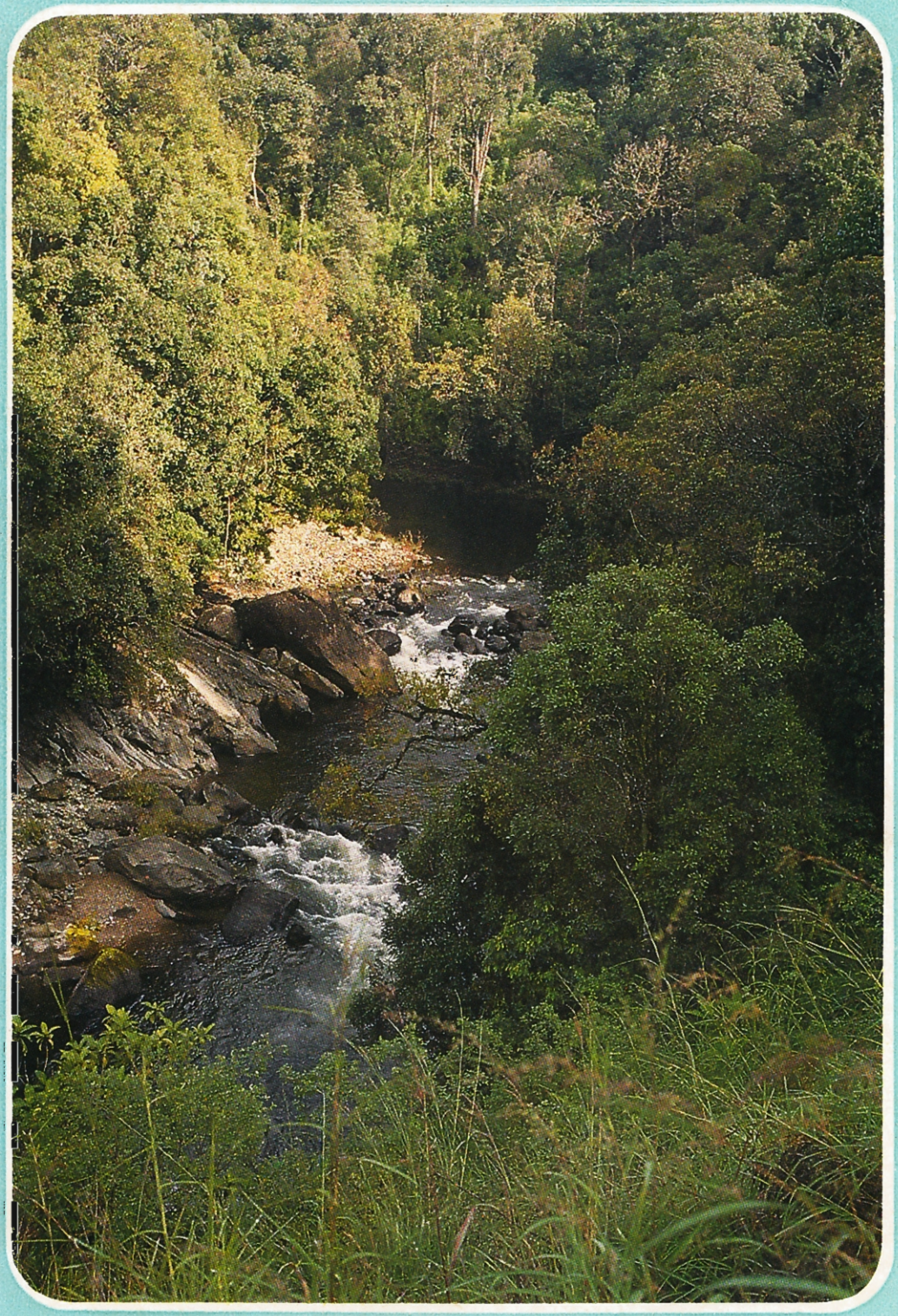
ISSN 0254 - 6426

evergreen

Number 18

March 1987



Newsletter of
kerala forest
research institute
peechi 680 653

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 and opinions for inclusion in the Evergreen. The Newsletter Committee reserves the right to choose among contributions and edit, where necessary. Address all communications to:

The Editor, Evergreen
Kerala Forest Research Institute,
Peechi-680 653, India.

kerala forest research institute

Evergreen ISSN 0254-6426

CONTENTS

Editor's column : Fire in Forests	... 1
Divisional Highlights : Soil Science	... 2
Interview : On Rainforest Management	... 4
Diseases of Forest Trees in Kerala	... 9
Forest Fire — A Burning Problem	... 12
Musth in Elephants	... 14
Early History of Teak Planting in Kerala	... 16
Autecological Studies in Forestry: An Appraisal	.. 18
Rural Institutions, Peoples' Participation and Social Forestry	... 21
Prospects of Cane Plantations : Malaysian Experience	... 24
Wood-Some Common Queries-V	... 26
Recent Publications	... 28
Seminar, Congress, Workshop, Training	... 30
Research Reports	... 31
Forth coming events	... 33
Campus News	... 34

Cover - Silent Valley Printed at Lumiere Photo - Subhash Kuriakose

Editor's Column

Fire in Forests

Fire is a major cause of destruction and degradation of our forests. With the increasing human pressure on forests the frequency of occurrence of fires has increased considerably. Urgent measures have to be taken to prevent and control forest fires; otherwise benefits obtainable from the forests will decline drastically.

Fire has been employed as a standard management tool in forestry. However, wild or accidental fire can adversely affect the forest ecosystem. The destructive nature of forest fire and its negative effects on production and conservation of forest resources is perhaps not well appreciated. A critical evaluation of the fund allocation and expenditure on forestry in Kerala reveals that fire protection and control receive very low priority.

Apart from the long term impacts on soil, fauna and flora, forest fire can also result in direct or immediate loss by destroying valuable trees, both in plantations and in natural forests. The root system of the trees will be damaged which will partially or completely kill the trees and also make them more susceptible to pests and diseases. There will also be a reduction in the soil fauna, both in quantity and in quality. Some of the other deleterious effects include lack of regeneration, poor coppicing and also the risk of invasion by weeds. Fire hardy shrubs will dominate in the burnt area. The physical and chemical properties of the soil will be changed due to fire and exposure to direct sunlight and rain can lead to soil erosion.

Although fire in a forest does not appear serious to the public compared to a fire incidence in an urban area, the approach to tackle the situation in both cases should receive same importance. There are standard procedures stipulated with regard to management of forests when fire occurs, like reporting, recording and even methods to control. Preventive methods include taking fire lines, appointing fire watchers during the dry spell of the year and creating public awareness by putting posters and signboards. For various reasons these are not implemented at the right time, mainly due to financial constraints. The practical difficulties of the field staff in reporting, assessing the damage or in controlling the fire may be looked into in a more realistic way. In the present system, it is difficult to get a clear picture on the loss or damage caused due to fire. Also information on the fire prone forest areas in the State, possible reason/motivation behind setting fire, duration and speed of spread, extent of damage, etc. are important and without these data it will be difficult to plan a management strategy to control forest fires.

In Kerala, forest fires are mostly due to deliberate or accidental acts by human beings. Sometimes people would light a fire on the litter near plantations/forest without fully realising the consequences. Throwing of a match stick or cigarette stub can create havoc. But very often people light fire deliberately to facilitate charcoal making, grazing, collection of firewood, etc. Most often it is a social problem and accordingly the approaches to tackle it should be carefully planned and implemented. The feasibility of involving local people and voluntary organisations in such situations may be looked into. Fire fighting in a forest area has its own specific problems like non-availability of water, and lack of communication and transporting facilities. All these aspects need careful thinking and planning. Public support to this can be expected only if we are able to highlight the seriousness of the problem and their long term implications.

We have a forest fire control training centre at Kulamavu, established under the Indo-New Zealand Technical Co-operation to train forest officers in modern forest fire control methods. The public at large should be made knowledgeable on the harmful effects of fire through mass media like films, slide show, lectures etc. for which the centre at Kulamavu should take the initiative.

Preventing forest fire is always advantageous than controlling it and hence we have to implement preventive methods in a more effective manner with support from the local people. It will be good if we take up this problem with an open mind and discuss the different aspects at various levels to arrive at a possible solution to tackle this burning problem.

Divisional Highlights - 9

Soil Science

Soils provide anchorage, hold water plus air and supply nutrients to trees. Studies on the nature and properties of soils are therefore essential for understanding soil-tree interactions in forest ecosystems. The Division of Soil Science, established in December 1976, has undertaken several problem-oriented projects with the motto 'soil management to ensure continued productivity from forest land.'

One project on taungya in relation to properties, erosion and management of soils brought out the appropriateness of rice as a taungya crop as opposed to tapioca and ginger. A sequal was the synthesis of literature and suggestion of low-input and cultural erosion control measures in forest plantations viz. maintenance of groundcover by taungya crops, undergrowth, undercrops or mulch, contour planting of tree seedlings, ridge-furrow system of tapioca planting and interplanting with leguminous shrubs.

Raising of teak and eucalypts, former a long and the latter a short rotation crop, may have both positive and negative effects on the soils they grow. Studies on the nature and properties of soils in plantations across Kerala indicated changes due to plantation activities; however, their intensities depended upon initial soil conditions, topography, climate and management practices. Soil deterioration may not be a major problem in the case of teak; however, continuous eucalypt cultivation may pose problems in later rotations. The effect of monoculture on soils, needs an integrated and indepth study and will depend on the future trends in plantation forestry.

Soil is one component of the land and therefore other site factors must also be taken into account when tree growth is evaluated. A project on the influence of site factors in Bombax plantations, revealed that stands in central and northern regions of Kerala did not gain as much height as those in the south and stunting in growth could be partly explained in terms of soil parameters like gravel, sand and organic carbon.

Organic matter is an essential component of soil in that it is a storehouse for several nutrients besides influencing the physical, chemical and biological properties of soils. In an investigation on organic matter in teak and eucalypt plantations, the results indicated minimal carbon changes in three transects and decline in two due to plantation activities.

Fertiliser treatment of forest stands is yet to become a reality. An attempt along this line in a project, effect of Mussoorie Rockphosphate on the growth of eucalypt seedlings, demonstrated that pit application of 100 150 g rockphosphate at planting time enhanced establishment and growth of seedlings in medium to strongly acidic soils. It appears that starter doses and cheaper sources of nutrients may prove to be appropriate for forest plantations.

Foliar analysis is one of the sensitive and practical methods for studying nutrition of trees. A study on foliar analysis to assess soil test methods for nitrogen, phosphorus and potassium indicated correspondence between leaf contents and extractable nitrate, phosphate and potassium levels in soils.

Physical, chemical and biological properties and processes influence tree growth and an investigation along this line revealed that among the physical parameters, gravel, sand and water-holding capacity influence eucalypt growth most. Another project was initiated to look into soils in teak plantations of different site quality. This study of six plantation transects, currently in progress, brings out the effect of gravel, sand, pH, exchange acidity and exchangeable bases on site quality.

Interdisciplinary studies are essential for an integrated approach in forest management and this Division has cooperated in several such studies: soil changes in Attappady area due to man-forest

interaction; soils in grasslands; soil requirements for selected medicinal plants; soil studies in Trichur Forest Division for preparing a soil-cum-vegetation map; effect of slash burning on planting site for teak; soil inputs for raising taller seedlings of evergreen species; and soil inputs in seed orchards of teak.

The Division has also undertaken studies of an advisory nature for the Kerala Forest Department by answering queries on various aspects based on field investigations. Broad-scale soil studies have been completed in Grassland Afforestation, Punalur, Konni, Trivandrum and Wynad Divisions. These investigations will generate soil database useful in forest management.

Ongoing projects in the Division are: physical and chemical properties of soils in albizia plantations; nutrient partitioning in an evergreen ecosystem; effect of varying soil moisture and bulk density on root growth of teak, eucalypt and albizia seedlings; and ex-situ decomposition of leaf litters of teak, eucalypt and albizia.

The Division looks ahead with focuses on soils in natural forests; soil suitability and changes in teak plantations; soils under bamboo, reed and cane stands; and soil studies for land-use prescriptions. This way, two sides of the coin – preservation and production aspects of forestry—are given the required emphasis.

Some of the important recommendations of National Commission on Agriculture - 1976 on fire Protection of forests

Record of forest fires should be maintained by all the States to plan fire prevention measures

Voluntary associations should be organized with local leadership to support administrative measures for protection of forests from fire.

Letters of appreciation and cash awards should be granted to local panchayats in fire prone areas for their fruitful co-operation and assistance.

Publicity for protection of forests from fire should be ensured both among urban and rural groups of population particularly by an imaginative use of the audio-visual medium.

There should be a provision for the award of enhanced punishment in the case of wilful fire damage to a forest.

A network of lookout stations should be built up for fire control.

Fuel condition for a particular forest area in the form of maps should be prepared for all fire-prone areas previously identified. The maps should show the probable rate of spread of fire and resistance to control.

Training programmes in fire detection, prevention and suppression should be arranged for all levels of field officers.

Research on various topics concerning forest fires should be properly organised.

Interview

On Rainforest Management

Dr. P. S. Ramakrishnan, FNA, is a leading ecologist and Professor and Head of the Department of School of Environmental Sciences, Jawaharlal Nehru University, New Delhi. He has done considerable work on the ecology of the North Eastern region of India. Prof. Ramakrishnan was interviewed on 27th January 1987 by Evergreen.

Evergreen: The rainforests are the most diverse ecosystems in the world and are being destroyed at a rapid rate due to various reasons. Can you mention some of the problems specific to the rainforests in India?

PSR. It is well known that the rainforests are generally extremely fragile and this is because of the fact that the rainforests have developed under high rainfall situations. Nutrients are leached out to a considerable extent. Therefore the soil has very little to offer to such a large biomass that it supports, and once you cut down the forests, the forests very often fails to regenerate. In other words the land gets desertified. There are various levels of desertifications, for eg. it may be taken over by the weedy communities like in Western Ghats where coarse grasses coming in and then it tends to remain in a state of arrested succession for a very long time. In extreme cases the entire land gets desertified or completely gets bald and the system never recovers.

Evergreen: In your opinion what are the immediate research needs for better management of rainforests in India?

> REGENERATION AND NUTRIENT CYCLING ARE THE TWO MOST IMPORTANT ASPECTS TO BE STUDIED FOR BETTER MANAGEMENT OF THE RAINFOREST.

PSR: You see, we know only very little of the rainforest as an ecological system. One of the important aspects to be studied in detail in the

rainforests is the problem of regeneration. There are many species which regenerate very quickly and there are a number of species which do not regenerate at all. The size of the gap determines to a certain extent the kind of regeneration that is possible. The smaller the gap, the quicker the regeneration and when the gap is small many of the mid successional or late successional species will come up. When the gap size goes beyond a point, even many of these early successionals are not able to regenerate. So regeneration is one of the major issues, whether you consider a small gap or a large gap.

