

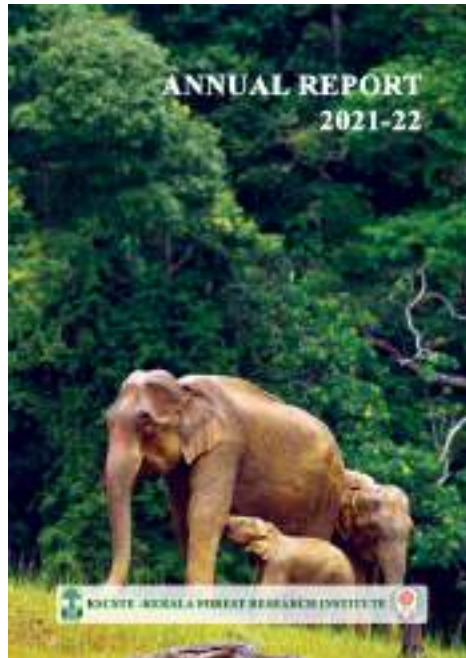
# ANNUAL REPORT 2021-22



KSCSTE -KERALA FOREST RESEARCH INSTITUTE



# KFRI ANNUAL REPORT 2021-22



**KSCSTE -KERALA FOREST RESEARCH INSTITUTE**  
An Institution of Kerala State Council for Science, Technology and Environment

Peechi-680 653 | Thrissur | Kerala  
[www.kfri.res.in](http://www.kfri.res.in)





Cover Image : Asian elephant (*Elephas maximus* L.)  
from Sholayar Forest Range | Vazhachal Forest Division

Photo credit : Sreejith Sivaraman  
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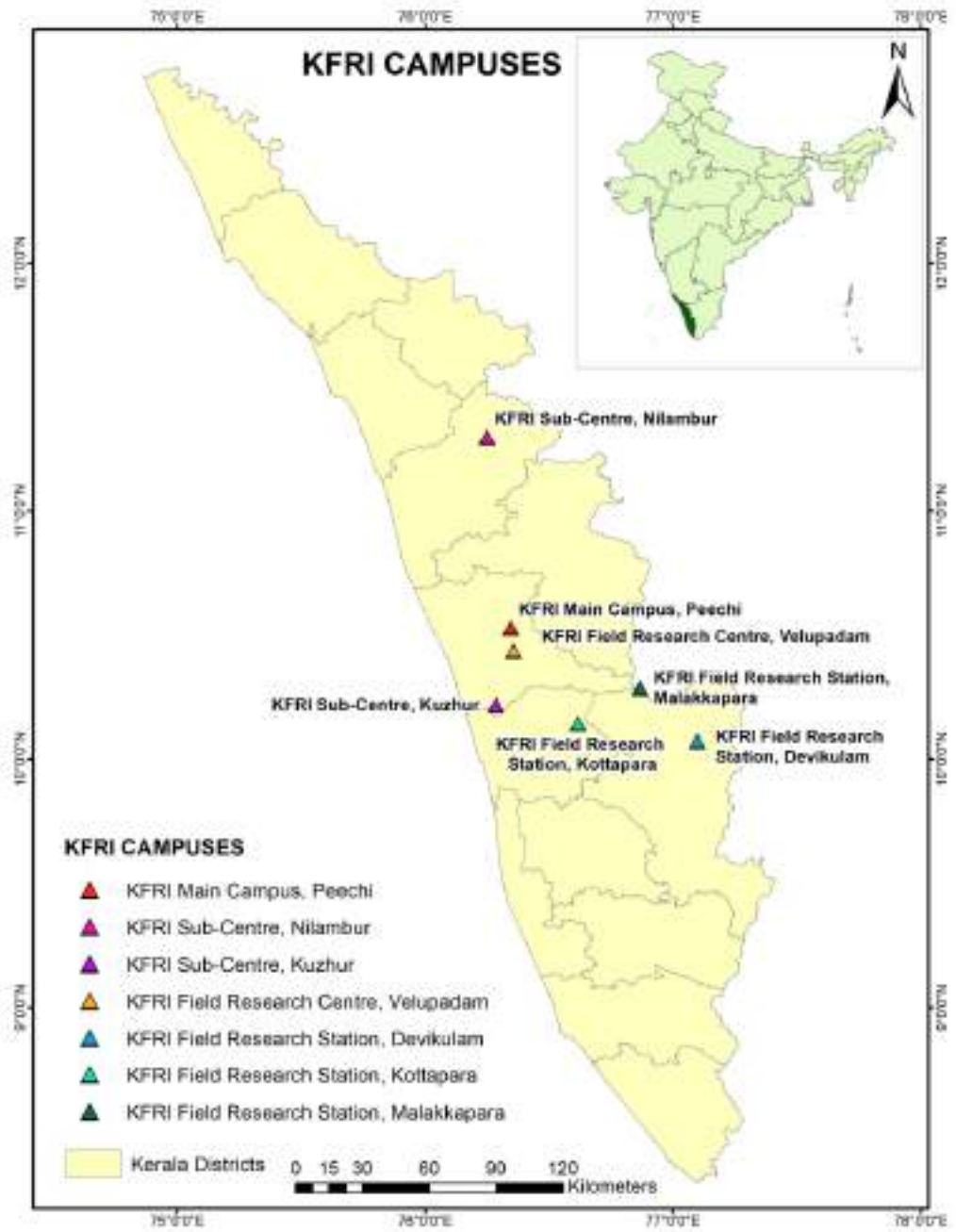
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## Director's Note...

