EVERGREEN

INTERNATIONAL SYMPOSIUM ON TROPICAL FORESTRY RESEARCH : CHALLENGES IN NEW MILLENIUM

Half Yearly Newsletter of the Kerala Forest Research Institute

No. 45 September 2000

Building Partnership in Forestry Research

With the dawn of new millennium, the consensus emerging from among the various circles is that partnership in research, like business enterprise, may provide higher dividends than the proprietorship known for credibility and profitability of a single body /organisation / country or individual. There seems to be really no "individual prosperity", if the fruits of new ventures are not shared beyond the boundary walls. The new message to the research community, strikingly relevant in forestry sector, appears to be *"build partnership bridges instead of ivory towers"*. To throw more light on the relevant issue, the current edition of EVERGREEN focuses attention on the outcome of the interaction meetings / conferences of local and global significance including the international symposium held at KFRI and the new FAO Strategic Plan for Forestry.

One of the resolutions passed in the XXI IUFRO World Congress Kuala Lumpur (2000) is that IUFRO should seek closer collaboration with other research organisations, while bringing its experience and networking powers to assist other research networks and consortia. The recommendations of the international symposium on "Tropical Forestry Research: Challenges in the New Millennium" held recently at KFRI also places high emphasis on cooperative research among the regional organisations and between the countries to tackle the common problems by networking approach with twining of institutions for sharing expertise with the financial support of international donor agencies. The new strategic plans laid out by FAO for forestry in the year 2000 attach high importance to build partnerships among member country governments, organisations (both within and outside the United Nations system), non-governmental and for private sectors including industry.

A case example that reminds the need for such a partnership is development of forest-based industries. The changing pattern of wood supply calls for a new approach for integrating wood research with plantation technology for wood farming on the one hand and with increased conversion efficiency of small diameter logs in the manufacture of value-added / new products on the other. Obviously, the various sectors looking for partnership in such a venture include: forest managers, farmers, researchers, industrial sectors and above all policy makers. Because most of the technologies are available in industrialised countries, partnership ventures could facilitate the flow of updated technology to developing countries including India. Perhaps, it is the only option when the situation demands huge investments on plantation development,

Conformable Harmony

research and structural changes of the industries for processing small dimensional materials with new or modified machinery for sawmilling, veneer production and manufacture of reconstituted products, including glue-laminated structural composites. The comprehensive analysis of Asia Pacific Forestry sector indicates that total annual investment needs for plantation development and structural changes of the industries in South Asian countries range from the level of US $ 891 million in the year 1994 to US $ 1237 million to the year 2010. Additional 10-15% of these figures are estimated for institutional infrastructure/ support, research, training/human resource development, technology development and dissemination.

Of late, various non-governmental and private sectors are getting involved in research and development programmes in addition to the Government institutions concerned with forestry research. Many networking institutions were established recently in the Asian Region. To mention a few, the Forestry Research Support Programme for Asia and the Pacific (FORSPA), Asia Pacific Association of Forest Research Institutes (APAFRI), Forestry Tree Improvement Programme (FORTIP), Asia Pacific Agroforestry Network (APAN), Regional Wood Energy Development Programme (RWEDP), International Network for Bamboo and Rattan (INBAR). These institutions foresee research and development through the stronger partnerships built, both within and between the countries, for pooling the limited available resources and share infrastructure/expertise for research and technology and to mobilise support from among national/international developmental agencies including private forestry sectors. For instance, one proposed model is illustrated above for building partnerships on world-wide teak wood research programme. The teak wood network integrates the collaborative efforts of IUFRO 5.06.02 Working Party (Quality Timber from

Teak Plantations) with other teak institutions, viz. TEAKNET and TEAK 2000 with the involvement of regional R and D organisations, possibly under the umbrella of IUFRO/APAFRI. It will facilitate in identifying research

partners with lead institutes of different countries to implement teak wood research, training and technology transfer activities. The major challenge is - how industries respond, with the political will of the respective countries, in implementing the voluntary codes of conduct through management practices, technology transfer and investment.

K. M. Bhat

-Editor

CONTENTS

From the Director's Desk

The Silver Jubilee Year was quite eventful for KFRI. For the first time we organized open-day week during 17-21 July, 2000, when the institute's research facilities and activities were opened to school and college students and public at large. About 300 children from various schools of Thrissur district visited the Institute and showed keen interest in forestry research and interacted freely with scientists. Since, such open-days are an important part of extension and key element in the outreach of the Institute to end-users, stake holders and public we have decided to hold open-day week every year. The other milestone was the Silver Jubilee International Symposium on "Tropical Forestry Research: Challenges in the New Millennium" organized during August 2000. The Symposium was attended by 102 participants from across the country and abroad. We hope that the national/international forestry research organizations will take cognesent of the recommendations of the Symposium which will go a long way in understanding the complexity of tropical forestry ecosystem and problem solving tropical forestry research as per the needs.

As we enter the new millennium, it is time that we plan the future forestry research needs which should reflect the changed scenario during the past few decades. On the scientific human resources front, KFRI is confronted with a problem which need to be addressed with an urgency. Since most of the scientists are in the age group of 40-50 years, joined during the first ten years, beginning with 2004, within a span of 8 years a large number of the scientists will superannuate. This will not only leave a vacuum in scientific human resources but slow down the pace of research. Unless an appropriate action is taken now to circumvent this catastrophic situation by recruiting additional scientists, it may be too late to save KFRI from pernicious condition. We are taking necessary steps to address this problem with all seriousness.

Training and extension are important facets of any research organization dealing with applied field like forestry where research results are to be utilized by the endusers and stake holders. With the capabilities we have in KFRI, acquired over the years we are ready to embark upon imparting training basically with two objectives: (1) to impart training with a view to desseminate information to our endusers and stake holders and (2) to generate additional resources needed for the developmental activities of the Institute. Needless to say that it has to be without affecting our research activities, which is our primary mandate. Hopefully, with the additional grant sought it will be possible to establish, in the near future, a full-fledged training, extension and education centre where we can attract clients from national and international organizations and impart training on various aspects of tropical forestry.

KFRI being the State Institute, it has certain limitations. If KFRI has to compete with the National and International organizations we have to strive hard to maintain high standard of research. Be it basic or problem solving applied research, there cannot be any compromise in quality, which can be achieved only through constant quest for innovation, perfection and consistency in the standard of our publications. It is not enough that we bring out KFRI Research Reports. We have to make earnest efforts to publish research results in standard national or international referred journals of repute.

J.K. Sharma

International Symposium on

"Tropical Forestry Research : Challenges in the New Millennium", KFRI Peechi 2-4 August 2000 – A Report

As part of the Silver Jubilee celebrations, KFRI organised an international symposium on "Tropical Forestry Research : Challenges in the New Millennium" during 2-4 August 2000 to take stock of the progress made in various fields of tropical forestry in the past and to identify gaps in information and to fix priority areas of research on a global basis. A total of 102 delegates from India and abroad participated in the 3-day Symposium.

The main objectives of the Symposium were:

- **To provide a common platform for researchers to share and exchange of information on tropical forestry**
- **To take stock of progress made in various areas of tropical forestry**
- **To identify short-comings and follow-up actions needed and**
- **To identify future priority areas of research in tropical forestry on a global basis.**

INAUGURAL SESSION

The symposium was officially inaugurated by Dr. D.N. Tewari, Member (Forestry), Planning Commission, Govt. of India. Mr. C.K. Nanu, Hon'ble Minister for Forests , Govt. of Kerala, presided over the function. Dr. M. R. Das, Chairman, State Committee on Science, Technology & Environment (STEC) and Ex-Officio Principal Secretary, Science & Technology, Govt. of Kerala, Trivandrum, welcomed the gathering. Dr. J. K. Sharma, Director, KFRI and convenor, made a presentation on the achievements of KFRI during the past 25 years. The keynote address of Mr. C. P. Oberoi, Inspector General of Forests, Govt. of India, who could not attend the function due to pressing official engagements, was read out.

Welcome address by Dr.M. R. Das

Mr. C.K. Nanu, Hon'ble Minister for Forests delivering the presidential address

Dr. D.N. Tewari, delivering the inaugural address

Presentation of KFRI's achievements by J. K. Sharma, Director

Mr. K. Sasidharan Nair, Principal Chief Conservator of Forests, Govt. of Kerala, delivered a special address. The silver jubilee souvenir was released by Dr. M. R. Das and

Vote of thanks by Dr. R.V. Varma

the Principal Chief Conservator of Forests, Govt. of Kerala, received the first copy. All the past directors of KFRI were honoured in a traditional way during the function. Except Dr.. S. Kedharnath, all the past directors (Dr. C. Chandrasekharan, Mr. K.K. Nair, Dr. P.M. Ganapathy, Dr. C.T. S. Nair, Dr. S. Chand Basha and Dr. K.S.S. Nair) were present in the function. Dr. R.V. Varma, Joint Convenor, proposed vote of thanks.

TECHNICAL SESSIONS

There were seven Technical Sessions for oral and poster presentations. In all, there were 46 oral presentations and 26 posters spread over 7 Sessions. Highlights of various Sessions are given below.

Session I. Tropical Forestry Research: Issues and Challenges

Chairman : Prof. P. S. Ramaksrihnan, India

Rapporteurs: Drs. U. M. Chandrashekara and V. Anitha, KFRI

There were three lead presentations. The highlight of the session was a paper by Dr. C.T.S Nair, FAO, who unequivocally suggested a change in approach to forestry research to deal with emerging problems. Similarly, urgent need for socio-economic research in forestry was emphasized by Dr. C. Chandrasekaran.

Dr. P. S. Ramakrishnan during symposium

Session II. Sustainable Management of Natural Forest
Chairman: Dr. John Parotta, USA
Rapporteurs: Drs. K. K. Nair and K. K. Ramachandran, KFRI

While one of the papers emphasised the need for protection and conservation of the flora in wildlife sanctuaries, another indicated the scope for using geo textiles as an ecofriendly product for soil protection and water conservation. The paper presented by Dr. A. R. R. Menon stressed the need for using GIS and RS techniques for the preparation of forest management plans in addition to resource and vegetation mapping.

Session III. Biodiversity and Conservation
Chairman: Dr. Richard Loyn, Australia
Rapporteurs: Drs. N. Sasidharan and George Mathew, KFRI

Dr.Richard Loyn addresses the delegates

There were four presentations dealing with biodiversity and its conservation. Papers dealt with importance of people in conserving biodiversity, for conserving biodiversity, place prioritization for biodiversity conservation and economic evaluation of biodiversity.

Session IV. Management of Forest Plantations in the Tropics
Sub session: Productivity and management
Chairman: Dr. K. S. S. Nair, India
Rapporteurs: Drs. K. Jayaraman and K. K. Seethalakshmi, KFRI

The lead paper by Dr. T. H. Booth demonstrated how relevant research, strengthened by partnerships, can be built for the advancement of sustainable plantation forestry. The other papers dealt with new management options and research strategies for improving the teak productivity in Kerala as well as future of poplars in India. Another speaker noted the declining yield of teak plantations in Kerala, suggesting ameliorating measures. Great potential of managing teak defoliator *Hyblaea puera*, using biological control strategies through NPV, was the highlight of another excellent presentation. A multidisciplinary review on work done on eucalypt at KFRI gave an impressive exposition of research done on various aspects to improve the plantation productivity in Kerala.

