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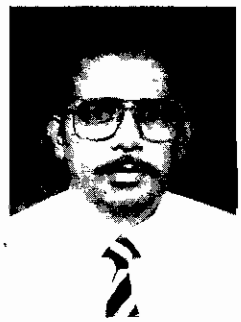
The Challenge to KFRI in the next decade

On the 3rd of July 1995, KFRI entered into the third decade of its existence. We, at KFRI, would like to believe that over the past two decades, KFRI has emerged as a pioneering centre of excellence in tropical forestry research, with world-wide reputation. This indeed is the feedback we receive from many international agencies. At present, we have research programmes supported by several international agencies - the Overseas Development Agency (ODA) of U.K., the Ford Foundation and McArthur Foundation of USA, Forestry Research Support Programme (FORSPA) of FAO, Centre for International Forestry Research (CIFOR), International Plant Genetic Resources Institute, and the World Bank. In the recent past, support had also come from the International Development Research Centre (IDRC) of Canada, and the Biodiversity Support Programme of USAID. At the national level,



Dr. K.S.S. Nair
Director, Kerala Forest Research Institute

research project support comes from the Ministry of Environment and Forests, Department of Science and Technology, Department of Biotechnology and the Ministry of Rural Development, all of the Govt. of India, and at the state level, from the Department of Forests, and the Department of Science, Technology and Environment. Scientists from KFRI have served as resource persons or organizers of several international meetings and programmes and have made their relevance felt in many different ways, both nationally and internationally. By any standard of judgement, we have fared well over the past two decades, although we could have fared even better.

When we started off in 1975, forestry research was a low priority item in the national agendas of most tropical countries. Forests were still being managed predominantly for timber production; and the word 'biodiversity' was rarely heard. All that has changed now, in a span of 20 years. Forestry research, particularly tropical forestry research, is now a high priority item internationally, and millions of dollars are being disbursed by a variety of developed country donors and international bodies for research and

This is an individual challenge to each scientist, a challenge to strike a balance betw een individual career interests and the priorities of the poor people who look to us for guidance.

development in tropical forestry. New funding mechanisms, organizations, and institutions have come into being to channelize this increased flow of support from developed to developing countries. In 1993, a new international centre, Centre for International Forestry Research (CIFOR) has been established in Bogor, Indonesia, supported by a Consortium of donors.

All these developments, one hopes, will support and strengthen the national forestry research efforts in the developing countries. Indeed, the increased flow of international funding to KFRI is a result of this new international initiative in forestry research. But sponsored research has its pitfalls. Unless we set our priorities right, we could easily be led to highly sophisticated but less relevant areas of research because donors have their own interests and priorities. This is an individual challenge to each scientist, a challenge to strike a balance between individual career interests and the priorities of the poor people who look to us for guidance.

The changing forestry scenario

Two developments have changed the forestry research scenario drastically in the recent past. First is the 1992 United Nations Conference on Envrionment and Development (UNCED) at Rio de Jeneiro, Brazil, which focussed strongly on forest conservation and resulted in the International Convention on Biodiversity, signed by almost all nations of the World. This has put us on the alert to recognize the value of our biodiversity and to make the best use of it before the scientifically advanced countries exploit it to their economic advantage. There is an urgent necessity now, for assessing the economic potential of our rich forest diversity, particularly of the non-wood forest products (NWFP), including medicinal plants, and to prospect them for value added products before we innocently export the raw materials. Traditionally, we have been good in describing our plant and animal wealth, but poor in prospecting them for economic advantage. Of course, suitable safeguards must be built in, to ensure the sustained availability of the raw resources. This then is an emerging area of research attention for KFRI - promoting sustainable economic utilization of NWFP - an area where little research has been done in the past by KFRI.

The second significant current development is the increasing involvement of the general public in forestry activities. This is happening in two ways. Firstly, recognizing that forests cannot be effectively conserved without people's participation, the professional foresters are seeking to involve local people in forest management and new models of social forestry, community forestry and participative forest management are being experimented with. Secondly, a large number of people have taken up tree planting as a private enterprise, around their homes, in agroforestry systems, in small woodlots and in commercial plantation enterprises. There are now dozens of private companies in Kerala and other states canvassing for investment in plantation enterprises of teak, mangium, etc. Many of them make tall, unrealistic claims of tree growth and resulting economic gains. The sad reality is that we have no hard data to dispute the tall claims of these companies. One of the reputed teak plantation companies has approached KFRI for advice on pest and disease control and collaboration to study growth potential under intensive management. Such enterpreneurship of private companies has challenged our complacency and is forcing us to think afresh and come out with better management systems to reap the full potential of plantation productivity.

Role of private sector

Forestry research under private sector is becoming increasingly important. Many private companies have produced tissue cultured or other vegetatively propagated seedlings of trees like teak and eucalypts. Autonomy of research institutions which gave them freedom from the unnecessary heirarchical controls exercised by the Govt. Departments was a good step forward to promote forestry research. This, combined with the greater accountability of employees in private sector

Recognizing that forests cannot be effectively conserved without people's participation, the professional foresters are now seeking to involve local people in forest management and new models of social forestry, community forestry and participative forest management are being experimented with.

Like forestry itself, forestry research is breaking its traditional boundaries and moving into new areas of relevance to people.

research establishments is perhaps more conducive to research productivity. Or is it? May be, only for some kinds of applied research. How dependent are the private sector research organizations on the research base created by public sector research establishments? We, at KFRI, are looking at some of these aspects - the strengths and weaknesses of private sector forestry research, and ways and means for mutual reinforcement of public and private sector research units - in a study currently in progress and supported by FAO/FORSPA. Surely, like forestry itself, forestry research is breaking its traditional boundaries and moving into new areas of relevance to people.

Expansion of research infrastructure

KFRI looks forward to attaining greater excellence in forestry research as it enters into the third decade of its existence. Of all the challenges we face, the problem of getting financial support for infrastructure, including manpower, is the greatest. A large number of donors are willing to support specific research projects, but no agency has offered so far to extend infrastructural support. To ensure the continued health and vitality of the Institute in the future, attention needs to be paid now to recruit additional scientific staff. Almost all the scientists of KFRI were recruited during the establishment phase of the Institute - 57% during the first 5 years and 34% during the next 5 years. No substantial addition has taken place over the past ten years. As we move into the third decade, we are handicapped by an imbalanced age structure, not conducive to the vitality of the organization. To face upto the challenge of future we need to fill more positions in emerging areas of expertise like remote sensing applications, geographic information systems, biotechnology, mathematical modeling, wood physics and chemistry, etc. as well as in interface areas like sociology.

Training needs

KFRI, with its accumulated research base in forestry and environment over the past two decades, is in a position to offer a package of training programmes to meet specific public needs. Subject to suitable funding, we propose to offer a series of 1 month training courses in well-organized modules like seed technology; forest nursery establishment and management; teak cultivation and management; selection, establishment and upkeep of avenue trees; etc., in addition to a series of 1 -week familiarization programmes on chosen themes such as 'What is biodiversity,' 'What is an ecosystem', etc. A proposal has been submitted to Govt. of India for supporting this venture to enpower a large number of people to convert their enthusiasm and interest into meaningful action programmes.

