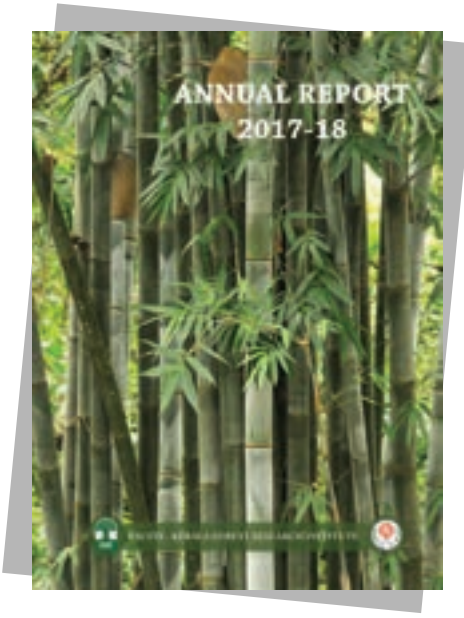
ANNUAL REPORT 2017-18

KSCSTE - KERALA FOREST RESEARCH INSTITUTE

KFRI ANNUAL REPORT 2017-18



KSCSTE - Kerala Forest Research Institute
An Institution of Kerala State Council for Science, Technology and Environment
Peechi-680 653, Thrissur, Kerala

Cover Image :
"*Dendrocalamus giganteus* Munro" at KFRI Peechi Campus
Photo Credit: Mr. Nirmesh TK, Ecology Department

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ANNUAL REPORT 2017-2018

CONTENTS

Director's Desk...

I am delighted to present the KSCSTE-KFRI Annual Report for the year 2017-18, during which the Institute has marched ahead with better visibility and recognitions through its significant contributions not only towards creation of new forestry knowledge but also through its commitment towards society including foresters, and other stakeholders.

As we know, forests are a natural treasure on earth and play a vital role in ecosystem; but this natural resource is being negatively affected in various ways. Sustainable management of forests gives multiple benefits. If managed with right policies and programmes, we can enhance forest productivity, which would lead towards a more sustainable green economy. In recent years, research in the realm of forestry has witnessed several important advances that essentially emphasize the much needed multi-disciplinary approach to our understanding of the problem, prospective and sustainable management of forest ecosystem and climate through time. In the absence of a precise understanding of forestry, it would not be possible to respond effectively towards a balanced forest ecosystem. Forestry is diversifying to study and identify the driving force behind the major changes in forest resources, demand for goods and services and options available for probable alternative scenarios. The spectrum of scientific issues and themes having an interface with forestry data on forest resources is truly remarkable, and encompasses diverse perspectives viz. form, function, and many others. Also remarkable are studies ranging from individual forestry plant to larger forestry scales viz. conventional to applied forestry, Forestry to Agroforestry, taxonomic and pathological, ecological, sociological to economical, silvicultural to tissue cultural, empirical to theoretical, local to global, and qualitative to quantitative.

During 2017-18, the institute has had 64 ongoing projects covering different aspects of forestry and allied areas. The external projects are sponsored by different state, national and international funding agencies like Science and Engineering Research Board, Department of Science and Technology, Department of Biotechnology, National Medicinal Plants Board, Kerala State Medicinal Plants Board, Kerala Forest Department, Kerala State Biodiversity Board, etc. In this context, National Medicinal Plants Board, Ministry of Ayush, Government of India established a Regional cum Facilitation Centre for Southern region in KSCSTE-KFRI. KFRI received Rs. 1684124, Rs. 30868992, Rs. 9037616 from international national and state funding respectively. Apart from this, KFRI had organised a national workshop on "*Developing Protocols for managing forests for stability and sustainability of ecosystems*" during 16-18thApril 2017 for foresters of India. KFRI received Rs. 12176750 State Plan Fund from the Kerala State Council for Science, Technology and Environment (KSCSTE), Government of Kerala, which was utilised for research/ extension projects and infrastructure development.

I take this opportunity to thank the Research Council, Management Committee, KSCSTE for co-operation, guidance and valuable suggestions and also congratulate the scientific and other support staff as well as research scholars who made their valuable contributions to the march of KSCSTE-KFRI towards excellence with relevance. I express my sense of gratitude to all my predecessors for their immense contributions, and guidance for future direction for fulfilling the expectations of stakeholders, State and the Nation.

Dr. S. Pradeep Kumar
Director

THE INSTITUTE

The Government of Kerala established the Kerala Forest Research Institute (KFRI) as an autonomous organization in 1975 under the Travancore-Cochin Literary, Scientific and Charitable Societies Act-1955. In 2003, KFRI was amalgamated with the Kerala State Council for Science Technology and Environment (KSCSTE), an autonomous body along with five other Research & Development Centres. The Institute mandate is to conduct research on all aspects of tropical forestry including wood science and technology, wildlife biology and socioeconomics. KFRI has created a strong niche among the leading forestry institutions in the country by conducting problem solving time bound research in thrust areas addressing the needs of the stakeholders. The Institute has been instrumental in evolving strategies for conservation and sustainable use of forest resources of the State.

The Institute is envisioned to become a Centre of Excellence in tropical forestry to offer scientific backbone for effective conservation of forest ecosystems and sustainable utilization of natural resources for ensuring benefits to the society. The Mission being to provide technical support to facilitate scientific management and utilization of forests for social benefits, thus, envisages to:

a. conduct inter/multidisciplinary research on priority areas of tropical forestry including Biodiversity conservation, wildlife management, socioeconomics, indigenous knowledge, value addition of forest products, participatory forest management and livelihood improvement of forest dwellers/dependents by scientific management of forest resources,

b. provide technical advice and solutions to practical problems related to forest conservation and sustainable utilization of forest resources, and

c. disseminate knowledge and information on forest-related matters to end-users, farmers, general public and transfer of technology to stakeholders for social benefits.

Main campus, Peechi

The main campus is located in central Kerala at Peechi, about 20 kms east of Thrissur city in a 28 hectares Reserve Forest area adjacent to Peechi-Vazhani Wildlife Sanctuary. The main campus is an assemblage of offices of international and national networks, sophisticated laboratory facilities, live collections and plant propagation facilities.

KFRI houses a number of highly sophisticated experimental research facilities. These include laboratories, collections, plant propagation facilities, networks and helpline, monitoring and centralized facilities. Laboratories include tissue culture, clonal multiplication, physiology, wildlife biology, soil science, molecular biology, wood science and technology, biochemistry, forest pathology, entomology, silviculture and geographic information system and remote sensing. These research laboratories are designed to serve staff scientists and research scholars as well as researchers from universities, industry, foreign institutions, and other government laboratories. Collections include arboretum, bambusetum, palmetum, herbarium, medicinal plants garden, orchidarium, xylarium, wildlife museum, soil science museum, teak museum, butterfly garden and insect collections, For plant propagation, there are nurseries, green houses, mist chambers and the Kerala Forest Seed Centre. Secretariat of two international Networks funded by the Food and Agriculture Organization of the United Nations, namely, the Asia-Pacific Forest Invasive Species Network (APFISN) and TEAKNET (International Teak Information Network) are housed in KFRI. KFRI also houses, the Regional Cum Felicitation Centre (RCFC) of National Medicinal Plant Board (NMPB), Department of AYUSH, Govt. of India in our Peechi campus. The monitoring facilities are the established permanent plots and weather stations. Library, Central Instrumentation Unit, Local Area Network (LAN), training facilities, stores, seminar and conference facilities, field work support (vehicles), staff accommodation, guest house and research scholars' hostel are the centralized facilities of KFRI. A Seismic Observatory operated and maintained by the National Centre for Earth Sciences (NCESS) is in KFRI main campus.

Sub-Centre, Nilambur

The Sub-Centre campus at Nilambur with facilities for laboratory work and field trials in a 43.36 hectare area is about 140 km away from the main campus. A bambusetum with 21 species of bamboos and trial plots of several tree species are maintained at the Sub-centre. The Sub-Centre also houses the famous Teak Museum, a Bioresources Nature Park, Medicinal Plant Garden and a model Butterfly Garden.

Field Research Centre, Velupadam

Spread over an area of 47.43 hectares, the Field Research Centre (FRC) at Velupadam in Thrissur District is 36 kms away from the main campus at Peechi. A valuable asset - bambusetum, one of India's largest live collections of bamboos, is the special attraction of Velupadam campus. Nursery and field trials are also conducted at the FRC campus.

Organization

Research in KFRI is undertaken in nine programme divisions, of them, seven are research divisions and two are supporting divisions. The Research Divisions are: Sustainable Forest Management, Forest Genetics and Biotechnology, Forest Management Information System, Forest Ecology and Biodiversity Conservation, Wood Science and Technology, Forestry and Human Dimensions and Forest Health. The supporting scientific Divisions are Extension and Training and Library and Information. A Programme Coordinator heads each Programme Division and each Department within the Programme Division has a Head and Divisions having laboratory and other facilities is under a Scientist-in-Charge (Facilities). The Research Coordinator, who heads the Research Monitoring and Evaluation Unit, oversees the implementation of programmes, facilitates and monitors research activities in the Institute. The Research Council is the vital body responsible for overseeing and guiding the formulation and implementation of various research programmes in KFRI. It comprises of eminent scientists in the field of forestry research in the country. It also monitors the quality and content of research undertaken by the Institute and provides guidance for improvement.

The Rules and Regulations of the KSCSTE guide the functioning of KFRI. The control, administration and management of the Institute are vested with the Management Committee chaired by the Director who as the Head of the

Institute is also responsible for the day-to-day administration and implementation of programmes. Besides, basic and applied research, KFRI also undertakes extension and training activities for transfer of technology and dissemination of information as well as consultancy for end-users and stakeholders. Every year regular training programmes are being conducted by KFRI on different modules of tropical forestry to meet the needs of stakeholders, at state, national, and international level. The Institute is accredited as a Research Centre of the Forest Research Institute, Deemed to be University, Dehradun, Cochin University of Science and Technology, and University of Calicut for enrolling students for research programmes leading to the award of doctoral degree.

Administrative and Accounts Sections of the Institute coordinated by the Registrar assist the Director in managing the day-to-day functioning of the Institute. An Internal Auditor scrutinizes the financial and expenditure matters of the Institute. The total staff strength of the Institute is 190 which include 27 scientists, 63 administrative staff and 7 technical staff. In addition, 93 project personnel's are attached to various research projects provide the necessary research support.

PROGRAMME DIVISIONS

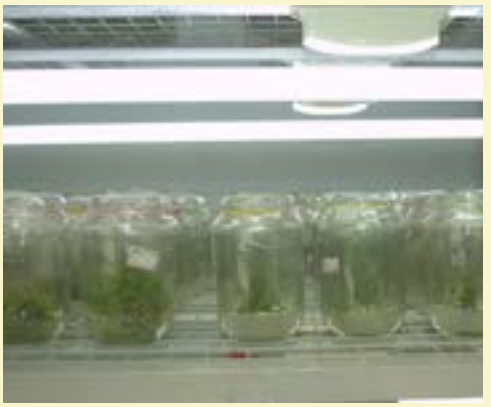
Sustainable Forest Management

The Programme Division comprises of Tree Physiology, Silviculture and Soil Science Departments. The key research areas of the Division are: improved nursery and silvicultural practices, seed technology, sustainable forest management and production of better clones and quality planting stock of plantation species. In addition, studies have also been undertaken on afforestation and eco-restoration of degraded sites, raising green belts in coastal areas, control of riverbank erosion by planting, evaluation of factors affecting plantation productivity, soil nutrient management for important forestry species, composting technology for soil amelioration and environmental physiology, especially water use, photosynthesis and microclimate. Division also undertakes weather parameters monitoring. Some of the current activities of the Division include assessment of medicinal plant resources of Northern Kerala, population analysis, seed biology and restoration of *Hopea erosa* and *H. racophloea* of Western Ghats, introducing biochar for enhancing the quality of degraded soils of plantation forestry sector in Kerala, popularisation of weed composting technology for soil carbon sequestration and livelihood improvement of rural poor and pedogenic influences on vegetation dynamics in major forested wetlands of Kerala Western Ghats.

Forest Genetics and Biotechnology

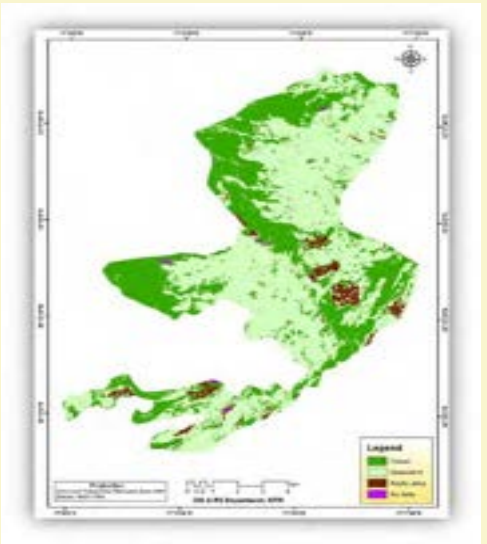
The Programme Division includes Forest Genetics and Tree Breeding as well as Biotechnology Departments with plant propagation, plant tissue culture and molecular biology facilities. The major research areas of the Division are genetic improvement of teak, clonal propagation of forest trees and medicinal plants through vegetative and micropropagation, field testing of superior clones, DNA fingerprinting, DNA barcoding, population genetics, molecular phylogeny, genomics and transcriptomics. Major achievements of the Division are the development of efficient mass clonal propagation methods for important forestry crops through macro and micropropagation, cost reduction in micropropagation, genetic improvement, plus tree selection and establishment of clonal seed orchards in teak, population.

genetic structure of teak and sandal provenances in India, DNA fingerprinting and genetic diversity studies of eucalypts, acacia and teak clones, genetic diversity of captive elephants, molecular phylogeny and biogeography of paleotropical woody bamboos & dipterocarps and development of institutional capability for DNA barcoding of life forms, among others. DNA barcoding facility caters



to the DNA barcoding requirements of various academicians and researchers in the field and undertakes consultancy services for various State Forest Departments and other agencies. The current research activities of the Division include development of clonal propagation protocols through micro and macro propagation for important forest tree species and medicinal plants, population demography, genetic structure and adaptive genetics for sustainable conservation and management of teak genetic resources, conservation genetics of selected RET species in the Western Ghats as well as DNA barcoding for biosystematics, authentication of Ayurvedic raw drugs and timber forensics.

Forest Management Information System



The Programme Division uses modern tools of remote sensing, GIS and statistics to advance the science of forest measurements, cater to the needs of co-researchers and partners, and manage a comprehensive database that supports the decision making process. The Division is well equipped with the state-of-the-art facilities to meet the expectations of post-doctorals, doctoral students, project fellows and master students. The Division has been actively engaged in various research activities including stand modeling, biodiversity mapping, ecosystem analysis, resource mapping, and population analysis. Currently, the core activities are more centered towards the different aspects of climate change research including the physical basis, mitigation and adaptation.

The Division also works on the greenhouse gas inventorying, carbon stocks assessments, and carbon sequestration estimations. The Division uses high spatial, spectral and temporal remote sensing data for characterizing the compositional and functional attributes of forest and trees outside the forest. The Division partners with various national and international organizations, and provides training on Remote Sensing and GIS.

Forest Ecology and Biodiversity Conservation

Programme Division comprises of Forest Ecology, Botany, Wildlife and Non-Wood Forest Products (NWFPs) Departments. The main research areas of the Division are biodiversity evaluation and conservation of fragile ecosystems, rehabilitation and restoration, ecosystem and landscape analysis, population ecology, traditional knowledge system analysis and biodiversity-informatics. Documentation and inventorisation of biodiversity of diverse forest types and Protected Areas, evaluation of below ground biodiversity, taxonomic studies and conservation of RET species of flora are some of the research areas of the Division. Through long-term monitoring programmes, Forest Ecology Department maintains and monitoring around 30 permanent plots in different forest ecosystems of Kerala. In addition, Wildlife Department attempts various as-

pects on inventorisation of fauna, endangered animals, man-wildlife interaction and wildlife census. A wildlife museum with an exhaustive collection of species is attached to the Wildlife Department. Phytochemical analysis of medicinal plants, nursery and plantation technology of selected indigenous timber species, ethno-biological studies and cultivation of medicinal plants and other NWFPs, such as, bamboos and rattans, are other activities of the Division. The NWFP Department also works on isolation, characterization and bioactivity studies of molecules from medicinal plants of Western Ghats, Some of the current activities of the Division include, assessment of ecosystem services for conservation and management of sacred groves in Kerala part of Western Ghats, structure, composition, dynamics and management of vayal ecosystem system in Periyar Tiger Reserve, ex-situ conservation of wild orchids of Western Ghats, systematics, phylogeny and biogeography of Dipterocarps in the Western Ghats, development of biomarkers as a predictive tool for organophosphate toxicity in terrestrial ecosystem, long-term monitoring of forest ecosystem dynamics of permanent plot in tropical wet evergreen forest of Kerala, maintaining and monitoring permanent plots in natural forests of Kerala and bioactivity guided fractionation and mechanistic elucidation of biomolecules from *Cocculus laurifolius* DC. of southern Western Ghats.

Wood Science and Technology

Programme Division focuses on research related to wood properties and utilization, wood structure, timber processing technology for increased durability, value addition, pulping characteristics of reed bamboos, among others. Division has facilities for Universal Testing Machine (UTM), image analyzer and NIR spectroscope. Many studies on wood structure, properties, quality assessment of teak, eucalypts and preservative treatments for species like rubber wood and coconut wood were undertaken by the Division. Currently, the ongoing studies of the Division include the genetic conservation of natural teak resources of India with emphasis on wood quality variation of natural teak provenances and the impact of climate change on the growth dynamics of tropical species like teak. Under the latter, the Division procured and established the latest state of the art, Tree-Ring measuring station imported from Germany. The major extension activities of the Division include, wood identification of tropical/temperate and exotic timbers for public sectors and judicial purposes. The well curated Xylarium serves this purpose to the scientific community.The Division was also involved in the consultancy services for the Archaeology Department, Government of Kerala in the renovation of Punalur Suspension bridge with regard to selection and quality assessment of Thambagam wood (*Hopea parviflora*) laid on the bridge. In addition, anatomi-

cal studies, utilization and value addition of products on bamboos and canes have been undertaken. Some of the current activities of the Division include, evaluation of *Ochlandra* germplasm, mass propagation and field trials of elites for selection of low lignin plant material with desirable pulping properties that less pollute the environment. KFRI has established a 0.5 hectare multi-locational field trial plot at the factory site of HNL, Velloor, Kottayam. At FRC, Palappilly a Common Facility Centre for Bamboo Enterprises with Department of Science and Technology, Govt. of India, support was established to impart training and technology transfer. Also Initiated was the establishment of replicable bamboo/ cane based model business units for entrepreneurs via training, demonstration and transfer of the innovations/technologies developed or available.

Forestry and Human Dimensions

The Programme Division comprised of Forest Economics and Sociology Departments mandates to study, review and evaluate Policy and management, People and forests and production, sustainability and conservation. The thematic areas covered, forest management systems, forest land use, institutional analysis, industry studies, natural forests, plantation economics, productivity of forest plantations, management of natural forests, econometric analysis, demand of and supply of wood in Kerala, forestry sector analysis, trees outside forests, bamboo, price fixation of pulpwood, history and human dimensions of Forest management, socioeconomics including farm forestry, Ecotourism-visitor mangement in Protected Areas, Non Timber Forests Products management, environmental and social impact assessments, economics of invasive alien sepcies, economic valuation and natural resource accounting inlcuding ecotourism development and policy studies. The current research areas include assessment of supply-demand position of wood for the State, economic valuation of ecosystem services, market economics covering medicinal plants market in south India, policy issues and strategic planning for a healthy forest and contented forest people, enriching, updating and maintenance of the existing database and repositories, and building capacity of decision makers, natural resource managers, local communities and other stakeholders to sustainably manage natural capital and create awareness amongst all relevant stakeholders about advances in forestry research.

