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Contents

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Evergreen, the KFRI Newsletter is currently brought out in March and September each year and is intended for free private distribution within the Institute and the Kerala Forest Department. Free copies will also be sent upon request to other persons or institutions connected with forestry activities. The views expressed here are those of the authors and do not necessarily reflect views of the institute. All interested persons are invited to send comments, opinions and short articles for inclusion in the Evergreen. The Newsletter Committee reserves the right to choose among contributions and edit wherever necessary.

Bamboo Market in Kerala

Introduction:

In Kerala, bamboo is distributed in the forests and also in the homesteads and farmlands. The common species found is *Bambusa bambos*. Other species like *Bambusa vulgaris, Dendrocalamus strictus* etc., are distributed sporadically. According to one estimate, Kerala forests accounts about 63,000 ha. of bamboo forests in 1981 and of this, about 35% or 22,000 ha. comprised of *Bambusa bambos* (Bennet, 1993). The area occupied by bamboo in the homesteads of Kerala is estimated to be about 581 ha. in 1987-88. (Krishnankutty, 1988).

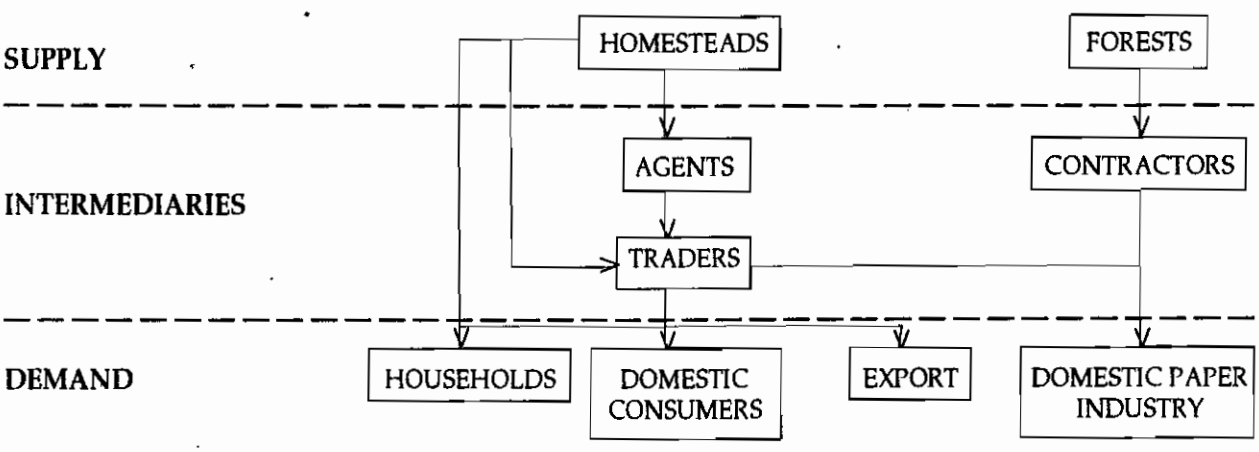
The bamboo market in Kerala is concentrated in the Northern districts especially in Palghat and Malappuram. About 80-90% of the bamboo depots are functioning in this area. Most of these depots are specialised only in bamboo trading, though a few are timber depots where bamboo is traded along with timber and poles. The structure of bamboo market in Kerala is unique unlike other States in India. Some of the features are, i) the market is mainly geared to cater the traditional demand from Tamil Nadu. ii) the supply source is predominantly homesteads and iii) the market shows the features of oligopsony. Thus the study of bamboo markets in Kerala merits special attention.

Demand and supply of bamboo :

Demand for bamboo constitutes internal and external demand. Internal demand comprises industrial demand, non-industrial demand and household demand. Industrial demand includes demand from pulp and paper industries and cottage industries (production of mats and baskets). Non-industrial demand is for construction of sheds and houses, scaffolding, centering (support for concrete works), and for agricultural purposes. External demand is from Tamil Nadu for construction and agricultural purposes, and from Karnataka for paper mills. This forms about 80-90% of the total marketed quantity of bamboo in Kerala.

Supply of bamboo in Kerala is from forests and homesteads. Bamboo from forests is entirely earmarked for the domestic pulp and paper industries. So the main supply of bamboo in the market is from homesteads. Earlier the households cut down bamboo because of its 'nuisance value'. But the increased demand has raised the farm prices, which in turn increased the income from bamboo to the households. It has now become an important source of supplementary income to the households. But the

Structure of bamboo market in Kerala



population pressure and consequent fragmentation of land holdings has considerably reduced the growing stock of bamboo in the homesteads. The practice of clear felling adopted by the traders, which delays the next harvest to 4 to 5 years, also contributes to the reduction in the supply of bamboo.

Marketing system:

The bamboo market in Kerala comprises of a long chain of vertical interaction involving farmers, traders, contractors, agents and consumers. The whole system can be divided into three stages of transactions, and four groups are involved in the system viz., farmers (households), the middlemen (includes agents, bamboo cutters, loading and transporting workers), traders and the final consumers. Following figure shows the present structure of bamboo market in Kerala.

Usually, depots collect bamboos from homesteads through agents who are attached to these depots. The number of agents depends on the size of the depot, which in turn depends on the quantum of sales. In the first stage, households sell bamboo to the agents. The value is arrived by bargaining between the parties. Value (farm price) depends on number of factors such as, the bargaining power of the two parties, distance from the market/depot, size and quantity of product etc. The price offered is for the full bamboo culms and for the whole clump. Price may vary from Rs. 5 to Rs. 40 per culm, depending on the length and girth of each culm. In the second stage, the agent fells the bamboo clump by himself or by employing bamboo cutters. Bamboo is cut into 2 to 3 pieces depending on the size and shape of the culms. Then the agent sells the same to the depots. Generally, the margin for the agent will be meager since the funds for purchasing bamboo is advanced by the dealer himself. In the final stage, the depots sell to the consumers. Some times there may be direct dealing with the depots and the households. This kind of trading is seldom practiced. The value of full bamboo which is sold in pieces ranges between Rs. 17 to Rs. 70. The net profit margin for the dealers varies from Rs.10 to Rs.15 per full bamboo.

As mentioned earlier, the bamboo market in Kerala shows some features of oligopsony. That is : i) the market is geographically narrower - concentrated in northern districts, which helps the traders to form implicit or explicit collusion when they purchase the commodity from the farmers. ii) since the producers are geographically scattered (spread over the rural areas), the traders are able to avoid collusion among the producers. iii) Price is the significant factor and non-price factors have no effect on the market system. and iv) the market caters mainly to the needs of large buyers such as bamboo traders in Tamil Nadu and pulp and paper mills in and outside the State. This situation help the traders to increase the price as when they desire.

