ANNUAL REPORT 2019-20

KSCSTE - KERALA FOREST RESEARCH INSTITUTE

KFRI ANNUAL REPORT 2019-20

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

Cover Image : The Malabar grey hornbill (*Ocyceros griseus*), an ecosystem engineer in the Western Ghats, feeding its chicks at KFRI Campus

Photo credit : Pranav Kaiprath, Extension and Training Division, KFRI

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ANNUAL REPORT 2019-2020

C O N T E N T S

Director's Desk...

The global concerns over natural resources, biodiversity and deteriorating environmental quality have peaked and the Kerala Forest Research Institute a scientific fraternity with its scientific outputs, involvements and timely interventions has made its presence felt in the state, national and international scene for over forty years now.

Forests a complex ecosystem hosts a substantial part of our planet's biodiversity and genetic resources. They are the largest storehouse of carbon after the oceans and act as carbon sinks. This role of the forest is of critical importance under the present climate change scenario. Human intervention in the forest ecosystems has resulted in a worldwide decrease of primary forest over a period of time. The rate of deforestation between 2015 and 2020 was estimated at 10 million hectares per year. Moreover, according to IUCN in 2020, about 27 per cent of all the species assessed falls within the category of threatened with extinction. There is thus an immediate need to conserve the health of the world's biodiversity through ecosystem management and protection.

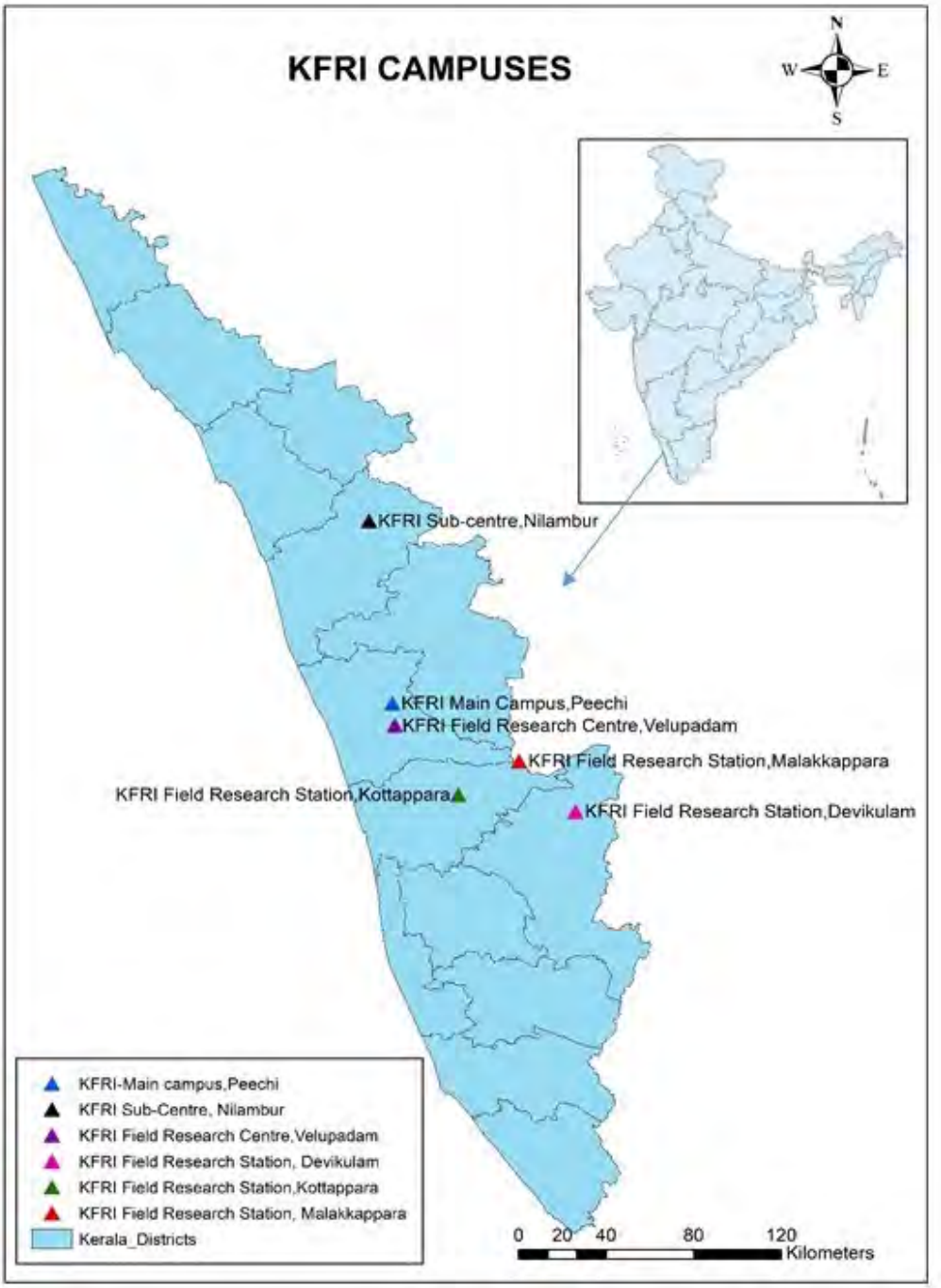
According to FAO, food, livelihood and management of natural capital resources cannot be looked upon separately. Sustainable management of forests and the agroforestry systems propounds multiple benefits and if managed with the right programs and policies, the sector can lead the way towards more sustainable, greener economies ensuring food security and tackling climate change. It also helps us in attaining the Sustainable Development Goals as per the 2030 Agenda by decoupling the demographic and economic growth from environmental impacts, including carbon emissions. From international policy changes to school and community projects, this year has seen an exceptional level of attention on our forests, and the challenges facing them.

The Kerala Forest Research Institute with its multi-disciplinary research team is constantly striving to make forestry research socially relevant. During the year 2019-20, KFRI has been making significant contributions in terms of research, extension and outreach activities of local importance as well as global relevance. There has been 118 ongoing research, extension, and establishments projects covering different aspects of forestry and social relevance.

Financial support for sponsored projects are from, the United Nations Development Program (UNDP), Food and Agriculture Organization (FAO), Zayed Species Conservation Fund, Abudhabi, Ministry of Agriculture, GOI, Department of Biotechnology (DBT), GOI, Ministry of Environment, Forests and Climate Change (MOEF & CC), GOI, Department of Science and Technology (DST), GOI, National Bamboo Mission (NBM), GOI, Airport Authority of India, GOI, CAMPA-Indian Council of Forestry Research & Education (ICFRE), Kerala Biotechnology Commission (KBC), Kerala Forest Department, Kerala State Council for Science, Technology and Environment (KSCSTE), Kerala State Disaster Management Authority (KSDMA), Kerala State Biodiversity Board (KSBB), Kerala District Panchayat, Palakkad. Zoological Park Wildlife Conservation & Research Centre, Govt. of Kerala, and KFRI Plan Grants

During the year of this report, the Institute received Rs.10.37 Lakhs as grants from Kerala Sate Council for Science Technology and Environment, Government of Kerala Financial support received from external agencies for specific projects was Rs. 548 lakhs. Funds from plan grants were utilized for research and extension projects and for infrastructure development. I place on record, the valuable guidance and unstinted support received from the Institute's Research Council, Management Committee, KSCSTE and the unrelenting co-operation and support from Scientists, Staff and Students of KFRI.

Dr.Syam Viswanath
Director


KFRI CAMPUSES
N
W
E
S
KFRI Sub-centre,Nilambur
KFRI Main Campus,Peechi
KFRI Field Research Centre,Velupadam
KFRI Field Research Station,Malakkappara
KFRI Field Research Station,Kottappara
KFRI Field Research Station,Devikulam
KFRI-Main campus,Peechi
KFRI Sub-Centre, Nilambur
KFRI Field Research Centre,Velupadam
KFRI Field Research Station, Devikulam
KFRI Field Research Station,Kottappara
KFRI Field Research Station, Malakkappara
Kerala_Districts
0 20 40 80 120
Kilometers

THE INSTITUTE

The Kerala Forest Research Institute (KFRI) was established by the Government of Kerala as an autonomous Institute 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 and Development Centres. The mandates of the Institute are to conduct research on all aspects of tropical forestry. 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. It 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, highly sophisticated laboratories, live collections and plant propagation facilities.

KFRI houses a number of experimental research facilities. These include laboratories, collections, 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, Pathology, Entomology, Silviculture, 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, Fernarium, 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. The secretariats of TEAKNET (the International Teak Information Network) funded by the Food and Agriculture Organization of United Nations, the Bamboo Technical Support Group of the National Bamboo Mission, Government of India and the Regional Cum Felicita-

tion Cen¬tre (RCFC) of National Medicinal Plant Board (NMPB), Ministry of AYUSH, Govt. of India are housed in the main campus of KFRI. The monitoring facilities are the established permanent plots and weather stations. A sophisticated analytical instrumentation laboratory - Centre for analytical Instrumentation Kerala (CAI-K) - is also located in the main campus. Library, 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. The Institute has a Sub-Centre at Nilambur in Malappuram District, Field Research Centre at Velupadam in Thrissur District, and Field Research Stations at Munnar, Kottapara, and Malakkappara.

Sub-Centre, Nilambur

The Sub-Centre campus at Nilambur with facilities for laboratory work and field trials in a 43.36 hectares area is about 140 kms 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 Bio Resources 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. At FRC, a Common Facility Centre for Bamboo Enterprises supported by Department of Science and Technology, Govt. of India 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

Field Research Stations, Malakkappara

Based on an MOU signed between Tata Coffee Ltd.(TCL) and KFRI in 2017, the field station in Malakkapparan located 170 Kms away from KFRI main campus belonging to TCL was provided to KFRI for research purposes. It supports the project and scientific staff in field oriented research activities and mainly accommodates researchers attached to KFRI long-term monitoring programme that has permanent plots including a 10 hector. plot in tropical wet evergreen forests of Karadishola, Sholayar.

Field Research station Devikulam.

The field station at Devikulam range of Munnar Division in Idukki district Suppose research programmes since 2000. The initial focus here was to produce the Eucalyptus clones for research projects.

KFRI is maintaining a germplasm of Eucalyptus in this station. The seedlings producing from the station are used for restoration programs of shola forest in high ranges. Now this station is a base camp for many research projects being implemented in high ranges.

Now this station is a base camp for many projects implemented by KFRI.

Field Research station Kottappara

The field station Kodanad range of Malayattoor Division in Ernakulam district. The research programme in this field station commenced in 1989, and initially focused production of Eucalyptus clones for research purpose and for the Kerala Forest Department. KFRI is maintaining a germplasm of Teak plus trees, Eucalyptus and Lac host plants in this station. The seedlings of major timber species including teak are produced in the station.

Organization

The research in KFRI is executed through programme divisions and departments. Clusters of three to four departments' form a programme division. There are 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 Divisions are Extension & Training and Library Information. Administratively, a Programme Coordinator heads a Division and a Head of Department manages each Department within the Division. Divisions having laboratory and other facilities is under a Scientist-in-Charge. The Research Coordinator, who heads the Research Monitoring and Evaluation Unit, oversees the implementation of research 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 and forest officials in the country. It also monitors the quality and content of research undertaken by the Institute and provides guidance for improvement.

The Institute is governed by the rules and regulations of the KSCSTE . The 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 conducted by KFRI on different modules of tropical forestry to meet the needs of International, National, and State level stakeholders.

The 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

financial and expenditure matters of the Institute. The total staff strength of the Institute is 83, which include 23 scientists, 53 administrative staff and 7 technical staff. In addition, 115 project personnel temporarily attached to various research projects provide the necessary research support.

The Institute is an accredited Research Centre of the Forest Research Institute Deemed to be University, Dehradun, Cochin University of Science and Technology, and the University of Calicut for enrolling students for research programmes leading to the award of doctoral degree. Besides, the Institute also undertakes several academic attachment programmes for several colleges and Universities at the International, National and State level. An Academic Coordinator heads the academic programme of the Institute.

Right to Information

The RTI is an Act to provide for setting out the practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, the constitution of a Central Information Commission and State Information Commissions and for matters connected therewith or incidental thereto. An individual may submit a written request to the Public Information Officer for information related to KFRI activities.

Public Information Officer:
Group Captain Biju B, Registrar,
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Smt. Sabitha Balakrishnan, Asst. Registrar,
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Appellate Authority:
Dr. Syam Viswanath, Director
KSCSTE - Kerala Forest Research Institute,
Peechi P.O, Thrissur District.
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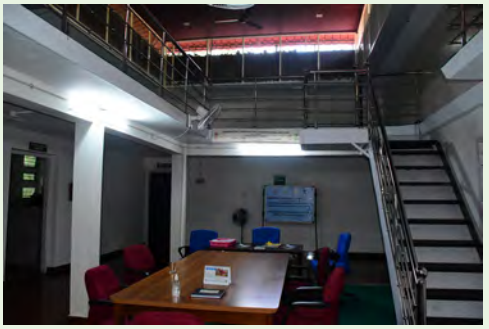
PROGRAMME DIVISIONS

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 river bank 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, conservation and management of red listed trees, climate change impact studies on endemic and threatened plants, medicinal plants resource enhancement, eco-physiology of recalcitrant tree seeds, developing nanocomposites from weed compost, bamboo waste processing, pedogenic influences on vegetation in mangrove ecosystems of Kerala, and chemistry and transformation of clay minerals under continuous teak rotation of Kerala Western Ghats. A soil museum dedicated to forest soils is attached to the Soil Science Department.