Library and Information

KFRI Library functions as a full-fledged resource centre on tropical forestry and as a special repository of literature on teak, bamboo and rattan. It also functions as the national level Bamboo Information Centre. KFRI library with a core collection of more than 17,000 books and 10,000 back volumes of journals on forestry and allied subjects caters to the information requirements of scientists and research scholars of the Institute and others who are committed to forestry. Online access to many of the core journals in forestry and allied subjects is made available which include both national and international journals. Additionally, it has access to CAB's bibliographic database which covers the major subjects like agriculture, environment, and forestry, among others and also archives from 1939. CAB Abstracts now comes with CABI Full Text and provides access to more than 220,000 journal articles, conference papers and reports. Online access to complete EBSCO database of Environment is possible, which contains more than 2.4 million records from more than 2,200 national and international titles dating back to 1888 as well as more than 190 monographs. The library collections include many of the valuable reference books, doctoral theses, publications of national and international bodies like Forest Research Institute (FRI), APAFRI, IRGWP, IUCN and IUFRO and databases in CDs and DVDs.

Access is made available to online catalogue of book and back volume collections of the library developed by using the software KOHA, open source Integrated Library Management software. Digital collections of the library include research reports, scientific papers and other documents published by KFRI scientists, which is possible to access through the library portal developed for the purpose. Digital resources of the library include KFRI Information Bulletins, Ph.D. theses, Annual Reports and all the published issues of the Evergreen-KFRI Newsletter. Collections of Ebooks, Eprints, Indian Forest Records and Bulletins (publications of FRI) and the collections of bamboo, teak and cane literature are also possible to search and download. Digital resources of the library are organized by using the software Dspace, an open source repository software. This can be accessed by the scientists and research scholars from their desktops in the institute. A total of 42 foreign journals and 57 Indian journals are subscribed during the period. Also a total of 91 books and 99 back volumes of journals have been added to the collection. The two websites, Indian Forestry Abstracts (IFA) and Bamboo Information Centre – India (BIC – India) are maintained by the library. The current projects are: an information system for forests of Kerala and Compilation of Indian Forestry Abstracts (IFA) – Phase III.

Forest Health

Programme Division has Forest Entomology and Forest Pathology Departments. The thrust areas of research are different aspects of insects, microbes and weeds in the forest ecosystem. Authentic collections of microbes and insects of Kerala forests and also of microbial pathogens of forest insects are maintained in the Division. One of the focal point is development of eco-friendly biological technologies for management of pests, diseases and weeds in forest plantations. In addition, management of nursery and plantation diseases, diversity of plant pathogenic fungi in different forest ecosystems, Vescicular-Arbuscular and ectomycorrhizal fungal diversity and biological control of invasive alien species are the thrust areas of research in Pathology Department. The Entomology Department is involved in monitoring of forest insect diversity, control of termites in plantations, wood damaging insects and teak defoliator, and traditional methods of post-harvest protection of bamboo from insect borers. The mass production technology of the biopesticide *Hyblaea puera* Nucleo Polyhedrosis Virus (HpNPV) has been standardized, and the application technology has been transferred to stakeholders. The concept of butterfly garden has been popularized and technical advice is being provided to various agencies for the establishment of butterfly parks. Some of the current activities of the Division include, studies on plant growth promoting Rhizosphere and Rhizoplane fungi of grasses and their ability to control important fungal diseases of forest nurseries and management of the invasive Alien Giant African Snail (*Achatina fulica*) in Kerala.

Extension and Training

Programme Division effectively transfers the expertise and technologies developed in KFRI to different stakeholders. The Division liaises with various users stakeholders, facilitates transfer of technology and conducts training programmes in different aspects of tropical forestry like forest management, forest seed management, medicinal plant cultivation, environmental impact assessment, biodiversity monitoring and evaluation, remote sensing and GIS, root-trainer technology, clonal propagation, tree improvement and statistical application in forestry. The Division has excellent facilities for conducting training programmes including lecture halls, trainees' hostel and vehicles for field trips. The Division also liaisons and coordinates technical support to the various stakeholders and departments, researchers, student community and general public.

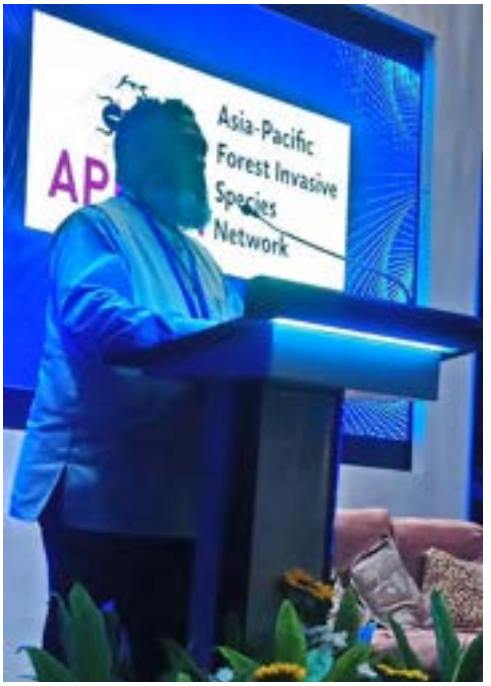
Support Sections

The research activities in KFRI are well supported by its Administration, Accounts and Engineering Sections. The Administrative Section looks after the day to day administrative activities of the Institute. Administrative Section headed by Registrar, helps Director in the smooth management of the Institute. All administrative sanctions related to project implementations are handled at Administrative Section. The transporation requirements for project implementation, trainings and other logistics are taken care by administrative section. KFRI has a fleet of vehicles including buses, jeeps for off-road high altitude transport, cars and two wheelers. The financial and accounting management of the Institute is taken care by Accounts Section. All financial transactions related to projects implemented by the Institute are handled at the Accounts Section. The Accounts Section is responsible for all payments, including payroll. It is also responsible for maintenance of relevant records and accounts and for ensuring effective financial management practice in place. The Engineering Section handles civil and electrical works separately. The civil section looks after the implementation of new constructions and maintenance of existing infrastructure. The electrical section is responsible for the installation and maintenance of electrical infrastructure and uninterrupted power supply.

NETWORKS

Asia-Pacific Forest Invasive Species Network (APFISN)

Asia – Pacific Forest Invasive Species Network (APFISN) is a cooperative alliance of 33 member countries of the Asia – Pacific region. The Network operates under the umbrella of Asia – Pacific Forestry Commission (APFC), which is a statutory body of the Food and Agricultural Organization (FAO) of United Nations. APFISN was established in 2004 during the 20th Session of the Asia – Pacific Forestry Commission (APFC) held in Fiji as response to the immense costs and dangers posed by invasive species to the substantial management of forest in the Asia – Pacific region. APFISN focuses on inter country cooperation that help to detect, prevent, monitor, eradicate and /or control forest invasive species in the Asia – Pacific region.



Species and habitat-specific protocols for the management of FIS, dissemination of these protocols among researchers and forest managers, promote data exchange and collaboration between member countries and discuss new strategies for APFISN were the key focal points of the Workshop on '*Habitat and species specific protocols for management of Forest Invasive Species* (FIS) *in the Asia-Pacific region*' held at Bandaranaike Memorial International Conference Hall, Colombo, Sri Lanka (23-27 October 2017). The successful conduct of the same by APFISN was highlighted by the presence of Mr. Kenichi Shono (FAO RAP, Thailand), Dr. Shiroma Sathyapala (FAO RAP, Italy), Dr. Weerawardana NDR (Forest Dept., Sri Lanka), Dr. Sajeev TV (Coordinator, APFISN), and national representatives. Prominent delegates

from Asia-Pacific region have shared their experiences, views and suggestions on the topic. The entire Workshop had five scientific sessions, where the final session exclusively addressed the FIS related issues of Sri Lanka.

'**INVASIVES**' a bimonthly newsletter of the APFISN is intended to share information among countries in the Asia – Pacific region on Forest Invasive Species (FIS). The Newsletter comprises of a short description of APFISN, a short description of new invasive threat, recent news on invasive species, new publications, new books and future events. Fact sheets on *Mikania micrantha*, *Parthenium hysterophorus*, *Lantana camara*, Coconut leaf beetle, *Mimosa diplotricha*, Papaya mealy bug, *Eucalyptus* rust, *Achatina fulica* and Blue gum chalcid have been produced and disseminated. A fact sheet gives information about the taxonomic position of a species, its distribution, biology, description, infesting habitats, threats and damage, spread, uses and management. APFISN has secured a third prize for the best stall in the National Biodiversity Congress 2017 held at Thiruvananthapuram (22–26 February 2017), organized by Kerala State Biodiversity Board, Government of Kerala.

TEAKNET (International Teak Information Network) FAO

TEAKNET manned by an International Steering Committee is headquartered at KFRI, Peechi, and is the host institution for the functioning of TeakNet since 2008. It is an International Network established by FAO to address the issues of the global teak sector. TEAKNET continues its general activities of publication of the quarterly electronic newsletter (TEAKNET-Bulletin), website mainte-

Presenters and delegates of the Partner Event

Dr. Pekka, IUFRO Div.5 Coordinator at Museum of Anthropology, University of British Columbia

nance and updating data, enrolment of new members, answering the technical queries across the globe etc. is done by the Secretariat. TEAKNET conducted two Partner Events during the year April 2017 to March 2018 as detailed below.

TEAKNET in association with IUFRO Teakwood Working Party (Div 5.06.02) organized a Partner Event "Teak Resources for a Sustainable Future" on 16 June 2017 at Vancouver and delegates from the Africa, Asia, Europe, Latin America and from other regions attended the Partner Event. Prof. (Dr.) Yafang Yin from Chinese Academy of Forestry and Executive Secretary of International Association of Wood Anatomists (IAWA), Leiden, The Netherlands chaired and moderated the session that had six speakers. The topics covered included: Development of Teak market and industry: Challenges and ways forward (Tetra Yanuariadi, ITTO, Japan), Genetic gain in clonal deployment of teak (*Tectona grandis* Linn. f.) and operational implications at Novel teak Costa Rica (Mario Espinoza, Novelteak, Costa Rica), TEAKNET: a complete networking solution for the teak stakeholders (Sreelakshmy MP, Thulasidas PK; TEAKNET, India), Effect of thermo-treatment on the physical, chemical and mechanical properties of wood *Tectona grandis* and *Gmelina arborea* from forest plantations (Roger Moya, Costa Rica Institute of Technology, Costa Rica), Global Teak Support Program for conservation and sustainable use of teak genetic resources (Thulasidas PK (TEAKNET); Michael Kleine (IUFRO); Walter Kollert (FAO)) and a poster on Shrinkage characteristics of plantation grown Teak (*Tectona grandis* Linn.) in Edo State, Nigeria (Stephen Amiandamhen, David Izekor, University of Stellenbosch, South Africa). TEAKNET also set up an Exhibition Booth together with IAWA for the network activities and membership drive for greater visibility among the forest products community and delegates of IUFRO conference. The Partner Event on "Teak in Productive Landscapes: An Introduction to Global Efforts for the Conservation and Sustainable Management of Teak Resources" was held at the 27th Session of FAO Regional Forestry Commission Asia-Pacific during 23-27 October 2017, in Colombo,

Sri Lanka. It was officially opened on 24th October in Bandaranaike Memorial International Conference Hall (BMICH), and inaugurated by the President of the Republic of Sri Lanka, Mr. Maithripala Sirisena. In view of the imminent threat of losing natural teak forests and in order to expedite the research results achieved so far, the international partners IUFRO, FAO, and TEAKNET promoted the initiation and implementation of a global program for the conservation, improvement, development and sustainable use of teak genetic resources. Dr.Michael Kleine, Deputy Executive Director from IUFRO Headquarters, Vienna chaired and moderated the session, which was attended by over 26 participants from 15 countries. Following short presentations about the concept of a future global teak support programme and its important components related to natural teak forests, small holder teak growing, genetic improvement, silviculture and wood quality, a panel of experts from ITTO, FAO, ICRAF and local research institutions deliberated on potential areas of work of a future global teak support programme. The session wrapped up with the participants hailed the initiatives of TEAKNET, IUFRO and FAO to carry forward the key messages evolved to include it in the development assistance and collaborative future GTSP programme for the sustainable management and conservation of teak genetic resources in its native and planted teak forests regions. TEAKNET and IUFRO jointly set up an Exhibition Booth at the APFC meeting venue at Bandaranaike Memorial International Conference Hall (BMICH) from 23 to 27 October 2017th during the days of Commission meeting for greater visibility, interaction and communication with forestry community at large.

REGIONAL CENTRES

Bamboo Technical Support Group (South Zone), National Agroforestry and Bamboo Mission, Ministry of Agriculture, Govt. of India

The Bamboo Technical Support Group (BTSG-KFRI) consisting of a team of scientists form different disciplines set up at KFRI and supported by the National Bamboo Mission (NBM), Ministry of Agriculture and Cooperation, Government of India since 2006, offers technical support for different stakeholders in the bamboo sector. Training programmes for field functionaries and farmers on propagation, cultivation and utilization of bamboo has been a major activity of the BTSG for several years. Other activities have been to conduct specific R&D, offer technical support on bamboo to the National Bamboo Mission and to farmers and artisans. KFRI has set up a bamboo nursery to provide quality planting mate-

rial of the important commercial bamboo species to farmers. A Bamboo Information Centre (www.bicindia.org) has been set up and is a valuable source of published literature on bamboo.

The Bamboo Processing Centre at FRC Velupadam, Thrissur, under the Bamboo Technical Support Group–KFRI was established with the support of the National Bamboo Mission. The Bamboo Processing Centre is currently working as Common Facility Centre for bamboo based Entrepreneurs, imparting technical know-how in the various stages of bamboo processing from raw materials to end products. The Centre was extended to two more buildings and couple of new machines were added to facilitate the Centre. They include one each of Bamboo Seasoning Plant, Matt Weaving Machine, Bamboo Incense Stick making machine, Bamboo round stick making machine, stick sizing machine and stick polishing machine. Training programmes were conducted for 98 different stakeholders including Bamboo/Cane entrepreneurs, artisans, students, women groups and common people in bamboo processing methods, preservative treatment methods, traditional production processes, manufacturing various bamboo products like bamboo star, crib, bamboo pen, penholder, wastepaper basket, bamboo tray, among others. Bamboo based rehabilitation programme was conducted for mentally challenged students in the Centre. Outreach training programmes were conducted for about 116 stakeholders in various districts of Malappuram, Kozhikode and Kollam using the portable machine tools of the Centre. KFRI also provided Entrepreneurship Development Programmes for emerging Bamboo Entrepreneurs projecting Bamboo Processing Centre as a model business unit. The machines and facilities of the Bamboo Processing Centre were demonstrated to NGOs, research students, entrepreneurs and architects working on bamboo and allied fields.

Regional Cum Facilitation Centre (RCFC) - National Medicinal Plants Board, Ministry of AYUSH, Govt.of India

The National Medicinal Plants Board (NMPB) under the Ministry of AYUSH, Govt. of India is the apex body for promotion of medicinal plant sector in the country. For effective coordination of NMPB programmes, Regional Centers were established in different regions of the country. NMPB has recognised Kerala Forest Research Institute, Peechi to set up Regional cum Facilitation Centre for the Southern part of India. The NMPB-RCFC (Southern Region) is a one-stop shop for all matters related to

the medicinal plants sector in the southern region covering States of Kerala, Tamil Nadu, Andhra Pradesh, Telengana, Karnataka and Union Territories of Lakshadweep, Pondicherry and Andaman & Nicobar Islands. Major objectives of the NMPB-RCFC (Southern Region) are, (a) co-ordinate all activities of NMPB in the southern region, (b) co-ordinate with all other organizations in medicinal plants sector and ensure streamlining their activities in the Southern Region; (c) develop managerial and technical skills among stake holders in production of quality planting materials (QPMs), cultivation, conservation, harvesting, semi-processing, value addition, storage, marketing, and quality control; (d) provide financial and technical support for organizing trainings, workshops, seminars, and interaction meetings; (e) facilitate development of agro-technology of endangered and high-demanding species; (f) facilitate production of region-specific quality planting materials; (g) facilitate/strengthen marketing of medicinal plant produce; (h) assist different organizations in formulating project proposals in the priority areas identified by NMPB and (i) document and disseminate success stories of activities supported by NMPB.

FACILITIES

Arboretum

Arboreta are special places for the cultivation and display of a wide variety of evergreen and moist deciduous trees. It is a living laboratory, which functions as an outreach, teaching and research facility dedicated to preserving the beauty and ecological functions of our biodiversity hotspot. KFRI Arboretum established in the Peechi campus in 2003 in an area of about 5 hectares currently has 3200 accessions belonging to 178 species under 50 families and 128 genera, with more than 50 taxa endemic to southern Peninsular India. Arboretum is maintained with grid maps with markings of the location details of each of the live collection. Among the 178 taxa in the arboretum, there are two gymnosperms and 176 angiosperms. Among the angiosperms, 162 taxa are dicotyledons belonging to 118 genera and 47 families and monocotyledons are represented by 14 species of 3 genera and 2 families. A collection of wild nutmegs, key components of '*Myristica* swamps', characterized by evergreen, water-tolerant trees considered as the most primitive of the flowering plants or "living fossils" are special attraction in KFRI Arboretum. *Myristica fatua* (Kotthapanu) *Myristica beddomei* (Pathiripoovu), *Myristica malabarica* (Ponnampayin), *Gymnacranthera farquhariana* (Undappayin) are few among them. It is also recognized internationally by Index Seminum with ID No. 1518 and is also enlisted in the National Network of Botanical Gardens in India.

Bambusetum

The KFRI bambusetum at Field Research Centre, Velupadam in Thrissur District of Kerala (10° 26' 07.95" N; 76° 21' 32.92" E) was established during 1988-95 for the ex situ conservation of Indian bamboo species and to create awareness and promote the cultivation of bamboo and its products. Moreover, it acts as a living laboratory which can be effectively utilized for taxonomical, molecular, silvicultural, ecological and synecological studies apart from its educative and aesthetic values.

The Bambusetum also serves as a genetic resource for future crop improvement programmes for forest managers and farmers. Offsets, rhizomes and seedlings from different parts of the country (Andhra Pradesh, Arunachal Pradesh, Assam, Himachal Pradesh, Karnataka, Kerala, Meghalaya, Mizoram, Orissa, Tripura and West Bengal) were used as planting materials for establishing bambusetum. It has different types of bamboos like climber bamboos (*Dinochloa andamanica*), monopodial or runner bamboos (*Melocanna baccifera*) and clump form bamboos (*Bambusa bambos*). Fourteen genera with 56 species were the established bamboo species till 2016: *Bambusa* (20 spp.), *Cephalostachyum* (2 spp.), *Dendrocalamus* (9 spp.), *Dinochloa* (2 spp.), *Gigantochloa* (6 spp.), *Guadua angustifolia, Melocanna baccifera, Ochlandra* (6 spp.), *Oxytenanthera abyssinica, Phyllostachys sulphurea, Pseudoxytenanthera* (3 spp.), *Schizostachyum dullooa, Sinoarundinaria edulis* and *Thyrsostachys* (2 spp.). During 2016-17, the bambusetum was enriched with 10 new species from North-Eastern States: *Bambusa bambos* var *giganteus, Bambusa cacharensis, Bambusa dampiana, Bambusa japonica, Bambusa manoharani, Bambusa vulgaris var wamini, Dendrocalamus hookeri, Melocanna clarkia, Oxytenanthira parviflora, Teinostachyum griffithi.* Flowering in three species of bamboo viz. *Dendrocalamus asper, D. giganteus* and *D. stocksii* was observed in the bambusetum during the year. Currently, the bambusetum with 66 species of bamboos is one of the biggest in the country.