Market needs:

The major consumers are the traditional buyers from Tamil Nadu and the pulp and paper industries within and outside the State. The traditional buyers use bamboo mainly as a substitute for timber for construction purposes, for support for banana crop and for weaving mats and baskets. Even though there are about 30 to 40 size classes of bamboo (ranging between 10 feet to 22 feet) available in the market, the most in demand is the variety of 18 feet length. This is commonly known as 'Vazha Mula', used as prop to support for banana crop. For the paper industries, bamboo is for pulping, they can use any type of bamboo. The depots sell the left outs and curved bamboos to the paper mills on the basis of weight. So each and every piece of bamboo is worthwhile for the depots. The entry of paper mills in the market and the competition between different groups of buyers has increased the price for bamboo considerably.

Price variations:

The price of bamboo has increased considerably over the years. The price of first quality 22 feet length bamboo has increased from Rs. 1.25 in 1965 (Muhammad, 1967) to Rs. 48 in 1994, In the same way the price of 18 feet and 12 feet length bamboo has increased from Rs. 0.95 to Rs. 35 and Rs. 0.45 to

Rs. 14 respectively during the same period. The price of bamboo sold to the paper industry has increased from Rs. 700 per tonne in 1984 to about Rs. 1250 in 1994. Many factors have contributed to this, probably the most important being the increase in demand and consequent reduction in supply. Another factor for price rise can be attributed to the government policy of reservation of bamboo forests to the paper industry.

Conclusion:

The importance of bamboos is increasing owing to its increased demand for various purposes. The increased demand has increased the intensity of depletion of this resource especially in the homesteads. This has clearly reflected in the market prices. Oligopsony situation prevails in the bamboo market helps the traders to determine the price and quantity which in turn affects its sustainbability. The increased prices can be one of the motivating factors for undertaking extensive cultivation of bamboos in Kerala. Thus there should be immediate steps to educate people about the potential of this resource and enhance the cultivation. This will not only increase the income of the farmers, but also reduce pressure on our forests.

Jayasankar. B
P.K. Muraleedharan
Division of Economics

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The Diagnosis and Recommendation Integrated System (DRIS) in Soil Nutrient Management

Trees and other vegetation require nutrients for healthy life. As these nutrients perform such important functions, their deficiency results in serious changes like reduction in cell size, cell division, internal structure and adversely affecting the vital physiological processes. Though their status can be found out by soil as well as foliar analysis, their deficiency can also be seen from the symptoms which develop in plants. Because of the dynamic nature of foliar composition, which is strongly influenced by aging processes as well as interactions affecting nutrient uptake and distribution, foliar analysis can become a complex exercise. The Diagnosis and Recommendation Integrated System (DRIS) copes with the difficulties inherent in diagnostic procedures.

Nutrient concentration and aging:

Generally the nutrient concentrations (nutrient mass/total dry plant mass) change remarkably with plant age. General foliar concentrations of N, P, K and S tend to decrease during aging. In contrast, Ca and Mg concentrations tend to increase in very early and late stages of growth in some crops. Normally diagnostic system depends on certain norms derived from plant tissue of a specific age and catagorise plants as healthy or unhealthy based solely on nutrient concen-

tration. Thus the stage of growth in sampled plant is a prime concern and diagnosis based on such standards are usually applied only to samples harvested within narrowly specified stages of growth and the procedure although simple in theory, can be difficult to practise, in such a way that first an accurate determination of the stage of growth must be made in the field at the time of sampling which dependent upon the accuracy of trained sampler. Second, the sampler must accurately communicate this information to the diagnostician, so that proper norms can be selected. Third, little research can be initiated to determine cultivar maturity group on nutrient concentration at given growth stages.

An alternative to this approach was suggested as a part of DRIS by Beaufils, who pointed out that if N, P and K concentrations (relative to dry matter) decrease during aging, then the ratios N/P, N/K and P/K (or their reciprocals) should remain fairly constant. Similarly, because Ca and Mg concentrations usually increase during aging, a quotient formed from these two nutrients (Ca/Mg or Mg/Ca) should also produce a constant value.

In essence, DRIS provides a means of ordering nutrient ratios into meaningful expressions, which are called DRIS indices. Simply stated, a nutrient index is a mean of the derivations of the ratios containing a given nutrient from their respective normal or optional values. The nutrient indices, then give an indication of the relative status of nutrient constituents in the plant material relative to other constituents included in the diagnosis.

DRIS norms:

The first step in implementing DRIS is the establishment of standard values or norms, based on crop response model. In other practices of normal distribution of observations of populations for foliar nutrient data collected in the field, are normally distributed and in that, low yields are more likely to be under than over fertilised.This leads to more indicative of management practices than of plant responses. In DRIS, this difficulty has been overcome by dividing data sets or populations of obervations into high and low yielding sub groups separated by cut off values. Then averaging values from the high yielding group to obtain estimates of tissue parameter optima and the coefficient of variation (CV) of the high yielding data provides a measure of the relative spread or breadth of the yield response surface at upper yield levels. In DRIS calculations, only one expression is used to relate each nutrient pair.

DRIS norms, calculated on the basis of finite sets of field data, must be tested to insure validity and accuracy. First DRIS is usually conducted in field or green house grown plants selected from factorially designed fertiliser trials. The data will be independent from those used to generate the norms and CVs used in index calculations. First, using data from an experiment in which yield responses have been obtained to the nutrients being studied, plants from the control or lowest treatment level are diagnosed and the most needed nutreints determined. Then the treatment with additions prescribed by the initial diagnosis is located and the yields are compared. If yield increases when appropriate treatments is applied, the diagnosis is considered as success, otherwise the prescribed treatment cannot be found as a part of the experimental lay out.