Another major issue is of course, the problem of nutrient cycling. The soil is very poor and there is nothing much in the soil. All the nutrients are held in the biomass and therefore the nutrient cycling in a natural forest is primarily based upon the litterfall and that is one of the reasons which contributes to the fragility of the system. Therefore once this tight cycling of nutrient is upset, then it is very difficult to restore this.

Evergreen : Can you elaborate further on nutrient cycling based on your own studies?

PSR : I think nutrient cycling problems within a tropical rainforest is one of the things about which we know very little. When I say we know very little, I mean in terms of not only the whole system but also with respect to the individual species. Some of the studies that we have undertaken suggest that some tree species tend to take up nutrients at a much faster rate and tend to accumulate this nutrients in the biomass because of quick growth and then when the leaf fall occurs they tend to reabsorb the nutrients back into the tree trunk much more effectively than some of the other species. This is very important in conservation of nutrients, particularly in a rainforest because the species which tends to conserve nutrients - there are two mechanisms - by which they can optimise the nutrient use. If you have got a pool of nutrients, there are some tropical tree species which have got a very fast turn over of leaves and that is one of the ways to ensure that a minimum amount of nutrient is used again and again in an effective manner. Another method is that there are some species which can retranslocate the nutrients into the tree trunk before the leaf fall takes place and conserve it in that manner. Some species are more efficient than other species. We started studies on some of these areas in the North Eastern region, but I think there is a lot more to be learned if we have to manage the rainforest purely from the point of view of these kinds of differences that exists between different ecological catagories of species.

Evergreen: Do you mean to say that regeneration and recycling are the only important areas from the point of view of management?

PSR: There are so many areas one could talk about. But these two are the most important and you cannot manage a forest unless you know the regeneration strategy and you cannot manage a forest in a soil which is extremely deficient in nutrients unless you know the various kinds of mechanisms which operate or which internalise the nutrient cycling as effectively as possible.

Evergreen: Shifting cultivation is one of the oldest forms of agricultural practices. How does it affect the ecosystem?

> ONE OF THE THINGS THAT HAS BEEN SAID VERY OFTEN IS THAT THE SHIFTING CULTIVATORS ARE THE PEOPLE WHO HAVE BEEN RESPONSIBLE FOR DAMAGING ALL THE RAINFORESTS. IN FACT I DON'T AGREE WITH THAT VIEW POINT.

PSR: Well, shifting agriculture is a practice on which everybody talks so much and yet so little is known even now on a broader basis. One of the things that has been said very often is that the shifting cultivators are the people who have been responsible for damaging all the rainforests. In fact I don't agree with that view point. What has happened is that the industrial man has gone in a very large way into the rainforests for timber harvest for industrial purposes. In the North Eastern region this has been going on since 1930 and still continuing at a rapid rate. So when we harvest large areas of land and thus disturb the system, it never recovers back. In other words you have created a desertified environment and when the shifting agriculture farmer tries to operate, he has got much less area to operate. You have reduced the land, not the shifting agricultural farmer. Then we

find easy excuses to put the blame on others and argue that shifting cultivation should be banned because these people go and cut down the forest and cultivate and damage all the forest. I don't say that they don't damage the forest. They also damage the forest. But we are the ones who have been responsible for aggravating the situation.

Evergreen: What is the long term impact of shifting cultivation?

PSR: When you talk about the long term impact, the question comes whether shifting cultivation is going to continue on a long term basis. All the available information at our disposal suggest that this is going to continue for another 30 or 40 years or may be even 50 years What is going to happen after 20 or 30 years we don't know. Shifting cultivation is basically a very sound agricultural practice for the humid tropics. So much of distortions have come about in the shifting agricultural system and we should try to remove these distortions.

Taking away the people from shifting agriculture has failed because we tried to impose a technology which we consider is important for the people and therefore people don't accept it They also don't accept it because we try to impose a technology which is good for some other climatic situations. For example, terracing which works reasonably well in western Himalayas, when you try to do this in the eastern Himalayas, what happens is that the life of terrace is very short because of high rainfall. The soil is extremely weak and highly porous and if you check the run off, the vertical loss or leaching loss is very heavy. Most of the fertilizer used gets washed away through leaching and therefore the farmer does not find it economically viable to do this. After a period of time the land gets degraded and then the farmer permanently shifts away from there.

Evergreen: Can you throw some light on the selection of tree species in a shifting agricultural system?

PSR: Recently the Meghalaya government has introduced a native species viz. ***Alnus nepalensis*** into the shifting agriculture both during the cropping phase as well as during the fallow phase. We have been suggesting the introduction of

> WHEN YOU HAVE A SHIFTING AGRICULTURAL SYSTEM YOU LOOSE SOMETHING LIKE 600KG OF NITROGEN PER HECTARE IN A YEAR THROUGH NATURAL PROCESSES IT WILL TAKE 12 TO 15 YEARS TO PUT BACK THIS NITROGEN. BUT WHAT ***ALNUS*** DOES IS THAT IT RECOVERS ALL THE 600KG OR MOST OF IT OVER A PERIOD OF FIVE YEARS.

this species for quite some time. The governmental agencies are trying to implement this in a large scale, and quite a few tribals have accepted this. ***Alnus*** can be harvested every five years. It can be cut at ground level and coppices very well After the next five years it will be again ready for harvest. So you get timber, furniture material and you can even sell off these materials. What is more important is that it fixes nitrogen. When you have a shifting agricultural system you loose something like 600 kg of nitrogen per hectare in a year. Through natural processes, it will take 12 to 15 years to put back this nitrogen. But what ***Alnus*** does is that it recovers all the 600 kg or most of it over a period of five years So given the population pressure that you have now, given the land area that is available now, given the length of the cycle that you have now, you are trying to make that cycle both ecologically and economically viable

Evergreen: We have ***Alnus nepalensis*** in the High Ranges of Kerala. Will it grow in low altitudes also?

PSR I was not knowing that ***A. nepalensis*** is available in Kerala. Now somebody should try whether some strains of this species will establish in the low elevation. In Meghalaya it grows from a height of 200 to 5000 feet above sea level. So it has got a wide range of altitudinal distribution.

Evergreen: ***Leucaena*** is a good species with similar properties and we have been trying to introduce it. What is your opinion?

PSR: See, the trouble with us is that when somebody, especially a foreign expert comes and says that you plant ***Leucaena***, we all accept it. But

we have got right in our doorstep something which is much better than ***Leucaena*** and we never try to explore it. ***Alnus*** is one such species. As you know, India is so rich in legumes and nobody has ever cared to look at this group of plants. The advantage is that with native species you are playing it safe With exotics you are not always sure about the long term outcome.

AS YOU KNOW, INDIA IS SO RICH IN LEGUMES AND NOBODY HAS EVER CARED TO LOOK AT THIS GROUP OF PLANTS.

Evergreen: How best can we achieve welfare of the tribals without causing serious environmental problems?

PSR: You see, the tribals have got a lot of science accumulated through their traditional technology. For example, when we talk about multiple cropping, we have only a two way interaction i. e. you have got two species in your mixture, one legume and let us say one cereal. But you see, the tribals have got something like 30 or 35 crops growing in their plot and so, many species interact with one another. They are able to do a good job of it.

TRIBALS HAVE GOT A LOT OF SCIENCE ACCUMULATED THROUGH THEIR TRADITIONAL TECHNOLOGY, THROUGH A LEARNING PROCESS.

Coming to the nutrient cycling, I mean resource cycling, the tribals, cultivation practices are very efficient in this respect. They are much more conscious of it and they not only cycle their resources within the agriculture systems, but cycle between agriculture and animal husbandry. We also talk about agroforestry; shifting agriculture itself is an agroforestry system. So here is something which has been practised since time immemorial by the tribals. What I mean is that some of the traditional technology available with tribals may be viable, some of it may need redevelopment. Any development that you want to do in the tribal areas, it is not going to be a success unless you have people's participation. If you want to capture their interest you must talk something which they can understand and this is one of the things that we don't do. But you can have technological inputs put into a traditional system over a period of time. Not in a jarring way, but in a gradual manner. Some of the technological input that we give should really reduce their tedious way of doing things.

Evergreen: What do you think about monocultures that we practice now in most plantations? Why not mixed plantations?

WE NEED NATURAL FORESTS, MIXED PLANTATIONS AND PURE PLANTATIONS. HOW WOULD YOU LIKE TO APORTION THE LAND FOR EACH OF THESE ACTIVITIES IS MORE IMPORTANT THAN DECIDING ON MONOCROPPING OR MIXED CROPPING.

PSR: Monocropping of tree species has got certain advantages. It is much easier to operate and also easier to harvest. On the other hand, when you talk about mixed plantation simply mixing of two species is not sufficient. The species must be compatible from the point of view of their own biology and also from the point of view of the ecology of the area. Also mixing merely two species does not make it better than monocropping. So to me it is a question of maintaining a balance. Probably monocropping will continue for a much longer time than you and I would desire it to continue. We need natural forests, mixed plantations and pure plantations. How would you like to aportion the land for each of these activities is more important than deciding on monocropping or mixed cropping.

Evergreen: What is your opinion on large-scale monoculture plantations of eucalypts? Is this species ecologically acceptable?

PSR: It is not a question of whether we should have eucalypts or whether we should not have eucalypts. What we want to know is whether eucalypts is good for all situations. Even if it is good for all situations, we should know whether we should plant the whole area with eucalypts or to restrict to one third or one fifth of the area so that it becomes ecologically more viable. So, one has to determine on the basis of an

analysis what would be the optimum size of the land area that should be occupied by a given species or a mixture of species. We usually make generalisations and pass sweeping statements and that won't help much.

Evergreen: What should be our approach to restore the degraded forests? What is your opinion in involving people in such programmes?

PSR: This is a very difficult question to answer. The problem varies from place to place. If you are talking about the tribal areas where shifting agriculture is being practised, the restoration activities should centre around shifting agriculture. In some other situation the agroforestry systems are to be emphasised.

IT IS ALWAYS DESIRABLE TO EXPLORE THE POSSIBILITIES OF GETTING LOCAL LEADERSHIP IN EDUCATING THE MASS.

Regarding involvement of people, the environmental awareness differ in different localities For example, people living in the coastal areas may not be much aware of the importance of ecorestoration as people living in the Western Ghat border. It is always desirable to explore the possibilities of getting local leadership in educating the mass. Governmental agencies can not do much in such programmes.

Evergreen: What is your opinion on the use of modern techniques like tissue culture in forestry?

PSR: It has got extremely limited value under Indian situation, because, there are much easier, much cheaper techniques that are available with all the labour force that is available at our command to propagate trees. But as you know every one of us has got the craze to be in the fashion. We do not have the basic information on our trees like how the seeds germinate, how do they grow, whether a seed has got dormancy, what is the natural regeneration processes etc. So I think, talking about tissue culture under that kind of a situation is putting the cart before the horse. In many of the developing countries they have already started talking about mixed plantations because one single strain spread over a large area can create problems particularly under stress conditions. My own individual opinion is that tissue culture is not one of the priority areas in forestry.

WE DO NOT HAVE THE BASIC INFORMATION ON OUR TREES LIKE HOW THE SEEDS GERMINATE, HOW DO THEY GROW, WHETHER A SEED HAS GOT DORMANCY, WHAT IS THE NATURAL REGENERATION PROCESSES ETC. SO I THINK, TALKING ABOUT TISSUE CULTURE UNDER THAT KIND OF A SITUATION IS PUTTING THE CART BEFORE THE HORSE.

Evergreen: Finally, what in your opinion can KFRI contribute to solve some of these problems?

PSR: Your Institute is uniquely placed and have a rich forest area at your disposal. I would say something like a goldmine and anything you touch upon will be new. You have the resources and potential and we look upon you as a model for other similar institutions in the country.

Diseases of Forest Trees in Kerala

1. *Albizia falcataria*

Albizia falcataria (L.) Fosberg, a native of Moluccas, New Guinea, New Britain and Solomon Islands, is one of the fast growing tree species in the world suited for humid tropics. In Kerala, planting of ***A. falcataria*** under afforestation programme was initiated during the mid 1970s and so far 1350 ha of plantations have been raised by the Kerala Forest Department and Kerala Forest Development Corporation. Since no information was available on diseases of ***A. falcataria*** in Kerala, a survey was conducted during 1982-85 in numerous nurseries and plantations of ***A. falcataria*** in the State. The survey has revealed the occurrence of two diseases (web blight and seedling wilt) in nurseries and three diseases (Botryodiplodia die-back, Phomopsis shoot die-back and partial bacterial wilt) in plantations. Details of these diseases and their possible control measures are described below.

NURSERY DISEASES

Web blight

Causal organism: ***Rhizoctonia solani*** Kuhn. state of ***Thanatephorus cucumeris*** (Frank.) Donk.

Occurrence: Web blight, a common seedling disease, is recorded generally during dry-warm period (December-April) and it may continue to affect the seedlings up to August. The incidence of the disease in seedbeds depends on age of seedlings and their density; generally, it is high when the disease occurs in young seedlings (1 to 2 month-old seedlings). The younger seedlings are killed outright due to infection but only premature defoliation occurs in older seedlings.

The disease appears in seedbeds as irregular patches of web entangled seedlings. These patches enlarge rapidly from the periphery affecting the neighbouring healthy seedlings under high humidity and high seedling density. Occasionally, the disease may cover the whole seedbed.

Symptoms : The disease is characterised by the formation of a web of mycelium which entangle a group of seedlings (Fig. 1). Initially, the infection causes flaccidity in healthy leaflets followed by development of water-soaked lesions. Gradually the infection also spreads to the rachis resulting in drooping of the whole leaf. Soon leaves turn brown and premature defoliation and abscission of the rachis occur. In most cases dead leaves covered with fungal mycelium can be seen hanging around the base of the stem. The disease spreads in a seedling from lower to upper whorl of leaves and from seedling to seedling through contact.

Control measures : As the web blight manifests and spreads when the seedling density and relative humidity are high it is recommended to avoid crowding of seedlings and overwatering the seedbeds. Furthermore, applying a prophylactic treatment of Bavistin at 500 µg a i /ml (i.e., 1 g of Bavistin in 1 l of water), a week before sowing the seeds in the beds can ensure a disease free nursery. After appearance of the disease, however, atleast two

Fig. 1. Two-month-old seedlings of ***A. falcataria*** affected with web blight. Note the mycelial strands arising from the soil and climbing up on the stem and foliage.

applications of Bavistin (1000 µg a. i./ml i.e., 2g of Bavistin in 1 l of water) at weekly interval will be necessary

Seedling wilt

Causal organism: Fusarium solani (Mart.) Sacc.

