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The Editor
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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.

Impact of Selection Felling on Natural Forests

K. Balasubramanyan
Division of Ecology

The tropical wet evergreen forests, very often equated to the tropical rainforests, are considered as a store house for plywood industries, railway sleepers etc. To sustain an uninterrupted flow of resources the commonest silvicultural system adopted is the 'Selection System'. In essence, it envisages selective removal of usually the oldest or largest trees. This system is expected to enable natural regeneration without upsetting the species composition in a natural forest. The exploitable girth class, the felling cycle and the number of trees to be removed in a given unit area have been standardised. Generally the girth limit is 180 cm at breast height and the felling cycle, 30 years. The maximum number of trees permitted to be removed from any one hectare, during each felling cycle used to be 8 to 12. However, due to increasing pressures and abundance of overmature trees in certain areas, a shorter felling cycle is adopted and sometimes the limit of the number of extractable trees is also violated beyond the prescriptions of Working Plans, thus endangering the sustainability of the operation.

Fig. 1
Palaquium ellipticum - an axed tree about to fall

This selective felling, as practised in the Western Ghats of southern India is considered to be the best silvicultural system, despite its assumed disadvantages.

In practice, arbitrary increase or decrease in the felling cycle, extractable number of trees per unit area and the girth limit have often been made. Shorter felling cycles of as low as 15 years, number of trees exceeding 12 per hectare and girth limit as low as 150 cm GBH are commonly encountered. No attempt has been made so far to assess the impact of this system from various environmental angles A study was carried out in Pothumala felling series of Nelliampathy range, Nemmara Division. The area lies between 10° 25' and 10°30' N latitude and 76° 35' and 76° 45'E longitude at an elevation of about 900 m. The mean annual rainfall is about 3660 mm and temperature varies from 20-25°C. Observations over three years led to the following conclusions.

1 There is a marked increase in the minimum and maximum atmospheric temperature, consequent to selective logging, amounting to roughly 7°C. The minimum soil temperature shows an increase of 6°C and maximum 4.3°C between worked and unworked areas. This difference is felt even within a short span of three months.

2 Mean relative humidity showed a difference of about 22%. During dry season it accounts for 7% and during rainy season about 11%.

3 The incidence of light at different strata also shows remarkable variations. At the ground level at 8 A. M. the difference was of the order of 3,100 lux while at the 10, 20 and 30cm. levels, it was 10,447, 48,305 and 68,749 lux respectively. The difference at noon at the four levels are of the order of 5,331, 43,528, 78,401 and 1,19,293 lux respectively. In the evenings it is 3,356, 30,302, 45,422 and 48,185

Fig. 2
Stacking of top ends and secondary damages to *Canarium strictum*

lux respectively at various levels between the worked and unworked areas. The difference in light intensity at the ground level ranges between 2,10,00 and 2,91,00 lux immediately before and after felling.

4 Natural regeneration of the desired species in selectively logged area is very poor and this can be attributed to drastic changes in the microclimatic conditions, viz., soil and atmospheric temperature, relative humidity and light availability at various levels.

5 Damage due to logging is found to be particularly heavy. Nearly 46% of the loss can be ascribed to crown damage. The tall nature of the trees and their large, spreading crowns are responsible for such a situation. Similarly dashing of trees against each other during the process of felling also causes considerable loss.

6 Besides all these factors, billeting, stacking the boles and cut ends do not permit regeneration.

7 Unscientific road alignment and elephant dragging are other factors which cause disturbance to the remaining vegetation and affect the regeneration of potential species for the subsequent felling.

8 Even if one adheres strictly to the working plan prescriptions of 6 trees per hectare, the opening created is found to be of the order of 68%.

Nursery and Planting Techniques for canes

K. K. Seethalakshmi
Division of Plant Physiology

The availability of cane from the forests of Kerala is insufficient to meet the increasing requirement of cane industries. Due to over exploitation and shrinkage of natural forests, natural regeneration of cane has been slowed down considerably. The Kerala Forest Department was forced to introduce a ban on the extraction of canes since 1983-84 to ensure natural regeneration. Now the cane industries in Kerala mainly depend on other states like Karnataka and Assam for raw material. The problems of transport and damage caused during transit resulted in a steady increase in cost. The raw material thus obtained is insufficient to run the industrial units in Kerala to their full capacity. Many skilled workers are thrown out of job and the rest are provided with only part-time work. Thus the cane industry in Kerala is facing serious threat due to acute shortage of raw material.

One way to circumvent this problem is to increase the existing resources by large scale cultivation as done in other Asian countries. Canes can be easily planted in the existing natural habitats without causing much disturbance. Since large scale planting has not been taken up so far, nursery and planting techniques were not standardised even for the elite commercial species occurring in Kerala. This paper summarises some of the methods attempted at KFRI and found suitable for raising cane plantations. Planting stock can be raised from seeds and suckers.

From seeds

1 Cane fruits were collected when they are ripe. At maturity the fruit changes its colour and simultaneously the pulp covering the seed turns

sweet. At this time the fruits are eaten by birds and monkeys and they start falling down from rachis. Fruiting periods of different cane species occurring in Kerala are given in Table-1.

2 The sarcotesta (scaly outer cover of the fruit) was peeled off and the seeds were soaked in water for 48 hours. This will induce fermentation. The pulp was removed completely to clean the seeds. The seeds were floated in clear water to collect only those settled at the bottom.

3 To avoid fungal infection the seeds were soaked in 1% solution of sodium pentachlorophenoxide for 10 minutes (Amrut Industries Products, Chemical House, L. B. Shastri Marg, P.B. No, 46, Thane) and then embedded in moist saw dust for two weeks.

4 The seeds are then transferred to polybags (size about 20 x 15cm) filled with sand-soil mixture (1:3). A thin layer of saw dust is spread as a top layer over the sand-soil mixture to retain moisture.

5 These bags are maintained in the nursery under partial shade with regular watering for about one year. It will be ideal to spread a polythene sheet in the nursery beds before keeping the bags. Otherwise, while removing for outplanting, damage will be caused to the roots which pierce the bags and penetrate the soil.

Coconut leaves or loosely woven coirmats can be used for providing shade in the nursery. The seedlings require only about 20-30% light. The time taken for germination varies from one month to one year depending on the species.

Note : Generally cane seeds are viable only for a short period of one to two months and seed moisture content of 40-60% should be maintained for storing the seeds without losing viability. At above 60% humidity the seeds tend to germinate and below 40% they become non-viable. It will be better to sow the seeds soon after collection.

From suckers

Generally, all the mature canes are extracted from accessible areas before they start flowering or fruiting and this reduces the availability of seeds considerably. In the absence of seeds suckers from clustering rattans could be separated from the clump and used as planting material for which the followig method can be adopted.

1 Suckers of about 30-45 cm height were removed from the clumps without damaging the roots during the onset of monsoon.

2 Trimmed most of the leaves, covered the basal region with wet soil, enclosed the suckers in gunny bags and transported to nursery. Care was taken to prevent wilting.

3 The basal part of the suckers were treated with 5 to 10 ml of N A A 1000 ppm (1 gm of Naphthalene acetic acid obtained from Lobha Chemie, P. B. No. 2042, Bombay, dissolved in 1 litre of 50% ethyl alcohol) and planted in polybags filled with sand-soil (1:3) mixture. The bags were kept in the nursery under partial shade with regular watering for about one year. The suckers which establishes in the bags can be used for field planting like seedlings.

Table 1. Fruiting period of *Calamus* species occurring in Kerala

	Species	Local names	Fruiting period
1	*Calamus gamblei*	Pachachural, Ottamoodan	May — June
2	*C. hookerianus*	Velichural, Kakkachural, Vanthal, Kallan	Jan. — Feb.
3	*C. metzianus*	Odiyanchural	May — June
4	*C. pseudotenuis*	Not available	Feb. — May
5	*C. rotang*	,,	March — May
6	*C. thwaitesii*	Pannichural, Vandichural Thaddyanchural	Feb — May
7	*C. travancoricus*	Arichural	May — June

Source : Renuka, C and Seethalakshmi, K. K. 1988. Phenology and propagation of *Calamus* — their bearing on practical application. *In* RIC occasional paper No. 5, Rattan Information Centre, Malaysia. Pages 1-5.

Planting

Both seedlings and rooted suckers can be used for planting. Natural habitat of rattans can be selected and the site preparation is better initiated during May. The planting is to be done at the onset of monsoon (June - July). The method developed by SAFODA (Sabah Forest Development Athority, Sabah, East Malaysia) was adapted with slight modifications.

1 Blocks of required size are demarcated and planting lanes are taken at 10 m intervals from east to west. Planting path of 2 m width are cleared of undergrowth, retaining trees and shrubs, and all the debris removed. The remaining 8 m area is left undisturbed.

2 Staking is done at 2 m intervals along the planting lanes (this gives a density of 500 plants/ha) and pits of 30 x 30 x 30 cm were taken.

3 Treatment with about 500ml of a dilute solution of Aldrex 30 EC was given in pits prior to planting for termite control. (1 ml. commercial sample of Aldrex 30 EC 30% solution is added to 5 litres of water).

4 The seedligs are placed in the pits after removing the polythene cover without disturbing the soil covering the roots. The pits are then filled with soil upto the collar level of seedlings.

5 Weeding is done (only in the planting lanes of 2 m width) at 3rd and 8th months after planting and this may be required whenever necessary for initial three to four years till the seedlings establish.

Study initiated on Soil and Plant Community Relationships in Wet Evergreen Forests of Silent Valley

M. Balagopalan
Division of Soil Science

The tropical rainforests is a climax formation and represents the farthest advance towards a hydrophilous type of vegetation. In such a formation, the number of inhabiting species is very large and communities with one dominant species are exceptional. But distinct communities comprising more than one dominant species or variations of such communities have been reported. This may be caused by several factors. Six distinct plant communities were recognised in the wet evergreen forests of Silent Valley as per the Working Plan for the ghat forests of Palghat Division (T. V. Venkateswara Iyer, 1932).

They are;

1 *Cullenia* — *Palaquium*
2 *Palaquium* — *Mesua*
3 *Poeciloneuron* — *Palaquium*
4 *Mesua* — *Calophyllum*
5 *Ochlandra* — *Calophyllum*
6 *Ochlandra* — *Poeciloneuron*

These six communities occur in different locations, some of which occupy very large areas.

Cullenia - Palaquium community is the most widespread among the communities and the occurrence of which is strictly confined to south of Chembotti stream and across the Kundipuzha along the Kummattanthodu and to the south of it.