Bioresources Nature Park

Bioresource Nature Park is located at KFRI Sub-centre Nilambur, and was established with the financial support from Department of Biotechnology, Ministry

of Environment and Forest, Government of India and Department of Planning and Economic Affairs, Government of Kerala. The Bioresources Nature Park has different conservation themes, for groups, viz. algae, bryophytes, pteridophytes and plants found in specialized ecological niche, i.e. xerophytes (cacti and succulents) and hydrophytes (aquatic plants). Besides these beneficial plants (medicinal plants), ornamental and aesthetic plants (orchids), with special reference to endemic and rare, endangered and threatened (RET) species are also featured in the park. Propagules of over 1500 species of plants have been collected and introduced in the thematic areas of the nature trail. In the orchid house of the park, one can familiarise with some of the rare orchids, south Indian endemic species, medicinal orchids and commercially important orchids including some of the prettiest orchids in south India. The Fern House features around 80 species of ferns, including endemic, rare, endangered and ornamental ferns. The Aquatic plants include different forms, such as, floating hydrophytes, submerged and rooted hydrophytes, emergent rooted hydrophytes, and floating leaved and rooted hydrophytes. The Xerophyte and Succulent garden has both outdoor landscaped rock garden and a green house to display medicinal and ornamental species. A collection of bio-fence and bio-fuel species among other attractions too are displayed. Thallpohyte and Bryophyte specimens are displayed in a specially designed shade house with mist and drip irrigation facilities. In the Palm Garden, besides the 40 ornamental palm species, many palms which have economic, ecological and cultural significance are grown. A Taxonomic Garden, where plants of over 100 angiosperm families are assembled is part of the Bioresources Park. The butterfly garden in the Park has been developed by planting larval and adult host plants and subtle modification of the habitat whereby one gets to see the entire life cycle of variety of butterflies. The Nature Park also has a model bamboo house established by the State Bamboo Mission.

Butterfly Garden

The half a hectare area in KFRI Peechi main campus designated as butterfly garden is an effort at in-situ conservation of butterflies. Butterfly gardens are

considered as an important tool in the field of nature education. Butterflies are attracted into semi-natural garden space where food plants of butterflies and their caterpillars are carefully selected and grown. KFRI developed this concept and created varieties of micro-habitats in the garden for attracting butterflies belonging to various groups. Large number of butterflies including the rare, endemic and endangered butterflies frequent the garden and captivates the eyes of the visitors in the background of which they receive elucidative lessons on life history of the butterflies besides their co-evolution, intricate ecological linkages, diversity, food requirements and other details. KFRI has two butterfly gardens, one in its main campus at Peechi and another in the Sub-centre at Nilambur. Some of the butterflies that can generally be seen in the garden include Common Rose *(Pachliopta aristolochiae*), Malabar Rose (*Pachliopta pandiyana)*, Common Mormon (*Papilio polytes*), Southern Sahyadri Birdwing (*Troides minos*), Asian Cabbage White (*Pieris canidia*), Common Grass Yellow (*Eurema hecabe*), Red Pierrot (*Talicada nyseus*), Common Castor (*Ariadne merione*), Common

Crow (*Euploea core*), Dark Blue Tiger (*Tirumala septentrionis*), Glassy Tiger (*Parantica aglea*), Blue Tiger (*Tirumala limniace*), Chocolate Pansy (*Junonia iphita*), Great Eggfly (*Hypolimnas bolina*), Water Snow Flat (*Tagiades litigiosa*), Chestnut Bob (*Iambrix salsala*), among others. The garden has 58 host plants of butterflies, among which 47 are larval host plants and the other 11 nectar plants. Some butterflies breed here, some are regular visitors with definite times for their visit and some visit the garden occasionally. The regular monitoring of the butterflies reported the presence of 12011 individuals belonging to 61 species. The aggregation among tiger butterflies (Blue tiger, Dark Blue tiger, plain tiger, striped tiger and common crow) at alkaloid sources such as, *Crotalaria retusa* was observed in the garden. During this period, number of schools, colleges and institutions received technical support and guidelines from KFRI for establishing a butterfly garden.

Central Instrumentation Unit

The Central Instrumentation Unit a centralized facility established in 2006, is an assemblage of sophisticated analytical instruments used by scientists and researchers of different departments of the Institute. Since inception, various instruments have been added to the facility and now it caters to the demand of researchers within and outside the institute at a larger scale. The major instruments in the CIU are high performance liquid chromatography, gas chromatography, GC-mass spectrometer, CHNS elemental analyzer, autoanalyzer, real time PCR

machine, spectrophotometer and soil CO2 exchange system, among others. The Unit also has a sample preparation lab and other minor instruments like, muffle furnace, precision water bath, analytical balance, rotary shaker and ultrapure water system. The CIU is actively invoved in internal as well as external sample analysis and also offers the facilities to researchers from other organizations on a payment basis.

Central Nursery

The Central Nursery, situated at the KFRI main campus has a collection of about 120 species high in demand under timber yielding, fruit bearing and medicinal categories of plants. The nursery ensures the timely availability of planting material to the farmers, general public and other Departments. Besides the above species and aspects, the nursery is engaged in handling a number of rare and threatened species from the Western Ghats, related with various research programmes conducted by the Institute. Standardization of nursery techniques of various species in collaboration with KFRI Seed Centre is the other major responsibility of the Central nursery. The data generated in the nursery is used in the ongoing research programmes and is useful in future research programmes too.

Herbarium

The Herbarium at KFRI, established in 1982, is recognized by the International Association of Plant Taxonomists, and is known by the acronym KFRI by Index Herbarium (Taxon 37: 503. 1988). The herbarium has over 11000 specimens demonstrating more than 2140 species from 203 families and is one of the major reference herbarium of forest plants. It has extensive specimen collection of flowering plants of Kerala, especially medicinal plants and a pan Indian collection of rattans, palms and bamboos of India including Andaman and Nicobar Islands. The species in the herbaria are indexed in alphabetical order with collection numbers under respective plant families and Bentham and Hooker's system of classification (1867-1883) has been followed for the systematic arrangements. The predominant plant families in the collection are Poaceae (171 spp.), Orchidaceae (151 spp.), Arecaceae (109 spp.), Fabaceae (81 spp.), Euphorbiaceae (96 spp.) and Rubiaceae (90 spp.). The herbarium is also represented with more

than 90 species of Pteridophytes. For instant access of specimens from any part of the world, all specimens are digitized and that can be accessed by botanists and other researchers free of charge through the data portal at http://kfriherbarium.org/. The website provides basic and advanced search capabilities. Default search can be conducted in all fields of the herbarium database, while advanced search allows searches in specific fields.

Kerala Forest Seed Centre

Kerala Forest Seed Centre (KFSC) established under World Bank assisted Kerala Forestry Project in 2003 as a collaborative programme of KFRI and Kerala Forest & Wildlife Department (KFD). It is located in the main campus of the Institute (10.52668o N; 76.35095o E). It is under direct administrative control of the Director, KFRI. Functioning of the Centre is monitored by an Advisory Committee comprising officials from both the establishments. KFSC is led by a Senior Scientist of KFRI having professional experience in the field of Seed Technology. A Range Forest Officer and a Section Forest Officer on working arrangement is deputed from KFD to the KFSC. The Centre caters the requirement of certified seeds of forestry species to the KFD, other Government Departments, NGOs and farmers in and outside State. Main objective is to collect seeds from superior trees/ stands, process, grade, store and caters to the requirement of stakeholders. Its service is being extensively utilized by research institutions, students, entrepreneurs and farmers. Teak seeds from Seed Production Areas (SPAs) in Kerala are brought to KFSC during March – April. The seeds are subjected for grading, and routine tests like rapid viability test and germination test as per ISTA rules. Depending on the storage physiology, healthy and viable seeds are stored at optimum storage conditions in plastic bins/gunny bags/plastic bags. The seeds in stock are being tested at frequent intervals for viability. In addition to supply of seeds, the facility is utilized for research in Seed Science and Technology on tropical forestry species of the Western Ghats and provide training to forestry professionals, researchers, students and others interested in seeds.

Medicinal Plants Garden

The medicinal plant garden at Peechi campus spreads over 0.5 hectares, consisting of 350 species of medicinal plants including of herbs, shrubs, climbers and trees. It is maintained as a reference collection of authentic medicinal plants of Kerala forests. The collection in the garden is enriched by bringing new plants collected from the wild or through exchange with other botanic gardens. As part of labeling the plants during this period, 165 metal boards were displayed

for both field and potted plants including special groups. A potential medicinal plant, *Salacia fruticosa* has been studied for floral biology as the species had low fruit set. During the period, 35 groups covering school/college students, researchers and general public were visited the garden.

Orchidarium and Fernery

The Orchidarium and Fernery are meant to provide artificial habitats for orchids and ferns and helps in the ex situ conservation, multiplication, besides providing materials for study purposes. Orchids and ferns are peculiar group of plants with wide range of economic and conservation importance. Orchidaceae, one of the largest families of flowering plants, consists of about 700 genera and 30,000 species and with untold number of hybrids. Though about 265 species have been recorded from Kerala, some species are known only by their type collections and

few are presumed to be extinct. Among the orchids of Kerala, thirteen species are used medicinally. At present, the Orchidarium/Fernery of KFRI has 240 species including rare, threatened, terrestrial, epiphytic species of Orchids and Ferns, and also some rare ornamental orchids and Ferns.

Palmetum

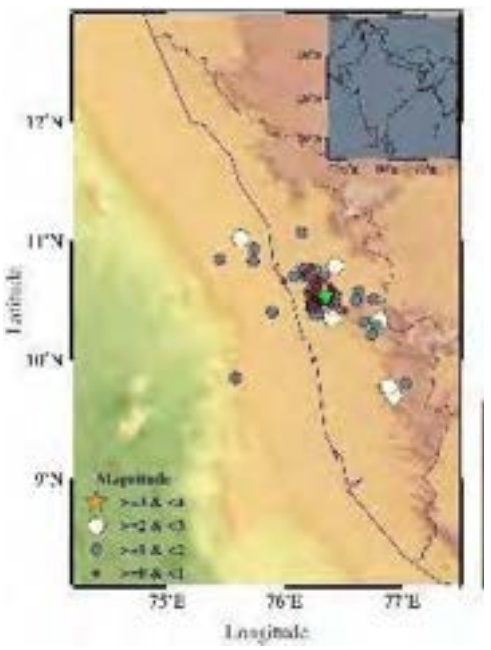
Palmetum is the live collection of indigenous and exotic palms. KFRI Palmetum was established in the year 2000. We have a collection of 135 species of palms under 52 genera. Of these, 75 are indigenous palms and 60 are exotic species with 8 species critically endangered, 9 endangered, 8 vulnerable and 23 near threatened categories as per IUCN standards. The exotic species include those which are commonly found in Indian parks, gardens and along avenues. Rare species like *Bentinckia condapanna, Bentinckia nicobarica, Rhopaloblaste augusta, Calamus nagbettai, C.brandisii, C. vattayila, Wallichia disticha, W. nana, Korthalsia laciniosa, Korthalsia rogersii, Licuala spinosa* and mangrove species like *Phoenix paludosa* and *Nypa fruticans* are also present in the collec-

tion. Palmetum serves as a facility for educating the public about taxonomy, economical importance and conservation of palm resources.

Seismic Observatory

Seismic observatory at Peechi, located in the main campus of KFRI is operated under the aegis of National Centre for Earth Science Studies (NCESS). This station is one of the 10 permanent stations set up by the DST in 1999 (presently funded by MoES) for strengthening earthquake monitoring in the Peninsular India and for improving the location of earthquakes as well as azimuthal coverage in the shield region. The observatory is functioning well and generating high quality data. The data recorded at Peechi observatory is used for detailed studies of local and regional earthquakes and is also useful for evaluating the seismogenic potential of Peninsular India and especially in the Western Ghats region in Kerala. The data is systematically archived on hard disks/DVDs. The observatory provides data to government agencies as well as other research institutes, which are used for the disaster management planning and various research works. The observatory plays host to a remarkable number of visitors including students and serves as a good educational facility to the public. The compiled data is sent to the National Seismological database centre of IMD annually, in MINISEED and SEISAN formats. This station is linked with INCOIS through VSAT connection. is also provided data to NGRI and NCS

seismic database. Details of the tremors from Kerala were given to different government agencies of Kerala like Disaster management Cell of Kerala, Thrissur, Palakkad and Idukki Collectorates, as per their request. The information provided by the observatory is used by the district administrators for public outreach. Data from this station, along with the data from other stations, can be used for devising new methodologies to ensure safety and security during construction of dams and other major installations.



Soil Museum

The KFRI soil museum showcases the diversity of forest soil and mineral resources in the State and provides critical inputs for forest management. The main attraction is a collection of soil monoliths featuring the soils in different types of forests viz. shola, evergreen, semi-evergreen, moist and dry deciduous, bamboo, grasslands, teak plantations, degraded forests and agroforestry systems in Kerala. A monolith is essentially a profile representing the soil typical of a region, with all the basic characteristics preserved intact. It displays vertical sections of the soil from the surface to the bedrock below displaying the various horizontal layers or genetic horizons. Each monolith was dug from the ground and processed for more than a month before being mounted for display. The forest soil museum is the first of its kind in India and provides valuable information on soil genesis and transformation in the humid tropics. It provides signatures of the vegetation, cli-

mate, rainfall, topography, and rocks in a particular region. Any degradation of a forest ecosystem is reflected in the soil profile and can be a valuable tool in forest management and conservation.

Teak Museum

The teak museum was established in the Sub-Centre campus of KFRI in collaboration with the KFD in 1995 owing to the historical significance of the region. The world's first Teak (*Tectona grandis*) plantation was raised in Nilambur way back in the 1840s. This museum is the first of its kind in the world dedicated to a single species–Teak. The museum offers information on several aspects of teak, such as history, cultivation management, utilization and socio economics. The ground floor of the double-storied museum exhibits a translite of Kannimara Teak, the oldest naturally growing teak tree located at the Parambikulam Wildlife Sanctuary and the life-size replica of the trunk of the largest known teak tree growing in the Malayattoor Forest Division. Another translite of a giant tree present in the oldest teak plantation in the Conolly's Plot at Nilambur offers the visitors a glimpse into the teak plantation activities undertaken 160 years ago. Some of the other attractions here are the traditional granary and a miniature model of sailing vessel called Uru made of teak wood. Teak poles of varying sizes and qualities obtained during the process of 'thinning' of teak plantations are also displayed along with the necessary details of standard classification of teak poles. The depiction of foliage, flowers, fruits and bark of the

tree gives us a deeper insight into other characteristics of teak. Here, one can also find the large stump of a 480-year-old teak tree brought from Nagarampara forest range in Kottayam Division. A Teak Information System (touch screen facility) in the museum helps the visitors to get information on various aspects of teak tree, such as, habit and distribution, history, morphology, cultivation, harvesting, timber and utilization. In addition, various educational, extension and programmes like orientation programmes, workshops, nature study programmes and summer training course are also organized for various stakeholders. Other activities like contests, field trips and exhibitions, and documentary fests are also conducted for the students and the general public. The museum attracts large number of visitors including students, farmers and teak users.

Tree Health Helpline

The Tree Health Helpline at KFRI is an outreach initiative mechanism tapping the accumulated expertise of the scientific community in KFRI. Problems faced at single tree level to those at nurseries and plantations are attended through the helpline. Tree growers of both private and public sectors are expected to be the beneficiaries of this initiative. The helpline attends largely to the queries received from the State Forest Department on pests and diseases associated with teak and eucalypts. The queries received were mostly related to pest attack, fungal problems, species site matching, species identification, fertilizer application, harvesting time, planting techniques, wood quality, physiological problems, micronutrient deficiency, parasitic issues, suitable intercrops, seeds, seedling availability, etc. Key activities during the period include the preparation and distribution of Tree Health Helpline brochures and a Health Card for accessing the health of avenue trees. The various social issues undertaken include the health assessment of various avenue trees in highways and cities in Kerala.

Wildlife Museum

The wildlife museum has a comprehensive collection of well preserved specimens belonging to various taxa from different locations across Western Ghats, a collection from different projects undertaken by KFRI since 1978. It has variety of preserved specimens including many mammals, invertebrates, amphibians, fishes, birds and reptiles. More than 1000 specimens were collected as study materials, for awareness creation and reference materails for research students. Majority of the collection are identified and labeled. The collection has 76 amphibians including rare and endangered living fossil *Nasikabatrachus sahyadrensis*, 90 reptiles including rare coral snakes, kraits and many more reptiles, 49 mammals include rare little Indian Porpoise, flying squirrel, spiny dormouse and 8 aves. Other than vertebrates there are a number of preserved invertebrate species including mollus *eretrix* species and spiders from various regions of the State are also preserved. The specimen collection at the museum is used for graduate and undergraduate training, species identification workshops and educational programs by State and local agencies. The major objective is to support and encourage morphology based taxonomy and research and education which will establish KFRI as a key reference facility in Kerala addressing environmental issues, such as, wildlife conservation, endangered species recovery, native fish decline, landscape ecology, systematics and biodiversity studies.

Xylarium

Xylarium is a collection of authenticated wood samples that is well curated and accessible to the scientific community for research, teaching, environmental education and other programmes. KFRI xylarium was established in the year 1979, and has a collection of 587 specimens, 133 samples representing 68 genera and 114 species from Kerala, India and the rest are from 13 foreign countries. It has been indexed in Kew Royal Botanic Garden, UK in its Index Xylarium 4 - a directory of Institutional Wood Collections from around the world. The dimension of the KFRI xylarium sample is: 10 x 6 x 1 cm for small specimens and 16 x 10 x 2 cm for large specimens following international standard.

The xylarium database has detailed records, covering, family name of the tree from which the wood was collected, species name, original wood specimen No., date of collection, collector(s) name, herbarium No. of the voucher specimen, country, altitude, latitude, longitude, habit, habitat, and note on collection or accession. For each wood specimen, there will be a corresponding voucher herbarium specimen deposited in the KFRI Herbarium with the same accession number. KFRI offers few Indian species for mutual exchange of xylarium samples.

