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at Kerala Forest Research Institute
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Forestry Research and Training: New Trends

Inadequate training is recognised as one of the root causes of mismatch of technology with the real needs of end-users/rural communities. It is for this reason that our readers lately notice KFRI's activities covering various aspects of forest education and customised training rather than continuing research alone for sharing the resources/knowledge in sustained manner. This is reflected in the message from Dr. J. K. Sharma, Director of KFRI, in reviewing the recent situation of research and training support. However, there is no compromise in research efforts being put in solving practical problems of tropical forestry, as enunciated in an article by Dr. Jose Kallarackal, Plant Physiologist, in the current edition, based on precise eco-physiological studies using sophisticated modern techniques being undertaken by KFRI. Further, the Research Updates elsewhere in the current issue throw light on the recent research and training themes which include:

- non-wood forest products, viz. field identification of rattans and commercial exploitation of medicinal plants
- species composition, biodiversity conservation and management of shola forests, macro flora of Peechi-Vazhany Wildlife Sanctuary, lichen flora of Western Ghats
- plantation technology with clonal propagation techniques/units, control of invasive weeds, pest problems of intensively managed teak plantations and evaluation of high input management on growth and timber quality of teak plantations as well as soil management strategies for successive rotations
- utilisation of secondary and non-conventional timbers like rubberwood as substitutes for primary timbers, value-addition by cultivation of edible mushroom from wood-waste and litter, technology transfer, etc.

One major problem identified in the existing system of forestry research, training and education in India is inadequacy of funds and human resources. This is particularly discernible in areas of new plantation establishment and resource management where coordinated efforts are lacking. Although some of the recommendations of Indian National Agriculture Commission (1976) were implemented with forestry education courses in agricultural universities, many problems are encountered with inadequacies of institutions, technological weakness, insufficiency of investment funds, lack of meaningful participation including that of industrial sector.

A newly designed forest education, research and training programme envisaged at KFRI focusing on the following aspects should work in the context of sustainable development in an environmentally sound, economically viable and socially acceptable way.

- Although utilisation of trees and forests is inherent aspect of forestry, there is a recent shift in emphasis on tourism, recreation, agroforestry, non-wood forest products and wood production in the context of sustenance.
- Role of regional training networks, comprising industry linkages and inter-disciplinary and inter-institutional collaborations.
- Multidisciplinary approach focussing genetics and biotechnology, resource mensuration, biodiversity and sustainable management, appropriate silviculture, harvesting and utilization, economics, resource evaluation and social sciences.
- New mode of education covering scientific conduct of research as well as monitoring and evaluation.

K. M. Bhat
Editor

Resource Sharing

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From the Director's Desk

Kerala Forest Research Institute has come a long way since its establishment 26 years ago, our Institute has secured a unique place among the leading forestry research organizations in tropical forestry. This has been possible due to time bound and problem solving applied research undertaken by KFRI in key areas of tropical forestry. Initially, all the research projects were supported through institutional grants received from the State Government. However, over the years the trend has changed and now all the research projects are externally funded generating about Rs.200-250 lakhs every year for research. Though external funding has strengthened KFRI's research base, paucity of funds for developmental activities has brought stagnation in further progress which has started to show its impact on the quality of research. During the past 20 years there has not been any significant upgradation in infrastructure, instrumentation and human resources due to inadequate funding. We have been trying earnestly to secure additional funding and our efforts have now succeeded. The Planning Commission, Government of India has granted through the State Government one-time additional central assistance of Rs.5 crores to KFRI for infrastructure development. The grant will be utilized for additional laboratory space, Meeting/ Conference rooms, Exhibition area; Research Scholar's Hostel; Guest House and Training, Extension & Education Centre, in addition to maintenance of residential quarters and completion of some of the unfinished works pending for the past several years. I am hopeful this grant will provide fillip to further progress by strengthening infrastructure of the Institute to meet the challengers of the 21st century.

JK Sharma

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Ecophysiological Approaches to Problem Solving Research in Forestry

Jose Kallarackal
Plant Physiology Division

It is well known that the forest/plantation productivity is a product of the genetic make up of the species and the environment. In this article, the intention is to examine how the studies undertaken at KFRI on the interaction of the environment with the physiology of the trees have helped us to understand different problems in tropical forestry.

Exotic or indigenous species?

Several exotic species have found to be suitable as plantation species in Kerala during the last half a century. *Eucalyptus tereticornis*, *E. grandis*, *Acacia auriculiformis*, *A. mangium* are a few of the more recently introduced species in plantations. *Anacardium occidentale* (cashew) and *Hevea brasiliensis* (rubber) are also introduced species in Kerala although few critics of exotic species seldom realise this fact. In spite of the several merits recognised for some of the exotics, they have been subjected to severe criticism, especially for their water use characteristics. The "eucalypt controversy" has been a subject of emotional debate in India and elsewhere (Kallarackal, 1992; Kallarackal, 1993). Since the phreatic aquifers are important sources of water for domestic and farming purposes in Kerala, planting of eucalypts has generated resentment among the public.

Do the eucalypt roots reach the water table?

This question can be answered by excavating the root system of a few trees, which is a difficult task. The phreatic water table in Kerala is mostly located between 8 and 15 m deep as noticed from many open wells. The general belief is that tree roots do not go deeper than 3 m. However, while measuring the predawn water potentials of eucalypt trees from different locations, it was noticed that the water potentials were quite high

Measurement of stomatal conductance in *Acacia auriculiformis* tree using a porometer.

A sap flow gauge fixed to a teak tree is used to monitor the transpiration in the tree. The datalogger stores the data at programmed intervals.

(often higher than -0.5 MPa) even in dry season, which made us to think that the trees are getting water from some or other sources in spite of the general dryness of the soil (Kallarackal and Somen, 1994). Besides, the transpiration estimations using Penman-Monteith equation showed that the roots must be more than 8 m deep if they have to transpire this much water. To test the ecophysiological evidences, we excavated the root system of two eucalypt trees. It was found that the roots of these two trees travelled almost 10 m and were extracting water from the water table available at that depth.

How to solve the problem of extraction from water table?

Eucalypts have been planted at 2m x 2 m spacing in Kerala for a long time resulting in a density of 2500 trees per ha. Water use by *Eucalyptus tereticornis* was studied in two plantations, differing in tree density, one with the traditional 2500 trees per ha and another with 1090 trees per ha. Hourly transpiration by the Penman-Monteith equation was estimated for the above two plantations round the year. It was found that the plantation with less density transpired only half the quantity of the water when compared to the plantation with the traditional density (Kallarackal and Somen 1997a). Certainly, this is a big saving on the water. However, doubts have been expressed about the reduced yield from a plantation with lesser density. Some studies indicated that increasing the planting density beyond 1000 trees per hectare may not

help to increase the yield of usable biomass (Adlard et al.,1992; H.D.Kulkarni, personal communication). What could be the reason for this? When seedlings are planted with closer spacing, they tend to grow taller because a light demanding species such as eucalypt will be trying to obtain maximum sunlight. This means that the tree will be producing a large number of branches too, thereby contributing much to the production of unusable biomass. Similarly, the roots will also behave although we do not pay much attention to the roots in this regard. Owing to the high competition for water and nutrients in the soil, the roots tend to go very deep. This again means that much of the photosynthates are contributed to the unusable root biomass. At the same time, water is extracted from both surface and deeper soil layers including the phreatic aquifers. On the other hand, in a widely spaced plantation, the trees need not grow tall for competing for light, thus the trees tend to increase in girth. Similarly, the roots also tend to spread laterally than deeper because of less competition for water and nutrients. Studies in Australia have shown that root systems were deeper and denser at high tree densities, although total length and mass of roots produced per tree decreased with increasing tree density (Eastham and Rose, 1990). It should be pointed out here that in most countries where eucalypt is grown in plantations, the density is not more than 1250 trees per ha, usually achieved by 4 m x 2 m spacing, which seems to be ideal for mechanising the plantation operations.

Are the eucalypts bad?

Since eucalypts in general consume more water than other species, there is a tendency to consider them as bad or unsuitable (Kallarackal, 1997). An ecophysiological analysis of *Eucalyptus grandis*, another eucalypt species planted at high elevations in Kerala showed that this species is very economical in its water consumption (Kallarackal and Somen 1997b). There was partial to complete stomatal closure in this species during the dry period. This is because the stomata of many tree species, especially those found in the tropics, have the capacity to sense the dryness in the atmosphere (vapour pressure deficit) and close their stomata to prevent loss of water from the plant and soil. This means that there are good eucalypts too! Doesn't this also mean that it is the choice of the species that matters?

Is there a better eucalypt species?

The finding that *E. tereticornis* is a high water consumer led us to look for a better plantation management strategy as well as another eucalypt species which would be more economical in its water use and possible to be grown in the plains of Kerala. Ecophysiological measurements during three years on 12-year-old trees of *E. urophylla*, *E. camaldulensis*, *E. brassiana*, *E. pellita*, and *E. deglupta* resulted in several interesting findings (Kallarackal and Somen 1998). Water potential measurements indicated that all the above species have very deep root system, thereby, not much different from *E. tereticornis*. However, when the stomatal conductance in the above species was examined, it was found that *E. urophylla* showed conductance values nearly half that of other species. This means that they are loosing much less water than the other species. This would make this species suitable for locations where water conservation is also important along with wood production. Unfortunately, hardly any large-scale trial has been conducted in India about the possibility of using this species in plantations. However, the small trials conducted at KFRI (J.K. Sharma, personal communication) show that the species has a good potential of being grown in plantations in Kerala. It may be pointed out that *E. urophylla* is one of the two eucalypt species which originated outside the Australian continent, in Timor island. This species is now much used in the Brazilian plantations.

What information do we have about other exotic and native species?