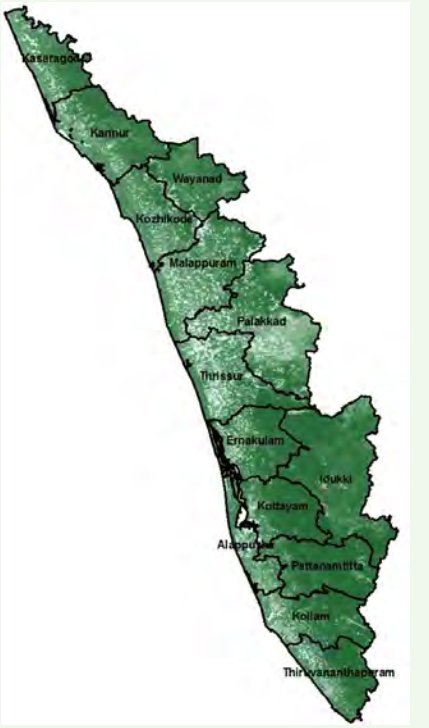
Forest Genetics and Biotechnology

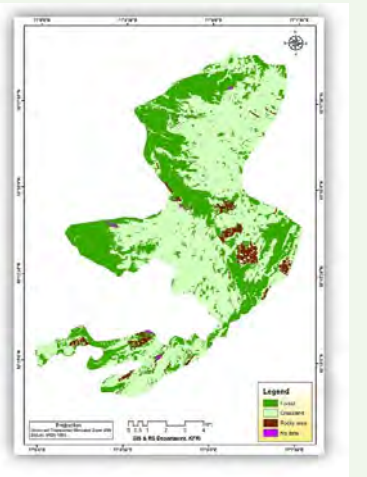
The Programme Division includes Genetics and Tree Breeding as well as Biotechnology Departments with plant propagation, plant tissue culture and molecular biology facilities. The major research areas of the Division are genetic improvement of teak, clonal propagation of forest trees and medicinal plants through vegetative propagation 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 bar-

coding 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, adaptive genetics and transcriptomics for sustainable conservation and management of teak and sandal 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 has been actively engaged in various research activities including stand modeling, biodiversity mapping, ecosystem analysis, resource mapping, and population analysis. Currently, the core activities focus on 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, GPS and GIS.





Forest Ecology and Biodiversity Conservation

The Programme Division comprises of Forest Ecology, Forest Botany, Wildlife Biology 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, long-term monitoring of forest ecosystem through permanent plots, human-wildlife interaction and biodiversity inventory and documentation. The major activities of Forest Botany Department includes, 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. Impact of flood on floral elements and soil biota in Pamba, Periyar, Bharathapuzha and Chalakkudy Rivers in Kerala was one of the major project executed by the Department after the 2018 flood scenario. The Wildlife Biology Department attempts various aspects on inventorisation of fauna, endangered animals, manwildlife interaction, conservation activities of critically endangered Cyad, Cycas annaikalensis and wildlife census. Developing long term monitoring tools and strategies for mitigating human-wildlife conflicts in Kerala in one of the major activity of the Department. 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, ethnobiological 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 the Western Ghats. Major projects of the Department includes, studies on the pesticide usage pattern on the ecosystem of Munnar landscape and bioactivity guided fractionation and mechanistic elucidation of biomolecules from Cocculus laurifolius DC. of southern Western Ghats. Ecology Department works on long-term monitoring of forest ecosystems in Kerala through permanent sample plots and of Strobilanthes kunthianus in Eravikulam National Park, biodiversity characterization at community level in India using Earth Observation Data, impact of flood at ecosystem level, eco-physiology, plant functional traits of forest trees and climate change response of tropical trees.

Wood Science and Technology

The 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. The Division undertook many studies on wood structure, properties, quality assessment of teak, eucalypts and preservative treatments for species like rubber wood and coconut wood. The Division also focuses on 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 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. 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. In addition, anatomical studies, utilization and value addition of products on bamboos and canes have been undertaken. Activities include, evaluation of Ochlandra germplasm, mass propagation and field trials of elites for selection of low lignin plant material with desirable pulping properties and facilitating the establish-ment of bamboo and cane enterprises through training and technology transfer.

Forestry and Human Dimensions

The Forest Economics and Sociology Departments of the Division mandates to study, review and evaluate (a) policy and management, (b) people and forests, and (c) production, sustainability and conservation. The thematic areas covered are forest management systems, land use, institutional analysis, industry studies, natural forests, plantation economics, productivity of forest plantations, management of natural forests, econometric analysis, demand and supply of wood in Kerala, forestry sector analysis, trees outside forests, bamboo, price fixation of pulpwood, history and human dimensions of forest management, tribal communities, socioeconomics including farm forestry, visitor management in protected areas, NTFPs management, environmental, and social impact assessments, economics of invasive alien species, economic valuation and natural resource accounting including ecotourism development and policy appraisal. The current activities include, research on economic valuation of ecosystem services, market economics covering medicinal plants market in south India, economics of alien invasive species, policy issues, development experiences of selected tribal groups in the Western Ghats, enriching, updating and maintenance of the existing database and repositories, capacity building of decision makers, natural resource managers, local communities and other stakeholders, create awareness amongst all relevant stakeholders about advances in forestry research.

Forest Health

The Programme Division has Forest Entomology and Forest Pathology Departments. The thrust areas of the Forest Entomology Department in KFRI include monitoring of forest insect diversity, control of termites in plantations, wood damaging insects and teak defoliator, traditional methods of post-harvest protection of bamboo from insect borers, etc. 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. Research programmes in the Department of Forest Entomology include (a) Evaluation of the present and potential insect pest problems relevant to forestry in Kerala, (b) Development of suitable methods or procedures to reduce the economic loss caused by the pests, (c) Study of the soil biology with special reference to the insect biota and (d) Biological control of the insect pests. In addition to this problem-solving research, some fundamental studies on the taxonomy, biology and ecology of insects are undertaken to increase our understanding of the interaction between insects and trees and the role of insects in the forest. Research highlights of the Entomology Department includes: management of biological invasion in Kerala, control and management of teak borer pest, Cossus cadambe, *ex-situ* conservation of lac insect genetic resources, standardization of methods for control of termites in eucalypt plantations, identification and control of insect borers of stored commercial

wood, study on loss of wood increment in teak due to insect defoliator, Hyblaea puera, management strategy for Hyblaea puera in teak using a potential of natural enemy Hyblaea puera Nucleo Polyhedrosis Virus (HpNPV). Investigations are made on the seasonal incidence and control of pests of Ailanthus, Albizia and Gmelina, incidence of pests in natural forests and develop methods to manage insect pest populations, popularization of the concept of butterfly gardens and provide technical advice to various agencies for the establishment of butterfly parks. The Department maintains a representative collection of identified insects and is equipped to provide identification service to other research organizations on the Lepidopteran fauna.

The Department of Forest Pathology has been working on morpho-molecular characterization and ex-situ conservation of phytopathogenic fungi causing various fungal diseases in forestry plants as well as commercially important medicinal plants in different ecosystems of Kerala part of Western Ghats. Additionally, the Department focuses on plant growth promoting microbes for high quality bamboo planting production and detection of Ganoderma disease in plantations and Agro-ecosystems of Kerala. The Department is also exploring possibilities to manage plant diseases using eco-friendly, cost effective approaches like biofertilizers and biocontrol agents. During this period, the Department established a well-equipped Molecular Pathology Laboratory with support of DBT, Govt. of India. Furthermore, the Department has been actively engaged in FAO sponsored project for the study of invasive pathogens in Nepal.

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 and showcases the Institute in various National and State level exhibitions. During the period, KFRI organized 12 training programmes.

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 includes 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 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 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, IUFRO and databases in CDs and DVDs.

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). 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 28 foreign journals and 27 Indian journals are subscribed during the period. Also a total of 60 books have been added to the collection. The two web-sites, Indian Forestry Abstracts (IFA) and Bamboo Information Centre – India (BIC – India) are maintained by the library. Upgradation of library portal, an information system for forests of Kerala and compilation of Indian Forestry Abstracts (IFA) – Phase III are the current ongoing projects.

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 transportation requirements for project implementation, trainings and other logistics are taken care by administrative section. KFRI has a fleet of vehicles including bus, 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

TEAKNET

TEAKNET, an International Network established by FAO of the United Nations addresses the issues of the global teak sector including institutions and individuals interested in teak. TEAKNET is basically manned by an International Steering Committee headquartered at the KSCSTE - Kerala Forest Research Institute (KFRI), Peechi, India since 2008. The Network aims to transform the global teak sector from its current suboptimal state to that of a dynamic entity for the benefit of all stakeholders concerned with the global teak sector. Regular TEAKNET activities includes website updation, release of quarterly online TEAKNET Bulletin, enrollment of new TEAKNET Members and clearing doubts regarding various aspects of teak cultivation and management and teak trade at a global level.

TEAKNET is a project partner in the ITTO – Teak Mekong project '*Enhancing the conservation and sustainable management of teak forests and legal and sustainable wood supply chains in the Greater Mekong Sub-region* (PP-A/54-331)' executed by ITTO, Japan and funded by the Govt. of Germany for a period of 3 years which was initiated in March 2019. The ITTO Teak Project - Phase I aims to assist governments, local communities and smallholders to enhance natural teak forest management, production and marketing through the establishment of legal and sustainable wood supply chains, improving local economy and local communities' livelihood in the Mekong Sub-region comprising Thailand, Myanmar, Vietnam, Cambodia and Lao PDR.

Being the ITTO Teak project partner, TEAKNET participated in the Regional Workshop on '*Sustaining Teak Management in Mekong Basin*' organized on 24-27 September 2019 at Yangon, Myanmar and also took part in the Lao Teak Forum 'Sustainable Teak Value Chains for Sustainable Local Development' on 19–20 February 2020 at Vientiane capital and Luang Prabang, Lao PDR. Researchers and experts from 14 countries representing Government organizations, universities, policy makers, teak plantation managers, wood industry, international organizations and NGOs participated in these two workshops.

TEAKNET successfully conducted a partner event entitled '*Global teak market: challenges and opportunities for emerging markets and developing economies*' in the XXV IUFRO World Congress on 05th October 2019 at Expo Unimed at Curtiba, Brazil. The event was organized by the IUFRO Teakwood Working Party (Div5.06.02) co-sponsored by International Teak Information network (TEAKNET) supported by the FAO Regional Office for Asia and the Pacific (FAO-RAP), Bangkok. The theme of the event was '*Towards sustainable development of the global teak sector in a changing world*'. The teak session was chaired by Prof. Mario Tomazello Filho, Universida de de Sao Paulo, Brazil and Dr. Gilles Chaix, CIRAD -BIOS, Montpellier, France; Co-chaired by Dr. P. K. Thulasidas, TEAKNET, India.

MEMBERSHIPS

Asia-Pacific Association of Forestry Research Institutions (APAFRI)

The Asia-Pacific Association of Forestry Research Institutions (APAFRI) is an independent non-profit body, which aims to enhance research and technology development capabilities in support of conservation and management of forest resources in the Asia-Pacific region. In the APAFRI 8th General Assembly (28th-30th November 2018), at Putrajaya, Malaysia Dr. Syam Viswanath, Director, KFRI, participated in the Asia Pacific Forestry Week (17th-22nd June 2019). The presentations followed by panel discussions by leading experts during the plenary session I and II provided several insights on the main themes of APFW 19 'Forests for peace and well-being'.

Talks and deliberation on '*Climate change challenges*' in the overall context of how forests are influenced by major drivers of change in the last two decades provided a clear picture on the future of forestry sector and challenges in achieving the 17 sustainable development goals (SDGs) in the Asia Pacific region which is also applicable in Indian forestry scenario.

The participation in certain specific sessions organized by NIFoS, CIFOR and APAFRI (18th June 2019) under the theme "*International forum for integrated forest restoration*" (18th June 2019) with special focus on '*Forest and landscape restoration*' in North and South Korea and session on '*Role of forestry research Institutes on forest plantation*

and landscape' organized AFI, APAFRI and NIFoS (19th June 2019) provided key insights on the problems and challenges faced.

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 from 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 bamboo nurseries to provide quality-planting material of the important commercial bamboo species to farmers. A Bamboo Information Centre with information on various aspects of bamboo with valuable source of published literature on bamboo is under continuous updation. BTSG is also planning to publish technical bulletins, information bulletins on various aspects related to bamboos. The Bamboo Processing Centre at 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, giving them technical support in the various stages of bamboo processing from

raw materials to end-products. KFRI also provides Entrepreneurship Development Programmes for emerging Bamboo Entrepreneurs. The machines and facilities of the Bamboo Processing Centre are demonstrated to NGOs, research students, entrepreneurs and architects working on bamboo and allied fields. The products of the Centre are demonstrated and exhibited in exhibitions and fests. Similarly, bamboo shoot processing facility, management of bamboo wastes in primary processing units, bamboo bazar, certification of different bamboos species through molecular techniques are other important activities of BTSG, KFRI.

Regional Cum Facilitation Centre – Southern Region (RCFC-SR), National Medicinal Plants Board (NMPB), Ministry of AYUSH, Government of India

The NMPB is the apex body, under the Ministry of AYUSH, for promotion of the medicinal plants in the country. NMPB has established six Regional Cum Facilitation Centres (RCFCs) in the country to function and serve as one-stop shop with five-fold objectives: (i) provide technical inputs to stakeholders for enhancing their managerial and technical skills, (ii) develop agro-technology of medicinal plants, (iii) facilitate production and distribution of Quality Planting Materials (QPMs), (iv) assist various organizations in formulation of project proposals in the priority areas identified by NMPB, and (v) attend to field assessment/evaluation of NMPB projects and other works assigned by NMPB from time to time. RCFC-SR, housed in KFRI Peechi, is the first of the six Regional cum Facilitation Centres established by NMPB in 2018. RCFC (SR) covers five southern states (Andhra Pradesh, Karnataka, Kerala, Tamil Nadu, Telangana), and the three Union Territories (Puducherry, Lakshadweep, Andaman and Nicobar Islands). During this period, RCFC (SR) has conducted four regional workshops, two seminars and six training programs and approved eight projects on Quality Planting Materials (QPM), provided financial assistance to eight short-term QPM projects as well as monitored seven short tern research projects in the southern region.