On-forest trials

A large part of the success of KFRI has been due to its close interaction with the State Forest Department, facilitated by a number of formal and, more importantly, informal arrangements for exchange of information, views and materials, consultations and collaborative activities. There is further scope to expand and strengthen such collaboration; particularly for on-forest trials of the technologies being developed by KFRI for vegetative propagation, afforestation of degraded lands, genetic improvement of species, pest and disease control, etc. For various reasons, researchers often tend to shy away from such on-forest trials, and as a consequence, there is a wide gap between what can be practised and what is practised. This is another area of challenge to KFRI in the next decade. As the famous entomologist, C.F.C. Beeson once wrote, what the Executive Forest Officer needs are not suggested remedies but tested remedies; not life histories of pests, but death histories.

Do communicate to me, if you have suggestions on any aspect related to forestry or on your expectations from KFRI.

Sponsored Research - a definition

" We are all familiar with sponsored programmes in the television. For example, a manufacturing company or firm, sponsors the telecast of, say, the Miss Universe Contest or the Wimbledon Tennis match, in return for an opportunity to advertise their product for sale. Sponsored research is similar. It can be defined as that research supported or paid for by a sponsor for a specific reward or purpose. This purpose may vary depending upon the kind of sponsor".

- K.S.S. Nair,
in 'Sponsored research - How good it is to meet the real needs of developing countries'- Paper presented in the 20 th IUFRO World Congress, August 1995.

Joint Forest Management : Hope on the horizon

Introduction

Manifold depletion of natural resources in the country in recent decades has been a major source of concern among the planners, social scientists, foresters and intellectuals alike. Human environmental relations are confronted with major problems due to degradation of forests. Degradation continues unabated with the pressure on land combined with the commercial exploitation of the forests. Local communities are usually the most immediate and adversely affected by such degradation. Millions of people live inside or in the periphery of forest land depending on its resources for their sustenance. With the degradation of forest the life of these local comunities too deteriorates as the socio - economic and cultural systems of these people are inter-linked with the ecology of the forest. Traditional forest management which relied on force, fences and firearms to protect the forests left a lot to be desired and forest management programmes have been re-oriented so as to respond to the local community's needs also. Only when the preservation need coincides with the interests of the local communities can forests be effectively protected. Thus the local communities must be motivatd to identify themselves with the development and protection of forests by making the forest produce available to them preferentialy. The recognition of this point of view in recent times have given rise to the new concept of 'Participatory' or 'Joint Forest Manangement' (JFM).

Only when the preservation need coincides with the interests of the local communities can forests be effectively protected.

What is JFM ?

JFM is a new system of forest management based on the cooperative interaction between Forest Department and local communities to protect forest lands from degradation which is taking place at an alarming rate. In this system of manangement the Forest Department and the local communities become equal partners in protection, regeneration, management and benefit sharing. The strategy is to create employment opportunities for the local communities through resource building activities and sharing of benefits. Resource development activities are identified taking into consideration their needs and priorities and the physical potential of their environment. Micro plans are thus prepared in consultation with community members giving them a variety of options to choose from (Palik, 1993). In JFM emphasis is given on regeneration of natural forests through protection rather than afforestation as it is monetariy beneficial and more effective. In principle, JFM envisages collection of Non Wood Forest Products (NWFPs) to be more important than production of timber which was the main objective of traditional forest management.

The Arabari Experience

The concept of JFM was first experimented with in 1971-72 in the Arabari reserve range of East Midnapur division in the State of West Bengal. It covered an area of 1272 ha., and consisted of 11 villages with a total population of 168 households. Due to the heavy dependence of the local populace on this range, the Divisional Forest Officer found it necessary to involve the villagers in protection activities. The local people who were conscious of the demerits of deforestation when assured of a source of livelihood during the lean period agreed to render full support. This would enable the forest to regenerate and regain productivity. The entire range of 1272 ha. was demarcated and brought under the purview of plantation scheme. The work commenced during the lean period providing the local people equal employment opportunities. A Forest Protection Committee consisting of twenty two persons from the eleven partaking villages was constituted and under the aegis of this Committee various labour generating schemes were implemented. The Committee was also given rights to the collection of all NWFPs. Fuel and fodder needs of the villages were also taken care of. One man and one woman from each village guarded the forest during the day time along with forest guards. Unauthorised people spotted cutting wood were caught and fined. If a member of the committee was at fault he/she was severely reprimanded by the committee. Given the exclusive rights to restrict aecess and use of NWFP and a share in the timber, the villages surrounding the Arabari forest tracts effectively protected the forests, with the net result of an increase in productivity.

This experience encouraged the West Bengal forest department to formulise the partnership through a special Government order which entitled communities to get 25 % of the final yeild from the sale of pole timber at the end of the 10-15 year rotation. The success of Arabari prompted not only other parts of West Bengal but also

other States to experiment with this new system for rejuvenating degraded forests. Of the 25 States in India, 14 have already issued orders for JFM of their forest areas.

Main Features

In a major shift from the earlier system of forest management the Ministry of Environment and Forests, Government of India issued policy instructions to all State Forest Departments on June 1st 1990, promoting active participation of local communities and NGOs in the regeneration, management, protection of degraded forest tracts. The major provisions of these guidelines are given below.

1. The programme should be implemented under an arrangement among the voluntary agency/NGO, the village community (beneficiary) and the State Forest Departement. No ownership or lease right over the forests land should be given to the beneficiary or to the voluntary agency/NGO.

2. The beneficiaries should be entitled to a share in usufructs to the extent and subject to the condition prescribed by the State government. The voluntary agency/ NGO should not be entitled to usufructory benefits.

3. Access to forest land and usufructory benefits should be only to the beneficiaires who get organised into a village institution, specifically for forest regeneration and protection. the beneficiaries should be given usufruct like grasses, lops, and tops of branches and MFPs. If they successfully protect the forest, they may be given a portion of the proceeds from the sale of trees when they mature.

4. Areas to be selected for the programme should be free from claims of any person who is not a beneficiary under the scheme. The selected site should be worked out in accordance with a working scheme (protection, natural regeneration) duly approved by the State Government. Such scheme may remain in operation for a period of ten years and revised / renewed after that. The working scheme should be prepared in consultation with the beneficiaries.

5. For raising nurseries, preparing land for planting and protecting the tree after planting, the beneficiaries should be paid by the forest department.

6. It should be ensured that there is no grazing at all in he forest land protected by the village community. permission to cut and carry grass free of cost should be given so that stall feeding is promoted. No agriculture should be permitted on the forest land.

7. Along with trees for fuel, fodder and timber, the village community may be permitted to plant fruit trees, medicinal plants and trees helping soil and water conservation. Cutting of trees either by village communities or by the Forest Department should not be permitted before they mature. In case of energy needs, the village communities should be taken into confidence.

8. The benefit of people's participation should go to the village communities and not to commercial or other interests. The selection of beneficiaries should, therefore, be done from only those families which are willing to participate through their personal efforts.

9. The Forest Department should closely supervise the works of the benficiaries/NGOs. Should they fail or neglect to protect the area from grazing or do not perform the operation prescribed in the working scheme in a satisfactory manner, the usufructory benefits should be withdrawn within or without paying compensation to anyone for any work that might have been done prior to it.

Success of JFM

A number of factors attribute to the successful functioning of JFM, but most important among them are the co-operative interaction between the Forest Departments and local communities, and the preparation and implementation of an effective micro plan. India's forest policies date back to over hundred years. Under British rule, the state established monopoly control over forests, reserved large tracts for timber extraction, severely restricted the customary rights of local populations to these resources and encouraged commercially profitable species at the cost of species used by the local communities. There was also large scale clearence and felling for railways, ships, bridges, tea and coffee plantations, irrigation projects and crop cultivation to increase the government's land revenue base and so on (Guha, 1989). After independence, State monopoly over forests continued with the extension and strengthening of British policies. While forests continued to be expoloited for commercial gains the local people's rights to NWFPs were further curtailed and they were considered a main hurdle towards forest conservation.