Occurrence : Seedling wilt does not appear to be a common disease. The disease appears during March/April in patches affecting about 60% of the seedlings in seedbeds.

Symptoms : The lower leaves of seedlings turn yellow and get defoliated Gradually the yellowing proceed towards the growing shoot. The affected seedlings, appeared to be stunted with only 1-2 leaves remaining near the apex, die within a month. The roots of such seedlings show prominent discolouration due to infection.

Control measures : Bavistin applied as soil drench at the rate of 2000 µg a. i./ml i.e., 4g in 1 l of water has been found to be very effective in controlling seedling wilt disease

PLANTATION DISEASES

Among the three plantation diseases Botryodiplodia die-back was the most common followed by Phomopsis shoot die-back; partial bacterial wilt appears to be uncommon

Fig 2 Four-year-old trees of *A. falcataria* affected wrth Botryodiplodia die-back disease.

Botryodiplodia die-back

Causal organism : Botryodiplodia theobromae Pat

Occurrence : This is the most serious disease of *A. falcataria* prevalent in plantations throughout the State. Large-scale mortality of trees in isolated patches (Fig 2) has been recorded in several plantations in central and southern Kerala. Generally, high incidence of die-back occurs during the dry-warm period. But during or just after monsoon the incidence apparently declines as many trees with low severity recoup partially with the production of new shoots and callusing over of the canker. The disease appears to be more common in plantations prone to fire and cattle grazing and also where taungya crop of tapioca has been raised.

Symptoms: The initial symptom of die-back is appearance of a stem canker during the dry period, generally near the ground level, in the form of a depressed greyish-black area (Fig 3). This is followed by yellowing of leaflets which gradually defoliate prematurely. Slowly shoots in the upper part of the crown of the tree show symptoms of die-back Under favourable conditions the canker spreads lengthwise to several centimeters (Fig 4) as the infection progresses further. The bark over the canker splits

Fig. 3. A young stem canker at the base of the stem extending to the root.

Fig. 4. A 3-year-old tree of *A. falcataria* with a long canker. Note the formation of callus at the margins of the canker.

longitudinally and gets detached. The wood of the affected trees shows greyish-black discolouration in streaks due to profuse mycelial growth. As the canker advances further, more branches die, including the main terminal shoot and tree appears to be almost dead. However, during the following monsoon numerous epicormic shoots develop from the living part of the stem. Some of the shoots grow rapidly giving somewhat healthy appearance to trees. However, during the next dry-warm period the canker may also spread downward affecting the root system. Within 2 to 3 years the tree is killed.

In some cases the initiation of infection may be from the roots rather than the stem. This is observed in trees with partially exposed root system. The infection from the root canker spreads to feeder roots and other large roots leading to stem collar. The infection may progress further upwards giving rise to a stem canker.

Control measures : Affording protection to *Albizia* plantations from fire and biotic factors (cattle grazing) will prevent bark injuries, which form potential site for infection by the wound pathogen, *B. theobromae*. Removal of tapioca stem, which forms a good substrate for the pathogen, from the plantations after the harvest of tubers will reduce the inoculum pressure considerably, thus minimizing the disease hazards. These two measures as a part of the management system will certainly contribute towards avoiding the development of die-back disease in *Albizia* plantations.

Phomopsis shoot die-back

Causal organism : Phomopsis mendax (Sacc.) Trav.

Occurrence : The disease usually occurs in side branches in upper part of the crown of trees weakened either by fire or Botryodiplodia die-back. It does not appear to be a serious disease as no mortality of trees is observed.

Symptoms : The first symptoms of the disease are yellowing of leaves leading to premature defoliation. This is followed by death of the apical shoot. At this stage prominent cankers are observed on the affected branches. Under humid conditions often fructifications develop over the cankers.

Control measures : If protection is afforded to plantations against fire and Botryodiplodia die-back the incidence of this disease can be minimised considerably.

Partial bacterial wilt

Casual organism : Pseudomonas sp.

Occurrence : The disease was recorded only in one plantation at Thundathil (Malayattoor For. Div.). The incidence of the disease, which occurred in patches, was about 2%.

Symptoms : In the affected plants, initially leaves of lower branches on one side turn yellow and finally wilt and dry up. Such plants have decayed feeder as well as primary roots which become greyish-black. As the root infection proceeds further towards the stem, more side branches are killed. Finally when the infection appearing as greyish-black sunken canker on one side of the stem, has already reached above ground the terminal shoot gets killed. From the healthy side of the stem numerous epicormic branches develop, which also do not survive for long as the stem is completely girdled by the spreading canker down below at the base.

Control measures : As the disease was observed only in one plantation and the incidence was low, it does not appear to be of serious concern. Avoiding bark injuries may help to check the manifestation of the disease.

J. K. Sharma and K. V. Sankaran
Division of Pathology

Forest Fire – A Burning Problem

A forest fire is any wildfire not practised for the area by an authorised plan. Fire can disrupt plans of forest management by injuring or killing trees of all ages, burning seeds and seedlings consuming litter and organic matter completely or partially and destroying merchantable timber. Fire alter the forest environment leading to soil erosion, moisture stress and degradation of site and finally to desertification. Broad leaved species with thin bark and having resin and oils are more vulnerable to fire. If the high temperature damages cambium beyond recovery the tree eventually dies. Fire damage may cause local lesions which serve as entry points for insects and decay fungi, that ultimately kill the tree. Surface roots are destroyed resulting in decreased nutrient uptake, entry of root pathogens through damaged root and above all reduce the anchorage of trees. Poles and saplings are easily affected by fire Except for fire hardy plants, establishment becomes all the more difficult. Coppicing ability of some species is adversely affected due to the annual recurring fires which keep them stunted. The gap in forest caused by destruction of native species is taken over by weeds. Native tree species are gradually replaced by more fire hardy shrubs and trees with thick resistant bark, changing the structure and composition of the forest Burning of litter and other organic matter exposes the land to direct sunlight and rain, leading to soil erosion. Combustion of organic matter reduces the availability of organics otherwise helpful for the growth of soil microorgnisms especially nitrifying bacteria and fungi that releases nitrogen in the form readily available to plants. Bush fire raises temperature even upto 700°C which alters physical characteristics of soil resulting in reduced infiltration and water absorption

Causes of forest fire: Causes of fire can be broadly grouped into natural and anthropogenic. Fire outbreak due to spontaneous electric discharge from lightning or friction between conducive surfaces are the two natural phenomena. Fire also originates from power lines, passing through forests, due to short circuiting and consequent discharge. However, these occur very rarely, and we are more concerned with man-made fires caused either intentionally or accidentally.

Fire caused by deliberate attempts is the most destructive and common. Fire, set for direct or indirect economic gains is of common occurrence in forests. It is resorted to collect charcoal and ash, to facilitate removal of logs or other forest produces like reeds and bamboos and also as the first step towards encroachment. The free input of ash carried by the rain water down the burnt hills add to the soil fertility of the valley The tender grasses that sprout immediately after the rain in a burnt area provides an excellent fodder and this motivates the graziers to set fire to forests.

Types of fire: Wild fire can occur as ground fire consuming soil organic matter in the forest floor or as sub surface fire as peat fire. The commonly occurring fire in our forest is surface fire when all the litter, undergrowth, flammable understorey shrubs and slash are burnt. Crown fire occurs when fire spreads through the crown of trees, burning all the upper branches and foliage.

Fire detection: Keeping a proper record of various aspects of past fire outbreaks and a critical analysis of such instances will give an indication of the possibilities and nature of future flare ups in a particular area. Traditional methods of fire detection are being slowly replaced by modern electronic equipments and infra red sensors. The dissemination of information is rapid, but extinguishing a wildfire still remains a challenge.

Methods of prevention and control : As the first line of control, prevention of forest fire is the most ideal. The best method of prevention is the removal of flammable sources from fire prone areas. Fire prevention involves both the control of fire risks and fire hazards, achieved through manipulation of quantity, arrangement continuity, ignitability and burning rate of the fuels. To achieve the above goals, two methods are commonly adopted - prescribed

burning (controlled fire) and removal of dead snags-by clearing the flammable materials from strip of specified width and location mechanically, chemically or even by burning. These strips otherwise known as firebreaks serve as a barrier to stop fire that may occur or to provide a control line from where to work against possible fire outbreak.

As mentioned earlier, human behaviour and ignorance of the long term effects of fire are the most important factors contributing to the fire problem in forests. To exclude the human factor, the chief alternatives are either to remove man from the area or to educate the people on the harmful effects so that people refrain from intentional burning. The objective of such a measure is to create an informed awareness and fire consciousness and to sufficiently motivate them to prevent fire whenever one flares up. Educating the public through mass media like news papers, radio, T. V., film, etc. has only a limited success. Voluntary organisations with a mass base, dedicated and committed to a purpose and working locally may be the most effective.

Regulation of public use envisages meaningful restrictions on the use of forests where risk of fire exists. Such measures involve restriction of smoking or restricted entry to fire prone areas. Enforcement of law is also necessary to control a small minority of recalcitrant incendiarists who are indifferent to education and restrictions.

Fire suppression: The spread of wildfire in time and space depends upon the fuel, the weather, topography and many other factors. All fire fighting is based on certain principles like removing the fuels, reducing the temperature of burning fuels and excluding oxygen needed for combustion. Removal of fuel, the common method in conventional forest fire fighting is done by immediately creating a barrier strip or fire line free of fuels around a raging fire to prevent its spread. Spraying or pouring water over the fuels reduces the kindling temperature, arresting burning. In industrial fire fighting water and chemicals are the main tools. Since immediate availability of water and chemicals are difficult in forest, throwing soil and beating over the burning fuel are done. This excludes partially the oxygen necessary for combustion, in addition to cooling of the fuels.

Conclusion : Measures currently followed are totally inadequate in preventing and controlling forest fires. A stage has come when people cannot remain silent spectators and behold forest destruction with fatalistic resignation. Saving the forests and retaining the greenary of our hills have become a serious matter and it must not be viewed as the responsibility of the professional foresters alone. It is high time people themselves come forward and actively get involved in the protection of our forests.

K. C. Chacko
Division of Silviculture

M. Balasundaran
Division of Plant Pathology

"A growing tree is a living symbol of a progressive nation."

— Jawahar Lal Nehru

Musth in Elephants

Elephants are unique in their size and possession of trunk. There is one more organ uniquely possessed by this pachyderm - the temporal gland. The glands are located on both sides of the head just over the temporal arch between the ear and the eye and its external orifice is a vertical slit located in the temporal depression. This gland was first reported by Perrault in 1734 and is present in both sexes.

The active phase of the gland is marked by swelling of the surrounding skin and overflowing of a blackish fluid. The active time span of the gland and the behaviour during the period are known as musth.

Studies in Sri Lanka on captive Asian elephants showed that musth never appeared in males under 10 years of age and appeared sporadically in males from 14 to 20 years of age. Though musth is found in all age groups, a report of temporal gland secretion in a one-year-old African calf requires special mention. Much of the studies on the size and structure of temporal gland was on African elephants. An increase in weight of the gland with the age of the elephant has been reported in the African species. The largest gland recorded weighed 1500 g in an old bull and that of an 11 year old bull weighed only 230 g. The rate of growth of the gland is similar in both sexes upto an age of 20 years, but thence accelerated to weigh twice as much in the males than in the females.

Morphology and histology

One of the earliest descriptions of the morphology of the gland was in 1925 by Eales and then in 1971 by Sikes. They described it as an apocrine cutaneous gland. A recent report on the morphology and histology of the gland describes the structure of an excised temporal gland as a large round mass of encapsulated tissue comprising numerous lobules that are held together by connective tissue. Each lobule consists of compound tubular alveoli from which two layered ducts are connected to larger ducts. Several inter-lobular ducts lead to a series of secondary ducts that open to a main duct out of the temporal gland and into a pore in the fissure of the skin. The alveoli consists of a row of columnar epithelial cells oriented around the lumen, and myoepithelial cells in the periphery. The structure and histology of the temporal gland in Asian elephants do not differ from that of African species.

The active time span of the gland varies with elephants. The musth period in wild elephant bulls in Sri Lanka lasts from 1 to 34 days and is short in old bulls whereas it lasts long in young ones. However, some of the younger bulls had one or two short musth period lasting only a couple of days. The musth period of an adult bull in captivity of Tamil Nadu forest department lasted 45 days in 1985. Though most of the observations of musth in the wild in Sri Lanka were in rainy season, no significant correlation between rainfall and occurrence of musth could be established.

Behaviour during musth

An elephant in musth is generally considered as aggressive and in captivity, they are normally tied with two chains. But this is not the case always. There are elephants in musth which are very calm and quiet. In Sri Lanka, wild elephants in musth have been reported to be tolerant of the individuals. The author has observed an elephant in musth in Periyar feeding quietly with a herd near by a sounder of wild-boar. A musth elephant normally covers a wider range and rub the cheek portions of the body on trees and other objects in the forest. However, this is still a controversy as elephants normally rub their body parts, including cheek portion, on trees.

Function

Though the temporal gland was reported as early as 1734, the function of the gland is still a subject of controversy. Most of the conclusions in the early seventies were based on field observations on the behaviour of elephants in musth.

As the level of testosteron was found to be high in Asian elephants in musth, it was argued that the musth period is correlated to reproduction. There is also an opinion that, the musth in bulls functions as a spacing mechanism between adult bulls.