FACILTIES

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 3350 accessions belonging to 190 species under 50 families and 130 genera, with more than 50 taxa endemic to southern Peninsular India. Arboretum is maintained as grid maps with markings of the location details of each of the live collection. Among the 190 taxa in the arboretum, there are 3 gymnosperms and 187 angiosperms. Among the angiosperms, 166 taxa are dicotyledons belonging to 118 genera and 47 families and monocotyledons are represented by 21 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 FRC, Velupadam, in Thrissur District of Kerala (10° 26' 07.95" N; 76° 21' 32.92" E) was established during 1988-85 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 pro-

grammes 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 2018-19, a new accession of *Pseudoxytenanthera bourdillonii* (Peerumedu, Idukki) and a cultivated accession of *Sasa veitchii* (Wayanad) were added to the collection. Currently, the bambusetum with 66 species of bamboos is one of the biggest in the country.

Bioresources Nature Park

The Western Ghats region of India is one of the hotspots of biodiversity in the world with rich plant and animal diversity, and some species are endemic to the region. Conservation of such vast biological resources for the future, while continuing to utilize them to meet the present needs, is really a challenging task. In this context, apart from reduction of habitat loss and in-situ conservation of flora and fauna, ex-situ conservation of unique plant and animal wealth of the region as well as education and awareness on biodiversity conservation, management and sustainable utilization are significant. With this background, the KSCSTE-Kerala, with financial support from Department of Biotechnology, Ministry of Environment and Forest, Government of India and Department of Planning and

Economic Affairs, Government of Kerala, has established a Bioresources Nature Park at its Sub Centre in Nilambur. In this Park, plants are assembled in thematic area, such as, Orchid House, Fern House, Xerophytes and Succulent House, Medicinal Plants Garden, Palms and rattan Garden, hydrophytes Garden, Butterfly Garden and Taxonomic Garden. By having a rich plant diversity assembled in above mentioned theme area, this Bioresources Nature Park is now developed as an ex-situ plant conservation area and an important nature education and ecotourism hub in Kerala. The increasing trend of annual visitors is also indicating that the visitors have acknowledged the educational and recreational value of the Bioresources Nature Park.

Butterfly Garden

The butterfly gardens developed by KFRI is an important achievement in the field of nature education and an effort for in-situ conservation of butterflies. It involves recreation of lost habitats of butterflies through careful landscaping and host plant introduction. KFRI has set up three parks in - 1) KFRI main campus, Peechi, 2) KFRI Sub Centre, Nilambur

and 3) Thenmala, Ecotourism area. The butterfly garden in the KFRI, Peechi campus is a main attraction for school and college students from all over Kerala. Based on requests from appropriate authorities, KFRI has established 82 butterfly gardens and have spread its awareness via lectures in schools, colleges, research centres, hospitals, government offices and public firms in Kerala. Furthermore, workshops were conducted for teachers to network the butterfly gardens in the state. From the KFRI butterfly garden, 5109 sightings of butterflies that belongs to 73 species were done so far. Among the various butterflies recorded, about 11 species are endemic to Western Ghats, 26 species are under the rare category and 12 species having protected status under the Wildlife (Protection) status. Participants attending various Training and Extension programmes offered by the Extension and training Division of KFRI which include Forest Officers of the State and Centre cadres, College Teachers, Agricultural and Horticulture Department staff as well as dignitaries visiting the Institute are enthusiastic visitors to the garden. Apart from providing entertainment, care is also taken to impart awareness to the information pertaining to the biology, ecology and conservation of butterflies. The ultimate aim is to generate conservation awareness among the students and the public.

Centre for Analytical Instrumentation – Kerala (CAI-K)

The Centre for Analytical Instrumentation was created with a vision to have an assemblage of sophisticated analytical instruments in a centralized facility which will help better management with qualified and dedicated scientific personnel, continuous monitoring, regulated power supply and ambient conditions, among others and provides services to a wide spectrum of stakeholders. The Centre was actively involved in the envisioned objectives of a) providing analytical services to researchers, academicians and other interest groups and b) conduct training programmes on analytical instrumentation. A number of samples for routine analysis were received during the period. The total number of samples analysed were close to 1300 and an income of 04.50 lakhs was generated during the period April 2019 - March 2020. In addition, a water quality analysis lab has been initiated during the period for the analysis of potable water quality including physical, chemical and biological parameters. Presently, the facility is mainly used for water quality analysis requirements of the projects executed in KFRI, though it is open to general public on payment basis. During the year, a month long training programme on soil pollution monitors were conducted as a part of Green Skill Development Programmes (GSDP) sponsored by Ministry of Environment, Forest and Climate Change (MoEF & CC), Govt. of India. A total of 07 students were trained in various aspects of soil pollution and its monitor-

ing mechanisms. In addition, internship programmes of one-week duration were conducted for undergraduate students and individual instrument specific training was conducted on request.

Central Nursery

The Central Nursery, situated at the main campus has a collection of about 183 species of high demand under timber yielding, fruit bearing and medicinal categories of plants. The nursery ensures the timely availability of planting materials 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 one of the major responsibilities of Central nursery. The data generated in the nursery is used in various ongoing research programs and is useful in future research programmes of the Institute.

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 18000 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 Forest range officer and a Forest Section 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 cater 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. During 2019-2020 about 15.287 of tonnes of 56 forestry species including Teak (11.406 t) other

miscellaneous species (3.888 t) like Mahogany, Sandal, Asokam, Malaveppu, Kanjiram, among others have been collected and supplied to the stakeholders through KFSC.

Medicinal Plants Garden

The Medicinal Plant Garden at Peechi campus spreads in 0.6 hectares, consisting of 380 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 from wild or through exchange with other Botanic gardens. In 2019-20, 44 plant accessions of 38 species were made through various plant collections, of which 7 are new introductions to the garden. As part of labeling the plants, 60 metal boards were displayed for both field and potted plants. Studies on the floral biology of Salacia gambleana and Salacia oblonga were carried out as part of M.Sc. Dissertation programmes. During the period, 591 individuals comprising 23 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 help 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. Currently, the Orchidarium/Fernery has 245 species including rare, threatened, terrestrial,

epiphytic species of Orchids and Ferns, also maintaining some rare ornamental orchids and Ferns.

Palmetum

Palmetum is a live collection of indigenous and exotic palms. KFRI Palmetum was established in the year 2000. We have a collection of 155 species of palms under 56 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 includes 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* as well as mangrove species like *Phoenix paludosa* and *Nypa fruticans* are also present in the collection. 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 campus of KFRI, operated under the aegis of National Centre for Earth Science Studies. This station is one of the 10 permanent stations set up by the DST in 1999 for strengthening earthquake monitoring in the Peninsular India.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 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 regularly compiled data recorded here 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. Data is also provided 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 is the first of its kind in India dedicated to forest soils and provides valuable information on soil genesis and transformation in the humid tropics, showcases the diversity of forest soil and mineral resources in the State and provides critical inputs for forest management. Different forest ecosystem and other land covers make strong imprints on the soil beneath them and the information on these changes facilitates improved land management decisions that maintain soil productivity and therefore preserve forest sustainability and long-term ecosystem health. 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. It provides signatures of the vegetation, climate, 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. Currently, there are 15 soil monoliths in the museum which depicts the variation in morphological properties of soil beneath different forest ecosystems

in the Kerala part of Western Ghats.

Teak Museum

Recognizing the historical importance of Nilambur leading to a momentous shift from a purely extraction and regulatory function of forestry to a phase of resource development, KFRI has established a Teak Museum in its Sub Centre campus and it was opened to the public on 21st May, 1995. The Teak Museum reminisces the history of teak cultivation and then brings the visitor to the present where teak still holds sway as the most sought after timber. The displays in the Museum explain the numerous facets of teak research that KFRI has undertaken and offers a glimpse of the multifarious

uses teak timber has been put to in the State. The artifacts include traditional household objects like the granary, swing cot, cloth-chest, etc. To regale visitors, details are provided of some of the giants of the teak world from Kerala forests. The Museum also has a world class library on teak and an auditorium for audio visual presentations. A Teak Information System (Touch Screen facility) in the Museum also helps the visitors to get information on various aspects of teak tree such as its habit and distribution, history, morphology, cultivation, harvesting, timber, utilization, among others.

Tree Health Helpline

Tree health helpline attends to all queries related to tree planting and management, such as, site selection, species site matching, planting, thinning, soil testing, fertilization, pest, disease and weed management, multi-species interactions, landscape level forestation programmes, tree/wood sample identification, preservative treatments and economic valuation. During the period of April 2019 – March 2020, a total of 200 queries multidisciplinary in nature were registered in tree health helpline. It included pest attack (19), wood quality (1), fungal problems (8), species – site matching (17), plant species identification (14), insect species identification (5), species information (38), fertilizer application (17), tree status enquiry (3), giant African snail control (12), invasive plant control (1), managing of trees (15), planting techniques (16), physiological problems (2), soil queries (5), seeds and seedling availability (12), parasitic problems (1) and other social issues (14). The queries related to pests and diseases were mostly concerned with the pests of *Tectona grandis, Swietenia mahagoni, Artocarpus heterophyllus, Santalum album, Mimusops elangi, Mangifera indica, Ficus religosa, Dalbergia sessoides* among the trees and garden plants. Fertilizer application for teak was mostly reported in the tree health helpline. Some of the cases were regarding the enquiry of health status of the trees and selection of appropriate sites for planting trees.

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 materials for research students. Majority of the collection are identified and labeled. The collection has 76 amphibians including rare and endangered living fossil, Nasikabatrachus sahyadrensis, 95 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 molluscs, Meretrix species and spiders from various regions of the State. 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 are 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 collec-

tion, 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 a few Indian species for mutual exchange of xylarium samples.

RESEARCH AND EXTENSION

Completed Research Projects

Research Report No.557

Establishment of model bamboo plantations and nursery: bamboo plantation

(Raveendran VP, Soman CK, Pillai PKC)

Establishment of model plantation and nursery of bamboos suitable for weaving and handicraft is one of the major objectives of the Bamboo Technical Support Group (BTSG) project in consideration with its varied uses and high economic potential. The report documented five plantations in Kerala (Angamaly - Ernakulam Dist., Desamangalam & Kuttanellore - Thrissur Dist., Pattambi - Palakkad Dist., Aralam – Kannur Dist.) raised in non-utilized Government lands during 2012-13 by the support of BTSG South

Zone and discussed growth performance of the bamboo species with reference to multi-locational conditions. Total area of the five plantations covers 2.69 ha and planted with 13 species viz., Bambusa balcooa, B. tulda, B. vulgaris (Yellow), Dendrocalamus asper, D. hamiltonii, D. sikkimensis, D. brandisii, D. giganteus, Guadua angustifolia, Gigantochloa rostrata, Ochlandra travancorica, Teinostachyum dulloa, and Thyrsostachys oliverii. The planting stocks developed through tissue culture, rooted cuttings, seedlings and offsets were used for the establishment of plantations. All the five plantations were well established and survived with a better performance of plant growth.

Research Report No. 558

Baseline study for assessing potential for improvement of productivity of bamboo

(Chandrashekhara UM, Raveendran VP)

In a rapidly changing socio-economic and marketing opportunities, both at the regional and national level, cultivation of different species of bamboo is gaining importance. The National Bamboo Mission (NBM) has initiated programmes to increase the area under bamboo plantations in Government and private lands outside forests to supplement farm income and contribute towards resilience to climate change as well as to meet quality raw material requirement of industries. The Kerala Forest Research Institute undertook a project to promote cultivation of 14 species of bamboos (*Bambusa balcooa* Roxb., *Bambusa bambos* (L.) Voss, B*ambusa nutans* Wall. ex Munro, *Bambusa tulda* Roxb., *Bambusa vulgaris* cv. Wamin McClure, *Bambusa vulgari*s Schrad. Ex Wendl., *Bambusa wamin* E.G.Camus, *Dendrocalamus asper* (Schult.) Backer, *Dendrocalamus hamiltonii* Nees & Arn. Ex Munro, *Dendrocalamus longispathus* (Kurz) Kurz, *Dendrocalamus sikkimensis* Gamble ex Oliv., *Dendrocalamus strictus* (Roxb.) Nees, *Gigantochloa rostrata* K.M. Wong and *Thysostachys oliveri* Gamble), prioritized by the NBM as commercially important species in the State of Kerala. Since these species were planted in the same geographic region and clumps are of same age (5-year old), their culm characteristics and biomass production potential was studied. The total number of culms per clump in different species varied between 5 and 32 and with lowest number in *D. strictus* and highest in *B. bambos*. The culm diameter was high in *B. bambos* (8.0 cm). Culm wall thickness and culm weight in different species did not correlate significantly. Partitioning of culm biomass among stem, branches and leaf components in different bamboo species indicated a common pattern with 67 per cent, 23 per cent and 10 per cent of total culm weight distributed among stem, branches and leaves, respectively. This observation may be useful to estimate the total culm biomass, once the weight of any one of the three components is known. Regression equations between culm diameter/weight of each culm component, and also between d2h (culm diameter2 x culm height) and weight of each culm component were developed. In ten out of fourteen species studied, there exists a significant correlation between biomass of three components (stem, branch, leaf)

and dbh or (dbh)2 x h. However, in B. *balcooa*, B. *nutans*, B. *tulda* and D. *strictus*, correlation between leaf biomass and independent variable (dbh or (dbh)2 x h) was weak. The estimated total biomass in 5-year old bamboo farms of different species varied from 10.6 t ha-1 (D. *sikkimensis*) to 95.7 t ha-1 (B. *bambos*). The annual biomass production was also comparatively high in B. *bambos* (19.8 t ha-1 yr-1) and low in D. *longispathus* (2.5 t ha-1 yr-1). Thus, attempts may be made in the State to promote different species of bamboo-based micro and macro industries. At the same time package of practices to enhance their biomass potential need to be evolved.