The United Nations has declared the decade 2021-2030 as the Decade on Ecosystem Restoration. Habitat loss, invasive species, overexploitation, pollution and climate change associated with global warming are identified as the primary drivers of biodiversity loss world over. Human impacted landscapes, such as, the forests, mangroves, river banks, watersheds, among others, are adversely affected by development, thereby impacting the ecosystem and flow of ecosystem services. Suitable protocols and programmes are to be evolved for ecosystem repair, restoration and rehabilitation by intensive research in the field. The United Nations Environment Programme (UNEP) states that in India, ecosystem restoration could also form the basis of post-COVID recovery.

Ecosystem services augment the knowledge and understanding about the effects of climate on community decisions and actions. Ecosystem services can aid and endure social adaptation to environmental variations amidst the transformation of ecological structure and functions, through protecting vulnerable communities from climate change impacts and providing both material and non-material benefits to the social community. This involves emphasizing sustainable management of ecosystems by public, preservation of ecological status and integrity of ecosystems and restoration of degraded ecosystems. Forest research therefore is called upon to shift focus towards providing decision makers and managers a support system for managing forests to maximize ecosystem services.

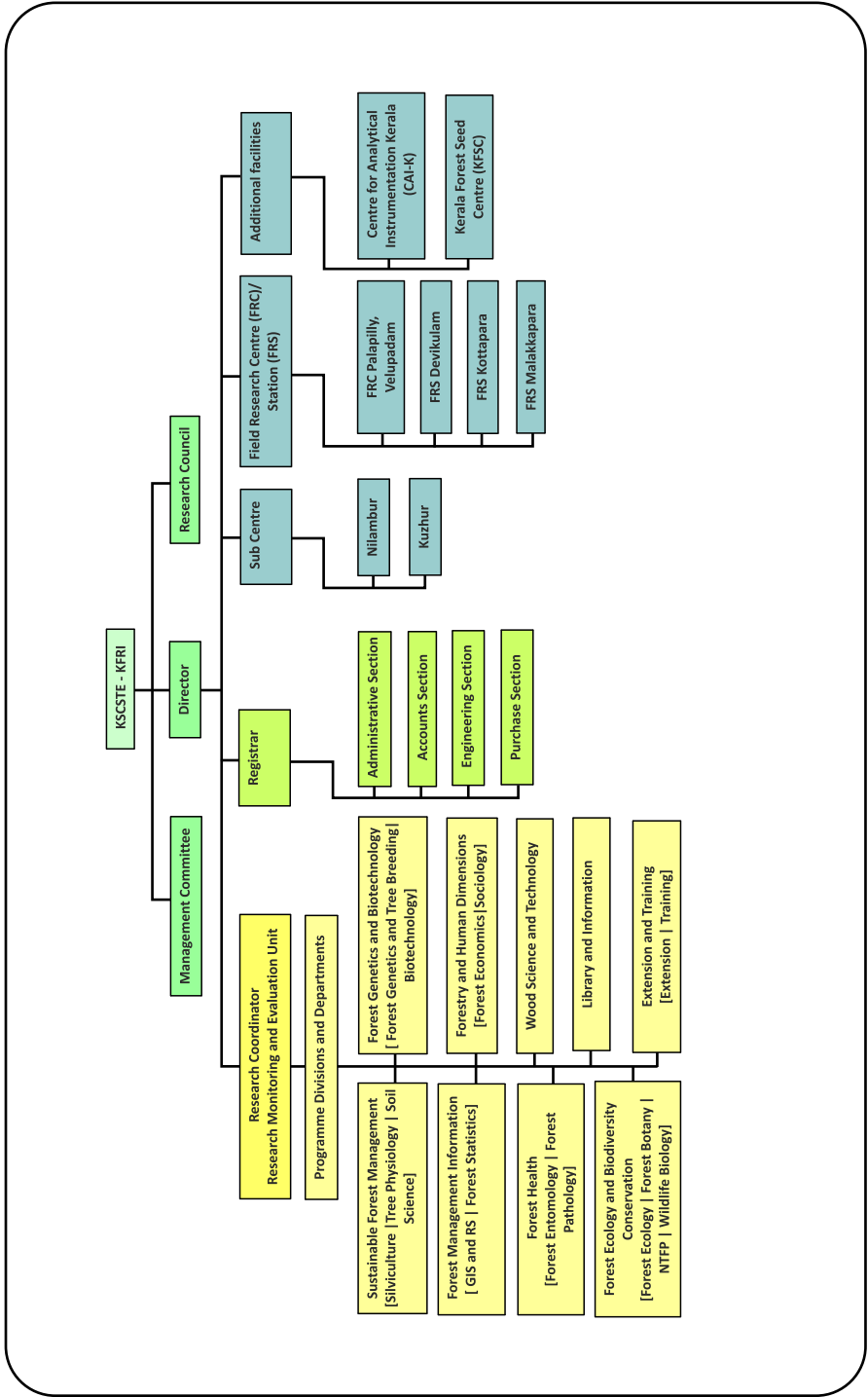