Sub session: Environment
Chairman: Dr. Trevor Booth, Australia
Rapporteurs: Dr. A.R.R. Menon and Ms. P. Rugmini, KFRI

An interesting paper on evaluation of economic values of plant diversity in monoculture eucalypt plantations was presented by Dr . K. K. Sangha (Australia). Excessive water use by eucalypt which has been an environmental concern, in the past was another presentation. *Eucalyptus urophylla* was identified as a better efficient, ecophysiologically ideal species for plantations. A paper on global climate change and forest productivity highlighted long-term regulation of some of the biological process, especially photosynthesis which may have a direct impact on carbon and water balance of the ecosystem.

Sub session: Genetics and Propagation
Chairman: Prof. H.Y. Mohanram, India
Rapporteurs. Drs.V. V. Sudheendrakumar and Dr. T. Surendran, KFRI

A detailed paper on vegetative propagation of *Acacia* hybrid evoked considerable interest which outlined a simple technology for clonal propagation. In another excellent presentation for the first time, genetic variability was established in teak using RAPD markers.

Session V. Forests and People
Chairman: Dr. C. Chandrasekharan, India
Rapporteurs. Drs. P.K. Muraleedharan and K.V. Sankaran, KFRI

Some excellent papers emphasized the significance of man-forest interaction from the point of view of management of forests, whether it is community forestry or participatory forestry. The importance of people as a partner in the management of forests was also highlighted.

Session VI. Ecology and Biodiversity of Western Ghats
Chairman: Mr. K. Balachandran Thampi, IFS, India
Rapporteurs: Drs. C. Renuka and E.A. Jayson, KFRI

The session covered diverse aspects such as NWFP management, plant diversity, faunistic diversity, community involvement in protected area (PA) management, invasion of exotic plants in disturbed, man modified forest ecosystem and conservation efforts. The session brought out very clearly that multidisciplinary and multi-institutional efforts are needed to tackle the ecology and biodiversity of Western Ghats. In addition, there are still a large number of gaps in knowledge to be filled up on priority basis.

Session VII. Wood and Non-wood Forest Products
Chairman: Dr. Steve Read, Australia.
Rapporteurs : Drs. K.V. Bhat and E.J. Maria Florence, KFRI.

Under non-wood forest products, papers highlighted on the ecology and economics of NWFP production, status of rattans in India, NWFP (edible fleshy fungi) of Manipur, and two decades of bamboo research at KFRI. The paper on ecology and economics of NWFP reviewed the current status and identified future strategies for sustainable management of NWFP, value addition, etc.

Under wood products, presentation on utilization of plantation grown timbers highlighted the research activities of KFRI in this field. The paper projected future trends and research priorities for efficient utilization, value addition, assessment of wood quality etc. Another paper reviewed the work done in the field of wood deterioration by marine organisms and emphasized the need for adoption of scientific wood protection

Participants

technology as an economical viable option for optimal utilization of timbers for marine purposes

Poster Session The Poster Session was organised on 3rd August in which 26 posters were presented relating to the following themes

Sustainable Management of Natural Forests
Biodiversity and Conservation
Management of Forest Plantations in the Tropics
Wood and Non Wood Forest Products

Poster Session

All the posters displayed were evaluated by a Poster Award Committee (Prof. H.Y. Mohanram, Chairman, Dr. N.B. Singh and Dr. P.S. Easa) and the best poster in each Session was adjudged and prizes given away during the concluding session.

Concluding Session
Chairman: Dr. Ian Ferguson, University of Melbourne, Australia
Rapporteurs : Dr. S. Sankar and Mr. K. C. Chacko, KFRI.

Dr. Ian Ferguson gave away the best poster awards to the following potser presentations.

1. "Influence of fire on growth and regeneration of tropical moist deciduous forest" by SM. Sundarapandian, K. Chinnathampi and P.S. Swamy
2. "Reed underplanting in older teak plantations : A healthy soil management practice" by M. P. Sujatha, A.I. Jose and S. Sankar
3. "Biodiversity in tropical moist forests : A study of sustainable use of non-wood forest products in the Western Ghats, Kerala" by P.K. Muraleedharan, N. Sasidharan and K.K. Seethalakshmi
4. "Soil faunal diversity in natural forests Vs agroforestry systems" by B. Ambika Varma, P.B. Bijumon and Stany Varghese.

Dr. Ian Ferguson at concluding session

Papers Presented by KFRI Scientists

Balagopalan, M., Nandakumar, U. N., Indira, E. P., Jayaraman, K., Varma, R. V. and Chundamannil, M. 2000. Problems and prospects of management of teak plantations in Kerala.

Bhat K. M., Bhat K.V., Dhamodaran T.K. and Gnanaharan, R. 2000. Utilisation of plantation grown timbers: new challenges

Chacko, K.C., Balagopalan, M., Balasundaram, M., Florence, E. J. M., Jayaraman, K., Kallarackal, J., Mohanan, C., Pandalai, R. C., Sankaran, K. V., Sharma, J. K., Somen, C. K., Sudheendrakumar, V. V., Surendran, T., Thomas, P. Thomas and Varma, R. V. 2000. Eucalypt research in Kerala: A review.

Dhaneshkumar, P., Ashoka P.K. and Balasundaram, M. 2000. Nodulation behaviour of mangium (*Acacia mangium* Willd.) and seedling response to *rhizobium* inoculation.

Dhamodaran, T.K. and Gnanaharan, R. 2000. A way to couple quality with production in the utilization of rubber wood.

Easa, P.S., George Mathew., Jayson, E.A. and Ramachandran, K.K. 2000. Faunistic diversity in the South-western Ghats of Kerala.

Jayaraman, K., Easa, P. S. and Jayson, E. A. 2000. Predicting the variation in detection function in line transect sampling through random parameter model.

Jayaraman, K. and Lappi, J. 2000. Estimation of height-diameter curves through multilevel model for teak.

Kallarackal, J. and Somen, C.K. 2000. Tree water use in selected plantaion species of Kerala.

Menon, A.R. R., Nair, P.V.K. and Nandakumar, U.N. 2000. Application of geographical information system and remote sensing techniques in forestry: an overview.

Mohan Kumar, B., Muraleedharan, P.K and V. Mahajan, 2000. Linkages between Ecology and Economics: An analysis of the Non- wood Forest Production Scenario in India

Mohan Varghese., Balasundaram, K., Murugeshan, K., Induchoodan, N.C. and Siddappa. 2000. Breeding *Acacia mangium* for improved productivity in Kerala, India.

Muraleedharan, P.K., Sasidharan N. and K.K. Seethalakshmi., Biodiversity in Tropical Moist Forests: A study of Sustainable use of Non-wood Forest Products in the Western Ghats, Kerala.

Muraleedharan, P.K., Manoharan, T.R and George Mathew. 2000. Economic valuation of biodiversity: problems and prospects.

Nair K. K. N., Renuka, C., Sasidharan, N., Muktesh Kumar and Yesodharan K. 2000. Knowledge on the plant diversity of Kerala: the present scenario and future needs

Renuka, C., Bhat, K. M., Dhamodaran, T.K., Muraleedharan, P.K., Mohanan, C. and Seethalakshmi, K.K. 2000. Rattans of India: status and opportunities

Rugmini, P. and Balagopalan, M. 2000. Growth of teak in successive rotations: A case study at Nilambur, Kerala, India.

Seethalakshmi, K.K., Gnanaharan, R., Mukteshkumar, Menon, A.R.R., Nair, P.V.K., Pandalai, R. C., Mohanan, C., Chandrashekara, U. M., Thomas, P. Thomas., Bhat, K. V., Krishnankutty, C. N., Muraleedharan, P. K., Mathew, George., Surendran, T. and Indira, E. P. 2000. Two decades of bamboo research at Kerala Forest Research Institute.

Sudheendrakumar, V.V., Evans, H.F., Varma, R.V., Sajee, T.V., Mohandas, K., Sathyakumar, K.V. and Nair, K.S.S. 2000. Management of teak defoliator, *Hyblaea peura* using baulovirus within a control window concept.

Sujatha, M.P., Jose, A.I. and Sankar, S. 2000. Reed under planting in older teak plantations-A healthy soil management practice.

Varma, R.V. and Swaran, P.R. 2000. Termite control in tropical forestry: challenging attitudes and techniques.

Visit our website : http://www.kfri.org

International Symposium on"Tropical Forestry Research: Challenges in New Millennium": RECOMMENDATIONS

Tropical Forestry Research: Issues and Challenges

1. Rehabilitation strategies for degraded ecosystems should take on board: a) Landscape management approach and b) site-specific approach with a judicious use of native/exotic species for enabling an accelerated succession.
2. Forestry management strategies should be based on well-designed linkages between silvicultural, ecological and socio-economic dimensions ; appropriate methodologies should be developed with policy dimensions in view.
3. Research and development institutions should a) prioritise forestry research with changing time relating to contemporary demands, b) foresee upcoming crises in forestry sector and c) manage crises efficiently.
4. Efforts should be made for regional / inter country co-operation in tackling some of the common problems such as pests, diseases, site-species matching, species / provenance trials, etc. and exchange of plant material for research.
5. Possibilities should be explored for networking and twinning of institutions to promote exchange of experts on regional/ inter country basis. Funds for such activities should be made available by international donor agencies.

Sustainable Forest Management, Biodiversity and Conservation

1. More research should be carried out to improve our ability to estimate values of biodiversity services.
2. More effective methods of forest rehabilitation or restoration should be developed. Appropriate and cost effective soil conservation techniques should be adopted to check soil degradation.
3. Need based research should be undertaken to assess the best ways to integrate or segregate production and conservation.
4. The GIS & RS techniques should be used for the preparation of Forest Management Plans in addition to resource and vegetation mapping.

Management of forest plantations in the tropics

1. There are vast opportunities to use plantations for wood production and for environmental benefits such as a carbon sequestration, amelioration of degraded lands and biodiversity enhancement. These opportunities should be fully explored by promoting collaborative research in plantation forestry, especially in areas of tree improvement and site management practices for maximum production.
2. Native species should be promoted in the forest plantation scenario. Intensive species trials on regional and inter country basis should be undertaken for species-site matching and standardisation of management practices.
3. Teak under intensive management is emerging as a viable commercial alternative to many plantation crops and hence research on integrated management of teak need to be intensified. Collaborative multidisciplinary research should be carried out for enhancing the productivity of teak under conventional and intensive management forestry. Certain institutions / organisations should be identified on region or country basis and adequate funds provided by National and International donor agencies for the purpose.
4. The possibility of realising high yields for plantation crops using superior clones and better management practices has been demonstrated in many countries. While the research on these lines should be intensified, package of practices for the current technology should be brought out for the benefit of the growers. Efforts should be made to resolve some of the regional issues on marketing and price fixation.
5. In each country, a suitable mechanism for registration of new clones, their exchange for research purpose and their dissemination to planters should be developed.

Environment

1. Socio-economic impact assessment studies should be undertaken before introducing new tree species. Local knowledge, especially use of plants and animals, should be considered as part of this process.
2. Low-cost techniques for evaluating the effects of climatic and atmospheric change on tree species should be further developed, tested and applied.
3. Greater account should be taken of tree water use characteristics when selecting species for planting in particular locations.

Genetics and Propagation

1. Intensive studies should be undertaken on progeny trials, clonal propagation, tissue culture, nutrient inputs and growth simulation in important native and exotic plantation species.
2. For accelerating the tree improvement programmes for desirable traits, molecular marker studies should be carried out for important plantation species.

Forests and people

1. Socio-economic research and capacity building should be taken up to assist Forest Department, other agencies and local communities for introducing joint forest management.
2. Biological research should focus on effect of human disturbance on group of plants and animals that are of interest to people, making greater use of replicated retrospective studies, especially non wood forest products.
3. Communities in and around forests should be given more rights to harvest non-timber forest products with the added responsibility to be involved in tree plantation development on degraded lands.
4. People should be given rights to harvest wood as well as non-wood forest products in their own home gardens / homesteads and community lands.