Palaquium - Mesua community is seen in the Thondakulam plateau, the spurs radiating from Poochipara hill and the adjoining area to the east of Kundipuzha.

Poeciloneuron-Palaquium community prevails in the northern half of Silent Valley adjoining Cheriyawalakkad, on both sides of Kundipuzha.

Mesua - Calophyllum community is confined to the east of Kudipuzha and far north of Kattimudi, and north of Walakkad. It is also seen in between Walakkad and Sispara, and near the abandoned Poonnamala rest house.

Ochlandra - Calophyllum community occurs in the Thondakulam plateau and on the western slopes to the south of Kathisundan. There are considerable stretches of reeds inhabiting marshy tracts. Standing along with the reeds are species *Calophyllum elatum, Hopea glabra, Eugenia* sp. and *Bischofia javanica* of which *Calophyllum elatum* dominates.

Ochlandra - Poeciloneuron community is found in marshy areas on the banks of Kundipuzha near Cheriyawalakkad.

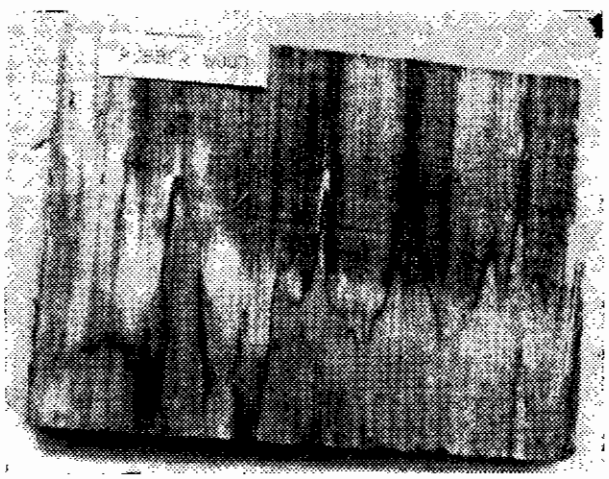
These six plant communities in the wet evergreen forests of Silent Valley offer a unique opportunity for studying the relation between each community and environment. A project entitled Soil and plant community relationships in wet evergreen forests of Silent Valley has been initiated in the Division of Soil Science to determine the properties of soils under the six plant communities. It is supported by a research grant from the Govt. of India under the Nilgiri Biosphere Reserve Research Programme.

Sapstain Microorganisms Associated with Some Commercially Important Timbers of Kerala

E. J. M. Florence
Division of Plant Pathology

Abnormal discolouration of sapwood caused by microorganisms is commonly referred to as sapstain. Generally, staining is due to either superficial growth of moulds over the exposed surface or deep penetration of fungal hyphae into the wood. Soon after the tree is felled, the cut ends and other portions of the logs from where the bark is removed, get exposed to infection by air-borne spores of staining fungi.

Discolouration of wood is one of the defects which can cause considerable loss to the value of wood products. Sapstain, besides affecting the appearance of the wood, may contaminate goods stored in contact with the stained wood. In paper industries, though the stained timber is not discarded, it is known to require more chemicals for bleaching the pulp. Due to the susceptible nature of some of the timbers to sapstain, they are processed at the earliest to avoid infection and this urgency often causes practical problems to the manufacturers.



Rubber wood stained with *Botryodiplodia theobromae*

In Kerala, small scale wood-based industries such as packing case, plywood and match units utilize a large quantity of wood from softwood tree species. It is estimated that there are about 460 packing case, 80 plywood and 140 match wood units in the State. *Hevea brasiliensis* (Rubber) is the main source of wood used for manufacturing packing cases The major timber species utilised in match industry are *Bombax ceiba, Ailanthus triphysa* and *Alstonia scholaris.*

In Kerala due to the favourable environmental conditions, such as high rainfall accompanied by high humidity, sapstain has become a serious problem. A preliminary survey conducted in some of the wood based industries in Trichur district shows that almost all the species (*Hevea brasiliensis, Ailanthus triphysa, Bombax ceiba, Alstonia scholaris, Mangifera indica, Anacardium occidentale, Macaranga peltata* and *Erythrina stricta)* surveyed were susceptible to sapstain fungi. Fungi like, *Aspergillus, Penicillium, Trichoderma, Memnoniella, Mucor, Syncephalastrum, Absidia* etc., were found to colonise the surface of the wood without penetrating deep inside. They also imparted various colours on the surface of the wood. *Botryodiplodia theobromae, Alternaria, Acremonium, Scytalidium, Fusarium, Ceratocystis,* etc., were some of the fungi causing stain on the surface as well as deep inside the wood. *Botryodiplodia theobromae* was found to be the most dominant of all. It was associated with sapstain of all the timber species surveyed. In most of the timbers, infection by *B. theobromae* accounted for more than 50%. The fungus was found capable of causing stain throughout the year in all the timbers surveyed.

The protective chemicals traditionally applied to green timber, such as water-soluble chlorophenates (usually sodium pentachlorophenol or sodium tetrachlorophenol) are toxic which will persist in the environment, and accumulate in animal tissues. Research is in progress in several laboratories around the globe to find out nontoxic chemical wood preservatives.

Biological control, a well known technique in agriculture, is now seriously considered for protection of wood against sapstain fungi. In our laboratory, a bacterium, isolated from wood surface, has been found to have a broad spectrum of antibiotic activity against all the major sapstain fungi isolated from various timbers. Preliminary trials have indicated that the bacterium has significant potential as a biocontrol agent as it inhibited the growth of staining fungi on wood blocks. Detailed work on various aspects such as effect of sapstain on strength of wood, chemical and biological control of sapstain etc. is in progress.

Periyar Tiger Reserve

P. S. Easa
Division of Wildlife Biology.

There are twelve Wildlife Sanctuaries and two National Parks in Kerala. Periyar, Wynad, Parambikulam, Neyyar, Peechi-Vazhani, Shenduruny, Chinnar, Idukki, Aralam, Peppara, Thattekkad and Chimmony are the Wildlife Sanctuaries. The two National Parks are Eravikulam and Silent Valley. In the previous issues of Evergreen infromation was given about Eravikulam National Park (No. 16, 1986) and Parambikulam Wildlife Sanctuary (No. 21, 1988). This article deals with Periyar Tiger Reserve.

Periyar Tiger Reserve with an area of about 777km², is the largest wildlife sanctuary in Kerala. Situated in the Peerumedu taluk of Idukki district, the Reserve is about 113 km east of Kottayam and about 135 km west of Madurai. The area is bordered by Tamil Nadu on the north, east and southeast. The other sides are the reserve forests of Kottayam and Ranni divisions.

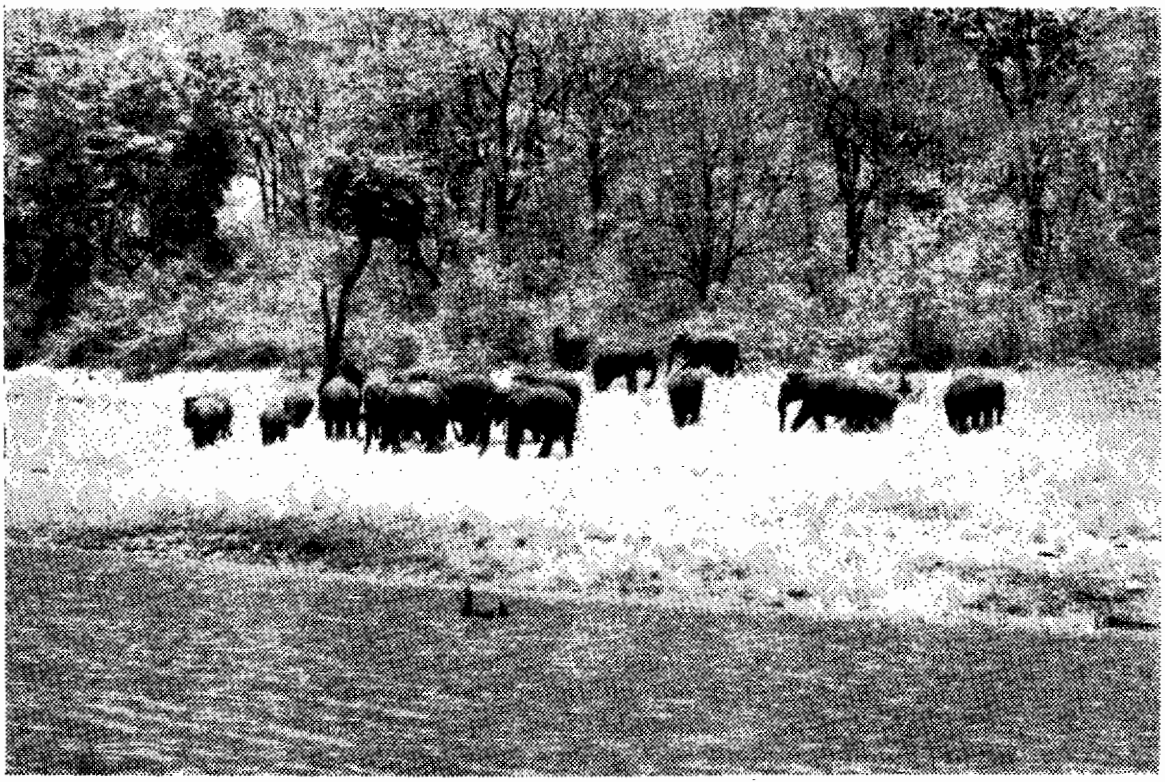
The history of Periyar Wildlife Sanctuary,popularly known as Thekkady Wildlife Sanctuary, begins with the construction of a masonry dam across the river Periyar in 1895 for irrigating the areas of Tamil Nadu. This resulted in the creation of an artificial lake of about 26 km². The forest around the lake was declared as reserve forest in 1899. In 1933, the Maharaja of the erstwhile Travancore State appointed C. H. Robinson as the first game warden and the Nellikkampetty Game Reserve was formed in 1934. More area was added to this in 1950 constituting Periyar Wildlife Sanctuary. The sanctuary was declared as Tiger Reserve in 1978.

The Reserve has a wide variety of vegetation allowing greater faunal diversity. The area is one of the best chunk of undisturbed evergreen forests of Kerala. About 41 km² of grassland in the Reserve has been planted with eucalypts.