Most of the reports on musth and associated behaviour are from the African species. When the

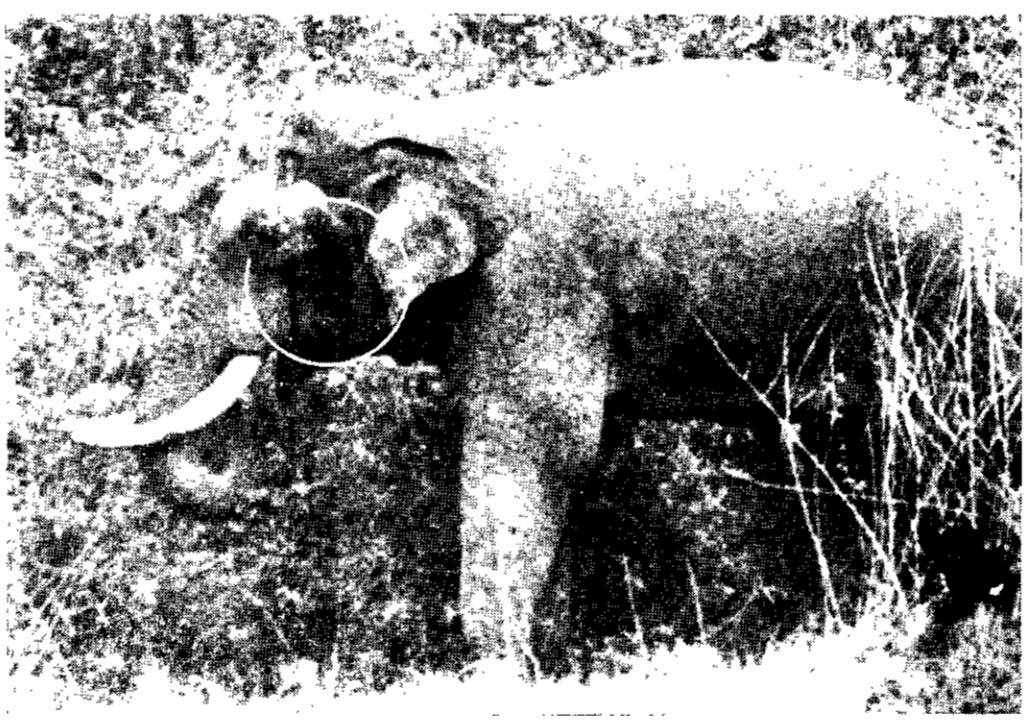
African elephants were subjected to various types of stress and strain in the field, it resulted in the discharge of the temporal gland secretion. It was suggested that reduced water supplies and scarcity of food can cause stress that can apparently lead to increased temporal gland activity. No relationship between musth and age, sex, reproduction, or social status could be established The chemical analyses of the temporal gland secretion of African elephants showed a wide range of variability of cholesterol measurements (12-70 mg%) and this chemical individuality of cholesterol levels and further field observations led to conclude that the secretion aid in recognition of individual elephants.

Observations of Hamilton on the Lake Manyara elephants is probably the best report from the field.

The very recent report on the function of the gland is based on chemical analysis of the secretion collected from 15 mature African elephants. Cresol was the major component isolated from the secretions of females and Farnesyl hydrate in males. It was concluded that cresol variation among individual elephant aids in recognizing individuals and the farnesol hydrate prevalent in male secretion is involved in scent marking.

Chemical nature of the temporal gland secretion of the Asian elephant is being carried out by the author.

In summary, the temporal gland, uniquely possessed by the proboscids secrete a phenolic liquid which aids in individual recognition. This is also used in scent marking.



A wild elephant in musth. Note the location of the temporal gland.

As stated earlier the gland of an adult bull weighs 2-3 times that of an adult cow. But he found that out of the 210 animals he observed in each sex, 90% of the females were secreting compared to 54% in males. He has also observed an elephant with one gland active and the other dry. Further, the frequency of the secretion among adults was found to be relatep to population density. According to him, the secretion is not related in any obvious way to time of day, season, sexual activity, or to the position in the social hierarchy. He suggested home range marking, individual recognition and perhaps alarm as the possible functions of the temporal gland secretion.

Further reading

Eisenberg, J. F., McKay, G. M. and Jainudeen, M. R. (1971). Reproductive behaviour of the Asiatic elephant (***Elephas maximus*** L) Behaviour 38 (3-4) : 193-225.

Wheeler, J. W., Rasmussen, L. E., Ayorinde, F., Bussf I. O. and Smuts, G. L. (1982). Constituents of temporal gland secretion of the African elephant (***Loxodonta Africana***) J. Chem. Ecol. 8(5) : 821-825.

P. S. Easa
Division of Wildlife Biology

Early history of teak planting in Kerala

In 1750 England faced a shortage of timber supplies due to depletion of Oak forests. Oak at that time was very much required for building war ships to counteract the French across the channel. Thus, the first real interest in the conservancy of forest in India originated from England, the chief reasons being safety of the empire which depended on the 'Wooden Walls'. Teak timber formed the main demand of government for ship building, military and other purposes. A timber syndicate was formed in Malabar with Mr. Maconochii of the Medical Service as its head. In August 1800, the Court of Directors authorised the Bombay Government (Malabar was in the Bombay Presidency then), to assume this royal privilege on behalf of the East India Company. As the province of Malabar had been by then transferred to Madras Presidency, no action was taken on the matter by the Bombay Government. In 1805, the Court of Directors enquired the Govt. of Bombay to report as to what extent the King's navy might depend on a permanent supply of teak in Malabar. This enquiry resulted in the constitution of a forest committee charged with a comprehensive programme of enquiry both into the capacity of forests and into the proprietory rights in them. The committee reported that the more accessible forests had been almost devastated by the Arabs who utilized teak in large quantities for building their fleet and also to tap the more distant forests, construction of costly roads might be needed. At the same time, the Committee pointed out that if protection was afforded to these forests a valuable property would gradually be built up. On 10th November 1806, Captain Watson, a Police Officer was appointed as the first Conservator of India to ensure sustained supply of teak and other timber suitable for ship building. On 25 April 1807, a general proclamation was issued declaring that the royalty rights in teak claimed by former Government were vested in this Government and all unauthorised felling by private individuals prohibited.

The Conservator, who was in charge of Malabar and Travancore, soon established a timber monopoly and furnished the Government with a plentiful supply of cheap timber. But the method employed caused discontent among the proprietors and contractors and the feeling rose to such a pitch that the conservatorship was abolished in 1823. In 1831, the Indian Navy Board recommended the reestablishment of Conservatorship. However, the Madras Board of Revenue took no action on this. In 1838, the Board stated that if a Conservator of Forests was necessary, the control should be with the revenue officer and that they were not in favour of appointing another independent authority.

In 1842, the court of Directors suggested improvement of forests by the formation of teak plantations and this work was initiated by the then Collector of Malabar Mr. H. V. Conolly. Mr. Conolly estimated the average annual quantity of teak required for the naval dockyard at Bombay on the supposition that one vessel was constantly under construction for which 6000 candies* (about 2000 trees) of timber was required. He recommended the acquisition by Government 260 Sq. miles (673.4 Sq km) of forest to get 120,000 trees planted annually in succession over 60 coupes It was in the year 1840, that the Government first acquired on lease from Thrikkaliyur Devaswom an area of about 20 Sq. miles of forest with the object of getting sustained supply of teak.

In the initial stage, the technique of raising teak plantation was unknown. To get the seed germinated itself was a difficult task. The work of sowing and transplanting was undertaken during the monsoon of 1842, but the attempt was not successful. As a result, Mr. Smith who was in charge of the operation was dispensed with. Sergeant Graham who succeeded Mr. Smith resigned the job and as such the whole burden fell on Shri Chathu Menon, a subconservator at that time. He, with the help of Mr. Bates, the Head Accountant of the Collector's office managed to get a number of teak seedling raised and from 1844, the planting was carried out with better success at Nilambur. Mr. Chathu Menon started his plantation at an espacement of 7 feet (2.1 m) (Quincunx).

* (1 candy = 13 cft = 0.396 cum)

The great success of teak plantation in India must be ascribed to Messrs Conolly and Chathu Menon, who had undergone many hardships and great sacrifices to evolve a technique and make teak planting a success. Even as Collector of Madras, Mr. Conolly controlled the management of teak plantations of Nilambur as is evident from the frequent inspections and reports. Mr. Chathu Menon who was in charge of the plantations during 1844-'62, appears to have never left the plantation and seems to have kept excellent control over his subordinates and labourers. By 1876, 1255 hectares (3100 acres) of teak plantation had come into being in Nilambur.

The idea of planting teak in old Travancore was originated from Dewan, Raja Sir T. Madhava Rao. In his letter dated January 9, 1864 to the Resident Mr. Fisher, he pointed out the need for establishing teak plantations in Travancore as done by Mr. Conolly in Nilambur, to compensate for the large extent of denuded accessible forests. The Dewan's proposal became fruitful on 13th May, 1865, when teak planting commenced in Vemburam about 6.4 km (4 miles) from Malayattur. The planting of teak in Ariencavu was started during 1889-1890. The system of planting 4 months-old seedling from nurseries raised in dry weather was given up and instead nurseries were raised during monsoon and one year old seedlings were outplanted in the following year. With this change the plantings continued till 1891 when Bourdillon found that the seedlings were of large size and so he stumped them and planted at a distance of 1.52 × 1.52m over 1.2 hectare in Ariencavu. This marks a significant development in the technique of raising teak plantations.

From 1892-1893, the planting of teak began to be more regular and the execution of different works more systematic. This period might be regarded as the second stage of teak planting. This covered a period of 15 years from 1892-1893 to 1906-1907. During that time the necessity and importance of thinning in older plantations was realised and a set of rules framed for the guidance of the officials to carry out thinning.

A scheme was drawn up for regulating the thinning of various plantations. In 1907 Deputy Conservator, Mr. V. K. Govinda Menon, was put on special duty to prepare a report on the teak plantations of the state and draw up a working plan for the thinning to be carried out in all the plantations during the period of 10 years that followed.

From 1908 planting of teak entered the third stage of development. During this period the system of selling at site was introduced first at Ariencavu and then in other divisions. During 1916-1917 all the teak plantations in the state of Travancore were constituted into a separate division and Deputy Conservator, Mr. M. Velu Pillai was put in charge of the newly formed plantation division. He continued to be in charge of the division till 1918, and he was succeeded by Assistant Conservator Mr. P. Raman Pillai. During 1919-1920 the plantation division was abolished and the plantations in each division were entrusted to the respective Divisional Forest Officers

During 1921-1922 Mr. Velu Pillai conceived the idea of raising teak plantations under the taungya system. Though it was a failure initially, subsequent planting of 44.5 hectares (110.0 acres) at Kadiyar in Konni and 39.5 hectares (97.50 acres) at Cheyara proved a complete success in spite of initial uncertainities. Under the taungya system, the planting cost went down to a neglible level and moreover the plantations were better stocked and well weeded in early stages and the teak plants showed better growth. The introduction of taungya system in the planting of teak in the state was a significant event.

Division of Silviculture.

Teak Museum cum Study Centre

A study centre for teak under KFRI is nearing completion at Nilambur sub-centre. This will be developed as a centre of excellence for studies on teak. Information on any aspect of teak, specimens of teak wood of scientific importance etc. may please be sent to the Director, Kerala Forest Research Institute, Peechi-680 653, Kerala, India.

Autecological Studies in Forestry: An Appraisal

Ecology is a vast subject of wide applications in forestry. Knowledge of ecology is one of the components in forest management. The subject of ecology is generally distinguished into two disciplines, viz. autecology and synecology. Autecology is an analytical science that deals with the study of individual organism or species while synecology deals with communities.

The significance of ecological studies in forestry has been reviewed elsewhere. The aim of the present paper is to highlight the importance of autecological studies in forestry with special reference to Kerala.

There are three major areas where autecological researches can contribute significantly, viz. conservation, domestication and management.

Conservation is a measure by which species that are already on the verge of extinction or moving towards it are protected. Species acquire endangered and threatened status either due to habitat disturbance, over-exploitation or due to reproductive and regenerative imbalances.

Domestication of trees in large scale for wood is otherwise termed plantation forestry. Forestry research in the immediate future should oscillate more towards developing package of practices for our prospective indigenous species. Autecological studies can contribute significantly in domestication and artificial regeneration.

Management of forests, in the current sense is tilted more towards conservation. Autecology contributes to the silviculture of each species; it also influences the management practices.

Autecological Approaches

In essence, the autecological approach is a multidisciplinary approach to the problems of a single species. In relation to forestry, study of the following aspects are important.

Geography and Economic Ecology

For a proper planning it is necessary to have a general idea of how much volume of timber of each species is necessary to meet the states' requirement for the coming years. For this, the following informations are required: 1. the extent of demand of the species in terms of annual marketed volume, and 2. volume of annually extractable timber of the species. When the two pieces of information are compared it will be possible to deduce how much more of the species have to be raised. Quantitative data on tree species, especially the commercially important ones, is very important. Nevertheless, we do not have quantitative data of distribution such as the area inhabited by the species, the range of density, frequency, abundance, etc.

Socioeconomics

Studies on factors determining demand and price of the species, its sociological aspects such as availability in the market and to people dependent on the species for livelihood (example bamboos and reeds), the flow of the species within and outside the state etc. may be useful in developing appropriate administrative strategies.

Ecotaxonomy and Experimental Morphology

The importance of this study can be explained with an example. The genus *Mesua* is represented in Kerala by one or two species, viz. *M. ferrea* and *M. nagassarium*. *M. nagassarium* is generally considered to contain three or four varieties and one or two subspecies. Each of these morphotypes is characterised by distinct leaf and flower types. The above taxonomic considerations were made from a limited number of sample specimens obtained from occasional collections. No effort has so far been made to determine whether they are ecotypes or cytotypes having specific ecological preferences. If gap filling operations of the species is sought for, the ecological preferences of these morphotypes weigh considerably.

Environmental studies

The following environmental aspects are worth studying:

Physical features of site such as terrain, drainage, proximity of streams, depth of water table; physical and chemical properties of the soil; physiognomy of vegetation type including gaps in canopy; edaphic factors; and biotic factors such as soil microflora, pests, pathogens, predators, herbivory and human interferences.

Morphology and Morphogenesis

The necessity of these studies is dealt with in relation to the root. Roots are the organs that absorb water for the plants. The extent of roots that a species possesses, therefore, is a measure of its water absorbing capacity. The extent of roots in turn is dependent upon the morphology of roots. However, practically very little is known about the morphology of the roots in tropical trees.

In majority of the trees the original tap root at some stage of its metamorphosis either becomes rudimentary or gets totally eliminated. With the result, some of the sinkers derived from the lateral roots take up the function of the tap root especially in evergreens. In tropical trees, whether the sinker roots reach the water table and utilize it is not yet studied. If they do so morphogenetic studies of root metamorphosis and growth are of great importance.

Growth Studies

Measurements such as girth, height and age of trees are of importance in silviculture, for preparation of volume table and to determine: 1. the minimum girth for felling, 2. overmature trees, and 3. the span of felling cycles.

Physiology

In most plantation species raised for timber production considerable biomass is lost in the form of flower and fruit. If this reproductive growth can be manipulated in favour of vegetative growth, wood formation can be increased. A chemical method of suppressing reproductive growth in plantations of teak and other species may be very useful. Physiological studies of flowering and flower initiation are prerequisites in controlling generative growth.

Phenology

Broadly speaking, the seasonal changes of leaf and branch shedding, flowering and fruiting are the subjects of phenological studies. Characterisation of temporal aspects such as season, extent in terms of number of days and months, periodic aspects such as once in three years, once in four years and quantitative aspects such as intensity (density) and biomass produced by each of these phenomena are worth studying.