Calculating DRIS indices:

DRIS provides mathematical means of ordering a number of nutrient ratios or products into nutrient indices that can be easily interpreted. The standard values are then used to generate indices by the following equations, in this case, for the hypothetical nutrients A through N;

$$\text{A index} = \frac{[f(A/B) + f(A/C) + f(A/D) \ldots\ldots + f(A/N)]}{z}$$

$$\text{B index} = \frac{[f(A/B) + f(B/C) + f(B/D) \ldots\ldots + f(B/N)]}{z}$$

$$\text{N index} = \frac{[-f(A/N) - f(B/N) - f(C/N) \ldots\ldots - f(M/N)]}{z}$$

where, when A/B >= a/b

$$f(A/B) = \frac{(A/B-1)}{a/b} \times \frac{1000}{cv}$$

or when A/B < a/b

$$f(A/B) = \frac{(1-a/b)}{A/B} \times \frac{1000}{cv}$$

in which A/B is the value of the ratio of the two elements in the tissue of the plant being diagnosed, a/b is the optimum value or norm for that ratio. cv is the coefficient of variation associated with the norm and z is the number of functions comprising the nutrient index. Values of the other functions such as f(A/C), f(A/D) etc. are calculated in the same way as f (A/B) using the appropriate norms and cvs. A nutreint index, then is a mean of functions of all ratios containing a given nutrient.

In a plant sample with optimal nutrient balance, all nutrient indices would equal zero. However, it is important to recognise that an individual nutrient is not necessarily present in optimum concentration if its index equals zero. For instance, results of a diagnosis were as follows.

Nutrient	N	P	K	Ca	Mg
Index	-21	0	+7	+7	+7

N had the most negative index, was relatively least abundant, and was likely to be yield limiting if nutrition were govening growth. Although P index equalled 0, less abundant than K, Ca or Mg, was the second most needed nutrient in this diagnosis. K, Ca and Mg levels are excessive relative to N and P and include the recommendations supplementing the supply of N and to a lesser extent P, even though the P index equals 0.

Generally, the Diagnosis and Recommendations Integrated System represents a step forward in our abilities to diagnose nutritional plant conditions and may ultimately have a significant impact on nutrient management practices. However as with other diagnostic systems, DRIS is dependent on the quality of the empirically determined information, ie; its input. To date, DRIS norms have been published for a wide range of plants .

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Preservation of rubber wood: Treatment methods and applications

Timber scarcity and escalated price of available timbers have made people to be willing to consider non-durable timbers treated with preservative chemicals. After much initial reluctance, treated rubber wood is now finding many applications. Rubber wood is available in plenty, to the tune of about 700,000m^3 round wood per year. In comparison to the price of other non-durable timbers, rubber wood is still cheap.

Rubber wood is such a perishable timber that the Bureau of Indian Standards has included it as one of the reference timbers for testing the natural resistance of timbers to decay. If the wood is not treated with preservative chemicals, one can never ensure the service life of the products made out of rubber wood. It is thus widely accepted that rubber wood should be treated with preservatives for its effective utilization.

As there is so much confusion regarding the treatment methods and preservative chemicals, this article attempts to answer questions on the different types of treatment methods available and commercially available preservative chemicals and what to use and when to use.

If we take the Indian context, preservative chemicals commercially available are copper-chrome-arsenate (CCA), copper-chrome-boric (CCB), boric acid-borax, pentachlorophenol (PCP), synthetic pyrethroides, etc. Different treatment methods include vacuum-pressure (full-cell process), diffusion process, soaking, etc.

For some people, preservation of rubber wood means treating with copper-chrome-arsenate chemicals under vacuum-pressure method only. This is far from the truth. In general, the end-use determines what chemicals to use and depending on the chemicals, one can choose what treatment method to employ. For example, if we want to use rubber wood for furniture, in its natural colour, preservative chemicals that can be used are limited to boric acid-borax or pentachlorophenol. Boric acid-borax chemicals can be introduced into rubber wood to adequate retention either by diffusion process or by vacuum-pressure method, or by alternating/oscillating pressure method. If one chooses to treat rubber wood with PCP, the treatment has to be carried out either by vacuum-pressure method or by double vacuum method depending on the chemical retention required. Now, let us consider what treatment methods will be applicable for what end uses and what chemicals are preferred.

Soaking

As the permeability of rubber wood is high, dried rubber wood (15-20% moisture content) can take in some amount of chemicals if the wood is left for soaking overnight. The concentration of the chemical should be kept low so that uniform penetration will be there for at least few millimeters. However, treatment quality cannot be ensured in this method.

Rubber wood can be treated with water-borne preservatives (CCA, CCB) by this method. The service life expected of the treated wood will be short and wood is suited for light packing cases. If the wood is wet, however, penetration of chemicals will be almost negligible. Assembled items like window frames (12-15% moisture content) can be treated by soaking in pentachlorophenol dissolved in a suitable solvent. Synthetic pyrethroides can be added to give protection against borers. The advantage of this method is that the treated assembled items need not be dried once again.

Diffusion process

For rubber wood up to 50mm thickness, this is the most effective and cheap method of treatment. Boric acid-borax, which are water soluble and which do not get precipitated, are the ideal chemicals for this treatment. Adding sodium pentachlorophenoxide (NaPCP), not only helps in controlling specific staining fungi during diffusion storage, but also helps in increasing the efficacy of the treatment. An effective replacement for NaPCP, which has now been banned, is a combination of TCMTB (thio cyano methyl) thio benzo thiazole) and MBT (methylene-bis-thiocyanate). However, these two chemicals are not manufactured in India. Of the available fungicides, captafol has shown promise.

The advantage of the method is that green wood can be treated and also the natural colour can be retained. The treated wood is ideally suitable for furniture, paneling and other items used indoors. Diffusion process is in no way inferior to vacuum-pressure method for treating rubber wood for interior use. In fact, through-and-through penetration of chemicals is possible under the diffusion process.

Rubber wood for light to heavy packing cases which will not be put to harsher conditions outdoors can be treated with boric acid-borax by this method. The diffusion storage period can be reduced for this.

If this treated rubber wood is to be used as core stock in blockboards, flush doors, etc., diffusion process is ideal. Here also, the diffusion storage period can be reduced. However, adequate chemical retention should be ensured.

Vacuum-pressure method

For treating rubber wood with water-borne pre-

servatives like CCA and CCB, the only effective method is vacuum-pressure method. The treated wood can be used for exterior applications including heavy packing cases, cable drums, etc. The treated wood will have bluish-green colour and will have to be painted if it is to be used for door frames, furniture, etc.

One should be judicious in choosing the right chemicals. Both CCA and CCB are effective in outdoor use. If the treated wood is to be used in a highly termite-prone area, CCA will be better. However, for uses like door frames, heavy packing cases, cable drums, etc., CCB will do the job.

To ensure uniform penetration of preservatives, the wood should be dried to about 30% moisture content. If the wood is wet, chemicals will precipitate at the periphery and though the retention of chemicals may be adequate, chemical penetration will be shallow. Most of these chemicals will get removed when the wood is further processed (like planing).