Ecology and Biodiversity of Western Ghats

1. Research should be accelerated on inventorying the flora and fauna and vegetation mapping and characterisation using modern tools such as Geographic Information *System(GIS) and Remote Sensing(RS)* techniques. More data should be generated on less known plant and animal groups, especially habitat and species diversity and genetic diversity.
2. Studies should be carried out on habitat requirements of individual species for effective conservation. Effective strategies should be evolved for the protection and conservation of the rare and endangered plant and animal species.
3. Integrated research should be carried out on different aspects involving people, forests, agriculture, animal husbandry, hydrology, etc. at micro and macro watershed basis for formulating effective and viable sustainable management strategies for the development of Western Ghats.
4. Massive awareness campaign should be undertaken with the participation of people, NGO's and politicians for the effective conservation of biodiversity and sustainable utilisation of forest products.

RESOLUTIONS of the XXI World Congress, 2000, Kuala Lumpur, International Union of Forest Research Organizations

CONSIDERATIONS	RESOLUTIONS
Recognizing the great contributions made by forests, trees, industries and the forestry profession to human environmental, economic and socio-cultural welfare, **further recognizing** the contributions to poverty alleviation, the stimulating of development and reversing environmental decline, **further recognizing** the importance of cultural diversity, and **further recognizing** that research is undertaken at different intensities depending on the geographical extent of a problem, the level at which it is approached, and the inter-relationships with other problems,	IUFRO should continue and expand its stimulation and support for research, and provide the knowledge necessary to achieve sustainable forest management within differing physical and social landscapes; it should seek to reconcile conflicting demands for wood and non-wood products, environmental services and social benefits; IUFRO should also seek appropriate knowledge, particularly from indigenous people.
Noting the increasing attention paid to forests by international and national agencies, international NGOs, commercial enterprises and academic institutions, and the need for reliable information by decision-makers in such organizations, and services	Research should be increasingly directed towards forest policy-related issues in the major environmental and social conditions including urban, mountain and dry environments; IUFRO has a major role in enhancing the interface of science, policy and industry, aiming at better provision of all forest benefits, goods
Being aware of the place of forestry in the considerations of several inter-governmental processes, and of IUFRO's unique capacity to mobilize a broad range of individual and collective expertise,	IUFRO should strengthen its contributions to international debates and political processes, specifically those relating to:- genetic resources and biotechnology; biodiversity; sustainable forest management; climate change and carbon sequestration; soil; water; fire; deforestation, forest degradation and desertification. It should promote the transfer of socially acceptable, environmentally sound techniques.
Considering the public concern for the possible impacts of forestry activities on global and local environments, social welfare and biodiversity, and **remembering** that IUFRO's research traditionally focusses and progresses in major disciplines.	Research should increase within single disciplines while simultaneously moving towards an inter-disciplinary, problem-solving approach; IUFRO should seek closer collaboration with other research organizations, while bringing its experience and networking powers to assist other research networks and consortia.
Appreciating the research undertaken and the forest and forest products technologies developed, especially by IUFRO member institutions and individual scientists, **realizing** that much of this information is available in scattered sources and forms, and **observing** the rapid development and availability of information technologies,	Existing information should be made available in accessible and appropriate forms for the wide range of users; forest research institutions should strive to divulge their research results; use of the IUFRO Net, and development of the Global Forest Information Service led by IUFRO, should be intensified and IUFRO research units should continue to disseminate statements of the current state of knowledge in their specific fields.
Believing that forest research capacity is low in countries with developing and emerging economies, and that women scientists are under-represented and insufficiently supported in forest research,	IUFRO should expand its collaboration with other organizations that seek to enhance biophysical and social research capacity in countries with developing and emerging economies; it should encourage the role of women and disadvantaged researchers in forest sciences.

KFRI's Representation in XXI IUFRO World Congress

The XXI IUFRO World Congress, Kuala Lumpur 7-12 August 2000 was attended by Dr. J. K. Sharma (Director) and four scientists, Drs. K. M. Bhat, T. K. Dhamodaran (Wood Science), C. Monahan and E.J. Maria Florence (Pathology). The following papers were presented in different technical sessions:

- Status of Forest Diseases in India and Future Research Needs" by J.K. Sharma
- "Outbreak of Epidemiological diseases: Potential Threat to Tropical Forestry in India" (oral) and "Diseases and Disorders of Bamboos in Asia" (poster) by C. Monahan
- "Evaluation of chemicals for the control of sapstain on rubberwood" (poster) by E. J. Maria Florence.
- "Technology packages for quality wood products of teak plantations: challenges and promises for the 21st Century" by K. M. Bhat.
- "Preservative treatment of rubberwood: a way to couple quality with production" (poster) by T.K. Dhamodaran and R. Gnanaharan
- "Growth stresses and some wood quality attributes in planted teak" by T. Okuyama, H.Yamamoto, I. Wahyudi, Y.S. Hadi and K.M. Bhat

In their capacities as Coordinators of the Working Parties, Drs. J.K. Sharma and K. M. Bhat organized the technical sessions , "IUFRO 7.02.07 : Diseases of Tropical Forest Trees: Impacts of Diseases on Sustainability of Tropical Forests" and "5.06.02 : Timber Quality from Teak Plantations" respectively.

Dr. K. M. Bhat was presented IUFRO Scientific Achievement Award, in the opening ceremony, in recognition of his contributions in the field of forest products. He also served as a member of the Poster Judging Committee for forest products during the congress.

FAO Strategic Plan for Forestry – A Quick Glance

A quick glance at the *FAO Strategic Plan for Forestry* cannot miss to record the FAO,s mission, goals, medium term objectives, current priority activities and vision in forestry. It sets the course for organisation's work in forestry in the years to come and will enable FAO to better help its member countries succeed in their quest for *sustainable forest management (SFM)*. Here are the highlights:

FAO'S FORESTRY MISSION

- To enhance human well-being through support to member countries in the sustainable management of the world's trees and forests

FORESTRY GOALS

- The contribution of trees and forests to sustainable land use, food security and economic and social development and cultural values at national, regional and global levels be maximized.
- The conservation, sustainable management and improved utilization of trees and forest systems and their genetic resources
- The increase in worldwide access to reliable and timely forestry information

STRATEGIES

- Continue to execute mandated roles efficiently and effectively
- Set clear priorities for work
- Build mutually beneficial partnerships with other organizations

MEDIUM-TERM OBJECTIVES

- Strengthen the information and databases on forest and tree resources
- Strengthen national forest policies
- Strengthen the technical foundation for sustainable forest resources conservation and development and forest product development and utilization.
- Improve or maintain the health and condition of forests
- Strengthen countries' institutional, legal and financial framework for the forestry sector
- Improve regional and international discussion and collaboration of forest policy and technical issues
- Strengthen partnership with other groups working in forestry
- Increase social and economic equity and improve human well-being through support to participatory forestry and sustainable management of forests and trees in marginal areas

CURRENT PRIORITY ACTIVITIES

1. Global forestry statistics and information. Development of a forestry information system; Global Forest Resources Assessment (FRA 2000)
2. Technologies and methodologies for the conservation and sustainable use of trees, wooded lands and forests
3. Policy and institution strengthening
4. Support to international processes influencing forests

The Tallest Tree in the World

The current record holder for the tallest tree is a redwood (*Sequoia*) growing in northern California. 'The Mendocino Tree' which measures 367 feet and 6 inches was reported to be the tallest individual tree in the world by the National Geographic Magazine (April 2000). Since 1995, the title was held by 'The National Geographic Tree' - another redwood, which is 365 ft and 6 inches tall. Besides redwoods, eucalypts are also among the tallest species of trees.

- E. M. Muralidharan, Genetics Division

LATE- BREAKING NEWS....

CSIRO (Australia) Honours KFRI

The CSIRO (Australia) Forestry and Forest Products Division honoured the KFRI in the opening ceremony of the International Symposium held at KFRI during 2-4 August 2000 for the outstanding contributions made by KFRI to tropical forestry. Dr. Trevor Booth, representing the CSIRO, spoke on the occasion and presented the memento to Dr. J. K. Sharma, Director, KFRI.

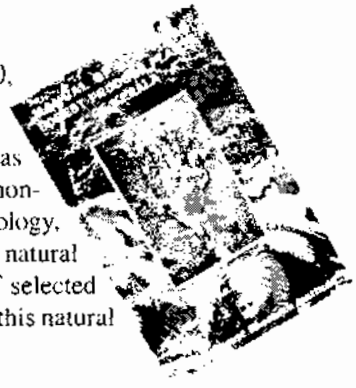
"Open Day" Week at KFRI

As part of the Silver Jubilee celebrations, KFRI observed a week-long "Open Day" schedule during 12-17 July 2000 to enable the public as well as the school children /college students of Trichur town and nearby places to get acquainted with the work being carried out for the benefit of the society. The programme was a grand success as evinced by the visits of over 3000 people. The visitors were briefed about the activities with slide shows and exhibitions. The general overwhelming response from the public prompted KFRI to organise "Open Day-week' every year.

KFRI – the venue of *District Level Consultation and Planning on Millennium Dialogue*

A meeting of the District Level Consultation and Planning on Millennium Dialogue was held at KFRI on 8 May 2000. Over 50 scientists and technologists from IRTC, KSEB, KERI, KFRI and the representatives of different colleges of Trichur attended the meeting. Dr. M. P. Parameswaran, and Dr. R. V. G. Menon addressed the audience and explained the vision, mission and technical aspects of the whole programme

New Release



Manual of Non-wood Forest Produce Plants of Kerala by K. K. N. Nair, 2000, KFRI Peechi , 459p. Price: Indian Rs. 450, Overseas US $ 50.00 + postage

This book contains exhaustive data on 160 species of flowering plants, which are potential as medicinal, drugs, gums, tannins, dyes, canes, bamboos and so on, belonging to the category of non-wood forest produces. Updated botanical nomenclature, local names, diagnostic descriptions, ecology, products and uses, marketing details and regeneration aspects are provided for each species. The natural distribution of all the species in Kerala, supplemented by maps, and colour photographs of selected species are also provided. Natural habitats, socio-economic aspects and conservation needs of this natural resource are highlighted in the introductory chapter.

Research Updates

More data are needed on heartwood formation in intensively managed teak plantations

Teak has a world-wide reputation for its natural durability of heartwood. At the instance of Sterling Tree Magnum Ltd., a study was designed to generate information as to whether fast growth itself will result in quicker formation of heartwood and whether intensive management practices and site conditions influence the yield and durability of heartwood of short rotation teak timber. With an unprecedented withdrawal of sponsorship, the project was terminated before compeltion of the tenure . The preliminary results, based on the limited samples, indicate that heartwood formation begins at the age of even before 3 years in fast growing trees of intensively managed plantations and heartwood percentage increases considerably with age of the trees. Microscopic observations were also made on the histo-chemical changes occurring from sapwood to heartwood region to throw light on the secondary changes taking place during heartwood formation. The extractives were most abundant near the heartwood boundary where all the parenchyma cells, vessels and fibres were filled with extractives. As the study remained incomplete, in recently publsihed KFRI Research Report No. 181, Dr. K. M. Bhat of Wood Science Division recommends for further studies to evolve plantation management strategies including those in farm forestry sectors.