Research Report No. 560

Establishment of a Centre for primary processing of bamboo at KFRI (Dhamodaran TK, Raveendran VP, Soman CK, Muralidharan EM)

The traditional bamboo utilization industry in the Kerala State being limited to highly unorganized/weaker sectors and experiences extreme difficulties in availing the technological developments in the field. Growth of plastic materials caused an evasion of the skilled local traditional bamboo artisan community from the precious eco-friendly livelihood material, bamboo, due to reasons of unsustainable livelihood. Promotion of bamboo industry through introduction of value addition technology by mechanical processing seems to be the only remedy. In this regard, an attempt has been made to establish a model bamboo primary processing Centre (BPPC) for organizing future Research and Development works as well as for training and demonstrations for the sustainable development of bamboo utilization sector in the State. Based on the preliminary informal survey on the traditional skills and industrial product orientation of the location, the model Bamboo Primary Processing Centre was

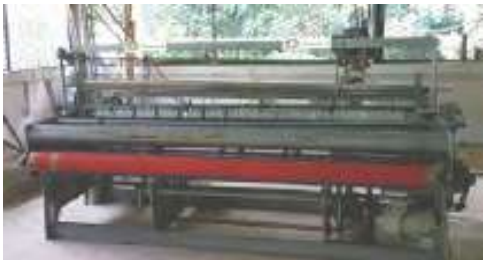
established at the Field Research Centre - FRC - Velupadam campus of KFRI. Appropriate basic primary processing machineries suitable for the production of bamboo slivers used in woven mat production were procured viz., bamboo cross cutting machine, external knot removal cum skin removal machine, hydraulic splitting machine, internal knot removal cum skin removal machine, heavy duty slicing machine, and fine/thin slivering machine. These machines were appropriated for use with the local species, the machineries were installed and conducted trial runs successfully. The Bamboo Processing Centre is established as a means of reviving traditional bamboo sector by demonstrating the benefits of mechanized processing of bamboo as well as to motivate modern industrial entrepreneurs interested in bamboo as an eco-friendly industrial raw material. The Centre is designed to strengthen the bamboo utilization sector through the inputs from the Institute as well as for the local livelihood improvement in bamboo sector as a future model.

Research Report No. 561

Strengthening of bamboo primary processing of Centre at KFRI - Phase I (Dhamodaran TK, Soman CK)

Realizing the situation of non-availability of any local facility for training and demonstration on value-added utilization of bamboo through mechanical processing in the State, a Bamboo Primary Processing Centre (BPPC) was established in KFRI during 2012-14 through the financial assistance from the Annual

Action Plan Programme of the National Bamboo Mission (NBM). It was further planned to strengthen the Centre with more diverse machineries so as to facilitate the conduct of training and demonstrations to the relevant stakeholders. As the BPPC established already consisted of the basic mechanical processing machineries for the primary processing of bamboo viz., bamboo cross cutting machine, external knot removal cum skin removal machine, hydraulic splitting machine, internal knot removal cum skin removal machine, heavy duty slicing machine, and fine/thin slivering machine; the Centre was further strengthened with a vacuum pressure impregnation plant appropriate to industrial scale (mass) preservative treatment of bamboo, one power loom for bamboo curtain blind making and one laser engraving machine for bamboo souvenirs making by way of procuring and installing the facilities and by conducting successful trial runs. This was a step to convert the BPPC as a Common Facility Centre (CFC) with mechanical processing facilities for the primary as well as downstream processing of bamboo for product making. Link-



ages were developed with the already existing local industries and interested NGO groups for running the Centre and marketing the products. The BPPC established is thus further strengthened to a model self-sustainable bamboo primary processing Centre with the Annual Plan Programme support of the National Bamboo Mission (NBM) of the Government of India. The objective of the Centre was to strengthen bamboo utilization sector and improve livelihood potential through employment generation. Training programmes of various durations were also provided to school students, vocational course aspirants and undergraduate students in Forestry in bamboo processing.

Research Report No. 562

Strengthening of bamboo processing Common Facility Centre at KFRI Phase II (Dhamodaran TK)

Realizing the situation of non-availability of a common facility Centre (CFC) for training and demonstration on value-added utilization of bamboo through mechanical processing in the State, a Bamboo Primary Processing Centre (BPPC) was established in KFRI during 2012-14 through the financial assistance from the Annual Action Plan Programme of the National Bamboo Mission (NBM). The Centre was equipped with all the major machineries for the mechanical primary as well as downstream processing of bamboo. The Centre was further strengthened with more diverse recent machineries such as the power operated bamboo mat weaving machine and model machineries for incense sticks production from bamboo so as to facilitate the conduct of future training and

demonstrations and the undertaking of Research Development and extension projects on value-added utilization of bamboo. The Centre was tuned to slowly shift into the mode of a CFC. Linkages already established with existing local industries and interested NGO groups for running the Centre and marketing the products was further strengthened by means of making arrangements for employment generation to the local skilled bamboo artisans by way of extending the services of recognized skilled trainers to the needy bamboo artisan community enterprises. Trainings were given in the design and manufacture of high quality market demanding trendy bamboo products. The BPPC established is thus further strengthened to a model self-sustainable CFC with the Annual Plan Programme support of the NBM, Government of India. Two training programmes of 2 to 5 days duration were conducted and more than 50 artisans were trained in the manufacture of diverse bamboo products employing the mechanical processing facilities established. All the trainees were exposed thoroughly to the primary and downstream mechanical processing of bamboo and the machineries installed at the CFC.

Research Report No. 563

Developing appropriate technology and establishing a plant for activated carbon production from coconut shells for community based organisations

(Dhamodaran TK)

Coconut shells, a ligno-cellulosic woody material, offer an excellent raw material for the value added product, shell charcoal, an important industrial product and raw material for the production of activated granular shell carbon. Traditional shell charcoal production by the existing earth pit earth and drum methods are highly air polluting due to ground level smoke spread. Charcoal production in the cluster or community level offers an additional livelihood to coconut farmers and the rural poor. As the existing method of industrial scale production of activated carbon being the rotary kiln method which has very little scope for down-scaling due to techno-economic considerations, fluidized bed reactor (FBR) system was identified as the appropriate technology for small or community level production of active carbon. It was in this context, that KFRI developed an appropriate clean technology to produce charcoal and physically (steam) activated granular shell carbon at the cluster or community level in an earlier project funded by the Coconut Development Board (CDB). The present work aimed at further upgrading the technology and up-scaling the capacity of the plants (charcoal plant and activation plant) developed so as to appropriate the technology for adoption in small to medium scale coconut-based industrial

enterprises for their sustainable survival. Both the charcoal production and activation plants are designed for continuous operation by way of operating three shifts per day. The design of the pollution-free continuous vertical carbonizing plant is with an input capacity of 3 tons raw material (coconut shell) per day developed by KFRI was upscaled to an input capacity of 6 tons per day and further improved technically by incorporating a shell drier for pre-drying the raw material. The shell drier is designed for fitting above the carbonizer hood so that only dried shell will enter into the charcoal plant. This facilitates the use of shells with higher moisture content during the rainy season. The plant is successfully designed for a targeted charcoal yield of around 30 per cent. The design of the vertical fluidized bed reactor (FBR) activation plant with an input capacity of 0.3 ton shell charcoal per day developed by KFRI was further improved to a horizontal rotary fluidized bed reactor (RFBR) for taking the technical benefit of high quality product coupled with cost effectiveness; the input capacity was up-scaled to 2 ton shell charcoal per day, targeted for the standard (50 %) active carbon yield. Both the upgraded plants were successfully designed; fabricated, installed at the CPCRI campus in Kasaragod, Kerala and trial runs were conducted. The process parameters were optimized for desired quality products and assessed the quality of products for industrial use. It was found that products from both the plants (shell charcoal and activated granular shell carbon) conform to the specifications of Indian Standards. The design drawings, description and operational details of the newly developed design upgraded up-scaled plants were documented. Both the plants are ready for further demonstrations to potential entrepreneurs and for use of the Community Based Organizations (CBOs). The

technologies are ready for commercialization. Economic analysis showed that a system which can process 6 tons of shells per day is financially viable for self-sustaining and accordingly the earlier pilot plant designs were upscaled for an input capacity of 6 tons of shells per day. As far as technical viability is concerned, scope exists for further automation of both the carbonization and activation plants. Additionally, scope also exists for developing appropriate technology for the CBO level production of impregnated active carbons for specialty purposes (e.g. silver impregnated granular active shell carbon) from the RFBR high grade active carbon produced. Both the pollution-free plants developed are techno-economically appropriated for cluster or community level production of charcoal and activated carbon.

SPECIES NEW TO SCIENCE

Xylophis Beddome,1878:

The systematics of the Indian (semi) fossorial snake *Xylophis perroteti* (Duméril, Bibron & Duméril, 1854) was reassessed based on morphological and DNA sequence data for type, historical, and new specimens. A population from the Anamalai Hills is distinct from broadly topotypic *X. perroteti* from the Nilgiri Hills (from which they are separated geographically by the lowland Palghat Gap) on the basis of both external morphology and DNA sequence data. We describe the Anamalai form as a new species, *Xylophis mosaicus sp.* nov. The new species is more closely related to *X. perroteti* than to *X. stenorhynchus* and *X. captaini*. A new key to identify the species of *Xylophis* is presented.

Formicococcus tectonae Joshi, Bindu & Gullian

A new species of mealybug, *Formicococcus tectonae* Joshi, Bindu & Gullan sp. n., is described and illustrated based on the adult females collected from teak, in plantations of Thrissur district, Kerala, southern India. The mealybug lives in tunnels made by the teak trunk borer,

Cossus cadambae (Moore) (Lepidoptera: Cossidae).

Sonerila sulpheyi

A new species of *Sonerila* (Melastomataceae: Sonerileae), *S. sulpheyi*, from the Southern Western Ghats of India is described. The branched inflorescence is the distinguishable character of this new species amongst acaulescent members of *Sonerila*. They are mostly found in moist rocks of shola margins at elevations of 1350 m, in Wayanad forests of Western Ghats, India.

Hopea sasidharanii Robi & Sujanapal

A new species of the important timber trees family Dipterocarpaceae, *Hopea sasidharanii* Robi & Sujanapal, from Shenduruny Wildlife Sanctuary of Kerala, India is described. The species is morphologically similar to *Hopea utilis*, but differs majorly by the elliptic or elliptic-ovate, thickly coriaceous leaves with 5-9 lateral veins which are looped near the margins and sparsely puberulent inflorescence with purplish flower buds

ONGOING RESEARCH PROJECTS

INTERNATIONAL

1. Studies on pattern of usage of pesticides and their impact on the ecosystem of plantation and adjacent areas in GEF-Munnar landscape project area (Dr. R Jayaraj), United Nations Development Program (UNDP).

2. Study on diversity and current status of fish and fisheries in GEF-Munnar landscape project area (Dr. TV Sajeev), United Nations Development Program (UNDP).

3. Study on the impact of invasive plant species on ecology of GEF-Munnar landscape project area (Dr. TV Sajeev), United Nations Development Program (UNDP).

4. Conservation of critically endangered cyad, *Cycas annaikalensis* in India (Dr. P Balakrishnan), Zayed Species Conservation Fund, Abudhabi.

5. Building capacities to improve and sustain forest health to enhance the resilience of forests and livelihoods of forest dependent communities in Nepal (Dr. TV Sajeev), Food and Agriculture Organization (FAO).

NATIONAL

6. Network project on conservation of lac insect genetic resources (Dr. TV Sajeev), Ministry of Agriculture, Govt. of India.

7. Documentation of population demography and genetic structure of teak for developing sustainable conservation strategies and resource management (Dr. Suma Arun Dev), Department of Biotechnology (DBT), Govt. of India.

8. Authentication of major commercially traded raw drugs in the Ayurvedic systems of medicine in India (Dr. Suma Arun Dev), National Medicinal Plant Board, Ministry of AYUSH, Govt. of India.

9. The medicinal plants market in south India: economic value and tribal rights (Dr. V Anitha), National Medicinal Plant Board, Ministry of AYUSH, Govt. of India.

10. Establishment of a Herbal Garden as a peri-urban green space of Nilambur, Malappuram District, Kerala (Dr. P Sujanapal), National Medicinal Plant Board, Ministry of AYUSH, Govt. of India.

11. *Ex-situ* conservation of threatened and endemic species and spreading conservation education and awareness through improvement of infrastructural facilities in the Bioresources Nature Trail Botanical Garden of KFRI Sub Centre, Nilambur (Dr. UM Chandrashekara), Ministry of Environment, Forests and Climate Change (MOEF & CC), Govt. of India.

12. Facilitating the establishment of Bamboo and Cane Enterprises through training and technology transfer (Dr. KV Mohammed Kunhi), Department of Science and Technology (DST), Govt. of India.

13. Exploring the possibility of developing semiochemical based control strategy for the management of *Cossus cadambae*- the borer pest of *Tectona granidis* through isolation & identification of its pheromone system (Dr. TV Sajeev) SERB - Department of Science and Technology (DST), Govt. of India.

14. Demographic survey and restoration of two endangered variants of '*Daruharidra*', *Berberis tinctoria Lesch*. and *Coscinium fenestratum* (Gaertn.) Colebr. in the Western Ghats. (Dr. P Sujanapal), National Medicinal Plant Board, Ministry of AYUSH, Govt. of India.

15. Biodiversity characterization at community level in India using earth observation data (Dr. KA Sreejith), Department of Biotechnology (DBT), Govt. of India.

16. Management of destructive invasive alien species in the high range mountain landscape of Munnar in the Western Ghats of Kerala (Dr. TV Sajeev), Department of Science and Technology (DST), Govt. of India.

