Division. Study completed.

2 Soils of the Nilambur Subcentre Campus; an interpretative study (1: 2000 scale). Gravel, sand, silt + clay, organic carbon, pH, exchange acidity, and exchangeable bases analyses of 172 soil samples from 40 soil pits. Writing of report. The soil information will be utilized for overall development of the Subcentre Campus.

3 Soils in KFDC albizia plantation of Kottoor Subunit.

4 Soils under miscellaneous species in Paruthippalli Range.

5 Soils under miscellaneous species in Kulathuppuzha Range.

6 Soils in the Grassland Afforestation Division.

7 Mortality in teak nursery at Chettikkulam, Vellikkulangara.

8 Observations on soils in KFDC plantations near Silent Valley Estate, Munnar.

9 Observations on soils under ailanthus plantations in Erumeli, Ayyappancoil and Nagarampara Ranges.

6.8 Wildlife Biology Division

1 Mr. P. S. Easa participated in the Animal Census at Eravikulam National Park. 17-5-1987 to 25-5-1987.

2 Mr. P. S. Easa gave talks on wildlife at TKM Engineering College, Sree Krishna College, Guruvayur, Maharaja's Technical Institute, Trichur, College of Veterinary and Animal Sciences, Mannuthy, Nature camp at Kodakara and Chalakudy, Science Exhibition, Bharath Jan Vijnan Jatha etc.

3 Mr. K. K. Ramachandran and P. S. Easa participated in the Census work at Silent Valley from 1-3-1987 to 6-3-1987.

4 Mr. P. S. Easa organised competitions in connection with Wildlife Week Celebrations for School and College students.

5 Mr. K.K. Ramachandran organised various competitions for school children in connection with Wildlife Week Celebrations, 1987, sponsored by KFRI Staff Association.

6.9 Wood Science Division

A total of 26 timber specimens were identified and technical information on the species provided. Treated wood samples were examined for preservative penetration. Beehives were made out of boron-treated rubber wood. Information on the treatment, strength properties and load-bearing capacity of rubber wood was given to 19 different entrepreneurs. Technical

information on saw dust utilization, manufacture of preservative chemicals, pulp yield of bamboo, load-bearing capacity of different timbers, etc was provided by the Division.

7. CONFERENCES/SEMINARS/SYMPOSIA/WORKSHOPS ATTENDED

7.1 International

Dr. C. Renuka attended the International Seminar on Rattan held at Chiangmai, Thailand during 12-14 November 1987 and presented a paper entitled, 'Rattan industry in Kerala'.

Mr. Muktesh Kumar participated in the Farm Forestry Training Programme held in China from 1 to 30 May 1987. He presented two papers entitled, 'Farm forestry in the homesteads of Kerala' and 'Bamboos in India with special reference to Kerala'.

Dr. K. M. Bhat participated in the Rattan Seminar held at Chiangmai, Thailand on 12-14 November 1987 and presented a paper entitled, 'State-of-the-art report on management and utilization of rattan resources in India' by K. M. Bhat, C. Renuka, K. K. Seethalakshmi, P. K. Muraleedharan and C. Mohanan.

7.2 National

Mr. N. Sasidharan attended the training camp for the tribals on the collection of medicinal plants held at Vythiri and gave a talk on 13 June 1987.

Dr. K. Balasubramanyan participated in the "National Seminar on Estuarine Management" at Trivandrum on June 4th & 5th, 1987 and presented a paper entitled "Mangrove vegetation of Kerala".

Dr. A. R. Ramachandra Menon, was deputed for a ten months training programme in Remote Sensing commencing from July 1987 at Indian Institute of Remote Sensing, Dehra Dun.

Dr. George Mathew participated in the Workshop on Biosystematics of Insects held at the Entomology Research Institute, Loyola College, Madras from April 27-30 and presented a paper - 'Biosystematics in Lepidoptera and its importance in forest entomological research".

Dr. R. V. Varma attended the National Symposium on Social Insects at the University of Agricultural Sciences, Bangalore during Oct. 7-8, 1987 and presented a paper entitled "Field evaluation of preservative treated rubber wood against subterranean termites" by R. V. Varma and R. Gnanaharan.