Appropriate nursery management techniques warranted for satisfactory performance of micro propagated plantlets of teak and eucalypts

The performance of micro propagated plantlets of *Tectona grandis* and *Eucalyptus tereticornis* was assessed based on a field trial, with a randomised complete block design, conducted at the KFRI Field Research Centre, Veluppadam, Thrissur. The vigour and field hardiness was compared to the conventional planting material used in forestry plantations. In teak, the survival rate gradually showed a declining trend in the micro propagated plants throughout the course of 21 months of field growth, whereas the control plants (stumps), maintained a steady rate of high survival and were uniformly above 80%. No significant differences in height and girth increments were noticed between control and micro propagated plantlets. In eucalypts also, the rooted cuttings recorded a steady trend of high survival rate (above 80%) where as the micro propagated seedlings showed low survival (40%) throughout the study period of 21 months. Height and girth increments were even lesser in micro propagated plantlets than in the controls. In a recently concluded research project (KFRI Research Report No. 182), Drs. E. M. Muralidharan and R.C. Pandalai conclude that better nursery management practices need to be followed if the full potential of micro propagated plantlets is to be realised. They also recommend for the use of larger plastic bags or root trainers for raising the propagules and for greater care during *ex vitro* rooting of micro shoots. According to them, potential of micro propagated teak plantlets needs to be tapped, to take advantage of its unique field hardiness, for production quality stumps in teak.

The ecosystem of Mangalavanam mangrove needs protective measures

The study of vertebrate fauna in Mangalavanam mangrove area showed the occurrence of at least seven species of fishes, three species of reptiles, 42 species of birds and five species of mammals. The area was found as an ideal roosting site for little cormorants and night heron birds. According to Drs. E. A. Jayson and P.S. Easa, Scientists of Wildlife Biology Division, the major factors detrimental to the ecosystem of this protected area include: leasing land for other purpose, dumping waste in the lake, parking of oil tankers in Salim Ali Road, puramboke land encroachment and uncontrolled weed growth. In a recently completed research project (KFRI Research report 183), better management strategies were suggested for protection of this mangrove area.

Package of nursery and plantation practices for reed bamboos

Based on the comparison of four different regeneration methods and assessment of field performance, Dr. R. C. Pandalai (Silviculture Division) gives a package of nursery and plantation practices for establishing new plantations of reed bamboos (KFRI Research Report No. 187). Quality planting stock could be raised in the nursery from seeds, wildlings, by vegetative propagation techniques like rooting of culm and rhizome cuttings. However, better field establishment, faster growth and development were evident when either seedlings or rooted culm cuttings were used for out planting. The best season for vegetative propagation of reed bamboos is from March-May, the summer months of the year. Artificially regenerated areas are to be protected from elephants for successful establishment of reed bamboo plantations.

New Research Projects

KFRI 354 / 2000 : Habitat suitability index model for Nilgir Tahr in Eravikulam National Park.

Investigators : P.S. Easa and M.Sivaram.
Duration : 2 Years (April 2000 to March 2002).
Sponsored by : Kerala Forest Department (World Bank).

KFRI 357 / 2000 : A data base on forest resources of Kerala.

Investigator : M. Sivaram.
Duration : 18 months (April 2000 to Sept 2001).
Sponsored by : Science, Technology and Environment Committee.

KFRI 361 / 2000 : Quantitative inventory of non – wood forest products in northern Kerala.

Investigators : N.Sasidharan, U.M.Chandrashekara, P.K.Muraleedharan, M.Sivaram.
Duration : 3 Years (June 2000 to May 2003).
Sponsored by : Kerala Forest Department (Development).

Recent Publications

Book edited

- Ramakrishnan, P.S., Chandrashekara, U.M., Elouard, C., Guilmoto, C.Z., Maikhuri, R.K., Rao, K.S., Sankar, S. and Saxena, K.G. 2000. Mountain Biodiversity, Land use Dynamics, and Traditional Ecological Knowledge. UNESCO, New Delhi. Oxford & IBH Publ. New Delhi. 353p.

Chapters in Books/Proceedings

- Bhat K.M., Priya P.B. and Ancy Mathew 2000. Wood biomechanics of fast grown juvenile teak (*Tectona grandis* L.f). In: *Plant Biomechanics 2000* (Eds. Spatz H.C. and Speck, T.). Thieme Verlag Sttutgart. New York, pp397-402
- Easa, P.S. 2000. Animal diversity conservation and challenges. In: *Biodiversity and Ecology: Concepts and Facts*. (Eds. M. Sivadasan and K.V. Mohanan), University of Calicut, pp38-44.
- Kallarackal, J. 2000. Impact of converting natural vegetation into plantations on the watershed hydrology of the Western Ghats of India. In Proceedings of the Regional Workshop on Watershed Development, Management and Evaluation in the Western Ghats Region of India. 28-29 February 2000, CWRDM, Kozhikode, Kerala, India.pp. 102-107.
- Menon, A.R.R. and Varghese, A.O. 2000. Biodiversity Monitoring. *In Biodiversity and Ecology –Concepts and Facts* (Eds. Sivadasan, M. and Monahan, K.V.), University of Calicut, pp102–116.
- Menon, A.R.R., Varghese A.O. and Martin Lowel, K.J. 1999. Impact of Fire on Moist Deciduous Forest Ecosystem of Southern Tropical Forests of India. In: *Impacts of Fire and Human Activities on Forest Ecosystems in the Tropics*. Proc. International Symposium on Asian Tropical Forest Management III: 52-61.
- Mohanan, C. 2000. Introduction of root trainer technology in forestry - impact on nursery disease management. In: *Diseases and Insects in Forest Nurseries*. (Eds. Lilja, A and Sutherland, J.R.) Proc. 4th Meeting of IUFRO Working Party 7.03.04. Finnish Forest Research Institute, Suonenjoki, Finland. pp39-48.
- Mohanan, C. 2000. Epidemiology and integrated management of web blight in bamboo nurseries in India. In: *Diseases and Insects in Forest Nurseries*. (Eds. Lilja, A and Sutherland, J.R.) Proc. 4th Meeting of IUFRO Working Party 7.03.04. Finnish Forest Research Institute, Suonenjoki, Finland, pp107-128.
- Mohanan, C. 2000. Status of forest nursery diseases in India and emerging trends in seedling disease management. In: *Diseases and Insects in Forest Nurseries*. (Eds. Lilja, A and Sutherland, J.R.) Proc. 4th Meeting of IUFRO Working Party 7.03.04. Finnish Forest Research Institute, Suonenjoki, Finland, pp 231-242.
- Varghese A.O. and Menon, A.R.R. 1999. Distribution pattern of tree species of Southern Western Ghats: A case study from Peppara Wildlife Sanctuary. In *Biodiversity, Taxonomy and Conservation of tropical flowering plants*, (Eds. .Sivadasan M. and Mathew, P.), Mentor books, Calicut 145 – 153.

Scientific Papers

- Balasundaran, M., Thomas, T.P., Sujatha, M.P. and Sankaran, K.V. 2000. Effect of soil properties on status of root nodulation of *Acacia auriculiformis* in acidic soils. Indian Journal of Forestry 23: 212-216.
- Bruce,A., Wheatley, R., Humphris, S.N., Hackett C A and Florence, E.J.M. 2000. Production of volatile organic compounds by Trichoderma in media containing different amino acids and their effect on selected wood decay fungi. Holzforschung 54: 481-486.
- Indira E.P., Chand Basha, S. and Chacko, K.C. 2000. Effect of seed size grading on the germination and growth of teak (*Tectona grandis*) seedlings. *J. Trop. For. Sci.* 12 (1) : 21-27
- Indira, E.P.and Rugmini,P. 1997. Genetic control of seedling height and girth in *Ailanthus triphysa*. *J. Tree Sci* 16 (1): 56-58
- Indira, E.P. and Rugmini,P. 1997. Variability and heritability in *Bambusa bambos* (L.) Voss. *J. Tree Sci.* 16 (2): 120- 122.
- Jayashankar, B and Muraleedharan.,P.K. 2000. Efficiency of Agroforestry Product Markets in India: A Comparative Study of Bamboo and Wood Markets. *Indian Journal of Agricultural Economics*, 55 (2), 194-207
- Jayson, E.A. and D.N. Mathew, 2000. Seasonal changes of tropical forest birds in Southern Western Ghats. *J. Bombay Nat. Hist. Soc.* 97(1): 52-61.
- Jayson, E.A. 2000. Occurrence of Black Stork *Ciconia nigra* (Linnaeus) in Kole wetlands of Thrissur, Kerala. *Newsletter for Birdwatchers* 40(3): 39-40.
- Jayson, E.A. 2000. Mammals and birds of the proposed Nature Study Centre area, Malayatoor, Kerala. *Indian J. For.* 23(2): 197-201.
- Muraleedharan, P.K., Anitha,V, Seethalaksmi, K.K. Sasidharan, N. and Sreenivasan, M.A. 2000. Collection and Marketing of Non-wood Forest Products in Kerala: Institutional Efficacy, *Journal of Non-wood Forest Products*, 7(1/2): 1-8.
- Nair, K.K.N. and R. Jayakumar 2000 . Ethnobotany of Hill-pulaya and Muthuva tribes in Chinnar Wildlife Sanctuary, Western Ghats of India. *J. Non-timber For. Prod.* 7: 16-45.
- Sasidharan, N., K.P. Rajesh and Jonny Augustine, 1999. *Zeuxine affinis* (Lindl.) Benth. ex Hook. f. (Orchidaceae) – a new record for Peninsular India. *Rheedea* 9: 159-161.
- Sasidharan, N and Jomy Augustine, 1999. A new species of *Syzygium* Gaertn. (Myrtaceae) from Southern Western Ghats, India. *Rheedea* 9: 155-158.
- Sasidharan, N. 2000. Diversity and Endemism among the Flora of Western Ghats with Reference to Kerala. *In*: M. Sivadasan and K.V. Mohanan (eds.). *Biodiversity and Ecology: Concepts and Facts*. Department of Botany, University of Calicut, pp33-37.
- Sasidharan, N. 2000. Rare and Threatened Plants in Shenduruny Wildlife Sanctuary, A Protected Area in The Kerala Forests. In : G. Kumaravelu & K. K. Chaudhuri (eds.) Proc. National Seminar on Endemic and Endangered Plant and Animal Species of Eastern and Western Ghats, Tamil Nadu Forest Department, Chennai, pp70-78.
- Varghese A. O. and Menon, A.R.R. 1999. Floristic composition, dynamics and diversity of Myristica swamp forests of Southern Western Ghats, Kerala. *Indian forester* 125(8): 775-783.
- Varghese A.O., Menon, A.R.R. and Balasubramanyan, K. 1999. Assessment of ecological amplitudes of tree species: a case study from Peppara Wildlife Sanctuary, Southern Western Ghats, India. Malaysian Forester, 62(3): 118-129.

KFRI Research Reports

- Balasundaran, M., Maria Florence, E.J. and Sharma J.K. 2000. Raising planting stock of Eucalyptus clones for the Kerala Forest Department. KFRI Research Report No. 180.
- Bhat, K. M. 2000. Investigations into heartwood formation in intensively managed teak plantations. KFRI Research Report No. 181.
- Muralidharan, E. M. and Pandalai, R. C. 2000. Assessment of field performance of micropropagated teak and eucalypt. KFRI Research Report No.182.
- Jayson, E.A. and Easa, P.S. 2000. Documentation of vertebrate fauna in Mangalavanam mangrove area. KFRI Research Report No. 183.
- Pandalai, R.C. 2000. Regeneration techniques for reeds. KFRI Research Report No. 187.