17. Population dynamics of selected endemic and threatened trees in the protected areas of Kerala: temporal analysis in the contest of climate change (Dr. PA Jose), Department of Biotechnology (DBT), Govt. of India.

18. Morpho-molecular characterization and *ex-situ* conservation of phytopathogenic fungi of Aralam Wildlife Sanctuary, Kerala and evaluation of antifungal efficiency of five selected medicinal plants leaf extracts against isolated most phytopathogenic fungi. (Dr. Shambhu Kumar), Department of Biotechnology (DBT), Govt. of India.

19. Participatory NTFP yielding medicinal plants resource enhancement: capacity building through protocols for propagation, enrichment planting and management practices of ten high demanding medicinal plants of the Western Ghats, Kerala (Dr. PA Jose), National Medicinal Plant Board, Ministry of AYUSH, Govt. of India.

20. Genome wide and geospatial approaches for enhancing the adaptive potential of

threatened rattan resources in India (Dr. Suma Arun Dev), Department of Biotechnology (DBT), Govt. of India.

21. Biological management of pest and diseases of selected commercially important medicinal plants (Dr. GE Mallikarjuna Swamy), National Medicinal Plant Board – Regional Cum Facilitation Centre (RCFC- Southern Region), Ministry of AYUSH, Govt. of India.

22. Assessment of adaptive genetic diversity in teak and sandalwood to guide conservation and genetic improvement efforts (Dr. Suma Arun Dev), Department of Biotechnology (DBT), Govt. of India.

23. Annual Action Plan – BTSG - Coordination (Dr. VB Sreekumar), National Bamboo Mission (NBM), Govt. of India.

24. Big bamboo nursery (Mr. VP Raveendran), National Bamboo Mission (NBM), Govt. of India.

25. Management of bamboo waste in primary processing unit (Dr. MP Sujatha), National Bamboo Mission (NBM), Govt. of India.

26. Bamboo shoot processing facility (Dr. R Jayaraj). National Bamboo Mission (NBM), Govt. of India.

27. Establishment of bamboo bazaar (Dr. AV Raghu), National Bamboo Mission (NBM), Govt. of India.

28. Training of farmers/artisans/field functionaries (Mr. VP Raveendran), National Bamboo Mission (NBM), Govt. of India.

29. Organizing workshops and seminars (Dr. V Anitha), National Bamboo Mission (NBM), Govt. of India.

30. Identification of genetically superior bamboo species (Dr. EM Muralidharan), National Bamboo Mission (NBM), Govt. of India.

31. Strengthening of tissue culture lab (Dr. EM Muralidharan), National Bamboo Mission (NBM), Govt. of India.

32. DNA barcoding of bamboos - Phase 2 (Dr. Suma Arun Dev), National Bamboo Mission (NBM), Govt. of India.

33. Plant growth promoting and biocontrol microbes for high quality bamboo planting stock production (Dr. GE Mallikarjuna Swamy), National Bamboo Mission

(NBM), Govt. of India.

34. Germplasm collection of *Litsea* and *Persea* (Jiggat) species (Dr. EM Muralidharan), National Bamboo Mission (NBM), Govt. of India.

35. Evaluation of alternative species for Jiggat production, characterization of accessions for growth, adaptability and gum production (Dr. VB Sreekumar), National Bamboo Mission (NBM), Govt. of India.

36. Characterization and quality assessment of bark/gum of alternative species for Jiggat production (Dr. R Jayaraj), National Bamboo Mission (NBM), Govt. of India.

37. Plantation technology for Jiggat species (Dr. EM Muralidharan), National Bamboo Mission (NBM), Govt. of India.

38. Standardization of sustainable harvesting methods for Jiggat species (Dr. PA Jose), National Bamboo Mission (NBM), Govt. of India.

39. Bird hazard to aircrafts in Thiruvananthapuram Airport (Dr. VB Sreekumar) Airport Authority of India, Govt. of India.

40. Studies on diversity, distribution and morphomolecular taxonomy of foliicolous hyphomycetous fungi of Peechi-Vazhani Wildlife Sanctuary Kerala (Dr. Shambhu Kumar), SERB - Department of Science and Technology (DST), Govt. of India.

41. Conservation, improvement, management and promotion of sandalwood (Santalum album Linn.) cultivation in India (AICRP-3), (Dr. Suma Arun Dev), CAMPA-Indian Council of Forestry Research & Education (ICFRE), Govt. of India.

STATE

.42. Bioactivity guided fractionation and mechanistic elucidation of biomolecules from *Cocculus laurifolius* DC. of southern Western Ghats (Dr. R Jayaraj), Kerala Biotechnology Commission (KBC), Govt. of Kerala.

43. Genetic Improvement of selected tree species- Phase I: plus tree selection, standardization of the propagation techniques, establishment of seed orchard and clonal hedge garden (Dr. TK Hrideek), Kerala Forest Development Fund (KFDF), Govt. of Kerala.

44. Economic valuation of ecosystem services in the moist deciduous forests of Kerala (Dr. V Anitha), Kerala Forest Development Fund (KFDF), Govt. of Kerala.

45. Development of management protocols for already established invasive alien species in the protected and other forests of Kerala (Dr. TK Hrideek), Kerala Forest Development Fund (KFDF), Govt. of Kerala.

46. DNA Barcoding as a promising molecular tool for timber forensics (Dr. Suma Arun Dev), Kerala Forest Development Fund (KFDF), Govt. of Kerala.

47. Chemistry and transformation of clay minerals under continuous teak rotations of Kerala Western Ghats (Dr. S Sandeep), Kerala State Council for Science, Technology and Environment (KSCSTE),Govt. of Kerala.

48. Evaluation of selected clones of teak through multisite testing to identify site specific clones for large scale plantation (Dr. TK Hrideek), Kerala Forest Development Fund (KFDF), Govt. of Kerala.

49. Flood mapping of Palakkad, Thrissur and Ernakulam Districts (Dr. Shijo Joseph), Kerala State Disaster Management Authority (KSDMA), Govt. of Kerala.

50. Impact of flood on floral elements and soil biota in Pamba, Periyar, Bharathapuzha and Chalakkudy Rivers in Kerala (Dr. VB Sreekumar), Kerala State Biodiversity Board (KSBB), Govt. of Kerala.

51. Voluntary relocation of resident population in Wayanad Wildlife Sanctuary-Phase II (Dr. V Anitha), Kerala Forest Development Fund (KFDF), Govt. of Kerala.

52. Preparation of detailed project report for wildlife friendly Palakkad district (Dr. P Balakrishnan), District Panchayat, Palakkad.

53. Developing a conservatory of palms and bamboos in the proposed Zoological Park at Puthur, Thrissur. (Dr. VB Sreekumar), Thrissur, Zoological Park Wildlife Conservation & Research Centre, Govt. of Kerala.

KFRI PLAN GRANTS

54. Plant metabolic studies in the genus *Embelia* found in Kerala (Dr. AV Raghu).

55. Genetic improvement of selected tree species - Phase I: establishment of germplasm collection at KFRI (Dr. TK Hrideek).

56. Compilation of Indian Forestry Abstracts (IFA) Phase III (Dr. KF George).

57. Evaluation of clonal teak plantations with particular reference to growth and wood properties (Dr. TK Hrideek).

58. Long term monitoring of *Strobilanthes kunthianus* in Eravikulam National Park-Phase I. (Dr. KA Sreejith).

59. Establishment of Nodal Centre of alien invasive species research and management (Dr. TV Sajeev).

60. Resolving species complexes using molecular systematics: a case study of few taxa in the Western Ghats (Dr. VB Sreekumar).

61. Restoration and reassessment of selected IUCN listed endangered tress in the Western Ghats (Dr. PA Jose).

62. Historical review of ecological and development trajectory of various sectors in Anamalais and Highranges of the southern Western Ghats (Dr. M Amruth).

63. Studies on the effect of elicitors and precursor feeding on in vitro production of secondary metabolites and plant growth in *Oroxylum indicum* (Dr. AV Raghu).

64. Sophisticated analytical instrumentation facility (Dr. R Jayaraj).

65. Mapping, biodiversity inventory and tree health assessment of KFRI campus (Dr. K.A. Sreejith).

66. Development of protocol for rapid detection of *Ganoderma* disease in plantations and Agro-ecosystems of Kerala (Dr. GE Mallikarjuna Swamy).

67. Assessing landslide vulnerability of forest systems in Kerala and developing restoration protocols (Dr. S Sandeep).

68. Development of nanocomposite organic manure from weed compost (Dr. MP Sujatha).

69. Study on plant functional traits of selected tree species of Kerala (Dr. KA Sreejith).

70. Diversity and dynamics of a tropical forest ecosystem in southern Western Ghats in the context of changing climate (Dr. Syam Viswanath, Dr. KA Sreejith).

71. Scaling up of protocol in vitro tuberization for production of quality planting material of two tuber yielding medicinal plants and promotion of organic home-stead farming as an income generation opportunity for rural women in Kerala (Phase I) (Dr. AV Raghu).

72. Developing long term monitoring tools and strategies for mitigating human-wildlife conflicts in Kerala (Phase I) (Dr. P Balakrishnan).

73. The economics of replacing *Acacia* and *Eucalyptus* plantations with native species and the offset cost in terms of ecosystem services and benefits derived from Kerala part of Anamalai Landscape (Dr. V Anitha).

ONGOING EXTENSION PROJECTS

1. Regional-Cum-Facilitation Centre – NMPB for sustainable development of medicinal plants (Southern Region) (Dr. P Sujanapal).

2. KFRI-KILA Bambusetum (Dr. AV Raghu).

3. Preparation of a handbook on woody plants endemic to Kerala (Dr. PA Jose).

4. Implementation of 'Harithakeralam Programme' at KFRI (Dr. VB Sreekumar).

5. Beach cleaning - mass cleaning cum awareness drive at Malappuram and Thrissur Districts (Dr. AV Raghu, Dr. VP Raveendran).

6. 32nd Kerala Science Congress at Yuvakshetra Institute of Management Studies (YIMS), Palakkad (Director, KFRI).

7. 27th National Children's Science Congress - media and publicity (Dr. AV Raghu, Dr.TK Hrideek).

8. Preparation of compensatory mangrove afforestation and conservation plan related to the widening and improvement of NH 17 from Kannur to Thalapady (Karnataka-Kerala border) in Kerala (Dr. P Sujanapal).

ONGOING ESTABLISHMENT PROJECTS

1. Maintaining Permanent Plots – Phase II (Dr. KA Sreejith).

2. Maintenance and enrichment of Microbial Collection (Dr. GE Mallikarjuna Swamy).

3. Maintenance of Wildlife Museum (Dr. P Balakrishnan).

4. Maintenance of Butterfly garden at KFRI-Peechi campus & establishment of new gardens in schools (Dr. TV Sajeev).

5. Maintenance and enrichment of Insect Collection (Dr. TV Sajeev).

6. Enrichment and maintenance of Medicinal Plant Garden (Dr. PA Jose).
7. Maintenance of KFRI Herbarium (Dr. VB Sreekumar).
8. Maintenance of Arboretum and Palmetum at Peechi campus (Dr. VB Sreekumar).
9. Tree Health Help Line (Dr. TV Sajeev).
10. Strengthening and enriching Institute Central Nursery (Dr. P Sujanapal)
11. Commercial Nursery- Palappilly (Dr. AV Raghu)
12. LAN, Internet and Website (Dr. TK Hrideek)
13. Research Monitoring and Evaluation Unit (Dr. TV Sajeev)
14. Digital Archiving of Administration Records and Multimedia services for public relations (Registrar).
15. Strengthening and capacity building in administration (Registrar).
16. Mathrubasha-facilitating/strengthening the application of mathrubasha (Malayalam) in office use (Registrar).
17. Wood Processing and Preservative Treatment Plant (Dr. TK Dhamodharan).
18. Monitoring of teak experimental plots, clonal multiplication area (CMA) and production of superior clonal plants (Dr. TK Hrideek).
19. Maintenance of Orchidarium and Fernery (Dr. P Sujanapal).
20. Maintenance of Research Nursery for Bamboos (Dr. EM Muralidharan).
21. Maintenance of Forest Seed Processing Unit (Dr. P Sujanapal).
22. Maintenance of Bambusetum (Dr. VB Sreekumar).
23. Maintenance of Arboretum at Palappilly (Dr. VB Sreekumar).
24. Bamboo Processing Centre (Dr. TK Dhamodharan).
25. Maintenance and enrichment of Bio-Resources Nature (Dr. GE Mallikarjuna Swamy).

26. Maintenance of Field Research station at, Devikulam (Dr. TK Hrideek).

27. Maintenance of Field Research Station, Kottapara, Ernakulam (Dr. TK Hrideek).

28. Design and conduct of forestry training programmes (Mr. VP Raveendran).

29. Design and conduct of extrain and outreach programmes (Dr. KV Mohammed Kunhi).

30. Forestry extension and conservation education programmes (Dr. AV Raghu).

31. Maintenance of field trial plot of Ochlandra at HNL, Kottayam and germplasm at FRC Palappilly (Dr. EM Muralidharan).

32. Soil health restoration programmes through participatory approach (Dr. MP Sujatha).

33. Upgradation and maintenance of Soil Museum at KFRI (Dr. MP Sujatha).

34. Campus Garden Development (Dr. PA Jose).

35. Research Management (Registrar).

36. Updation of KFRI Library Portal (Dr. KF George).

37. Field Research Centre (FRC), Palappilly - Eco Tourism and Conservation Awareness Programmes (Dr. AV Raghu).

31. Field Research Centre (FRC), Palappilly- Eco Tourism and Conservation Awareness Programmes (A.V. Raghu)

PUBLICATIONS

Research Papers in Journals

1. Chandrasekhara UM, Reshma PK (2019) Sceience educatinal and recreational benefit of the Bioresource Nature park at Nilambur, Kerala, India,. Current Science 117(2): 187 - 188.