KPRI in its pursuit to address the global concerns that have far reaching consequences is committed to ecosystem restoration research of impacted landscapes, that includes restoration of endemic, endangered (IUCN Red listed) and overexploited plants, invasive alien species, river banks, landslide locations, degraded mangrove sites (under the Rebuild Kerala Programme) and restoration of Ecologically Fragile Land (EFL) Areas – a commitment to ecosystem resilience of the impacted landscape and vulnerable communities. During 2021-22, the Institute had 134 ongoing projects (Research/Extension/Consultancy/Maintenance) looking at different aspects of forestry, covering global and local relevance. Our sponsors included the Food and Agricultural Organization (FAO); United Nations Development Programme (UNDP); ICLEI South Asia; United States Agency for International Development (USAID); Ministry of Environment, Forests and Climate Change (MoEF&CC), Government of India;

Department of Biotechnology (DBT); Department of Science and Technology (DST); National Bamboo Mission (NBM); CAMPA-Indian Council of Forestry Research and Education (ICFRE); Airport Authority of India, Govt. of India; National and State Medicinal Plants Boards (NMPB and SMPB); National Highway Authority of India, Govt. of India; Kerala State Council for Science Technology and Environment, Govt. of Kerala; Kerala Forest and Wildlife Department; State Department of Planning and Economic Affairs; Kerala State Biodiversity Board (KSBB); Department of Environment and Climate Change, Govt. of Kerala; Zoological Park Wildlife Conservation and Research Centre, Govt. of Kerala; Local self-government organizations and the KFRI Plan Grants. The Institute received Rs.1722.14 Lakhs as grants from Kerala State Council for Science Technology and Environment, Government of Kerala of which Rs. 738.00 lakhs is under Plan Grants and the rest under Non-Plan. Financial support sanctioned by external agencies amounts to around Rs. 530.00 Lakhs. Funds from Plan Grants were utilized for research, extension projects and for infrastructure development.