Call for Sharing Rural Technology for Oil Curing of Canes (Rattans)

Under the UNDP and Government of India (Ministry of Textiles : Office of Development Commissioner-Handicraft) Programme, the Division of Wood Science, KFRI has recently improved the rural technology for oil curing of canes in order to introduce quality raw material, which is free from bio-deterioration and fungal discolouration, into the market in the context of manufacturing cane craft of high aesthetic value. KFRI also conducts periodic field demonstrations to impart training near the cane extraction sites in Kerala. Those organisations, viz. Cane (Rattan) Cooperative Societies of the SC/ST Federation and the State Forest Departments, who wish to share the facilities and simple cane curing technology, are invited to contact:

The Director
Kerala Forest Research Institute
Peechi 680 653
Tel: 0487-282037
Fax: 0487-282249

A Breakthrough in Clonal Multiplication of Teak (*Tectona grandis* L.f.)

T. Surendran
Plant Physiology Division

Teak (*Tectona grandis* L.f.) is one of the high quality timber trees in India. In Kerala, we have approximately 70,000 ha of teak plantations. The conventional method of stump-planting is followed for raising plantations of teak. Since focused attention was not given so far to genetic improvement of teak, the productivity of teak plantations in Kerala is on the decline. As a step to overcome this, attempts are being made in KFRI, for cloning of Candidate Plus Trees (CPTs) of teak to raise superior planting stock. A technique standardized at KFRI for cloning of Candidate Plus Trees of teak is briefly described below.

Production of juvenile shoots

Production of juvenile shoots, in sufficient numbers, is essential for the success of clonal multiplication programmes. Generally, cuttings obtained from the crown of large trees

Figure 1. Juvenile epicormic shoots produced from large branch cuttings of teak inside the Mist Propagation Unit.

Figure2. A root trainer with well rooted and sprouted juvenile epicormic shoot cutting of teak.

are unable to root or able to root with very low percentage of success. Since the age of the shoot and rooting ability are inversely related, the age/maturity of the shoots is an important factor to be considered in propagation programmes. When the shoots mature, endogenous levels of hormones change as function of reduction in juvenility factor accompanied by anatomical change such as development of more sclerenchymatous tissues with a decline in meristematic activity. All these changes contribute to the less rooting behaviour of the mature shoot cuttings. This necessitates the production of juvenile shoots for cloning of mature CPTs with appropriate techniques. The production of juvenile epicormic shoots in teak can be carried out as follows:

Large branch cuttings falling in the diameter range of 3-10 cm are collected from the crown of Candidate Plus Trees and further made into large-sized cuttings of 50 cm length. Care is taken not to damage the bark or buds present on the branches. These cuttings are planted in large plastic sacks (18 X 12 cm X 200 g)

filled with garden soil and sand (1:1) and kept inside the Mist Propagation Unit. Intermittant misting is provided (10 seconds misting at an interval of every half an hour), and light, temperature and humidity conditions regulated. Under these conditions, the dormant buds present on the branch cuttings break open and the epicormic shoots start growing within 7-10 days. From each branch cutting on an average, 8-12 juvenile epicormic shoots are produced within a period of one month. This way the branch cuttings are allowed to sprout and produce sufficient number of juvenile epicormic shoots.

Rooting of juvenile epicormic shoots

Epicormic shoots produced on the large branch cuttings are harvested and used for clonal propagation. Such harvested epicormic shoots should have attained 15 to 20 days' maturity and should have a length of 10-15 cm with 2 to 3 pairs of leaves on them. While preparing these epicormic shoot cuttings for rooting, their apical buds and leaves are kept intact. The distal halves of leaf laminae are removed in order to minimize desiccation during rooting. These shoot cuttings are treated with indole butyric acid (IBA) at a concentration of 6,000 ppm prepared in talc and inserted into vermiculite filled root trainers. The treated cuttings are kept in the Mist Propagation Unit to provide intermittent misting under controlled conditions of light and temperature. Within a period of 30 to 45 days the shoot cuttings develop roots on them. The rooted cuttings are transferred to polythene bags (12 cm X 6 cm) filled with soil and sand (1:1) and are kept in hardening chamber for about 45-60 days. The properly rooted and hardened cuttings could be taken out for field planting. By this method, it is possible not only to propagate large Candidate Plus Trees aged 40 years or more but also to clone the superior trees on a large scale.

The success in cloning of CPTs also depends on the rooting behaviour of selected individual trees. Age of the trees, their genetic constitution, phenological characters, etc. are some of the influencing factors. As much as 40% to 90% variation in rooting behaviour was observed between the CPTs, in the studies carried out on cloning of teak at KFRI.

Looking Back at Bamboo

U.M.Chandrashekara
Agroforestry Division

Bamboo, by virtue of its availability, versatility and being the oldest building material, has been closely associated with the life of people in India since time immemorial. In his book – "*Prehistory and Protohistory of India*", Sankalia described the houses of Agatapura (present day Ahar near Udaipur)- a key site of the *Harappan chalcolithic* culture (2200 B.C. to 1600 B.C.). The plinth of these houses was built with roughly dressed slabs of schist while the walls were made with mud and mud bricks. The sloping roof was thatched with bamboos, and additionally covered with grass and leaves. Bamboo was used for house construction by the neolithic people (1657 B.C. to 1443 B.C.) inhabited in Navdatoli of the Narmada basin. These houses were round, square or rectangular huts, raised on thick wooden posts. Around these houses were put bamboo screens, plastered with clay from outside and inside. Similar pattern of houses is still seen in some tribal communities of Kerala. A piece of charcoal collected from an archaeological site from Inamgaon of Poona district in Maharashtra turned out to be a specimen of *Dendrocalamus*. This also gives a clue that the neolithic and chalcolothic people used bamboo. Even during the period of Mughal dynasty the huts in villages were constructed with the use of bamboo and thatch. According to Babur, the founder of Mughal dynasty in India, and the author of *Babur-nama*, bamboo and thatch were used because such huts could be rapidly constructed and easily dismantled.

'*I offer you dried sugarcane, white sugarcane, reeds and bamboos*' - this is the part of a prayer in *Atharva Veda* (*Veda* serial number 475, 453 and 454). This is indicative of the fact that the bamboo was regarded as one of the basic resources required by the people in the *vedic* age (1500 B.C. to 1000 B.C.). In their book on "*Advanced History of India*", Sastri and Srinivasachari wrote, "in South India cultivable lands were abundant and the necessities of life plentiful during the first century A.D. to 300 A.D". During this period while the people depended on forests for produces such as bamboo, rice, jack-fruit,

honey and tubers of *Dioscorea*, other crops such as ragi, sugar cane, pepper, turmeric and cotton were cultivated.

"*The Arthasastra of Kautilya*" (4th Centuary B.C.), a treatise on state-craft, deals with wealth, revenue and other aspects of economic importance including bamboo resources. Sensarma (1993) mentioned that *Kautilya* considered the bamboos as distinct class of plants and named the class "*Venuvarga*" with the following groups - *Venu, Utaja, Cinaya, Capa, Satina, Kantaka* and *Bhalluka*. (*Arthasastra*: Chapter 2.17.35)

In ancient India, bamboo was used for medicine to treat both the human-beings and animals. According to *Kautilya*, the bamboo was useful in treating for intoxication (*madana dosa*). A paste of the root of bamboo with algae, if mixed with the fat of frog, was said to cure burning (*Arthasastra*: Chapter, 14.4.179). In the *Vishnudharmothara Mahasastra* (500 A.D. to 700 A.D.), it was mentioned that barks of Nygrodha (*Ficus benghalensis*), Oudhumbara (*Ficus glomerata*), Ashwatha (*Ficus religiosa*), Plaksha (*Butea monosperma*) and Vethasa (bamboo) were to be powdered and mixed with ghee to make a paste. This paste was effective in healing wounds of animals (*Hymn* 19-20).

It seems that during the 4th centuary A.D. and afterwards cultivation of bamboo was not uncommon. For instance, *Khana*, wife of *Varaha Mihira* (505 A.D. to 587 A.D) advised the farmers that better crops could be obtained from bamboo, amorphophallus and coconut if the soils were enriched with paddy husk, ash and salt respectively. She also recommended to cultivate some tuber crops as undercrops of bamboo clumps. Sri Misra Chakrapani, in his book *"Vishva Vallabha"*, mentioned that bamboo grew well in dry lands. Further, gregarious growth of bamboo in wet lands was also reported *(Hymn 10)*. Kashyapa, a ninth-century plant scientist, in his *"Krishi Sukthi"* advocated the king to encourage forestry by growing bamboos in vast tracts of lands including those with walled enclosures (*Hymn* 85-94). Kashyapa also suggested to preserve the seeds of bamboo and other plants for the betterment of people and birds (*Hymn* 371- 374).

According to Sri Misra Chakrapani, plants or bushes, which were thorny or with milky latex, should not be grown inside or near the dwelling places and if they were present, they should be removed for the happiness and health of household members (*Hymn 21*). Therefore, it seems that cultivation of bamboo in homesteads was not encouraged during the 19th century A.D. However, literature shows that during the sixth century A.D., in some parts of India, homestead bamboo cultivation was common. For instance, in Assam, during this period, the houses were usually conceded in dense groves of bamboo, plantain and jack-fruit. Similarly, the villagers of Bengal lived, more or less secluded, in detached homesteads surrounded by a belt of fruit trees or bamboo thickets. The screen of the trees or bamboo thickets secured that privacy which the Bengali liked for his domestic life.

Villages of Orissa are characterised by the linear cluster of houses which are buried in clumps of mangoes, bananas, jack fruits, bamboos and plantains. Homesteading is also the traditional system of farming in Kerala. In ancient literature, it states, "in every homestead, one finds a couple of jack trees, papayas, a few drum-stick trees, pepper, a clump of bananas and several coconut trees". Here, bamboo was not mentioned and it seems that the management of bamboo, especially in rural parts of the State, might have started coinciding with the scarcity of forest resource and land to the rural community. In the history of Kerala, the period during 1818 –1842 is well known for the elimination of bamboo and other natural forest plants in order to pave way for extending cultivation of agricultural crops and commercial trees including teak in plantations. This policy of the government might have made it difficult to poorer sections of the people to obtain bamboo for their various requirements. The forced shortage of availability of bamboo might have necessitated many farmers to manage at least a bamboo clumps in their lands especially home gardens. Consequently, several techniques and practices of management and sustainable use of bamboo in rural Kerala have evolved. Some of them are still available with the rural communities in the State. For instance, some farmers knew that the land around bamboo clumps could be cultivated with certain crops so that the maximum land in homesteads could be utilized. However, they preferred to grow shade tolerant crops such as ginger, turmeric or chilly (white variety). Preference to these crops was due to the fact that they were short duration crops and could be harvested much before the cutting of bamboo branches for fencing in the month of January-February. Another important reason for selecting these crops was that they were suitable to grow on raised beds and thus any root competition from bamboo could successfully be overcome. In order to avoid above-ground competition of bamboo with other crops, some farmers detopped (cut the top portion) the clums. Farmers have also generated knowledge of trenching around bamboo to avoid the spread of roots to nearby area where other crops could be grown. Mounding of soil around bamboo clump was another important cultural practice for bamboo clum management. Spreading of paddy husk around the clump to increase soil fertility and obtain better yield from the clumps was also common in the State. It is worthwhile to note here that this soil fertility management practice was also mentioned by Khana.

To conclude, since the time immemorial, bamboo is part of the life of Indian people. The literature on the history of India also indicates that people of the country, irrespective of ethnicity and level of culture, were dependent on bamboo for various purposes. At present, despite the fact that both the demand and the price of bamboo are increasing day-by-day, the annual bamboo production, especially from the homesteads in Kerala is declining at an alarming rate. Rejuvenation of many traditional systems, relevant to the present day management, and sustainable utilisation of bamboo are needed.