Of about 32 species of mammals reported from the Reserve, three species belong to primates. They are (i) the lion tailed macaque, (ii) Nilgiri langur and (iii) bonnet macaque. The lion tailed macaque is endemic to Westen Ghats and considered to be one of the endangered species. Nilgiri langur is the commonest primate observed in the Reserve, while bonnet macaques are rare. Three species of cats seen in the area are tiger, leopard and jungle cat. Population of tiger in the Reserve is estimated to be around 36 in 1975. Small Indian civets and toddy cat represent the civets. Of the four species of mongooses reported from Kerala, three species are seen in Periyar. These are the common mongoose, the ruddy mongoose and the striped.

Wild dogs are commonly sighted near the lake shore cornering the sambar deer, the main prey species. Jackals are very rare. The sloth bear though common in certain areas, are rarely sighted. The flying squirrel, Malabar giant squirrel and the three striped palm squirrel are the three types of squirrels found in this area. Porcupine, though not commonly sighted, are present in abundance in certain areas, especially in grasslands. Black naped hare is the only hare reported from the area.

Periyar is famous for elephants. Herds of this pachyderm moving along the lake shore and some-



A herd of elephants in the Reserve

times swimming across the lake is the major attraction to the tourists visiting the Reserve. Periyar and the adjacent reserves contain the largest population of elephants in Kerala. The population in Periyar alone is estimated to be about 800. Poaching for tusks has considerably reduced the number of tuskers leading to a highly disproportionate sex ratio of about 1:25 between male and female. However, the population seems to be on the increase as evident from the number of calves in the population.

Gaur is the second largest herbivore found in this Reserve. Hundreds of these were seen earlier. But the outbreak of rinderpest in 1974 brought down the population to about 50. However, the population is recovering from the catastrophe and has recorded a steady growth.

Sambar deer is the commonest deer species found in the Reserve. Barking deer, though rare, is sighted very frequently at some places like Manakkavala watch tower area. Mouse deer is rarely seen due to its small size and shy nature.

Wild boar, the only non ruminant ungulate found in India, is seen in good numbers. Pangolin, flying fox, Malabar spiny mouse and otter are also seen in the reserve.

The area is also rich in avifauna. About 181 species are reported from the area of which 16 are migrants. The avifauna include the endangered great Indian hornbill.

Periyar is one of the major tourist attractions of Kerala. Over a lakh of people visit the Periyar Wildlife Reserve every year. The Sabarimala temple situated inside the tiger reserve is visited by lakhs of pilgrims. The uncontrolled tourism managed by different agencies and pilgrimage to Sabarimala are the major problems threatening wildlife in Periyar. Poaching for ivory and meat, mostly by people entering the area from Tamil Nadu, also poses a serious threat. Declaring the adjacent Tamil Nadu areas as sanctuaries and inclusion of the adjacent reserves in Kerala to this reserve will solve the problems to a great extent.

Antler Growth and Behavioural Changes in a Captive Sambar Deer

K. K. Ramachandran
Division of Wildlife Biology

A male sambar deer was brought from Peechi Reserve forest to Periyar Tiger Reserve in December 1980 for studying its food habits. It was about 9 months old and had only spike antlers (Fig. 1).

Fig. 1 sambar deer with spike antlers.

The animal shed both of its spikes at an age of about 14 months (on 16th May 1981). There was slight difference in the length and weight of two antlers at the time of shedding, the right spike was 31cm long and weighed 128 gms while the left was only 30.5 cm and 120 gms.

One month after shedding of the spikes (in June 1981) growth of velvet antlers was initiated. The rounded tip had two prominent bulges corresponding to the brow-tine and the main branch (Fig. 2). Both became clearly distinguishable within two months (Fig. 3). At this time the main antler was about 14 cm long while brow-tine was only 4 cm. Subsequently, the main branch started growing at a faster rate and attained a length of 18 cm within another month.

The sambar deer showed interesting aggressive behaviour while it was taken to field before the spike shedding. It tried to attack people with its head slightly down and the sharp spike pointing towards them. During this display the sambar ruffled up its neck hair (piloerection) most often accompanied by gnashing. The frequency of this behaviour decreased after shedding of the spikes. The defencelessness of the animal was compensated when it started relying on kicking powerfully with its front legs. On one or two occasions the keeper narrowly escaped from this kind of kicks.

Fig. 2 Initiation of velvet antlers

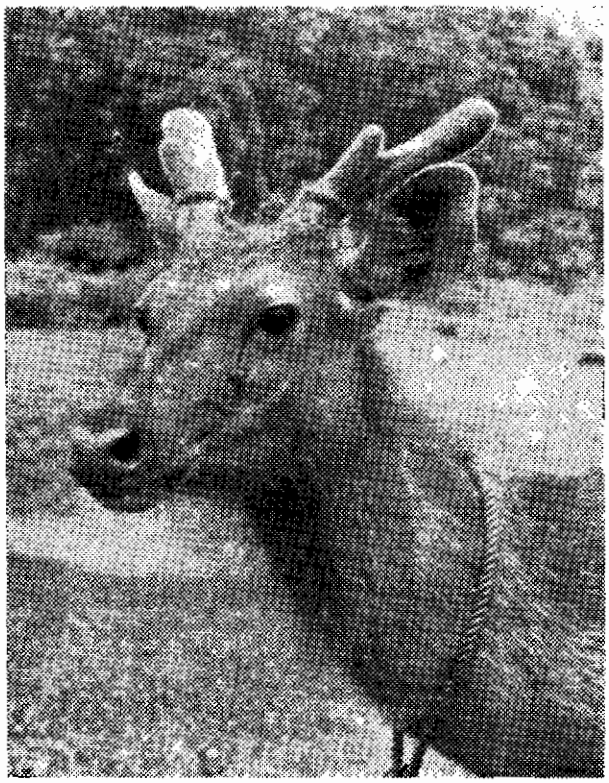


Fig. 3 Sambar deer with velvet antlers

In the wild, these animals are vulnerable to predators at the time of shedding of antlers Alternate means of defence like the one described above may help the deer to escape from predators to a certain extent.

Antlers and Horns

Antler is a living tissue and sensitive to touch and pain. During development, it is covered with a hairy skin called velvet. The velvet is having a rich supply of blood vessels and nerves. When in velvet, bleeding occurs profusely if injured and at this stage, the antlers are tender and fragile. As the season progresses, the antlers become ossified, the velvet is shed and the bare tines of bone are exposed. The antler is a deciduous organ that is cast off and renewed annually. Horn in contrast consists mainly of Keratine and is not a living sensitive tissue. Horns grow slowly and attain their definitive size and shape by extension from their source. If the horny material is cut off, it is not regenerated.

First KFRI - KFD Interaction Seminar, 17 February 1989 A Report

The principal objective of Kerala Forest Research Institute (KFRI) is to undertake research and advanced studies in all disciplines related to forestry, wildlife, management and utilization, with a view to provide the required know-how to accomplish the protective, productive and social functions of the forests in Kerala. Hence, the research undertaken by KFRI has to be directly linked to priorities in forestry. This is ensured by a Research Advisory Committee, comprising Senior Forest Officers and representatives of other organisationss, which reviews the progress of implementation of projects and suggests problems that require attention by KFRI. However, for a greater interaction among forest managers and scientists, a wider participation of forest officials was felt necessary. Recognising this need, beginning 1989, an annual interaction seminar was planned with the following main objectives :-

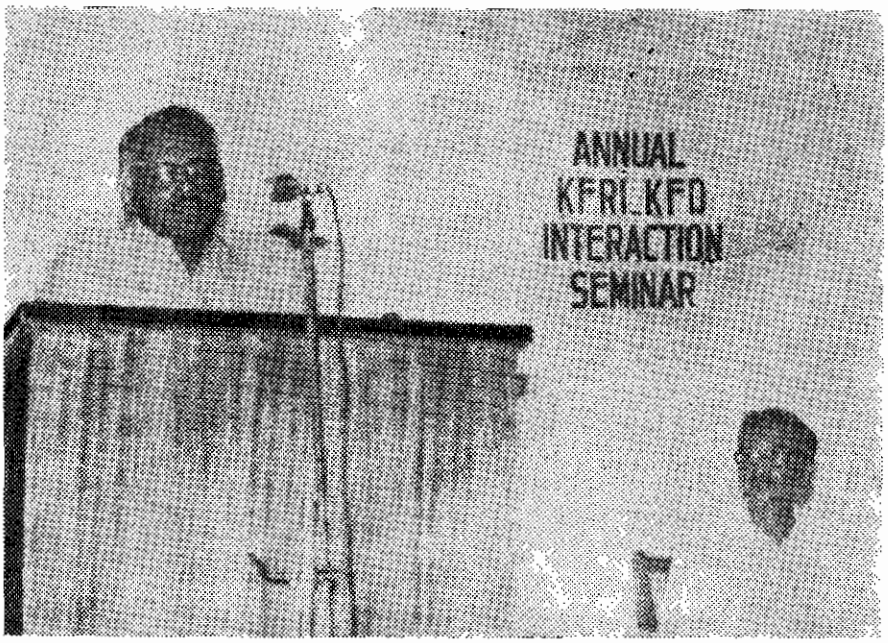
1 Better understanding between practising foresters and researchers.

2 Identification of (i) gaps in knowledge (ii) research problems and (iii) projects for collaboration between KFRI and Forest Department.

3 Implementation of research findings in the field, identification of problems encountered and suggestions for improvement.

4 Identification of suitable study areas and cooperation in their maintenance.

The first seminar was held on 17 February 1989 at KFRI, Peechi to focus attention on Plantation Forestry. Of the 26 papers received 6 were from the Forest department and 20 from KFRI. There were 78 participants including Dr. P. M. Ganapathy, member, Executive Committee and Governing Body of KFRI, 34 forest officials and 43 scientists from KFRI. The programme started at 8.00 A M. with registration of the participants. This was followed by the Inaugural Session and Technical Session I in the forenoon; and Technical Session II and the Concluding Session in the afternoon.



Shri G. Mukundan, C C F inaugurates the seminar

The Inaugural Session started at 9.00 AM with a welcome address by Dr. K. S. S. Nair, Director (in-charge). Shri G. Mukundan, CCF (Protection & Development) inaugurated the Seminar. This was followed by the presidential address by Dr. P. M. Ganapathy. The Inaugural Session concluded with vote of thanks by Dr. J. K. Sharma, Convener of the Seminar.

In the Technical Session I, chaired by Shri. G. Mukundan, 11 papers on various aspects such as nursery and planting practices of indigenous species, bamboo and rattan cultivation, slashburning, thinning and rotation of teak plantations were discussed in detail.