We have made detailed observations on water use of *Tectona grandis* (teak), *Acacia auriculiformis* and *Anacardium occidentale* (cashew) (Kallarackal and Somen, 1992). It was found that teak is a good water conserver during the dry period because it is a leafless tree during that period. However, teak was found to transpire vigorously when water was available plenty in the soil. From some of the other ecophysiological measurements, it appears that teak roots do not explore the water table. *Acacia auriculiformis*, although with full flushes during the dry season, has well-developed stomatal control in response to atmospheric dryness. These trees also do consume a lot of water when soil has plenty of water. In cashew, ecophysiological measurements showed a lot of similarity with *E. tereticornis*. The cashew trees have less-developed stomatal response to atmospheric dryness. Water potential measurements also indicated a very deep rooting nature for these trees. Excavation studies done elsewhere corroborates our ecophysiological measurements.

When Penman-Monteith equation was used to estimate the annual evapotranspiration in the above trees, it was found that the difference in water consumption on an annual basis was not remarkably different. However, when seasonal water use was separately estimated, it showed that some species consumed enormous quantities of water than the others. A species with a high consumption of water during the dry period should be considered damaging to the water table because with the seasonal rainfall in Kerala, such a water use pattern could create reduction in stream flow. On the other hand, if a species is consuming water when the surface soil is fully wet as it happens during and soon after the heavy Kerala monsoons, there is not much cause for worry.

A sap flow gauge showing the details of the sensor. The middle rod going into the tree generates heat pulses that are monitored above and below using thermistors.

Managing eucalypt plantations for higher productivity

The productivity of eucalypt plantations in Kerala is deplorably low. What could be the reasons for this. Since plant productivity is the product of its genetics and environment, it is important to consider both while selecting a species for planting programme. When dealing with environmental limitations, we should look at production limited by light, water, nutrition and diseases. To address these parameters, a number of experiments are being undertaken in different locations in Kerala under a project sponsored by ACIAR in collaboration with CSIRO, Australia. Ecophysiological studies will determine the cause of lower productivity and also find the reasons for higher productivity in some of the experimental treatments. This includes measurements of stomatal conductance, photosynthesis and sap flow through the trunks of trees.

Will global increase in CO_2 help Photosynthesis and hence productivity?

A silver lining in the cloud of global warming seen by some environmental scientists is the increased productivity of plants due to increased photosynthesis caused by elevated CO_2 in the atmosphere. It is generally believed that elevated CO_2 in the atmosphere will help to increase the photosynthetic rate. But, is this a universal phenomenon for all the species? Ecophysiological studies done in collaboration with the New Zealand Forest Research Institute have shown that this need not be true. Beech (*Nothofagus fusca*) trees grown for several months at elevated CO_2 showed that there was a down regulation of photosynthesis due to triose phosphate utilisation limitation. However, in pines, photosynthesis was higher at elevated CO_2 levels (Hogan et al., 1996).

Problem of yield in Oil Palm?

Another problem that drew our attention was the possibility of growing oil palm in some of the

non-traditional areas in India, in the States of Andhra Pradesh, Karnataka and Maharashtra (Kallarackal, 1996). Microclimate measurements accompanied by ecophysiological measurements showed that the temperature in Maharashtra goes much below the ideal temperature requirement of the oil palm. Besides, the photosynthetic rates of the leaves were extremely low, to the extent that they were one-fifth of the rates shown in Malaysia. Similarly in Karnataka, growing of oil palm in high elevations showed almost similar problems as that of Maharashtra, but not to the same extent. However, the atmospheric dryness caused the highly sensitive oil palm stomata to close very frequently. Oil palm, which has a sex determination regulated physiologically, will resort to maleness if there are physiological stresses. This was found to be the cause for the failure of many oil palm plantations in the above two States. On the contrary, in Andhra Pradesh, the palms were successfully grown if introduced in the coastal zone.

Mistletoe attack on teak trees

One of the problems of growing teak in plantations in certain areas in Kerala is the high incidence of the mistletoe, *Dendrophthoe falcata*, which in course of time can kill the trees. One of the interesting observations we made was the survival of the parasite, whether the trees are in full flushes or in the deciduous state. When photosynthesis measurements were made on the parasite leaves, they were found equally photosynthesising in bright as well as dim light conditions. What a fantastic adaptation for a plant! This means that their survival is ensured in a deciduous tree like teak, both during the leafy and leafless stage. Interestingly, the mistletoe maintains water potentials much lower than the host tree, thereby it can suck water from the host using a gradient in pressure. The reason for the dying branches of the mistletoe-infected teak tree is the extraction of water from the wood tissues of the tree during the leafless stage of the teak. Since teak is leafless during most part of the dry season, there is no mechanism to replenish the lost water in the wood tissue; finally the branches die due to local dryness. The infestation of an evergreen tree with the mistletoe may not be as lethal when compared to the deciduous species.

Can we check the health of a plant?

One of the latest achievements in eco-physiological research is the possibility to assess the healthy functioning of a plant even if the phenotypic manifestation of the malfunctioning is not apparent. For example, seedlings of several plant species seem to grow better under shade although the mature plant is a light-demanding species. However, the exact quantity of shade requirement is a matter of trial and error. But by making a chlorophyll fluorescence measurement on the intact leaves (using a non-destructive method) it is possible to ascertain the stresses to which the plant is subjected. It is possible to assign a performance index number to plants subjected to different shade conditions and choose the one with a higher performance index number. We have used this method in collaboration with the University of Geneva, Switzerland, to know the shade and irrigation requirements of *Acacia auriculiformis* seedlings and found that their performance index was highest at 50 per cent shade and watered once in two days if not rain fed. Similarly, we found that we could determine the correct dosage of application of pesticides such as chlorpyriphos (which is an anti-termite compound), without causing any physiological damage to the plants.

The future

With the invention of more and more field oriented instruments that are capable of measuring many of the intricate physiological phenomena in plants, which was not possible before, the field of ecophysiology is making tremendous progress. For example, measuring photosynthesis by giving artificial light for field plants is a relatively new development. Techniques for direct measurement of transpiration is now well developed using the heat pulse method and the sap flow gauge. Stress suffered by plants, sometimes not phenotypically manifested, can now be measured using the fluorescence method. Leaf area index of plants can be measured with a click of a button rather than going for detailed destructive sampling. Above all, the microclimate parameters, which give the essence to all ecophysiological investigations, can be monitored using automated weather stations that can be programmed even for collecting data at seconds' interval. We hope that some of these technologies will help us to look deeper in solving some of problems of forestry in the future.

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New Release

A Handbook on Statistical Analysis in Forestry Research

by **Dr. K. Jayaraman,**
Statistician, KFRI

This handbook gives a virtual introduction to the basics of statistical planning and inference as applied to forestry research. This document had its origin as lecture notes for the course on statistical analysis specified for Ph.D. students registered under the Forest Research Institute (FRI) - Deemed University, Dehra Dun, India. Thus the contents conform to the syllabus specified for the said course. The style of presentation is suited for postgraduate students in biological sciences. The concepts and applications are discussed in forestry context with real life examples. The book is intended to be of use mainly to forestry students but will also be a valuable reference book for teachers and scientists in research institutions in forestry and allied fields.

LATE-BREAKING NEWS .....

Biosphere Review Meeting

KFRI, on behalf of the Ministry of Environment and Forests, Govt. of India organised a meeting to review the progress of research projects and management action plans under Biosphere Reserve Scheme during 8 - 11 September, 2000. Dr. A. K. Kundra, Special Secretary, Mr. R. H. Khwaja, Joint Secretary and Dr. R. K. Rai, Director and Shri M. S. Bali, Director (Finance) also participated in the meeting.

Prof. Amlesh Choudhary, Fr. C. J. Saldanha, Dr. P. Pushpangadan and Prof. R. S. Tripathi were the experts in the Review Meeting. A total of 58 participants including Biosphere Reserve Directors and Scientists representing various Institutions attended the meeting .

The Biosphere Reserve Managers made detailed presentations highlighting management problem requiring research inputs and interventions by various stakeholders. After detailed presentation by scientists and managers, the meeting of Working Groups were organised. A field visit was organised on 10th September, 2000 to Silent Valley to facilitate field exposure to scientists & managers especially from various BRs from Northern India.

Training Course in Western Ghats

A series of training programmes were organised for the benefit of NGOs and Watershed level Implementing Officers of the Western Ghats Development Programme, Planning and Economic Affairs (E) Department, Govt. of Kerala. The following regional training programmes were held to cover the different districts of Kerala.

Kerala Forest Research Institute, Peechi, 28-30 November, 2000
Sulthan Bathery, Wayanad, 29-31 January, 2001
Chaithanya Pastoral Centre, Kottayam, 26-28 February, 2001
Kerala Forest School, Arippa, 7-9 March, 2001

Three hundred Officers representing various departments including Agriculture, Animal Husbandry, Dairy Development, Minor Irrigation, Soil Conservation and Soil Survey Planning, Forest and NGOs participated. The topics covered the physical features, natural resources of Western Ghats and the problems of conservation. Drs. P. S. Easa (Wildlife) and S. Sankar (Agroforestry) from Kerala Forest Research Institute were the resource persons.

Training in Herbarium Techniques

The Division of Non-wood Forest Products organised a training programme on "Herbarium Techniques" for foresters and forest guards of Central Circle, Kerala Forest Department during 15-16 and 22 -23 February, 2001. Dr. N. Sasidharan was the resource person.

Training in Forest Nursery Management

The Division of Silviculture organised a one-day training programme on "Forest Nursery Management" for the 25 inmates of Kerala Institution for the Blind, Alpara, Thrissur on 25 January, 2001. The training was co-ordinated by Dr. R. C. Pandalai (Silviculture). Dr. E. M. Muralidharan (Genetics) gave a lecture on low-cost tissue culture technology during one-day training programme on forest nursery manangement inmates of the Kerala Institution for the blind, 25 January 2001, Alpara.