People's participation was restricted to the forestry programmes and sharing of fringe benefits. The forest communities considered the forest officials as usurpers of their legitimate rights. Thus misunderstanding and conflicts continued and the rift

between the forest officials and the local communities widened.

JFM anticipates a totally different approach from the forest officials as well as the local communities. Stress is given for opening new communication channels between the two and establishing mutually beneficial co-operative activities. Apart from restricting government policies and adoption of a new benefit sharing formula, mass education and environmental awareness programme should be provided to the local communities.

Micro planning is necessary to ensure people's participation in the management of resources, assessment of the needs of the participating community, to regulate the benefit flow to the participants and to identify and highlight local resources. Micro plans are prepared jointly by the Forest Department and the participating committees. The efficient functioning of these plans is ensured by Divisional Forest Officer and Range Officers.

Supportive policies

JFM programmes implemented in many States have not taken a uniform approach due to social, economic and cultural differences. Consolidating the experiences of the States, a uniform module suitable for different regions must be formulated in order to increase the efficiency of JFM.

A two day workshop on sustainable forest management was held at New Delhi in September 1990 to discuss various problems of JFM, in which policy makers, foresters, NGO leaders and social scientists from different parts of the nation participated. The participants, many of whom have been associated with pioneering JFM system over the past decade suggested the following steps needed to be taken in establishing a policy supportive to the emergence of successful JFM programmes.

(1) Issuance of State level resolution encouraging the forest department to work with committees in the management of forest lands through formation and empowerment of communities protecting forest lands.

(2) The resolution should provide a framework for JFM agreement, resource sharing rights and protection responsibilities, so that the forest officers and rural participants have clear understanding regarding the form of the management partnership.

(3) For low income rural families to participate in JFM programmes, it is essential that material benefits begin flowing as soon as possible. Harvesting of regenerating grasses and leaves can begin during the first year. Enrichment planting activities should emphasise fast growing species.

(4) Some budget provision may also be necessary to support community forest management groups who are deprived of income during the early phases of forest regeneration. This allocation should support employment which will speed ecological recovery and enhance forest productivity.

(5) Government orders should allow NGO participation in assisting forest departments and committees to establish joint protection and management systems.

(6) Resolutions should require communities participating in the JFM activities to develop methodologies to control grazing through social fencing and stall feeding.

(7) As departments expand JFM systems and activities, extensive staff orientation and training is necessary to develop attitudes and approaches which encourage interaction with community forest management groups (Poffenberger, 1990).

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" A medieval English monarch, in seeking to prove to his subjects the limitations of his powers, installed himself on the beach and commanded the tide to cease advancing. King Canute demonstrated that this was not possible. There are striking parallels with recent activities of conservation organizations. Conservationists have been sitting in ivory towers exhorting the world to conserve the environment in general - but these exhortions were not based on the realist of what did or did not work on the ground".

- Jeffrey A. Sayer, In 'Science and International Conservation', CIFOR Occasional Paper No. 4, March 1995.

The Forest - Stream Linkages in Tropical Ecosystems

Streams generally originate from the evergreen and moist deciduous biomes of high altitude mountains. Small to medium-sized streams in the forested catchments are surrounded by dense vegetation. This stream-side vegetation is called Riparian forests. Riparian vegetation acts both as a source and filter for energy and materials entering stream ecosystems. The riparian forests considerably provide shading to the streams thereby preventing sunlight to enable them in photosynthesis. As a result the Photosynthesis-Respiration (P/R) ratio will be less than 1 and the stream will therefore be heterotrophic. Such streams will have to be dependent on the riparian forests for the energy requirements. It is calculated that in woodland streams with dense riparian canopy, more than 98% of the energy is imported from the terrestrial surroundings, while less than 2% is derived from stream photosynthesis by periphyton and lower plant species. This type of major energy source in woodland streams is exogenous and is called allochthonous energy sources.

The energy sources enter into the streams (Fig.1) in two forms via Particulate Organic Matter (POM) and Dissolved Organic Matter (DOM). The POM is strictly derived from allochthonous sources such as leaves,twigs,bark,nuts,fruits and flowers. They are generally >1 mm in diameter and are called Coarse Particulate Organic Matter (CPOM). The DOM gets into the stream in solution from the surrounding riparian forests. The CPOM is subjected to leaching in the turbulent waters of the stream and the microorganisms in transport such as bacteria, aquatic hyphomycete fungi and protozoans colonize on the surface of CPOM. During the long residence period in the streams (1day-several days) the CPOM is reduced to Fine Particulate Organic Matter (FPOM). This fine particles are generally <1 mm in diameter.

Animals which feed on CPOM are called shredders. The shredders convert only about 40% of what they ingest into their own tissue and the remainder is egested as faeces. This makes a significant contribution in the FPOM pool (approximately 2 to 7 mg of faeces per large shredder per day is contributed to the system). The high carbon source in CPOM is the main reason for the colonization, growth and metabolism by microbes. The presence of microbial colonies on CPOM is an additional energy source for shredders which feed on CPOM. Thus the reduction of CPOM to FPOM is brought about as a result of physical abrasion in the turbulent stream environment, animal feeding processes (zoobenthos) and microbial metabolism. The rate of conversion of CPOM to FPOM is dependent on temperature, extent of terrestrial pre-conditioning and qualitative characteristics of CPOM.

The leachate from CPOM as well as DOM from the terrestrial system entering via, run-off and subsurface groundwater are converted to FPOM by physical flocculation and microbial assimilation. This FPOM particles from the watershed enter the streams directly in relatively smaller proportions (< 5%) in addition to the FPOM created through physical and biological reductions of CPOM. Animals that feed on FPOM are referred to as collectors because they reaggregate small particles with their ingestion activities. The collector feeding may increase or decrease particle size within the FPOM pool, but often the faeces are similar in size to the ingested particles. This collecting mechanisms are mainly employed to filter FPOM from transport in water or to gather fine organic particles from the sediment. Similarly as collectors there is another group of invertebrates called filter-feeders which carry out the role of re-filtering organic particles in the FPOM pool.

The functional group of stream invertebrates like shredders, collectors and filter-feeders belong to different taxa of insects such as ephemeropterans, odonats, plecopterans, hemipterans, megalopterans, lepidopterans, trichopterans, coleopterans and dipterans.

The leaf litter is the most important energy input in forest streams. It is decomposed in about 12 weeks in tropical streams, whereas a turnover time of about a year is required in temperate climates. Therefore it is inevitable that the energy in the form of nutrients and detritus (organic matter) should be retained or taken back into the forest to prevent energy loss due to rapid downstream transport. Thus the functional role of stream consumers (invertebrates and microbes) is very important that they catch and retain these materials, mineralize and process them into smaller particles. Hence a rapid, complete nutrient drain is prevented.

This retention is enhanced by organic debris dams found in upstream sections and also by egestion and re-ingestion of organic particles by invertebrates. The nutrients and detritus in the pools are cycled through the bodies of numerous invertebrates (collectors and filter-feeders) becoming more completely mineralized with each step in the transfer and its downstream export is slowed or even stopped. This process is called spiralling. This process of spiralling, coupled with microbial recolonization in faecal pellets of invertebrates and their reusage, reduces the rate of passage of allochthonous materials downstream and ensure that most of the mineralization of materials takes place closer to the origin of input.