Dr. K. S. S. Nair, Dr. V. V. Sudheendrakumar and Mr. K. Mohanadas attended the 'National Symposium on Integrated Pest Control - Progress and Perspectives', held at Trivandrum from Oct. 15-17, 1987. Dr. K. S. S. Nair presented a paper 'Pest Management in Indian Forestry - How to bridge the gap between theory and practice'. He also chaired one of the Sessions on Biocontrol. Dr. V. V. Sudheendrakumar presented a paper 'Comparative pathogenicity of some *Bacillus thuringiensis* strains on larvae of *Eligma narcissus* (Lepidoptera, Noctuidae), a major pest of *Ailanthus triphysa* by R. V. Varma, M. I. Mohamed Ali and V. V. Sudheendrakumar.

Mr. K. C. Chacko participated in the one day Workshop conducted by the Kerala Sastra Sahitya parishad at Ernakulam on 5 June 1988.

Dr. S. Sankar attended a Workshop on Tribal Development at Palghat, organised by the Kerala Tribal Development Department and KIRTADS, during 24-26 Sep. 1987.

Dr. R. Gnanaharan attended the National Seminar on processing and marketing of coconut held at Bangalore on 19-20 April 1987 and presented two papers entitled, 'Commercial exploitation of coconut wood-Prospects' and 'Basic structure of coconut wood and its utilization potential in comparison with other structural woods'.

Mr. T. K. Dhamodaran participated in the one day Workshop conducted by the Kerala Sastra Sahitya Parishad at Ernakulam on 5 June 1987.

APPENDIX III

STAFF AS ON 31.3.1988

Dr. C. T. S. Nair, Director

Administration

1	Shri. PK Balan	—	Registrar
2	.. CD Johny	—	Dy. Registrar (Admn)
3	.. P Aravindakshan	—	Dy. Registrar (Fin)
4	.. P Achuthankutty	—	PA to Director
5	Smt. VK Leela	—	Office Assistant
6	Shri. MK Aravindakshan	—	..
7	.. MS Sukumaran	—	..
8	Shri. VK Mohanan	—	..
9	.. EV Eshac	—	..
10	.. KK Thomas	—	..
11	Smt. M Kamalamma	—	..
12	Shri. PA Sulaiman	—	..
13	.. KA Gopalan	—	..
14	Shri. TJ Alfred Headisjis	—	Stenographer
15	Smt. Grace Andrews	—	..
16	.. Mary Kuruvilla	—	Receptionist
17	Shri. PM Venugopalan	—	Typist
18	.. VD Johny	—	Driver
19	.. P Mohandas	—	..
20	.. K Chandran	—	Attender
21	.. KR George	—	..
22	.. PN Subramanian	—	..
23	.. PS Raman	—	..
24	.. MB Dasan	—	..
25	.. MA Sankarankutty	—	..

Engineering

26	Smt. KN Rajamma	—	Office Assistant
27	Shri. PR Jose	—	Sergeant
28	.. KS Gopalan	—	Overseer
29	.. PP Sunny	—	Skilled Maintenance Asst.
30	Smt. TV Chandrika	—	Typist
31	Shri. BP Sreedharan	—	Attender
32	.. T Chandran	—	Driver
33	.. PI Madhavan	—	..
34	.. K Girijavallabhan	—	..

35	Shri.	K Dhorairaj	— Driver
36	,,	K Vijayan	— ,,
37	,,	S Shahul Hameed	— ,,
38	,,	Kurien Mathew	— ,,
39	,,	K Said Mohammed	— Watcher
40	,,	PM Vasu	— ,,
41	,,	Subramanian	— ,,
42	,,	AC Antony	— ,,
43	,,	K Nanu	— ,,
44	,,	CK Vincent	— Cleaner
45	,,	KC Subramanian	— Pump Operator
46	,,	D Skariah	— ,,
47	,,	KM Velayudhan	— ,,
48	,,	ET Devassy	— ,,
49	Smt.	VM Amminy	— Full Time Sweeper
50	,,	KD Chinnamma	— ,,
51	Smt.	PK Thankamani	— Part Time Sweeper
52	,,	AK Amminy	— ,,
53	,,	KC Mary	— ,,
54	,,	EV Thanka	— ,,
55	,,	KV Bharathi	— ,,