Leaf Roots Too?

Every living paranchymatous cell of a plant seems to have inherent potential to regenerate and develop into a whole plant. This ability known as 'totipotency' is effectively exploited by tissue culturists and plant propagators for mass multiplication of the desired plant species. Usually cuttings from plant parts like root, stem, leaves and other special structures, formed for propagation such as bulbils, runners, offsets and rhizomes are widely used for vegetative multiplication. Irrespective of the vegetative parts used for propagation of plants, it is the ability and readiness of the plant parts to develop and differentiate new roots and shoots, that makes the propagation technique successful. The actual physiological and biochemical changes

occurring in a plant tissue before differentiating them into roots or shoots are yet to be fully understood. Generally, a pair of leaves is left intact when leafy stem cuttings are used for vegetative propagation. In many cases the distal half of the leaf is usually severed off for reducing the leaf area to an optimum, in order to minimise evapotranspiratory loss of water during the rooting phase of the plant propagation. Cuttings are usually subjected to hormone treatment before inserting into the rooting medium. The lower 2 to 3 cm portion only receives the hormonal treatment normally. Adventitious roots develop at the lower portions of the cuttings, as a result of the hormonal induction in treated parts of the cuttings.

When juvenile epicormic shoot cuttings of teak were set for rooting in vermiculite filled root trainers in Mist Propagation Unit at KFRI, we could observe the leaf midrib tissue, differentiating and transforming into adventitious root. The leafy cutting received hormonal treatment with IBA in talc preparation before inserting into the growing medium. The distal halves of the leaves were trimmed off. While planting, the nodal portion of the cutting where the leaf originates was also kept partially inserted into the vermiculite medium. It appears that this condition facilitated the production of an adventitious root at the base of the leaf, by transformation of the tissues of the leaf midrib. This indicates that tissues of other plant parts such as leaf in tree species like teak also possess the potential to root. Since there was no dormant bud present, the rooted leaf could not be transformed into a whole plant! More studies are necessary to understand this phenomenon.

- T. Surendran (Plant Physiology)

Edible mushrooms from waste paper

Edible mushrooms (*Pleurotus sp.*) are generally cultivated using paddy straw, sawdust or any agricultural waste material. Mushrooms can also be produced using cellulosic material such as waste paper. Pre-soaked waste paper is mixed with mushroom spawn in plastic trays or polythene bags and kept in a cool room with temperature ranging between 20-24°C and humidity 80-95 per cent. Mushrooms, grown on the waste paper, can be harvested after one month. Since the cost of old newspaper is very low, it will be economical to use as substratum for the cultivation of mushrooms. Boiling the substratum as done in the case of other substrates can be avoided when newspaper is used for growing mushrooms.

- E. J. Maria Florence (Plant Pathology)

Volume -weight relation of stacked bamboo and reed

Volume-weight relations of stacked bamboo (*Bambusa bambos*) and reed (*Ochlandra travancorica*) were estimated for the first time, through a low intensity field sampling in selected forest ranges in Kerala during the period February-March, 2000. Stacked volume refers to the volume of the stack closely packed with green poles (fresh utilisable portions of the culms immediately after felling) of bamboo or reed. Green weight refers to the weight of green bamboo or reed and oven-dry weight refers to the weight in oven-dry condition. The estimated volume-weight relations are as follows:

One cubic metre stacked green bamboo equals 0.268 tonne green weight (or 0.132 tonne oven-dry weight)

One cubic metre stacked green paper-reed equals 0.207 tonne green weight (or 0.087 tonne oven-dry weight)

One cubic metre stacked green weaving-reed equals 0.231 tonne green weight (or 0.113 tonne oven-dry weight).

The above figures are the multiplication factors for converting stacked volume (in cubic metre) to weight (in tonne). Therefore to convert a given volume (in cubic metre) of stacked green bamboo or reed to green or oven-dry weight (in tonne), the stacked volume has to be multiplied with the respective conversion factor. Significant variation is noticed in the mean green weight per cubic metre among the localities. Therefore, there is a need for a detailed study with more coverage of different regions of Kerala and different seasons to prepare the conversion factors. Till then, the above figures are recommended for using in commercial transactions.

- C. N. Krishnankutty (Statistics Division)

RESEARCH UPDATES

Field key prepared for identification of rattans of Kerala

Correct identity of the species is crucial in scientific management and sustainable utilisation of forest resources. In order to help the Kerala Forest Department in seed collection of desired species for raising nurseries and plantations, Dr. C. Renuka (Botany-Taxonomy) has prepared a field key for identification of rattans, the climbing palms of the family Arecaceae (KFRI Research Report No. 188). Rattan is taxonomically one of the most difficult groups of plants. Due to the specific flowering season, rattan plants are generally seen in the vegetative condition, making the identification a difficult task. The key is therefore prepared based on the habit of leaf sheaths and fruits for easy field identification with the aid of plant description and photographs. An illustrated glossary is also provided in addition to the scientific terms used in the text. For each species, distribution, phenology and uses also are indicated.

Efficacy of selected insecticides and fungicide to control the borer attacks in rubber wood

One of the common problems encountered rubber wood in utilisation is its susceptibility to insect borers. The results of the evaluation of the efficacy of selected insecticides individually and in combination with a fungicide Chlorothalonil (0.5%), both in the field and laboratory conditions, were published in KFRI Research Report No. 189. Considering the effectiveness in controlling insect and fungal problems, Drs. George Mathew and R. Gnanaharan recommended treating with Chlorpyriphos 20 EC (0.5%) or Fenvalerate 20 EC (0.1%) with Chlorothalonil 75 WP (0.5%) for commercial use.

Substitution of costly teak with unconventional timbers suggested for beehives

The results of the field study conducted on the evaluation of the suitability of locally available timbers as beehives, especially as substitute to the costly teak wood, are published in KFRI Research Report No. 190. The timbers tested included jack, eucalypt, coconut wood, silver oak and treated rubber wood in addition to teak. The performance of the beehives in the field was evaluated with the help of professional beekeepers. With regard to workability and durability all the timbers tested were good and compared well with teak wood. All timbers were free from growth of algae, fungi, etc. According to Dr. R.V. Varma, treated rubber wood was acceptable to bees and the honey yielded from such hives was normal in its composition.

Macro-fungal flora of Peechi-Vazhany Wildlife Sanctuary documented

A survey of macro-fungi occurring in the Peechi-Vazhani Wildlife Sanctuary situated in Trichur District, was conducted during the period of three years (1995-1997). About 600 specimens represented by 57 species of 37 genera were documented in the recently completed KFRI Research Report No 191; about 61 per cent of fungal flora belonged to Aphyllophorales while 11 species represented Agaricales. Among the Agaric macrofungi, *Termitomyces microcarpus* and *T. eurrhizus* are known to be edible. According to Drs. E. J. Maria Florence and K. Yesodharan, most of the macro-fungi collected had a wide distribution in Kerala although a number species were known to have a rare occurrence in India . Majority of the collected specimens were white rot fungi while *Fomitopsis rhodophaeus* and *Nigroporus niger* were brown rot fungi. *Collibia leucophaea, Mycena alphitophora* and *Marasmius androsaceus* were found abundantly on decomposing leaf litter. *Ganoderma lucidum* and *Hydnum subvinosum* were saprophytic as well as pathogenic.

Population regeneration and invasion status of tree endemics in shola forests

In Kerala, southern wet temperate shola forests are distributed along the crest of the Western Ghats at elevations of 1500 m above msl. The arborescent flora of the shola forests at Eravikulam is composed of 36 species of flowering plants. At Silent Valley, the sampled area contained 37 woody plant species, of which 27 were endemic, constituting 72.9 per cent of the recorded total woody flowering plant taxa. The arborescent flora of the two areas also contained the disjunctively distributed species *Rhododendron arboreum* var. *nilagirica*, pointing to the phyto-geographic importance of the forest type. Drs. K. K. Nair and A. R. R. Menon conclude that structurally the population of arborescent flora of Eravikulam and Silent Valley sholas contains about 60 per cent of woody endemic plants. Regeneration of arborescent endemics with more numbers of seedlings that had crossed the mortality stage is at Eravikulam. In both the shola forest areas, woody endemic species invaded the grassland (KFRI Research Report No. 192).

Commercial exploitation and consumption of medicinal plants by the drug industry in Northern Kerala

A study was conducted on the consumption pattern of raw drugs, the supply sources and dependency on forests by the Ayurvedic drug industry in northern Kerala (KFRI Research Resort No. 193). The annual consumption of 140 raw drugs was estimated to be 11,350 tonnes, 16 items being above 200 tonnes. The main sources of raw drug supply to the manufacturing units are forests (49%), non-forest areas (14.3%), cultivation (13.5%) and imports (7.4%). Considering the growth of the Ayurvedic industry, future demands for raw drugs can be met only through cultivation. According to Drs. N. Sasidharan and P. K. Muraleedharan, often unrelated species are used as substitutes to some of the preferred species of the raw drug. Non-availability of genuine raw drugs, mistaken identity, lack of expertise for identifying raw drugs and increase in the price are the main reasons for substitution and perhaps adulteration. No attention is given to standardisation of quality criteria for herbal drugs.

Lichen flora of Kerala part of Western Ghats explored

Lichens are a unique group of plants composed of a photobiont and a mycobiont associated in a symbiotic manner. The field exploration of macrolichens flora of Kerala, during the period 1997-2000, revealed the occurrence of 254 species in an area of 38,863 km^2 exhibiting the richness and diversity of 43 genera belonging to 18 families (KFRI Research Report No. 194). The family *Parmeliaceae* dominated with 80 species under 14 genera followed by *Physciaceae* (43 species under 6 genera), *Usneaceae* (40 species under 1 genus), *Collemataceae* (29 species under 2 genera), etc. Dr. M. S. Muktesh Kumar claims that as many as 63 species were found to be new to peninsular India and 109 species new records for Kerala. Species like *Parmotrema praesorediosum* and *Collema tenax* have been recorded for the first time from southern India. Among the 18 various localities surveyed during the study, Mannavan shola of Idukki district holds highest number of species with 101 macrolichens followed by Siruvani-Muthikulam hills (60 species), Silent Valley National Park (52 species), Nelliampathy hills (47 species), Silent Valley Estate of Munnar (39 species), and Uppupara area of Periyar Tiger Reserve (39 species) possess large number of macrolichens. It is evident from the study that macrolichens constitute an important component in the flora of the tropical forest as they play varying role in the pioneer, transition and climax ecosystems.