In the post-lunch Technical Session II, chaired by Dr. S. Chand Basha, CCF (Social Forestry and Projects), 7 papers were presented. Improvement of productivity of eucalypt plantations, influence of soil factors on productivity in plantations, pest problems in *Ailanthus*, control of the weed *Mikania* in plantations, afforestation of degraded areas and an information system for plantation management were the topics for discussion.

The concluding session was chaired by Dr. P.M. Ganapathy where, 8 discussion papers were taken up first. This was followed by presentation of reports of sessions by the Rapporteurs and discussion on conclusion and recommendations of the seminar. The seminar concluded at 5.15 P M with vote of thanks by the Director (in-charge).

Recommendations of the Seminar :

1 Preparation of state of art report on teak plantations in Kerala.

2 Studies on thinning and rotation in teak plantations.

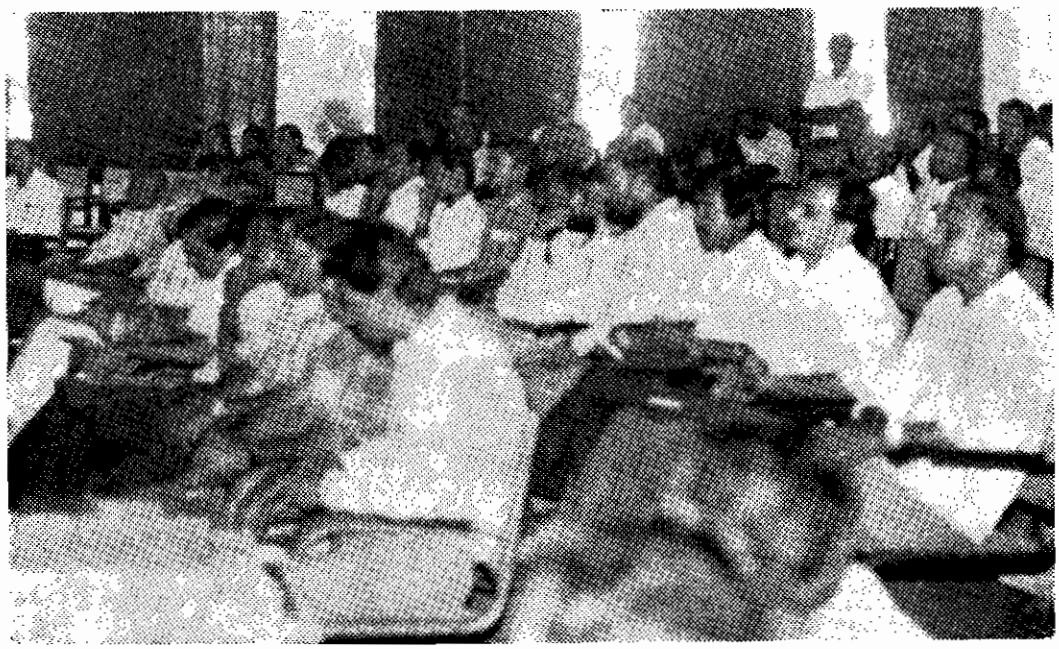
3 Identification of fast growing indigenous species suitable for industrial use and development of a package of practices for cultivating them.

4 Studies on the effect of fire on plantations and natural forest and effective ways for controlling fire.

5 Studies on control of the weed *Mikania micrantha* in plantations.

6 Studies on water relations of eucalypts.

7 Studies on fertilizer requirement of various species distributed under Social Forestry programme.



General view of the participants

The Forest Department agreed to collaborate with KFRI in the following areas :

1 *Pilot plantations of bamboos through vegetative propagation.*
2 Development of a management information system in the Institute.
3 Locating about 50ha of suitable experimental area for plantation trials on fast growing species.
4 Control of weeds, especially *Mikania,* in plantations.

J. K. Sharma
Convener
and
K. C. Chacko
Associate Convener

National Environment Awareness Campaign

As part of the National Environment Awareness Campaign, Kerala Forest Research Institute organised camps and classes for school children and the public to make them aware of the increasing need to conserve our environment.

In a function organised by the District Collector at Vettilappara High School in Chalakkudy, two scientists of the Institute, Dr. A. R. R. Menon and Mr. Thomas P. Thomas took classes on Forests, Rivers and Water.

The institute organised a full day camp on 7th January 1989 in which 30 students and 7 teachers from the Peechi and Pattikkad High Schools participated. In the camp, 6 scientists of the Institute delivered lectures on various topics relevant to environmental conservation such as, Role of forests in water conservation (Dr. T. G. Alexander) Flora and fauna (Dr. A. R. R. Menon and Mr. K. K. Ramachandran) Microorganisms (Dr. K. V. Sankaran) and Soil and natural resource conservation (Mr. Thomas P. Thomas and Mrs. E. P. Indira.) The students and teachers were presented nature study kits made available for this purpose by the National Museum of Natural History, New Delhi and a copy each of a book in Malayalam entitled 'Pakshikalute Atbhuta Prapancham'.

Thomas P. Thomas
Convener

Know your Information Sources

Commencing with the current issue of Evergreen we are starting a new series entitled. 'Know your information sources'. The purpose of this series is to bring to the notice of information users the characteristics of various information sources such as, directories, guides to literature, abstracting and indexing services and computerised databases.

National Union Catalogue of Scientific Serials in India, 4v. 1988

Indian National Scientific
Documentation Centre (INSDOC)
New Delhi - 110 067

Any library, however large it would be, cannot subscribe to all the journals published in the world. Even in special libraries devoted to a specialised discipline like forestry it is difficult to subscribe all journals required by the scientists. Increasing budgetary restrictions on the one hand and escalating subscription rates on the other pose serious problem to libraries.

Whatever the constraints are, the scientists require information from all the journals published in their field and the success of research depends to a considerable extent on dissemination of information. One of the techniques of information science to overcome this problem is to compile a union catalogue of serials in India.

It was against this background the Indian National Scientific Documentation Centre (INSDOC), compiled a National Union Catalogue of Scientific Serials in India (NUCSSI). The task of providing access to more number of journals to our scientists and scholars has been made easy by the compilation of this voluminous work.

NUCSSI contains journals holding data relating to about 35,000 titles in the field of science and technology subscribed in 800 major libraries in the country. The journals are listed alphabetically disregarding articles, prepositions, conjunctions etc and cross references are provided wherever necessary.

Under each title the libraries subscribing to it are listed. Each participating library is assigned a code and this code is given under each journal, e.g.

MBESIS is the number for Indian Institute of Science

M = Karnataka
BE = Bangalore
S = Science, Technology in general
IS = Indian Institute of Science

A typical entry in the NUCSSI is as follows

Animal behaviour Abstracts
Association for the Study of
Animal Behaviour (London)
London. 1, 1973 +

BPRAGB 2, 1974 +
NTRAFR 5, 1977 +
PMIUKU 5, 1977 +
WCAZZS 7, 1979 +
YGIUGU 2, 1974 +

The entry indicates that 5 libraries in India are subscribing to Animal Behaviour Abstracts. After the symbol representing the library the volume and the corresponding year from which the library is getting the journal is also indicated. The plus (+) signs at the end indicate that these libraries are getting this journal currently.

The NUCSSI is a very effective information source to locate journals in the field of Science and Technology from any of the major libraries in the country. As most of the libraries listed in the NUCSSI has photocopying facility, it is not very difficult to obtain photocopies of journal articles from the concerned library.

The effort undertaken by INSDOC in compiling this very important bibliographic tool is very much laudable because it brings together scientists who are users of information and scientists who are producers of information at lesser expenses.

K. Ravindran
Library

Training in Wood Science and Technology for the FACT Engineers

A training was organised by the Wood Science Division of the Institute in basic wood science and technology for the engineers of the Fertilizers and Chemicals, Travancore (FACT). The training was given for two days (23rd September at Peechi and 6th October, 1988 at Ambalamedu). The training included lecture classes and laboratory work. Various topics on which information imparted included wood anatomy, properties of timber, suitability of species for different end uses, wood drying and preservation, timber as a construction material, optimum use of timber and substitutes for timber. Some exposure to wood identification was also given. About 20 civil engineers participated in the training.

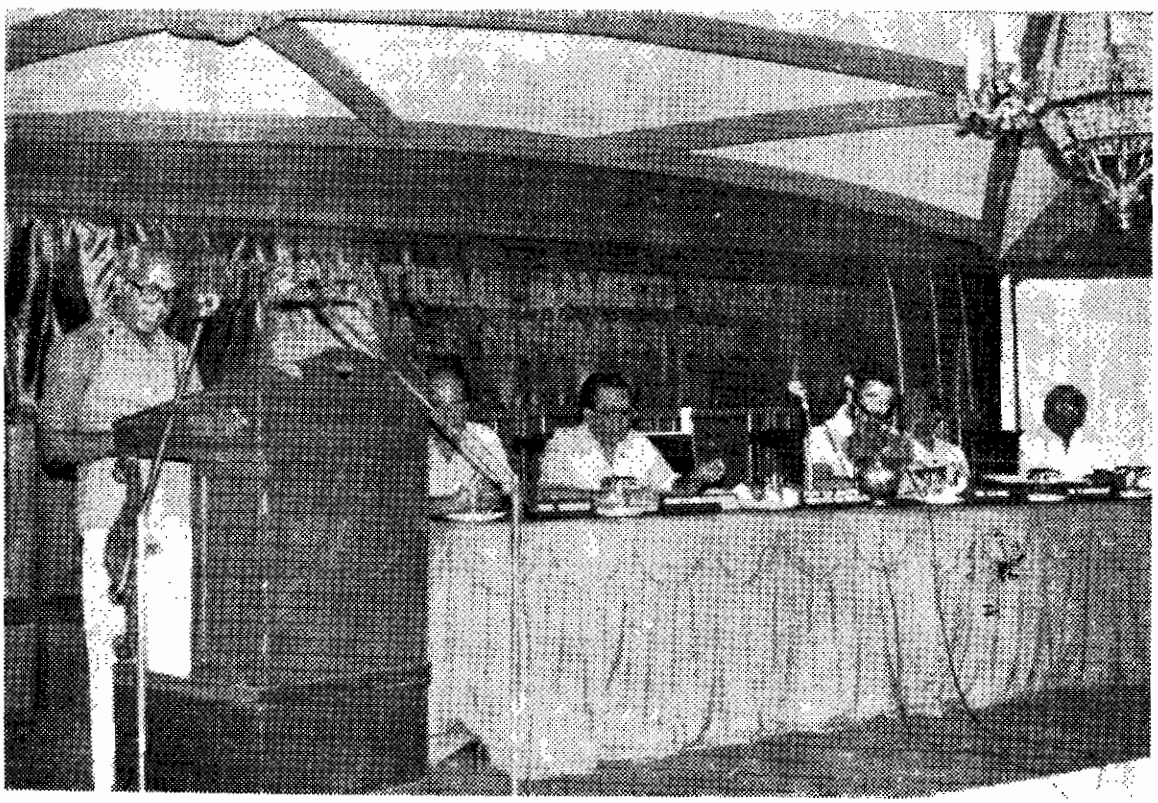
R. Gnanaharan
Wood Science Division

A Special feature

International Bamboo Workshop

14-18 November, 1988. Cochin

An international Bamboo Workshop was held at Cochin from 14-18 November 1988, to discuss various scientific, technical and socio-economic aspects of bamboo production, management, cultivation and utilisation. The workshop was organised by the Kerala Forest Research Institute and sponsored by the International Development Research Centre (IDRC), Canada. The International Union of Forestry Research Organisations (IUFRO), the State Committee on Science, Technology & Environment and the Kerala Forest Department co-sponsored the workshop. A total of 97 participants including 34 from 16 foreign countries attended the workshop. The participants included scientists, resource managers, administrators and information specialists.