Library

56	Shri.	K Ravindran	— Librarian
57	,,	K Sankara Pillai	— Asst. Librarian
58	,,	Subash Kuriakose	— Artist Photographer
59	Smt.	N Sarojam	— Library Asst.
60	Shri.	KH Hussain	— ,,
61	Smt.	KM Suseela	— Office Assistant
62	Shri.	V Asokan	— Typist
63	,,	CA Jose	— Binder
64	,,	VS Neelakantan	— Attender
65	,,	KK Ahammed	— ,,

Botany (Physiology)

66	Dr.	Jose Kallarackal	— Scientist C
67	Dr.	KK Seethalakshmi	— Scientist D
68	Shri.	T Surendran	— ,,
69	,,	CK Soman	— Field Asst.
70	Smt.	D Sumangala Amma	— Stenographer
71	Shri.	PA Sankarankutty	— Attender
72	,,	KM Sivaraman	— Garden Worker

Botany (Taxonomy)

73	Shri. N Gopalakrishnan Nair	—	Scientist D
74	Dr. KK Narayanan Nair	—	,,
75	Shri. N Sasidharan	—	,,
76	Dr. C. Renuka	—	,,
77	Shri. MS Muktesh Kumar	—	,,
78	,, KK Unni	—	Field Asst.
79	,, T Prabhakaran	—	Gardener
80	,, VN Balakrishnan	—	Attender
81	Smt. AM Lalitha	—	Garden Worker
82	,, TG Chandrika	—	,,

Ecology

83	Dr. K Balasubramanyan	—	Scientist C
84	Shri. K Swarupanandan	—	Scientist D
85	Dr. AR Ramachandra Menon	—	,,
86	Shri. PK Chandrasekhara Pillai	—	Field Asst.
87	,, KR Sevaraman	—	Attender

Entomology

88	Dr. KSS Nair	—	Scientist B
89	Dr. R Venugopal Varma	—	Scientist C
90	Dr. George Mathew	—	,,
91	Dr. VV Sudheendrakumar	—	Scientist D
92	,, K Mohanadas	—	Scienlist E
93	,, P Padmanabhan	—	Field Asst.
94	Smt. K Annapoorni	—	Stenographer
95	Shri. ET Kuttykrishnan	—	Attender

Genetics

96	Shri. Mathew P Koshy	—	Scientist D
97	Smt. EP Indira	—	Scientist D
98	Shri. KK Ramesh	—	Field Asst.
99	,, AR Sreenivasan	—	Attender

Management

100	Dr. K Jayaraman	—	Scientist C
101	Smt. P Rugmini	—	Scientist D
102	Dr. PK Muraleedharan	—	Scientist E
103	Shri. Mammen Chundamannil	—	,,
104	,, CN Krishnankutty	—	,,
105	,, AR Rajan	—	Programmer
106	,, A Ramakrishnan	—	Stenographer
107	,, EO James Tidode	—	Typist
108	,, EP Somasekharan Nair	—	Attender

Pathology

109	Dr. JK Sharma	— Scientist B
110	Shri. C Mohanan	— Scientist D
111	Smt. EJ Maria Florence	— "
112	Shri. M Balasundaran	— "
113	" MI Mohamed Ali	— "
114	Dr. KV Sankaran	— Scientist E
115	Shri. K Yesodharan	— Field Asst.
116	" MC Mohandas	— Attender
117	" TS Chandrika	— Garden Worker

Silviculture

118	Shri. KC Chacko	— Silviculturist
119	Dr. R Chandarasekhara Pandalai	— Scientist E
120	Shri. Nandakumar U Narath	— "
121	" MS Jayaraman	— Junior Silviculturist
122	" K Rajendran	— Office Assistant
123	" M Cherukunhan Nair	— Attender
124	" KS Karunakaran	— "
125	" P Avunni	— Watcher
126	" K Mohanan	— "
127	" AK Sulaiman	— Cook-cum-Attendant
128	" V Mohamed Ali	— Garden Worker
129	Smt. AV Thankam	— "
130	" KT Pathumma	— "
131	Shri. P Mohammed	— "
132	" CJ John	— "
133	" CP Showkat ali	— "