Mushroom cultivation using forest litter and waste wood

Over the past decade, cultivation of edible mushroom has gained importance because of its nutritional value and generation of self-employment to a large number of people. In Kerala, using the agricultural waste, the most commonly cultivated mushrooms are *Volvariella volvacea, Pleurotus* spp. and *Agaricus bisporus*. In one of the studies, the feasibility of using forest leaf litter, wood wastes and fallen trees for the cultivation of mushrooms especially *Pleurotus* species has been demonstrated by Drs. E. J. Maria Florence. and M. Balasundaran. As documented in KFRI Research Report No. 195, among all the wood waste materials tested, leaf litter was the best substrate. Among different *Pleurotus* species, *P. florida* was identified as the highest yielding mushroom. Among the various methods of cultivation tried, polythene bag method yielded higher quantity of mushrooms. Training on mushroom cultivation for the benefit of the tribals at Vazhachal created awareness of the importance of edible mushrooms to initiate cultivation for their own consumption as well as livelihood.

Biotic disturbance - potential threat to shola management?

The montane closed evergreen forests found at altitudes above 1800 m possess a distinct type of vegetation type and are called shola forests (southern Wet Montane Temperate forests). Based on reconnaissance survey, literature search, interview of certain forest officials and personal observations, a study was conducted on the disturbed shola forests of Munnar Forest Division (KFRI Research Report No. 196). There was a skewed girth class distribution of tree community with poor representation of individuals belonging to the girth class 30.1-90.0 cm. In the forest patches of Mannavan shola, Manthan shola and Pullaradi shola, collection of small wood and poles is a common practice. Socio-economic analysis in villages located near these shola forests revealed that the people living in nearby areas of Mannavan shola, Pullaradi shola and Manthan shola depend heavily on forests for their livelihood. According to Drs. U. M. Chandrashekara and P. K. Muraleeharan, firewood collection, grazing and revival of shifting cultivation are the major threats to the management of shola forests. The suggested conservation and management options include: enrichment planting, alternative energy plantations /lemongrass, firewood production in agroforestry systems, silvopastoral systems, suspension of shifting cultivation and prevention of encroachment.

Soil fungal flora in shola forests and grasslands of Eravikulam National Park - a unique species composition?

The results of an inventory of soil microorganisms, made in the shola forests and grasslands of Eravikulam National Park (ENP) during the period of three years, were reported by Drs K. V. Sankaran and M. Balasundaran in KFRI Research Report No. 197. The population of actinomycetes and bacteria in soils of shola forests and grasslands (>2000 m msl) was low

compared to low elevation areas (<500 m msl) in South India. Mitosporic fungi (pencillia, aspergilli and *Trichoderma*) formed the main constituent of soil mycoflora while *Streptomyces* spp. dominated the actinomycete population. Interestingly, the species composition of fungi in soils of ENP showed close resemblance to that of temperate regions. Shola forests and grasslands yielded floristically dissimilar communities of soil microfungi indicating the variation in the environmental conditions between the two ecosystems. Thirteen species of fungi isolated during the present study formed new records for India. All the fungal isolates (34 genera and 101 species) are now conserved *ex-situ* in the culture collection facility at the Kerala Forest Research Institute. The striking feature of the soil fungal flora of shola forests and grasslands of ENP is the uniqueness in species composition compared to that of low elevation areas in the State. The abundance of rare species of *Penicillium* and other fungi indicates that these two ecosystems may contain fungi with great potential for innovative biotechnology. Efforts are warranted to conserve the microbial diversity of these unique ecosystems through protection from disturbance and exploitation.

Pest problems of intensively managed STM teak plantations

The results of the preliminary study conducted on pest problems of intensively managed teak plantations raised by Sterling Tree Magnum Company, Tamil Nadu are given in KFRI Rseearch Report No. 198. The major pests recorded were *Hyblaea puera* and *Eutectona machaeralis*. The peak period of teak defoliator incidence in Andipetty plantation was during September-November. Incidence of *E. machaeralis* was observed during Dec-Feb. According to Drs. R.V.Varma, V.V. Sudheendrakumar and T.V.Sajeev, generally the teak defoliator incidence in the Northern Tamil Nadu appeared to be correlated with the onset of northeast monsoon. Other minor pests recorded from the plantations were an unidentified species of mealy bug, teak sapling borer *Sahyadrassus malabaricus*, bark feeding termites, white flies, *Aleurodicus* sp., *Cerambycid* beetle, *Dihammus* sp. and coffee borer *Zeuzera coffeae*. In one of the plantations at Rasingapuram, where groundnut was raised as a cover crop, serious damage to terminal bud of teak by *Helicoverpa armigera* was noticed for the first time.

ICFRE Technologies transferred to wood using industries in Kerala

A package of technologies, viz. for solar drying of timber, vapour phase ammonia plasticization for bent wood furniture, ammonia fumigation for improved surface coloration and simple techniques of wood preservative treatment appropriate for rural areas - developed by ICFRE were transferred to the end-users particularly wood using industries in Kerala. For dissemination of relevant knolwledge, an information bulletin in Malayalam entitled, *'Chila thiranjedutha thadisamskarana sankethika vidyakal'* (*'Some selected wood processing techniques'*), was prepared and published as a KFRI Information Bulletin No. 15. Besides conducting wood technology clinics in different districts and "Open House" programmes of the Wood Science Division, wide pubilcity was given through local newspapers and TV programmes. According to Drs. R. Gnanaharan and T. K. Dhamodaran, the target beneficiaries of this technology tansfer programme include: industries, trade and consultancy organizations, NGOs, DICs, Grama Panchayats, Universities and local colleges (KFRI Research Report No.199)

Effects of high inputs on growth and timber production in juvenile teak plantations

Growing teak in high input plantations for timber production is relatively a new concept. Based on the short-term observations made during the initial phase of juvenile teak plantations, effects of high inputs on growth and timber quality of teak were evaluated in a recently published KFRI Research Report No. 200. Fertilization with irrigation had a significant effect on tree height and volume. Debudding (pruning) facilitated the formation of clear boles although reduced tree volume was suspected during the initial two years' growth. With high input management, heartwood proportion of 5-year-old trees increased slightly without getting affected in bending and compression strengths although stiffness of the timber was estimated to be 76% of the standard teak value. Wood figure (colour, grain, texture) was slightly different in view of the tendency of losing typical ring porosity during the initial three years of vigorous growth despite the fact that timber displayed the resumption of ring-porous character after the initial three years' growth, delimiting the wood figure differences only to the inner core. It was comparable in natural durability to the juvenile wood of traditional forest plantations and to the inner heartwood of very old teak. There were also significant tree-to-tree variations in decay resistance against the white rot fungi indicating scope for selection in genetic improvement of timber durability. According to Drs. K. M. Bhat, K.C. Chacko and M. Balagopalan, these observations imply that the difference in market value of the timber is expected to be minimal for 15-20- year-old trees grown in high input plantations.

Soil management forhigher productivity ofteak plantat-ions of successive rotations

There is general apprehension that the productivity of teak declines in successive rotations due to land degradation. A study was undertaken to examine the changes in soil conditions and their effects on the growth of teak in successive rotations. The results presented in KFRI Research Report No. 201 reveal that there was significant decline in soil fertility and tree height in successive rotations although soil properties could explain only 14% of the variation in tree height implying its dependence more on other factors. While the soil properties such as gravel and organic carbon contents varied significantly, soil texture, pH, total N, available K and Ca did not differ between the rotations nor did the site index.. Based on the above observations Drs. M. Balagopalan and K.C. Chacko recommend for soil management, including soil erosion control measures and manipulation of slash, weed and litter, in order to reduce soil deterioration.

Short-term herbicidalcontrol measures for mikania - the alien invasive weed of forest plantations

A comprehensive survey on the occurrence, spread and severity of incidence of the alien invasive weed - *Mikania micrantha* (mikania) revealed that it was widespread in the Kerala part of the Western Ghats with varying levels of infestation, posing serious threat to natural forests, forest plantations and agricultural/ agroforestry systems. The infestation was most severe in the southern (82.5%) and central (75.5%) zones and relatively sparse in the northern zone (45.3%). None of the sites surveyed in Karnataka and Goa was infested. Mikania-invaded areas were more numerous in the moist deciduous forests (56%) than other forest types. Among the forest plantations, 75% of the teak plantations surveyed were infested followed by 70% of miscellaneous and 58% of eucalypt plantations. Young teak plantations (1-3 yr-old) were the worst affected by the weed. Although 92% of the agricultural systems surveyed were infested, in general, severity of infestation was low due to intensive weed management. Data from permanent sample plots in the State indicate that the infestation by the weed is on the increase in all the ecosystems surveyed. The survey results in KFRI Research Report No. 202 showed that i) mikania grows luxuriantly wherever the canopy is open in the forest areas; ii) invasion by the weed is generally low in high altitude areas (>1000m msl); and iii) all the biotypes of mikania occurring in the Western Ghats represent only one species viz., *Mikania micrantha*. The integrated management

strategies suggested by Drs. K.V. Sankaran, P.K. Muraleedharan and V. Anitha included application of Grazon DS herbicide (combination of triclopyr 300 gl^{-1} and picloram 100 g l^{-1}) as a short-term control measure in forest plantations since pathogens associated with mikania had little potential as bio-control agents of the weed.