RESEARCH AND EXTENSION ACTIVITIES

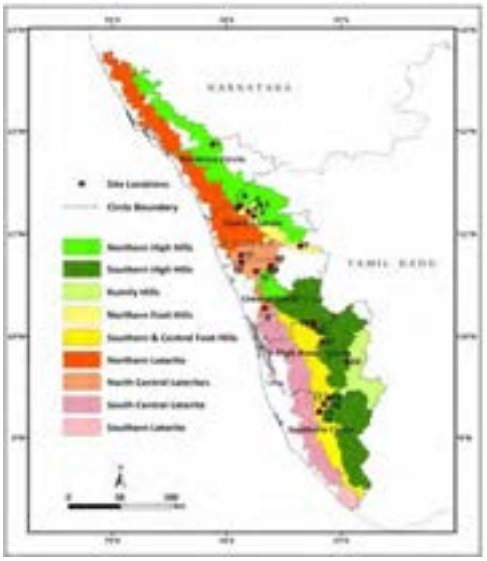
Completed Research Projects

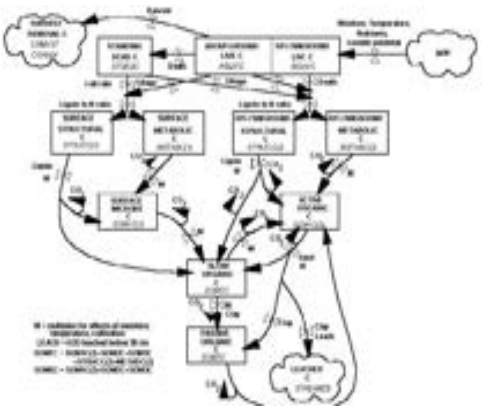
KFRI Research Report No. 523

Soil organic carbon pools and its dynamics in the managed teak plantations of Kerala Western Ghats

(Sandeep S)

Soil organic carbon plays a major role in sustaining ecosystems and maintaining environmental quality as it acts as a major source and sink of atmospheric carbon. The present study aims to assess the soil carbon stocks and pools in the teak systems, their interactions with soil colloids and its turnover under different projected climate change scenarios. Soil samples were collected from plantations of 40 - 50 years of age. A stratified random sampling method was adopted where the agro - ecological units was used as the main strata and site qualities (I, II, III and IV) as substrata. The results showed that the mean carbon stocks in teak plantations of Kerala Western Ghats varied from 7.38 - 12.10 kg m-2 and the Southern High Hills (Zone D) with a much cooler climate (mean annual temperature 21.6 °C; rainfall 3602 mm) was found to store a significantly higher amount of carbon in the 1 meter soil depth than all the other teak growing zones. The carbon fractions in these teak plantations were found to vary between zones. Active and slow carbon pools were found significantly higher in site quality I and II. In contrast, there was no significant difference in the passive SOC concentration among different zones or site qualities. Even though the studied teak plantations exhibited a wide range of soil types, the presence of almost equal amounts of passive carbon





in them showed that the recalcitrance of carbon in these soils is mainly due to their chemical structure rather than soil enabled protection against decomposition.

The elemental composition of the extracted humic acids showed that their carbon and nitrogen contents ranged from 26.2 - 44.4 % and 4.1 - 6.3 % respectively. Though site quality IV had comparatively higher C/N ratio than the other sites,

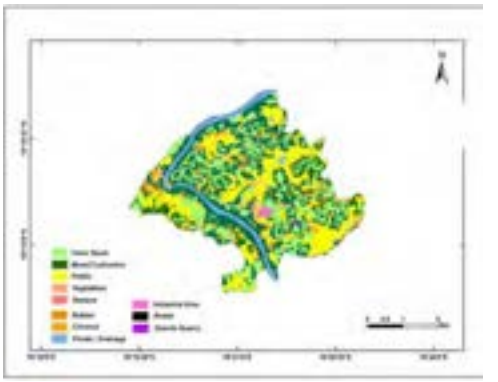
this was found to be well within the critical limits of 10:1 required to sustain carbon and nitrogen mineralization. The E4/E6 ratio values, Kumada's classification system and spectroscopic analyses by way of FTIR analyses indicated that the humic substances in these systems were a polymeric mixture of many molecules predominantly aromatic with phenolic and amine substituents linked together. The scanning electron microscope (SEM) and transmission electron microscope (TEM) images established that these humic acids are also poly crystalline and shapeless with particle sizes in the micro ranges.

KFRI Research Report No. 524

Soil and water quality status of Kadukutty region

(Sandeep S, Thomas P Thomas)

Kadukutty in Thrissur District has a long history of industrial and agricultural development. Soil and water qualities of Kadukutty region were studied and baseline information generated. It was seen that 35 per cent of the land in the region is under mixed cultivation. Rice, coconut, banana, pepper, arecanut, nutmeg, rubber and vegetables are the main crops cultivated in the panchayat. The pH of the soils ranged from 4.64 in vegetables to 5.42 in mixed cultivation. Soil organic carbon contents were found to be in the medium to high ranges. Heavy metal content in soil showed that cadmium, lead and nickel were beyond the permissible limits in most of the soils in Kadukutty. To increase the information capacity (mobility/bioavailability) of generated results, a speciation analysis suggested by EU Standards, Measurement and Testing Programme called BCR process of the heavy metals in soil was conducted. The order of mobility of the metals in soil systems for the first fraction is Ni > Mn = Pb > Zn > Cd > Cu > Fe . Ni, Pb and Mn seemed to be the most mobile elements in the region. Enrichment factor values showed that accumulation of these metals in soils occurred mainly due to anthropogenic activities - industrial as well as agricultural. Earthworms were abundant in sites where predominantly organic cultivation was practiced and absent in sites with high synthetic fertilizers and chemical inputs. Water quality of the region was assessed by collecting samples from wells and prominent water courses draining the area. The pH values of Kadukutty region were found to vary between 3.70 - 5.60 and 5.20 - 6.20 in wells and water courses respectively. The values in wells were much lower than the prescribed BIS and ICMR standards especially around the industry. Heavy metal contents were found to be within the permissible limits and pesticides could not be detected in any of the analyzed



water samples. All the analyzed water samples indicated high pollution levels by coliform bacteria. Fecal coliforms were found to be present in 60 per cent of the analyzed well water samples. Aquatic macro invertebrates though present in water courses, their community compsition was seen shifted towards the tolerant taxa.

KFRI Research Report No. 525

Environmental impact of pesticide application in Cardamom Hill Reserves (CHR) of southern Western Ghats

(Jayaraj R, Sandeep S, Hrideek TK, Mallikarjuna Swamy GE, Amruth M, Sajeev TV, Muralidharan EM)

The Cardamom Hill Reserves (CHR) of southern Western Ghats, is an ecosystem highly disturbed in multiple ways, attributable to widespread anthropogenic activities, mainly exhaustive agricultural interventions. Currently, this region is intensively managed for its cultivation, as it is high value naturally growing crop. This study looked into the negative effects of pesticide application on the ecosystem health in CHR, in view of the adverse effects of insecticides and plant protection chemicals including toxic and hazardous pesticides used against pests and for better yields.The survey highlighted the key cultivars of the region [cardamom (78.13 %), mixed crops (9.38 %), tea/coffee (1.04 %) and banana/cocoa (2.00 %)] and the major pesticides being used in the plantations [organophosphorus (45.6 %), neonicotinoids (12.66 %), pyrethroids (12.66 %), unknown/ not declared (18.99 %), carbamates (5.06 %), GABA receptor blockers (2.53 %) and organochlorides (2.53 %)]. The soil-stress studies using *Eisenia fetida* proved the avoidance of unfavorable environment by soil invertebrates leading to aggressive movement of earthworms from the pesticide-contaminated region. In situ toxicity studies established the toxic effects of chlorpyrifos on *Eisenia fetida* evidenced by high mortality rate, weight loss, increased lipid peroxidation levels, decreased total protein levels and glutathione depletion. Soil microbial dehydrogenase assay revealed the low microbial activity in the soils of the study region. Photosynthetic efficiency test and karyotype analysis conducted on dominant plants of the region identified the stress level of common plant species in CHR under continuous pesticide application. Ball metaphase noted in *Artocarpus heterophyllus* suggests direct destructive

effects of pesticides at chromosome level. *Aspergillus niger*, *Blastomyces dermites*, *Cladosporium herbarum*, *Collectotricum gloesporioides*, *Paecilomyces* sp., and *Penicillium crysogenum* were identified as promising pesticide degrading microbes in the study area and they are promising candidates for developing novel microbial consortia for pesticide degradation in soils. The chemical characterization of the soil revealed that the soil pH in CHR vary between 3.56-6.98 and nearly 65 per cent of the samples were very strongly to extremely acidic. Soil organic carbon in the soils was very high in most of the soils, but the restricted decomposition at low temperatures leads to wider variation in C:N ratio in these soils. The soils were adequate in P and K.

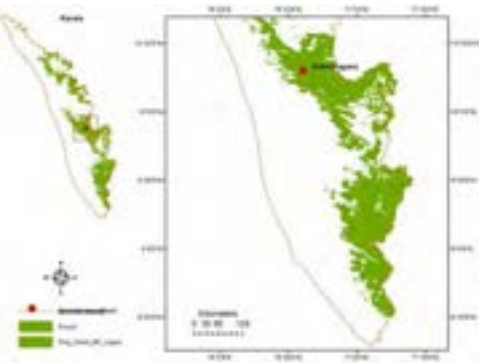
The pesticide adsorption studies revealed that the soils of CHR have good retention capacity for the pesticides chlorpyrifos, quinalphos and dimethoate. The adsorption isotherms also showed that, though the amount of maximum absorbed pesticide decreased with pH, the binding strength increased. Column-leaching experiments showed that the retained pesticides are highly vulnerable to leaching under continuous rains which can easily pollute ground water and nearby water bodies. The field experiments at CRS Pampadumpara revealed that under high doses of pesticide application, there is a gradual accumulation of all the pesticides in soils and plant bodies. In soil, this will either be degraded or leached and in plants, the decomposition is very slow as accumulated levels were seldom found to decrease in any of the experiments during the analyzed period. The plant-accumulated pesticides have a high potential for bioaccumulation as it moves along the food chain. Hence, it is always advisable to adopt methods of pest control with no or minimum levels of chemical pesticides. The study highlighted the degraded nature of the ecosystem in the region with adverse effects on the soil biota and plants due to unscientific pesticide use.

KFRI Research Report No. 526

Population evaluation and development of propagation protocol for three Rare, Endangered and Threatened (RET) trees from Kerala part of Western Ghats.

(Soman CK, Jose PA, Sujanapal P, Sreekumar VB)

Intensive field investigations were carried out to study the population distribution, structure, diversity and reassessment of conservation status of three target species selected viz., *Aporosa bourdillonii Stapf., Drypetes confertiflora* (Hook.f.) Pax & Hoffm. and *Inga cynometroides* (Bedd.) Bedd. Ex. Baker; of the Kerala part of the Western Ghats. The study further focused on the development of propagation protocol for these species as part of large scale multiplication and subsequent management of the populations. A distribution map for each species was prepared after conducting population survey and identification of species. The quantitative analysis of vegetation, abundance in terms of floristic structure and diversity was worked out and Importance



Value Index of the species was estimated. The vegetative propagation methods with the aid of auxins were standardized for the species. The seeds were analyzed for viability and storage practices. The population evaluation study revealed and recommended the revision of conservation status of target species viz. *A. bourdillonii* to Critically Endangered, *D. confertiflora* as Endangered and *I. cynometroides* to Critically Endangered.

KFRI Research Report No. 527

Ensuring sustainable livelihood of Tribals through skill development and employment generation: An Action Research Programme in Wayanad, Kerala

(Sankar S)

An action oriented project with a tribal group of honey collectors, was conducted in Wayanad forest area for training and capacity building aimed at skill development for livelihood improvement from 2009 to 2011 with financial support from DST, GOI. Through a PRA meeting conducted in the landscape which was the abode of two tribal groups viz. Kurumba and Kattunaickan, the target group of honey collectors was identified. A group of 20 Kattunaickans (15 men and five women) were provided with training for two years and assistance in marketing honey. The programme covered: understanding ecology and quality of honey, estimating bee nests and impact of harvest, baseline surveys and information on tools & methods of honey harvest, filtration, storage cans, and honey harvest for processing, value addition packing and sale (training purpose). Staff of Keystone Foundation, Kotagiri, provided immense support in realizing the programme.

KFRI Research Report No. 528

Ex-situ conservation of wild orchids in the Western Ghats of Kerala, India

Sreekumar VB, Sujanapal P, Jose PA, Sreejith KA, Raghu AV.

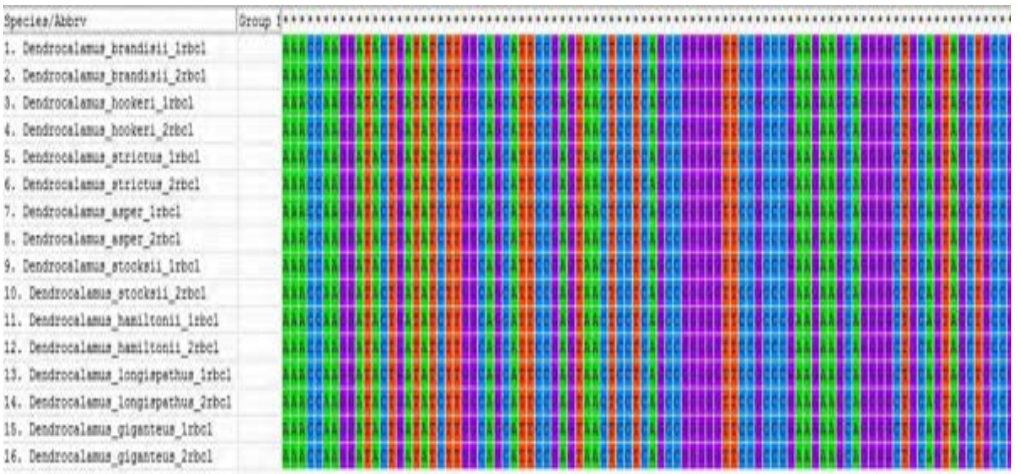
Orchids are unique flowering plants with their bewildering range of flowers and beautiful colour combinations provide a source of profound aesthetic pleasure. The orchid family (Orchidaceae) compared to other angiosperms families, has a high proportion of threatened genera, with most containing threatened species. IUCN red listed 36 species from India including *Paphiopedilum druryi* (Critically Endangered) and *Vanda spathulata* (Vulnerable), the two threatened species found in Kerala. A project on "Ex-situ Conservation of Wild orchids in the Western Ghats of Kerala" envisaging collection, identification, propagation and conservation of indigenous orchids from forests of Kerala part of the Western Ghats was implemented at Kerala Forest Research Institute. As an outcome of this work, 321 accessions of 129 species representing 53 terrestrial and 76 epiphytic orchids were added to the existing Orchidarium of Kerala Forest Research Institute. The epiphytic orchids like *Aerides crispa* Lindl., *Dendrobium anamalayanum* Chandra., Chandras. & N.C.Nair, *Oberonia santapaui* Kapad., *Habenaria digitata* Lindl. and terrestrial species like *Ipsea malabarica* (Rchb.f.) Hook.f., *Anoectochilus elatus* Lindl., *Pecteilis gigantea* (J. E. Smith) Rafin., *Satyrium nepalense* D. Don, are few among them.

KFRI Research Report No. 529

DNA barcoding as a valuable molecular tool for certification of bamboo planting materials

(Suma Arun Dev, Sreekumar VB, Muralidharan EM)

In bamboos, after the initial field level selection process for the superior mother clumps, the bulk planting materials generated viz. culm cuttings or rhizome transplants lack any distinguishing key morphological characteristics for traceability. These planting material generated



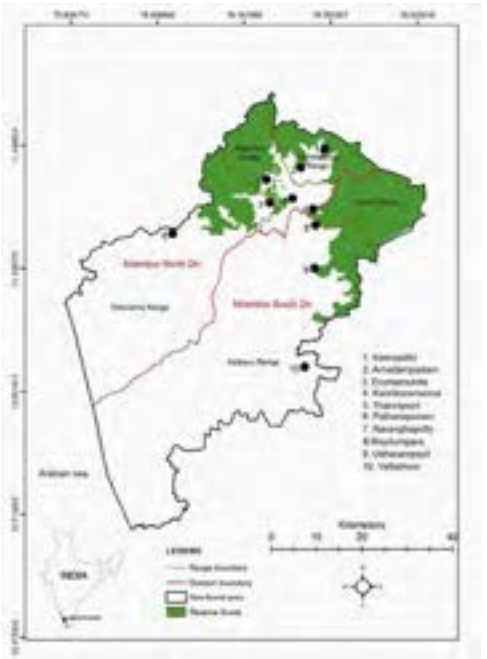
at the nursery level are directly procured for the establishment of commercial plantations without any further verification. Very often misidentification and mixing up occur at the nursery level and the error is not discovered until several years have passed. The objective of the preset study is to develop suitable DNA barcodes in the commercially important bamboo species of India belonging to four genera. The study evaluated the potentiality of seven CBOL recommended standard DNA barcode regions to arrive at a species-specific barcode. The *psbA-trnH* DNA barcode region generated unique species-specific barcodes for the commercial bamboo species in the genera *Bambusa, Dendrocalamus, Melocanna* as well as *Ochlandra*. To achieve precise identity in bamboo species, any national certification agency set up for the purpose can utilize *psbA-trnH* DNA barcode region to tag the species identity and to establish the authenticity of the multiplied planting materials.

KFRI Research Report No. 530

Assessment of human-wildlife conflict and mitigation measures in Northern Kerala

(Jayson EA)

The study carried out in Nilambur, Kerala State, assessed and estimated the extent of crop damage by wild animals in Nilambur South and Nilambur North Forest Divisions and suggests suitable mitigation measures to reduce and prevent the same. Crop raiding, cattle lifting, wild animals intruding into the settlements and human casualties were the four types of human–wildlife conflicts reported from the area, whereas, poaching and snaring are some of the adverse impacts of man on wild animals. Karulai, Kalikavu and Vazhikadavu Forest Ranges recorded the highest damage of crops. Information/data on the crops damaged as well as the damage caused by crop raiding elephants, wild pigs, Indian crested porcupine in the study area



were recorded. While the estimated economic loss per annum in the District was of Rs. 22 lakhs for cash crops reportedly damaged by Asian elephants for the crop raiding wild pigs the mean economic loss estimated was at Rs.15000/- per ha per annum. Mean economic loss by Indian crested porcupine in the Malappuram District was Rs.1322/- per ha per annum and highest damage was recorded from Edavanna Forest Range. Highest loss of coconuts by bonnet macaque was recorded from Kalikavu Forest Rage followed by Edavanna with a mean loss of 7 nuts per tree. Leopard and wild dog were res ponsible for the cattle lifting incidences and among them, five incidences were from Kalikavu and one from Vazhikadavu Forest Range. On preventive measures experimented, the Bee-hive fence was found effective against crop raiding elephants on one hand and on the other the sale of honey provided an additional income. However, on the implementation side, theft of the fence and maintainence during the monsoons was a limiting factor. The yellow coloured cloth and a bio-repellent experimented in the field proved effective against crop

raiding wild pigs. Respondents' insight (59 %) indicated wild pig as the major menace followed by bonnet macaque, Asian elephant and Indian crested porcupine. Furthermore, observed that only cash crops, such as, plantain, coconut and arecanut, rich in nutrients were raided mainly during the monsoon months when the vegetation is lush in the forest. The study highlights that crop damage by wild animals is severe in the Malappuram District and reports the localities wherein intervention is required. Practical suggestions to mitigate the conflict is reported in the study.