Boric acid-borax chemicals can be impregnated into rubber wood by this method also. As these chemicals do not precipitate, highly permeable rubber wood can be treated even at high moisture levels (50-60%) by vacuum-pressure method.

Alternating/oscillating pressure method

Instead of one vacuum-pressure cycle in the normal vacuum-pressure method, these methods will have 10-50 short cycles, depending on the thickness of wood, moisture level, chemical retention required, etc. These methods are suitable for treating green rubber wood with CCA or CCB.

As discussed above, different treatment methods and different preservative chemicals are available. Depending on the end-use, the right chemical should be used and a suitable treatment method should be employed, to get the required level of chemical retention and penetration.

Dr. R. Gnanaharan
Division of Wood Science

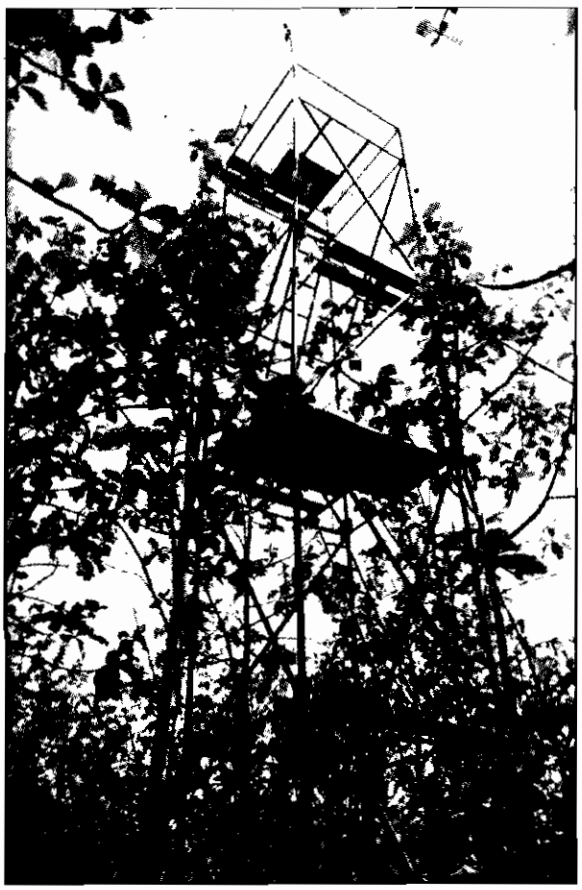
Water use of some indigenous and exotic trees in Kerala measured

The water consumption by different tree species have been a subject of debate for a long time. The excessive water use of eucalypts and acacia have attracted world wide attention. The water use of five tree species viz., *Eucalyptus tereticornis*, *E. grandis*, *Acacia auriculiformis*, *Anacardium occidentale* (cashew) and *Tectona grandis* (teak) which are grown extensively in plantations in Kerala, were recently measured at KFRI.

Micrometeorological measurements above the canopy (Fig. 1) was combined with physiological measurements on the leaves. These values were applied in the Penman-Montieth equation to arrive at the figures for transpiration. The values of water loss calculated on a per tree basis is as follows.

Species		Water use per tree (litres/day)
Eucalyptus tereticornis	(4-yr-old)	18 - 44
grandis	(4-yr-old)	13 - 40
Acacia auriculiformis	(4-yr-old)	10 - 24
Anacardium occidentale	(18-yr-old)	250 - 450
Tectona grandis	(12-yr-old)	15 - 85

It may appear that cashew and teak are the biggest water consumers. But it should be noted that the



Scaffold tower erected in a teak plantation to monitor the microclimatic and physiological parameters.

density of the above trees in a plantation is several times less than the other tree species studied. The water use of a tree is also not directly related to its age. Studies conducted elsewhere have shown that eucalypts achieve their maximum water use capacity when they are 4-5 years old.

The water consumption when taken on a plantation scale will present a very different picture. The evapotranspiration values for the plantations of the above trees measured in Kerala are as follows.

Species	Evapotranspiration (mm/year)
Eucalyptus tereticornis	1943
E. grandis	1419
Acacia auriculiformis	1784
Anacardium occidentale	1998
Techona grandis	1497

It may be noted that the above values have been arrived at by assuming that there is no net loss of water from the canopy during the three months (June-August) of the monsoon. The above values also include the water lost by rainfall interception. It is to be mentioned that eucalypts when planted at 3 x 3m spacing consumed only half the above quantity of water when considered on a plantation scale.

Jose Kallarackal and C.K. Somen
Division of Plant Physiology

Volume table for *Casuarina equisetifolia*

A provisional volume table for *Casuarina equisetifolia* was reported by Jayaraman *et al.*, (Jayaraman, K., Muraleedharan, P.K. and Gnanaharan, R. 1992. Evaluation of Social Forestry plantations raised under the World Bank Scheme in Kerala. *KFRI Research Report* 85. Kerala Forest Research Institute). The volume table is reproduced here for wider reference. The details of the data set used and the estimation procedure are available in the above mentioned report.

Tree volume table for *Casuarina equisetifolia*

Gbh (cm)	Volume (m^3)	Gbh (cm)	Volume (m^3)	Gbh (cm)	Volume (m^3)	Gbh (cm)	Volume (m^3)
15	0.008779	24	0.027272	33	0.061910	42	0.120099
16	0.010215	25	0.030216	34	0.067061	43	0.128431
17	0.011789	26	0.033357	35	0.072496	44	0.137226
18	0.013514	27	0.036711	36	0.078243	45	0.146447
19	0.015385	28	0.040301	37	0.084315	46	0.156138
20	0.017415	29	0.044112	38	0.090746	47	0.166354
21	0.019617	30	0.048167	39	0.097510	48	0.177051
22	0.021985	31	0.052489	40	0.104643	49	0.188283
23	0.024535	32	0.057061	41	0.112182	50	0.200070

Note: Volume refers to the solid volume with bark of wood greater than 10cm girth over bark.

K. Jayaraman and V. Sreekumar
Division of Statistics

Recent Publications

Scientific Papers

Balagopalan, M., Thomas, T.P., Mary, M.V., Sankar, S. and Alexander, T.G. 1992. **Soil properties in teak, bombax and eucalypt plantations of Trichur Forest Division.** Journal of Tropical Forest Science, 5:35-43.

Basha, S.C. and Nair, K.K.N. 1993. **Endemic angiosperms of the Western Ghats of India with special reference to Kerala: A review.** In: Rare Endemic and Endangered Angiosperms of Western Ghats (Ed. C.K. Karunakaran), Kerala Forest Department, 276-299 pp.