Even though little is known about the nutrient transfer across the stream and riparian forest, it is likely that a proportion of nutrient transfer occurs through the extensive trailing root mats of riparian vegetation. Another possible route of nutrient return is through the fishes. The fishes which consume the stream invertebrates as well as detritus move upstream and are eaten by terrestrial carnivores (birds etc.). Another important and potential nutrient transfer mechanism is through the emergence of adult insects as the bulk of the stream faunas is constituted by the nymphs and larvae of these insects. This emergence will return nutrients to the terrestrial environment as these insects ultimately enter into the terrestrial food chains or into the decomposition cycles.

Therefore, the stream invertebrates play significant role in nutrient retention in tropical forest ecosystems. Since, there exist a complex, sensitive and interconnected energy transfer mechanisms between streams and forests, watershed conservation and management strategies should be developed on a stream-forest perspective.

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Wildlife Biology Division

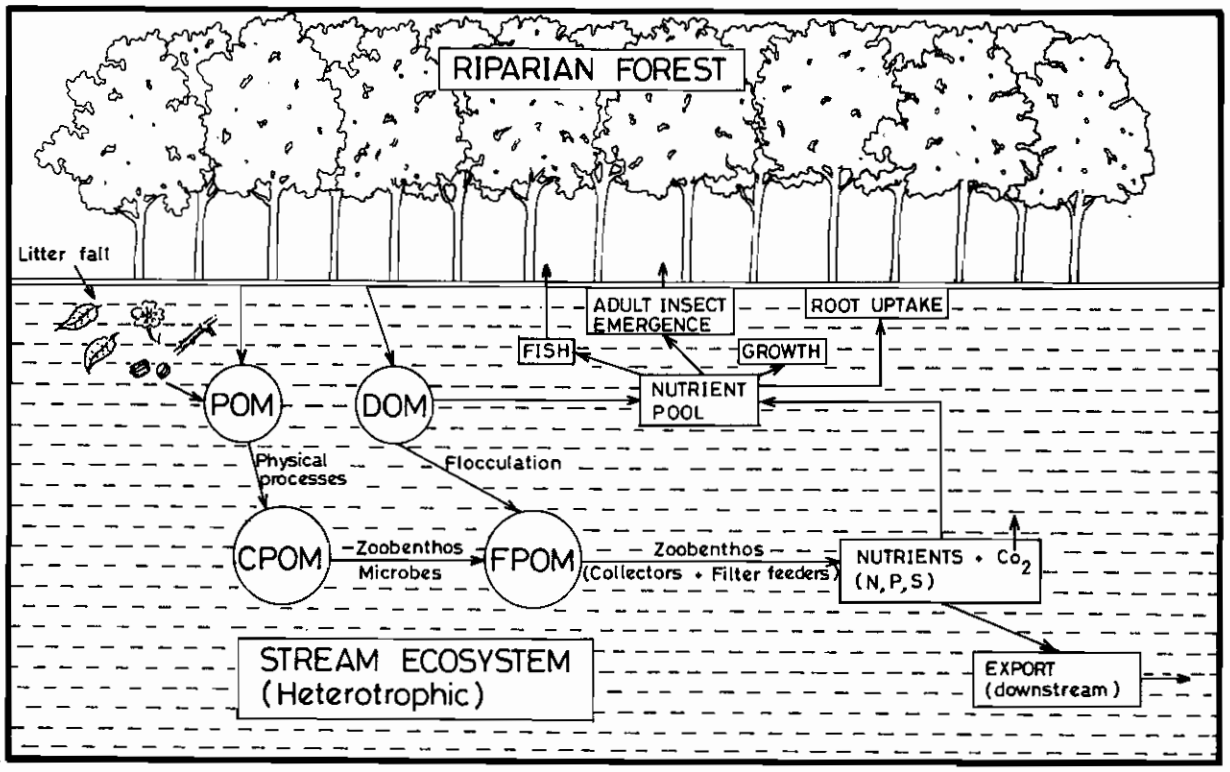


Fig.1 Diagrammatic representation of the energy transfer mechanisms between forest and stream ecosystems

Interview

Dr. Hugh F. Evans, Principal Entomologist at the Forestry Commission, U.K. visited KFRI during July 7-13, 1995. Evergreen took this opportunity to interview him and get his views on some aspects of biological control of forest pests. Dr. Evans was interviewed by Dr. R.V. Varma (Entomology Division) and Dr. E.M. Muralidharan (Editor, Evergreen).

E.M.: In your opinion, what has been the extent of success in biological control of forest pests all over the world - technically as well as in terms of economic viability ?

Evans: There has been an encouraging amount of success in use of biological control agents in forestry, particularly for temperate forest pests. In some cases, such as the use of the specific predatory beetle *Rhizophagus grandis* against the European spruce bark beetle, *Dendroctonus micans*, several different countries, including UK., France, Georgian Republic and Belgium, have developed successful programmes of rearing and release of the natural enemy. A considerable amount of work has gone into both "classical" biological control, where a natural enemy is released and becomes permanently established, and repeated biological control using microbial agents which have to be applied more than once. Economically, there may be considerable setting up costs, but once established, biological control agents may require no further intervention and, over time, become increasingly cost-effective. They are, therefore, economically viable.

E.M.: Does it require a lot of additional research effort to translate the results obtained in temperate regions to the tropical forests.

Evans: A considerable degree of extra research is required but the general principles of approach should be similar between temperate and tropical forests. A sound understanding of the dynamics of the pest and its interactions with the forest ecosystem is an essential baseline from which to develop biological control programmes or, if necessary, selective use of chemical pesticides within an Integrated Pest Management approach. The greater biodiversity of tropical forests and the faster rate of reproduction of both pests and beneficial insects poses special problems in monitoring but these can be solved with the necessary input.

R.V.: Based on your experience in Kerala for the past few days, what is your impression on the use of NPV for control of the Teak Defoliator. Will it be a viable option?

Evans: I have been impressed by the amount of information that already exists on the teak defoliator. This provides a very strong basis for the next stage of the work which integrates the biological requirements of use of NPV with data on monitoring and population dynamics. We will do this within a conceptual framework which is loosely termed **The Control Window**. Such an approach identifies the key factors, such as pathogenicity, larval feeding behaviour, virus persistence, etc. that must be accounted for in a field application programme. I am confident that the new project will succeed in this.

R.V.:Are the private farmers interested in growing trees on farm in UK? Do forest managers accept biological control methods or has it been neglected?

Evans: There is increasing interest in use of trees on former agricultural land in the UK. This is partially a result of financial incentives to remove land from full agricultural use under the European Union "set aside" rules. However, there is still a reluctance to commit land to forestry because of the long rotation span required before a financial return is expected. In terms of pest control, there is considerable progress in encouraging use of biological agents in forestry. Forest managers are kept fully informed of progress in research and we are fortunate to be able to cite the recent successes in use of *R. grandis* against *D. micans* as also the use of NPV against a defoliator on pine called pine beauty moth.

E.M.: How does genetic engineering of forest trees eg. with the *Bt* gene, compare with the biological control strategy?