2. Deepak V, Narayanan S, Das S, Rajkumar KP, Easa PS, Sreejith KA, Gower DJ (2020) Description of a new species of *Xylophis beddome*, 1878 (Serpentes: Pareidae: Xylophiinae) from the Western Ghats, India. *Zootaxa* 4755(2): 231-250.

3. Dhaneesh Bhasakar, Easa PS, Sreejith KA, Skejo J, Hochkirch A (2019) Large scale burning for a threatened ungulate in a biodiversity hotspot is detrimental for grasshoppers (Orthoptera: Caelifera). *Biodiversity and Conservation* 28 (12): 3221-3237. https://doi.org/10.1007/s10531-019-01816-6

4. Elsamol KB, Sreekumar VB, Thasini VM, Nimisha ES (2019) Avian frugivory and seed dispersal of an exotic palm, *Ptychosperma macarthurii* (H. Wendl. ex H. J. Veitch) H. Wendl. ex Hook. f. *Tropical Ecology* 60: 159–162.

5. Jose PA, Binoy NM, Jithin KV (2019) Optimizing clonal and seed propagation methods of *Cynometra beddomei* Prain – a critically endangered legume tree of Southern Western Ghats, Kerala. *Indian Journal of Forestry* 42(4): 105-108.

6. Jose PA, Sanil MS, Binoy NM, Swarupanandan K (2019) Incidence and impact of *Sahyadrassus malabaricus* (Moore) on planted seedlings of *Dipterocarpus bourdillonii* Brandis. *Indian Journal Forestry* 42(2): 105-108.

7. Joshi S, Jose BK, Gullan P, Sajeev TV, Anoop EV. 2020. A new species of mealybug (Hemiptera: Coccomorpha: Pseudococcidae) from *Tectona grandis* L.f. (Lamiaceae) in southern India. *Zootaxa* 4718(3): 391- 400.

8. Keerthi Vijayan, Suganthasakthivel R, Sajeev TV (2019) First record of body colour polymorphism in giant African snail *Achatina fulica* - a comparative study using mitochondrial cytochrome oxidase subunit I (COI) gene. *Entomon* 44(2): 155-160.

9. Neethu RS, Sajeev TV (2019) Are the white and black morphs of *Sida alnifolia* phytochemically different? *Journal of Pharmacognosy and Phytochemistry* 8(3): 2803-2811.

10. Priya K, Indira EP, Sreekumar VB, Renuka C (2019) Identification of female

sex-specific DNA marker in a dioecious rattan (*Calamus travancoricus* Bedd. ex Becc.). *Journal of Non-Timber Forest Products* 26 (l): 45 – 48.

11. Raghvendra Singh, Sanjeet Kumar Verma, Sanjay Yadav, Shambhu Kumar (2020). *Cercosporella bundelkhandae* comb. nov., from India. *Mycotaxon* 134 (2): 315-320.

12. Rini Vijayan KP, Raghu AV (2019). Polyphenolic profiling of two *Embelia* spp. endemic to south Western Ghats of India by liquid chromatography coupled with tandem mass spectrometry analysis. *Natural Product Research* DOI: 10.1080/14786419.2019.1687475

13. Rini Vijayan KP, Raghu AV (2019) Tentative characterization of phenolic compounds in three species of the genus *Embelia* by liquid chromatography coupled with mass spectrometry analysis. *Spectroscopy Letters* 52: 653-670.

14. Robi AJ, Sujanapal P, Sreekumar VB, Sanil MS, Dantas KJ (2020) *Hopea sasidharanii* (Dipterocarpaceae)—a new species from southern Western Ghats, India. *Phytotaxa* 429: 167-172.

15. Sajeev TV, Swamy GEM, George A, Vimod KK, Anitha K, Joseph S (2019). Avenue tree health assessment in a tropical city: A case study from Thiruvananthapuram Corporation, Kerala, India. *Climate Change and Environmental Sustainability* 7(2): 199-207.

16. Salim PM, Jose Mathew, Hrideek TK (2020) *Sonerila sulpheyi* (Melastomataceae, Sonerileae): A new species from the southern Western Ghats, India. *Phytotaxa* 435 (1): 076–080

17. Sruthi Subbanna, Syam Viswanath. 2019. Identifying potential areas for *Bambusa balcoa* Roxb. using ecological niche modelling tools. *Journal of Bamboo and Rattan* 18(1): 1-9

18. Suma Arun Dev, Sijimol K, Prathibha PS, Sreekumar VB and Muralidharan EM (2020) DNA barcoding as a valuable molecular tool for the certification of planting materials in bamboos. *3 Biotech10* (2): 59. doi: 10.1007/s13205-019-2018-8.

19. Umesh M, Thangadurai D, Kusum PA, Sreekumar VB, Sangeetha J (2019) Molecular diversity in wild populations of *Pinanga dicksonii* (Roxb.) Bl. (Arecaceae) from the Western Ghats of Karnataka using microsatellite markers. *Scientific Bulletin. Series F. Biotechnologies*, Vol. XXIII, ISSN 2285-1364.

Books Published

1. Amruth M, Raghu AV, Raveendran VP, Muhammed Kunhi KV, Viswanath S (Eds.) (2019) Medicinal Plants – Cultivation and Conservation, MoEF & CC, KSCSTE-KFRI.

2 .Amruth M, Raghu AV, Syam Viswanath (2020) Emerald Citadel, Coffee Table Book of our Western Ghats, KSCSTE-Kerala Forest Research Institute

3. Harinarayanan P, Raghu AV, Hrideek TK, Sanjeev AR, Raveendran VP (2019) 'Haridatta'. 27th National Children's Science Congress Souvenir, Department of Science and Technology and Kerala State Council for Science and Technology, p 60.

4. Sandeep S, Jayaraj R (2019) Training Manual: Soil quality analysis and pollution monitoring - Course handbook, KSCSTE – KFRI, Peechi.

5. Sujanapal P, Balakrishnan P (2019) Flora and fauna of the proposed Ponmudi Wildlife Sanctuary, Kerala. Technical Report submitted to the Kerala Forest and Wildlife Department. Kerala Forest Research Institute, Peechi.

6. Syam Viswanath, Mohanan. KV, Radhakrishnan VV, Hrideek TK, Raghu AV, Amruth M. (2019). Abstracts of papers, National Seminar on 'Forestry, Plant genetics and Improvement', KSCSTE- Kerala forest Research Institute and Gregor

Papers in Proceedings

1. Amal Siddique, Suma Arun Dev, Sreekumar VB (2019) DNA barcoding of wild nutmegs: an ecologically and economically important group in the Western Ghats, India. In: Proceedings of National Seminar on 'Environmental Education in India: Scope and Challenges, 29th -31st January, Kannur University, Kerala.

2. Anoja Kurian, Suma Arun Dev, Sreekumar VB, Muralidharan EM (2019) Low copy nuclear regions show promise as DNA barcodes for palms. In: Proceedings of Annual Conference of Indian Association for Angiosperm Taxonomy and National Symposium (Dan M, Dhyani A, Jothish PS, Beegam AR, Nazarudeen A, Suresh S, Anilkumar C, Prakashkumar R, Eds.) 11th-13th November, KSCSTE-JNTBGRI, Palode, Thiruvananthapuram.

3. Anu NA, Jose PA, Sanil MS, Binoy NM (2020) Ecological studies of *Vatica chinensis* L., a critically endangered dipterocarps of sacred groves of Kerala. In: Proceedings of 32nd Kerala Science Congress, 25th-27th January, Palakkad, p. 104.

4. Anuraj K, Jose PA, Gokul KG (2020) Flood impact on phenological records of *Ochreinauclea missionis* (Wall. Ex G. Don) Ridsd. and *Myristica beddomei* ssp. beddomei de wilde - two endemic and threatened trees of the Western Ghats, Kerala. In: Proceedings of UGC-SAP National Seminar on 'New Vistas in Botany', 13th-14th February, Department of Botany, Goa University, p.40.

5. Arunraj PT, Jose PA, Kanagaraj R (2020) Preliminary seed biological studies of *Cinnamomum verum* Presl. and *Sapindus trifoliatus* L. – two high demanding NTFP yielding trees of the Western Ghats, Kerala. In: Proceedings. UGC-SAP National Seminar on 'New Vistas in Botany', 13th-14th February, Department of Botany, Goa University, p.41.

6. Keerthy Vijayan, Suganthasakthivel R, Sajeev TV (2019) Multigene analysis reveals multiple invasions of the giant african snail into India. In: Abstracts of 'Research and Development conference on Invasive Alien Species Management and Biosecurity Measures', 8th-12th July, Manila, Philippines.

7. Patel B., Sivaraman S., Balakrishnan P. (2019). Nesting of Malabar Grey Hornbill Ocyceros griseus in a mosaic habitat in the southern Western Ghats. In: Abstract of the National Symposium on Avian Biology, Tirupati, December 07-10; IISER Tirupati and Association of Avian Biologists in India.

8. Patel B, Hrideek TK, Balakrishnan P. (2019). Diversity of tree-microhabitats in moist-deciduous forests of Indian tropics. In: Abstract of the 7th India Biodiversity

Meet-International Conference, November 19-21. Indian Statistical Institute, Kolkata.

9. Pranav K, Vishnu M, Raghu AV (2019) Medicinal plant cultivation: a case study from Anapantham Kadar Tribal Community colony, Thrissur, Kerala. In: Proceedings of national seminar on 'Forestry, Plant Genetics and Improvement' 3rd-4th December, Kerala Forest research Institute and Gregor Mendel Foundation.

10. Raghu AV (2019) Books you should definitely read. In: 'Haridatta'. 27th National Children Science Congress Souvenir (Harinaryanan P, Raghu AV, Hrideek TK, Sanjeev SR, Raveendran VP, Eds.), Department of Science and Technology and Kerala State Council for Science and Technology, pp 39-44.

11. Raghu AV (2019) Science = Questions ↔ Answers. In: 'Haridatta'. 27th National Children Science Congress Souvenir (Harinaryanan P, Raghu AV, Hrideek TK, Sanjeev SR, Raveendran VP, Eds.), Department of Science and Technology and Kerala State Council for Science and Technology, pp. 13-14.

12. Rini Vijayan K, Raghu AV (2019) Phytochemical characterization, variability and quantification of active compounds in five species of *Embelia* found in Kerala. In: Proceedings of national seminar on 'Forestry, Plant Genetics and Improvement' 3rd-4th December, Kerala Forest research Institute and Gregor Mendel Foundation.

13. Sajeev TV, Sam S, Mubeen M, Naduvalloor T (2020) The questions children ask: An age-type question correlation using the 'First Question' database. In: Proceedings of the 32nd Kerala Science Congress, 25th-27th January, Palakkad (selected as the best oral presentation).

14. Sangeeth Chandran, Raghu AV (2019) Cultivation of *Holostemma adakodien*: a decade data shows scope for women empowerment in villages of Kerala. In: Proceedings of national seminar on 'Forestry, Plant Genetics and Improvement', 3rd-4th December, Kerala Forest research Institute and Gregor Mendel Foundation.

15. Sanil MS, Jose PA, Ranjith CV, Binoy NM (2020) Restoring wild nutmegs for conservation and management: a case study from Kerala. In: Proceedings of International Symposium on 'Plant Taxonomy and Ethnobotany', 13th-14th February, Botanical Survey of India, Kolkata, p. 135.

16. Sanil MS, Sreekumar VB, Suma Arun Dev, Sreejith KA, Swathi Balakrishnan (2019) Distribution and cause of rarity of dipterocarps in the Western Ghats, India. In: Proceedings of International Conference "Provectus Plantae 19", 24th May, University of Kerala, Thiruvanathapuram.

17. Shambhu Kumar, Rekha Raju, Raghvendra Singh (2020) Systematic identification and characterization of phytopathogens associated with leaf spot diseases of two timber plants (*Xylia xylocarpa* (Roxb.) Taub. and *Dipterocarpus indicus* Bedd.) of Aralam Wildlife Sanctuary, Kerala, In: Proceedings of National Seminar on 'Recent Advances on Fungal Diversity, Plant-Microbes Interaction and Disease Management', 28th-29th February, CAS in Botany, Banaras Hindu University, Varanasi, p.110.

18. Subin K, Jose PA (2020) Identifying reproductive constraints in two endemic and endangered species of Hydnocarpus (Achariaceae) in Western Ghats, Kerala. In: Proceedings of International Symposium on 'Plant Taxonomy and Ethnobotany', 13th-14th February, Botanical Survey of India, Kolkata, p. 138.

19. Suganthasakthivel R, Nair KM, Sajeev TV (2020) Invasive alien plants in Kerala: A decadal revisit. In: Proceedings of 32nd Kerala Science Congress, 25-27 January, Palakkad.

20. Suganthasakthivel R, Vijayan K, Sooraj M, Nair, KM, Sumi MS, Raj, PR, Naduvalloor T, Sajeev TV (2019) Molecular characterization and ecological niche modelling of the invasive Red Cabomba, *Cabomba furcata* (Schult. & Schult.f. 1830) in India. In: Abstracts of 'Research and Development conference on Invasive Alien Species Management and Biosecurity Measures', 8th-12th July, Manila, Philippines.

Popular Articles

1. Sajeev TV. Jeevaparinamathe kurichu ariyunnavar aakanum padipikkendathu – Samakalika Malayalam Vaarika – 16th March 2020.