Quantitative phenological studies are useful for a variety of purposes. It helps to have a general idea about the role of the species in adding biomass to the soil, to determine the peak season of flowering and fruiting, and to identify the periodicity of good seed years.

Reproductive Ecology

The broader subject of reproductive ecological studies is categorized into three disciplines, viz. study of breeding systems, seed ecological studies and regeneration studies.

Breeding systems: The significance of the study of breeding systems can be well illustrated by taking a local example. Flowering and fruiting are very profuse in ***Lagerstroemia microcarpa*** throughout the areas of it's distribution in Kerala. Nevertheless, regeneration of the species is extremely poor. The failure is due to the absence of an embryo in the seed which may be due to pollen sterility, self incompatibility, absence of proper pollinators, meiotic abnormalities, inherent incompatibilities during embryogenesis or seed predators. ***Cynometra travancorica,*** a species of restricted distribution, is yet another example where seed set is not recorded and seeds are undescribed.

Seed Ecology: The following aspects of seed ecological studies are useful; units of dispersal (diapore), it's morphology (size, shape and weight), method of dispersal, agents of dispersal, dormancy, methods of removing dormancy, viability, pathogens, pests and predators, optimal conditions of growth etc. In addition, tropical seed ecology is totally handicapped in the absence of seed floras, identification manuals and efficient technical vocabulary for properly describing the seeds.

Regeneration Ecology

Regeneration is the process by which an exploited forest resumes the forest vegetation after a

period. When regeneration occurs through natural means, the process is termed natural regeneration. When it is effected by external agents like man, it is termed artificial.

A first hand knowledge of the pattern of natural regeneration of individual species is necessary. Quantitative relations between number of seeds, seedlings recruitments (poles) and mature (extractable) and overmature trees in the stand, would give a statistical picture of the pattern of regeneration. Estimation of mortality percentages in various stages of growth can help in decision making on cultural operations that are to be done to optimse restocking.

Artificial regeneration is the method of restocking in plantation forestry. So far plantation trials were made only for a few species. Many of our moist deciduous and wet evergreen species are potential plantation species. Package of practices for these prospective species are yet to be evolved. Methods of raising enough number of propagules, developing convenient propagules and standardisation of nursery, transplantation and silvicultural techniques are to be attempted.

Synecology

Synecological aspects of individual species in natural systems provide information for the benefit of plantation forestry.

In natural communities of two or more species, 'interference' between species exists. The result of these interferences can be deleterious when allelopathy and difference in growth rate prevail. Such interferences can also operate in mixed plantations. Studies of positive and negative associations for the species in different soil and forest types are good pieces of study that can guide: 1. in prospecting the possible areas for raising plantations of the species, 2. in determining the species that are to be or not to be mixed planted with the species in question, 3. in what proportions the mixed plantings are to be done, 4. to determine the feasible optimum proportion of a species in a mixed planting, and 5. to determine the feasible variants of proportions for different site specificities.

Genetic Improvement

Genetic improvement of some of our plantation species have been attempted. However, studies on genetic variability, selection and breeding for better and disease/pest resistant genotypes are totally lacking for otherwise potential taxa. ***Vateria indica - V. macrocarpa*** complex, ***Dipterocarpus bourdilloni - D. indicus*** complex, ***Mesua nagassarium - M. ferrea*** complex, ***Dysoxylum malabaricum - D. ficiforme*** complex, ***Dalbergia sissoides - D. latifolia*** complex etc. with closely related species or intraspecific taxa represent gene pools of high variability where breeding attempts may also be fruitful.

Utilization

With the advancement of technology in the latter half of the 20th century, the spectrum of usable raw materials has enlarged considerably. Plywood, particle board, compressed wood, and chemical and radiation techniques have expanded the use of wood of all kind. Species of ***Diospyros, Parinarium, Ormosia*** and the like which were neglected or ranked 'secondary' have to be investigated in detail from the utilization point of view.

K. Swarupanandan
Division of Ecology,

"Trees mean water, water means bread, and bread is life."

— K. M. Munshi

Rural Institutions, Peoples' Participation and Social Forestry

Forest management in the country has traditionally adopted a protection-oriented approach. Large scale conversion of forests, particularly for extension of agriculture, has led to consider people as the enemy of forests. With the growing shortage of essential commodities like fuelwood, fodder and green manure, the pressure on forests has increased, resulting in serious ecodegradation. The traditional response to this is to strengthen the protection outfit. But such an approach only helps to transform a socio-economic problem to a law and order problem. The inappropriateness of this has become evident and the need to meet the basic needs of the people as an essential pre-requisite for environmental protection has been recognised. Social forestry programme being implemented throughout the country is a direct outcome of this.

Like any other developmental activity, social forestry falls in the realm of political economy, and technical developments have to be dove-tailed to socio-political imperatives. Traditional forestry was primarily undertaken in reserve forests and the focus was on meeting urban/industrial demand or to ensure protection to realise some of the environmental benefits. Institutions and technologies have been developed and evolved to fulfil the above objectives. Centralised production to cater to the national and regional demands have favoured the development of large heirarchical institutions, and peoples' participation in forestry was considered unimportant. Such an approach, is, however, unsuitable for social forestry.

Objectives of Social Forestry

Most definitions on social forestry tend to be unduly restrictive and fails to convey its full implications. Importance of trees and forests has been well recognised in traditional land use and forestry and agriculture were well integrated. The main objective of social forestry is to strengthen this linkage at the farm, village and regional levels. At the farm level, social forestry focuses on integrating tree cropping with agriculture, and takes the form of farm forestry. Direct economic benefits in the form of fuelwood, green manure, fodder etc. are the main focus of farm forestry. At the village and regional levels social and environmental objectives become as important as the economic objectives. Inequalities in the distribution of income affects the access of the rural poor to basic needs goods like fuelwood, fodder, etc. In such a situation common property resource like forests tend to be exploited far beyond their recuperative ability, causing degradation. Social forestry aims to fulfil the felt needs of people and thereby protect the environment also.

Social forestry is proving more difficult to implement than was thought initially. Most of the problems are primarily institutional. People's problems and priorities have not always been properly identified. Technologies based on traditional approaches are attempted to be thrust upon, ignoring the socio-economic conditions. A critical examination of the institutions and technologies adopted in social forestry is necessary to reorient the programme as a true people's programme.

Institutional Framework

As such the two main institutions involved in social forestry, particularly farm forestry, are (i) the forest department and (ii) the individual farmers. The former acts as a source of technical support, through supply of seedlings, information on planting and aftercare, and other technical aspects while the latter is the main agent for the actual implementation of the programme. Successful implementation depends on the compatibility of the information push approach of the department and the demand pull from those who implement the programme. Interestingly, the desired identity between the two seldom occurs. Departments implementing plans and programmes in a top down manner tend to focus on fulfilling financial targets, or incorrectly defined physical targets like number of seedlings distributed. Social and economic conditions of land owners vary considerably, and a standard approach fails to perceive the subtle differences in the pattern of demand pull. Thus, supply

of eucalypt or matti *(Ailanthus triphysa)* may not be appropriate in a situation where there is a severe shortage of fodder and green manure, whereas in an area where cottage scale match industry is well established, matti will be the most preferred species. Similarly, an absentee land owner may prefer to plant eucalypts while a small farmer would like to introduce species with multiple end uses. Socio economic environment in which an individual land owner operates varies considerably, and the traditional departmental approach tend to be inflexible to accommodate such differences.

An evaluation of the social forestry programme in India indicates that farm forestry has been relatively successful in areas where the programme is oriented to specific demands. While there are criticisms against the large scale conversion of agriculture land to eucalypts in states like Gujarat, Uttar Pradesh, Haryana and Maharashtra, the performance is directly linked to the enthusiasm evinced by the farmers. Big farmers have been a convenient target for target-oriented social forestry. Whether the achievement of physical target is a sufficient condition to fulfil social objectives is a moot question.

The bio-physical diversity coupled with the socio-economic complexity of Kerala necessitates a different approach which is more responsive to subtle differences between regions, villages and farms. There is a need to develop appropriate institutions at the village and block level which will be in a better position to effectively respond to the varying requirements.

Institutional problems are much more serious in respect of implementing social forestry programmes in common land, particularly road and canal sides, village and community land and even forest land. In most cases common lands support limited resource use. Increasing pressure has led to severe degradation resulting in a drastic reduction in their carrying capacity. Two important, but related issues in social forestry programme in common land are (i) how people's involvement can be ensured in reclothing the area and maintaining it under optimal levels of productivity and (ii) how benefits from social forestry will be distributed.

In the absence of people's involvement in community forestry, invariably it is undertaken as a departmental programme. This is an extremely costly approach, and the requirement of staff, vehicles, etc. tend to be prohibitive. Further, protection continues to be a problem, as symbolised by the extensive barbed wire fencing. Problems also arise at the stage of distribution of benefits, which as such has been conveniently ignored. A mechanism need to be developed to identify the neediest and to make the resources available to them. Failure in this respect would necessitate distribution of the produce through the market mechanism.

Technological Issues

Implementation of social forestry raises several technological issues. For the involvement of people, it is necessary that technologies adopted are simple and adaptable to the local situation. Technologies however, develop under given historical conditions, and there is a close link between institutions and technologies. For example, the Forest Department is familiar with the silviculture and management of plantations and the technology has certain specific characteristics like single species orientation and the large scale operations. The focus of research has also been directed towards efficient management of large scale plantations. Such a technology has little relevance in the context of farm forestry, especially of the type adopted in our conditions. Homesteads in Kerala are characterised by intensive cultivation of a mixture of species of herbs, shrubs and trees. Each cultivator knows the subtle differences in the micro environmental conditions, and species are introduced in a judicious manner. Obviously the Forest Department's package of practices stipulating spacing, method of planting, weeding and aftercare may not be quite suitable to the cultivator. There is, therefore, an urgent need to develop practices which can be implemented by people without much support.

Interestingly, the whole problems of growing and tending plants in mixtures has been neglected, while a lot of attention has been given to raising seedlings in nurseries. The latter is less complicated, while the former requires a thorough understanding of the species-environment interaction.

A study of the existing practices of raising tree crops in the homesteads in Kerala clearly reveals the need for people oriented techniques. Techniques for cultivation of most of the commonly available indigenous species are known to people. Raising seedlings and their planting are highly decentralised requiring little help from any of the organised agencies. Social forestry should strive to support and promote the development of such techniques. However, the present emphasis on exotics tend to undermine the development of local technology. No doubt,

exotics should not be rejected purely because they are exotics. It is necessary to study the comparative costs and benefits, not only from the point of view of the direct economic benefits, but also from the point of adaptability of the technology. Many of the exotics that have been introduced into Kerala have ceased to be exotics mainly because they have fulfilled a felt need and people have been able to adapt the technology easily. Social forestry programme should give considerable importance to development of appropriate tcehnology and its transfer to people. Without this, social forestry is unlikely to develop as a self-sustainable programme.

Future Options

Obviously if social forestry has to succeed and fulfil its objectives, considerable institutional and technical issues have to be resolved. The compartmentalised approach to development planning should be discarded and a mechanism for integrating the activities of the various agencies should be evolved at the panchayat, block and district levels. Within the rural administrative set up forestry cells should be established and these cells should be responsible for the preparation and implementation of forestry programmes including social forestry.

The most important step in evolving appropriate technologies for tree planting involves the establishment of village level nurseries with the involvement of schools, co-operative societies and such other institutions. If the focus is on indigenous species, techniques are readily available and the local people will be in a position to develop new techniques with adequate support from extension agencies and research institutions Seedlings should be available for planting as and when required, and it should be available close to the planting area. This can be achieved only through a highly decentralised system of production and distribution of seedlings.

As indicated earlier, now there are no viable institutional set up to promote social forestry as a peoples' programme. Although the need for growing trees is well recognised, this has not taken place largely due to social and economic factors. It is necessary that the situation that exists in each area is studied thoroughly and constraints are identified. Only local level organisations will be in a position to understand the specific problems and respond with appropriate solutions.

Social forestry now being implemented has created considerable awareness among the people on the importance of tree growing. Rather than sticking on to what is stipulated in project documents, it has to evolve as a people's programme. There is an urgent need to develop appropriate rural institutions which are able to take over the functions of the forest department. Otherwise, social forestry will continue to be a departmental programme defeating the very purpose for which it has been initiated. Solutions are not easily perceivable, but it is precisely here the challenge of social forestry lies.

Conclusion

Success of social forestry will depend upon developing appropriate rural institutions which will be able to make social forestry a people's movement in all respects. Technologies for producing seedlings, their planting and after care should be developed and adapted to suit the varying requirements. It should be a self-sustaining programme not dependent on massive financial inputs from external agencies. Considering the long tradition of tree growing in Kerala, it is not at all difficult to evolve a social forestry programme appropriate to our conditions. There should be a broad based debate on what is appropriate for us, and programmes should be chalked out based on a consensus.

C. T. S. Nair
Director

"The earth has enough for everyone's need. But not for everyone's greed."

— Mahatma Gandhi

Prospects of cane plantations - Malaysian experience

Reduction of area under forests coupled with the over exploitation in easily accessible areas has resulted in the depletion of cane resources. The only viable solution to minimise the wide gap between demand and supply is to raise large-scale plantations. Although experimental cane plantations have been raised in Andamans and West Bengal, no attempt has been made so far for cultivation on a commercial scale in India. Reports from Indonesia, Malaysia and China show that large-scale trial plantations are being established in these countries. During the colloquium on rattan propagation, organised by the International Development Research Centre (IDRC), Canada, at Sabah (East Malaysia) in January 1987, the author visited some of the rattan plantations raised by Sabah Forest Development Authority (SAFODA). Rattans are planted under logged over rain forests (Fig. 1).

Fig. 1. A view of the forest where rattans are planted.

Kinabatangan rattan project was initiated in 1978 with the following major objectives: (i) to increase cane resources (ii) to have better land development with minimum disturbance to land and water (iii) to earn substantial foreign exchange (iv) to support cane processing and manufacturing industries and (v) to provide rural employment. Initially the planting was carried out with two species, *Calamus caesius* and *C. trachycoleus;* both are pencil-thick canes. The major planting area is on the banks of the Kinabatangan, the longest river in Sabah. After a severe flooding in 1979 which lasted for about 40 days, *C. caesius* suffered 100% mortality. However, 85% of *C. trachycoleus* seedlings survived. At present, of the 5000 ha of rattan plantations on the banks of the Kinabatangan river, 3800 ha is of *C. trachycoleus* and 1200 ha of *C. caesius;* the latter is planted on hilly areas which are not subjected to frequent flooding. Besides the ability to withstand submersion *C. trachycoleus* has another advantage for better establishment because in addition to suckers, it produces aerial structures known as stolons. The stolons spread above ground and produce branches that develop to stems; root formation is also observed when they come in contact with soil (Figs. 2and 3).