Soil Science

134	Dr. TG Alexander	— Scientist B
135	Dr. S Sankar	— Scientist D
136	Shri. M Balagopalan	— "
137	" Thomas P. Thomas	— "
138	Smt. MP Sujatha	— Scientist E
139	Shri. AV Velayudhan	— Attender

Wildlife Biology

140	Dr. P Vijayakumaran Nair	— Scientist D
141	Shri. KK Ramachandran	— "
142	" PS Easa	— "
143	" EA Jayson	— "
144	" KV Sidharthan	— Attender

Wood Science

145	Dr. R Gnanaharan	— Scientist C
146	" K Mahabala Bhat	— "
147	" K Vishnu Bhat	— Scientist E
148	Shri. TK Dhamodaran	— "
149	" PK Thulasidas	— Laboratory Asst.
150	" MC Reghunathan	— Attender

GOVERNING BODY

1 Prof. NM Joseph — Chairman
Minister for Forests, Government of Kerala

2 Prof. N Balakrishnan Nair — Vice-Chairman
Chairman
State Committee on Science,
Technology & Environment

3 Shri. V. Krishnamurthy
Secretary to Government
Planning & Economic Affairs Department

4 Shri. R Narayanan
Secretary to Government Finance Department

5 Shri. M Sivarajan
Principal Chief Conservator of Forests, Kerala

6 Dr. EG Silas
Vice-Chancellor
Kerala Agricultural University, Vellanikkara

7 Shri. AG Oka
Inspector General of Forests
Ministry of Environment & Forests, New Delhi

8 Shri. KK Nair
Retd. Chief Conservator of Forests
Komath House
Cannanore Road, Calicut-673 011

9 Dr. PM Ganapathy
Director
Indian Plywood Industries Research Institute
Tumkur Road, Bangalore-560 022

10 Dr. JC Varmah
Ex-President, Forest Research Institute & Colleges
Shivdham
194-E, Rajpur Road,
Rajpur, Dehra Dun-248 006

11 Prof. PS Ramakrishnan
Director
GB Pant Institute of Himalayan
Environment & Development
Ministry of Environment & Forests, New Delhi

12 Mr. AK Kaderkutty
Managing Director
Western India Plywoods Ltd.
Baliapattom, Cannanore-670 010

13 Director
Kerala Forest Research Institute

EXECUTIVE COMMITTEE

— Chairman

1 Prof. N Balakrishnan Nair
Chairman
State Committee on Science,
Technology & Environment.

2 Shri. V. Krishnamurthy
Secretary to Government
Planning & Economic Affairs Department

3 Shri. M Sivarajan
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Komath House, Kannanore Road.
Calicut-673 011

5 Dr. PM Ganapathy
Director
Indian Plywood Industries
Research Institute, Bangalore-560 022

6 Director
Kerala Forest Research Institute

Phone: 25612

Balakrishnan & Co.,
Chartered Accountants
Near Thiruvambadi Temple
Trichur-680 001

AUDITORS' REPORT

We have audited the annexed Balance Sheet of the KERALA FOREST RESEARCH INSTITUTE, PEECHI, as at 31st March, 1988 and the annexed Income and Expenditure Account for the year ended on that date, signed under reference to this report, and report that:

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

2) The Balance Sheet and the Income and Expenditure Account dealt with by this report are in agreement with the books of account.

3) In our opinion and to the best of our information and according to the explanations given to us, the accounts together with notes thereon, give a true and fair view:

   a) in the case of the Balance Sheet, of the state of affairs of the Institute as at 31st March, 1988