Evans: Genetic engineering of forest trees has both advantages and disadvantages compared with conventional use of biopesticides. In the case of *Bacillus thuringiensis*, incorporation of the toxin gene into trees has been carried out successfully and appears to be offering promise of control against a range of leaf feeding pests. The advantage of this approach is that the *Bt* is effective as soon as the insect begins feeding,

regardless of its position on the tree. Thus there is no need to worry about whether a spray application has been effective in reaching all the feeding sites of the target insect. The potential disadvantages are firstly in the possibilities of non-target species also ingesting the *Bt* and secondly in an increased risk of resistance developing because of the continuous exposure of the pests to *Bt*.

E.M.: Would you consider genetically engineered biological control agents (eg. NPV) as a potential danger to the environment? Should government regulations be made stronger? How do people in the developed countries perceive the testing of genetically engineered plants?

Evans: Genetically engineered biopesticides should be viewed from the point of view of their costs and benefits. They offer considerable promise in increasing the rate of kill (a current constraint in use of NPV, for example) and in potentially allowing other genes to be included that make it easier to assess the fate of the biopesticide in the environment. In such situations the host range of the engineered virus is unlikely to change because the virus has to begin replication before the inserted gene is triggered. The same constraints that apply to wild-type viruses are also applicable to the genetically engineered microrganisms. The biggest potential risks arise from possible widening of host range so that the inserted genes pass into non-target pests. There is also the possibility of recombination with indigenous viruses. The message, therefore, is that each case should be looked at on merit until there is a much wider body of information on the general as opposed to the specific risks posed by these organisms. In this respect Government regulations are essential and should, ideally, be similar between countries to ensure consistency in approach. The public have been kept well informed of the debates on release of genetically engineered micro-organisms and there has been relatively little adverse reaction. However, it is not clear whether this is acceptance or merely a feeling that little can be done to influence the situation. Good communication is the key.

E.M.: What is your message to the forest manager on biological control of forest pests?

Evans: I think the key task is to show that the use of biological control is cost effective and carries an additional environmental premium compared with use of chemical control agents. This task is that of the researcher and the forest manager can only help. The problems come in technology transfer because the use of biological agents often requires a more complex monitoring and management regime than for other methods of control. Forest managers may be reluctant to set up this additional infrastructure but I feel that we can cite the increasing number of successful programmes to make them more aware of the advantages of the approach. It is up to the researchers to ensure that technology transfer is carried out efficiently and in non-technical language.

Photo by E.M. Muralidharan

Urban Forestry !!

Recent Publications

Research Papers

Balagopalan, M. 1995. Soil characteristics in natural forests and *Tectona grandis* and *Anacardium occidentale* plantations in Kerala. India. J. Trop. For. Sci. 7:635-644.

Balagopalan, M. and Jose A.I. 1995. Altitudinal effect on tropical and subtropical forest soils in Kerala, India. Ann. For. 3:87-95.

Balagopalan, M. and Jose A.I. 1995. Distribution of inorganic carbon, nitrogen, organic phosphorus and organic sulphur in the tropical and sub-tropical forest soils and their inter-relationships. J. Trop. Agric. 33:84-86.

Bhat, K.M. 1994. Wood diversity in Indian *Dalbergia* species: Implications for utilization and genetic improvement. In : S.B. Westley and J.M. Roshetko (eds.) *Dalbergia*: Proceedings of an International Workshop. Nitrogen Fixing Tree Association, USA. pp 40-47.

Bhat, K.M. 1995. A note on heartwood proportion and wood density of 8-year-old teak. Indian For. 121: 514-517.

Bhat, K.M. and Benny, A.G. 1995. Improving fibre yield and quality of eucalypts in India: Problems and prospects. In : B.M. Potts *et al.* (eds) Eucalypt Plantations: Improving Fibre Yield and Quality. Proceedings of CRC-IUFRO Conference, 19-24 February 1995, Hobart, Australia. pp 255-257.

Bhat, K.M. and Ancy Mathew 1995. Structural basis of rattan biomechanics. Biomimetics 3: 67-80.

Bhat, K.M., Danbury, D., Chaturvedi, A.N., Joshi, R.B., Joshi, M.R., Kamaluddin, M., Kamala, B.S. and Keshav, K. 1994. Wood production and use - A field manual. In : J.M. Roshetko and S.B. Westley (eds). pp 13-20.

Easa, P.S. and Balakrishnan, M. 1995. The population, density and structure of Asian elephants in Parambikulam Wildlife Sanctuary, Kerala, India. J. Bombay Nat. Hist. Soc., 92(2): 225 - 229.

Gnanaharan, R. 1995. Sawn timber output from short rotation *Acacia auriculiformis*. J. Trop. For. Prod. 1: 66-70.

Gnanaharan, R., Janssen, J.J.A. and Arce, O. 1995. Bending Strength of *Guadua* Bamboo: Comparison of Different Testing Procedures. INBAR Working Paper No. 3. 24 p.

Jayson, E.A. and Christopher, G. 1995. Sighting of Spiny Doormouse *Platacanthomys lasiurus* Blyth, 1859 in Peppara Wildlife Sanctuary, Trivandrum Dist., Kerala. J. Bombay Nat. Hist. Soc. 92(2):258.

Jayson, E.A. and Mathew, D.N. 1995. Diversity and species abundance distribution of birds in the Western Ghats Tropical forests, India. Poster presented in the Seminar on 'Measuring and monitoring forest biological diversities: The International Network of Biodiversity plots'. May 23-25, 1995. The Smithsonian Institution at Washington D.C., U.S.A.

Muktesh Kumar 1995. Orchids of Westen Ghats: their distribution and classification. J. Econ. Tax. Bot. 11: 65 - 72.

Muktesh Kumar 1995. A re-investigation on the taxonomy of the genus *Ochlandra* Thw. (Poaceae-Bambusoideae). Rheedea. 5(1): 63-89.

Nair, K.K.N., Pandalai, R.C., Bhat, K.V., George Mathew and Mohammed Ali 1995. Botany, wood characteristics and silvicultural techniques of the South-East Asian indigenous timber species - *Adina cordifolia* (Haldu). Ann. For. 3(1): 53-64.

Renuka, C. and Vijayakumaran, T.T. 1995. Notes on the identity of *Calamus pseudorivalis* Beec. (Arecaceae) with a new species of the genus from Andamans. Rheedea 4(2): 138-143.

Renuka, C. and Vijayakumaran, T.T. 1995. Some new species of rattans from Andamans & Nicobar islands. Rheedea 4(2): 120-108

Shaji, C.P. and Easa, P.S. 1995. Extension of Range of *Danio (Brachydanio) rerio* Hamilton Buchnan. J. Bombay Nat. Hist. Soc., 92(2): 274.

Sutton, B.C. and Sankaran, K.V. 1995. A new species of *Selenophoma* on *Elaeocarpus* from India. Mycological Research 99: 1199-1200.

Chapters in Books

Renuka, C. 1995. Genetic diversity and conservation of rattans. In : V.R. Rao and A.N. Rao (eds.) Bamboo and rattan genetic resources and use. IPGRI, Singapore and INBAR. New Delhi.

Sankaran, K. V. and Florence, E.J.M. 1995. Macrofungal flora and checklist of plant diseases of Malayatoor forests (Kerala). In: Advances in Forestry Research. Ram Prakash. pp. 147-168.

New Research Projects

KFRI/ 239/ 95 :
Atlas of teak soils in Kerala.

Investigators: M. Balagopalan (Soil Science)
Objectives: i. To identify the properties of soils under teak. ii. To assess soil suitability for teak growth.
Duration: 2 years
Funded by: Kerala Forest Department.