KFRI Research Report No. 531

Ecology and Restoration of *Cynometra beddomei* and *Kingiodendron pinnatum* - two endemic and endangered tree legumes of the Western Ghats of Kerala

(Jose PA, Sujanapal P, Chandrasekhara Pillai, Sandeep S)

The population survey of *K. pinnatum* enabled to locate 17 populations in 12 forest areas of Kerala. A total of 432 adult individuals of the species were enumerated within 168 km^2 of the 12 forest sites. The vegetation grouping of *Hopea-Kingiodendron- Vateria* was noticed in its distribution range. The population diversity analysis representing north, central and south zones of the State, exhibited moderately low IVI values. The distribution and ecological data generated suggested reversion of conservation status from Endangered to the Vulnerable (VU) for these species in the State. A moderate

to high N, low to moderate P, moderate to high K soil identified in situ could be used for restoring species in identical habitats. The long intervals in flowering, isolated flowering among populations, abscission of fruiting primordia, etc. are concerns over the reproductive barriers of the species. Stem rooting success (100 %) was achieved with auxins viz. IAA 1000 and IBA 1000 and 3000 ppm. Ring air layering was successful (100 %) with IAA 1000 ppm. The enrichment planting of 1550 seedlings in four population sites recorded success rate of 85-92 per cent after one year of planting. The population survey of *C. beddomei* enabled to locate 5 populations in Kerala. Altogether, 59 adult trees and 273 seedlings were counted among the populations. The extreme reduction in pre-reproductive individuals (17 %), poor performance in natural regeneration (77 % of unestablished seedlings) etc., showed declining trend of the populations. The lower IVI values among five population sites indicated the poor dominance of the species. The fewer number of populations, extreme lower number of adult individuals, poor natural regeneration and lower IVI values suggested upgradation of conservation status from Endangered (EN) to Critically Endangered (CR) for the species. A moderate to high N, low P and a moderate to high K soil along with identified habitat conditions could be used for restoring habitats of the species. The long intervals in flowering, individual flowering among populations, abscission of fruiting primordia, seed pest infestation by *Alcidodes* sp. indet. (Coleoptera : Curculionidae), poor seedling bank in situ, etc.

invoke concern over the reproductive barriers of the species. The intermediate type seeds exhibited 42-45 days normal viability period. The critical moisture content was noted at 38-40 per cent with 40 per cent germinability. Seedlings (40 Nos.) planted in two sites at Kakkayam forest recorded 86 per cent survival after one year of planting.

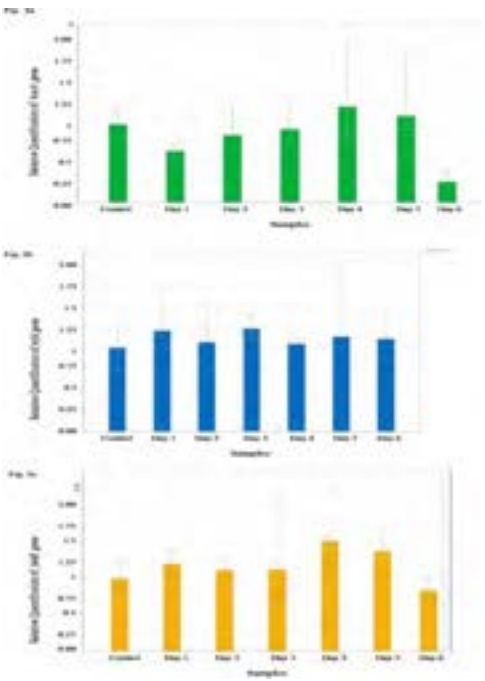
KFRI Research Report No. 532

Quantification of antifungal lipopeptide gene expression levels in *Bacillus subtilis* during antagonism against rubber wood sapstain fungus

(Suma Arun Dev)

The aesthetic value of the rubber wood is lost due to the bluish black disco-

louration caused by sapstainfungus, *Lasiodiplodia theobromae*, which leads to an economic loss in the wood industry. In our earlier study, *Bacillus subtilis* B1 has been identified as the potential biocontrol agent against *L. theobromae*, the dominant sapstain fungus infecting the rubberwood. *Bacillus subtilis* is known for its biocontrol activity against a wide range of fungal pathogens by various means including the action of non-ribosomal antifungal lipopeptides viz. iturin, surfactin and fengycin. The present study aims to characterize and quantify the gene expression levels of these antifungal lipopeptidic genes using RT-qPCR during inhibition process in the dual culture. Among the three lipopeptide genes, fengycin biosynthetic gene was constantly expressed in high amounts throughout the antagonism. The gene for surfactin biosynthesis was also expressed all through and may have helped in the growth and spreading of *B. subtilis* B1. Bacilysin biosynthetic gene expressed only in the fourth and fifth days dual culture might have complemented the action of fengycin in inhibiting the sapstain fungus.



KFRI Research Report No. 533

Capability development in instrumental methods of analysis.

(Muralidharan EM, Balagopalan M)

The Central Instrumentation Unit (CIU) was established in 2006 with an objective of providing a central facility of latest and advanced analytical instruments for all the researchers in KFRI. The CIU has imparted training on the use and maintenance of sophisticated instruments to students and researchers with the involvement of the service engineers of the instruments. The CIU also offers the facilities to researchers from other organizations on payment basis. The CIU is housed in a separate wing on the -1 floor of the Silver Jubilee Block of KFRI. The Unit is provided with separate cubicles to facilitate the segeregation of the equipment for convenience of use as well as to provide air conditioning, wherever necessary. A sample preparation room where all samples are stored and preparations are done is also available. The Instrumentation Laboratory room that has more work area was partitioned into 6 cabins in 2013. Continuous Flow Analyzer and CHNS Analyzer are placed in separate cabins to the left of the Instrumentation Laboratory and all the heat generating

equipments like water bath, oven etc. are placed to the right side of the Instrumentation Laboratory in separate cabins. The CIU now functions under a Scientist-in-Charge and the day to day work is done with the help of a Research Fellow trained in handling of sophisticated instruments. The Central Instrumentation Unit has the potential to become an advanced sophisticated instrument facility that can be utilized by researchers within KFRI and outside. Further additions to the available instruments is envisaged to achieve this goal.

KFRI Research Report No. 534

Digital archiving of Ph.D Theses and reprint collections of KFRI Library using an open source content management software

(Sarojam N, Hussain KH, George KF)

Digital revolution has brought drastic changes in information storage, access and retrieving processes. Many of the barriers that hinder the steady flow of information are removed by digitization. Both digital and web technology have emerged as the best means to preserve precious document resources and make them accessible through network. Digitized documents can be well organized, stored and retrieved more conveniently than printed documents. In KFRI Library, and in other libraries, PhD theses were not easily available for reference. There was no way to know the availability of subject specific thesis. There

is consistent demand for the PhD thesis produced by KFRI as largely the research is centered and focused in the Kerala part of the Western Ghats. The huge collection of reprints in the library consists of journal articles, papers presented in seminars, chapters of books, reports, among others. Most of the reprints are very old, brittle and torn and in many cases, very few pages are intact. Digitization of these documents has helped to make it available whenever it is required. Library space too could be optimised. Digital archiving of these collections associated with its efficiency in search and retrieval has enabled the researchers to access the full text from their desktop.

KFRI Research Report No. 535

Establishment of a Green-belt and mosaic planting for phytoremediation at campus of Nitta Gelatin, Koratty

(Raveendran VP, Seethalakshmi KK, Balagopalan M)

Nitta Gelatin India limited (NGIL), one of the most successful Indo-Japanese industrial ventures, started its oprerations in 1975 and commercial production in

1979. As per recommendations of the Expert Committee meeting, convened by the Hon'ble Minister of Industries on 03 November 2011, KFRI established green-belt and mosaic plantation around the factory premises. Bamboos and other tree species were used in establishment of green cover around the factory to address environmental problems owing to industrial activities. Four bamboo species viz. *Bambusa balcooa, Dendrocalamus sikkimensis, Gigantochloa rostrata* and *Schizostachyum* (*Teinostachyum*) *dullooa* were planted along the border. Seedlings of 11 out of 26 tree species were planted as mosaic plantation and majority of them planted were found well adapted to the location. Further study is needed to find out the extent of pollution and its impact on the ecosystems around the NGIL factory premises.

KFRI Research Report No. 536

Bamboo Technical Support Group (BTSG)-Training

(Raveendran VP, Muralidharan EM)

To support the National Bamboo Cell, which is the prime central agency to implement the projects under NBM, Bamboo Technical Support Group (BTSG) have been already established in three different zones (South, North and East). KFRI Peechi has been approved by the National Steering Committee of the NBM to host BTSG for the South Zone. BTSG for south zone covers six states viz., Kerala, Karnataka, Tamil Nadu, Andhra Pradesh, Goa and Maharashtra. As per the objectives of the Action Plan training programmes on Resource Enhancement and Utilization of Bamboo were conducted, each for duration of five days. The course included eleven lecture sessions, visit to KFRI facilities like Tissue Culture Laboratory, Bamboo Information Centre, KFRI Library and Kerala Forest Seed Centre. The training also included

a two-day field visits to the KFRI Sub Center, Chandakunnu, Nilambur, Field Research Center, Velupadam, URAVU - Wayanad and Bamboo handicraft clusters at Trikaipatta, Wayanad.

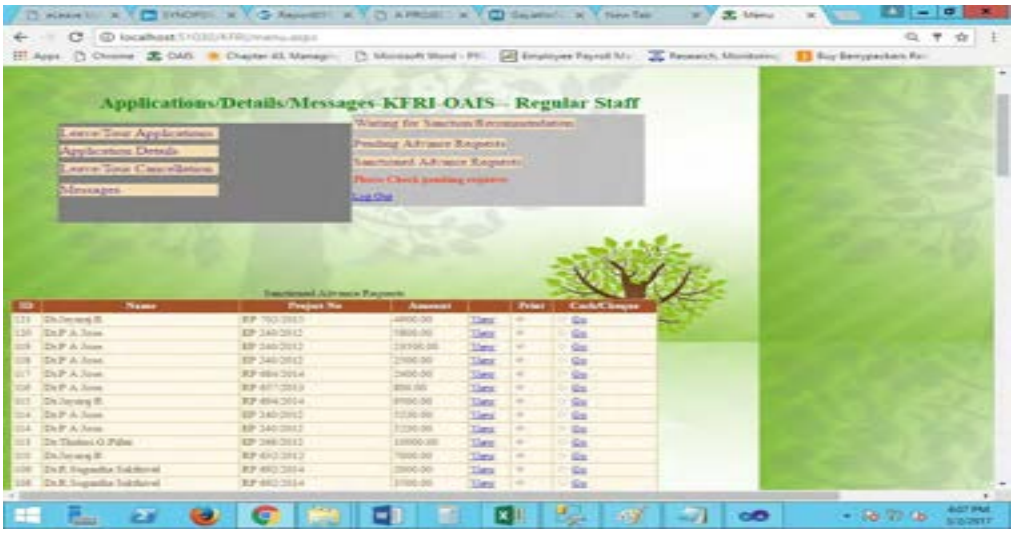
KFRI Research Report No. 537

Development and management of research and office information system – Facility development

(Jayson EA)

Research evaluation and monitoring Unit was established on 1st April 1997 to coordinate and monitor the progress of various research projects, and to evaluate the findings in the final research report. Monitoring and evaluation are vital management utilities that are essential and equally useful for the progress of projects. They help ensure accountability in the use of resources, provide a clear basis for decision-making and offer practical lessons from experience to guide future development interventions. The research monitoring and evaluation unit has overall control on the research and supporting work executed in the Institute. The unit monitors all project activities, expenditures and progress towards achieving the project output and provide recommendation for further improvement of the logical framework. The unit reports the progress of the projects monthly, quarterly, half-yearly and annually on all project activities to the Kerala State Council for Science, Technology and Environment and other concerned funding agencies on demand.

In the project entitled " A compendium of project profiles and a digital archive of project records in Kerala Forest Research Institute an archiving system " had been developed. This project was initiated with a component for digitizing the information and communications associated to the research and administration in the RME Unit and a component for the development of a software module to automate the RME Unit. Additionally, to make changes in the database and software to be more user friendly by adding new modules. Apart from the support to research and administration work, RME Unit has developed software tools needed for data analysis, daily monitoring and management of the day-to-day functioning in RME Unit.



The developed software is named as OAIS, which has four inter related packages/modules namely 1. Leave/Tour application module 2. Advance Request module 3. Sanction Order Request module and 4. Tax Report mining module. The software was developed after completing the system analysis and the flow chart and other operating details are given in the report. RME monitored and reviewed projects, assisted in the annual budget preparation, supported Right to Information Act enquiries, prepared reports to Central and State Government Departments, KSCSTE and other funding agencies and provided full administrative support to Director and Registrar for efficient management of the Institute. The project paved the way to streamline the research activities of the Institute, apart from developing a software for efficient functioning of the Institute.

ONGOING RESEARCH PROJECTS

1. Assessment of ecosystem services for conservation and management of sacred groves in Kerala part of Western Ghats (*U.M. Chandrasekhara)

2. Assessment of medicinal plant resources of northern Kerala (*P. Sujanapal)

3. Evaluation of *Ochlandra* germplasm, mass propagation and field trials of elites - Phase 2 (* P.K. Thulasidas)

4. Impact of climate change on growth dynamics of tropical tree species in the Western Ghats region as evidenced from dendro-ecological studies (*P.K. Thulasidas)

5. Kerala Forest and Environment Index (KF & E-Index) (*V. Amruth)

6. Plant metabolic studies in the genus *Embelia* found in Kerala (*A.V. Raghu)

7. Foraging ecology of selected birds in the Kole wetlands of Kerala, India (*E.A. Jayson)

8. Network project on conservation of lac insect genetic resource (*T.V. Sajeev)

9. Fire as a management tool: A case study from selected forest ecosystems in Kerala (*K.A.Sreejith)

10. Ecology and patch dynamics of the endangered grizzled giant squirrel, *Ratuya macroura dandolena* habitats in South India with special reference to its conservation (*E.A. Jayson)

11. Development of biomarkers as a predictive tool for organophosphate toxicity in terrestrial ecosystem (*R. Jayaraj)

12. Long-term monitoring of forest ecosystem dynamics: Phase I: Establishment of 10 ha. permanent plot in tropical wet evergreen forest of Kerala (*K.A. Sreejith)

13. Plant growth promoting rhizosphere and rhizoplane fungi of grasses and their ability to control important fungal diseases of forest nurseries (*G.E. Malllikarujuna Swamy)

* Principal Investigator

14. Ecology and conservation genetics of *Atuna indica* and *Hydnocarpus longipedunculatus* – two rare and endemic trees in the Kerala part of the Western Ghats (*P.A. Jose)

15. Exploring the potential for hybridization in bamboo species in flower in KFRI bambusetum (*E.M. Muralidharan)

16. Study on reproductive constraints and seed characteristics of *Terminalia paniculata* (*P.K.C. Pillai).

17. Developing a digital library for the Teak Museum (*N. Sarojam)

18. Quantification of antibiotic gene expression levels in *Bacillus subtilis* during co-inhibition of rubberwood sapstain fungus using real-time PCR (*Suma Arun Dev)

19. Bioactivity guided fractionation and mechanistic elucidation of biomolecules from *Cocculus aurifolius* DC. of Southern Western Ghats (*R. Jayaraj)

20. Genetic improvement of selected tree species - Phase I: Establishment of germplasm collection at KFRI (*T.K. Hrideek)

21. Factors affecting roosting ecology of birds in Kerala (*E.A. Jayson)

22. Pedogenic influences on vegetation in the mangrove ecosystems of Kerala (*S. Sandeep)

23. Developing a sampling methodology for the snail *Achatina fulica* and to estimate the population size in infested sites of Kerala (*T.V. Sajeev)

24. Exploration of medicinal plant resources of Lakshadweep island with special reference to indigenous knowledge (*P. Sujanapal)

25. Wood balance study in Kerala 2014 - 15 (* V. Anitha)

26. Documentation of population demography and genetic structure of teak for developing sustainable conservation strategies and resource management (*Suma Arun Dev)

* Principal Investigator

27. Genetic improvement of selected tree species- Phase I - plus tree selection, standardization of the propagation techniques, establishment of seed orchard and clonal hedge garden (*T.K. Hrideek)

28. Management of the invasive alien giant african snail (*Achatina fulica* Bowdich) in Kerala (*T.V. Sajeev)

29. Economic valuation of ecosystem services in the moist deciduous forests of Kerala (*V. Anitha)

30. Authentication of major commercially traded raw drugs in the ayurvedic systems of medicine in India (*Suma Arun Dev)

31. The medicinal plants market in South India: Economic value and tribal rights (*V. Anitha)

32. Development of management protocols for already established invasive alien species in the protected and other forests of Kerala (*T.V. Sajeev)

33. Establishment of a herbal garden as a peri-urban green space of Nilambur, Malappuram District, Kerala (*U.M. Chandrasekhara)

34. Bird hazard to aircrafts in the Cochin Naval Air Station (*INS Garuda) (*E.A. Jason)

35. Facilitating the establishment of bamboo and cane enterprises through training and technology transfer (*T.K. Damodaran)

36. Exploration of medicinal plant resources of Panju islands of Maharashtra (*P. Sujanapal)

37. Collection, identification, documentation, exploration and conservation of biodiversity of parasitic foliicolous hyphomycetous fungi from Tarai forests flora of Uttar Pradesh (*Shambu Kumar)

38. DNA Barcoding a promising molecular tool for timber forensics (*Suma Arun Dev)

39. An information system for forests of Kerala (*K.F. George)

40. Evaluation of clonal teak plantations with particular reference to growth and wood properties (*P.K. Thulasidas)

* Principal Investigator

42. Chemistry and transformation of clay minerals under continuous teak rotations of Kerala Western Ghats (*S. Sandeep)

43. Exploring the possibility of developing semio-chemical based control strategy for the management of *Cossus cadambae*- the borer pest of *Tectona grandis* through isolation and identification of its pheromone system (*T.V. Sajeev)

44. Long term monitoring of *Strobilanthes kunthianus* in Eravikulam National Park-Phase I (* K.A. Sreejith)

45. Evaluation of selected clones of teak through multi-site testing to identify site specific clones for large scale plantations (*T.K. Hrideek)

46. Establishment of Nodal Centre of alien invasive species research and management (*T.V. Sajeev)

47. Resolving species complexes using molecular systematics: a case study of few taxa in the Western Ghats (*V.B. Sreekumar)

48. Restoration and reassessment of selected IUCN listed endangered tress in the Western Ghats (* P.A. Jose)

* Principal Investigator

ONGOING ESTABLISHMENT & MAINTENANCE (ESTM) PROJECTS

1. Maintaining Permanent Plots – Phase II (K.A. Sreejith)
2. Maintenance and enrichment of Microbial Collection (G.E. Mallikarjuna Swamy)
3. Maintenance of Wildlife Museum (E.A. Jayson)
4. Maintenance of Butterfly Garden at KFRI-Peechi campus and establishment of new gardens in schools (T.V. Sajeev)
5. Maintenance and enrichment of Insect Collection (T.V. Sajeev)
6. Enrichment and maintenance of Medicinal Plant Garden (P. A. Jose)
7. Maintenance of KFRI Herbarium (V.B. Sreekumar)
8. Maintenance of Arboretum and Palmetum at Peechi campus (V.B. Sreekumar)
9. Tree Health Help Line (T.V. Sajeev)
10. Strengthening and enriching Institute Central Nursery (P. Sujanapal)
11. Commercial Nursery- Palappilly (A.V. Raghu)
12. LAN, Internet and Website (T. K. Hrideek)
13. Research Monitoring and Evaluation Unit (T. V. Sajeev)
14. Digital archiving of administration records and multimedia services for public relations (T.K. Damodaran)
15. Strengthening and capacity building in administration (T.K. Damodaran)
16. Mathrubasha - facilitating/ strengthening the application of Mathrubasha (Malayalam) in office use (T.K. Damodaran)
17. Wood Processing and Preservative Treatment Plant (T.K. Damodaran)

18. Monitoring of Teak Experimental Plots, Clonal Multiplication area (CMA) and production of superior clonal plants (T.K. Hrideek)