   and

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

For BALAKRISHNAN & CO.,
Chartered Accountants
Sd/-
T. V. Balakrishnan
Proprietor

28th September 1988

KERALA FOREST RESEARCH INSTITUTE, PEECHI

Balance Sheet as at 31st March, 1988

Previous year Rs. P.		LIABILITIES		Current year Rs. P.
		GENERAL FUND		
	1,98,94,936 49	Balance as per last Balance Sheet	2,14,91,976 86	
	68,30,000 00	Add: Grant Received from Government of Kerala	58,82,795 00	
	2,67,24,936 49		2,73,74,771 86	
2,14,91,976 86	52,32,959 63	Less: Excess of Expenditure over Income	56,67,001 18	2,17,07,770 68
		RESERVES AND SURPLUS		
		Capital Reserve:		
3,00,603 68		Surplus in Grants (excess of income over the expenditure incurred) in respect of projects sponsored and financed by external agencies transferred on completion of the projects.		3,00,603 68
		CURRENT LIABILITIES AND PROVISIONS		
6,38,602 10		As per Schedule-A		14,33,557 89
2,24,31,182 64		Total Liabilities		2,34,41,932 25
		ASSETS		
		FIXED ASSETS		
86,84,136 22		As per Schedule-B		84,76,109 53
		CAPITAL WORK IN PROGRESS		
1,23,09,017 45		As per Schedule-C		1,24,95,564 65
		CURRENT ASSETS, LOANS AND ADVANCES		24,70,256 07
14,38,028 97		As per Schedule-D		
2,24,31,182 64		Total Assets		2,34,41,932 25

Note: Previous year's figures have been regrouped/rearranged where necessary.

Sd/-
Chairman
EXECUTIVE COMMITTEE

Sd/-
Director
KERALA FOREST RESEARCH INSTITUTE

Auditors report annexed
For BALAKRISHNAN & Co.,
Chartered Accountants
Sd/-
T. V. BALAKRISHNAN
Proprietor

Trichur,
28th September, 1988

KERALA FOREST RESEARCH INSTITUTE, PEECHI

Income and Expenditure Account for the year ended 31st March 1988

	Current year Rs. P.	Previous year Rs. P.
INCOME		
By Interest on Savings Bank and Fixed Deposit Accounts (includes Rs. 27,747 78 in respect of unspent grant of IDRC projects)	66,414 21	38,139 40
.. House rent recovery from staff	50,701 50	51,380 85
.. Rest House rent from Nilambur	4,113 75	3,732 50
.. Hire charges of vehicles	20,185 65	19,614 05
.. Seminars and symposis	Nil	60,909 34
.. Photocopying charges	6,855 10	14,557 60
.. Sale of books	40,007 31	Nil
.. Miscellaneous Income	6,126 58	21,966 94
.. Excess of expenditure over income	56,67,001 18	52,32,959 63
Total	58,61,405 28	54,43,260 31
EXPENDITURE		
To Salaries and Allowance	35,44,674 41	30,59,161 26
.. Contribution to Provident Fund	2,40,626 00	1,83,696 00
.. Workers Provident Fund	3,500 00	Nil
.. Leave Travel Concession	10,943 40	2,246 00
.. Group Gratuity Assurance	53,912 50	26,593 80
.. Travelling Expenses	1,17,826 70	1,19,712 71
.. Medical reimbursement	41,995 75	40,521 85
.. Leave Salary and Pension contribution	17,566 25	53,424 00
.. Postage	26,130 65	28,381 30
.. Telephone charges	51,353 70	46,702 80
.. Bank charges	246 00	125 53
.. Printing and Stationery	1,71,261 31	2,44,350 73
.. Subscriptions to journals & periodicals	1,62,710 06	2,16,886 02
.. Repairs and maintenance of vehicles	3,22,820 19	2,86,669 89
.. Consumable stores & chemicals	2,03,403 86	2,00,547 95
.. Repairs & Maintenance-Building/Equipment	1,00,524 06	1,68,552 80
C/o.	50,69,494 84	46,77,573 64

		Current year Rs. P.	Previous year Rs. P.
	B/F	50,70,494 84	46,77,589 64
.. Advertisement charges		29,076 00	12,185 00
.. Staff welfare expenses		6,793 23	19,933 38
.. Garden Development expenses		7,244 90	9,165 72
.. Audit fees		6,000 00	6,000 00
.. Legal charges		4,717 00	3,985 00
.. Electricity charges		96,354 50	72,863 95
.. Panchayat & Municipal property tax		24,364 40	24,302 78
.. Lease Rent of Land		2 00	2 00
.. Campus Development		2,426 85	2,055 04
.. Seminars and symposis		4,627 40	16,366 95
.. Miscellaneous expenses		17,194 06	17,446 55
.. Photocopying charges		29,316 25	Nil
.. Depreciation on Fixed Assets		5,63,795 85	5,81,373 30
Total		58,61,405 28	54,43,260 31