Prof. N. M. Joseph, Minister of Forests, Kerala, inaugurates the seminar

INAUGURATION

renewability should not be endangered

"I do understand that there is a limit to biological productivity, and that in our eagerness to harvest the maximum of produce from the forest, we should not endanger the renewability of the forest. But have we tried our best? I am sure that there are several ways by which the productivity of forest could be improved - in the case of production of bamboos and reeds - by scientific management of the natural bamboo and reed areas, standardising optimal techniques for raising and harvesting plantations, and encouraging bamboo cultivation in private holdings etc....."

Prof. N. M. Joseph
Minister of Forests, Kerala

Delegates - a general view

bamboo handicraft industry to be developed

"It is essential that our bamboo handicraft industry is developed to the full extent so that the bamboo resources are put to the best use and maximum benefit. This could go a long way to solve rural unemployment and to earn good foreign exchange from exports. The present revenue estimated at about 80 million rupees per annum can be further increased if bamboo industries are started and developed along the right lines."

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

bamboo projects supported by IDRC

"Soon after initiating the forestry programme in Asia, IDRC became aware of the role bamboo played in the life of Asian people.We also realised the serious problems the resource was facing because of the increasing demand and the indiscriminate cutting that was taking place as a consequence. Starting with two projects in 1980, we now have bamboo projects in 7 Asian countries. More recently we have begun supporting similar research in Africa".

A. K. Oka
IDRC Representative, India

absence of land use policies

"In India bamboo has become scarce and the cause of this would be the same in all the developing countries. It is the absence of land use and grazing policies coupled with problems of population explosion. At the time of reservation of forests, tree clad areas were set aside for meeting the rural needs of firewood, small timber, mulch and fodder as community privilege areas. Unfortunately, this category of land was also considered the pool for the extension of agriculture. Today what is left of the community privilege area is totally degraded and the pressure, particularly of grazing and fuel wood collection, which the community privilege areas were meant to take has shifted to the reserve forests. Along these lines hangs the tale of production of bamboo in India today."

S. Shyam Sunder,
Principal Chief Conservator of Forests
Karnataka

bamboo resources declining in India

"In India, due to various reasons bamboo resources are declining though the requirements in the form of demands is on the increase. There is urgent necessity to increase productivity of the existing natural stands and to augment the resources with artificial regeneration. In India a few species of bamboos have been planted in many parts of the country. First plantations have not been successful everywhere because of various factors, especially the biotic factors like grazing and fire. It is high time that the research needs and priorities are identified."

S. Sivarajan
Principal Chief Conservator of Forests
Kerala

basic research necessary

"We have three groups of bamboos - one strictly monocarpic, the one which flowers only once in a life time; the second group not so strict but somewhat erratic in their flowering behaviour they are neither annuals nor perennials but they have got their own biological rhythm; the third group of bamboos as our Thai friends have recognized will flower every year without fail. That is where our gold mine is. But one of the drawback for that is, when these bamboos flower or fruit some of them have embryos and others do not. This is where perhaps the basic research is necessary as some of the speakers were saying - in cytology, embryology and related aspects. If we can solve that kind of problem and produce seeds every year then you will have a constant supply of seed resource which can be utilised to fill up the forests with better quality of bamboos".

Prof. A. N. Rao
National University of Singapore

research on marketing aspects lacking

"I believe that greater emphasis must be given to the utilisation aspects of bamboos. Even the limited research today is so far mostly properties-oriented but not products - oriented. We are lacking completely the research on marketing aspects of bamboo. It should be known which properties are to be tested for which products, otherwise people will buy in due course baskets made of plastics which are colourful, cheaper and durable."

Prof. W. Liese
University of Hamburg

STATUS REPORTS

Thailand

" It has now been realised that bamboo forests of Thailand are not fully and efficiently utilised to their full potential. The development of this field will surely contribute very much to economy of the rural people and the country as a whole".

Boonchoob Boontawee

Nepal

"The bamboos are traditionally propagated by vegetative means in which more than 2 m high culms with rhizomes are planted vertically. Research is currently underway to discover alternative potential techniques. Work on tissue culture of bamboo is being carried out."

A. N. Das

Philippines

"Bamboo research has achieved a national priority in the Philippines. A more systematic approach in the promotion and dissemination of bamboo research is in the offing."

Z. B. Espiloy

Sri Lanka

"Attention is drawn to the possibility of intensifying the use of bamboo resources through systematic management and the promotion of its use as a substitute for small timber."

N. De Zoysa

East Africa

"Bamboo is one of the most important resources with a high potential for increased productivity and easy for general management and integration into farming systems as a multi-purpose resource species. To protect, manage and expand bamboo resources in East Africa as presently realised, more information is required for expansion strategies, silvicultural invention and more efficient utilisation."

B. N. Kigomo (Kenya)

MANAGEMENT OF NATURAL BAMBOO STANDS

urgent conservation action needed

"Excessive exploitation in the past, coupled with mass flowering and death, followed by a serious failure of regeneration have all but decimated the bamboo resources in the forest divisions of Lansdowne and Kalagarh in outer Himalayas and Siwaliks of Western Uttar Pradesh. An urgent conservation action is needed not only for restoration of habitat of bamboo in the fragile ecosystems but also identifying *in situ* conservation reserves."

S. N. Prasad (India)

Arundinaria alpina in Kenya

"The life cycle of *A. alpina*, the only bamboo species indigenous to Kenya, is 7-14 years. Flowering occurs in different zones but in patches of 0.5 ha in over large areas and in cycles of about 40 years."

J. M. Were (Kenya)

leaf litter dynamics

"There are two annual peaks in leaf litter fall of *Phyllostachys pubescens*. Weight loss of litter was found to be rapid initially, but negligible after twenty weeks."

F. Mingyu (Peoples Republic of China)

diseases of bamboos

"Survey in nurseries, plantations and natural stands indicates that bamboos are susceptible to various diseases. A large number of fungi were found associated with diseases of leaf, culm and rhizome."

C. Mohanan (India)

endangered *Ochlandra* spp. in Kerala.

"Of the 9 species of *Ochlandra* known to occur in Kerala (India) five of them viz. *O. ebracteata, O. setigera, O. beddomei, O. sivagiriana and O. talboltii* are reported to be endangered and restricted in distribution."

Muktesh Kumar (India)

bamboos in homesteads

"In Kerala, bamboo occupies an area of 581 ha with 39 million number of culms in the homestead. The harvest during the year 1987-88 was 9.1 percent of the growing stock. Quantity of bamboo used during 1987-88 was around 32 million culms.

C. N. Krishnankutty (India)

remote sensing to identify bamboo brakes

"Remotely sensed data in the form of large scale aerial photographs and landsat MSS CCT were used to delineate bamboo brakes in moist deciduous forests in Attappady region, Kerala, using various photo elements."

A. R. R. Menon (India)

bamboo pests

"Pests of standing bamboo can be grouped as defoliators, shoot and stem borers and sap suckers. Major pests include *Pyrausta coclesalis, Cyrtotrachelus dux, C. longimanus* and *Oregma bambusae.*"

Pratap Singh (India)

disease survey

"Leaf and branch blight, grey blight of culms, abnormal defoliation and withered culms are the major diseases of bamboos. In reeds, leaf and culm blight, and brown spot of leaves were prevalent."

B. Balakrishnan (India)

MANAGEMENT OF BAMBOO PLANTATIONS

fertiliser application

"Compounds of N. P. K and Si applied in furrows at the rate of 375 kg. ha^{-1} in the spring season gave a yield of 7872.5 kg. of culms in *Phyllostachys pubescens.*"

F. Maoyi (Peoples Republic of China)

effect of varying spacing and fertility levels

"Closer spacing (1m × 1m) in *Dendrocalamus strictus* resulted in higher leaf area per clump, leaf area index, leaf area duration, rate of dry matter production and crop growth rate which are instrumental in increasing total dry matter production. Application of 100 : 50 : 50 kg. N, P_2O_5 and K_2O per ha per year increased total dry matter."

V. C. Patil (India)

container size and growth of *Bambusa* seedlings

"In larger polythene containers (18 cm × 40 cm) *Bambusa arundinacea* seedlings showed increase in root, rhizome and shoot biomass, length of of longest root and number of roots per plant. However, the number of shoots and height of the plants were not influenced by container size,"

K. C. Chacko (India)

role of bamboos in secondary succession

"The secondary succession after slash and burn agriculture is fast. The plant communities are continually developing, changing and then disappearing or they give way to another community. Bamboos are such one community which prevails on these lands for longer time due to their longivity and faster growth."

K. S. Rao (India)

three patterns of flowering in bamboos

"They were clump flowering, culm flowering and continuous flowering. With the exception of continuous flowering pattern all bamboos died after flowering period. Seeds of bamboos that flowered gregariously and the clump flowering pattern are more viable than others."

A. Anantachote (Thailand)

seed storage of *Thyrsostachys siamensis*

"Seed viability can be extended by reducing initial moisture content before storing. Seeds of *Thyrsostachys siamensis* stored for 27 months under low temperature such as cold room (2-4°C) and deep freezer (-5°C) maintain high percentage of viability."