2. Sajeev TV . Covid-19: Sasthravum prathirodhamum – Chandrika Weekly, 28th March 2020.

3. Sajeev TV. Mahamaarikal: Samooham, Saasthram, Prathirotham. Dool News, 8th April 2020.

4. Sajeev TV. Invasive, alien, most fearsome. - The Hindu, 15th April 2020.

5. Sajeev TV. Mahamaariyude oru ghattavum vyavasthanirapekshamam alla – Thecritic.in

6. Sajeev TV Namukku venam sasthrabhimukahyamulla rashtreeyam. - Samakalika Malayalam Vaarika – 11th November 2019.

7. Sajeev TV. Arthur Fleckinum CK Raghavanum thammil enthu? Joker veendum kaanumbol. Asianetnews.com, 14th October 2019.

8. Sajeev TV. Kaalavastha ini pravachikkanaaville. Madhyamam, 21st October 2019.

9. Sajeev TV. Pralayam urulpottal melmannu nasham. Chandrika, 17th August 2019.

10. Balakrishnan P, Bindu TN (2019) Tree cavities: microhabitat for animals. Aranyam: 30-32 (popular article in Malayalam), Trivandrum, Kerala.

11. Nimisha ES, Sreekumar VB (2019) Edanadan Chengalkunnukal (Popular article on lateritic biotops) Aranyam. Volume 40 (2) 38, Trivandrum, Kerala.

12. Remya Unnikrishnan, Suma Arun Dev, Jayaraj R (2020) Oushada Sasya Guna Nirnayam: Sadhyathakal (popular article in Malayalam on adulteration in ayurvedic raw drugs). Aranyam, Kerala Forest Department, January, pp. 28-31, Trivandrum, Kerala

13. Sreejith KA (2019) Jaivasambushtamee vanavayalukal, Aranyam, Kerala Forest and Wildlife Department, September, pp. 30-33, Trivandrum, Kerala

14. Sreekumar VB (2019) Ettakkadukal. (Popular article on reeds). Aranyam. Volume 40(2): 37 Trivandrum, Kerala.

15. Viswanath S, Sandeep S, Sreejith KA (2019) Vana avasavyavasthayil kattutheeyude prabhavam- Yojana magazine, May, pp. 20-25

EXTENSION AND OUTREACH

ENDOWMENT AWARDS

Mr.Alex CJ, Ph.D. Research Scholar, Forest Health Division, KFRI is the recipient of the Dr. K.M. Bhat Memorial award 2018. The award was presented by Dr. Anoop EV, Prof. & Head, Dept. of Forest Products and Utilization, College of Forestry, KAU, Thrissur on 24 October 2019. The family of late Dr.K.M.Bhat has instituted an award for the best emerging Scientist of KFRI, below 35 years of age among the Research scholars of KFRI. The Award consists of a Certificate, Gold medal and Cash prize of Rs. 5,000.

Dr. Anoja Kurian and Mrs. Keerthy Vijayan, Research Scholars of Forest Biotechnology and Forest Entomology Departments, KFRI are the joint recipients of the Dr. K.M. Bhat Memorial award 2019 The Award was handed over by Dr. Gopakumar S, Professor, Department of Natural Resource Management, College of Forestry, Kerala Agricultural University, Thrissur.who also delivered the memorial lecture on 3rd January 2020 at KFRI.

EXTENSION AND OUTREACH

Training Programmes

1. Green Skill Development Programme – GSDP - Certificate Course on 'Value addition & Marketing of NTFPs (Plant Origin) - Bamboo Craft' from 02.01.19 to 20.02.19 supported by Ministry of Environment, Forest and Climate Change, Government of India. 16 participants completed the programme (VP. Raveendran)

2. GSDP-Certificate Course on Propagation & Management of Bamboo from 02.01.19 to 31.01.19 supported by Ministry of Environment, Forest and Climate Change, Government of India. 6 participants completed the programme (VP. Raveendran)

3. Five days hands on training on Remote Sensing, GIS and Resource Mapping from 27.05.19 to 31.05.19 - Self-generating. 15 participants completed the programme (KA. Sreejith, VP. Raveendran, Shijo Joseph)

4. National Academic Committee Meeting of National Children's Science Congress 2020 – 2021 from 08.08.19 to 10.08.19 supported by Kerala State Council for Science Technology and Environment. 26 participants completed the programme (VP. Raveendran, KV. Mohammed Kunhi, AV. Raghu)

5. Facilitating the establishment of Bamboo and Cane Enterprises through training and technology transfer from 19.08.19 to 23.09.19 supported by Department of Science & Technology (DST), Govt. of India. 45 participants completed the programme (KV. Mohammed Kunhi, EM. Muralidharan, V. Anitha, AV. Raghu, VP. Raveendran, K. Satheeshkumar)

6. One-day training programme on 'Seedling Production, Vegetative Propagation, Cultivation & Management of Bamboo, 11.10.19 supported by National Bamboo Mission (NBM), Govt. of India. 100 participants completed the programme (VP. Raveendran)

7. One-week compulsory training course for IFS officers on 'Conservation and Development of medicinal plants and benefit sharing with local communities from 21.10.19 to 25.10.19 supported by Ministry of Environment, Forest and Climate Change, Government of India. 24 participants completed the programme (AV. Raghu, M Amruth, VP. Raveendran, AV. Raghu, KV. Mohammed Kunhi)

8. GSDP - Training on 'Propagation & Management of Bamboo' from 30.12.19 to 17.01.2020 & 03.02.2020 to 28.02.2020 supported by Ministry of Environment, Forest and Climate Change, Govt. of India. 11 participants completed the programme (VP. Raveendran, AV. Raghu)

9. GSDP - Certificate Course on 'Value addition & Marketing of NTFPs (Plant Origin) - Bamboo Craft' from 30.12.19 to 17.01.2020 & 03.02.2020 to 18.03.2020 supported by Ministry of Environment, Forest and Climate Change, Government of India. 11 participants completed the programme (VP. Raveendran, AV. Raghu)

10. GSDP - Certificate Course on 'Pollution Monitors: Soil Pollution' supported by Ministry of Environment, Forest and Climate Change, Government of India. 7 participants completed the programme (R. Jayaraj, S. Sandeep, VP. Raveendran)

11. Training cum exposure visit on "Conservation and Livelihood of Kerala Forest" for PGDFM Students, IIFM – Bhopal from 10.12.19 to 20.12.19 supported by Indian Institute of Forest Management (IIFM), Bhopal. 36 participants completed the programme (VP. Raveendran, AV. Raghu)

12. GSDP- Certificate Course on 'Valuation of Ecosystem Services and Green GDP' supported by Ministry of Environment, Forest and Climate Change, Government of India. 11 participants completed the programme (V. Anitha, VP. Raveendran)

FRC-National Bamboo Day

Dr. TK. Narayanan, Vice Chancellor, Kerala Kalamandalam Deemed University, Cheruthuruthy, Thrissur, inaugurated the World Bamboo Day in FRC, Velupadam on September 18, 2019. Dr. Syam Viswanath, Director, KFRI presided and the Forest Range officer and Panchayat member offered felicitations in this function. Bamboo culinary to the women groups of Kerala, painting competition for school children and bamboo craft exhibition were also organized as a part of this Workshop.

World Environment Day (in main campus and central nursery)

The World Environment Day was organized at FRC, Velupdadam, with planting of tree saplings and “Knowing bamboo, knowing life” a special interactive field level class by Dr. Syam Viswanath, Director, KFRI. The National Green Corps (NGC) students of Thrissur, Dr. VB Sreekumar, teachers and NGC coordinators attended the function.

National Seminar on Forestry, Plant Genetics and Improvement

The National Seminar on Forestry, Plant Genetics, and Improvement jointly organized by KFRI and Gregor Mendel Foundation, University of Calicut was held at KFRI, Peechi on 3rd-4th December 2019. Padmasree MC. Dathan, Scientific Advisor to Chief Minister of Kerala was inaugurated . Dr. Syam Viswanath, Director KFRI presided over the function and the keynote address was given by Dr. J Thomas, Former Rubber Production Commissioner. . The Seminar was attended by about 150 participants including 104 delegates from 24 organizations across the country attended the seminar.

National Faculty Development Programme

Kerala Forest Development Institution and Entrepreneurship Development Institute of India (EDII) jointly organized National Faculty Development Program on the topic "Entrepreneurship and Startups" with the financial aid from Government of India. Twenty members representing 12 Academic/Technical Institutions participated in the training programme conducted from 21.12.2019 to 04.01.2020. The aim of the programme was to facilitate the members who completed the training from Entrepreneurial Development Clubs (ED Club) in their respective institutions. These clubs are responsible to spot and train potential entrepreneurs among the students in the near future.

Workshop on Children Literature

KFRI and Kerala State Institute of Children Literature jointly organized a Workshop on “Children Literature” on 9th & 10th, November 2019 at Extension Training Division of KFRI. Dr. Vidhyasagar, Dean, Forestry College, Vellanikkara, inaugurated the function. Sri. Paliyara Sreedharan, Director, Kerala State Institute of Children Literature presided the inaugural function. Dr. K Papputy, Dr. CR Das, Dr. TV Sajeev and Dr. AV Raghu handled various sessions in the Workshop. A total 32 participants attended this Workshop.

Documentary

"Virginal Cultivation", a documentary based on the medicinal plant cultivation by the indigenous adivasi 'Kadar' community at the 'Sasthaampoovam' colony in Mattathoor Grama Panchayath (Thrissur Dist.) shares the life stories of those who are searching for alternatives through herbal plant cultivation from the heritage of getting livelihood only by collecting and distributing forest resources. The direction credits for the same is due to Dr. AV Raghu, Senior Scientist, KFRI.

Beach Cleaning - Mass Cleaning Cum Awareness Drive (AV Raghu , M Amruth, VP Raveendran (MoEF & CC, GOI)

Beach cleaning - mass cleaning cum awareness drive, undertaken by MoEF & CC, Govt. of India, with the support of KFRI and NGC were organized in Thrissur & Malappuram districts in Kerala., namely. The programme was inaugurated formally at Mannalamkunnu beach, Chavakkad on 16th, November 2019 by the honourable Member of Parliament, Sri. TN. Prathapan. The honourable Member of Legislative Assembly Sri. K.V. Abdul Khader presided over the function. District Collector Sri. S. Shanavas IAS also partook in the event. Dr. Syam Viswanath, Director, KFRI and Dr. AV Raghu, Scientist, KFRI explained the key points and importance of the project. Chavakkad Block Panchayath President C. Musthakh Ali, District Sports Council President Sambhashivan Manoj Srivasthav attended the programme. About 100 tonnes of plastic refuse were recovered during the cleaning program.

ACADEMIC PROGRAMMES

Doctoral Degree awarded

1. Alex CJ. 2020. Ecology of Kavvai River Basin- A fragmented landscape in Kerala. Faculty of Environmental Studies, CUSAT.

2. Keerthy Vijayan. 2020. Tracking the invasion: molecular phylogeography and phyloclimatic modelling of the giant african snail Achatina fulica (Bowdich,1822) in south India. FRIDU.

3. Anoja Kurian. 2019. Molecular systematics of rattans of south India. Faculty of Science, CUSAT.

4. Vidya R Sankar. 2019. Study of constraints in efficient micropropagation of bamboo. Faculty of Science, CUSAT.

Ongoing PhD Programmes

There are 38 Doctoral Programmes covering Forest Research Institute - Deemed to be University (03 Nos.), Cochin University of Science And Technology (13 Nos.) and University of Calicut (22 Nos.). The major scholarship sponsors are CSIR (27 %), UGS JRF/SRF (13 %), KSCSTE (53 %), and DST-Inspire (7 %).

Masters attachment programmes

Total number of 58 attachments covering Biochemistry, Biotechnology, Botany, Chemistry, Environmental Science, Environmental Science and Management, Forestry, Life Science, Microbiology, and Zoology were completed during the reporting period. The Academic programme also had 31 Internships covering B-Arch, Biotechnology, Botany, Climate Change and Adaptation, Environmental Science, Microbiology, and Social Science.

Kerala Forest Reserch Institute, Peechi

(A unit of Kerala State Council for Science, Technology & Environment. Govt. of Kerala)

INCOME & EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH 2020

EXPENDITURE	Sch No.	As at 31.03.2020 (Rs)	As at 31.03.2019 (Rs)	INCOME	Sch No.	As at 31.03.2020 (Rs)	As at 31.03.2019 (Rs)
Infrastructure Strengthening (Non Plan)	IX	1,99,72,875.22	1,68,23,375.76	Grant from Government of Kerala	VI	11,85,77,056.21	11,71,98,867.96
Salaries and Allowances (Non Plan)	X	8,21,61,702.00	7,97,38,873.00	Other Receipts	VII	1,24,79,831.81	1,35,58,937.96
Depreciation	IV	2,68,98,101.67	2,40,32,447.21	Depreciation transferred to Capital Reserve		2,68,98,101.67	2,40,32,447.21
Other Project Expenses		6,15,01,433.00	5,16,21,173.31	Income from other Projects	VIII	6,15,01,433.00	5,16,21,173.31
Project Expenses under Plan scheme		2,89,22,310.80	3,41,95,557.16				
Total		**21,94,56,422.69**	**20,64,11,426.44**	**Total**		**21,94,56,422.69**	**20,64,11,426.44**

Kerala Forest Reserch Institute, Peechi

(A unit of Kerala State Council for Science, Technology & Environment. Govt. of Kerala)

BALANCE SHEET AS ON 31ST MARCH 2020

LIABILITIES	Sch No.	As at 31.03.2020 (Rs)	As at 31.03.2019 (Rs)	ASSETS	Sch No.	As at 31.03.2020 (Rs)	As at 31.03.2019 (Rs)
Reserves and Surplus	I	22,39,44,924.89	23,17,83,359.42	Fixed Assets	IV	19,50,26,697.04	18,19,93,352.57
Current Liabilities & Provisions	II			Capital Work in Progress		-	2,08,71,779.00
Creditors for Expenses		63,85,815.25	64,84,844.00				
Creditors For Fixed Assets		11,68,224.00	6,10,453.00	**Current Assets, Loans and Advances**	V		
Other Liabilities		1,31,55,806.00	35,60,540.00	Cash With Banks		26,26,00,479.65	24,47,91,938.66
Provisions		10,99,83,926.00	11,73,58,038.00	Cash in Hand		80,714.00	56,797.00
				Loans and Advances		1,13,45,806.79	61,60,155.15
Unspent Balance of Grant-in-Aid(Net)	III	11,44,15,001.34	10,10,58,076.15	Other Current Assets		-	69,81,288.19
Significant Accounting Policies and Additional Information	XI						
Total		**46,90,53,697.48**	**46,08,55,310.57**	**Total**		**46,90,53,697.48**	**46,08,55,310.57**

INSTITUTIONAL COMMITTEES

RESEARCH COUNCIL

Chairman

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

Members

Director,
Institute of Forest 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,
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. CTS. Nair,
Former Director, KFRI &
Former Executive Vice President,
KSCSTE.