Over the years, SAFODA has standardised the planting technique for *C. trachycoleus* and the

method is as follows. Planting operations start with the field preparations. During field preparation the area is surveyed and divided into blocks, each block varying in size from 20 to 40 ha. The undergrowth is removed completely (underbrushing) to facilitate the lining operations. Lines are marked 9.14 m apart from east to west; a compass is used to ensure the direction (lining). Planting lanes of 2m wide are cleared of all the undergrowth upto 15cm height and slash removed. Each planting lane is 7.14m apart (espacement 9.14 x 2.13 m). Staking is done at 2.13 m apart and 40 cm away from one edge of the planting lane. This provides a wider inspection path, helps canes to climb easily on the trees, and minimise the damage from wild animals, especially elephants. Planting holes with a depth of 22 cm and a diameter of 15 cm are made using a curved digger. Care is taken to ensure that the seedlings are watered well before transporting from nursery to the planting site. For planting, one side of the polythene bag is slit carefully, seedlings are placed in the pits and covered with soil. If the seedlings are planted too deep, it reduces the suckering capacity. Seedlings that fail to establish are replaced after three months. Weeding is carried out at 5 and 12 months interval after planting. After six months, when the seedlings establish, tree canopy is thinned to allow 40 - 50% light and this operation is repeated every year when the canopy closes again. Other than floods and drought, the major damage to seedlings is from wild animals especially elephants. SAFODA had to erect an electric fence to keep these animals away. Harvesting is not yet started in these plantations.

Fig. 2. *Calamus trachycoleus* — root formation on the stolon.

Fig. 3. *Calamus trachycoleus* — formation of a new branch on the stolon.

The success of SAFODA with the Kinabatangan rattan project indicates that if a concerted effort is made it is not impossible to conserve this valuable forest resource and exploit it commercially in India also. Although SAFODA has standardised the nursery and planting techniques they emphasise that further research is required on various aspects like better harvesting technology, physiological and genetical factors affecting growth and also an assessment of yield from plantations.

Both *C. caesius* and *C. trachycoleus* do not occur in India, but an initial trial to introduce the former in Assam and Kerala indicated that this species can survive here. It will be worthwhile to introduce other superior quality Malayan canes such as *C. manan, C. scipionum* and *C. trachycoleus*.

Further reading :

Basu, S. K. 1984. The present status of Rattan palms in India, Proceedings of Rattan Seminar, 2-4 October, 1984, Kuala Lumpur, Malaysia. IDRC, Ottawa, Canada.

Shim, P. S. 1987. Outplanting techniques of *Calamus trachycoleus*, Paper presented in Colloquium on Rattan propagation, problems and challenges, 19-22nd January, Sabah. IDRC Ottawa, Canada.

K. K. Seethalakshmi
Division of Plant Physiology

Wood - Some Common Queries - V

1 What is the difference between grain and texture? What is cross-grained wood?

Many use 'grain' and 'texture' interchangeably although their meanings are different. Texture refers to the finer structure of the wood. Wood having small and closely spaced pores, such as ebony, white cedar, manja-kadambu, is called fine textured. Wood with large pores, such as kunnivaga, karumaruthu, is called coarse-textured.

Grain refers to the direction, arrangement or appearance of the fibres in wood. When the fibre alignment does not coincide with the longitudinal axis of the piece of wood, the wood is said to be cross-grained. Any form of cross-grain, such as curly, spiral, wavy, interlocked and combinations of these which occurs in structural timber is a defect, and the strength will be less. However, because of the figure that is produced in peeling or slicing, it has decorative value.

2 What is the chemical composition of wood?

Wood is made up of the following chemicals: cellulose, lignin, hemicelluloses, extractives and ash-forming minerals.

Cellulose is the major constituent of wood comprising nearly 50 percent of wood substance by weight. The intimate association of cellulose with lignin and hemicelluloses imparts to wood its useful physical properties. Cellulose is the basic raw material for paper, rayon, films, lacquers and explosives.

Lignin comprises 23 to 33 percent of softwoods, but only 16 to 25 percent of hardwoods. As a chemical, lignin is an intractable, insoluble material. To remove it from the wood on a commercial scale requires vigorous reagents, high temeratures, and high pressures. One sizable commercial use for lignin is in the formulation of drilling muds, used in the drilling of oil wells, where its dispersant and metalcombining properties are valuable. It has found use also in rubber compounding and as an air-entraining agent in concrete mixes. Lesser amounts are processed to yield vanillin and solvents such as dimethyl sulphate and dimethyl sulphoxide.

Hardwoods contain an average of 20 to 30 percent hemicelluloses with xylose as the major sugar. Softwoods contain an average of 15 to 20 percent hemicellulases, with mannose as the main sugar unit. The hemicelluloses play an important role in fibre-to-fibre bonding in the paper making process.

Unlike the above major constituents of wood, the extractives are not part of the wood structure. However, they do contribute to properties such as colour, decay resistance, density, flammability, etc. They include tannins and other poly-phenolics, colouring matters, essential oils, fats, resins, waxes, gums, starch and simple metabolic intermediates. They can be removed by exraction with solvents like water, alcohol, acetone, benzene and ether. The extractives may range from 5 to 30 percent in weight of wood substance.

Ash-forming minerals comprise 0.1 to 3 percent of wood substance. Calcium, potassium, phosphate and silica are common constituents.

3 Is there any process to make wood water-resistant?

Paints, varnishes, lacquers and wood-penetrating water repellents will be able to retard the rate of moisture absorption. However, to make the wood water resistant, a bulking agent should be deposited within the wood cells. Highly water-soluble, thermosetting, cell-penetrating phenol-formaldehyde resins are the most successful bulking agents used. In this method, the wood is soaked in the aqueous phenol-formaldehyde resin solution or, if air-dry, is impregnated with the solution under pressure until the resin content eqals 25 to 35 percent of the weight of dry wood. The resin containing wood is dried at low temperatures to remove the water and then heated to higher temperatures under compression (compreg) or without compression (impreg) to set the resin. Although resins are deposited in the cell walls, compreg will be more water-resistant than impreg because the free lumen space will be reduced considerably beause of compression.

Another chemical commonly used is polyethylene glycol-1000 (PEG). This also will bulk the cells. The main drawback is that PEG will still remain water soluble and cannot be further cured. Above 60 percent relative humidity, treated wood will become sticky, if not properly protected.

A better method to make wood water-resistant is to impregnate it with certain liquid vinyl monomers that do not swell wood and then to polymerise it by gamma radiation or by catalyst heat systems. However, this method is quite expensive. Another method to reduce the accessibility of water to wood is by acetylation. In this method, the active bonding links of the microfibrils of the cell wall are made much less attractive to water by substitution with acetyl groups.

4 What is the effect of metals on wood?

A common example of the deterioration of wood in contact with metals is that which occurs when wood is in contact with rusting iron. The amount of deterioration varies with the moisture content of wood. The acidic nature of most woods contributes to the rate of corrosion of metals in contact with wood and, by increasing the solubility of the primary corrosion products, may accelerate the degradation of the wood itself.

Salt-type preservatives which become fixed in wood do not cause corrosion problem, in general. However, preservative salts that do not become insolubilized in wood and salt-type fire retardants cause serious corrosion of all metals whenever the the moisture content of the wood exceeds 15 percent.

5 Is the retention of chemicals different for woods to be used indoors and out-doors?

Yes. Woods to be used indoors need to have only low retention compared to high retention for woods used outdoors. Please refer to the Indian Standard IS: 401-1982 'Code of practice for preservation of timber' for the levels of retention recommended for different end-uses.

6 Will the strength of wood treated with fire-retardant chemicals be reduced?

To ensure fire protection, large amounts of flame retardant chemicals must be impregnated into wood. As most of the fire-retardant chemicals are hygroscopic, treated wood will pick up water under humid conditions and strength will decrease with increasing moisture content In some circumstances, strength reduces by 20 percent. However, strength of treated timber will not deteriorate with time.

7 Some decayed wood look brownish and some whitish. Why is this difference?

Wood decay fungi are generally classified into three categories: white rots, brown rots and soft rots. White rot fungi utilise all the major wood components including cellulose and lignin and the wood gets bleached. That is why the wood looks whitish. In the case of brown rot fungi, they utilise the cellulose and not lignin. However, the fungi turn the colour of lignin into slightly brownish and hence the name brown rot. They produce a crumbling type of decay. Soft rot fungi penetrate the secondary wall and contact within the cell wall creating cavities. Hardwood species are more readily attacked by soft rot fungi than soft woods (conifers). They attack wood with very high moisture content. The surface of wood attacked by soft rot fungi usually exhibits cubical checking pattern.

8 Wood from the central portion of certain trees seems to be very weak. Is this observation correct? Will the strength of wood be affected by growth stresses?

When a tree is growing, the new cells formed from the cambium are laid down under tension and this induces a compressive stress on the wood in the centre of the tree. In many species the natural compression strength of the wood is high enough to withstand such growth stresses, but in certain fast-growing species, this is not the case and compression failure occurs in the centre of the tree extending upwards and outwards for about one third of the way. This zone is known as brittleheart. Growth stresses cause shakes and star checks in logs. Brittleheart will have low strength value, particularly in impact bending.

R. Gnanaharan
Division of Wood Science

Recent Publications

Balagopalan, M and Alexander, T. G. 1985. Soil organic carbon distribution along transects in Teak and Eucalypt plantations. J. Tree Sci., 4(2) : 13-20.

ABSTRACT

This study was initiated to evaluate organic carbon (OC) changes along transects in teak and eucalypt plantations in relation to natural forests. A decline in OC level occurs in teak plantations of Karulai sequence and this is attributable to plantation operations in the early stages of second rotations. Eucalypt plantations at Kadasseri have relatively lower contents of OC than that of natural forest and the trend at Tirunelli is opposite. At Tirunelli, well-established root systems of seedling trees and the addition of branches, twigs and leaves after coppicing promote accumulation of OC.

Balasundaran, M. and Gnanaharan, R. 1985. Natural decay resistance of *Vitex altissima* Linn, F. J. Ind. Acad. Wood Sci., 16(2) : 75-77.

ABSTRACT

Vitex altissima was tested for its natural resistance against five decay fungi, three white-rotters and two brown-rotters, adopting accelerated laboratory test. The wood of *V. altissima* is highly resistant. Though the test fungus *Gloeophyllum trabeum* was highly virulent against the reference blocks of *Bombax ceiba*, it caused the least weight loss in *V. altissima*. *Polyporus versicolor* caused the maximum weight loss. The density of *V. altissima* varied from 620-830 kg/m^3. This points out that the amount of extractives present in the wood also may vary considerably resulting in different response to different fungi.

Gnanaharan, R 1886 Anti-sapstain chemicals for diffusion treatment of rubber wood. Int. Research Group on Wood Preservation Document No. IRG/WP/3367, 5p.

ABSTRACT

Performance of Sinesto B and Akzo EN494, two formulated products of alkyl ammonium compounds, was tested as fungicidal additive in boron solution to control mould and stain during diffusion storage of rubber wood. Sinesto B at 2% (a. i.) concentration has given good control over mould and its protection against sapstain was only satisfactory. Akzo EN 494 at 0 7% (a. i) concentration has given good performance against both mould and sapstain. These two chemicals have potential to replace soidum pentachlorophenoxide used for the purpose.

Indira, E. P. and Koshy, M. P. 1986. A report of monohybrid ratio for albino expression in *Bambusa arundinacea* (Retz.) Willd. Curr. Sci. 55(19) : 993-994.

ABSTRACT

During the studies on progency trial in *Bambusa arundinacea* (Retz.) Willd., albinos could be noticed in two out of thirteen families, which segregated in a simple Mendelian ratio of 3:1. The use of the albino gene carriers for monitoring the degree of natural selfing is discussed.

Mathew, G. 1985. Variations in the wing venation of *Pteroma plagiophleps* Hampson (Lepidoptera, Psychidae) J. Res. Lepid. 24(4) : 359-363

ABSTRACT

Studies on the wing venation of *P. plagiophleps* Hamp., (Psychidae) collected from different host plants and localities in Kerala State (India) have revealed the occurrence of 6 types of venational patterns in that species. Most of the observed variations related to the forewing veins 4 and 5, 8 and 9, 11 and 12. Three of these venational patterns agreed with the venation described for the species *P. plagiophleps*, *P. dealbata* Dierl and *P. postica* Sonan respectively. The study reveals the unreliability of using venation for the segregation of species belonging to the genus *Pteroma*.

Mohanan, C. and Sharma, J. K. 1986. *Bipolaris spicifera* and *Exserohilum rostratum* causing leaf spots of *Eucalyptus tereticornis* - new record from India. Curr Sci. 55(19) : 990-992.

ABSTRACT

Foliar infection of *Eucalyptus tereticornis* seedlings caused by *Bipolaris spicifera* (Bain) Suhram., anamorph of *Cochliobolus spicifer* Nelson and

Exserohilum rostratum (Drechsler) Leonard and Suggs, anamorph of ***Setosphaeria rostrata*** Leonard are reported for the first time from India.

Mohandas, K. 1986. A new host record for the teak defoliator, ***Hyblaea puera*** (Lepidoptera: Hyblaeidae). Curr. Sci. 55 (23): 1207-1208.

ABSTRACT

Vitex altissima (Verbenaceae) is newly recorded as a host plant of *H. puera*, an important defoliator of ***Tectona grandis*** (Verbenaceae).

Mohandas, K. 1986. ***Brachymeria excarinata*** (Hymenoptera: Chalcidae) as pupal parasitoid of ***Calopepla leyana*** Latr. in Kerala, India, a new record. Entomon. 11(4): 279-280.

ABSTRACT

Brachymeria excarinata Gahn is newly recorded as a pupal parasitoid of ***Calopepla leyana*** Latr. (Coleoptera: Cassididae) a pest of ***Gmelina arborea*** (Verbenaceae).

Muktesh Kumar, M. S. and Manilal, K. S. 1986. Morphology and anatomy of ***Satyrium nepalense*** Don. J. Plant Anat. Morph. 2(2) : 59-62.

ABSTRACT

The anatomy of the flower of ***Satyrium nepalense*** Don is described in detail. The median trace of the labellum gives off two branches laterally which traverse downwards to supply the two spurs in this species, in contrast to the observations recorded by earlier workers. No evidence is found to support the earlier assumption that the ovary has an outer ring of three fertile carpels and an inner ring of three sterile carpels. The similarity of this species to monandrous orchids is not confined to the pollinial structure alone. The structure of its vascular supply to anthers and other perianth parts is also typically that of the latter.