S. Ramyarangsi (Thailand)

addition of N enhances biomass production in *Bambusa* seedlings

"Addition of NPK at the rate of 40, 27 and 25 g respectively per pot was found to be the best treatment combination for enchancing the growth of *Bambusa arundinacea* seedlings."

T. P. Thomas (India)

a new approach

"Soil working, fertiliser application, protection, irrigation and thinning trials have substantially improved the growth of bamboos. Maximum productivity was obtained when soil working, fencing, application of 0,5 kg of urea and rock phosphate per clump and irrigation once a month were combined."

A. C. Lakshmana (India)

insect pests can be serious in young plantings

"Recent survey for insect pests in young bamboo plantings under teak showed that many seedlings were infested with defoliators and sap suckers. Infestation by sap suckers was important since many of the affected seedlings also showed signs of die-back.".

G. Mathew (India)

PROPAGATION

effective method of raising bamboo

"Rhizomes and clumps raised in the ground appeared to be the most suitable and effective method of raising bamboo in the nursery. Rhizomes showed the highest survival rate."

A. U. Haq (Kenya)

branch cuttings.. ...practical and effective

"Branch cuttings is the practical way of propagating bamboo for commercial or large scale plantation.....Big branches have more potential for rooting than small ones."

R. Vongvijitra (Thailand)

tissue culture

"Tissue culture could complement vegetative propagation of *Dendrocalamus strictus*. *In vitro* flowering could also similarly increase the importance of tissue culture in bamboo."

A. F. Mascarenhas (India)

from somatic embryos

"*In vitro* methods offer an attractive alternative to seeds and offset propagation - one method is the formation of plantlets from somatic embryos."

Usha Rao (India)

growth regulating substances for rooting of reeds

"Treatment with naphthyl acetic acid and indole butyric acid increased rooting response of *Ochlandra travancorica* and *O. scriptoria*. Growth of treated cuttings in the field was better in terms of culm production and girth of culms."

K. K. Seethalakshmi (India)

PROPERTIES AND UTILISATION

as an alternative material

"The ongoing destruction of forest areas accompanied by an augmenting shortage of timber has led in a number of countries to an increasing awareness of the multifunctional services which bamboo can provide. By applying research results, cultivation, management and processing of bamboos have been much improved and an impressive enthusiasm for bamboo has since been developed. However caution must be expressed to be aware of certain adverse characteristics of the plant and its products so that its natural limits are not overstressed".

W. Liese (W. Germany)

strength

"There is a general increase in strength when bamboo is dried from green condition. The increase in strength from green to air dry condition was much lower than that in wood. For this reason there seems to be less risk in using green bamboo for construction purposes as far as strength is concerned."

S. Prawirohatmodjo (Indonesia)

uses of *Sinocalamus affinis*

"*Sinocalamus affinis* is a very valuable bamboo species in China which is widely used in weaving of traditional bamboo articles as well as paper making and mat-board manufacture".

W. Hsiung (China)

Slope-inhabiting bamboo is better

"*Gigantochloa pseudoarundinaea* growing in hill slopes in Java showed higher specific gravity, static bending and tensile strength than those growing in valleys".

E. A. Widjaja (Indonesia)

abrasive resistance

The abrasive resitance of *Bambusa vulgaris var striata* and *Gigantochloa scortechinii* is superior to that of *Koompassia malaccensis* and rubber wood and thus these bamboo species can be used successfully for flooring purposes".

A. L. Mohamod (Malaysia)

bamboo fibres

"The tensile strength of multilayered bamboo fibre reinforced plastic composites varies from 264 to 386N/mm^2 depending upon their stacking sequence".

U. C. Jindal (India)

bamboo boards

"Improvement of the process of bamboo board manufacture developed by the Indian Plywood Industries Research Institute is of immediate interest to make it widely acceptable and commercially viable."

S. S. Zoolagud (India)

preserving bamboo

"Bamboo can be treated easily and effectively with preservatives like ASCU, provided they are notched in a pattern. It neither reduces the strength, when used in compression or bending, nor does it pose any problem in the proper distribution of ASCU".

V. R. Sonti (India)

simple and cheap method

"Traditional method of preservation - soaking in ponds works only for species with low starch content. Soaking method using diesel oil seems to be most applicable alternative

A. Sulthoni (Indonesia)

bamboo filters

"In Java, low cost bamboo trickling filters and a pond system were both useful in the secondary treatment of municipal waste water. In densely populated or mountainous regions the advantages of bamboo filter systems outweigh those of the pond system. In regions abundant in water resources, the pond systems should be preferred".

W. Kirchhof (Germany)

bamboo pipes for water supply

"For the past few years, Tanzania has made successful attempts to build rural water supply schemes by using pipes made out of bamboo conduits. Most of the scientific and technical problems involved in this have been resolved to a satisfactory extent".

T. N. Lipangile (Tanzania)

ethnotechnology

"A preliminary survey in North Eastern region revealed that there was an enormous resource of not only bamboo but also skills and techniques the local communities have perfected over the centuries".

M. P. Ranjan (India)

storage pests

"Ten species of beetles are known to damage stored bamboos or bamboo products in Kerala. However, only two, *Dinoderus minutus* and *D. ocellaris* are recognized as serious pests".

G. Mathew (India)

BAMBOO AS AN ENGINEERING MATERIAL

Bamboo inclusions in soil structures

"The use of bamboo as a construction material can be extended to include the role of reinforcement elements in soil structures such as enbankment and retaining walls. Bamboo reinforced geotechnical design are visualised as a future possibility for use in constructing soil structures".

R. A. Douglas (Canada)

bamboo as a reinforcing material

"The stiff nature of bamboo and its relative high tensile strength render it suitable as an earth reinforcing material. Although the techniques of reinforcing earth structures using natural materials, such as bamboo and wood has been reported a very long time ago it is yet to receive serious research attention".

K. S. Low (Malaysia)

as a building material

"In building industry bamboo is not still exploited to the full. A propoasl is therefore made to raise an IUFRO/CIB - sub group on bamboo as a building material".

J. Janssen (The Netharlands)

bamboo house construction

"Properly seasoned and chemically treated bamboos can be successfully used in the construction of house components like trusses, purlins etc. The methodology of reinforcing the mud walls by treated bamboos, making of wire pin etc. have been elaborated at the Forest Research Institute and Colleges, Dehra Dun to make the appropriate techniques acceptable to the common people.

H. N. Mishra (India)

bamboo housing — typhoon damage

"Round bamboo major structural members and split bamboo minor structural members can be made to work effectively in low-cost houses provided sufficient attention is paid to their connection. Nailed connections will not hold all species of bamboo during typhoon loads as the bamboo has a tendency to split, allowing it to pull over nail heads".

G. N. Boughton (Australia)

the Costa Rican bamboo national project

"With the disappearance of the natural forests in Costa Rica it has become of great urgency to substitute wood with a material inexpensive, resistant and available in rural areas. Bamboo satisfies all these requirements and the Costa Rican Bamboo National Project has been conceived as a necessary and national answer to implement in the country a new and proven building technology".

A. C. Chaves (Costa Rica)

low cost construction material

"Bamboo as a substitute for steel in normal and light weight concrete beams and slabs have been studied experimentally. Several curing methods and water repellent materials have been considered to reduce their water absorption and improve their bonding ability with concrete".

K. Ghavami (Brazil)

SOCIO - ECONOMIC AND INFORMATION NEEDS

intersectoral allocation of bamboo resources

"The more challenging and fundamental task is to redefine development to suit our needs and resource endowments. Allocation policies between the modern industrial sector and the traditional sector with respect to fast depleting resources is meaningless unless conservation issues are also tackled.

M. Chundamannil (India)

only 10 percent of raw material for traditional workers

"Shortage of raw-material is the major problem faced by industry and is the result of short-sighted policy of the Government, neglecting the basic needs of traditional workers. The fact that an industry with 3,00,000 dependents is allotted only 10 percent of the total available raw-material in the State is not a justifiable one, considering its employment potential".

P. K. Muraleedharan (India)

Bamboo Information Centre - China

"The Chinese Academy of Forestry has established a Bamboo Information Centre (BIC) supported by the IDRC, Canada."

Z. Shi-Lin (China)

BIC in India too

"By establishing a Bamboo Information Centre at the Kerala Forest Research Institute Bamboo research in India can be served effectively".

K. Ravindran (India)

Imperatives and research strategies

"Tasks that are to be accomplished are : 1. preparation of a data base on bamboos; 2. definition of key areas of basic and applied research, 3. collection of clonal germplasm, 4. determination of the best configuration of workshops and training schemes that can be convened to optimise skills; 5. initiation of co-ordinated preparation of detailed research plans and 6. development of tissue culture practices of propagation complementary to those used in conventional garden and field practices."

A. N. Rao (Singapore)

RECOMMENDATIONS OF THE INTERNATIONAL BAMBOO WORKSHOP

The third International Bamboo Workshop in its closing session made the following statements with regard to future course of action in terms of research and development relating to bamboo, the miracle grass.

1. Development

The forum almost unanimously agreed that international co-operation in the field of bamboo research should be enhanced through :

a) the establishment of an International Bamboo Research Institute (INBRI):

b) exchange of scholars and scientists for a meaningful period of time for greater exchange of information and

c) the establishment of an engineering database

2. Research

The forum having recognised the work that has gone on in the last decade through international agencies like IDRC, wish to state that these research efforts need to be continued, especially in the following areas:

a) basic research in cytology, eco-physiology, reproductive biology, plant protection and deterioration;

b) market-service strategies, product design and development for urban and rural areas, anthropological studies;

c) studies on bamboo as shelter, especially in terms of architectural structures to enhance durability and finally conservation.

Further, the forum also indicated that greater and meaningful recognition has to be given to the scientists, especially those involved in the dissemination of science and technology to the community

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Papers presented at the International Bamboo Workshop by participants from Kerala Forest Research Institute

Mohanan, C. Diseases of bamboos in Kerala.

Chacko, K. C and Jayaraman, M. S. Effect of container size on growth of *Bambusa arundinacea* Willd. seedlings in nursery.

Seethalakshmi, K. K., Surendran, T. and Somen, C. K. Vegetative propagation of *Ochlandra scriptoria* and *O. travancorica* by culm cuttings.

Chundamannil, M. Inter-sectoral allocation of bamboo resources : the social and economic issues.

Muraleedharan, P. K. and Rugmini, P. Problems and prospects of traditional bamboo based industry in Kerala.