Sd/-
Chairman
EXECUTIVE COMMITTEE

Sd/-
Director
KERALA FOREST RESEARCH INSTITUTE

Referred to in our report of even date
For BALAKRISHNAN & CO.,
Chartered Accountants
Sd/-
T. V. BALAKRISHNAN
Proprietor

Trichur,
28th September, 1988

KERALA FOREST RESEARCH INSTITUTE, PEECHI

CURRENT LIABILITIES AND PROVISIONS - SCHEDULE 'A'

	31-3-1988 Rs P.	31-3-1987 Rs. P.
Research work-in-progress (Schedule-E)	10,99,905 39	3,05,519 60
Security Deposit from Contractors	15,344 00	25,422 00
Salaries Payable	2,96,569 50	2,67,676 76
T. A. Payable	—	8,380 75
Medical reimbursement payable	1,589 60	1,416 60
Lease Rent payable to Govt. of Kerala	22 00	20 00
Electricity charges payable	7,600 40	8,231 65
Audit Fees payable	6,000 00	12,000 00
Telephone charges payable	920 50	18 00
Printing & Stationery payable	1,070 00	—
CPF subscription pending remittance	1,166 00	8,326 00
GPF subscription pending remittance	100 00	—
LIC subscription pending remittance	668 00	120 74
CPF Loan recoveries pending remittance	275 00	375 00
Co-operative Society recoveries pending remittance	1,217 50	455 00
Post Office R. D. recoveries	50 00	100 00
State Life Insurance	20 00	—
Workers PF subscription	500 00	—
Earnest Money deposit of contractors	390 00	390 00
Caution Money deposit - Library Membership	150 00	150 00
Total	14,33,557 89	6,38,602 10

Sd/-
Director
KERALA FOREST RESEARCH

Sd/-
Chairman
EXECUTIVE COMMITTEE

Referred to in our report of even date
For BALAKRISHNAN & CO.,
Chartered Accountants

Sd/-
T. V. BALAKRISHNAN
Proprietor

Trichur
28th September, 1988

KERALA FOREST RESEARCH INSTITUTE, PEECHI

Schedule of Fixed Assets as on 31st March 1988

SCHEDULE - B

Description	ORIGINAL COST			DEPRECIATION			NET BLOCK	
	Total as on 1-4-1987	Additions	As on 31-3-1988	As on 1-4-1987	For the year	As on 31-3-1988	As on 31-3-1988	As on 31-3-1987
	Rs. P.	Rs. P.	Rs P.	Rs. P.	Rs. P.	Rs. Ps	Rs. P.	Rs. P.
Buildings, Compound Walls and Roads	64,89,645 39	1,90,609 00	66,80,254 39	10,11,062 08	1,67,583 91	11,78,645 99	55,01,608 40	54,78,583 31
Cycles	1,034 63	...	1,034 63	940 28	18 87	959 19	75 48	94 35
Motor Vehicles	5,67,965 70	...	5,67,965 70	5,34,683 48	8,931 50	5,43,614 98	24,350 72	33,282 22
Electrical Fittings	5,26,057 13	52,180 90	5,78,238 03	2,93,122 15	42,105 13	3,35,227 28	2,43,010 75	2,32,934 98
Library Books	15,25,856 49	76,073 10	16,01,929 59	9,58,001 41	96,589 23	10,54,590 64	5,47,338 95	5,67,855 08
Offices Equipment	2,67,401 98	1,200 00	2,68,601 98	1,24 785 71	21,213 60	1,45,999 31	1,22,602 67	1,42,616 27
Furniture and Fixtures	9,49,159 99	13,782 16	9,62,942 15	5,18,948 31	44,399 38	5,63,347 69	3,99,594 46	4,30,211 68
Insectorium and Potting Shed	1,79,889 88	...	1,79,889 88	42,522 56	6,868 37	49,390 93	1,30,498 95	1,37,367 32
Research Equipment	31,74,547 64	21,924 00	31,96,471 64	15,27,512 49	1,74,670 28	17,02,182 77	14,94,288 87	16,47,035 15
Boat	32,219 81	...	32,219 81	18,063 35	1,415 58	19,479 53	12,740 28	14,155 86
Total	137,13,776 64	3,55,769 16	140,69,547 80	50,29,642 42	5,63,795 85	55,93,438 27	84,76,109 53	86,84,136 22