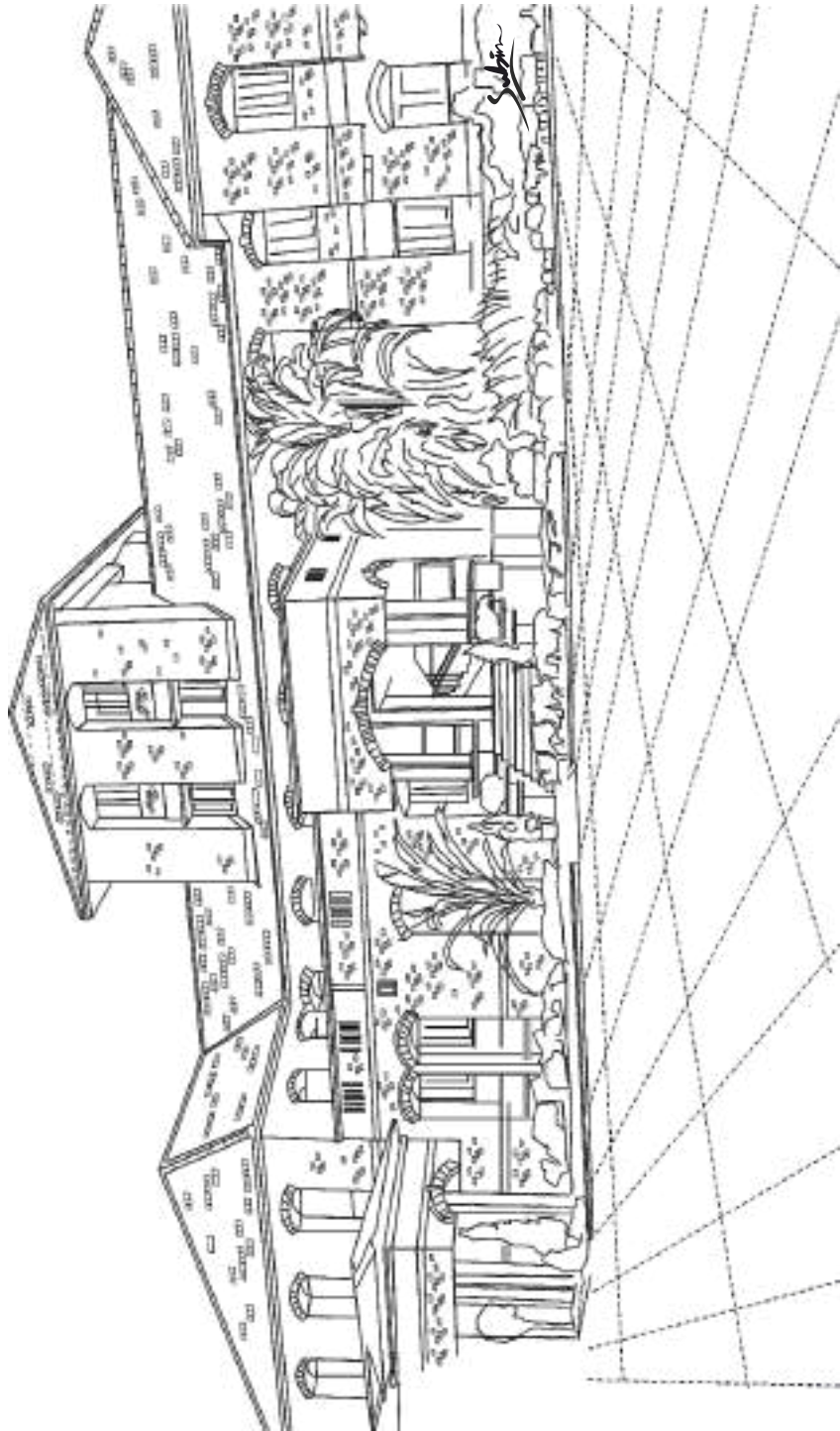


Dr. Syam Viswanath  
Director

# ORGANOGRAM









**K**erala 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, socio-economics, 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, Physiology, Wildlife Biology, Soil Science, Molecular Biology, Wood Science and Technology, Biochemistry, Pathology, Entomology, Silviculture, Ecology, 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, Insect and Microbial collections. For plant propagation and clonal multiplication, there are nurseries, green houses, mist chambers and the Kerala Forest Seed Centre. The secretariats of the International Teak Information Network (TEAKNET) funded by the Food and





Agriculture Organization of United Nations, the Bamboo Technical Support Group (BTSG) of the National Bamboo Mission, Government of India and the Regional Cum Facilitation Centre (RCFC) of the National Medicinal Plant Board (NMPB), Ministry of AYUSH, Govt. of India are housed in the main campus of KFRI. The monitoring facilities are the permanent plots established and maintained in different forest ecosystems 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, fieldwork support (vehicles), staff accommodation, guest house and research scholars' hostels are the centralized facilities of KFRI. A seismic observatory operated and maintained by the National Centre for Earth Science Studies (NCESS) is in KFRI main campus. The Institute has a Sub-Centre at Nilambur in Malappuram District and Kuzhur at Thrissur District, Field Research Centre at Velupadam in Thrissur District, and Field Research Stations at Munnar, Kottapara, and Malakkappara.

### **Sub Centre, Nilambur**

The Sub Centre (KFRI Sub Centre) campus is situated in the fringe of the Nilgiri Biosphere Reserve at Nilambur with facilities for laboratory work and field trials in a 43.36 hectares area and is about 140 kms away from the main campus. The