Ravindran, K. Bamboo Information Centre - India: Project proposal.

Menon, A. R. R. Utilization of remote sensing data in identifying bamboo brakes.

Muktesh Kumar. Reed bamboos (*Ochlandra*) in Kerala: distribution, ecology and utilization.

Krishnankutty, C. N. Bamboo resource in the homesteads of Kerala.

Mathew, G. and Varma, R. V. Occurrence and pest status of some insects attacking bamboo in newly established plantings in Kerala, India.

Thomas, T. P. Effect of N, P and K on growth of *Bambusa arundinacea* seedlings.

Mathew, G. and Nair, K. S. S. Storage pests of bamboos in Kerala-An overview.

New Publications

Scientific Papers

1. **Bhat, K.M. and Renuka, C.** 1986. Variation in the physical characteristics of Kerala grown rattans of Peninsular India. Malaysian Forester 49:185-197.

2. **Bhat, K. M., Renuka, C.** and **Thulasidas P. K.** 1988. Occurrence of multiple perforation plate in the vessel elements of *Calamus* (Lepidocaryoidea). Current Science, 57 : 1027 - 1028.

3. **Mohanan, C.** 1988. Foliar diseases of *Pongamia pinnata* caused by *Asperisporium pongamiae* and *Urohendersonia pongamiae* in Kerala. Indian Journal of Forestry, 11 (3) : 202—203.

4. **Mohanan, C.** 1988. *Colletotrichum* foliar infections on *Leucaena leucocephala* in Kerala, India. Current Science, 57:1299-1300.

5. **Sudheendrakumar, V. V., Nair, K. S. S.** and **Varma, R. V.** Seasonal incidence of *Eutectona machaeralis* (Walker) in teak plantations at Nilambur, Kerala. Indian Journal of Forestry 11 (3) : 250-253.

6. **Easa, P. S.** 1987. Chemical composition of the temporal gland secretions of an Asian elephant, *Elephas maximus*. Elephant, 2(3) : 67-68.

7. **Varma, R.V., Mathew, G , Mohanadas, K. Gnanaharan, R., and Nair, K. S. S.** 1988. Laboratory evaluation of insecticides for the control of bamboo borers *Dinoderus minutus* and *D. ocellaris* (Coleoptera : Bostrychidae). Material und Organismen 23(4) : 281-288.

8. **Muktesh Kumar and Manilal, K.S.** 1988. Floral anatomy of *Apostasia odorata* and the taxonomic status of Apostasioides(Orchidaceae). Phytomorphology, 38(2,3): 159-162.

9. **Sasidharan, N. and Sivarajan, V. V.** 1989. *Curcuma peethapushpa*. A new species of Zingiberaceae from India. Notes of Royal Botanical Garden. Edinburgh, 45(3):425-427.

10. **Sankaran, K.V., Mohanadas, K., Mohamed Ali, M.I.** 1989. *Beauveria bassiana* (Bals.) Vuill., a possible biocontrol agent against *Mylloceros viridanus* Fabr. and *Calopepla leayna* Latreille in South India. Current Science, 58 (8): 467-469.

11 **Varma, R.V., Mohanadas, K. Mathew, G. and Nair, K. S.S.** (1989). Evaluation of some common insecticides against *Pteroma plagiophleps* Hamp. A bagworm pest of *Albizia falcataria* Indian Journal of Plant Protection, 17:89-90.

Abstracts of Research Reports

Balagopalan M. 1989. Physical and Chemical Properties of Soils in *Albizia falcataria* Plantations. KFRI Research Report 57. Final report of Project Soils 11/84.

Albizia falcataria (L) Fosberg, native to the eastern islands of the Indonesian archipelago and the New Guinea, is one of the fastgrowing trees in the world. The tree has been planted in Kerala by the Forest Department and Forest Development Corporation under afforestation programme. Even though a few studies on nursery as well as plantation soils of *Albizia* have been conducted in Philippines, Indonesia and Taiwan, no systematic attempt has so far been carried out in Kerala, This investigation was initiated for in-depth study of physical and chemical properties of soils in *Albizia falcataria* plantations.

Study areas were selected in 1977 plantations at Arippa and Kolla-thirumed. Leaving about 10m on the periphery on all sides, 20 ha was demarcated in the study areas. Plots of 10m x 10m were laid out randomly for every hectare in the two areas. From each plot, one soil pit was taken and samples from 0—20, 20—40, and 40—60 cm layers of soil pits were collected. Also, one core sample was taken from 0—20 cm layer for bulk density determination. Heigh and girth at breast height (gbh) of 20 trees aroundt the soil pit were also recorded. Soil samples were air-dried, passed through 2 mm sieve and gravel contents (particles > 2 mm) were calculated. Analysis for sand, silt, clay, organic carbon, pH, exchange acidity, exchangeable bases, total N, P, K, Ca and Mg, were carried out. Soil organic matter fractionation was also done for the surface samples.

At Arippa, gravel, clay and total Mg increase with depth whereas sand, silt organic carbon, pH, exchangeable bases total N K and Ca decrease. There is no trend for exchange acidity and total P. The soils are sandy loam in the surface and loam in deeper layers. They are strongly acidic. For organic carbon: total N ratio, there is also no pattern and it is 13.96 in the 0—60 cm layer. Humic acid: fulvic acid ratio is 0.80 in the surface.

At Kollathirumed, there is no trend for gravel, sand, pH and total P while clay and total Mg increase with depth. In the case of silt and total N, even though there is a decline, they remain the same in the two deeper layers. Organic carbon, exchange acidity, exchangeable bases, total K and Ca diminish with depth. The soils, in general, are loam and strongly acidic. As regards organic: total N, no trend is observed and in the 0—60 cm layers it is 14.36. Humic acid: fulvic acid ratio in the surface is 0.89.

The results show that at Arippa and Kollathirumed the soils, in general are fertile and on the surface, they are not compacted. There is also favourable environment for enzymatic activity in the soils and the humus substances decompose to fulvic type.

Intercorrelation among soil properties in the 0—60cm layer in the two areas pooled together reveals that gravel is negatively correlated with most other soil properties while pH shows no correlation with any other property. Organic carbon is significantly correlated with exchangeable bases and total N. Multiple Linear Regression Analysis shows that tree height and gbh are significantly influenced by soil properties; 46 and 81% of the variations in height and gbh of trees are attributable to soil properties.

Thomas P. Thomas. 1989 Effect of varying soil moisture and bulk density on teak, eucalypt and albizia root growth. KFRI Research Report No. 58. Final report of Project Soils 13/84.

Physical properties of the soil control to a great extent the growth of roots into the soil. Mechanical impedance to root penetration has been found to be a major deterrent. This project was an attempt to study the effect of soil bulk density and moisture on root growth of teak, eucalypt and albizia.

A preliminary trial in pvc pots (15 cm ht., 7cm inner dia.) with eucalypt and albizia seedlings was conducted initially. Later, a more elaborate experiment was conducted with surface soil from the Peechi campus, compacted to 1.1, 1.4 and 1.6g cm^{-3} bulk densities, the corresponding soil moisture holding capacities being 27. 16 and 14%. In concrete pots of 35 cm height and 25 cm inner diameter. Six week old polypotted seedlings of teak, eucalypt and albizia transplanted in these pots were harvested after 6 months.

The results indicate that length and biomass of roots of all the three species were reduced significantly by increasing bulk density and associated decreasing moisture content. An increase in bulk density to 1.4 g cm^{-3} itself caused significant reduction in root length of teak and eucalypt while in albizia, significant reduction was observed only with a bulk density of 1.6 g cm^{-3}. Root biomass of all the three species decreased significantly only with a soil bulk density of 1.6g cm^{-3}. Shoot length of teak was not affected by treatments while shoot dry matter production was significantly higher in the second treatment. Though root elongation of teak and eucalypt was restricted by a bulk density of 1.4 g cm^{-3} their thickness and branching have increased even beyond this density and hence significant reduction in biomass was found only with 1.6 g cm^{-3} bulk density. In albizia root elongation and biomass production was severely restricted only with a soil compaction of 1.6 g cm^{-3}.

The results showed that root growth of teak, eucalypt and albizia was reduced with increasing soil compaction and associated moisture stress. Hence soil management practices for reducing bulk density are needed while planting compacted sites with teak, eucalypt and albizia to ensure proper establishment and growth.

Dr. R. Gnanaharan (Wood Science) attended the Sub-Committee meeting on the Popularisation of Rubber Wood on 30th September 1988 at Kottayam. He also attended the ICFRE consultation meeting on the Strategies for Research in Wood Science and Technology, on 27th October 1988 at Bangalore.

Dr. K. S. S. Nair, (Entomology) participated in a symposium on Insect Plant Interactions : Recent advances and future trends, from 28-30th October 1988 at Madras and presented a paper entitled "Role of host trees in the dynamics of forest insect outbreaks".

Dr. R. V. Varma (Entomology) and Mr. M. Balasundaran (Pathology) participated in the Eighth Symposium (PLACROSYM) on Plantation Crops Research and Development from 28th-30th December 1989 at Cochin and presented the following papers.

1. Tea mosquito (*Helopeltis antonii*) feeding as a predisposing factor for entry of wound pathogens associated with die-back in cashew (R. V. Varma and M. Balasundaran.)

2. Inflorescence blight and shoot die-back of cashew (M. Balasundaran).

Mr. K. Ravindran (Librarian) participated in the National Seminar on Distance Education and Role of Libraries, from 2-4 December 1988 at Quilon and presented a paper entitled"Role of Public Libraries in Distance Education".

Dr. J. K. Sharma and Mr. C. Mohanan (Pathology) and Mr. M. Balagopalan (Soil Science) participated in the National Symposium on Forest Biology in Service of Mankind, from 5-6 January 1989 at Madurai and presented the following papers.

1. Protection against fungal diseases (J. K. Sharma and C. Mohanan)

2. Decay of standing trees in natural forest and their possible management strategies (C. Mohanan).

3. Properties of soils in the natural forests of Trivandrum Forest Division (M. Balagopalan)

Dr. N. G. Nair (Botany) and Dr. A. R. R. Menon (Ecology) attended the Workshop on Environmental Awareness, from 10-12 January 1989 at Trivandrum.

Dr. S. Sankar (Soil Science) participated as a resource person in the National Environment Awareness Camp for Adivasis of Attappady from 13-15 January 1989.