KFRI/ 240/ 95 :
Ecology and behaviour of Gaur (*Bos gaurus*) in Periyar Tiger Reserve, Kerala.

Investigators: P.S. Easa (Wildlife), N. Sasidharan (NWFP), Research Range Officer, Thekkady.
Objectives: i. To collect information on population, movement pattern and home range of the species. ii. To study the food and feeding habits and the habitat utilization of the species. iii. To record the activity time budget. iv. To document the distribution of the species in the state.
Duration: 3 years
Funded by:Kerala Forest Department (Wildlife Wing)

KFRI/ 241/ 95 :
Eco-restoration of a degraded watershed in Attapady.

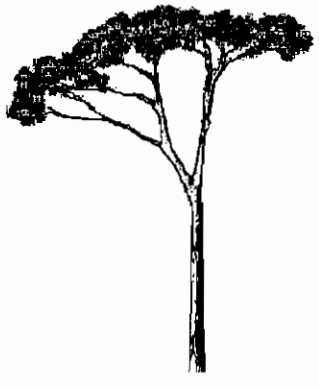
Investigators: R.C. Pandalai (Silviculture), S. Sankar (Agroforestry), K.V. Mohamed Kunhi (Agroforestry)
Objectives: i. To reforest a degraded watershed by planting indigenous multiple end-use species. ii. To study the effects of different soil and water conservation techniques. iii. To create an awareness on eco-restoration of watersheds. iv. To establish a model watershed.
Duration: 3 years
Funded by: Department of Wasteland Development, Ministry of Rural Development.

KFRI/242/95:
Tissue culture of rattans (canes) for clonal propagation.

Investigators: E.M. Muralidharan (Genetics), R.C. Pandalai (Silviculture).
Objectives: i. To develop micropropagation and embryo culture protocols for five species of rattan using embryos or mature plant parts through any of the possible pathways of plant regeneration. ii. To induce multiple stems at plantlet level to ensure clustering habit and early suckering. iii. Production of sufficient plantlets for conducting a field trial along with conventional propagules.
Duration: 3 years
Funded by: Department of Biotechnology, Government of India.

KFRI/243/95:
Genetic diversity and conservation of rattans.

Investigators: C. Renuka (Botany), E.P. Indira (Genetics), E.M. Muralidharan (Genetics).
Objectives: i. To study the distribution, ecology and genetic diversity of *Calamus palustris, C. andamanicus* and one rattan species of Southern India. ii. To study the reproductive biology of the species. iii. To study the phenotypic and genotypic variations within the species using isozyme markers. iv. To carry out cytological studies on the species.
Duration: 2 years
Funded by: International Plant Genetic Resources Institute, (IPGRI) Singapore.



KFRI/244/95:
Biodiversity conservation potential and ecosystem rehabiltation using traditional knowledge at Chinnar Wildlife Sanctuary, the Western Ghats, Kerala, South India.

Investigators: S.Sankar (Agroforestry), K.K.N. Nair (Botany), P.S. Easa (Wildlife), K.K. Ramachandran (Wildlife), K. Swarupanadan (Ecology), R.C. Pandalai (Silviculture), U.M. Chandrasekhara (Agroforestry).
Objectives: i. To gather information on land use patterns and to evaluate their ecological suitability to conserve biodiversity. ii. To map the vegetation of the area. iii. To identify major species of the area in relation to tribal uses/cultivation.
Duration: 3 years
Funded by: The MacArthur Foundation and UNESCO

KFRI/245/95:
Use of baculovirus control agents within an integrated pest management strategy against teak defoliator *Hyblaea puera*

Investigators: K.S.S. Nair, R.V. Varma, V.V. Sudheedrakumar, K. Mohandas (Entomology)
Objectives: i. To determine the *Hyblea* population density related to baculovirus. ii. Development of baculovirus mass production methods, formulation and quality control. iii. Development of methods for application of baculovirus using technology appropriate for end users.
Duration: 3 years
Funded by: Forestry Commission, U.K.

Participation in Seminars, Symposia and Workshops

International

Mr. K.C. Chacko, Silviculturist-in-Charge, Division of Silviculture attended an Expert Consultation Meeting on Nonwood Forest Products, organised by the FAO at Yogyakarta (Indonesia) during January 17-27, 1995.

Mr. K.C. Chacko, Silviculturist-in-Charge, Division of Silviculture, attended the Second Regional Seminar organised by FORSPA and the Ministry of Forestry at Yangon, Myanmar during May 29-June 3, 1995. Mr. K.C. Chacko presented a satellite paper on *'Silvicultural problems in management of teak plantation'.*

Dr. U.M. Chandrashekara participated in a training course `Making Forest Policy Work' organised in the Oxford Forestry Institute, Oxford, UK during July 10-28, 1995. He also visited the Natural Resources Institute, Kew Botanical Gardens, Natural History Museum, International Mycological Institute and University of Bangor.

Mr. U.N. Nandakumar attended an International Meeting of Experts on Bamboo and Rattan Inventory organised by FRIM, Malaysia at Kualalumpur (Malaysia) during March 28-29, 1995 and presented a paper on *'Status of rattan and rattan inventory in India'.*

National

Dr. P.S. Easa attended the Meeting on 'Land Use and Bio-diversity Conservation' organised by Economic Development Institute, World Bank and Ministry of Environment and Forests and SACON from March 27 to April 1, 1995 at Coonoor.

Dr. R. Gnanaharan delivered a Keynote Address entitled, *'Developments in Timber and Timber Products Technology'* at the Workshop on Assessment of New Building Materials Technology Developments in India held at the Regional Engineering College, Calicut on March 23, 1995. He also presented a paper, *'Bamboo for structural applications: A hurdle to overcome'.*

Mrs. E.J. Maria Florence attended the National Seminar on Applied Mycology at the Department of Botany, University of Poona held during March 24-25, 1995 and presented a paper on *'Wood deterioration caused by sapstain fungi'*

Mrs. E.J. Maria Florence and Dr. C. Mohanan attended the Workshop on 'Mushroom cultivation and post-harvest technology' held at TBGRI, Palode, on June 30, 1995.

Dr. E.M. Muralidharan attended the All India Symposium on 'Recent Advances in Biotechnological Applications of Plant Tissue and Cell Culture' held at CFTRI, Mysore from June 22-24, 1995 and presented a poster paper on *'Low-input micropropagation of some species of Zingeberaceae'*

Mr. U.N. Nandakumar represented KFRI in the Rural Programme Advisory Committee meeting of 'Farm and Home ' programme of All India Radio on August 4, 1995.

Invited Talks

Mr. K.C. Chacko delivered a guest lecture on 'Improved plantation and nursery techniques including seed collection and storage in forestry' on August 14,1995 for a batch of State Forest Service officers who were attending the XI Refresher Course at the State Forest Service College, Coimbatore.

Mr. K.C. Chacko acted as a resource person for IFS Officer's training course on Agroforestry. A lecture on 'Plant management in Agroforestry' was offered.

Mr. K.C. Chacko delivered a lecture on ' Career opportunities for Forestry Graduates' at the College of Forestry, Vellanikkara. As a follow up, the college authorities were put in touch with a number of potential employers.

Mr. K.C. Chacko gave a lecture on 'Teak Cultivation' for the agricultural officers and farmers on April 29, 1995 at KFRI.

Dr. P.S. Easa gave a talk on 'Wild-life Conservation' at the , National Service Scheme Camp conducted by Horticulture College, Kerala Agricultural University and held at Peechi on May 31, 1995.