KFRI Sub Centre is one of the important green institution in Malappuram District with a rich floral and faunal diversity on the bank of Karimpuzha, a tributary of Chaliyar River. The campus is quite clean, green and free from pollution. The campus is rich in plant diversity with a total of 1643 taxa of angiosperm plants belonging to 840 genera and 152 families. Among these, 1452 taxa represented species (sub species and natural varieties included) while the remaining 191 taxa represented cultivars and hybrids. It may also be noted that the types of existing plant species are dependent upon the local geology, naturally occurring or introduced soils, water availability, and the amount of human intervention. Thus, a range of landscapes from carefully tended areas to areas that have reverted to nature under the influence of the forces that control ecological succession can be seen within the campus. A bambusetum with about 35 species of bamboos are maintained at the Sub Centre. The Sub Centre also houses the famous Teak Museum, Bio-Resources Nature Park, Medicinal and Herbal garden and a model of Butterfly garden.

### **Sub Centre, Kuzhur**

The Sub Centre at Kuzhur, is taken over by KSCSTE – Kerala Forest Research Institute, Peechi as on 01.01.2022, from KSCSTE- Jawaharlal Nehru Tropical Botanic Garden and Research Institute. The Centre is established in 2019 with the financial support of Kerala State Industrial Development Corporation (KSIDC). The Sub Centre, is situated in an area of around





1.27 acres. Presently, the Sub Centre is equipped with a full-fledged 10000 sq. feet Plant Tissue Culture laboratory. The laboratory consists of media preparation, inoculation, incubation and sterilization rooms. The facility has a total production capacity of 5,00,000 plants per annum. The Sub Centre mainly aims at expanding the cultivation of *Pandanus* (screw pines) by providing plantlets of different species of *Pandanus*, suited for different purposes including restoration programs, thereby helping the revival of traditional industries based on the plant in Kodungallur and its surrounding Panchayats. The Sub Centre is currently focused in the production of tissue culture raised plantlets of different species of screw pines (*Pandanus odorifer*,

*P. furcatus*, *P. leram*, *P. tectorius*, *P. pygmaeus*), forestry species (bamboo, teak), agriculture crops (banana, ginger), ornamental plants (*Aglaonema*, *Calathea*, *Philodendron*, *Spathiphyllum*, Orchids, Anthurium, spider lilly, *Cordyline*, etc.) and medicinal plants.