Semi-permanent field clonal propagation unit designed for *Eucalyptus*

Vegetative propagation is an important component of tree improvement programme through which mass production of true to type progenies of superior parent trees is made possible. As sophisticated mist chambers with automatic control systems for maintaining humidity and temperature are not feasible in the field for clonal multiplication, a semi-permanent field clonal propagation unit was designed for eucalypts. The efficiency of the mist chamber was improved by designing a below-ground level mist chamber with two trenches, each of 11 m x 1.35 m x 0.60 m size, provided with 15 nozzles in the middle of each trench for producing mist. The mist was produced through operating a kerosene pump of 1.5 HP. Each trench had a protective tunnel type polythene cover and two such trenches of a mist chamber were provided with a hut type shed covered with polythene sheet for protection from rain. To reduce heat and light falling over the shed, a covering of 50 per cent shade net was provided. According to Drs. J.K. Sharma, M. Balasundaran and E. J. Maria Florence, such a clonal multiplication facility is cost-effective with the cost per ramet during the subsequent years works out to be Rs.3. This includes 10 per cent increase in recurring expenditure including labour charges and the cost of replacement of damaged root trainer, root trainer stand, etc. The performance of the clones of *Eucalyptus tereticornis* and *E. camaldulensis* produced in the filed has shown promise (KFRI Research Report No. 204).

Role of shola forests in maintaining water courses in the high ranges of the Western Ghats (Wayanad)

Shola-grassland ecosystem restricted to the high ranges of the Western Ghats are peculiar in vegetation, soil, microclimate etc. due to its location. They conserve soil and water and thus feed the streams even during the lean periods. The role of shola forests in maintaining water courses in the high ranges of the Western Ghats (Wayanad) was examined in two adjacent shola-grassland catchments, which differed in morphometry and extent, based on quantification by velocity-area method with stage level recorder on stream flow (KFRI Research Report No. 205). Within the permissible limits of observations made on a single year, while emphasising the need for long-term observations, Drs. Thomas P. Thomas and Sankar suggest that shola forests do play a positive role in maintaining the water courses in the high ranges of Kerala. The microclimate and soil properties of the shola were conducive for the retention of water and as reflected in the soil moisture status in different seasons.

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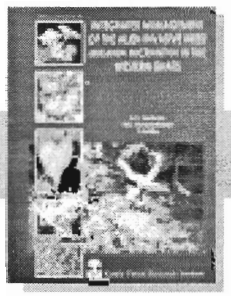
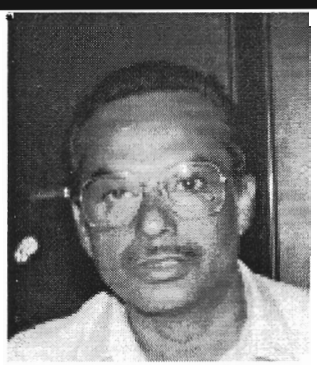


Obituary



Shri E.V. Eshac (1946 – 2001)

It is with profound sadness that we announce the untimely death of Mr. E.V. Eshac on 08-07-2001 leaving his wife and four daughters. In his death, K.F.R.I has lost a very sincere and diligent employee who served as Office Assistant with highest devotion to his duties assigned to him over the past 21 years. His endearing nature will always be remembered his colleagues.

May the Almighty give the strength and comfort to his bereaved widow and other members of the family.

Butterfly Garden at KFRI

George Mathew
Division of Entomology

Butterflies hovering over the flowers are an added attraction to any garden. The concept of butterfly gardening is to create a natural habitat where flowering plants and butterflies coexist. Such a habitat not only helps to conserve the butterfly fauna but also provides educational opportunities to children and public at large. A butterfly garden offers access to people to study specific food requirements, breeding pattern, life history, behavioural specialities and habitat adaptations of butterflies at close quarters in natural habitat.

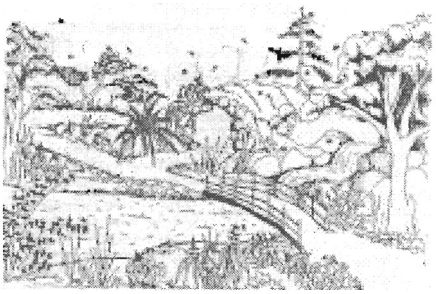


Fig.1

Plants share a significant role in the life history of butterflies. The larvae of the butterflies (caterpillars) are voracious feeders and are very specific in their food choices. Various groups of butterflies show clear-cut preferences in their choice of food - the yellows generally develop on Leguminosae, the common crow on figs, the lime butterflies on rutaceous plants and so on. The adults (butterflies) usually feed on the nectar of flowers but may also feed on juice of fruits and decaying exudate from the stem of plants. Each species of butterfly is specific in its choice of food and habitat. The tiger butterflies lick the sap from alkaloid containing plants, the evening browns feed mostly on over-ripe fruits and sappy exudates, blues and coppers lick the excreta of wild animals and the blue bottles aggregate near damp places. Some inhabit the canopy of trees, lianas, and shrubs, some prefer to remain in moist areas along the streams, while others frequent the openings in forests basking in sunshine.

The order Lepidoptera which includes the butterflies maintaining second position in their number and diversity among insects. Out of the 1,00,000 or more species of Lepidoptera, over 12,000 are butterflies. Of these nearly 1,500 species (distributed under 10 different families) are native to the Indian sub continent. The thick forest belt of Kerala adjoining the Western Ghats contain over 300 different species. Among the butterflies of Kerala, the southern birdwing (*Troides minos* Cram.), the common rose (*Pachliopta aristolochiae* Fb.), the crimson rose (*P. hector* Lin.), the common crow (*Euploea core* Cram.), the common grass yellow (*Eurema hecabe* Lin.), the yellow pansy (*Junonia hierta* Fb.) and the gram blue (*Lampides boeticus* Lin.) are some very common butterflies. Urbanisation has led to the destruction of the habitat of several butterflies, forcing them to recede into the remote depths of forests.

A butterfly garden allows the butterflies to be reared in an artificially created habitat. The high diversity among butterflies with preference to specified habitats and food source enable a garden to incorporate different species of plants and diversity of habitats. The landscape plays a significant role in the structure and form of a butterfly garden. Open land masses exposed to constant sunlight are best suited for butterfly gardens. The diversity of habitats can be maintained in the garden by artificially creating plains, hills, meadows, valleys, brooks, streams and ponds on the land mass selected for the butterfly garden. A garden with rich plant diversity will attract a variety of butterflies. It is, however, necessary to make a local survey on the butterfly fauna and their diversity before establishing a butterfly garden. As butterflies are highly habitat specific, only butterflies of native habitat can be sustained in the garden (Fig. 1).

Since the immature stages of butterflies are voracious feeders, sufficient provisions should be made to supply adequate stocks of host plants. For this, a glass house providing constant supply of food plants has to be maintained near the garden to satisfy the food requirements of the caterpillars.

Fig.2

The Kerala Forest Research Institute at Peechi, has established a butterfly garden in an area of 0.5 hectare with the financial assistance of the Ministry of Environment and Forests (Fig. 2). In this garden, Lime (lime butterfly), *Aristolochia spp.* (southern birdwing), *Cassia spp.* (grass Yellow), Cinnamom (common mime), *Ficus spp.* (common crow), etc. have been planted as specific food plants of butterflies given in parentheses. Ixora, Lantana, Button-rose, Mussaenda, Clerodendron, Zinia, etc. have been provided in the forage area as the major nectar source for butterflies (Figs. 3 & 4).

Occasionally, certain butterflies not seen in the locality or tend to be very rare can be lured and

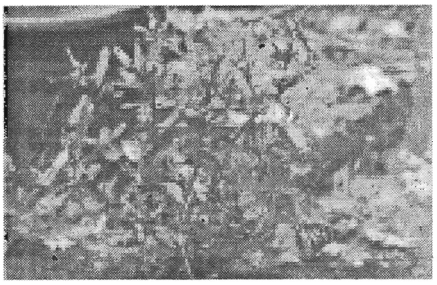


Fig.3

sustained in the garden by the establishment of their food plants. The example can be cited that of red pierrot (*Talicada nyseus* Guerin-Menevilie), which has now become very common in the garden established in KFRI campus after introducing its host plant Bryophyllum. In addition, a number of butterflies such as crimson rose, blue mormon, lemon emigrant, mottled emigrant, commander, common palmfly, monkey puzzle, striped tiger, plain tiger, dark blue tiger, blue tiger, glassy tiger and common crow have formed resident populations within the study area. Of these, the multi species aggregation of striped tiger, plain tiger, dark blue tiger, blue tiger, glassy tiger and common crow on alkaloid containing plants (*Crotalaria retusa* and *Calotropis* sp.) is a major attraction of the garden.

In many countries such as Papua New Guinea, Britain, Canada, Australia, Singapore and Malaysia, butterfly gardens and butterfly houses are a conservation cum tourism oriented venture attracting millions of people. Current estimates indicate that there are between 50 and 60 butterfly houses in Britain attracting 5 million people annually. It has been stated that the gate collections alone exceeded £5 million in Britain. In India, initial attempts to establish a butterfly garden has been initiated by KFRI as early as 1993. At present, butterfly gardens have been established in a few more places like Calcutta (at Science City) and Hyderabad (Nehru Zoo).

Fig.4

For a developing country like India, agro-industrial urbanisations are inevitable. The consequences of these developments can be curtailed to some extent by venturing into a programme like 'butterfly gardening' which would rehabilitate the biodiversity and ensure peoples attention and subsequent participation in conserving and managing the nature's limited resources.