19. Maintenance of Orchidarium and Fernarium (V.B. Sreekumar)

20. Maintenance of Research Nursery for bamboos (E.M. Muralidharan)

21. Maintenance of Forest Seed Processing Unit (P. K.C. Pillai)

22. Maintenance of Bambusetum (P. K.C. Pillai)

23. Maintenance of Arboretum at Palappilly (A.V. Raghu)

24. Bamboo Processing Centre (T.K. Damodaran)

25. Maintenance and enrichment of Bio-Resources Nature Park (U.M. Chandrasekhara)

26. Maintenance of Field Research Station at Devikulam (T.K. Hrideek)

27. Maintenance of Field Research Station, Kottapara, Ernamkulam (T.K. Hrideek)

28. Maintenance of field trial plot of *Ochlandra* at Hindustan Newsprints Limited (HNL), Kottayam and germplasm at FRC Palappilly (P.K. Thulasidas)

29. Soil health restoration programmes through participatory approach (M.P. Sujatha)

30. Upgradation and maintenance of Soil Museum at KFRI (M.P. Sujatha)

31. Campus garden development (P.A. Jose)

32. Research Management (T.V. Sajeev)

PUBLICATIONS

Research Papers in Journals

1. Sreekumar VB, Hussain KH, Renuka C. 2017. Virtual herbarium of Kerala Forest Research Institute, Peechi, Kerala, India. Current Science 112(3): 466-470.
2. Sarojam N, Raman Nair R. 2017. Design and development of Bamboo Information System. Informatics Studies 4(1): 19-28.
3. Jithin KV, Jose PA. 2017. *Lepidagathis benojiana* sp. nov. (Acanthaceae) from the Western Ghats, Kerala, India. Nordic Journal of Botany 35: 436–439.
4. Greeshma P, Jayson EA. 2018. Is floating and wading, a common behavior of Indian pond heron (*Ardeola grayii*). J. of Entomology and Zoology Studies 6(1): 179-180.
5. Suma Arun Dev, Michael SK, Anitha V, Feroze M. 2018. Cholanaickan tribes are prone to sickle cell disease in near future. Current Science 114(1): 22-23.
6. Sajitha KL, Suma Arun Dev, Maria Florence EJ. 2017. Biocontrol potential of *Bacillus subtilis* B1 against sapstain fungus in rubber wood. European J Plant Pathology 150: 237–244.
7. Jose PA, Kuruvila ST, Binoy NM. 2018. Distribution and population status of *Kingiodendron pinnatum* (Angiosperms: Fabaceae): An endemic and endangered legume tree in southern Western Ghats, Kerala, India. Journal of Threatened Taxa 10(7): 11963-11968. 1.
8. Bhaskar D, Prejith MP, Rajkumar KP, Alex CJ, Prasad TS, Sreejith KA. 2017. Butterfly diversity in lateritic biotope of Kavvayi River Basin, Kerala. India Current World Environment 12(1): 132-141.
9. Bhaskar D, Sreejith KA, Mohanadas K, Easa PS. 2017. Impact of prescribed burning on grasshoppers. The GSG Newshopper Newsletter, IUCN SSC Grasshopper Specialist Group. Issue 5: 21p.
10. Nishad PM, Greeshma P. 2017. Birds in and around MACFAST Campus, Thiruvalla, Kerala. International Journal of Zoology and Research 7(4): 19-24.
11. Roshnath R, Sashikuma C, Greeshma P, Harikumar C, Sreekumar B, Mavelikara H, Sivakumar AK. 2017. Common bird monitoring program, Green Partners Programme. Kerala Heronry Survey 2016– A Summary. Malabar Trogon 15 (3): 40-45.

Books / Chapters in Books

1. Raghu AV. 2017. KFRI Brochure Malayalam and English, Extension and Training Division, KFRI
2. Raghu AV, Jinesh VC. 2017. FRC Palappilly Brochure Malayalam
3. Pradeep Kumar S, Amruth M, Raghu AV, Mohammed Kunhi KV, Raveendran VP. 2017. Medicinal Plants-Benefit Sharing, Development, Conservation, Extension & Training Division, KFRI.

4. Hrideek TK, Chandramohan K.T. 2018. Crops of Kerala- An Overview, Gregor Mendel Foundation,Calicut University, Kerala, India.
5. Thulasidas PK, Bailleres H. 2017. Wood quality for advanced uses of teak from natural and planted forests. In: Kollert, W., Kleine, M. (Eds), The Global Teak Study: Analysis, Evaluation and Future Potential of Teak Resources. IUFRO world series volume 36. Vienna. 108p.
6. Hugh B, Glauner R, Doreen G, Thulasidas PK. 2017. Future of teak: What policy makers and managers need to consider summary and policy recommendations. Kollert W, Kleine M (Eds), The Global Teak Study: Analysis, Evaluation and Future Potential of Teak Resources. IUFRO World Series Volume 36. Vienna. 108p.
7. Chandrashekara UM. 2017. Medicinal plant gardens for developing urban green spaces and plant conservation. In: Pradeep Kumar S, Amruth M, Raghu AV (Eds), Medicinal Plants: Benefit Sharing, Development and Conservation.
8. Chandrashekara UM, Sasidharan N. 2017. Bioresources nature trail in Nilambur, Kerala: Towards biodiversity education. In: Paramjit Singh D, Sudhansu S. (Eds). Indian botanic gardens: Role in conservation, Botanical Survey of India.
9. Sasidharan N. 2017. Conservation and management of medicinal plants: An overview In: Pradeep Kumar S, Amruth M, Raghu AV (Eds). Medicinal Plants: Benefit Sharing, Development and Conservation, pp. 9-14.
10. Greeshma P, Jayson EA. 2018. Asian open bill stork (*Anastomus oscitans*), not a nutcracker: A study from Kole wetlands of Thrissur, Kerala. In: Sivaperuman C, Venkataraman K (Eds), Indian Hotspots. Springer Nature, Singapore, pp. 139-149.
11. Sivaram M, Ramachandran KK, Jayson EA, Nair PV. 2018. Statistical techniques for estimating the abundance of Asiatic elephants based on dung piles. In: Sivaperuman C, Venkataraman K (Eds.), Indian Hotspots: Vertebrate faunal diversity, conservation and management, Volume 1. Springer Nature, Singapore.
12. George KF. 2018. RFID technology in libraries. In: Francis AT, Chelatayakkot V, Sathian KP (Eds). Librarians Role of Teaching, pp. 87-94, Daya Publishing House, New Delhi.

Papers in Proceedings of conferences/ Seminars

1. George KF. 2017. Growth of rattan literature: A bibliometric study. In: Baskaran C. (et al.) (Eds). Proceedings of the information resources in academic and public libraries-DIRAPL 2017 held at central library, Alagappa University, Karaikkudi on March 16-17, pp. 190-197.
2. Sani Lookose, Anju Antony. 2017. Teak museum at KFRI Sub Centre, Nilambur as a destination for promoting science education and conservation awareness among the students and society. In: Proceedings of the 29th Kerala Science Congress on Genomics in health and disease at Thiruvalla on 28-30 January 2014.

3. George KF. 2017. Digitization of rare documents in KFRI library. In: Kumbar M, Harinarayana NS, Chandrashekara M. (Eds). 2017. National conference on digital libraries, library automation and open courseware: issues and best practices, November 10-11, Mysuru.
4. Bharath Nair. 2017. Antagonistic activity of rhizoplane and rhizosphere mycoflora of *Cynodon dactylon (L.)* Pers. grass against fungal diseases of mahogany seedlings' in 5th National Conference on Biological Control: Integrating recent advances in Pest and Disease management at NBAIR, Bangalore.
5. Bharath Nair. 2018. *In vitro* efficacy of *Trichoderma harzianum* against major fungal pathogens of teak and mahogony seedlings. In: National Conference on 'Emerging Trends in Mycotechnology' at KME Society's G. M. Momin Women's College, Bhiwandi, Mumbai.
6. Bharath Nair. 2018. *In vitro* biocontrol evaluation of rhizosphere mycoflora of *Setaria barbata* (Lam.) Kunth grass against foliar pathogens of mahogany seedlings. In: International Conference in 'Advanced Research in Life Science' held in S. G. M. College, Karad.
7. Suganthasakthivel R, Vijayan K, Sasi R, Sajeev TV. 2017. *Indrella ampulla* on cardamom and *Platacanthomys lasiurus* on pepper: environmental niche modelling of two Western Ghat endemic species attaining horticultural pest status. In: National seminar on 'Natural resources management for horticultural crops under changing climatic conditions (with special reference to drought management of plantation crops and spices), CWRDM, Kozhikode.

ENDOWMENT AWARDS

Dr. K.M. Bhat Memorial Endowment

The Dr. K.M. Bhat Endowment was instituted by the family of late Dr. Bhat for the best doctoral work carried out at KFRI. The 8th Dr. K.M. Bhat Endowment carrying a gold medal, certificate of merit and cash prize of Rs. 5,000/- was awarded to Dr. Lakshmi C.J, Chakkamadathil House, Vadanappally P.O. Thrissur, Kerala. Dr. Lakshmi's work is on 'Development of seed handling techniques for selected commercial bamboo species'. The award was presented by Padma Shri M. Chandradathan, Scientific Advisor to the Chief Minister, Govt. of Kerala (Distinguished Scientist and Former Director of ISRO Centres) on 12th May 2017.

Dr. C. Chandrasekharan Memorial Endowment

Mr. Ranjith A.P., Research Scholar, Department of Zoology, University of Calicut, is the recipient of the Dr. C. Chandrasekharan Memorial Award 2017. The award instituted by the family of Dr. Chandrasekharan in memory of KFRI'S first Director, an expert in tropical forestry, carries a purse of Rs. 20,000/-, a gold medal and a certificate. Shri. P.K. Kesavan IFS, Principal Chief Conservator of Forests and Head of Forest Force, Kerala Forest Department, Thiruvananthapuram, delivered the Dr. Chandrasekharan memorial lecture at KFRI on 18th January 2018 and gave away the award to the winner.

TRAINING PROGRAMMES AND WORKSHOPS CONDUCTED

1. Developing Protocols For Managing Forests for Stability And Sustainability of Ecosystems, 17.04.2017 to 19.04.2017, KFRI Plan Fund (E.M. Muralidharan, T. V. Sajeev, B.S. Corrie, E.A. Jayson)

2. Comprehensive Training on Tropical Forestry and Exposure Visit to Kerala, 14.05.2017 to 20.05.2017, Assam Project on Forestry and Biodiversity conservation Society, Guwahati (V.P. Raveendran, K.V. Mohammed Kunhi, A.V. Raghu)

3. Medicinal Plants: Cultivation and Harvesting for the Farmers of Kerala, 18.01.18 to 19.01.18, State Medicinal Plants Board, Government of Kerala (A.V. Raghu, K.V. Mohammed Kunhi, V.P. Raveendran, P. Sujanapal, M. Amruth, T.K. Hrideek)

4. Exposure visit of Front line staff of Assam Forest Department, 09.06.17 to 18.06.17, Assam project on Forestry and Biodiversity Conservation Society, Guwahati (V.P. Raveendran, K.V. Mohammed Kunhi, A.V. Raghu)

5. One Day Workshop on Transformational Leadership, 04.08.17, KFRI Plan Fund (V.P. Raveendran)

6. One Day Workshop on Goods and Service Tax, 08.08.2017, KFRI Plan Fund, (K. Satheesakumar, K.V. Mohammed Kunhi)

7. Two-Days Training Workshop on Raising Stakes of Local Communities in Conservation of Forest and Wildlife: Institutionalization of Eco-tourism Involving Local Communities, 22.08.17 to 23.08.17, Ministry of Environment Forests and Climate Change, Govt. of India (E. A. Jayson, V. P. Raveendran, K.V. Mohammed Kunhi, A.V. Raghu)

8. National Interaction Meeting of Practitioners and Researchers of Traditional Systems of Medicine, 12.10.2017 to 13.10.2017, State Medicinal Plants Board, Government of Kerala (U. M. Chandrasekhara)

9. Four Days Management Development Programme for Bamboo Entrepreneurs, 06.11.17 to 09.11.17, I-STED, DST, GOI (K.V. Mohammed Kunhi, V.P. Raveendran, A.V. Raghu)

10. National Children's Science Congress, 16.11.17 to 17.11.17, Kerala State Council for Science and Technology (V. P. Raveendran, K.V. Mohammed Kunhi, A.V. Raghu)

11.Training programme for KFRI Staff and Target Groups Including Participation in Forest Sports, 20.11.17 to 23.11.17, 28.11.17, KFRI Plan Fund (K.V. Mohammed Kunhi, V.P. Raveendran, A.V. Raghu)

12.One-Week Refresher Training Course on: Conservation and Development of Medicinal Plants and Benefit Sharing with Local Communities for officers of Indian Forest Service, 04.12.2017-21.12.2017, Ministry of Environment Forests and Climate Change, Govt. of India (A.V. Raghu, M. Amruth, V.P. Raveendran, K.V. Mohammed Kunhi)

13.Coordinating Field Visit and Training for PGDFM Students IIFM-Bhopal in the forests of Kerala, 12.12.17 to 21.12.17, Indian Institute of Forest Management, Bhopal (K.V. Mohammed Kunhi, A.V. Raghu)

EXTENSION ACTIVITIES

1. Consultative Meeting, Economics & Statistics Department, Government of Kerala, Forestry Input Cost in Kerala.

2. World Environment Day Celebration 2017, Inauguration and Seedlings Distribution by Dr. B.S. Corrie IFS, KFRI Central Nursery.

3. World Environment Day Celebration 2017, Inauguration and Seedlings Planting by Hon. Shri. K. Rajan Hon. MLA., Onnamkunnu, Pattikkad.

4. World Yoga Day Celebration 2017, Shri. Sivakumar, Yoga practitioner, KFRI Main Auditorium.

5. One-Day Workshop, Shri. Antony Thommichan, “Transformational Leadership”, KFRI Main Auditorium.

6. Invited Talk, Padma Shri M. Chandradathan, Scientific Advisor to the Chief Minister, Government of Kerala (Distinguished Scientist and Former Director of ISRO), KFRI Main Auditorium.

EXHIBITIONS AND VISITORS

Visitors from 89 different Institutes, Government Departments, Non-Government Organizations and farmers group visited KFRI during 2017-2018. Thrissur. KFRI facilities were rented out for six programmes organized by external agencies. KFRI stall received first Prize for the best exhibits during Pooram Exhibition - 2017 at Thekkinkadu Maidan. The contributions of KFRI was exhibited at several places (given below)

1. Pooram Exhibition, 2017 (Dr. K.V. Mohammed Kunhi, Mr. V. P. Raveendran, Dr. A.V. Raghu, Dr. T.K. Hrideek, Mr. Shaji Varghese, Mr. C. B. Sajy, Mr. Sarath, Ms. Fincy, Mrs. Sheejakumary, Ms. Anusree, Ms. Ayswarya, Ms. Padmavathy, Mr. Sabik, Mr. Rakesh, Mr. Sudheesh, Mr. Ganesh, Mr. Jino, Mr. K. M. Gopalan)

2. CGFRM, KFRI, 2017 (Dr. K. V. Mohammed Kunhi, Mr. V. P. Raveendran, Dr. A. V. Raghu, Mr. Shaji Varghese, Ms. Anusree, Mr. Sabik, Mr. Rakesh, Ms. Fincy, Ms. Padmavathy)

3. IRDP Vipananamela, Thrissur, Palakkad, Kozhikode and Kannur, 2017 (Dr. A.V. Raghu, Dr. K. V. Mohammed Kunhi, Mr. V.P. Raveendran, Dr. M. Amruth, Mr. Shaji Varghese, Mr. C.B. Sajy, Ms. Anusree, Mr. Sabik, Mr. Rakesh, Mr. Sudheesh)

4. SARAS Mela, Edappal, 2017 (Mr. Manoj, Mr. Habeebulla, Mr. Shaji Varghese)

5. Bamboo Fest, Marine Drive, Kochi, 2017 (Dr. K.V. Mohammed Kunhi, Dr. E. M. Muralidharan, Mr. Shaji Varghese, Mr. Ejas, Ms. Vidya Sankar, Ms. Riny. P. Vijayan, Mr. Sabik)

6. National Science Congress, Thalassery, 2018 (Dr. K.V. Mohammed Kunhi, Mr. V. P. Raveendran, Dr. A.V. Raghu, Mr. Shaji Varghese, Mr. S. Sabik, Mr. T.A. Ejas)

7. Vasantholsavam Pushpamela, Kanakakunnu, Thiruvananthapuram, 2018 (Dr. A. V. Raghu)

8. GADHIKA, Tribal Handicraft Mela, Ponnani, 2018 (Dr. K. V. Mohammed Kunhi

9. CPI (M) State Conference Exhibition, 2018 (Dr. A. V. Raghu, Mr. Shaji Varghese, Mr. S. Sabik, Mr. T.A. Ejas)

10. SHASTRAYAN at Calicut University, 2018 (Dr. K. V. Mohammed Kunhi, Mr. Shaji Varghese)

11. AGRO FOOD PRO, Department of Industries and Commerce, Thekkinkadu Ground Thrissur, 2018 (Dr. K. V. Mohammed Kunhi, Mr. Shaji Varghese)

ACADEMIC PROGRAMMES

Doctoral Degree Awarded

Sl. No	Name	Guide	Thesis Title	University	Date of Awardw
1	Dantas K.J.	Dr. N. Sasidharan	Flora of Aralam wild life sanctuary	CALICUT	28.12.2017
2	Kuruvila Thomas IFS	Dr. K. K. Seethalakshmi	Population structure, carbon sequestration, litter dynamics and propagation of selected rare bamboos of Western Ghats	FRI-DU	27.02.2018

ONGOING PROGRAMMES

Post-Doctoral Programme

1. Dr. Anil K - Reproductive traits and phenology of endemic plant species in New Amarambalam reserved forests of Nilgiri Biosphere. SERB- DST-GOI
2. Dr. A.P. Zaibin - Using soundscapes to examine spatio temporal ecological dynamics and assess biodiversity of a protected area in the Western Ghats. SERB-DST-GOI

KSCSTE-Back to Lab Research Fellowship

1. Ms. Keerthy Vijayan - Tracking the invasion of *Achatina fulica* and its role in spreading the rat lung worm, *Angiostrongylos cantonensis*.
2. Ms. Neetu R.S. - Evaluation of phytochemical profiles of selected medicinal plants from different agro-climatic condition of Kerala

Doctoral Programmes

Sl. No.	Name of Student	Guide/Co-Guide	Topic
FOREST RESEARCH INSTITUTE- Deemed to be University			
1.	Neethu R.S.	Dr. T.V. Sajeev	Regional differences in phenotypic and phytochemical profiles of selected medicinal plants in Kerala
2.	Keerthy Vijayan	Dr. T.V. Sajeev	Tracking the invasion: Molecular phylogeography and phyloclimatic modelling of the giant African snail (*Achatina fulica* Bowdich) in south India
3.	Bharati Patel	Dr. T. K. Hrideek/ Dr. P. Balakrishnan	Diversity and abundance of tree-microhabitats and its potential as indicators of vertebrate diversity in tropical rainforests of the Western Ghats
4.	Arya Krishnan	Dr. K.A. Sreejith	Stand structure, diversity and dynamics of moist deciduous forests in Peechi-Vazhani Wildlife Sanctuary, Kerala
COCHIN UNIVERSITY OF SCIENCE AND TECHNOLOGY			
5.	Anoja Kurian	Dr. E.M. Muralidharan	Molecular studies on rattans of south India.
6.	Vidya R Sankar	Dr. E.M. Muralidharan	Study of the constraints in efficient micropropagation of bamboo
7.	Alex C.J.	Dr. T.V. Sajeev	Ecology of Kavvai river basin: A fragmented landscape in Kerala
8.	Greeshma P.	Dr. E.A. Jayson	Foraging ecology of selected birds in the Kole wetlands of Thrissur, Kerala
9.	Divya Soman	Dr. M.P. Sujatha/ Dr. V. Anitha	Assessment of ecosystem services from Parambikulam Tiger Reserve
10.	Renuka R.	Dr. S. Sandeep	Chemistry of mangrove soils in Kerala
11.	Vishnu P.S.	Dr. S. Sandeep	Pedogenesis and geochemical transformations in forest ecosystems of Western Ghats, Kerala