Sd/-
Chairman
EXECUTIVE COMMITTEE

Sd/-
Director
KERALA FOREST RESEARCH INSTITUTE

For BALAKRISHNAN & Co.,
Chartered Accountants
Sd/-
T. V. BALAKRISHNAN
Proprietor

Trichur,
28th September, 1988

KERALA FOREST RESEARCH INSTITUTE, PEECHI

CAPITAL WORK IN PROGRESS - SCHEDULE 'C'

		31-3-1988 Rs. P.	31-3-1987 Rs. P.
Peechi - Building IV Phase and New Type II Quarters, Directors quarters		87,42,041 47	87,12,498 93
Nilambur Construction		4,25,540 20	4,25,540 20
Teak Research Centre	17,28,110 32		
Less: Grant received from Government of Kerala	2,00,000 00	15,28,110 32	14,12,899 32
Advance for Construction: Kerala State Construction Corpn. Ltd.		26,579 00	26,579 00
Kerala Public Health Engineering Department		17,31,500 00	17,31,500 00
Mist Chamber Construction		41,793 66	—
Total		1,24,95,564 65	1,23,09,017 45

Sd/-
Director
KERALA FOREST RESEARCH INSTITUTE

Sd/-
Chairman
EXECUTIVE COMMITTEE

For BALAKRISHNAN & CO.,
Chartered Accountants
Sd/-
T. V. BALAKRISHNAN
Proprietor

Trichur.
28th September, 1988

KERALA FOREST RESEARCH INSTITUTE, PEECHI

CURRENT ASSETS LOANS AND ADVANCES - SCHEDULE 'D'

	31-3-1988 Rs. P.	31-3-1987 Rs. P.
A. Current Assets:		
Research Work-in-progress (Schedule-E)	2,46,899 68	3,72,136 72
Stock as valued and certified by Director		
Stock of Stationery	9,850 99	18,918 81
Stores and Chemicals	3,011 66	24,965 22
Unused stamps	478 80	574 45
Cash in hand	4,833 72	1,71,259 51
Balance in State Bank of Travancore:		
In Savings Bank Account	13,39,132 05	61,268 97
In Fixed Deposit Account (being security for Bank guarantee facility)	36,500 00	36,500 00
Balance with Treasury:		
In Savings Bank Account	317 94	1,76,944 79
In Fixed Deposit Account	3,11,500 00	3,00,600 00
Accrued interest	57,551 06	33,038 85
Sub Total	20,10,075 90	11,99,207 32
B. Loans and Advances:		
As per Schedule-F	2,30,812 53	1,20,516 95
Prepaid expenses:		
Journal subscriptions	2,21,217 84	1,15,561 70
Insurance	8,151 80	2,743 00
Sub Total	4,60,182 17	2,38,821 65
Grand Total	24,70,258 07	14,38,028 97

Sd/-
Chairman
EXECUTIVE COMMITTEE

Sd/-
Director
KERALA FOREST RESEARCH INSTITUTE

For BALAKRISHNAN & CO.,
Chartered Accountants
Sd/-
T. V. BALAKRISHNAN
Proprietor

Trichur
28th September, 1988

KERALA FOREST RESEARCH INSTITUTE, PEECHI

RESEARCH WORK IN PROGRESS - SCHEDULE "E"