Muktesh Kumar, M. S. and Sasidharan, N. 1986. Endemic Orchids of South India. J. Econ. Tax. Bot. 8(2) : 265-269.

ABSTRACT

An enumeration of 91 species of orchids endemic to South India is given. Three genera ***Diplocentrum***, ***Proteroceras*** and ***Smithsonia*** are found to be exclusive to South India. Need for further exploration and conservation of these valuable orchid wealth is emphasised.

Nair, K. K. N. 1986. An amended description of ***Dalbergia beddomei*** Thoth. (Fabaceae) relocated from Silent Valley, Kerala. J. Econ. Tax. Bot. 8(1) : 242-245.

ABSTRACT

This highly endemic species was first described in 1983 based on a collection of it made in 1885. Subsequently it was collected by the author from Silent Valley, Kerala, its type locality, during 1985. The paper provides an amended description of the species with illustrations and notes on its phenology and ecology.

Renuka, C. 1986. Distribution of canes in Kerala and the need for their conservation. Jour. Indian Bot. Soc., 65 (Suppl.): 54 (Abstr.)

ABSTRACT

Ten species of ***Calamus*** have been recorded from Kerala forests which include 2 new species and a new record to Kerala. Distribution of canes in the Kerala forests and the present status of their availability are discussed. With the increasing demand for cane products and destruction of the primary forests, the natural supply of this important forest product is fast diminishing. Conservation measures to be taken, both *ex situ* and *in situ* are suggested.

Renuka, C. and Manilal, K. S. 1986. Anatomy of the rattan flowers. RIC bulletin 5(2) 1-3, 8.

ABSTRACT

The floral anatomy of ***Calamus*** is distinct from that of other groups of palms. The male receives more vascular traces than the female flowers, which is contrary to the general condition in palms. The ventrals of the adjacent carpels are completely fused together showing the extent of carpellary fusion. Vascular supply to the three ovules arise from a central vascular complex. While the well developed staminodes are vascularised, the fully developed pistillodes show no vasculature. The species show a mixture of primitive and advanced floral anatomical characters, pointing to the distinctiveness of the group.

Sankaran, K. V., Balasundaran, M. and Sharma, J. K. 1986. Seedling diseases of ***Azadirachta indica*** in Kerala, India. Eur. J. For. Path. 16(5-6) : 324-328.

ABSTRACT

Occurrence of four diseases of foliage viz. two leaf spots, one leaf blight and a web blight caused by ***Colletotrichum capsici***, ***Cercospora subsessilis***, ***Sclerotium rolfsii*** and ***Rhizoctonia solani*** respectively and one each of stem (stem rot by ***S. rolfsii***) and root (wilt by ***Fusarium solani***) are reportod for the first time on seedlings of ***A. indica*** from Kerala, India.

Sankaran, K. V. and Sharma, J. K. 1986. ***Hydnum subvinosum,*** a rare parasite on ***Leucaena leucocephala*** in India. Trans. Brit. Mycol. Soc. 87 (3) : 401-405.

ABSTRACT

Hydnum subvinosum, a rare hydnoid fungus reported for the first time from India is redescribed and illustrated. ***H. subvinosum*** causes a serious stem canker disease of ***Leucaena leucocephala*** in Kerala, India.

Sasidharan, N. 1986. On the rediscovery and distribution of five endemic and endangered taxa in Kerala. Jour. Indian Bot. Soc., 65 (Suppl.) : 51 (Abstr.)

ABSTRACT

Five endemic and endangered species, namely ***Piper barberi*** Gamble, ***Syzygium travancoricum*** Gamble, ***Popowia beddomeana*** Hook. f. & Thoms, ***Morinda reticulata*** Gamble and ***Pothos armatus*** Fischer could be relocated outside their type localities in Kerala. Brief notes on their habitat and distribution is also provided.

Seminar, Congress, Workshop, Training

International

Shri P. S. Easa attended a training programme on Wildlife Conservation and Management, organised by the National Zoological Park, Smithsonian Institution, Washington, D. C., U. S. A. from 4th June to 8th August 1986.

Dr. K. Jayaraman attended the Forestry / Fuelwood Research and Development Workshop organised by the Winrock International Institute for Agricultural Development and the USAID at Bangkok from 24-27 September, 1986.

Dr. C. T. S. Nair attended the MAB - UNESCO International Workshop on Tropical Rainforest Regeneration and Management at Guri, Venezuela from 24-29 November 1986. He presented a paper entitled "Management of the tropical wet evergreen forests in India : A comparative account of the Silvicultural practices in Kerala, Andaman Islands and Assam".

Dr. K. S. S. Nair attended the 18th IUFRO World Congress at Yougoslavia from 8-14 September 1986 and presented two invited papers. 1. "Important insect pest problems of forest plantations in tropical India", by K. S. S. Nair. 2. "Population dynamics of teak defoliators" by K. S. S. Nair and V. V. Sudheendrakumar. The participation was made possible by a grant from NORAD (Norvegian Agency for Development Co-operation) awarded through the IUFRO World Congress Secretariat. During this trip, Dr. Nair also visited Forest Research Institutions in U. K. on a visitorship granted by the British Council from 15-26 September, 1986.

Dr. K. K. Seethalakshmi attended the colloquium on Rattan propagation, problems and challenges from 19-22 January, 1987 at Sabah, Malaysia and presented a paper - Phenology and propagation of Calamus - their bearing on practical application, by C. Renuka and K. K. Seethalakshmi. The trip was made possible through financial support from IDRC (International Development Research Centre Canada).

Dr. K. Swaroopanandan participated in the Regional Training Workshop on the Ecology and Conservation of Tropical Humid Forests of the Indo-Malayan Realm at Colombo, Sri Lanka during 17 February to 7 March, 1987 and presented a paper entitled "Regeneration problems in the wet evergreen forests in Kerala (India)". The participation was sponsored by MAB and world Heritage Convention.

Dr. R. V. Varma attended the International Symposium on Termitology on invitation from the Government of Andulusia (Spain) at Sevilla from 11-15

March, 1987 and presented a paper entitled- "Termite problem in Forest plantations and its control in India."

National

Dr. K. M. Bhat and Shri M. I. Mohamed Ali attended the Seminar-cum-demonstration regarding Semi-automatic Image Analysis organised by Leitz, W. Germany at Trivandrum on August 8, 1986.

Dr. P. Vijayakumaran Nair attended a training programme on Statistics for Biologists held at School of Biological Sciences, Madurai on August 12, 1986 and presented a paper-"Preparation of programmes for statistical analysis".

Shri. M. Balasundaran and Smt. Maria Florence attended the workshop on "Beneficial microbes in tree crop management", organised by CPCRI, Kasargode during 8-9 September, 1986 at Kasargode. Shri. Balasundaran presented a paper entitled "Effect of soil pH on root nodulation in ***Leucaena leucocephala***" by M. Balasundaran and M. I. Mohammed Ali. Maria Florence presented a paper entitled "Status of mycorrhiza in forest trees in India" by K. V. Sankaran and E. J. Maria Florence.

Shri P. S. Easa participated in the National Workshop on Conservation Biology organised by the Indian Institute of Science, Bangalore from 9-22 November, 1986.

Shri K. K. Ramachandran participated in the Field Workshop on Animal Census Techniques, conducted by the Wildlife Institute of India, Dehra Dun held at Sariska Tiger Reserve, Rajasthan from 17-20 November, 1986.

Dr. A. R. R. Menon participated in the 6th Annual Conference of Indian National Cartographic Association (INCA) held at the Centre for Earth Sciences Studies, Trivandrum from 24-26 November 1986. He also attended the National Symposium on the Biology and Utility of Wild Plants, held at South Gujarat University, Surat during 14-16 March 1987 and presented a paper entitled "Forest flora and conservation".

Dr. J. K. Sharma and Dr. K. V. Sankaran participated in the 14th Annual meeting of the Mycological Society of India and Seminar on Applied Mycology held on 26-27 December, 1986 at Poondi, Thanjavur. Dr. Sankaran presented a paper entitled "New record of ***Collybia leucocephaea*** from India and its association with decomposing ***Albizia*** leaf litter" by K. V. Sankaran and M. V. Mary.

Shri N. Sasidharan attended the 9th All India Botanical Conference held at C. A. S. in Botany, Madras University, Tamil Nadu during 28-30 December 1986 and presented a paper entitled "On the rediscovery and distribution of five endemic and endangered taxa in Kerala".

Dr. K. Balasubramanian and Dr. K. K. N. Nair attended the Workshop organised by the Department of Environment (DOE) at New Delhi from 12-13 January 1987, wherein Principal investigators of research projects funded by DOE participated. Dr. Balasubramanian reviewed the completed project, "Impact of selection felling in evergreen forests" and the progress of the ongoing project on the present ecological status of the proposed hydal project area in Pooyamkutty. Dr. K. K. N. Nair presented details of his completed project on ***Dalbergia***.

Dr. George Mathew participated in a Workshop on Strategies of Insect Pest Management in Coffee, Cardamom and Tea cropping systems organised by the Central Coffee Research Institute at Chikmagalore in January 1987 and presented a paper entitled "Cossid pests of plantation crops in India and the prospects of their management".

Shri K. H. Hussain attended a Workshop on computerisation of library operations held at Madras from 16-22 February 1987.

Research Reports

Nambiar, V. P. K., Sasidharan, N., Renuka, C. and Balagopalan, M. Studies on the medicinal plants of Kerala forests. K F R I research report No. 42. Final report of the project Bot. 01/1979. November 1986, 200 pp.

ABSTRACT

Medicinal properties have been reported for 529 plants that are found in the forests of Kerala. In this report the medicinal plants described are arranged in alphabetical sequence of the botanical name under respective plant's families. The families are arranged according to the system of classification

of flowering plants by Bentham and Hooker. The current botanical name is followed by important synonym (s), if any. The local name (s) and Sanskrit name (s) are also provided. The distribution of the plants in Kerala is given by forest types according to the classification of forest types by Champion and Seth. A brief description is provided to facilitate identification in the natural habitat. The medicinal properties and uses compiled from literature and the information obtained from tribals and Ayurvedic practitioners are given under separate heads. A glossary of medical terms used in the text is also provided.

Nair, K. K. N. Preservation of ***Dalbergia*** L. f. in Kerala by establishment of a germplasm bank. KFRI Research Report No. 43. Final Report of the Project Bot. 06/1983, 1986, 74 pp.

ABSTRACT

This is the final report of the project Preservation of ***Dalbergia*** L. F, (Fabaceae) in Kerala by establishment of a germplasm bank sponsored by the Department of Environment and Forests, Government of India. In this study, a total of 18 species and one variety of the genus ***Dalbergia*** is reported from the State. In the introductory part of this report, information on the taxonomic background of the genus is given in addition to details on geographical distribution, endemism, cytology, palynology, phenology, uses and conservation status of various taxa known from Kerala with specific recommendations on those which deserve protection measures for their continued survival. The taxonomic part constitutes a detailed systematic account of all the 19 taxa of the genus recorded in Kerala with their up-to-date nomenclature, revised descriptions, illustrations, distribution maps and details of distribution. Further, to facilitate easy identification of each taxon, a dichotomous key also is provided at the species level in the beginning of the systematic part.

Nair, K. S. S., George Mathew; Mohanadas, K. and Menon, A. R. R. A study of insect pest incidence in natural forests. KFRI Research Report No. 44. Final Report of the Project Entom 11/1983. December 1986, 28 pp.

ABSTRACT

Insect damage on trees was studied in representative natural forest in Kerala. Observations were made on 20 tree species in the moist deciduous forest (MDF) and 18 tree species in the evergreen forest (EGF). The study plots were situated at Peechi and Vazhani for MDF and Sholayar for EGF.

No major damage was observed although most trees had some insect associates causing occasional damage. Leaf feeding was the most common damage and it was noticed on all tree species, to varying degrees. However, loss due to insect feeding never exceeded 10% of the total foliage present at any particular time except in 4 species each in the two forest types. These exceptions were ***Grewia tiliifolia, Haldina cordifolia, Lannea coromandelica*** and ***Tectona grandis*** in the MDF and ***Anacolosa densiflora, Actinodaphne madraspatana, Cinnamomum verum*** and ***Litsea floribunta*** in the EGF; but even for these species the highest leaf loss was only 21%. Other types of damage, viz., sap-sucking, gall formation and stem boring were insignificant, except in ***Mesua nagassarium*** in the EGF, in which some trees were killed, apparently by a stem boring buprestid beetle.

A total of 85 species of insects were found on the 20 tree species studied in the MDF, of which about 60 per cent are new records on the respective hosts in India. Largely due to difficulties in observing and collecting, only 8 species of insects (mostly undetermined) were recorded from the 18 tree species studied in the EGF. These results indicate that a large part of the insect fauna of natural forests remain unrecorded.

The practical significance of the present findings is discussed. It is concluded that this study indicates the high-risk species for elimination from plantation trials but there is no guarantee that species that are at low risk in natural forest will be safe from pest problems in plantation.

Alexander, T. G., Sankar, S., Balagopalan, M. and Thomas P. Thomas. Soils in teak plantations of different site quality. KFRI Research Report No. 45. Final Report of the Project Soils 10/1984 March 1987, 17 pp.

ABSTRACT

Though there were a few soil studies in selected teak plantations of Kerala, none had been conducted specifically on soil properties in relation to site quality (SQ). This project restrict to six plantation transects of Arienkav, Mannarappara, Pothupara, Nellikkutha, Kurichiad and Begur area aimed to bring out the soil parameters influencing SQ.

Forth coming Events

3-5 April, 1987. Techniques for Wildlife Management, Lancaster, U. K.
Contact : Institute of Chartered Foresters, 22 Walker Street, Edinburgh EH 3, 37, HR, UK.

8-11 June, 1987. Reproductive Ecology of Tropical Forest Plants (MAB/IUBS Workshop), Bangi, Malayasia.
Contact : MAB Secretariat, 7 Place de Fontency, 75 700 Paris, France.

9-18 June, 1987. Development of Thinning Systems and Machines to Reduce Stand Damages, Garpenberg, Sweden.
Contact : H. Bryndum, Statens Forstilige, Klampenborg, Denmark.

24 July - 1 August, 1987 14th International Botanical Congress, Berlin, German Federal Republic.
Contact : Botanisches Museum Berlin, Dahlem, Konigin - Luise - Strasse 6-8, D-1000 Berlin 33, Federal Republic of Germany.

23 August - 2 September, 1987. Forest Seed Problem in Africa, Harare, Zimbabwe.
Contact : R. Seward, Forest Research Centre, P. B. No. HG 595, Highlands, Harare, Zimbabwe.