12.	Harishma K.M.	Dr.V.B. Sreekumar/ Dr. S. Sandeep	Modeling carbon sequestration and its dynamics in the mangrove systems of Kerala
13.	Ninu Jose M.	Dr. S. Sandeep	Molecular fingerprints and geo-chemical interaction of organo-na-no composite from forest floor humic acid in Western Ghats, Kerala
14.	Thasini V.M.	Dr. V.B. Sreekumar	Seasonal influence on phenology of woody species in a tropical moist deciduous forest of southern Western Ghats, India
15.	Remya Unnikrishnan	Dr. Suma Arun Dev	Molecular diagnostic markers for authentication and early sexing of *Coscinium fenestratum* (Gaertn.) Colebr.
16.	Swathi Balakrishnan	Dr. Suma Arun Dev	Molecular characterization and adaptive genetic diversity linked to wood property traits for sustain-able management of teak genetic resources.
17.	Alina Paul	Dr. R. Jayaraj	Bioactivity and mechanistic stud-ies of certain botanical extracts for their potential application as biopesticides
UNIVERSITY OF CALICUT			
18.	Mohamad Anaz K	Dr.N.Sasidharan	Systematic studies, utilization and conservation of the genus *Salacia* (Celastraceae) in South India.
19.	Sandeep Das	Dr. P.S. Easa	Ecology and behaviour of amphib-ians of Eravikulam National Park, with special reference to bush frogs.
20.	Dhaneesh Bhasker	Dr. P.S. Easa	Diversity and fire induced be-havioural dynamics of short-horned grasshoppers (Insecta: Or-thoptera: Caelifera) in Eravikulam National Park and Parambikulam Tiger Reserve, Western Ghats

21.	Rajkumar K.P.	Dr. P.S. Easa	Herpetofaunal diversity in swamp (Vayal) ecosystems in Periyar Tiger Reserve, Western Ghats.
22.	Rini Vijayan	Dr. A.V. Raghu	Micropropagation of selected species of *Embelia* Burm.f., characterization and *in vitro* productin of secondary metabolites
23.	Riju P.	Dr. E.A. Jayson	Assessment of human-wildlife conflict and mitigation measures in Malappuram District,Kerala, India.
24.	Bharath Nair	Dr. G.E. Mallikarjuna swamy	Biocontrol potential of rhizosphere and rhizoplane fungi of grasses against certain fungal diseases of forest nursery seedlings
25.	Sanil. M.S.	Dr. V. B. Sreekumar	Systematics and phylogeny of dipterocarps in the Western Ghats, India.
26.	Sanal C. Viswanath	Dr. T.K. Hrideek	Studies on plus tree selection, variability and seed biology of *Terminalia paniculata* Roth. (Combretaceae) in Kerala part of peninsular India.
27.	Muraleekrishnan K.	Dr. T.K. Hrideek	Studies on variability, phenology and management methods of the alien invasive tree, *Senna Spectabilis* (D.C.) Irwin & Barneby in Kerala, India
28.	Subin K	Dr. P.A. Jose	Conservation biology of *Atuna indica* (bedd.) Kosterm. and *Hydnocarpus longipedunculatus* Robi *et al*., two endemic tree species of Western Ghats of Kerala
29.	Suby	Dr. T.K. Hrideek	Study on the impact of allelochemicals of *senna spectabilis* (DC.) Irwin and Barneby invasion in Wayanad, Kerala

Masters attachment

Sl.No	Guide	Name of Student	Topic	College/ University
1.	Dr. T.K. Hrideek	Delna Davis	Comparison of morphological and physiological traits of different teak clones from a clonal multiplication area (CMA)	St. Josephs College, Irinjalakuda
2.		AmruthaVinod	Allelopathic potential of leaves of *Senna spectabilis* on *Ficus religiosa, Bauhinia variegata, Syzygium cumini, Shorea roxburghii*	St. Josephs College, Irinjalakuda
3.	Dr. T.V. Sajeev	Athulya P	Ecology and diversity of aquatic insects in river holes: a case study at Orappenkettu waterfall	Dept. of Env. Science, CUSAT,Kochi
4.		Ashina M.A.	The glassy blue tiger: biometrics, energetics and trophic interactions	Vimala College, Thrissur
5.		Vandana Bharathi C.V.	Studies on the pests of the lac insect host plants- *Flemingia semialata* and *Flemingia macrophylla*- in Kerala	Vimala College, Thrissur
6.		RevathyVenu	Aggregation of nymphalid butterflies on *Crotaleria retusa* and *Heliotropium keralensis*	SNM College, Mallankara
7.		Sreekutti	Biological and taxonomical study of predatory mites on *Bambusa bambos*	SNM College, Mallankara
8.		Ashiq	Ecology and natural enemy complex of Malabar Rose (*Pachliopta pandyan* Moore) in a Butterfly Garden in Central Kerala	Madras University
9.	Dr. M.P. Sujatha	Faniya Toby	Tracking fulvic acid complex in plants through scanning electron microscope	St. Mary's College, Thrissur

10.	Dr. Shijo Joseph	Anjaly George	Impact of climate change on the agroforestry systems of high-range landscapes of Kerala.	Kerala Agriculture University, Thrissur
11.		Nidish P. Madhu	Measuring the climate change mitigation potential of forests and TOF (Trees outside the forest) systems in Thrissur.	Kerala Agriculture University, Thrissur
12.		Ayisha Abdul Khalam	Development of higher resolution wetland database of Ernakulam District using remote sensing and GIS	Sree Sankara College, Kalady
13.		Sajana Florence Peter	Greenhouse gas inventorying - carbon emissions from road transport in the Thrissur district of Kerala	PSG College of Arts & Science, Coimbatore
14.		Sreeya Francis	Wetland mapping of Vadakarapathy Panchayat, wetland rejuvenation and environmental and ecological aspects of wetlands	St. Josephs College, Irinjalakuda
15.		Sreelakshmi Prakash	Is remote sensing effective in estimating the biomass of heterogeneous landscapes in Kerala	Sree Sankara College, Kalady
16.		Jitha K.C.	Patterns, productions and processes in agri and agro-forestry systems in the Wayanad district of Kerala, India	Dept. Env. Science, Kannur University
17.		Ruheena T.V.	Development of high resolution wetland database and web interface in the Mannarkkad Taluk of Kerala, India developing a web GIS platform for the wetland systems – a case study from Mannarkkad Taluk, Kerala	Dept. of Env. Science, Kannur University

18.	Dr. K.A. Sreejith	Nirajlal K.	Soil carbon dynamics and litter decomposition in natural forest of KFRI Peechi, campus.	KAU, Mannuthy Thrissur
19.		Sarath B	Vegetation dynamics of Madayipara laterite hillock in relation to weather	KAU, Mannuthy Thrissur
20.		Nikhil V.G.	Mangrove inventory of Thrissur District, Kerala	Dept. of Env. Science, Calicut University
21.	Dr. P.A. Jose	Silpa A.R.	Ecological study of *Kingiodendron pinnatum* (Roxb. ex DC.) Harm: an endemic and endangered tree of southern western ghats	Dept. of Env. Science, Calicut University
22.		Snema V.R.	Vegetative propagation of three endemic and threatened trees of the Western Ghats	St. Josephs College, Irinjalakuda
23.		Shilpa C.P.	Development of vegetative propagation techniques for three endemic medicinal plants of the Western Ghats, Kerala	St. Josephs College, Irinjalakuda
24.		Anjana Unni	Ecological study of *Atuna travancorica* (Bedd.) kosterm. An endemic and endangered tree of southern western ghats	Sree Sankara College, Kalady
25.	Dr. E.M. Muralidharan	Anitha V.A.	Approaches for overcoming shoot damage during root induction in in vitro cultures of *Bambusa balcooa*	St. Peter's College, Kolenchery
26.		Amrutha K.S.	Chitosan mediated control of endophytes in in vitro cultures of bamboo	St. Marys College, Thrissur

27.	Dr. V.B. Sreekumar	Blaze Maria P.V.	Phenetics and phylogenetics studies in native bamboo species of Kerala	St. Josephs College, Irinjalakuda
28.		Bevina T George	Chemotaxonomic studies in mangroves.	
29.	Dr. R. Jayaraj	Reshma K.V.	Analysis of the phytochemical constituents of medicinal plant *Sida alnifolia* and its adulterant *Sida acuta*	Mar Athanasius College, Kothamangalam
30.		Reshma Varghese	Development of methods for comparative chemical profiling of *Saraca asoca* and *Shorea roxhurghii*	
31.	Dr. Suma Arun Dev	Sruthi C. Madhavankutty	Authentication of *Pterocarpus santalinus* from its adulterant by DNA barcode method	St. Peter's College, Kolenchery
32.		Henna P. Jojo	Authentication of *Coscinium fenestratum* from its market adulterant using DNA Barcoding	St. Marys College, Thrissur
33.	Dr. G.E. Mallikarjunaswamy	Geethu T.S.	Isolation and identification of aquatic microbes and their antimicrobial activity	KUFOS, Kochi
34.		Meera K.	Isolation and characterization of pesticide degrading bacteria from Western Ghats of Kerala	Mar Athanasius College, Kothamangalam
35.		Nima T.G.	Isolation and characterization of phosphate solubilizing and cellulose degrading microbes of Panikkakavu sacred grove, Malappuram District, Kerala	SNGIST Arts & Science College, N. Paravur

36.		Lija Gopinath	Biosynthesis of silver nanoparticles from *Salacia gambleana* leaf extract, evaluation of antimicrobial and catalytic activity	Sree Sankara College, Kalady
37.		Sreedevi P.K.	Isolation, identification and screening of cellulose and lignin degrading fungi from soil and decaying wood samples	Sree Sankara College, Kalady
38.	Dr. Shambukumar	Haneefa M.K.	Antagonistic activity of phylloplane fungi against pathogenic fungi isolated from *Hydrangea macrophylla*	SNGIST Arts & Science College, N. Paravur
39.		Sikha K.S.	Isolation and characterization of folicolours fungi associated with *Morinda tinctoria* and *Myristica fragrans* and comparative phytochemical analysis of their healthy and diseased leaves	
40.		Jamsheer K.	Isolation and identification of pathogenic fungi from wild orchid leaves and activity of various biocontrol agents against these pathogenic fungi	
41.	Dr. S. Sandeep	Midhuna M.G.	Effect of soil solution aluminium on mineral stability in fire affected grassland systems of Western Ghats.	St. Mary's College, Thrissur
42.		Kavya Ramanujan	Thermodynamics of carbon sorption in teak planted laterite soils of Kerala	
43.		Sreelakshmi N.	Mineral organic interactions under continuous teak rotations in the midland laterites of Kerala	

44.		Ann Mariya Thomas	Effect of soil solution Fe (III) on mineral stability in fire affected grass systems of Western Ghats	Christ College, Irinjalakuda
45.		Surabhi S.R.	Modelling rice production in kole lands and its vulnerability to climate change	ACCER, KAU Main Campus, Vellanikkara
46.	Dr. U.M. Chandrasekhara	Fayiza P.	Diversity, distribution, basal cover, uses and management of plants in homegarden agroforestry system of Mampad Panchayath, Malappuram District, Kerala	KAHM Unity Women's College, Manjeri
47.		Mirfa P.K.	Diversity, distribution, basal cover, uses and management of plants in homegarden agroforestry system of Edappatta Panchayath, Malappuram District, Kerala	
48.		Jilna .P. Joy	Diversity, use and management of plants in homegarden agroforestry systems in Chokkad Panchayath, Malappuram District, Kerala	Providence Women's College, Calicut
49.		Silpa P.	Diversity, use and management of plants in homegardens agroforestry systems in Wandoor Panchayath, Malappuram District, Kerala	Mercy College, Palakkad

Kerala Forest Reasearch Institute Peechi

(A Unit of Kerala State Counsil for Science, Technology & Environment. Govt. of Kerala)

INCOME & EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31 MARCH, 2018

EXPENDITURE	Sch NO.	As at 31.03.2018 (Rs)	As at 31.03.2017 (Rs)	INCOME	Sch NO.	As at 31.03.2018 (Rs)	As at 31.03.2017 (Rs)
Infrastructure Strengthening (Non Plan)	IX	1,71,70,769	1,58,05,486	Grant from Government of Kerala	VI	14,88,31,764	23,65,48,642
Salaries and Allowances (Non Plan)	X	11,05,91,867	12,52,99,535	Other Receipts	VII	1,46,13,733	1,76,25,393
						2,30,64,892	2,32,42,564
Depreciation	IV	2,30,64,892	2,32,42,564	Depreciation transferred to Capital Reserve			
Other Project Expenses		6,60,46,707	9,20,06,912	Income from other projects	VIII	6,60,46,707	9,20,06,912
Project Expenses under plan scheme		3,56,82,862	11,30,69,014				
TOTAL		**25,25,57,096**	**36,94,23,511**	**TOTAL**		**25,25,57,096**	**36,94,23,511**

Kerala Forest Reasearch Institute Peechi

(A Unit of Kerala State Counsil for Science, Technology & Environment. Govt. of Kerala)

BALANCE SHEET AS ON 31 ST MARCH

LIABILITIES	Sch NO.	As at 31.03.2018 (Rs)	As at 31.03.2017 (Rs)	ASSETS	Sch NO.	As at 31.03.2018 (Rs)	As at 31.03.2017 (Rs)
Reserves and Surplus	I	21,13,86,505	21,02,51,747	Fixed Assets	IV	17,72,46,320	17,84,84,349
Current Liabilities & Provisions	II			Capital Work in Progress		52,21,958	28,49,170
Creditors for Expenses		62,29,020	67,92,737				
Creditors For Fixed Assets		16,67,414	-	**Current Assets, Loans and Advances**	V		
Other Liabilities		18,28,711	15,83,050	Cash With Banks		23,70,69,600	28,98,92,248
Provisions		14,62,89,577	14,47,26,523	Cash in Hand		44,843	67,817
				Loans and Advances		20,30,417	37,25,880
				Other Current Assets		42,68,266	12,91,608
Unspent Balance of Grant-in-Aid(Net)	III	5,84,80,176	11,29,57,017				
Significant Accounting Policies and Additional Information	XI						
TOTAL		**42,58,81,404**	**47,63,11,074**	**TOTAL**		**42,58,81,404**	**47,63,11,074**

INSTITUTIONAL COMMITTEES

RESEARCH COUNCIL

The KFRI Research Council comprising of eminent Scientists of the country advise in matters concerning research policies and monitors the quality of research undertaken at the Institute. The present Research Council is as follows. (Council (M) Order No. 91/17/KSCSTE Thiruvananthapuram, Dated 29.03.2017).

Chairman

Dr. Ramesh B.R.,
Researcher
Institut Francais de Pondicherry,
French Institute of Pondicherry,
UMIFRE 21 CNRS-MAEE

Members

Director,
Institute of Genetics and Tree Breeding
Indian Council of Forestry Research and
Education, P.B.No.1061, R.S. Puram P.O.,
Coimbatore – 641 002.

Prof. Dr. N.Parthasarathy, Professor & Dean,
Sciences & School of Life Sciences
Pondicherry University,
Puducherry – 605 014.

Dr. Raman Sukumar,
Professor,
Centre for Ecological Sciences
Indian Institute of Science,
Bangalore – 560 012.

Dr. C.T.S. Nair,
Former Director, KFRI &
Former Executive Vice President,
KSCSTE.

Dr. R.V. Varma,
Former Chairman
Kerala State Biodiversity Board.
Lakshmipuram, Royal Avenue,
Thrissur-680 020.

Member & Ex-Officio Convener

Director
Kerala Forest Research Institute.

MANAGEMENT COMMITTEE

The Management Committee looks after the administrative functions of the Institute. Under the Chairmanship of Director, the Committee takes care of the proper execution of administrative rules, smooth conduct of research activities and welfare of employees.

Director, Kerala Forest Research Institute	:	Chairman
Shri. K.B. Santhosh Kumar Addln. Secretary & Joint Chief Protocol Officer General Administration Department Thiruvananthapuram.	:	Member
Member Secretary, Kerala State Council for Science Technology and Environment.	:	Member
Executive Director Centre for Water Resources Development and Management, Kunnamangalam (P.O) Kozhikode.	:	Member
Dr. E.A. Jayson Scientist F, Kerala Forest Research Institute	:	Member
Registrar, Kerala Forest Research Institute	:	Convener

1.CONSULTATIVE GROUP FOR FORESTRY RESEARCH MANAGEMENT

1.	The Principal Chief Conservator of Forests & Head of Forest Forces	…	Chairman
2.	The Additional PCCF (D&P) & Disciplinary Authority	…	Member
3.	The Additional PCCF (FMIS)	…	Member
4.	The Additional PCCF (Development)	…	Member
5.	The Additional PCCF (WP&R)	…	Member
6.	The Additional PCCF (E&TW) The Additional PCCF (Administration)	…	Member
7.	The Additional PCCF(Southern Region)	…	Member
8.	The Additional PCCF (Protection)	…	Member
9.	The Additional PCCF (Vigilance)	…	Member
10.	The Additional PCCF (Northern Region)	…	Member
11.	The Additional PCCF (BDC)	…	Member
12.	The Additional PCCF (IHRD)	…	Member
13.	The Additional PCCF (SA&NO)	…	Member
14.	The Principal Chief Conservator of Forests Wildlife & Chief Wildlife Warden	…	Member
15.	The Principal Chief Conservator of Forests (Social Forestry)	…	Member
16.	The Principal Chief Conservator of Forests (Vigilance)	…	Member
17.	The Principal Chief Conservator of Forests (Dev. & PFM)	…	Member
18.	The Chief Conservator of Forests (Protection)	…	Member
19.	The Chief Conservator of Forests (FMlS)	…	Member
20.	The Chief Conservator of Forests (HRD)	…	Member
21.	The Chief Conservator of Forests (Administration)	…	Member
22.	The Chief Conservator of Forests (Vigilance)	…	Member
23.	The Chief Conservator of Forests (Social Forestry)	…	Member
24.	The Regional Chief Conservator of Forests (North)	…	Member
25.	The Regional Chief Conservator of Forests (South)	…	Member
26.	The Conservator of Forests (Biodiversity)	…	Member
27.	The Deputy Conservator of Forests (Research) North	…	Member
28.	The Deputy Conservator of Forests (Research) South	…	Member

29.	The Managing Director, Kerala Forest Development Corporation	…	Member
30.	The Associate Dean, Forestry Faculty, Kerala Agricultural University	…	Member
31.	The Director, Tropical Botanic Garden & Research Institute, Palode	…	Member
32.	The Director, Institute of Forest Genetics & Tree Breeding, Coimbatore	…	Member
33.	The Managing Director, Oushadi, Thrissur	…	Member
34.	The Director, Center for Earth Science Studies, Thiruvananthapuram	…	Member
35.	The Director, Center for Water Resources Development and Management	…	Member
36.	The Director, Rajiv Gandhi Center for Biotechnology, Trivandrum	…	Member
37.	The Managing Director, Oushadhi, Thrissur	…	Member
38.	The Director, Medicinal Plant Research Center, Arya Vaidya Sala, Kottakkal	…	Member
39.	The Managing Director, Hindustan Newsprint Ltd., Kottayam	…	Member
40.	The Managing Director, Kerala State Wood Industries Ltd., Nilambur	…	Member
41.	The Managing Director, Kerala State Bamboo Corporation Ltd.	…	Member
42.	The Director, Salim Ali Center for Ornithology and Natural History, Coimbatore	…	Member
43.	Director, Kerala Forest Research Institute, Peechi	…	Member
44.	Joint Director (Science & Technology Promotion), KSCSTE, Trivandrum	…	Member
45.	Research Coordinator, KFRI, Peechi	…	Member
46.	All Scientists of KFRI	…	Invitees
47.	Programme Coordinator, Training & Extension Division, KFRI	…	Convener