Gnanaharan, R. and Damodaran, T.K. 1993. **A pilot plant investigation of boron treatment of rubber wood: Arriving at an economical treatment schedule.** Holz als Roh-und Werkstoff, 51:279-282.

Gnanaharan, R., Mohanan, C. and Chand Basha, S. 1993. **Post-harvest technology for reed bamboo.** BIC India bulletin, 3:1-6.

Mathew, G. 1993. **Infection and implantation of some systemic insecticides for the control of teak carpenter worm (*Alcterogystia cadambae* (Moore) (Lepidoptera: Cossidae).** Journal of Tropical Forestry, 9:148-151.

Ramachandran, K.K. 1993. **Status survey and distribution of endangered grizzled giant squirrel in Chinnar Wildlife Sanctuary, Kerala, India.** Indian Journal of Forestry, 16:226-231.

Sankaran, K.V. 1993. ***Collybia leucophaea* - An addition to Indian agaric flora.** Acta Botanica India, 21:127-128.

Research Reports

Basha, S.C., Sankar, S. and Pandalai, R.C. 1993. **Evaluation of forest schemes of the Kerala Forest Department under the Western Ghat Develop-**

ment Programme. KFRI Research Report No. 92. Final Report of Research Project 141/'92 - Divisions of Soil Science and Silviculture.

Abstract: With the objective of economic upliftment of the people and conservation of ecology in the Western Ghats, the Planning Commission initiated the Western Ghat Development Programme (WGDP) during 1974-75. Objectives of WGDP during the Seventh Five Year Plan were (i) to maintain the ecological balance which is essential for the life support system (ii) to preserve genetic diversity (iii) to restore the ecological damage caused by human interaction and (iv) to create awareness among people and educate them on the far reaching implications of ecological degradation and to ensure their active participation in the ecodevelopment scheme.

While considering the development of forestry sector in the State, one cannot ignore the role of forests in maintenance of the ecological balance. So the schemes implemented under WGDP also gave due importance to the ecological development. Thus, Forest Department undertook the work of afforestation of delicate hill slopes for raising protection forests. As organized encroachment is one of the important problems in Western Ghat region, especially in Kerala, the need for forest protection was keenly felt. While drawing up programmes under this scheme the department gave importance to maintain and improve natural forests than to promote commercial plantations, so that future degradation is considerably checked.

The present study in its evaluation of the forestry schemes undertaken by the Kerala Forest Department under the WGDP (during the Seventh Five Year Plan period) showed that the forestry programmes implemented under the WGDP have been effective to a great extent in augmenting the forest resources. Moreover, the programmes implemented by the Forest Department under WGDP have fulfilled the objectives of ecorestoration and ecodevelopment to a large extent.

It is felt that, in future, forestry programmes under WGDP may be focused on raising of bamboos, improvement of productivity of the plantations, forest consolidation etc. Ecorestoration of the degraded forests by planting appropriate species should receive adequate attention for conserving both soil and moisture.

Other Publications

Books

Socio-economic research in forestry: Proceedings of a national seminar on socio-economic research in forestry, 18-20 May 1992, Kerala Forest Research Institute, Peechi. (Eds.) S. Chand Basha, P.K. Muraleedharan, K.K. Seethalakshmi, K.V. Sankaran and K.K.N. Nair. Price Rs. 350/-; Foreign - US$40/-.

History of Forest Management in Kerala: Mammen Chundamannil. Price Rs. 150; Foreign - US$15/-.

New research projects

KFRI 191/'93

Statistical analysis package for forest mensuration.
Investigator: K. Jayaraman
Objective: To develop a software package for statistical analysis in forest mensuration.
Supported by KFRI.

KFRI 192/'93

Afforestation of Ayyampilly Hills - Participatory Action Research programme.
Investigators: S. Sankar and U.M. Chandrasekhara
Objective: Revegetation of a degraded land at Ayyampilly with the involvement of local people for their benefit and for improving the overall ecology of the area.

Supported by Integrated Wasteland Development Project, Thrissur.

KFRI 193/'93

Analysis of data from long-term trials.
Investigator: P. Rugmini
Objectives: To develop methods of analysis of data from long-term trials with repeated measurements on the experimental units.
Supported by KFRI.

KFRI 194/'93

Underplanting Rattans in Rubber plantations.
Investigator: R.C. Pandalai
Objectives: (1) To standardize the planting techniques of Rattans in Rubber plantations (2) To standardize the age of Rattan seedlings for underplanting in Rubber plantations (3) To compare the performance of different Rattan species under Rubber.
Supported by Plantation Corporation of Kerala.

KFRI 195/'93

Bee keeping - use of unconventional timbers for bee lives.
Investigator: R.V. Varma
Objective: To study the suitability of different types of cheap and commonly available woods as bee boxes and to test them under field conditions to substitute teak wood boxes.
Supported by State Committee on Science, Technology and Environment, Thiruvananthapuram.

KFRI 196/'93

Management of bark feeding caterpillar *Indarbela quadrinotata* in *Albizia* plantations.
Investigator: George Mathew
Objective: To develop an appropriate pest management strategy to control this insect in plantations.
Supported by KFRI.

KFRI 197/'93

Ecorestoration of a micro watershed in Mukundapuram Taluk of Thrissur District.
Investigators: S. Chand Basha and S. Sankar
Supported by Planning and Economic Affairs Department, Government of Kerala.

KFRI 198/'93

Preparation of an illustrated manual of the commercial non-wood forest produce plants of Kerala.
Investigator: K.K.N. Nair
Objectives: (1) To prepare an authentic checklist of the NWFP plants of Kerala (2) To provide diagnostic descriptions, illustrations and distribution maps (3) To provide morphological details of the exploited part(s) (4) Publication of the manual.
Supported by KFRI.

KFRI 199/'93

Growth of teak in successive rotation in relation to soil conditions.
Investigators: S. Chand Basha, M. Balagopalan and K.C. Chacko
Objectives: (1) To correlate soil conditions in relation to growth of teak under three rotations (2) To recommend a strategy for future management.
Supported by KFRI.

KFRI 200/'93

Fungicidal management of quick wilt disease of Pepper in forest plantations.
Investigators: M.I. Mohamed Ali and K. Yesodharan
Objectives: (1) To find out the most effective dose of a fungicide against quick wilt disease of Pepper in the field (2) To control/manage quick wilt disease in the Pepper plantation by suggesting appropriate spray schedule(s) (3) To work out the cost benefit of fungicidal spray schedule(s).
Supported by Wildlife Wing of the Kerala Forest Department.