Dr. P. Vijayakumaran Nair and Mr. P. S. Easa (Wildlife Biology) participated in the National Symposium on Ecology, Biology, Management and Diseases of Asian Elephants, from 10-19 January 1989 at Kerala Agricultural University, Mannuthy. They presented the following papers in the symposium.

1. Interaction between teak plantations and elephants in Parambikulam Wildlife Sanctuary (P. Vijayakumaran Nair).

2. Movement pattern and home range size of Asian elephants, *Elephas maximus* in Parambikulam Wildlife Sanctuary (P. S. Easa).

Mr. C. N. Krishnankutty (Statistics) attended a course on Integrated Rural Energy Planning, from 23-28 January 1989 at National Institute of Rural Development, Hyderabad.

Dr. P. Vijayakumaran Nair (Wildlife Biology) participated in the National Seminar on Statistics for Biologists from January 30-February 5th 1989 at Madurai and presented two papers - 1. Computer programmes in statistical analysis and 2. Statistical application in forest biology.

Dr. N. G. Nair (Botany) participated in the National Conference on Coastal Zone Management, from 20-23 February 1989 at Cochin and presented a paper entitled" Coastal Zone Management—Lessons from the Bay Islands".

Mr. M. Balagopalan (Soil Science), Mr. P. S. Easa (Wildlife Biology) and Mr. Mammen Chundamannil (Economics) participated in the First Kerala Science Congress, from 26-28 February 1989 at Cochin University. The following papers were presented by them.

1. Physical and chemical properties of soils in eucalypt and teak plantations of Trivandrum Forest Division (M Balagopalan).

2. Factors influencing the home range and mobility of Asian elephant, *Elephas maximus* in Parambikulam Wildlife Sanctuary, Kerala (P. S. Easa).

3. Utilization of forests in Kerala (Mammen Chundamannil).

Dr. J. K. Sharma and Mrs. E. J. Maria Florence (Pathology) participated in the National Symposium on Epidemiology and Forecasting of Plant Diseases conducted by Indian Phytopathological Society from 28 February to 2 March 1989 at New Delhi and presented the following papers.

1. Effect of some nursery practices on incidence and severity of diseases and growth of *Eucalyptus grandis* seedlings (J. K. Sharma and C.Mohanan)

2. *Botryodiplodia theobromae* associated with blue staining in commercially important timbers and its possible biological control measures (E. J. Maria Florence).

Forthcoming Events

30 July-5 August 1989. Symposium on **State of the Art Methodology of Forest Inventory.** Syracuse, USA. For more information contact: Prof. T. Cunia, Faculty of Forestry, College of Environmental Science, State University of New York, Syracuse, NY 13210, USA

19 August-7 September 1989. IUFRO Symposium on **Seed problems of multipurpose trees and other tropical and sub-tropical species and seed radiography**. Gympie, Australia. Contact: Steven Midgley, CSIRO Division of Forestry and Forest Products, P. O. Box 4008, Queen Victoria Terrace, ACT, Australia.

26 August - 4 September 1989. IUFRO International Symposium on **Protective plantation technology.** For Information Contact : Prof. Xiang Kaifu, Department of Forestry, Northeast Forestry University, Box 325, Harbin, China Telephone-631 61521.

4-9 September 1989. **Workshop on Tree rings and Environment.** Lund. Sweden. For details contact T. Bartholm, Department of Quaternary Geology, Tornavegin 13, S 22363 Lund. Sweden.

4-7 September 1989. IUFRO Conference on **Population dynamics of forest insects.** Edinburgh, UK. For further information contact: Dr. A.D. Watt, NERC Institute of Terrestrial Ecology, Edinburgh Research Station, Bush Estate, Penicuik, Midlothian, EH 26 0QB, Scotland.

18-22 September 1989. **Forest Planning for people**. Blume mountains, New South Wales, Australia. Contact: E. Nicholson, Chair, IFA Conference Steering Committee, GPO Box 2667, Sydney, NSW 2001, Australia.

19-21 September 1989. IUFRO Symposium on **Management of nutrition in forests under stress.** Freiburgi Br. Germany, FR. Contact Address. Prof. H. W. Zoettl, Institute of Soil Science and Forest Nutrition, Albert-Ludwig-University, Berto-IdstraBe 17, D-7800 Freiburgi Br. Germany, FR.

24-30 September 1989. International Symposium on **Forest Genetics, Breeding and Physiology**, Voronezh, USSR. Contact: TSNIILGIS, IUFRO International Symposium-89, 105 Lomonosov Str., Voronezh, 394043, USSR.

24-29 September 1989. IUFRO working party meeting on **Crown and canopy structure relating to productivity.** Rhinelander, Wisconsin, USA. Contact Dr. J. G. Isebrands, USDA Forest Service, North Central Forest Experiment Station P. O. Box 898, Rhinelander, Wisconsin 54501, USA.

24-30 September 1989. **Global natural resource monitoring and assessments: Preparing for the 21st century.** Venice, Italy. For further information contact Mr. H. Gyde Lund, C/o USDA Forest Service, T.M., P. O. Box 96090, Washington, DC 20090-6090 USA. Telephone: 202447-2747.

24-28 September 1989. IUFRO meeting on **Harvesting and utilization of tree foliage.** Riga, USSR. More information is available from M. Dangavietis, The Latvian Research Institute of

Forestry Problems, SU 229021 Salaspils, Silava, Latvian SSR, US.

15-21 October 1989. **Wood structure and quality bases for improved utilization of timbers.** Los Banos, Philippines. Please contact: P. Baas, Rijksherbarium P. O. Box 9514, 2800 RA Leiden, The Netherlands.

20-23rd November 1989. **International Conference on Head water control,** Prague, Czechoslovakia. Contact address: Dr. Josef Krecek, Institute of applied Ecology, Agricultural University of Prague 28163 Kostelec N. C. I. Czechoslovakia, Phone 0203 97521.

3-7 October 1989. **International Conference on Environmental Education,** Goa, India. For information contact UNESCO Regional Office of Science & Technology for South and Central Area (ROSTSCA), 15 Jor Bagh, New Delhi-110 003.

7-21 December 1989. **Regional Training Workshop on the Basics of Mycorrhizae and its biotechnology,** New Delhi, India. For information contact UNESCO, Regional Office of Science & Technology for South and Central Area (ROSTSCA), 15 Jor Bagh, New Delhi 110 003.

20-24 March 1990. International symposium on **Fire and Environment - Ecological and Cultural Perspectives** Knoxville, Tennessee. For further information please write to Program Chair, Fire and Environment Symposium. P. O. Box 1071. The University of Tennessee, Knoxville TN 37901-1071.

11-15 June 1990. International symposium on **Research needs and applications to reduce erosion and sedimentation in tropical stepplands.** Suva, Figi. All correspondence should be addressed to Dr. Robert R. Ziemer, 1700 Bayview Drive, Arcata, CA 95521, USA.

Campus News

1 Shri. U. N. Nandakumar, Division of Silviculture completed the two year Diploma Course for which he was deputed to the State Forest Service College, Coimbatore and rejoined the Institute in January 1989. He secured the 5th rank and received the Gujarat Forest Development Corporation Prize for securing maximum marks in Wildlife Management.

2 Dr. R. C. Pandalai, Scientist, Division of Silviculture was transferred and posted as Scientist-in Charge of the Institute's Sub Centre at Nilambur with effect from 1-1-1989.

Joined KFRI recently

1 Mr. Abdul Vahab — Pump Operator
2 Mr. Anil Kumar — ,,
3 Mr. Sanjeeva Rao — ,,

Left KFRI

Mr. E. T. Devassy — Pump Operator

Retirement

Mr. P. K. Balan — Registrar

KFRI Seminars

1 Prof. A. Milburn
Head, Department of Botany, University of New England, Australia
: Disruption of waterflow in plants (22-10-1988)

2 Prof.S.Balasubramanian
Professor and Head, Department of Botany University of Peradeniya Sri Lanka
: Lowland evergreen forests of Sri Lanka (1-12-1988)

3 Prof. N.S. Ramaswamy
Former Director Indian Institute of Management 870, Koramangala - 6 Bangalore - 560 034
: 1 Social relevance of research
2 Team building (18-12-1988)

Visitors

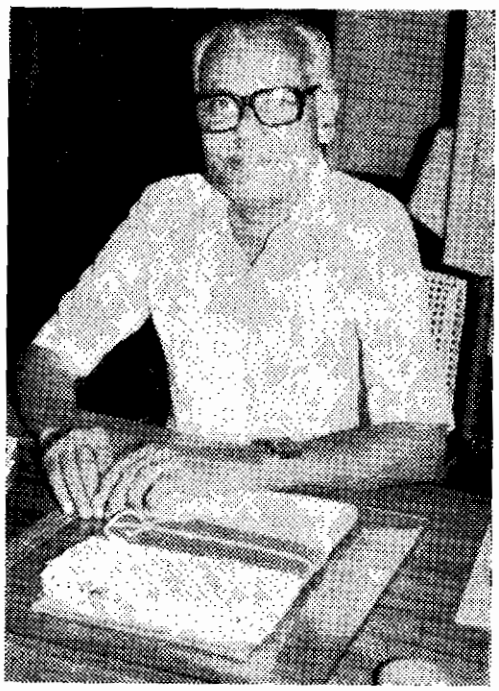
1 Dr. G. Dhanarajan (11-10-1988)
IDRC-Bamboo/Rattan Network Co-ordinator
5, Hargreaves Road
Penang 11600
Malaysia

2 Dr. John Hammel 12-12-1988
Agriculture University Wageningen
Forest Department
Gen Foulkes Weg 64
6700 AH Wageningen
The Netherlands

3 Mr. AG Oka, IFS 29-12-1988
Inspector General of Forests
Ministry of Environment and Forests
Govt. of India
New Delhi

4 Dr. Duleep Mathai 10-1-1989
Director
Wasteland Development Board
New Delhi

Mr. P. K Balan leaves KFRI



Mr. P. K. Balan, who had been serving the institute as Accountant, Deputy Registrar (Finance) and Registrar for over 13 years left the Institute on 31-3-1989 on retirement after superannuation.

Mr. Balan first joined the Institute in December 1976 as Accountant, on deputation from the office of the Accountant General, Trichur. In this capacity he gave strong support to Dr. P. M Ganapathy, the then Director to lay down a sound system of financial transactions. He was absorbed to KFRI service as Deputy Registrar (Finance) in December 1980. In June 1987 he was appointed as Registrar of the Institute. Mr. Balan was a conscientious officer and carried out administration smoothly and successfully.

His services to the Institute will be remembered always.

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