Avifauna of KFRI Sub Centre Campus at Nilambur

E. A. Jayson and C. Sivaperuman
Division of Wildlife Biology

The KFRI Sub Centre campus at Nilambur with an extent of 43 ha area has moist deciduous forest with bamboo breaks. The main tree species include *Ailanthus triphysa, Artocarpus hirsutus, Hopea parviflora, Pterospermum diversifolium, Terminalia paniculata* and *Wrightia tinctoria* while the common bamboos are *Bambusa bambos, B. vulgaris* and *Dendrocalamus striatus*.

A reconnaissance of bird fauna in the campus was conducted spanning three days in January 2001. A total of 58 taxa of birds belonging to 8 Orders and 21 Families were recorded from the area (Table). Red Spur Fowl, Spotted Dove, Blossom Headed Parakeet, Chestnut Headed Bee eater were the common species. Of the total bird species, 54 were resident and four migrants. Eurasian Golden Oriole, Asian Paradise Flycatcher, Indian Pitta and Indian Redrumped Swallow were the migrant birds. Maximum number of species recorded was insectivores (26) followed by omnivores (11), frugivorous (7), granivorous, carnivores, nectarivores each (4) and picivores (2) respectively.

Among the resident birds recorded, Rufous Babbler is an endemic species found only in the Western Ghats of India. Little Egret is a wetland bird but it was recorded from the campus. Common Hawk Cuckoo calls made reverberating screams in the campus during the survey times. A loud, screaming *brain-fever, brain-fever*, sound repeated with monotonous persistency usually 5 or 6 times, rising in crescendo and ending abruptly. The call is rendered in Hindi as *pee-kahan*? ('Where is my love'?) and in Marathi as *paos-ala* ('Rain's coming!'). Spotted Dove's calls, which is an oft-repeated, pleasant thought somewhat mournful *kroo-kruk-krukroo..... kroo-kroo-kroo*. Indian Pitta's were recorded in the nursery area of the campus. It is gaudy stub-tailed thrush like bird, green, blue, fulvous, black and white, with crimson abdomen and under tail. This species is a migrant coming from North India. A complete list of birds recorded from the campus is given below.

List of birds recorded at Nilambur SubCentre campus

Sl.No	Common name	Scientific name	Status
	Order: Ciconiiformes		
	Family: Ardeidae		
1.	Little Egret	*Egretta garzetta*	R
	Family: Accipitridae		
	Order: Falconiformes		
2.	Black kite	*Milvus migrans*	R
3.	Brahminy kite	*Haliastur Indus*	R
4.	Eurasian sparrow-hawk	*Accipiter nisus*	R
5.	Crested serpent eagle	*Spilornis cheela*	R
	Order: Galliformes		
	Family: Phasianidae		
6.	Grey francolin	*Francolinus pondicerianus*	R
7.	Red spur fowl	*Galloperdix spadicea*	R
	Order: Columbiformes		
	Family: Columbidae		
8.	Rock pigeon	*Columba livia*	R
9.	Spotted dove	*Streptopelia chinensis*	R
10.	Eurasian collared dove	*Streptopelia decaocto*	R
	Order: Psittaciformes		
	Family: Psittacidae		
11.	Roseringed parakeet	*Psittacula krameri*	R
12.	Plumheaded parakeet	*Psittacula cyanocephala*	R
13.	Vernal hanging parrot	*Loriculus vernalis*	R
	Order: Cuculiformes		
	Family: Cuculidae		
14.	Common hawk-cuckoo	*Cuculus varius*	R
15.	Banded bay cuckoo	*Cacomantis sonneratii*	R
16.	Blueface Malkoha	*Phaenicophaeus viridirostris*	R
17.	Indian koel	*Eudynamys scolopacea*	R
18.	Greater coucal	*Centropus sinensis*	R
	Order: Apodiformes		
	Family: Apodidae		
19.	Alpine swift	*Tachymarptis melba*	R
	Order: Coraciiformes		
	Family: Alcedinidae		
20	Common kingfisher	*Alcedo atthis*	R
	Family: Meropidae		
21.	Little green bee-eater	*Merops orientalis*	R
22.	Chestnutheaded bee-eater	*Merops leschenaulti*	R
	Family: Coraciidae		
23.	Indian roller	*Coracias benghalensis*	R
	Order: Piciformes		
	Family: Capitonidae		
24.	Whitecheeked barbet	*Megalaima viridis*	R
	Family: Picidae		
25.	Blackrumped flameback	*Dinopium benghalense*	R
26.	Browncapped woodpecker	*Dendrocopus nanus*	R
27.	Yellowcrowned woodpecker	*Dendrocopus mahrattensis*	R
28.	Heartspotted woodpecker	*Hemicircus canente*	R
	Family: Pittidae		
29.	Indian Pitta	*Pitta brachyura*	M
	Order: Passeriformes		
	Family: Hirundinidae		
30.	Indian redrumped swallow	*Hirundo daurica*	M
	Family: Oriolidae		
31.	Eurasian golden oriole	*Oriolus oriolus*	M
32.	Blackhooded oriole	*Oriolus xanthornus*	R
	Family: Dicruridae		
33.	Black drongo	*Dicrurus macrocercus*	R
34.	Ashy drongo	*Dicrurus leucophaeus*	R
35.	Whitebellied drongo	*Dicrurus caerulescens*	R
	Family: Sturnidae		
36.	Common myna	*Acridotheres tristis*	R
37.	Jungle myna	*Acridotheres fuscus*	R
	Family: Corvidae		
38.	Rufous tree pie	*Dendrocitta vagabunda*	R
39.	House crow	*Corvus splendens*	R
40.	Largebilled crow	*Corvus macrorhynchos*	R
	Family: Campephagidae		
41.	Large Cuckoo-Shrike	*Coracina macei*	R
42.	Scarlet Minivet	*Pericrocotus flammeus*	R
	Family: Irenidae		
43.	Common iora	*Aegithina tiphia*	R
44.	Bluewinged leafbird	*Chloropsis cochinchinensis*	R
	Family: Pycnonotidae		
45.	Redwhiskered bulbul	*Pycnonotus jocosus*	R
46.	Redvented bulbul	*Pycnonotus cafer*	R
	Family: Muscicapidae		
47.	Yellowbilled babbler	*Turdoides affinis*	R
48.	Jungle babbler	*Turdoides striatus*	R
49.	Rufous babbler	*Turdoides subrufus*	R
50.	Asian paradise flycatcher	*Terpsiphone paradisi*	M
51.	Brown Shrike	*Lanius cristatus*	R
52.	Ashy Wren-Warbler	*Prinia socialis*	R
53.	Common tailor bird	*Orthotomus sutorius*	R
54.	Oriental magpie robin	*Copsychus saularis*	R
	Family: Dicaeidae		
55.	Palebilled flowerpecker	*Dicaeum erythrorhynchos*	R
	Family: Nectariniidae		
56.	Purplerumped sunbird	*Nectarinia zeylonica*	R
57.	Purple sunbird	*Nectarinia asiatica*	R
	Family: Ploceidae		
58.	Blackheaded Munia	*Lonchura malacca*	R

R = Resident, M = Migrant.

CAMPUS NEWS

NEW RESEARCH PROJECTS

KFRI 292/2001: Pollination ecology of teak in Kerala, Phase II; Control of premature fall of teak flower and fruit.

Investigators : Maria Florence E.J and Mohanadas K.
Duration : Two years (Jan2001-2003)
Sponsored by : Kerala Forest Department

KFRI 366/2001: Tracing the origin and spread of teak defoliator outbreaks through a molecular approach.

Investigators : V V Sudheendrakumar, T V Sajeev, R V Varma (KFRI) and Moinac Banerjee (RGCB)
Duration : Three years (Mar.2001-Feb. 2004)
Sponsored by : Kerala Forest Department

Seminars/Symposia/ Workshops

Dr. M. Balagopalan (Soil Science) participated in the workshop on "Preparation of Package of Practices", 2 Nov.2000, Kerala Agricultural University, Vellanikkara, and in a seminar on "Recent Advances in Biology" 28 Feb. 2001, Regional Science Centre and Planetarium, Calicut.

Dr. K. M. Bhat (Wood Science) attended the workshop on "Fast growing and high yielding selected tree cultivars for Southern States", 28-30 Jan. 2001, Mysore Paper Mills, Bhadravathi and presented a lead paper on "Wood qualities of fast grown tree cultivars with special reference to teak".

Shri K.C. Chacko (Silviculture) and **Dr. Mammen Chundamannil** (Economics) participated in a workshop on "Greening India through Agroforestry and JFM" 12 Sept. 2000, Bangalore. Shri Chacko also attended a meeting on 'Annual Plan Proposals 2001-02 at State Planning Board Office, Thiruvananthapuram, 19 Oct. 2000 and a seminar on 'Efficient Use of Biomass: Opportunities and Prospects in Kerala', 17 Oct. 2000, Thiruvananth apuram.

Dr. P.S. Easa (Wildlife) participated in the workshop on management of elephant corridors in Southern India, 20-22 Dec. 2000. With **Dr. E.A. Jayson** (Wildlife), he also attended the Seminar on agricultural ornithology, Kerala Agricultural University. 27 -29 Sept. 2000. Dr. Easa chaired one of the sessions.

Dr J. Kallarackal (Plant Physiology) participated in the workshop on "Strategies for Green House Gases Abatement in Forestry Sector" 25 Sept. 2000, New Delhi and in the Golden Jubilee Symposium of Delhi University Botanical Society on "Biotechnological Innovations in Conservation and Analysis of Plant Diversity", 7-9 Feb. 2001. He also gave an invited lecture on "Conservation and Management of Forest trees using Landscape ecology concepts" in the symposium.

Dr. E.J Maria Florence (Plant Pathology) participated in the 13th Kerala State Science Congress, 29-31 Jan. 2001, Trichur.