KFRI 201/'93

Timber price trends in Kerala.
Investigator: C.N. Krishnankutty
Objectives: (1) To analyse timber price trends in Kerala and to forecast future prices (2) To examine the influence of change in forest timber production on

prices (3) To study the impact of import and export of timber on prices.

Supported by KFRI.

KFRI 202/'93

Micro-propagation of teak, Rosewood and Sandal.

Investigator: E.M. Muralidharan

Objectives: (1) To standardize micropropagation of teak, rosewood and sandal using both juvenile as well as mature tree explants (2) To produce sufficient plantlets for conducting a field trial to evaluate the performance of micropropagated plants.

Supported by KFRI.

KFRI 203/'93

Cambial activity and Juvenile wood formation in teak.

Investigator: K.M. Bhat

Objectives: (1) To determine the cambial periodicity and its influencing exogenous (environmental) factors in juvenile wood production including false growth ring formation in teak (2) To determine the exact age at which teak trees stop producing juvenile wood and begin to form mature cambial derivative (3) To evaluate the differences in size and proportion of different cambial derivatives, microfibrillar angle, specific gravity and bending strength (modulus of rapture) between the juvenile and mature wood.

Supported by Ministry of Science and Technology, Government of India.

KFRI 204/'93

Studies on the fern flora of Kerala with special reference to Sylvan Valley.

Investigator: M.S. Muktesh Kumar

Objectives: (1) *In situ* and *ex-situ* conservation of ferns in the natural habitats by setting up the sanctuary (2) Protection of germplasm of ferns and permeating study and development of Pteridology.

Supported by Kerala Forest Department.

KFRI 205/'93

Preparation of an action plan for the ecorestoration of a degraded micro watershed.

Investigators: S. Chand Basha, S. Sankar and A.R. Rajan

Objectives: (1) To survey the watershed and prepare thematic maps on slope, relief, hydrology, land use, soil and vegetation cover (2) To identify critical areas which deserve immediate attention during the ecorestoration programme (3) To carry out species - site matching for identifying suitable species for planting (4) To suggest most appropriate and cost-effective location specific soil and water conservation methods (5) To develop a geographic information system of the watershed which will help in implementing and scientifically assessing the success of the ecorestoration programme.

Funded by Kerala Forest Department.

KFRI 206/'93

Mushroom cultivation using forest litter and waste wood.

Investigator: E.J. Maria Florence

Objectives: (1) To standardize techniques for cultivation of edible mushroom using forest litter and waste wood as growth substratum (2) To prepare a protocol to conduct training programmes for the rural and tribal people for mushroom cultivation.

Supported by STEC.

KFRI 207/'93

Mass rearing of selected butterflies for possible reintroduction in conservation programmes.

Investigator: George Mathew

Objectives: (1) To standardize a methodology for mass breeding butterflies with a view to maintain them throughout the year in field cages (2) To explore the possibility of preparing 'curios' using dead insects which could be developed as a cottage industry.

Supported by KFRI.

Participation in seminars, symposia and workshops

Dr. U.M. Chandrasekhara (Agroforestry-cum-Publicity) participated in the Regional Workshop on Environmental Policy for Kerala held on 22 April 1993 at the Centre for Earth Science Studies, Thiruvananthapuram. He also attended the Fifteenth Zonal Research and Extension Advisory Committee meeting held on 4-5 May 1993 at Regional Agricultural Research Station, Pattambi.

Dr. R. Gnanaharan (Wood Science) attended the IRG-24 Conference held at Orlando, USA during 16-21 May 1993 and presented two papers: 1) Economical schedule for boron treatment of rubber wood: Pilot plant investigations by *R. Gnanaharan* and *T.K. Damodaran*. 2) Influence of moisture content of rubber wood on the growth of *Botryodiplodia theobromae* by *E.J.M. Florence, R. Gnanaharan* and *J.K. Sharma*.

Dr. K.M. Bhat (Wood Science) participated in an International Workshop on *Dalbergia* spp held at Hetanda, Nepal during 31 May-4 June 1993 and presented a paper 'Wood diversity of Indian *Dalbergia* spp and its implications in utilization and genetic improvement'. Also, he chaired two sessions. *Dr. Bhat* was a resource person at the four day training programme for senior officers of the Directorate of Industries and Commerce organized by KITCO, Cochin on 17 June 1993. *Dr. Bhat* also attended the net workshop of INBAR (International Network for Bamboo and Rattan) held in Singapore during 28-30 June 1993.

Dr. P.S. Easa (Wildlife Biology) attended the meeting on 'Wildlife Research Activities' convened by Ministry of Environment and Forests, Government of India at New Delhi on 3 June 1993. He also attended the International Seminar on the 'Conservation of the Asian Elephant', organized by the Bombay Natural History Society at Mudumalai during 13-18 June 1993.

Dr. S. Chand Basha (Director), *Dr. Jose Kallarackal* (Physiology), *Dr. K.K.N. Nair, Dr. C. Renuka* (Botany), *Dr. K. Swarupanandan* (Ecology), *Dr. V.V. Sudheendrakumar* (Entomology) and *Dr. K.V. Sankaran* (Plant Pathology) attended the project review workshop of the Ministry of Environment and Forests held at Madurai Kamaraj University from 17-18 June 1993.

Dr. K.K. Seethalakshmi (Plant Physiology) and *Dr. M.I. Mohamed Ali* (Plant Pathology) participated in the ICFRE/FAO/UNDP Regional Workshop on "Production of genetically improved planting material for afforestation programmes" as resource persons and gave lectures on 1) Biochemical and physiological factors affecting seed viability (*K.K. Seethalakshmi*) 2) Role of seed microflora and its management in tree improvement programme (*M.I. Mohamed Ali*) during 18-20 June 1993 at IFGTB, Coimbatore.

Dr. R. Gnanaharan attended the Technical Committee meeting convened by the Central Pollution Control Board, New Delhi on 14 July 1993 to deliberate on eco-friendly wood substitutes. He also attended the Task Force meeting for the promotion of rubber wood convened by UPASI, Kottayam at Kottayam on 28 July 1993.

Dr. E.M. Muralidharan (Genetics) attended GMF International Seminar held at the University of Calicut during 22-23 July 1992.

Dr. R.V. Varma (Entomology) attended the International Symposium on Pollination in Tropics during 8-13 August 1993 at Bangalore. He also attended the National Symposium on 'Chemical ecology of phytophagous insects' held at Entomology Research Institute, Madras from 17-19 September 1993 and presented a paper entitled 'Resistance in teak to the teak defoliator *Hyblaea puera*'.