Particulars	Grant received	Amount Spent	Balance 31-3-1988	Balance 31-3-1987
	Rs. P.	Rs. P.	Rs. P.	Rs. P.
Kerala Forest Department	3,25,444 10	5,44,888 10	2,15,444 00	3,59,444 00
Grant from Government of India for preservation of Dalbargia-Bot-06	25,206 00	25,208 38	0 38	8,708 38
-do- -do- for impact of selection felling in forest eco-system in Kerala Western Ghats	2,81,900 00	2,45,029 64	36,870 36	46,868 86
CSIR Collection of pollen grains	14,158 05	11,496 91	2,661 14	2,661 14
FAO - Econ-7	47,400 00	6,905 70	40,494 30	40,494 30
Pooyamkutty Project-Grant from Government of India	2,88,300 00	3,11,770 96	23,470 96	39,956 50
Grant from Coconut Development Board-Wood-08	55,000 00	41,977 42	13,022 58	18,487 10
Vegetation Map Parambikkulam-Ecol-07	30,000 00	12,073 44	17,926 56	19,863 01
Action Plan for Nilgiri Biosphere	25,000 00	773 31	24,226 69	24,226 69
Ford Foundation	2,86,412 00	1,76,134 00	1,10,276 00	1,10,412 00
IDRC 108/87 (Bamboo Project)	6,14,118 00	3,22,236 99	2,91,881 01	...
IDRC 109/87 (Cane Project)	5,07,387 00	2,44,312 43	2,63,074 57	...
Nilgiri Biosphere human studies 116/87	1,00,500 00	16,088 50	84,411 50	...
-do- -do- Ecological studies	1,10,400 00	4,102 70	1,06,297 30	...
-do- -do- Selected Indigenous Species 114/87	96,200 00	7,874 35	88,325 65	...
Social Forestry	1,50,000 00	1,34,102 70	15,897 98	...
F A O Authors Contract	22,631 25	18,598 50	4,032 75	...
Wood - 03 Extension	3,500 00	2,995 00	505 00	2,550 00
F A O - Land Evaluation	...	3,984 34	3,984 34	3,984 34
Total	29,83,556 40	21,30,552 69	8,53,005 71	66,617 12

Summary	Current year	Previous year
Amount overspent	2,46,899 68	3,72,136 72
Amount underspent	10,95,905 39	3,05,519 60

For BALAKRISHNAN & CO., Chartered Accountants

Sd/-
T. V. BALAKRISHNAN, Proprietor

Sd/-
Chairman
EXECUTIVE COMMITTEE

Sd/-
Director
KERALA FOREST RESEARCH INSTITUTE

KERALA FOREST RESEARCH INSTITUTE, PEECHI

LOANS AND ADVANCES - SCHEDULE 'F'

	31-3-1988 Rs. P.	31-3-1987 Rs. P.
Travelling Advance	31,456 00	23,086 50
Work Advance to Scientists	81,660 01	12,744 26
Leave Salary Adv. to deputationists	—	6,190 10
INSDOC, Bangalore	2,136 20	1,136 20
Telephone Deposits	23,450 00	8,650 00
Deposit with KSEB	22,529 00	22,529 00
Deposit with IOC	195 00	195 00
Deposit with DFO Nilambur	100 00	100 00
Chitra Sales Corporation	1,220 00	840 00
Private Trunk Call charges	469 50	363 00
Motor Vehicle Advances	4,805 00	10,162 00
Marriage Advance	3,443 00	8,068 00
Festival Advance	5,850 00	600 00
Kerala High Court	692 17	692 17
M/s. Coastal Traders, Trichur	2,000 00	1,000 00
Shree Venkiteswara Gas Agencies	588 30	...
Vennal Naidu & Sons	13,500 00	—
M/s. Thomsons, Trichur	140 00	...
Regional Research Centre	60 00	—
Executive Engineer, P.H. Division	3,000 00	—
Anert, Trivandrum	100 00	...
St. Joseph's Engg. Works	36,650 00	...
Training Exp. for V. N. Nandakumar	—	4,000 00
I. F. S. Training	—	23,960 72
CSIO, Cochin	—	200 00
	2,34,044 18	1,24,516 95
Less: Gopinathan Nair, CSIR	3,231 65	4,000 00
Total :	2,30,812 53	1,20,516 95

Sd/-
Chairman
EXECUTIVE COMMITTEE

Trichur,
28th September, 1988

Sd/-
Director
KERALA FOREST RESEARCH INSTITUTE

For BALAKRISHNAN & CO.,
Chartered Accountants
Sd/-
T. V. BALAKRISHNAN
Proprietor