Suggested reading

Chandrashekra, U. M. (1996). Strengths and weaknesses of traditional systems of bamboo cultivation in rural Kerala. *Agroforestry Forum*, 7(1):21-23.

Menon, A. K. (1961). *Ancient Kerala*. Ajantha Press, Trichur, Kerala.

Randhawa, M. S. (1980-1983). *A History of Agriculture in India*. 3 Volumes. Indian Council of Agricultural Research,, New Delhi.

Raychaudhri,S.P.(1941). *Agricultural Practices in Ancient India*. Indian Council of Agricultural Research Review Series No.4.ICAR, New Delhi.

Sankalia,H.D. (1974). *The Prehistory and Protohistory of India and Pakistan*, Poona.

Sensarma,P (1993). Bamboo in Kautilya's Arthasastra. *BIC-India Bulletin*, 3(2) 50-51.

Structure and Landscape Status of The Peppara Wildlife Sanctuary

A.R.R. Menon and A.O. Varghese
Ecology Division

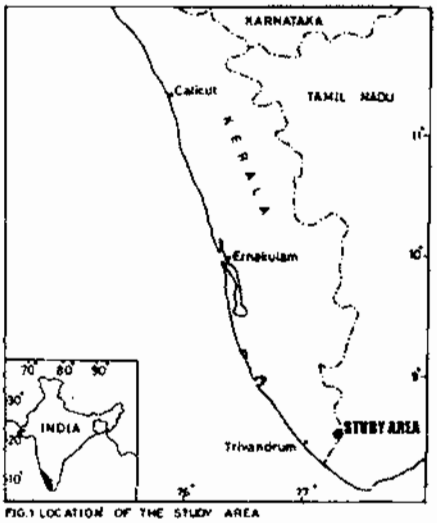


FIG.1 LOCATION OF THE STUDY AREA

Landscape ecology has recently emerged as an important discipline to study the structure, diversity and changes of landscape. The analysis of landscape vegetation is important to study the characteristics and interactions of landscape elements. Rapid deforestation often produces landscape level changes in forest characteristics and structure including area, distribution and habitat types. Changes in landscape pattern through fragmentation or aggregation of natural habitats can alter the abundance of single species or even entire communities (Quinn and Harrison, 1988). Remote sensing gives a perspective horizontal view and helps in delineating different landscape elements and their spatial characteristics (Gordon, 1991). Details of landscape elements of Peppara Wildlife Sanctuary, analyzed using remotely sensed data and GIS techniques, are provided here.

The study area, Peppara Wildlife Sanctuary, forms a part of Thiruvananthapuram district, the southernmost part of Kerala State (Fig.1). It is lying between 8° 34' 30" to 8° 41' 25" N. latitude and 77° 6' 50" to 77° 14' 5" E. longitude. The entire area lies within the catchments of Karamana River, which originates from the slope of Chemmunjimottai, the highest peak of the Sanctuary (1717 msl). The terrain is undulating with elevation ranging from 100 m to 1717 m. The area of the Sanctuary is 75 km² with tropical and montane subtropical climatic regimes.

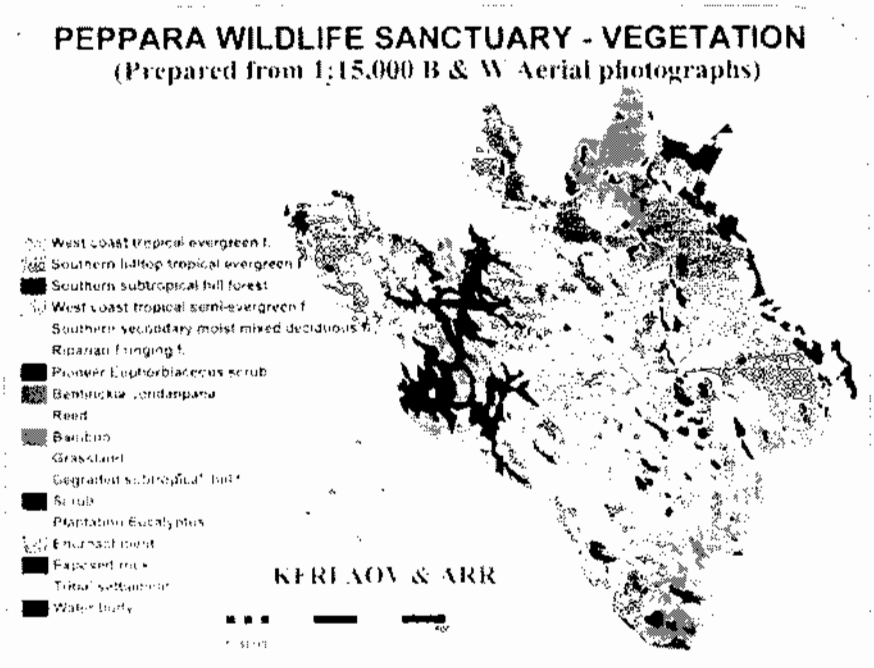


Fig.2 Landscape map

Remotely sensed information, in the form of 1:15,000 black and white aerial photographs, were used to prepare landscape map of the area (Fig.2). Digital Elevation Model (DEM) of the Sanctuary was created by ILWIS, a GIS package with digital image processing capabilities. For generation of DEM the contour lines of the study area were digitized and the height values assigned to the segments. On the DEM the IRS IC LISS III digital imagery prepared by the combination of bands 2, 3 and 4 were draped over (Fig.3).

A total of 23 landcover classes including 13 natural forests (Champion and Seth, 1968) are registered in the Peppara Wildlife Sanctuary (Table 1). High vegetation diversity as exhibited in this area may be due to spatial and temporal heterogeneity of the environment. Environmental factors of this Sanctuary in general (temperature and rainfall), change continuously across the landscape and influence the distribution of plant populations. Of the 13 natural forest types *Myristica* swamp forest and submontane hill valley swamp forest could not be recognised through aerial photographs because of the small areas they occupy and the inability to distinguish their pictorial elements from the West Coast tropical evergreen and semi-evergreen forests. The areas of different land cover classes were estimated using electronic planimeter from the land cover map prepared (Table 1). Total area of the sanctuary is 75.58 km². Of this, 67.85 km² (89.8%) are forested land and within this 15.96 km² (23.5%) are highly degraded, 30.37 km² (44.75%) moderately degraded, 19.64 km² (28.95%) dense forest, 1.83 km² grassland (2.7%) and 0.05 km² (0.07%) of eucalypt plantations. The ecosystem of this Sanctuary shows fragmentation due to natural and manmade causes. At low altitude, original primary forest is highly fragmented into numerous small patches of secondary forests. The climax forests become secondary moist deciduous forest type. West coast tropical semi-evergreen forest exhibits high rate of natural fragmentation in this sanctuary followed by southern secondary moist mixed deciduous forest. Artificial fragmentation of the forests of this sanctuary is mainly due to the construction of dam and planting of eucalypts in the adjoining areas in the northwest boundary. Artificial fragmentation has major impacts on species distribution. The primary forests of this Sanctuary at present are 29.42 km² (43.35%), among the rest, secondary forests

Table 1: Area (km²) and status of landscape elements of Peppara Wildlife Sanctuary (Prepared from 1: 15,000 B&W aerial photographs)

No	Landscape diversity	Density status of forest type			Total Area
		Low	Medium	High	
1	Southern hill top tropical evergreen forest	0.025	0.432	0.000	0.457 (0.604%)
2	West coast tropical evergreen forest	0.000	0.313	10.129	10.442 (13.814%)
3	West coast tropical semi-evergreen forest	4.872	4.934	4.461	14.267 (18.877%)
4	West coast tropical semi-evergreen forest with bamboo	0.967	0.000	0.000	0.967 (1.279 %)
5	Pioneer Euphorbiaceous scrub	0.000	0.000	0.555	0.555 (0.734 %)
6	Southern secondary moist mixed deciduous forest	4.749	22.103	2.144	28.996 (38.360%)
7	Southern secondary moist mixed deciduous forest with bamboo	0.260	0.000	0.000	0.260 (0.343%)
8	Bamboo brake	0.000	0.000	0.448	0.448 (0.592 %)
9	Riparian fringing forest	1.331	1.100	0.106	2.537 (3.356 %)
10	Southern sub-tropical hill forest	0.055	1.020	0.000	1.075 (1.422 %)
11	Degraded sub-tropical hill forest	0.443	0.000	0.000	0.443 (0.586 %)
12	*Ochlandra* reed brake	0.073	0.356	1.790	2.218 (2.934%)
13	*Bentinkia condappana* brake	0.069	0.112	0.026	0.207 (0.269%)
14	Scrubland	3.116	0.000	0.000	3.116 (4.122 %)
15	Grassland				1.832 (2.423 %)
16	Eucalyptus plantation				0.050 (0.066 %)
17	Encroachment				0.069 (0.091%)
18	Marsh				0.031 (0.039%)
19	Tribal settlement				1.723 (2.279%)
20	Exposed rock				0.975 (1.289%)
21	Reservoir				4.921 (6.510 %)
	Total	**15.96**	**30.37**	**19.65**	**75.589**

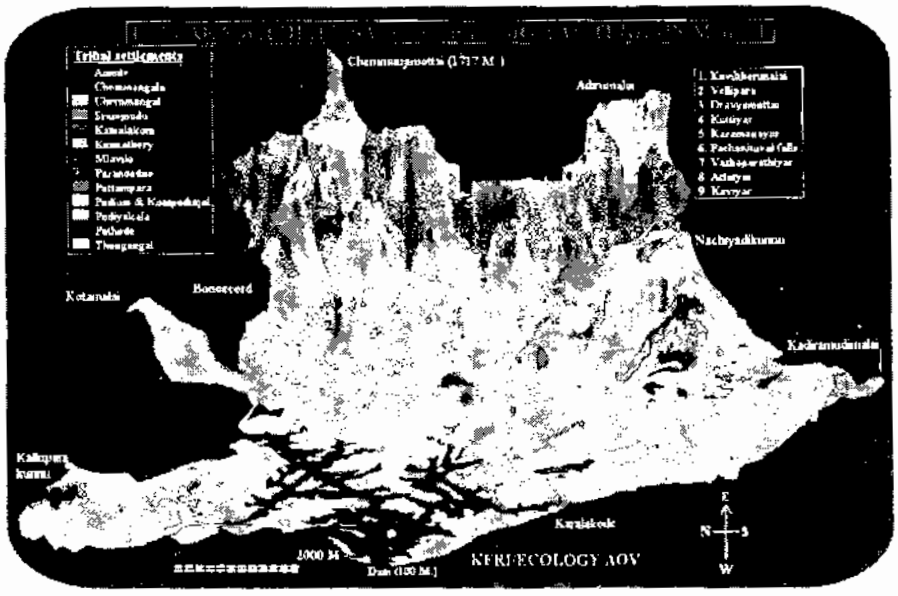


Fig.3 Digital terrain model

occupy 38.39 km² (56.57%), and cultural habitat, 0.05 km² (0.07%). Encroachments (0.069 km²) from the tea estate into the West Coast evergreen forest (north) of the Sanctuary could be seen in the aerial photographs.