Guest lecture

Dr. U.M. Chandrasekhara (Agroforestry-cum-Publicity), *Dr. E.M. Muralidharan* (Genetics) and Dr. K.K. Ramachandran (Wildlife Biology) gave the following lectures for the benefit of forest guards and field assistants at the Kerala Forest School, Arippa during

24-25 May 1993. 1) Agroforestry and agroforestry extension (*U.M. Chandrasekhara*) 2) Forest genetics (*E.M. Muralidharan*) 3) Wildlife and 4) Wildlife census techniques (*K.K. Ramachandran*).

Mrs. E.P. Indira (Genetics) delivered a lecture on 'Why do we conserve genetic diversity' for the training programme on 'species diversity, protection, conservation and sustainable management of the tree components in home garden agroforestry systems' at Kerala Forest Research Institute, Peechi on 19 June 1993.

Visits

Dr. R. Gnanaharan carried out a collaborative research on the standardization of testing procedures for strength determination of bamboo at the Technical University of Eindhoven, The Netherlands during 12 April-14 May 1993.

Training programme

Dr. R.C. Pandalai (Silviculture) attended the International Training Course on Bamboo Cultivation and Utilization at the Sub-Tropical Forestry Research Institute, Fuyang, Zhejiang, China from 15-29 April 1993. The course was organized jointly by the State Science and Technology Commission of China and the International Development Research Centre of Canada.

Workshops and Training Programmes Conducted

Regional workshop on 'Role of forests in conservation and sustainable development' Kerala Forest Research Institute, Peechi, 4 June 1993

A regional workshop on 'Role of forests in conservation and sustainable development' was organized by the Institute on 4 June 1993 at Peechi. The participants in the workshop included Chairman and members of the State Legislature Committee on Environment, leading Scientists and experts. The objective was to formulate a State level Environment Policy for Kerala taking into consideration various views and recommendations evolved during the workshop.

In the inaugural session, Mr. K.P. Noorudheen, MLA, Chairman of the Legislature Committee introduced the theme of the workshop to the audience. Dr. R. Ravikumar, Chairman, State Committee on Science, Technology and Environment, stressed the necessity to review the impact of various developmental efforts on the environment.

The inaugural session was followed by the technical sessions. Introducing the themes for discussion, Dr. S. Chand Basha (Director, KFRI) complimented STEC for co-ordinating the various activities towards formulating a State Policy for Environment. The themes presented in the technical sessions included natural forest sector (presented by Shri. T.K. Raghavan Nair, Chief Conservator of Forests, Kerala), man made forest sector (Shri. P.N. Surendran, CCF), wildlife and ecotourism sector (Shri. P.K. Surendranathan Asari, CCF), tribal people (Shri. G. Mukundan, Principal CCF), agroforestry sector (Shri. M.S. Nair, CCF) and utilization sector (Shri. N. Govindankutty, CCF). The paper presentation session was followed by discussions. Shri. N. Madhavan Pillai (CCF, Rtd.) acted as the moderator. Senior Forest Officers, Scientists and members of the Environmental Consultative Committee took part in the discussions. The recommendations of the workshop was presented by Dr. S. Sankar (KFRI). The workshop came to a close by 1PM.

Training programme for rural women on tree species conservation in homegardens
Kerala Forest Research Institute, Peechi, 19-20 June 1993

Training programme for rural women on tree species

A training programme for rural women on 'species diversity, protection, conservation and sustainable management of the tree component in the homegarden agroforestry systems' was organized at the Institute on 19-20 June 1993. The programme was sponsored by M.S. Swaminathan Research Foundation (MSSRP), Madras. Participants in the training programme included 19 women from Panancherry Panchayath (Thrissur District) and three others from non-governmental organizations.

The programme was inaugurated by Shri. John Joseph, IFS (Rtd.) on 19 June 1993. Smt. Rugmini Parameswaran, Member, Panancherry Panchayath presided over the inaugural function. Classes were organized to highlight the importance of the tree components of homegarden systems in the context of social, economical and ecological conditions of Kerala. The method of cultivation and sustainable utilization of diverse tree species was also discussed. A book entitled "Nammude Vrikshangale Ariyuka" (Know Our Trees - in Malayalam) was released as a resource material for the training programme. Participants visited two selected homegardens and obtained first hand information on how and where to grow trees and how to manage and utilize them, through discussions with the land owners and farmers.

Wildlife Census 1993

The task of organizing wildlife census in 1993 was entrusted with Wildlife Biology Division of the Institute as per the decision of the State Wildlife Advisory Board. Dr. P.S. Easa, Scientist-in-Charge of the Division was in full charge of the project and was ably assisted by his colleagues Dr. K.K. Ramachandran and Shri. E.A. Jayson.

The dates, methodology and implementation of the programme were discussed and approved in a meeting of the Chief Conservators and Conservators of Forests of the State convened by Principal Chief Conservator of Forests (General). Applications were invited from volunteers by publicizing the programme through media. Meetings of the Forest Range Officers were held at Kozhikode, Olavakkod, Chalakkudi, Idukki and Konni to discuss the methodology and to finalise the number of transects and man power requirement. Classes were conducted at ten centres for the field staff of the Forest Department. Representatives of voluntary organizations also attended the training programme.

In response to the advertisement, 2800 volunteers

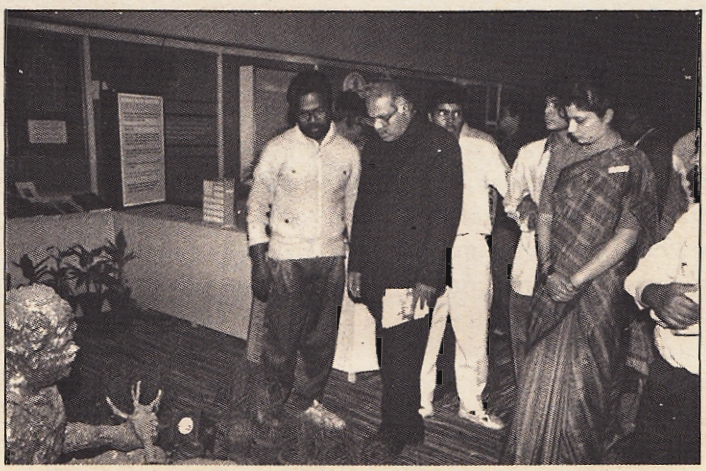
belonging to different walks of life applied for participation in the census and about 1400 attended the training programme held at Muthanga, Parambikulam, Chinnar, Vazhachal, Thekkady and Neyyar. Forest Range Officers, Wildlife Assistants and Scientists explained the methods and imparted field training to the volunteers.