Dr. P.S. Easa gave a talk on 'Our Wildlife' at the Holy Family Convent Girls High School, Trichur on June 15, 1995.

Dr. R. Gnanaharan gave a guest lecture to the participants of a refresher course at SFS College, Coimbatore on August 14, 1995.

Dr. R.C. Pandalai gave a lecture on 'Role of afforestation on the development of watershed' for the agricultural officers and farmers on April 29, 1995 at KFRI.

Radio/TV Talk

Shri. K.C. Chacko presented various aspects of Teak and Mangium cultivation in an interview for Doordarshan (Malayalam) under the programme 'Vipani'. (The interview was conducted at Peechi on August 5, 1995 by M/s. Hyphen Communications).

Dr. R. Gnanaharan gave radio talks in AIR on the 'utilization of coconut wood' on April 6 and 30, 1995.

Dr. P.S. Easa gave a talk entitled '*Ullasa Yathra* (Zoo) with Children' on All India Radio on June 3, 1995.

Shri. U.N. Nandakumar gave talk on 'Planting trees for wasteland development' (in Malayalam) in 'Farm and Home' programme of AIR on May 28, 1995.

Dr. R.C. Pandalai gave talk on 'Preservation of Sacred groves' (in Malayalam) in 'Farm and Home' programme of AIR on March 6, 1995.

Training

Dr. K.K. Ramachandran attended the training course in Remote Sensing Technology and Applications through Visual Interpretation and Digital Analysis, at the National Remote Sensing Agency, Hyderabad, from July 17- September 22, 1995

KFRI Participates in the IUFRO XX World Congress, Tampere, Finland, August 6-12, 1995

Nine Scientists from KFRI participated in the XX World Congress of the International Union of Forestry Scientists (IUFRO) held at Tampere, Finland during August 6-12, 1995 and presented papers.

Dr. K.S.S. Nair, Director, KFRI represented India and actively participated in the deliberations in the meeting of the International Council which is the highest policy making body of the IUFRO. He also participated in a memorial tree planting ceremony to commemorate the participation of a number of countries in the IUFRO Congress.

As many as seven scientists were nominated as office bearers of different Subject Groups/Working Parties or Project Groups.

Dr. K.S.S. Nair: Deputy Leader, Subject Group, Entomology.
Dr. J.K. Sharma: Chairman, Working Party on Diseases of Tropical Plantations.
Dr. K.K.N. Nair: Chairman, Working Party on Restoration Ecology.
Dr. M. Balasundaran: Chairman, Working Party on Mistletoes.
Dr. R. Gnanaharan: Daputy Leader, Project Group on Bamboo and Rattan Utilization.
Dr. K.M. Bhat, Deputy Leader, Project Group on Improvement of Wood Utilization.
Dr. V.V. Sudeendrakumar: Co-Chairman(Asia-Pacific Region) of the Working Party on Protection of Forests in the Tropics.

In their capacities as Chairmen of Working Parties S2.07.07 - Protection of Forests in the Tropics and S2.06.15 - Diseases of Tropical Plantations respectively, Dr. K.S.S. Nair and Dr. J.K. Sharma organised two Scientific Sessions during the Congress.

Dr. K.M. Bhat also chaired a session on wood quality.

All the participating scientists presented papers in the different sessions of the Congress.

1. *Patterns and process leading to degradationof tropical forests and strategies for restoration* by K.K.N. Nair
2. *Inventories of non-timber forest produce plants : conventional methods and trends* by K.K.N. Nair and U.N. Nandakumar
3. *Diseases of bamboos in Asia- an overview* by C. Mohanan.
4. *Diseases of emerging culms of bamboos in India and their significance in sustainable production* by C. Mohanan.
5. *Decay of standing trees in natural forests and its management* by C. Mohanan.
6. *Fungal staining and biodeterioration of rattan in India and their management* by C. Mohanan.
7. *Properties of fast-grown teak wood: The impact on enduser's requirements* by K.M. Bhat.
8. *Standardisation of grading rules for Asian rattans for enhancing value of furniture products* by K.M. Bhat.
9. *Processing practices on the utilization value of rattans* by T.K. Dhamodaran and K.M. Bhat.
10. *Chemical modification of rubber wood by acetylation and its effect on physical and mechanical properties* by T.K. Dhamodaran.
11. *A need for standardization of bending test procedures for bamboo* by R. Gnanaharan.

Teak Museum Inaugurated

The Teak Museum at the KFRI Sub-centre, Nilambur was opened for the public on 21 May, 1995 by the Hon. Minister for Forests, Mr. Kadavur Sivadasan. Other dignitaries present at the function were Mr. Aryadan Mohammed, Minister for Labour and Tourism, Dr. P.K. Iyengar, Chairman, STEC, Mr. K.V. Nambiar, Secretary Planning and Economic Affairs, Mr. Mukundan, PCCF and other senior officials of the Kerala Forest Department and Mr. K. Mohammed, President, Nilambur Panchayat.

In the design of the Museum and exhibits, the distinctive architectural style of Kerala and the traditional craftsmanship of the artisans has been adopted generously. Inside the Museum, the ground floor exposes the

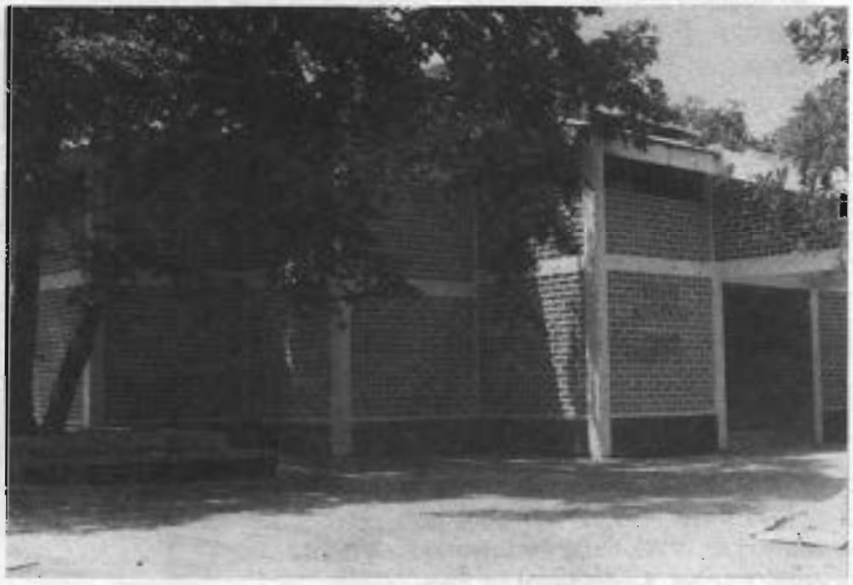
Inauguration of the Teak Museum

Nilambur - Teak country

The choice of Nilambur in Malappuram District in the North of Kerala as the venue of the Teak Museum is befitting as the earliest plantations of teak in the world were established here in the 1840's . Even today the Conolly Plot stands, not far from the Museum, in silent testimony to the pioneering efforts of Mr. Chathu Menon, Assistant Conservator and Mr. Conolly, Collector of Malabar who braved the elements and various other adversities of those distant days, to sow the seeds of what was to become Nilambur's claim to international fame. Nilambur teak still exudes that aura of exquisite timber that was renowned the world over from the first half of this century. The opening of the Teak Museum here was indeed an apt tribute to this enduring glory.

visitor to the grandeur of the teak plantations of the past and the present. The first floor of the Museum is divided into bays assigned to the different subject areas. They reflect the different facets of research on teak being carried out at KFRI and other centers around the world. The exhibits in the Teak Museum give a glimpse of the myriad uses that teak wood has been put to, ranging from shipbuilding to household articles. The Museum Library houses a collection of literature on teak in the form of books and reprints. A projection room for audio-visual presentations also forms part of the Museum.