Of the natural forests, subtropical hill forest and hilltop evergreen forests exhibit high rate of degradation. The dense canopy cover class is absent for these types and in some places degradation leads to a particular landscape dominated by grassland with scattered trees. Likewise, the riparian fringing forest, which acts as corridor for animals and barriers for fire in deciduous forest, is in a stage of degradation especially where tribal settlements are located. It was observed that grazing, illicit cutting and fire are the major factors affecting the natural vegetation. The type of biotic disturbance was found to be different at different altitudes. At lower altitudes, overgrazing and illicit cutting are the major factors, resulting in poor natural regeneration. As a result, scrub vegetation dominates at the

foothills. At mid-slopes, fire is of common occurrence and as a result, a savanna type of vegetation develops at certain places. Stunted trees of *Careya arborea*, *Emblica officinalis*, etc. with an average height of 4 to 8 m were seen scattered in these areas. Through successive and recurrent fires permanent grasslands are created in some places at high altitudes.

From a critical analysis of the map prepared from the remotely sensed data, the very fragile nature of riparian fringing forest, hilltop evergreen forest and subtropical hill forest could be ascertained. Habitat degradation and forest fragmentation are recognised as greatest threats to Peppara Wildlife Sanctuary. The structural analysis of landscape through remote sensing and GIS helps in problem identification and its severity, which is useful in planning ecosystem management.

References

Champion, H.G. and Seth, S.K. (1968). *A Revised Survey of the Forest Types of India*. Manager of Publications, Govt. of India, New Delhi, 404p.

Gordon, B. B. (1991). Seasonal and annual carbon fluxes in a boreal forest landscape. *J. Geophysics. Res.* 96 (D9): 17329-17338.

Quinn, J.F. and Harrison S. (1998). Effects of habitat fragmentation and isolation on species richness: evidence from biogeographic patterns. *Oecologia*, 75: 132-140.

Specialised training in bamboo and cane

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

* Cultivation, farm management, harvest and post harvest techniques of bamboos and canes.

* Value addition to bamboos and canes to cater to the needs of regional, national and international markets.

Campus News

Training Imparted

❖ **Drs J. Kallarackal** (Physiology) and **U.M. Chandrashekara** (Agroforestry) coordinated a workshop cum training programme on Landscape Ecology and Biodiversity monitoring during 7 -19 August 2000, as a part of the project supported by the Australian Assistance for International Development (AusAID). The training and workshop were led by Dr Steve Read (School of Forestry, Creswick, Melbourne Univerisity) and Dr Richard Loyn (Arthur Rylah Institute, Victoria, Australia). Dr Read took classes on landscape ecology concepts and Dr Loyn gave lectures on Bird diversity monitoring and conducted a one-day field training programme for KFRI and KFD staff at the Peechi Wildlife Sanctuary.

Dr. Steve Read and Dr. Richard Loyn giving instructions to the trainees

Dr. John Fryer (ACIAR) and Professor Peter Attiwill (Melbourne University on visit to eucalypt experimental sites

Overseas Assignment

Dr. K. Jayaraman (Statistics Division) carried out a consultancy assignment in Papua New Guinea and Vietnam for a period of one month during June-July, 2000. The assignment included advising the forestry researchers in PNG and Vietnam in the design and analysis of their experiments and also conducting a training workshop on the use of statistical techniques in forestry research. The assignment was sponsored by the FAO of the United Nations.

Seminars/Symposia/Workshops /Training

❖ **Dr. K. M. Bhat** attended the workshop on "Sustainable Forest management-Criteria and Indicators" 3-5 August 2000, Forest Research Institute Malaysia.

❖ **Mr. K.C. Chacko** attended the International Workshop on Democratic De-centralisation 23-24 May 2000, Thiruvananthapuram **Mr. Chacko** and **Dr. Mammen Chundamannil** also participated in a workshop on "Greening India through Agroforestry and JFM" ,12 September 2000.Bangalore.

❖ **Dr. T. K. Dhamodaran** participated in training course on "Forestry research strategy formulation, planning and management", 1-5 August 2000, Universty of Putra Selangor, Malaysia

❖ **Dr. P.S. Easa** participated in the Workshop on Management Plan preparation of Thattekkad/Idukki sanctuaries 6-7 March, 2000. He also acted as a moderator in the seminar on People's participation in the Management of Periyar Tiger Reserve.

❖ **Dr. E. P. Indira** attended a short course on "The application of biotechnology in Forestry" 1-5 August 2000 at the University of Putra Malaysia at Kuala Lumpur.

❖ **Dr. E. M. Muralidharan** attended the Meeting of Joint Parliament Committee on Protection of Plant Varieties and Farmers Rights Bill, 1999 held at KAU, Vellayani on 26 May, 2000.

❖ **Dr J. Kallarackal** participated in the Seminar on Environment and Climate Change, 17 June 2000 organized by the Kerala Sasthra Sahithya Parishad in Thirssur and presented a paper on "Can forests avert the greenhouse effect?"

❖ **Dr. N. Sasidharan** participated in the meeting of the Indian subcontinent Orchid Specialist Group at TBRGI, Trivandrum during 14-17 April, 2000, and

presented a paper on "Orchids of Periyar Tiger Reserve". He also participated in:

- National Seminar on Sustainable Management of Non-Timber Forest Products (NTFPs) of Western and Eastern Ghats, Thiruvananthapuram during 25-26 May, 2000 and presented a paper on "Gums and Resins Resources of Kerala and their Exploitation".
- Seminar on Aromatic and Medicinal Plant Resources: Kerala's Strength and Weakness, 16 October 2000, Aromatic Plant Research Station, Odakkali, Perumbavur and presented a paper on "Medicinal Plants of Kerala".

❖ **Dr. C. Renuka** participated in the National Workshop on 'Conserving Forest Genetic Resources',18-19 July 2000, Institute of Wood Science & Technology, Bangalore and presented a paper on ' Genetic Conservation of indigenous Palms in India'.

Guest Lectures/Training

❖ **Dr. P. S. Easa** (Wildlife Biology) served as a resource person in the population estimation programme of Nilgiri tahr in Eravikulam National Park organised by the Kerala Forest and Wildlife Department during 17-21 April 2000. He also gave lectures on biodiversity conservation in a programme organised by the KFRI Sub-Centre Nilambur under the Haritha Bodhavalkarana Programme on 25 March, 2000.

❖ **Dr. E. A. Jayson** (Willife Biology) took Nature Education classes at Choondal, Peechi, Punnayurkulam and Thrissur Zoo during August 2000

❖ **Dr J. Kallarackal** (Plant Physiology) gave a guest lecture on environmental protection at the Govt. Higher Secondary School, Peechi in connection with the World Environment Day Celebrations on 5 June 2000. The function was presided over by Dr J.K. Sharma, Director, KFRI who also inaugurated the planting of tree seedlings in the school campus. Dr. Kallarackal also gave a talk on weather data measurements to M.Sc. students of Environmental Science of Christ College, Irinjalakuda on 1 July 2000 and on water relations of plants to the visiting Ph.D. students of Kerala Agriculture University. He also organized the demonstration of modern instruments used in environmental physiology.

❖ **Dr. R.C. Pandalai** (Silviculture) as part of UNDP-Govt. of India project – "Resource enhancement and processing of canes and bamboo species suitable for handicraft", took classes on: (a) Nursery practices and plantation management for the benefit of farmers, NGOs and forest staff in different places, viz. Peechi, Nilambur and Muthanga during 27- 30 June 2000 and (b) Cultivation and management of bamboos at the Institute for Rain and Moist Deciduous Forest Research (IRMDFR), Assam during 19-20 April 2000 and State Forest Research Institute (SFRI), Itanagar on 24 April 2000.

KFRI Seminar

Mr. K.B. Brahmadathan, General Manager, Department of Telecommunications, Telecom District, Thrissur gave a popular talk on "telecommunication – backbone of information technology" on 30 May 2000 as part of the national technology day celebrations.

Radio Talks

Dr. P. S. Easa (Wildlife Biology) gave a talk in Malayalam on "Nature Clubs in School" in All India Radio, in August, 2000.
Dr. E. A. Jayson (Wildlife Biology) gave a radio talk in Malayalam on "Migratory birds" in All India Radio in April, 2000.
Dr. R. C. Pandalai (Silviculture) gave a talk on "Significance of farm forestry" in All India Radio on 5 March 2000

Ph. D Awards

Mrs. Anjana Shanker and **Mr. Sanathanan Velluva** were awarded Ph.D. degrees by the FRI Deemed University, Dehra Dun and Cochin University of Science and Technology respetively for their theses on "A study on the economics of collection, marketing and utilisation of non-timber forest products" and "Dynamics of land use in recently settled forest areas: a case study of Attappady, Kerala", respectively, prepared under the guidance of Dr. P.K.Muraleedharan (Economics Division).

Mr. M. Sivaram, Scientist, Division of Statistics, was awarded Ph.D. degree by the University of Madras for his thesis on "A biostatistical study on recent trends in infant mortality and its components and their relationship with reproductive and social factors" prepared under the guidance of Dr. J. Richard, Professor and Head, Department of Biostatistics, Christian Medical College, Vellore.

Honours/Nominations

Dr. K. M. Bhat (Wood Science Division) has been nominated as a new Member of the Enlarged Executive Board of IUFRO for the period January 1, 2001- December 31, 2005. He will also hold the position of Deputy Co-ordinator of IUFRO Division 5 (Forest Products) for the above period.

Dr. P.S. Easa (Wildlife Biology Division) has been nominated as member of the Core-Working Group of the Western Ghats Eco-region of the National Biodiversity Strategy and Action Plan.

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

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

The Director
Kerala Forest Research Institute
Peechi 680 653
Tel: 0487-282037
Fax: 0487-282249
Email: libkfri@vsnl.com

Did you Know

KFRI Offers Customised Refresher /Training Courses in Tropical Forestry and Allied Fields

KFRI offers refresher/training courses to various officers concerned with tropical forestry in one way or the other. The wide range of topics covered include: Present trends in forestry, Agro forestry practices for different agro-climatic regions and criteria for species selection, Management of trees and crops in home gardens, Economics of forest plantations, Economic importance of trees in home-garden agro-forestry system, silviculture of tree species suitable for different end uses, silviculture of bamboos and rattans, Current trends in seedling production and nursery management, Clonal propagation of teak and eucalypts, Watershed approach and wasteland development, Preservative treatment and seasoning for upgradation of wood quality, Remote sensing, Geographic information system, Weed and disease management in forestry, Insect pest management in forestry, Non-wood forest products (NWFP), Collection and marketing of non wood forest products, Legal provisions in forest conservation and tree farming, Joint forest planning and management (JFPM), Soil and water conservation, Soil nutrient management, Environmental impact of plantations, Wood as a source of energy/ industrial material, Forest biotechnology with special reference to tissue, Genetic engineering in forestry, Eco-tourism: a model for sustainable development, Plant and Animal biodiversity. Institutions interested in utilizing such services may contact the Director, Kerala Forest Research Institute, Peechi 680 653, Thrissur, Kerala, India

Fax: (91)(0) 487-282249
Email : libkfri@vsnl.com
Phone :+91 (0) 487-282037

Order Form for Priced KFRI Publications

ORDER FORM

I enclose Demand Draft No. ..... For Rs. / US $ .....
drawn in favour of Registrar, KFRI payable at Thrissur for the publications indicated below.