Dr. K. Mohanadas (Entomology) participated in Entomocongress 2000, 5-8 November 2000, Trivandrum and presented a paper - "Population trends of *H. puera* C. in a large teak plantation at Nilambur, Kerala" by K.Mohanadas and K.S.S.Nair. He also attended the 13th Kerala Science Congress, 29-31 Jan. 2001, KILA, Thrissur and presented a paper - "Low fruiting in teak- is it natural or due to ineffective pollinators or a case of biotic stress ?" by K.Mohanadas, Anand Gopinath, E.J.M. Florence and K.K.Radhakrishnan.

Dr. K.K. Ramachandran (Wildlife) attended the Stake holder's Workshop in Periyar Tiger Reserve 21 Sep. 2000.

Dr. N. Sasidharan (Non-wood Forest Products) participated in the workshop on Conservation Assessment and Management Plan for selected NTFP species in Nilgiri Biosphere Reserve (FGTB, Coimbatore, 19-20 Dec. 2000

Dr. V.V. Sudheendrakumar (Entomology) participated in the Entomocongress 2000, 5-8 Nov. 2000, Trivandrum and presented a paper ""The origin and spread of teak defoliator outbreak in Nilambur, Kerala " by V. V. Sudheendrakumar, K.S.S.Nair, T. V. Sajeev, R.V. Varma and K.Mohanadas

Drs. Thomas P. Thomas and M. P. Sujatha (Soil Science) attended the 13th Kerala Science Congress, Thrissur , 29-31 Jan. 2001.

Dr. R.V.Varma (Entomology) attended the following meetings/workshops

- Workshop on Package of Practice, 2- 4 Nov. 2000, Kerala Agricultural University
- One-day regional workshop on 'National Biodiversity strategy and action plan', KFRI 4 Nov. 2000
- International Entomocongress 2000, Trivandrum 5-8 Nov. 2000. He also presented a paper entitled "Pest problems in intensively managed forest plantations."
- National Symposium on - 'Vistas of Entomological Research for the New Millennium' 28-30 Dec. 2000, Chennai. He also delivered an invited talk on "Ecological services, pest status and management strategies for forest insects" and chaired one session.
- National Conference of AZRA, Madras Christian College, Chennai, 27 Dec. 2000 and gave an invited talk on "Pest control strategy in forestry - an outlook for future".

Visits abroad

Dr. R.C. Pandalai (Silviculture) visited Queensland Forest Research Institute, Gympie, Queensland, Australia and attended the training course on vegetative propagation of tropical forest tree Species, 6-24 Nov. 2000.

Dr. K.V. Sankaran (Plant Pathology) visited CSIRO (Australia) Centres in Perth, Canberra, Mount Gambier and Hobart (Tasmania) and University of Melbourne, School of Forestry (FORAD), Creswick, Centre for Forest Tree Technology, Heidelberg, University of New South Wales, Sydney and Queensland Forestry Research Institute, Gympie (Australia) during 4 Nov-19 Dec. 2000 in connection with the KFRI-CSIRO collaborative research project entitled "Improving productivity of eucalypt plantations in India and Australia". He gave seminars on 'Enhancing productivity of eucalypt plantations through improved silviculture - The Kerala experience" at CSIRO Centres in Perth, Canberra, Mount Gambier, Hobert and the University of New South Wales, Sydney.

Guest Lectures/ Training

Dr. M. Balagopalan (Soil Science) was the resource person for the courses conducted on "Forest Fire" for the staff of Pattikad Forest Range on 24 Nov. 2000 and 30 Feb. 2001.

Dr. P.S. Easa (Wildlife) was the resource person for the Training Programme for Park Managers organised by WII, 12-18Dec. 2000 and gave lectures in various colleges and Nature Camps

Dr. E.A. Jayson (Wildlife) gave an invited lecture on nature education on 18 Aug. 2000 at Thrissur Zoo.

Dr J. Kallarackal (Plant physiology) coordinated a Final Review Workshop of the AusAID funded project on Rehabilitation of degraded forests through landscape based participatory forest management on 26 Feb.- 7 Mar. 2001. Resource persons were Professor Ian Ferguson Dr E.K.S. Nambiar, both AusAID experts from Australia.

Dr. R.V. Varma (Entomology) was the resource person for the refresher course for college teachers organized by the Academic Staff College, University of Kerala.

Radio talks

Dr. E.A. Jayson gave radio talk on migratory birds

World Ozone Day (16 September)

This day was observed in KFRI on October 12th with a popular talk by Dr S.K. Ghosh, Director, Central Pollution Control Board, Ministry of Environment and Forests, New Delhi.

Distinguished Visitors

- Dr. Jacques Valeix, Director of CIRAD Foret, Montpellier, France, accompanied by Dr. Denis Depommier, Director, French Institute Pondicherry and French Research team, including Dr. Christian SALES, Wood Technologist, visited the Division and teak plantations (Nilambur) during 30 Nov. -1 Dec. 2000.
- Dr Tim Grove, CSIRO Division of Forestry and Forest Products, Perth, Australia - Jan. 2001.

Dr Don White, CSIRO Division of Forestry and Forest Products, Perth, Australia - Jan. 2001.

Professor Ian Ferguson, Dean, School of Forestry, Melbourne University, Australia - Feb. - Mar. 2001.

Dr. E.K.S Nambiar, Project Manager, CSIRO Division of Forestry and Forestry Products, Canberra, Australia - Feb - Mar.2001.

Shri K. Prasad IFS, PCCF (T&R), Uttar Pradesh.

Ph. D. awarded

Mr. C. F. Francy was awarded Ph.D. degree by the FRI Deemed University, Dehradun for his thesis on "Studies on the Noctuidae (Insecta; Lepidoptera) of Kerala", under the guidance of Dr. George Mathew (Entomology).

Mr. U.N. Nandakumar, Scientist (Silviculture) was awarded Ph.D. by FRI Deemed University for his thesis on "Ecosystem optimisation through multi-tier forestry: a systems approach" prepared under the guidance of Dr. S. Chand Basha, Former Director, KFRI.

Mr. Sunil Thomas was awarded Ph.D. degree by the Cochin University of Science and Technology for his thesis on "Detection of Sandal Spike Phytoplasma Using Immunological and Molecular Techniques" prepared under the guidance of Dr. M. Balasundaran (Pathology).

Nominations for Professional Bodies

Drs. M. Balagopalan and Thomas P. Thomas (Soil Science) were nominated as Members of the Expert Committee on Coir Geo-textiles, Industries Dept., Govt. of Kerala.

Dr. K. M. Bhat (Wood Science) was nominated as a Member of the Board of Studies, Department of Applied Botany, Mangalore University.

Dr. P.S. Easa (Wildlife) was nominated as a Member of the Board of Studies, Environmental Sciences, Mahatma Gandhi University, Kottayam and Thematic Working Group on Wild Animal Diversity and The Eco-Regional Working Group for Western Ghats of the National Biodiversity and Strategy and Action Plan.

Dr. R. V. Varma (Entomology) was nominated as a Member of the Board of Studies, Department of Zoology of the Calicut University.

Specialised training in bamboo and cane

Under the UNDP-Govt. of India (Handicraft Commissioner Ministry of Textiles) project KFRI organizes frequent training programmes on following aspects for the benefit of farmers, NGOs, Government agencies and other user communities

* Cultivation, farm management, harvest and post harvest techniques of bamboos and canes.
* Value addition to bamboos and canes to cater to the needs of regional, national and international markets.

KFRI Offers training course in field Identification of primary timbers of Kerala/ India

The Division of Wood Science, KFRI intends to impart training in field identification of primary Indian / Kerala timbers for the benefit of practising foresters and various end-users. The training module covers: methods, equipment, tool kit and procedure for field identification; diagnostic and anatomical (macroscopic and microscopic) features of the timber and lens keys for identification. The primary timbers include: aini, benteak, bijasal, dhaman, ebony, gurjan, haldu, hopea, irul, jack wood, kala siris, kindal, laurel, rosewood, teak, etc. For more details contact:

The Director
Kerala Forest Research Institute
Peechi 680 653

Statistical Consultancy Services Available at KFRI

Modern scientific research relies extensively on quantitative methods both in measurement and analysis, in studying any natural phenomena. The effective scientific research programme requires the use of well designed experiments or sample surveys coupled with rational modes of inference. Over the past several years, the Kerala Forest Research Institute has built up a strong team of experts, equipment and software to handle many sophisticated statistical design and analyse problems in forestry research and allied fields. The Division of Statistics has a consultative and collaborative role in the projects undertaken by the Institute and is involved in software development for statistical analysis and database management. The Division is headed by Dr. K. Jayaraman, who has a wide international experience in tropical forestry.

The Institute likes to share its expertise in this area with other similar institutions around the world on a no-loss-no profit basis. The Institute can undertake training programmes in statistical methods for forestry professionals surveys and statistical analysis of research data. Institutions interested in utilizing such service may contact the Director, KFRI.

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Coming Events

- 3-14 September, 2001. Developing the Eucalyptus of the Future. Valdivia, Chile. IUFRO. Contact : Dr Roberto Ipinza, Universidad Austral de Chile, PO Box 1241, Valdivia, Chile: Tel 56-63-216 186; Fax: 56-63-224 677;ripinza@valdivia.uca.uach.cl:WWW.infor.cl/iufro2001.

- 9-14 September, 2001. 5th International Flora Malesiana Symposium. Sydney, Australia. Contact: Dr Barry Conn, Royal Botanic Gardens Sydney, Mrs Macquaries Road, Sydney NSW 2000, Australia; fmv@rbgsyd.gov.au; plantnet.rbgsyd.gov.au/fm/fm.html.