The Museum is an excellent place to visit for students in general for an educational tour. For teak-enthusiasts and forestry researchers it offers a sweeping perspective of the world of this king of timbers.



The Teak Museum

Sculpture in front of the Museum

Educational Video (VHS)

THE TEAK DEFOLIATOR

A 20 minute scientific documentary produced by the Kerala Forest Research Institute on the teak defoliator, *Hyblaea puera* (Lepidoptera), the most dangerous forest plantation pest of the Asian tropics.

Depicts the biology, and the spectacular drama of the pest population outbreaks and defoliation which no words can fully describe.

Summarises our present knowledge on outbreak causation and suggests management methods.

Available from : The Librarian, Kerala Forest Research Institute, Peechi - 680 653, Trichur, Kerala, INDIA

Priced at US$ 50 per copy. Add US$ 30 for packing and postage. Special rate of Rs. 600 for bonafide users within India. (Please make the drafts payable to Director, Kerala Forest Research Institute, Peechi).

Campus News

KFRI Seminars

Dr. Hugh F. Evans, Principal Entomologist, Forestry Commission, U.K. on 'Biological Approaches to Forest Pest Management' on Thursday 13th July, 1995

Degrees/Awards/Nominations/Prizes etc.

Dr. P.S. Easa was nominated as Member, Programme Advisory Committee of All India Radio, Trichur.

Dr. P.S. Easa was nominated as consultant to WWF-India for Environmental Impact Assessment of Eco-development Programme proposed in Tiger Reserves in India - Periyar Tiger Reserve (Kerala), Rajiv Gandhi National Park (Karnataka), Buxa Tiger Reserve (West Bengal) and Similipal Tiger Reserve (Orissa).

Dr R. Gnanaharan was awarded an ITTO Fellowship to conduct a collaborative study at the New Zealand Forest Research Institute, Rotorua. He was in New Zealand for six weeks in June-July 1995. On his way back, he visited the Division of Forest Products, CSIRO, Melbourne, Australia on July 21, 1995.

Mr. C. Mohanan was awarded a Ph.D in Environmental Studies by the Cochin University of Science and Technology, Kochi in May, 1995.

Visitors

Dr. Hugh F. Evans, Principal Entomologist at the Forestry Commission, U.K. visited KFRI during July 7-13, 1995.

"Are there any forests in the Arabian Sea that it rains there ?" This retort, attributed to the irrepressible Late Mr. Seethi Haji, then Speaker of the State Assembly, came when the issue of impact of deforestation was brought up. Probably a rhetorical outburst said half in jest, it has however tickled the minds of quite a few who have all along felt that environmentalists have been crying wolf over any kind of developmental activity.

More than anything else, it underscores the need for scientists, especially biologists, to occasionaly come down a few steps and bring along the people rather than expect them to take all their statements as the gospel truth.

Editor

Obituary

Shri. K.S. Gopalan (1947 - 1995)

With profound sorrow we record the demise of our colleague Shri. K.S. Gopalan, Overseer, Engineering Section on July 17, 1995.

'Gopalji' was with KFRI from 1977 and he was involved with almost all of the civil work carried out during the establishment of the Institute campus at Peechi. In his death KFRI lost a sincere and commited employee. His simplicity, honesty and devotion to work had endeared him to friends and colleagues at KFRI.

May his soul rest in peace.

Symposia, Workshops and Training Programmes Conducted

KFRI hosts TSBF Board of Management Meeting

The Board of Management Meeting of the Tropical Soil Biology and Fertility (TSBF) Programme was held during 5-10 June, 1995 at KFRI. TSBF was initiated in 1984 under the patronage of the Man and Biosphere Programme of UNESCO and the 'Decade of the Tropics' initiative of the International Union of Biological Sciences (IUBS) to promote the biological management of soil fertility as an essential component of sustainable agricultural development.

Participants in the TSBF Meeting

Speaking on this occasion with the Scientists of KFRI, Prof.M.J Swift, Director of the TSBF Programme pointed out that the biological management of soil fertility is an holistic approach integrating the biological, chemical and physical processes that determine the natural fertility of soil with farmer's management practices. The programme also ultimately seeks to provide the means for improved soil and ecosystem management for the farmers, foresters, plantation managers and ecologists of the tropical region. In order to achieve these objectives, he stressed the importance of involvement of research institutes like KFRI in TSBF research programmes. Prof.P.S. Ramakrishnan, Vice-Chairman of the Board of Management, highlighting the ecological and socio-economic advantages of mixed-species homestead farming systems of tropics, called for research on the biological and organic resources management for improved soil fertility and for utilisation and conservation of biodiversity in such homestead agroforestry systems in order to make such systems more productive and ecologically, socio-economically viable. Scientists from KFRI, Rubber Research Institute,India, Varanasi Research Foundation, Karnataka, Madurai Kamaraj University and University of Agricultural Sciences, Bangalore also participated in the one-day workshop to develop research proposals within the TSBF research themes for implementing them in the Western Ghats zone of the South Asia Regional Network (SARNET) of the TSBF Programme.

Training in Nursery Methods

Dr. R.C. Pandalai organized a one-day training programme on July 7, 1995 on cultivation of *Pterocarpus santalinus, Wrightia tinctoria, Santalum album, Saraca asoka* and *Caesalpinia sappan* at Palappilly nursery for 15 farmers from the Pallam, Muthalamada Panchayat of Kollangode Taluk.

Farmers with Dr. Pandalai at the Training Programme

KFRI Publications

Author/Editor	Title	Price	
		India (Rs.)	Foreign (US$)
K.S.S. Nair, *et al.*	Ecodevelopment of Western Ghats	200.00	18.00
C. Renuka	Rattans of the Western Ghats	100.00	8.00
K.M. Bhat	Structure and Properties of South Indian Rattans	75.00	5.00
K.K.N. Nair, *et al.*	Tropical Forest Ecosystem Conservation and Development in South and South-East Asia	200.00	18.00
I.V.R. Rao, *et al.*	Bamboos : Current research	140.00	15.00
N. Sasidharan	Forest Trees of Kerala	15.00	5.00
S. Chand Basha & K. M. Bhat	Rattan Management and Utilisation	300.00	25.00
K.V. Sankaran, *et al.*	Litter Dynamics, Microbial Associations and Soil Studies in *Acacia auriculiformis* Plantations in Kerala	75.00	8.00
P.K. Muraleedharan *et al.*	Socio-economic Research in Forestry	350.00	40.00
Mammen Chundamannil	History of Forest Management in Kerala	50 (Individulas) 150 (Institutions)	15.00
----	Teak (Information Bulletin)	15.00	5.00
T.K. Dhamodaran	Upgradation of Rubber wood	75.00	8.00
C. Renuka	A Manual on the Rattans of Andaman and Nicobar Islands	175.00	20.00
K. Sankara Pillai & N. Sarojam	Bamboo Researchers and Projects of South and South-East Asia	125.00	15.00

Note : Booksellers are offered a discount of 25% on the published prices.

For copies contact : Librarian, KFRI, Peechi - 680 653, Kerala, INDIA