No.	Title	Rs.	US $
1	Ecodevelopment of Western Ghats (Seminar Proceedings)	200.00	30.00
2	Rattans of the Western Ghats	100.00	10.00
3	Structure and Properties of South Indian Rattans	75.00	8.00
4	Tropical Forest Ecosystem Conservation and Development in South and South East Asia (Seminar Proceedings)	200.00	30.00
5	Rattan Management and Utilization (Seminar Proceedings)	300.00	35.00
6	Litter Dynamics, Microbial Association and Soil Studies in Acacia auriculiformis Plantations in Kerala	75.00	8.00
7	Socio-economic Research in Forestry (Seminar Proceedings)	350.00	40.00
8	History of Forest Management in Kerala	150.00	15.00
9	Teak (Information Bulletin)	15.00	5.00
10	Upgradation of Rubber Wood	75.00	8.00
11	A Manual on the Rattans of Andaman and Nicobar Islands	175.00	20.00
12	Bamboo Researchers and Projects of South and South-East Asia: Directory	125.00	15.00
13	Impact of Diseases and Insect Pests in Tropical Forests (Seminar Proceedings)	500.00	50.00
14	Bamboos of South and South-East Asia: An Annotated Bibliography	300.00	30.00
15	Teak (Seminar Proceedings)	200.00	20.00
16	Field Guide to Animal Signs40.00	10.00	
17	Forest Trees of Kerala	50.00	15.00
18	Bamboos of India	1500.00	75.00
19	Basic Readings in Forest Economics	150.00	20.00
20	Palms of Kerala	300.00	30.00
21	Compost for Container Seedling Production in Forest Nurseries	100.00	20.00
22	Manual of Nonwood Forest Produce Plants of Kerala	450.00	50.00
23	Rare and Endangered Mammals of Kerala	50.00	10.00
24	Field Identification Key for Rattans of Kerala	125.00	15.00
25	Vana Vanyajeevi Sampathum Samrakshanavum (Malayalam)	25.00	
	POSTER		
26	Poster on Amphibians of Kerlala Part I: Frogs	30.00	—
	SOFTWARE PACKAGES		
27	KFRI Stat Pack (Statistical Analysis Package for Forest Mensuration)	5000.00	250.00
28	DESIGNEX (Exprt System for Designing Experiments in Forestry)	5000.00	250.00
	VIDEO FILMS		
29	Teak Defoliators	500.00	50.00
30	Bamboo A Crop	500.00	50.00

Postage in India and surface Mail Charge for abroad are free. If required by Air Mail, please add US$ 10.00 each for serial nos. 1, 4, 5, 7, 13, 14, 15, 18 and 22 for the rest US$ 5.00

- Book sellers will be given 25% discount
- Educational given 10% discount

Send your orders to:
Libraian, **KFRI, Peechi, Trichur 680 653, Kerala, India**
Ph: +91 (0)487 282 037 e-mail: libkfri@md2.vsnl.net.in

Please fill in your address

EVERGREEN

A newsletter of
Kerala Forest Research Institute
Peechi 680 653, Thrissur 680 653
Kerala, India

ISSN 0254-6426
No. 45 September 2000

Editor
Dr. K. M. Bhat

Associates
Dr. E. J. Maria Florence
Dr. T. K. Dhamodaran
Dr. C. N. Krishnankutty
Mr. Subhash Kapoor

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

Address all communications to :
The Editor, Evergreen
Kerala Forest Research Institute,
Peechi - 680 653, Thrissur, Kerala,
India.
Ph: 0487-282037,282061
Fax : 0487-282249
E.mail : kmbhat@kfri.org
Web site : http://www.kfri.org

Designed & Printed at
Lumiere Printing Works, Thrissur

Coming Events

- 2-6 April, 2001 The role of Women in Forestry Sector in Europe and in North America, Peter Poschen, Forestry and Wood Industries Specialist, International Labour Office, 4, route des Morillons, CH-1211 Geneva 22, Switzerland, Tel:+41-22-799 6188, Fax:+41-22-799 7967, E-mail:poschen@ilo.org
- 18-25 April, 2001. 16th Commonwealth Forestry Conference, Fremantle, Australia, Contact: Libby
- 30 April-3 May, 2001 1.07.00 Tropical Silviculture 2.09.00 Seed Physiology and Technology: Ike Tolentino, Institute of Renewable Natural Resources, College of Forestry & Natural Resources, University of the Philippines, Los Banos, College, Laguna 4031, Philippines, Tel:+63(49)536-2599; Fax:+63(49)536-3206; E-mail:eltj@mudspring.uplb.edu.ph
- 7-10 May, 2001 Nursery Production and Establishment of Broadlaves to Promote Sustainable Forest Management, Lorenzo Ciccarese, ANPA, Via V Brancati 48, 00144 Rome, Italy; e-mail :ciccarese@anpa.it Anders Mattsson, Dalarna University College, Herrgardssvagen 122, S-776 98 Garpenberg, Sweden Tel:46 225 26000; Fax: 46 225 26100, E-mail:amn@du.se
- June-July,2001 4th Int'l Conference on Forest Vegetation Management, Robert G. Wagner, University of Maine, Rm 233, 5755 Nutting Hall, Orono Maine 04469-5755, United States, Tel:+1-207-5812903;Fax:+1-207-5812833;E-mail:bob-wagner@umenfa.maine.edu
- 11-19 July, 2001,. Travelling Workshop on Linking the Complexity of Forest Canopies to Ecosystems and Landscape Function; Michael G. Ryan, USDA/FS Rocky Mountain Research Station, 240 West Prospect RD, Fort Collins, CO 80526-2098,USA,Tel:+1-970-498-1012;Fax:+1-970-498-1027, E-mail:mryan@lamar.colostate.edu
- 22-27 July, 2001. Tree Biotechnology: The Next Millenium; Steven Strauss, Oregon State University; Department of Forest Science; Forestry Science Lab. 020; Corvallis Oregon 97331-7501; United States, Tel:+1-541-7376558, Fax:+1-541-7371393, E-mail:strauss@fsl.orst.edu, Web site:http://WWW.cof.orst.edu/cof/extended/conferen/treebio
- August, 2001. Methodology of Forest Insect and Disease Survey in Central Europe, Michael McManus, USDA Forest Service, Northeastern Research Station Centre for Forest Health Protection 51 Mill Pond Road, Hamden, Connecticut 06514 United States, Tel:+ 1-203-2304321; Fax:+1-203-234315, E-mail (pers): mmcmanus/ne-ha@fs.fed.us
- 12-18 August, 2001. Conference on stand, process, hybrid and forest level modelling, Valeri Le may and Hamish Kimmins E mail:forestmd@interchange.ubc.ca,, Web site: WWW. Forestry.ubc.ca/forestmodel J.P.Skovsgaard, Danish Forest and Landscape Research Institute Hoersholm Kongevej 11, DK-2970, Hoersholm, Denmark. Tel(org): +45-45763200; Fax:+45-45763233, E-mail (pers):jps@fsl.dk.
- 10-15 September, 2001. (3-8 tour), IUFRO International Symposium: Developing the Eucalypt for the Future, Santiago Barros, Instituto Forestal, Huerfanos 554, P.O. Box 3085, Santiago, Chile, Tel: +56-2-6930700;Fax:+56-2-6381286, E-mail:sbarros@infor.cl, Web site:_http://WWW.infor.cl
- 22-26 September, 2001. Tree Rings and People, Paolo Cherubini; WSL, CH-8903 Birmensdorf, Tel: 41 1 739 22 78; Fax:+41 1 739 22 15, E-mail:paolo.cherubini@wsl.ch, Web site:http://WWW.Wsl.ch/forest/dondro2001/
- 8-15September, 2001. 4th Workshop "Connection between silviculture and wood quality through modelling approaches and simulation software", Genard Nepveu, National Institute for Agricultural Research (INRA), Research Team on Wood Quality, F-54280 Champenoux, France Tel(org):+33-3-83394041, Fax:+33-3-83394069, E-mail (pers): nepveu@nancy.inrafr
- 11-14 September, 2001. Dynamics of Forest Insect Populations, Andrew Liebhold, USDA Forest Service, Northeastern Forest Experiment Station, 180 Canfield St: Morgantown WV 26505, US Tel: +1-304-285-1512;Fax:+1-304-285-1505,E-mail:sandy@gypsy.fsl.wvu.edu;aliebhold@fs.fed.us, http://salava.metla.fi/iufro/iufronet/47/wu 70307/aberdeen-firstannounce.htm
- 12-14 September, 2001. Dynamics of Forest Insect Populations, Aberdeen, Scotland. IUFRO 7.03.07. Contact: Dr Andrew Liebhold, USDA Forest Service, Northeastern Forest Experiment Station, Forestry Sciences Laboratory, 180 Canfield St, Morgantown, West Virginia 26505, USA; Tel 1-304-285 1609;Fax: 1-304-2851505;E-mail:sandy@gypsy.fsl.wvnet.edu;
- 17-21 September,2001 Root and Butt Rots, Gaston Laflamme, Natural Resources Canada, Canadian Forest Service, 1055, rue du P.E.P.S. /PO Box 3800, Sainte Foy Quebec G1V 4C7, Canada, Tel: +1-418-6484149; Fax: +1-418-6485849, E-mail :glaflamme@cfl.forestry.ca
- 24-30 September, 2001, Uneven-aged Silviculture: Tradition and Practices in Central Europe; 1.14.00 Uneven-Aged Silviculture 4.01.03 Design, Performance and Evaluation of Experiments: Andreas Zingg, Swiss Federal Research Institute WSL, Zurcherstr.111, CH-8903 Birmensdorf, Switzerland, Tel:++41+1739 23 35; Fax: ++41+173922 15; E-mail: andreas.zing@wsl.ch,Web site:http://WWW.Wsl/forest/waldman/events/
- 8-11October, 2001. Forestry Meets the Public, Peter Poschen, Forestry and Wood Industries Specialist, International Labour Office, 4,route des Morillons, CH-1211 Geneva 22/Switzerland, Tel:+41-22-799 6188;Fax:+41-22-799 7967, E-mail:poschen@ilo.org
- October, 2001 Forest History in the Mountains of the World, Prof>Rawat, C2B/32C janakpuri, New Delhi, India, Tel:+91-5599426 or at 2B Sleepy Hollow Naino Tal 263001, India Tel (org): +91-5942-36149,36068, Fax:+91-5942-36260
- 27 November - Dececember, 2001. Intenational Workshop on the Debris Flow Disaster of December 1999 in Venezuela. Instituto de Mecanica de Fluidos, Facultad de Ingenieria, Universided Central de Venezuela Apartado Postal 47725, Caracas 1041-A Tel: 605-3131/3041/3137 Fax:605-3040 Jose Luis Lopez:jlopez@imf.ing.ucv.ve Reinaldo Garcia:regarcia@imf.ing.ucv.ve, Web site:;WWW.jifi2000.edu.ve
- 7 Dececember, 2001. Alpine Natural Disasters-Risk Management in Theory and Practice (GERMAN), Horst Schaffhauser, Institut fur Lawinen-und Wildbachverbauung, Rennweg 1, Hofburg, 6020 Innsbruck, Austria, Tel:+43-(0)512/573933; Fax: +43-(0)512-573933-5250; E-mail:fbva.aiatr@uibk.ac.at
- 15-19 January, 2002. UNESCO/IGCP Symposium on Landslide Risk Mitigation and Protection of Cultural and Natural Heritage, Conference Secretariat: Landslide Section, Disaster Prevention Research Institute, Kyoto University, Uji, Kyoto 611-0011, Japan, Tel:+81-774-384110, Fax:+81-774-325597,+81-774-384300, E-mail:jimu@landslide.dpri.Kyoto-u.ac.jp http://landslide.dpri.kyoto-u.ac.jp/jisuberi.html.
- 21-28 September 2003, XII World Forestry Congress, Quebec City, Canada, Contact: XII World forestry Congress, PO Box:7275, Charlesbourg, Quebec G1G 5E5, Canada; WWW.wfc2003.org