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

Member & Ex-Officio Convener

Director,
Kerala Forest Research Institute.

Management Committee

Director, KSCSTE - 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
The Executive Director, KSCSTE - Centre for Water Resources Development and Management, Kunnamangalam (P.O), Kozhikode	:	Member
Dr. U.M. Chandrashekhara, Scientist F, KSCSTE - Kerala Forest Research Institute	:	Member
Registrar, KSCSTE - Kerala Forest Research Institute	:	Convener

1.CONSULTATIVE GROUP FOR FORESTRY RESEARCH MANAGEMENT (PROGRAMME ADVISORY GROUP)

1.	The Principal Chief Conservator of Forests & Head of Forest Force	…	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)	…	Member
	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 &	…	Member
	Chief Wildlife Warden	…	Member
15.	The Principal Chief Conservator of Forests (Social Forest¬ry)	…	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 (FMIS)	…	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 Cor¬po-ration	…	Member
30.	The Associate Dean, Forestry Faculty, Kerala Agricultural University	…	Member
31.	The Director, Jawaharlal Nehru Tropical Botanic Garden & Research Insti¬tute, Palode	…	Member
32.	The Director, Institute of Forest Genetics & Tree Breeding, Coimbatore	…	Member
33.	The Managing Director, Oushadhi, Thrissur	…	Member
34.	The Director, Center for Earth Science Studies, Thiruva¬nan-thapuram	…	Member
35.	The Director, Center for Water Resources Development and Management	…	Member
36.	The Director, Rajiv Gandhi Center for Biotechnology, Thi-ru-vananthapuram	…	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., Kot¬ta-yam	…	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 Natu¬ral History, Coimbatore	…	Member
43.	Director, Kerala Forest Research Institute, Peechi	…	Member
44.	Joint Director (Science & Technology Promotion), KSC¬STE, TVPM	…	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)

Director	:	Chairman
Dr. UM. Chandrasekhara	:	Convener
Dr. S. Sandeep	:	Assoc. Convener
All Scientific staffs	:	Members

3. Ph.D & M.Sc. Student Attachment Programme Advisory Committee

Dr. MP. Sujatha	:	Chairman
Dr. KA. Sreejith	:	Member
Respective Research Guides	:	Invitees
Dr. TV. Sajeev	:	Convener

4. Equipment/Infrastructure Development Committee

Dr. R. Jayaraj	:	Chairman
Dr. TK. Hrideek	:	Member
Dr. VB. Sreekumar	:	Member
Mr. PI. Sherief	:	Member
Purchase-in Charge	:	Convener

5. Purchase Committee

Dr. TK. Dhamodaran, Registrar	:	Chairman
Deputy Registrar, Finance	:	Member
Dr. S. Sandeep	:	Member
Dr. EM. Muralidharan	:	Convener

6. Library and Information networking Advisory Committee

Librarian	:	Chairman
Dr. M. Amruth	:	Member
Dr. G. Mallikarjuna Swamy	:	Member
Dr. Shijo Joseph	:	Member
Dr. Suma Arun Dev	:	Convener

7. Website & Software/ hardware Committee/ LAN

Dr. T.K. Hrideek	:	Chairman
Dr. M. Amruth	:	Member
Dr. K.F. George	:	Member
Dr. Shijo Joseph	:	Member
Smt. Ricy Eliner Varkey, Technical Officer	:	Convener

8. Kerala Forest Seed Centre Advisory Committee (to be consti¬tut-ed as per the Proceedings G53/KFRI/79/ dtd 31.10.2011)

9. **Teak Museum & Nature Trial Advisory Committee**

Dr. UM. Chandrasekhara	:	Chairman
Dr. KA Sreejith	:	Member
Dr. P. Sujanapal	:	Member
Dr. Sani Lookose- Curator	:	Convener

10. Campus/Garden Development Committee

Dr. PA. Jose	:	Chairman
Dr. EM. Muralidharan	:	Member
Dr. MP. Sujatha	:	Member
Dr. PK. Chandrasekhara Pillai	:	Member
Smt. MK. Raji	:	Member
Dr. VB. Sreekumar	:	Convener

11. Editorial Committee for Journal of Bamboo and Rattan

Dr. EM. Muralidharan	:	Chief- Editor
Dr. PK. Thulasidas	:	Editor
Dr. AV. Raghu	:	Editor
Dr. TK. Hrideek	:	Editor
Dr. VB. Sreekumar	:	Editor

12. Annual Report Committee

Dr. V. Anitha	:	Chairman
Dy. Registrar (Adm)	:	Member
Dy. Registrar (Accounts)	:	Member
Dr. Suma Arun Dev	:	Member
Dr. R. Jayaraj	:	Member
Dr. Shambu Kumar	:	Member
Dr. KA. Sreejith	:	Convener

13. Newsletter Committee (EVERGREEN)

Dr. AV. Raghu	:	Chief Editor
Dr. M. Amruth	:	Associate Editor
Dr. PK. Thulasidas	:	Associate Editor

14. Stores /Auction and Disposal Committee

Dr. Mallikarjuna Swamy	:	Chairman

	Dr. R. Jayaraj	:	Member
	Smt. Anuja Prasannan (Assistant)	:	Member
	Smt. Anupa Vasu	:	Member
	Stores-in Charge (K.P. Manoj)	:	Convener

15. Sports Committee

	Mr. VP. Raveendran	:	Chairman
	Dr. TK. Hrideek	:	Member
	Dr. Shambu Kumar	:	Member
	Mr. VC. Jinesh	:	Member
	Smt. K. Keerthy	:	Member
	Mr. PI. Sherief	:	Convener

16. Committee for Transformation of Official Language to Malayalam

	Dr.TV. Sajeev	:	Chairman
	Smt. K. Annapoorni	:	Member
	Smt. Shirly Isaac	:	Member
	Dr. S. Sandeep	:	Convener

17. Exhibition Advisory Committee

	Dr. KV. Muhammed Kunhi	:	Chairman
	Mr. VP. Raveendran	:	Member
	Dr. M. Amruth	:	Member
	Dr. AV. Raghu	:	Convener

18. Seminar Committee

	Dr. Suma Arun Dev	:	Chairman
	Dr. Shambu Kumar	:	Member
	Dr. TK. Hritheek	:	Member
	Dr. P. Sujanapal	:	Convener

19. Committee to Prevent Sexual Harassment on Women

	Dr. V. Anitha	:	Chairperson
	Dr. MP. Sujatha	:	Member
	Ms. Maymol Joseph	:	Member
	Ms. CK. Sindhumol	:	Member

	Dr. Suma Arun Dev	:	Convener
20.	**Hostel/Guest House/ Cafeteria Advisory Committee**		
	Dr. AV. Raghu	:	Chairman
	Mr. VP. Raveendran	:	Member
	Dr. KA. Sreejith	:	Member
	Smt. Sabitha Balakrishnan	:	Member
	Mr. PI. Sherief- Guest House in charge	:	Convener
21.	**Building Committee**		
	Dr. TV. Sajeev	:	Chairman
	Dr. PK. Thulasidas	:	Member
	Smt. MK. Raji	:	Member
	Mr. PI. Shereef	:	Member
	Dy. Registrar (Accounts)	:	Member
	Registrar	:	Convener
22.	**Vehicle Advisory Committee**		
	Dr. P. Sujanapal	:	Chairman
	Dr. KA. Sreejith	:	Member
	Dy. Registrar (Admn)	:	Member
	Smt. C.K. Sindhumol (Assistant)	:	Member
	Mr. Shiju (Vehicle in charge)	:	Convener
23.	**Endowment Committee**		
	Director	:	Chairman
	Dr. E. M. Muralidharan	:	Member
	Muhammed Kunhi	:	Member
	Dr. P. A. Jose	:	Member
	Dr. R. Jayaraj	:	Member
	Dr. P. Sujanapal	:	Convener

STAFF LIST

Scientific staff

1.	Dr. Syam Viswanath	Chief Scientist (Director-on deputation)
2.	Dr. UM. Chandrasekhara	Senior Principal Scientist
3.	Dr. EM. Muralidharan	Senior Principal Scientist
4.	Dr. MP. Sujatha	Senior Principal Scientist
5.	Dr. TV. Sajeev	Senior Principal Scientist
6.	Dr. V. Anitha	Senior Principal Scientist
7.	Dr. KV. Mohammed Kunhi	Principal Scientist
8.	Dr. PA. Jose	Principal Scientist
9.	Dr. Suma Arun Dev	Senior Scientist
10.	Dr. Shambu Kumar	Senior Scientist
11.	Shri. VP. Raveendran	Senior Scientist
12.	Dr. KF. George	Senior Scientist
13.	Smt. Sani Lookose	Senior Scientist -Teak Museum Curator
14.	Dr. AV. Raghu	Senior Scientist
15.	Dr. TK. Hrideek	Senior Scientist
16.	Dr. P. Sujanapal	Senior Scientist
17.	Dr. GE. Mallikarjuna Swamy	Senior Scientist
18.	Dr. VB. Sreekumar	Senior Scientist
19.	Dr. S. Sandeep	Senior Scientist
20.	Dr. R. Jayaraj	Senior Scientist
21.	Dr. KA. Sreejith	Senior Scientist
22.	Dr. P. Balakrishnan	Scientist
23.	Dr. M. Amruth	Scientist

Administrative staff

1	Shri. B. Biju	REGISTRAR
2	Sri. K. Satheesakumar	Dy. Registrar(Accts)
3	Smt. Geetha Parakkott	Dy. Registrar (Admin.)
4	Smt. Sabitha Balakrishnan	Assistant Registrar
5	Smt. Shirly Issac	Section Officer Gr. II
6	Sri. K. Kamalakaran	Section Officer
7	Sri. VS. Krishnanunni	Section Officer

8	Smt. CK. Sindhumol	Assistant Gr. II
9	Smt. P. Anupa Vasu	Assistant Gr. II
10	Smt. Anuja Prasannan	Assistant Gr. II
11	Smt. K. Keerthy	Assistant Gr. II
12	Smt. Maymol Joseph	Assistant Gr. II
13	Sri. PS. Sudheesh	Assistant (Stay order)
14	Smt. PS. Manju	Assistant
15	Smt. A .Aneesamole	Assistant
16	Sri. KM. Shiju	Assistant
17	Smt. Grace Andrews	PA to Director Gr. II
18	Sri. KP. Manoj	Office superintendent
19	Sri. P Rajeesh	Clerical Assistant Gr. II (Nilambur)
20	Sri. TM. Abdul Vahab	Word Processing Assistant Gr. IV
21	Smt. PK. Sughada Devi	Typist (Stay order)
22	Sri. PK. Rajendran	Driver Gr. II
23	Sri. EO. Mathai	Driver Gr. II
24	Sri. CH. Herald Wilson	Driver Gr. II
25	Smt. AM. Lalitha	Office Attendant Gr. V
26	Smt. TG. Chandrika	Office Attendant Gr. IV
27	Sri. VK .Mohandas	Office Attendant Gr. IV
28	Sri. EP. Ulahannan	Office Attendant Gr. IV
29	Smt. K. Aparna	Office Attendant Gr.III (Nilambur)
30	Sri. K. Abdul Jaleel	Office Attendant Gr. II
31	Smt. S. Ashamole	Office Attendant Gr. II
32	Smt. C. Sujatha	Office Attendant Gr. II
33	Sri. E. Hamsa	Office Attendant Gr. II
34	Sri. T.P. Valsan	Office Attendant Gr. II
35	Smt. P. Deepa	Office Attendant Gr. II (Nilambur)
36	Sri. K. Mohammed	Helper Gr. IV (Nilambur)
37	Sri. KK. Mohammed	Helper Gr. IV (Nilambur)
38	Sri. AV. Chamy	Helper Gr. II
39	Sri. TS. Prakash	Helper Gr. II
40	Sri. MS. Santhosh Kumar	Helper Gr. II
41	Sri. TO. Simon	Helper Gr. II
42	Sri. MK. Suresh	Helper Gr.II

43	Sri. IO. Thomas	Helper Gr. II
44	Sri. N. Rajan	Helper Gr. II (Nilambur)
45	Sri. CP. Ummer	Helper Gr. II (Nilambur)
46	Smt. PS. Kadeeja	Helper Gr. II (Palappilly)
47	Smt. VL. Alphonsa	Helper Gr. II (Palappilly)
48	Sri. KA. Thankachan	Helper Gr. II (Kottappara)
49	Sri. CB. Sajy	Helper
50	Sri. PV. Santhosh Kumar	Helper
51	Sri. K. Rajan	Nursery Man Gr. II
52	Smt. S. Padmavathy	Nursery Man Gr. II
53	Sri. NK. Rajan	Nursery Man Gr. II (Palappilly)

Technical Staff

1	Sri. PI. Shereef	Technical Officer Gr. II
2	Smt. MK. Raji	Technical Officer Gr. II
3	Smt. Ricy Eliner Varkey	Technical Officer Gr. II
4	Sri. VC. Jinesh	Technical Officer (Palappilly)
5	Sri. MR. Anilkumar	Technical Assistant Gr. IV
6	Sri. OP. Ranjith	Technical Assistant (Binder) Gr. II

Deputed staff

1	Mohammed Habeebulla	Typist/Data Entry Operator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