2. INTERNAL RESEARCH GROUP (IRG)

1.	Director, KFRI	…	Chairman
2.	Dr. K. Mohanadas (till retirement) /Dr. E. A. Jayson (after the retirement of Dr. Mohanadas	…	Convener
3.	Dr. V. Anitha	…	Associate Convener
4.	All scientists	…	Members

3. Ph.D. RESEARCH & PG PROJECT ATTACHMENT ADVISORY COMMITTEE

1.	Dr. M.P. Sujatha	-	Ph. D. Research Coordinator & Chairperson
2.	Dr. T.V. Sajeev	-	Convener
3.	All recognized Research Guides	-	Member

4. EQUIPMENT/ INFRASTRUCTURE DEVELOPMENT COMMITTEE

1.	Dr. V.B. Sreekumar	…	Chairman
2.	Dr. T.K. Hrideek	…	Member
3.	Dr. A.V. Raghu	…	Member
4.	Smt. Anoja (Purchase In – Charge)	…	Convener

5. PURCHASE COMMITTEE

1	Dr. T.K. Dhamodaran (as Scientist F & Registrar)	…	Chairman
2	Dr. T.V. Sajeev	…	Member
3	CA. K. Satheesakumar (DRF)	…	Convener

6. LIBRARY ADVISORY COMMITTEE

1	Dr. E.A. Jayson	…	Chairman
2	Dr. M. Amruth	…	Convener
3	Dr. K.A. Sreejith	…	Member
4	Dr. K.F. George	…	Member
5	Smt. N. Sarojam	…	Convener

7. COMPUTER, INFORMATION NETWORKING, WEBSITE, SOFTWARE & COMMUNICATION DEVELOPMENT COMMITTEE

1	Dr. T.K. Hrideek	…	Chairman
2	Dr. M. Amruth	…	Member
3	Dr. K. A. Sreejith	…	Member
4	Smt. Ricy Eliner Varkey	…	Convener

8. KERALA FOREST SEED CENTRE ADVISORY COMMITTEE

1.	Director , KFRI	…	Chairman
2.	PCCF (WP & Research), KFD	…	Member
3.	CF (Central Circle), KFD	…	Member
4.	SRO (North), KFD	…	Member
5.	SRO (South), KFD	…	Member
6.	Dr. U.N. Nandakumar, HoD, Silviculture Dept, KFRI	…	Member
7.	Dr. T.V. Sajeev, KFRI	…	Member
8.	Dr. V.B. Sreekumar KFRI	…	Member
9.	Dr. E.A. Jayson, Research Coordinator, KFRI	…	Member
10	Dr. P.K. Chandrasekhara Pillai, S-i-C, KFSC	…	Convener

9. TEAK MUSEUM AND NATURE TRAIL ADVISORY COMMITTEE

1.	Dr. U.M. Chandrasekhara	…	Chairman
2.	Dr. K.V .Mohammed Kunhi	…	Member
3.	Dr. A.V. Raghu	…	Member
4.	Dr. P.K. Thulasidas		Member
5.	Smt. Sani Lookose, Teak Museum Curator	…	Convener

10. FINANCE COMMITTEE

1.	Director	…	Chairman
2.	Registrar	…	Ex-Officio Member
3.	Two Elective Member from the IRG	…	Member
4.	CA Satheesakumar, DRF	…	Ex-Officio Member Convener

11. GARDEN DEVELOPMENT COMMITTEE

1.	Dr. P.A. Jose	…	Chairman
2.	Dr. E.M. Muralidharan	…	Member
3.	Smt. Anupa Vasu	…	Member
4.	Dr. P. Sujanapal	…	Convener

12. CAMPUS DEVELOPMENT COMMITTEE

1.	Dr. T.V. Sajeev	…	Chairman
2.	Smt. M.K. Raji	…	Member
3.	Shri Abdul Jaleel	…	Member
4.	Shri P. I. Shereef	…	Convener

13. JOURNAL OF BAMBOO AND RATTAN (JBR) EDITORIAL COMMITTEE

1.	Dr. E.M. Muralidharan	…	Chief Editor
2.	Dr. V. Anitha	…	Associate Editor
3.	Dr. U.M. Chandrashekaa	…	Associate Editor
4.	Dr. S. Sandeep	…	Associate Editor
5.	Smt. N. Sarojam	…	Associate Editor

14. NEWSLETTER (EVERGREEN) & ANNUAL REPORT COMMITTEE

1.	Dr. V. Anitha	…	Chief Editor &Chairman
2.	Dr. M. Amruth	…	Assoc. Editor Member
3.	Dr. T.K. Hrideek	…	Assoc. Editor Member
4.	CA. Satheesakumar, DRF	…	Finance Member
5.	Dr. Suma Arun Dev	…	Assoc. Editor Member
6.	Dr. R. Jayaraj	…	Assoc. Editor & convener Convener

15. SPORTS COMMITTEE

1.	Dr. T.K. Hrideek	…	Chairman
2.	Smt. M.K. Raji	…	Member
3.	Shri. P.K. Rajendran	…	Convener
4.	Representative of Project Staff	…	

16. SEMINAR COMMITTEE

1.	Dr. K.V. Mohammed Kunhi	…	Chairman
2.	Dr. Shambukumar	…	Member
3.	Dr. A.V. Raghu	…	Member
4.	Dr. P.C. Shandrasekhara Pillai	…	Member
5.	Dr. M. Amruth	…	Convener

17. COMMITTEE FOR TRANSFORMATION OF OFFICIAL LANGUAGE TO MALAYALAM

1.	Shri Renjithkumar , DRA	…	Chairman
2.	Smt. Sherly Issac	…	Member
3.	Smt. Keerthy K	…	Member
4.	Smt. Maymol Joseph	…	Member
5.	Smt. K. Annapoorni	…	Convener

18. TRAINING & EXHIBITION ADVISORY COMMITTEE

1.	Dr. K.V. Mohammad Kunhi	…	Chairman
2.	Dr. V.B. Sreekumar	…	Member
3.	Dr. A.V. Raghu	…	Member
4.	Dr. P.K. Thulasidas	…	Member
5.	Mr. V.P. Raveendran	…	Convener

19. COMMITTEE TO PREVENT SEXUAL HARASSMENT ON WOMEN

1.	Dr. M.P. Sujatha	…	Chairman
2.	Dr. Suma Arun Dev	…	Member
3.	Dr. Seetha Sadanandan (C/o Kudumbasree State Poverty Eradication Mission, Ward16, cheenikadavu, Kannara, Panachery Pancha-yath, Thrissur District	…	Member
4.	Dr. T.K. Damodaran	…	Member
5.	Smt.Sabitha Balakrishnan	…	Convener

20. ADVISORY COMMITTEE FOR HOSTEL (MEN'S & WOMEN'S), IGH & CAFETERIA

1.	Dr. T.K. Dhamodaran (Registrar)	…	Chairman
2.	Dr. T.V. Sajeev	…	Member
3.	Dr. T.K. Hrideek	…	Member
4.	Smt. Anupa Vasu	…	Member
5.	Shri. P.I. Shereef	…	Member
6.	Representative from the Research Scholars" Hostel	…	Member
7.	Smt. M.K. Raji	…	Convener

21. BUILDING COMMITTEE

1.	Dr. T.K. Dhamodaran	…	Chairman
2.	Dr. Mamman, C.	…	Member
3.	Dy. Registrar (Accounts)	…	Member
4.	Shri. U.Y. John, Engineer-Convener	…	Convener

22. VEHICLE ADVISORY COMMITTEE

1.	Dr. P. Sujanapal	…	Chairman
2.	Shri. Kamalakaran, SO (Accounts)	…	Member
3.	Dr. K.A. Sreejith	…	Member
4.	CA. K. Satheesakumar, DRF	…	Member
5.	Shri. P.S. Sudheesh, Vehicle-in-Charge	…	Convener

23. ENDOWMENT COMMITTEE

1.	Director	…	Chairman
2.	Dr. T.K. Dhamodaran	…	Member
3.	Dr. V. Anitha	…	Member
4.	Dr. Shijo Joseph	…	Member
5.	Dr. M. Amruth	…	Member
6.	Dr. P. Sujanapal	…	Member
7.	Smt. K. Annapoorni	…	Member
8.	Dr. K.V. Mohammed Kunji	…	Convener

24. FRC DEVELOPMENT COMMITTEE

1.	Dr. T.K. Dhamodaran (Registrar)	…	Chairman
2.	Dr. V. Anitha	…	Member
3.	CA. K. Satheesakumar, DRF	…	Finance Member
4.	Dr. V.B. Sreekumar	…	Member
5.	Er. V.C. Jineesh	…	Member
6.	Dr. K.V. Mohammed Kunji	…	Convener

25. BAMBUSETUM, ARBORETUM, PALMATUM, DEVELOPMENT

1.	Registrar	…	Chairman
2.	Dr. V.B. Sreekumar	…	Member
3.	Dr P. Sujanapal	…	Member
4.	Dr. E.M. Muralidharan	…	Member
5.	Dr. Yogesh Joshi	…	Member
6.	Shri. V.P. Raveendran	…	Convener

26. BAMBOO PROCESSING CENTRE DEVELOPMENT COMMITTEE

1.	Dr. T.K. Dhamodaran	…	Chairman
2.	Dr. E.M. Muralidharan	…	Member
3.	Er. V.C. Jineesh	…	Member
4.	Dr. K.V. Mohammed Kunji	…	Convener

27. ETHICS COMMITTEE

1.	Dr. Mamman Chundamannil	…	Chairman
2.	Dr. V. Anitha	…	Member
3.	Dr. M. Amruth	…	Convener

28. AUCTION & DISPOSAL COMMITTEE

1.	Registrar	…	Chairman
2.	CA. K. Satheesakumar, DRF	…	Member
3.	Institute Engineer (Shri. U. Y. John)	…	Member
4.	Dr. M. Amruth	…	Member
5.	Smt. K. Raji	…	Member
6.	Shri. P.I. Shereef	…	Member
7.	Store – in – Charge (Shri. K. P. Manoj)	…	Convener

29. STORES COMMITTEE

1.	Dr. T.V. Sajeev	…	Chairman
2.	Dr. T.K. Hrideek	…	Member
3.	Dr. V.B. Sreekumar	…	Member
4.	Shri. K.P. Manoj	…	Convener

STAFF LIST 2017-2018

SCIENTFIC STAFF			
Sl. No	**Name**	**Designation**	**DOJ**
1.	Dr. S. Pradeep Kumar	Director-in-charge	
Research Monitoring & Evaluation Unit			
2	Dr. E.A. Jayson	Senior Principal Scientist	16-12-1981
Sustainable Forest Management			
3	Dr. U.N. Nandakumar	Senior Principal Scientist (Superannuated)	23-03-1983
4	Dr. M.P. Sujatha	Principal Scientist	11-12-1987
5	Dr. P.A. Jose	Senior Scientist	18-10-2014
6	Dr. P.K. Chandrasekhara Pillai	Senior Scientist	18-10-1983
7	Dr. P. Sujanapal	Scientist	09-12-2010
8	Dr. S. Sandeep	Scientist	09-03-2011
Forest Genetics & Biotechnology			
9	Dr. E.M. Muralidharan	Principal Scientist	27-05-1991
10	Dr. Suma Arun Dev	Senior Scientist	08-12-2010
11	Dr. T.K. Hrideek	Scientist	08-12-2010
Forest Ecology and Biodiversity Conservation			
12	Dr. U.M. Chandrashekara	Principal Scientist, Scientist-in-charge, KFRI Sub Centre, Nilambur	15-07-1992
13	Dr. V.B. Sreekumar	Scientist	01-03-2011
14	Dr. K.A. Sreejith	Scientist	01-03-2011
15	Dr. R. Jayaraj	Scientist	28-03-2011
Forest Health			
16	Dr. T.V. Sajeev	Senior Scientist	06-02-1997
17	Dr. Shambu Kumar	Senior Scientist	29-02-2016
18	Dr. G.E. Mallikarjunana Swamy	Scientist	20-12-2010
Wood Science & Technology			
19	Dr. P.K. Thulasidas	Scientist	28-06-1984

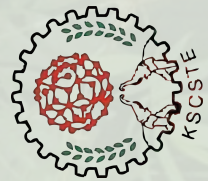
Forestry and Human Dimensions			
20	Dr. V. Anitha	Senior Scientist	07-09-1998
21	Dr. M. Amruth	Junior Scientist	01-03-2011
Forest Management Information System			
22	Dr. Shijo Joseph	Senior Scientist	26-02-2016
Extension & Training			
23	Dr. K.V. Muhammed Kunhi	Senior Scientist	24-10-1994
24	Shri. V.P. Raveendran	Scientist	25-02-1993
25	Dr. A.V. Raghu	Scientist	07-12-2010
Teak Museum Curator			
26	Smt. Sani Lookose	Senior Scientist-Teak Museum Curator	07-08-2002
Library & Information			
27	Smt. N. Sarojam, Librarian	Scientist - Librarian i/c (Superannuated)	06-07-1981
28	Dr. K.F. George	Senior Scientist	23-12-1994

ADMINISTRATIVE STAFF			
1	Dr. T.K. Dhamodaran	Registrar i/c &Chief Scientist, Head, Wood Science & Technology Dept.	02-08-1982
2	Shri. K. Venugopal	Dy. Registrar (Admin)	27-05-2008
3	Shri. K. Satheesakumar	Dy. Registrar (Accounts)	20-12-2013
4	Smt. Sabitha Balakrishnan	Assistant Registrar	03-09-1999
5	Smt. Shirly Issac	Section Officer Gr. II	16-09-2003
6	Shri. K. Kamalakaran	Section Officer	10-12-2009
7	Shri. V.S. Krishnanunni	Section Officer	28-08-2010
8	Smt. Grace Andrews	PA to Director Gr. II	27-01-1987
9	Smt. K. Annapoorni	P A to Registrar Gr. II	12-07-1982
10	Smt. C.K. Sindhumol	Assistant Gr. II	19-08-2010
11	Smt. P. Anupa Vasu	Assistant Gr. II	01-10-2011
12	Smt. Anuja Prasannan	Assistant Gr. II	17-10-2011

13	Smt. K. Keerthy	Assistant Gr. II	06-01-2012
14	Smt. Maymol Joseph	Assistant Gr. II	16-08-2011
15	Shri. P.S. Sudeesh	Assistant	16-09-2015
16	Shri. K.M. Shiju	Assistant	16-03-2018
17	Smt. A. Aneesamole	Assistant	15-03-2018
18	Smt. P.S. Manju.	Assistant	14-03-2018
19	Shri. K.P. Manoj	Office Superintendent	28-08-1992
20	Shri. T.M. Abdul Vahab	Spl. Gr. Word Processing Assistant	27-01-1989
21	Shri. P. Rajeesh	Clerical Assistant GrII	14-06-2000
22	P.K. Sughada Devi	Typist	02-02-2016
23	Shri. K. Mohammed Habeebulla	Typist	01-03-2016
24	Shri. T.C. Paul	Spl. Gr. Driver (Superannu-ated)	01-07-1994
25	Shri. P.K. Rajendran	Driver Gr. II	07-01-2012
26	Shri. E.O. Mathai	Driver Gr. II	07-01-2012
27	Shri.C.H. Herald Wilson	Driver Gr. II	24-02-2012
28	Shri. K. Krishnadasan	Driver	29-05-2012
29	Smt. K. Aparna	Office Attendant	23-08-2004
30	Shri. M.C. Mohandas	Senior Attendant	24-10-1977
31	Smt. N. Baby	Attendant Gr. IV	24-11-1995
32	Smt. K.K. Vanaja	Office Attendant	26-08-2003
33	Smt. A.M. Lalitha	Office Attendant Gr. V	01-08-1986
34	Smt. T.G. Chandrika	Office Attendant Gr. IV	01-03-1988
35	Shri. V.K. Mohandas	Office Attendant Gr. IV	01-01-1992
36	Shri. N.I. Thankappan	Office Attendant Gr. IV	01-01-1992
37	Shri. E.P. Ulahannan	Office Attendant Gr. IV	01-01-1992
38	Shri. C.P. Shoukathali	Helper Gr. IV	01-03-1988
39	Shri. K. Mohammed	Helper Gr. IV	01-01-1992
40	Shri. K.K. Mohammed	Helper Gr. IV	05-07-1994
41	Smt. P. Deepa	Office Attendant Gr. II	06-08-2009

42	Shri. I.O. Thomas	Helper Gr. II	11-06-2010
43	Shri. T.P. Valsan	Office Attendant Gr. II	11-06-2010
44	Shri. A.V. Chamy	Helper Gr. II	27-10-2010
45	Smt. S. Ashamole	Office Attendant Gr. II	19-08-2010
46	Shri. E. Hamsa	Office Attendant Gr. II	19-08-2010
47	Shri. K. Abdul Jaleel	Office Attendant Gr. II	16-08-2010
48	Smt. C. Sujatha	Office Attendant Gr. II	21-08-2010
49	Shri. T.S. Prakash	Helper Gr. II	29-05-2012
50	Shri. M.S. Santhosh Kumar	Helper Gr. II	29-05-2012
51	Shri. N. Rajan	Helper Gr. II	29-05-2012
52	Shri. T.O. Simon	Helper Gr. II	29-05-2012
53	Shri. C.P. Ummer	Helper Gr. II	29-05-2012
54	Smt. P.S. Kadeeja	Helper Gr. II	29-05-2012
55	Smt. V.L. Alphonsa	Helper Gr. II	29-05-2012
56	Shri. M.K. Suresh	Helper Gr. II	29-05-2012
57	Shri. K.A. Thankachan	Helper	29-05-2012
58	Shri. C.B. Sajy	Helper	29-05-2012
59	Shri. T.P. John	Helper Gr. II	29-05-2012
60	Smt. C. Rugmini	Helper	29-05-2012
61	Shri. P.V. Santhosh Kumar	Helper	29-05-2012
62	Shri. N.K. Rajan	Nursery Man	31-07-2007
63	Smt. S. Padmavathy	Nursery Man Gr. II	27-09-2008
64	Shri. K. Rajan	Nursery Man Gr.II	29-09-2008
	Technical Staff		
1	Shri. U.Y. John	Sr. Special Grade Technical Officer (Superannuated)	09-01-1981
2	Shri. M.R. Anilkumar	Sr. Special Grade Technical Assistant Gr. IV	30-01-1989
3	Shri. P.B. Sajeeva Rao	Sr. Special Grade Technical Assistant Gr. IV	30-01-1989

4	Shri. P.I. Shereef	Technical Officer Gr. II (Electrical)	10-08-2010
5	Smt. M.K. Raji	Technical Officer Gr. II (Civil)	18-08-2010
6	Smt. Ricy Eliner Varkey	Technical Officer Gr. II (I.T)	01-03-2006
7	Shri .V.C. Jinesh	Technical Officer Gr. II (Mechanical)	04-07-2014
8	Shri. O.P. Ranjith	Technical Assistant Gr. II (Binder)	03-10-2011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