- September 24-29, 2001 Taipei, China-Taipei Tropical Forestry Symposium: The Art and Practice of Conservation Planting, 1.07.00 Tropical Silviculture: 1.17.00 Restoration of Degraded Sites, Ching-Te Chien, Taiwan Forestry Research Institute, 53 Nan-Hai Road, Taipei, Taiwan 10051 Fax: 886-2-2389-5531, Email: chien@serv.tfri.gov.tw

- September 24-30, 2001 Zurich Switzerland, Uneven-aged Silviculture: Tradition and Practices in Central Europe, 1.14.00 Uneven-aged Silviculture 4.01.03 Desing, Performance and Evaluation of Experiments. Andreas Zingg, WSL, Zurcherstr.111,CH-8903 Birmensdorf, Switzeland Tel:+41+1739 23 35; Fax :+41+1 739 22 15Email: andreas.zingg@wsl.ch Web site: http://www/wsl.ch/forest/waldman/events/

- September, 2001. dynamics of Forest Insect Populations. IUFRO 7.03.07. Contact: Andrew Liebhold, USDA Forest Service, Northeastern Forest Experiment Station, 180 Canfield St Morgantown WV 26505, USA; sandy@gypsy.fsl.wvu.edu.

- 12-15 September, 2001. 104th Annual Convention and exhibt Showcase of the US National Hardwood Lumber Association. New Orleans, USA. Contact: Debby Whitten: d.whitten@nathardwood.org; www.nathardwood.org.

- 19-21 September, 2001. Continuous Cover Forests: Assessment, Analysis, Scenarios. Gottingen, Germany. IUFRO 4.00.00. Contact: Klaus v.Gadow, Universitat Gottingen, Institu fur Forsteinrichtung and Ertragskunde, Busgenweg5, D-37077Gottingen,Germany; kgadow@gwdg.de;sstacho@uniforst.gwdg.de.

- September, 10-15, 2001. Chile Developing the Eucalypt for the Future 2.08.03 Improvement and Culture of Eucalypts Santiago Barros, Coordinator Organizing Committee, Institute Forestal, Huerfanous 554,P.O. Box 3085, Santiago, Chile Tel: +56-2-6930700;Fax:+56-2-6381286, Email:sbarros@infor.clWeb site: http://www.infor.cl

- September 8-15, 2001 Harrison Hot Spring Resort British Columbia Canada, 4th Workshop Connection Between Silviculture and Wood Quality through Moderling Approaches and Simulation Software, 5.01.04 Biological Improvement of Wood properties, Gerard Nepveu, INRA, Research Tearm on Wood Quality, F-54280 Champenoux, France Tel(org):+33-3-83394041, Fax: +33-3-83394069, Email (pers) :nepveu@nancy.inra.fr

- September 20-22, 2001 Lviv, Ukraine Ecological-Economical Doctrine: Origins, Problems, Perspectives (ECO-2001) 6.17.00 Ecological Economics in Forestry; Ukrainian State University of Forestry and Wood Technology; Ivan Franko Lviv National University; International Institute-Association of Regional Ecological Problems , yurity Tunytsya, Ukrainian State University of Forestry and Wood Technology, 103 Gen. Chuprynka str., 79057 Lviv, Ukraine Tel/fax:+380-322-352269 Fax:+380-322-971765, Email: edufor21@forest.lviv.ua

- September, 19-21 Gottingen, Germany Continuous Cover Forests-Assessment, Analysis, Scenarios, 4.00.00 Inventory, Growth, Yield, Quantitative and Management Sciences: Div. 1.6.8, Klaus v. Gadow, Universitat Gottingen, Institut fur Forsteinrichtung and Ertragskunde, Busgenweg5, D-37077 Gottingen, Germany E-mail: kgadow@gwdg.de;sstacho@uniforest.gwdg.de

- September, 22-26 Davos switzerland Tree Rings and People-An International Conference on the Future of Dendrochronology, 5.09.00 Tree Ring Analysis; 4.01.08 Effects of Environmental Changes on Forest Growth; WSL, Tree Ring Society, Paolo Cherubini, Swiss Federal Research Institute WSL, CH-8903 Birmensdorf-SwitzerlandTel:+41-1-7392278;41-1-7392215 Email: paolo. Cherubini @wsl.chWeb site: http://www.wsl.ch/forest/dendro2001 (see also under Division 4)

- 23-28 September, 2001. International Conference on Advancing Community Forestry: Innovations and Scaling up experiences. Chiang Mail, Thailand. Contact: Dr Somsak Sukwong, Executive Director, Regional Community Forestry Training Centre for Asia and the pacific (RECOFTC), Kasetsart University, PO Box 1111, Bangkok 10903, Thailand; Fax 662-561 4880; fiess@ku.ac.th;www.recotc.org

EVERGREEN

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Coming Events

- 24-29 September, 2001. The Art and Practice of Conservation Planting. Taipei, Taiwan Province of China. IUFRO 1.07.00; 1.17.00. Contact: Ching-Te Chien, Taiwan Forestry Research Institute, 53 Nan-Hai Road, Taipei, Taiwan 10051; Fax 886-2-2389 5531; chien@serv.tfri.gov.tw.

- 26-28 September, 2001. Joint ATO/ITTO Conference on Further Processing of African Tropical Timber. Libreville, Gabon. Contact: Mr Gabriel Azizet, Director General of the Department of Forestry and Fisheries, Libreville, Gabon; Tel 241-760062; Fax 241-766896; boussengath@internet.gabon.com

- October, 2001. The Future of Perennial Crops: Investment & Sustainability in the Humid Tropics. Cote d'Ivoire. Contact: Dominique Nicolas, CIRAD, Boulevard de la Lironde, 34398 Montpellier Cedex 5, France; Tel 33-4-6761 6569; Fax 33-4-67 56 59; nathalie.mercier@cirad.fr

- 2-5 October, 2001. 5th Brazilian Symposium on Forest Transportation. Porto Seguro, Brazil; Tel 31-3899 52125; Fax 31-3891 2166;sif@mail.ufv.br

- October, 2001. Forest History in the Mountains of the World. Naini Tal, Central Himalaya Region, India. IUFRO 6.07.01. Contact: Prof. Rawat, C2B/32C janakpuri, New Delhi, India; or at 2B Sleepy Hollow, Naino Tal 263001, India; Tel 91-5942-36149; Fax 91-5942-36260;

- October, 2001. International Conference on Forestry and Forest Products Research (CFFPR 2001).Kuala Lumpur, Malaysia. Contact: Dr Shamsudin Ibrahim/Ms Safiah Yusoff, Forest Research Institute Malaysia, Kepong, 52109 Kuala Lumpur, Malaysia; Tel 603-6274 2633; Fax 603-6277 9643; sham@frim.gov.my or safiah@frim.gov.my; ww.frim.gov.my/CFFPR 2001.html

- 1-3 October ,2001. International Seminar on the Effects of Climate Change on Forest Grwoth and Implications for Forest Management. Dresden, Germany. IUFRO 4.01.08. Contact: Heinz Rohle; roehle@forst.tu.dresden.de; www.forst.tu-dreden.de

- 8-11 October, 2001. Forestry Meets the Public: an International Seminar. Ruttihubelbad, Switzerland. Contact: Martin Buchel, Chief, Bases and Training, Swiss Forest Agency, Ch-3003 Berne, Switzerland; Tel 41-31-324 7783; Fax 41-31-324 7866; martin.buechel@buwal.admin.ch

- 9-12 October, 2001. 2001 International Symposium on Value Accounting of Forestry Environment. Beijing, China. Sponsored by ITTO, Contact: Executive Chair, Mrs Yuling, Institute of Scient-tech Information, Chinese Academy of Forestry, Wan shou shan Beijing, China; Tel 86-10-6288 8322; Fax 86-10-6288 4836; yuling@isti.forestry.ac.cn;www.forestry.ac.cn

- 29 October.-2 November 2001. Extension: Assisting Forest Owner, Farmer and Stakeholder Decision-making. Lorne, Australia. Contact: Rowan Reid, Agroforestry and Farm Forestry Program, Dept of Forestry, University of Melbourne Vic 3010, Australia; Tel 61-3-8344 5011; Fax 61-3-9349 4172; rfr@unimelba.edu.au; www.mtg.unimelb.edu.au/iufro.htm

- 29 October.-3 November 2001. 31st Session of the International Tropical Timber Council. Yokohama, Japan. Contact: Collins Ahadome; itto@or.jp; www.itto.or.jp

- 30 October,-2 November 2001. Forest Science and Forest Policy in the Americas: Building Bridges to a Sustainable Future. IUFRO Task Force on Science/Policy Interface. Contact: John parotta, USDA Forest Service Re-D-SPPII, 201 14th St.SW, PO Box 96090, Washington,DC 20090-6090,USA; jparpita@fs.fed.us

- November, 2001. XV Latin American Congress of Soil Science. Cuba. Contact: Dr R.Villagas Delgada, Ave Van Troi No. 17203, Boyeros, Havana CP 19210, Cuba; Tel 53-7-579076; Fax 53-7-666036; XV@inica.edu.cu

- 20-24 November, 2001. 4th Machinery and Timber Products Show and 5th Plywood and Tropical Timber International Congress. Belem, Brazil. Contact: Wrsdopaulo;Tel55-11-37213116;wr-sp@uol.com.br;www.tropicalcongress.com.br

- 8-20 April, 2002. Alternative Ways to Combat Desertification: Connecting Community Action with Science and Common Sense. Cape Town 7975 South Africa;Tel27-21-7881285;robenpen@jaywalk.com; http://des2002.az.blm.gov/homepage.htm

- November, 2002. Collaboration and Partnership in Forestry. Santiago, Chile IUFRO 6.00.00 (All divisions). Contact: Susanna Benedetti, Instituto Forestal, Casilla 3085, Santiago, Chile; Tel 56-2-693 0722; Fax 56-2-638 1286;sbenedet@infor.cl

- 21-28 September, 2003. XII World Forestry Congress. Quebec City, Canada. Contact: XII world Forestry Congress, PO Box 7275, Charlesbourg, Quebec GIG 5E5, Canada;