24-28 August, 1987. Forest Growth Modelling and prediction, Minneapolis, USA.
Contact : Alan R. Ek, College of Forestry, University of Minnesota, 1530 North Cleveland Ave, St. Paul, MN 55108, USA.

4-13 September, 1987. Human Impacts and Management of Mountain Forests, Mt. Fuji, Japan.
Contact : T. Fujimori, Forest Products Research Institute, PB No. 16, Tsukulea, Norin, Kenkyu Danchi-Nai, Ibaraki 305, Japan.

5-9 October, 1987. International Congress of Plant Protection, Manila, Philippines.
Contact : E. D. Magallona, Department of Entomology, College of Agriculture, University of the Philippines, Los Banos, Laguna 3720, Philippines.

17-25 October, 1987. Role of Forestry Research in Solving Social-Economic Problems in Himalayan Areas, Peshawar, Pakistan.
Contact : Director General, Pakistan Forest Research Institute, Peshawar, Pakistan.

23-29 October, 1987. International Symposium on Restoration of Degraded Ecosystems, Srinagar, India.
Contact : M. K. Wali, College of Environmental Science and Forestry, State University of New York, Syracuse, NY 13210, USA.

October, 1987. Management of Water and Nutrient Relations to Increase Forest Growth, Canberra, Australia.
Contact : R. Squire, South West Research Centre, Victorian School of Forestry, Creswick, Victoria 3363, Australia.

1-7 November, 1987. International Symposium on Tropical Mountain Slope Ecology and Management, Kathmandu, Nepal.
Contact : T. Younes, IUBS Secretariat, 51 led. de Montmorency 75016, Paris, France.

7-10 January, 1988. International Conference on Biological Control of Vectors with Predaceous Arthropods, Layola College, Madras.
Contact : Dr. P. Venkatesan, Organising Secretary, P. G. and Research Dept. of Zoology, Layola College, Madras 600 034.

February, 1988. 4th International Round Table Conference on Dipterocarps, Sakaerat Biosphere Reserve, Thailand.
Contact : Maury-Lechon, Laboratoire de Phanerogamie, Paris, France.

July, 1988. 18th International Congress of Entomology, Vancouver, Canada.
Contact : L. A Maund, C/o. British Museum (Natural History), Department of Entomology, Cromwell Road, London SW7 5BD, UK.

25-29 July, 1988. Symposium on Growth Regulators in Fruit Production, Summerland, Canada.
Contact : N. E. Looney, Research Station, Summerland, B. C. NOH IZO, Canada.

18-27 August, 1988. International Congress of Plant Pathology, Japan.
Contact : T. Kommedahl, Stakman Hall of Plant Pathology, 1519 Gorter Avenue, University of Minnesota, St. Paul, MN, USA.

In each transect of 500m length and 100m width, 100 x 100 m plots were marked and a group of dominant trees (5-7) identified. Measured top height of these trees and based on height attainable at 50 years, computed SQ. From a soil pit in the centre of these trees, collected 0-20, 20-40 and 40-60cm depth samples. Bulk density, gravel, particle-size separates, maximum water-holding capacity of unsieved soil, pH (20:40 water), organic carbon, exchange acidity and exchangeable bases analyses were done. The contents of sand, silt, clay, organic carbon, exchange acidity and exchangeable bases were adjusted for gravel content; and 0-60 cm soil parameters were composited from the 0-20, 20-40 and 40-60 cm depth values for relating to SQ.

Analysis of variance of one-way classification of age/SQ groups showed significant differences in soil properties among groups. Increase of gravel and exchange acidity and decrease of sand, silt, pH and exchangeable bases resulted in lower SQ along a transect and generally across transects. Bulk density, clay, water-holding capacity and organic carbon trends were inconsistent. In a multiple linear regression analysis, soil variables accounted for 31% of the variation in top height and age 63%. Partial regression coefficients pointed to the prominent effects of gravel, sand, pH and exchange acidity. Thus, the variation in SQ along and across the six transects was explainable in terms of soil parameters. Field attempts to enhance SQ, with due weightage to gravel, sand, pH, exchangeable bases and other relevant site parameters are implicated.

Campus News

Mr. K. C. Chacko, Jr. Silviculturist from sub-centre, Nilambur returned to the Head Quarters at Peechi. He successfully completed the Diploma Course in Forestry (1985-'86) from State Forest College, Coimbatore where he obtained the First Rank and also the Gold medal and other eight prizes for his outstanding academic performance.

Dr. V. V. Sudheendrakumar, Scientist, Entomology Division who was working at the Sub-centre, Nilambur, returned to the Head Quarters at Peechi.

Mr. T. Surendran (Division of Plant Physiology) and Mr. Mathew P. Koshy (Division of Genetics) were deputed to the University College of North Wales, Bangor, U. K., under Colombo plan for M. Sc. Course in Environmental Forestry for one year commencing from October, 1986.

The existing Divisions of Forest Economics and Statistics were merged and a new Division - Management Division - has been formed.

Dr. K. Jayaraman, Scientist-in-Charge of the Division of Management was deputed to the University of Georgia, U. S. A. for one year on a Ford Foundation Post doctoral Fellowship to work on stand modelling in mixed forests.

Mr. U. N. Nandakumar, Scientist, Silviculture Division was deputed to Diploma Course in Forestry (1987-88) at State Forest College, Coimbatore in January, 1987.

The computer system in KFRI is upgraded to a multiterminal system with three terminals. The present systems configuration is a follows-

Hardware

CPU - 512 K; Hard disc - 10 MB; Floppy disc - 800 x 1; Terminals - 3; Printer-132 column EPSON DOT MATRICX AND QUME LETTER QUALITY.

Software

FORTRAN IV; FORTRAN 77; COBOL; C; C BASIC; D BASE II; PASCAL AND WORDSTAR

KFRI Library is acquiring an IBM PC AT Compatible Computer with a high capacity hard disk storage and printer as the basic units of hardware required for computerising the information retrieval activities of the library. When fully developed, the system will be a net work of PCs which can provide on line access to information. The software developed for this purpose by UNESCO (CDS/ISIS Microversion) will be made available to the Institute by the Department of Science and Technology, Government of India. In addition to making available bibliographic information of documents available in the library, a data base on Indian Forestry literature will be built up gradually.

Under the ODA Book Presentation Programme, the library received as donation from the British Council, 169 books worth £ 3500.

KFRI has been recognised as a Research Centre by the Cochin University of Science and Technology and by the University of Calicut.

KFRI organised an inservice course for IFS Officers from 16-2-87 to 21-2-87. Twenty eight Officers, from eight States attended the course.

A creche has started functioning in KFRI Campus from 15th August 1986 onwards for the benefit of the children of the employees of the Institute.

During summer, frequent fires have been noticed in and around the KFRI campus. Volunteer fire fighting squads consisting of the staff members of the Institute were formed.

Joined KFRI Recently

Mr. P. A. Sulaiman	—	Office Assistant
Miss. Grace Andrews	—	Stenographer
Dr. P. Gopinathan	—	CSIR Pool Officer, Wildlife Division

Left KFRI recently

Miss S. Sobhana Amma — Stenographer

Visitors

Prof. M. G. K. Menon — 1-09-1986
Scientific Adviser to
Prime Minister and Member,
Planning Commission, New Delhi

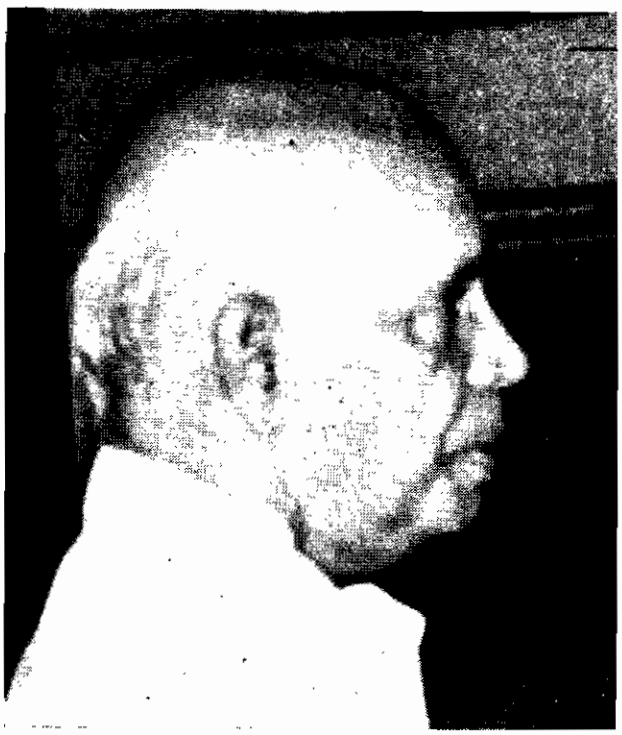
Dr. Manju Sharma — 1-09-1986
Chief, Science, Planning Commission
New Delhi

Justice Sivaraman Nair & — 19-09-1986
Justice John Mathew
Kerala High Court
(Visited KFRI Sub-Centre, Nilambur)

Mr. Charles Hatch Forestry Adviser, USA	16-10-1986
Mr. Karim Oka Project Officer, IDRC New Delhi	28-10-1986
Mrs. Sarala Gopalan Secretary, Govt. of Kerala Trivandrum	31-10-1986
Prof. A. M. Stuart Professor of Zoology University of Massachusetts, USA	15-12-1986
Mr. William Stewart Asst. Programme Officer Ford Foundation	15-12-1986
Mr. Alan Oswald (Rtd. Conservator of Forests, Madhya Pradesh) Australia	26-12-1986
Swami Renganadananda Sree Ramakrishna Ashram Hyderabad	26-12-1986
Prof. P. S. Ramakrishnan Jawaharlal Nehru University New Delhi	27-01-1987
Prof. L. Roche Professor of Forestry University college of North Wales Bangor, U. K.	12-02-1987
Hon. Justice V. S. Malimath Chief Justice of Kerala (Visited KFRI Sub-centre, Nilambur)	28-02-1987

A team consisting of Mr. R. V. Singh, President FRI, Mr. Narayan Singh, DIG of Forests and Mr. R. Srinivasan, Jt. Secretary, Govt. of India visited KFRI on 7-1-1987 in connection with the reorganisation of Forestry Research in India.

An expert team of FAO/Govt. of India consisting of five members visited KFRI on 31-3-1987 to draw up plans for reorganisation of Forestry Research in India.



Obituary

Dr. S. VASUDEV

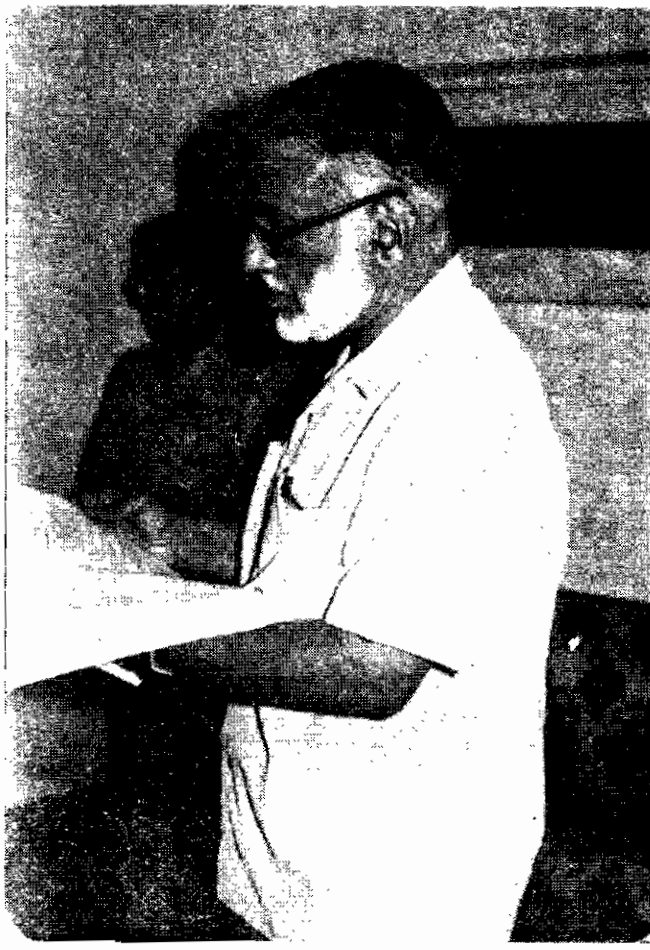
(1927-1987)

We record our deep sense of sorrow at the sad demise of Dr. S. Vasudev on 28th February, 1987 at Trivandrum. He was Principal of the Government Engineering College, Trivandrum and later became the Director of Technical Education. He succeeded Dr. K. I. Vasu as Chairman, State Committee on Science, Technology and Environment. Dr. Vasudev served as Chairman of the Executive Committee of KFRI for about five years. His contributions to the development of Science and Technology in the State will always be remembered.

We convey our heartfelt condolences to the bereaved family and pray that his soul may rest in peace.

DISTINGUISHED VISITORS

Hon. Justice V. S. Malimath Planting a tree at the KFRI sub-centre, Nilambur.



Prof. M. G. K. Menon

Shri. R. V. Singh, Shri. Narayan Singh and Shri. R. Srinivasan.

Swami Renganadananda

Recent KFRI Publications

Research Reports

No. 42. Nambiar, V. P. K., Sasidharan, N., Renuka, C. and Balagopalan, M. 1986. Studies on the medicinal plants of Kerala forests. Final report of research project Bot. 01/79. 200 pp.

No. 43. Nair, K. K. N. 1986. Preservation of *Dalbergia* L. f. in Kerala by establishment of a germplasm bank. Final report of the research project Bot. 06/83 (Study sponsored by Department of Environment and Forests, Government of India), 74 pp.

No. 44. Nair, K. S. S., Mathew George, Mohandas, K. and Menon, A. R. R. 1986. A study of insect pest incidence in natural forests. Final report of research project Entom. 11/83, 28 pp.

No. 45. Alexander, T. G., Sankar, S., Balagopalan, M. and Thomas, T. P. 1987. Soils in Teak plantations of different site quality. Final report of research project Soil 10/84, 17 pp.

No. 46. Renuka, C., Bhat, K. M. and Nambiar, V. P. K. 1987. Morphological, anatomical and physical properties of *Calamus* species of Kerala forests. Final report of research project Bot. 05/82, 58 pp.

Books

1 Eucalypts in India-Past, Present and Future. Proceedings of the National Seminar on Eucalypts KFRI, Peechi, 30-31 January, 1984, KFRI, 1986. 521 pp. Rs. 250/-.

2 Ecodevelopment of Western Ghats. Proceedings of the National Seminar on Ecodevelopment of Western Ghats, KFRI, Peechi, 17-18 October 1984, KFRI, 1986. 315 pp. Rs. 200/-.