Hon. Minister for Forest and Wildlife, Shri. K.P. Viswanathan formally inaugurated the census programme at Muthanga on 29th April 1993. Of the 1400 trained volunteers, 852 participated in the census. The census data was analysed at the Institute and the report was released.

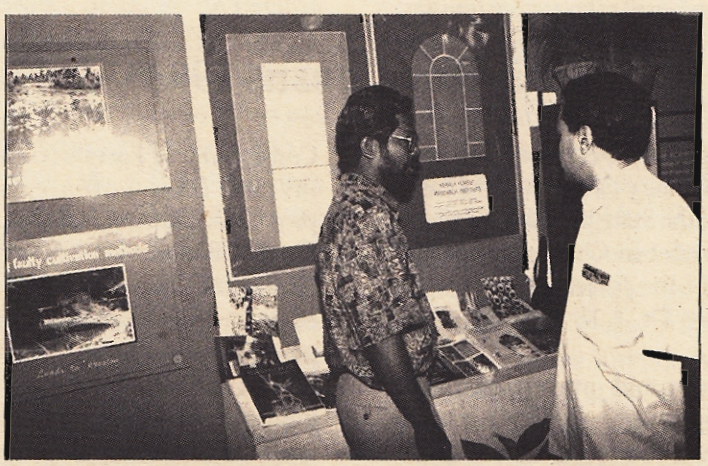
The Wildlife Census 1993 was unique in that there was large scale public participation in the programme and that a variety of methods were applied to collect the information which would be useful for the Wildlife Managers. It is needless to say that, the wildlife census report (1993) is the outcome of concerted efforts of Foresters, Scientists and volunteers.

KFRI puts up stall at India International Trade Fair

New Delhi, 13-24 November 1993.



Shri. P.J. Kurien M.P., Ex-Union Minister, visiting KFRI stall.



Shri. P.K. Kunhalikutty, Hon. Minister for Industries, Kerala visiting KFRI stall.

Forthcoming events

30 May-2 June 1994

ZALF - Institute of Forest Ecology: International Symposium on Agroforestry, Berlin, Germany.
Contact: Organizing Committee, "Agroforestry", ZALF - Institute of Forest Ecology, Dr. Zinn Weg, D-16225 Eberswalde, Germany.

6-9 June 1994

SIT'94 - Inventories for Ecosystem Management, Oregon, USA.
Contact: G. Lynd, USDA Forest Service, FIERR, P.O. Box 96090, Washington DC, USA.

20-24 June 1994

International Conference on Ecology and Environment, Drake Bay, Costa Rica.
Contact: C. Vargas, Department de Computacion, ITCR, Aptdo 159, Cartago, Costa Rica.

3-8 July 1994

International Expert Workshop on Nitrogen - Fixing Trees for Acid Soils, Tursialba, Costa Rica.
Contact: Mark H. Powell, Nitrogen Fixing Tree Association, 1010 Holomua Road, Paia, Hawaii - 96779-9744, USA.

4-6 July 1994

Origin and Evolution of the flora of the Monsoon Tropics, Tinaroo, Australia.
Contact: ASBS Symposium, C/o Mr. J. Clarkson, P.O. Box 1054, Mareeba, Qld 4880, Australia.

5-10 July 1994

Interforst '94. 7th International Trade Fair for Forestry and Log Timber Technology, Munich, Germany.
Contact: Munich Trade Fair Corporation, Messegelande, Postfach 121009, D-8000, Munchen 12, Germany.

24-27 July 1994

International IUFRO/NEFU/FAO Seminar on Forest Operations under Mountainous Conditions, Harbin, China.
Contact: Prof. Li Guangda, Department of Forest Operations, Northeast Forestry University, 8 Hexing Road, 150040 Harbin, People's Republic of China.

24-29 July 1994

Advanced Technology in Forest Operations: Applied Ecology in Action, Corvallis, USA.
Contact: Dr. L. Kellogy, Forest Engineering Department, Oregon State University, Corvallis, OR 97331-5706, USA.

26-29 July 1994

2nd Asian Agricultural Association Conference, Tosyakarta, Indonesia.
Contact: Directorate of Afforestation and Social Forestry, Ministry of Forestry, Manggala Wanabakti Building Jl. Gatot Subroto Senyan, Jakarta 10270, Indonesia.

20-26 August 1994

VI International Congress of Ecology, Manchester, UK.
Contact: The Secretary, 6th ICE, Department of Environmental Biology, The University, Manchester M13 9PL, UK.

21-27 August 1994

XXI International Ornithological Congress, Vienna, Austria.
Contact: Interconvention, 1450 Vienna, Austria.

Campus news

Ph.D. awarded

Shri. K.K. Ramachandran, Scientist-C, Wildlife Biology Division has been awarded Ph.D. degree by the University of Kerala for his thesis entitled 'Certain aspects of ecology and behaviour of Malabar giant squirrel *Ratufa indica maxima* (Sehreber)'. The study was carried out under the guidance of Dr. M. Balakrishnan, Department of Zoology, University of Kerala.

Shri. M.I. Mohamed Ali, Scientist-C, Plant Pathology Division was awarded Ph.D. degree by Cochin University of Science and Technology for his thesis entitled 'Studies on seed pathology and seedling diseases of some important indigenous tree species of Kerala'. The study was conducted under the guidance of Dr. J.K. Sharma, Scientist-in-Charge, Division of Plant Pathology.

KFRI Publications

Author/Editor	Title	Price	
		India (Rs.)	Foreign (US$)
K.S.S. Nair et al.	Ecodevelopment of Western Ghats	200.00	18.00
K.K.N. Nair et al.	Tropical Forest Ecosystem Conservation and Development in South and South-East Asia.	200.00	18.00
I.V.R. Rao et al.	Bamboos : Current research	140.00	[illegible]
N. Sasidharan	Forest Trees of Kerala	15.00	5.00
C. Renuka	Rattans of the Western Ghats	100.00	8.00
K.M. Bhat	Structure and Properties of South Indian Rattans	75.00	5.00
S. Chand Basha & K.M. Bhat	Rattan Management and Utilisation	300.00	25.00
K.V. Sankaran et al.	Litter Dynamics, Microbial Associations and Soil Studies in *Acacia auriculiformis* Plantations in Kerala	75.00	8.00
Mammen Chundamannil	History of Forest Management in Kerala	50 (Individuals) 150 (Institutions)	15.00

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