The Sub Centre is envisioned to evolve as a Research and Development (R&D) Outreach and Bio-incubation Centre of the Institute. The envisaged activities in a phased out approach include (1) upscaling the facility so as to cater to the extension activities of the research projects and outreach activities of the Institute (2) mass propagation of plant species of commercial importance in line with demand from various stakeholders such as KFRI scientific fraternity, local farmers, R&D institutions, government and public sector enterprises, NGOs, academicians and individual entrepreneurs (3) genetic fidelity testing of tissue culture raised plantlets (QPMs) (4) production of QPMs of tree species and other miscellaneous multipurpose native tree species and medicinal plants in high demand, through nursery established and managed at the Centre (5) training of manpower in plant tissue culture (Training for academicians, internship students and Masters attachment programs) to generate a regular income (6) as a Bio-incubation Centre for start-up entrepreneurs in tissue culture.

### Field Research Centre (FRC)

**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 (DST), 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 (FRS)**



**Malakkappara:** This field station is located 170 kms away from the KFRI main campus. The property belongs to Tata Coffee Ltd (TCL) and based on an agreement signed between TCL and KFRI in 2017, it was provided for research purposes of KFRI. It supports field-oriented research activities, mainly to accommodate research personnel attached to the Institute.



There are around 10 permanent plots in Sholayar landscape which represent heterogeneity in altitude, vegetation etc.



This includes a 10 hectare plot in tropical wet evergreen forests of Karadishola, where long term ecological monitoring in the context of climate change is going on.

**Devikulam:** The FRS is located at Devikulam range of Munnar Forest Division in Idukki district. The Station has nurseries and polyhouses for the production and maintenance of seedling stock of different tree species. A germplasm of eucalypts was maintained in this station for the supply of quality planting materials. The seedlings produced from the station were used for restoration programs of Shola forests in high ranges. Now the station is actively involved in raising seedlings of medicinal plants for establishing medicinal plant gardens in the high altitude regions. In addition, the FRS functions as a base camp for personnel in various research projects being implemented in high ranges and also supports various field based experiments.

**Kottapara:** Located at Kodanad range of Malayattoor Forest Division in Ernakulam district. The research programmes in this field station commenced in 1989, and initially focused on the production of *Eucalyptus* clones for research purposes and Kerala Forest Department (KFD). Presently, Institute is maintaining a germplasm of teak plus trees, *Eucalyptus* clones and host plants of lac insects in this station. The seedlings of major timber tree species including teak are produced in the station.





## Organization

The research in KFRI is executed through Departments clustered under Programme Divisions. 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 are 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 monitoring and guiding the formulation and implementation of various research programmes in KFRI. It comprises of eminent scientists in the field of forestry research and accomplished 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 Kerala State Council for



Science Technology and Environment (KSCSTE), Govt. of Kerala. The administration and management of the Institute are vested with the Management Committee chaired by the Director as the Head of the Institute and is also responsible for the day-to-day administration and implementation of programmes. Besides basic and applied researches, 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 80, which includes 21 scientists, 53 administrative staff and 06 technical staff. In addition, 91 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 (FRI-DU), Dehradun, Cochin University of Science and Technology (CUSAT), and the University of Calicut for enrolling students for research programmes leading to the award of doctoral degree. Besides, the Institute also undertakes academic attachment programmes for several colleges and Universities at the International, National and State level. KFRI signed an MoU with Ghent University, Belgium. This has opened an official platform for the exchange of researchers including

faculties and students between two Institutions, and further to develop collaborative research programs. This has made it formally possible for KFRI to collaborate with Ghent University in their TreeWatch.net program, a global network to monitor hydraulic and carbon dynamics of trees. The Institute has also signed MoUs with the Kerala Agricultural University, Kerala Veterinary and Animal Sciences University, Kannur University, Rajagiri School of Social Sciences as well as various colleges in the State. An Academic Coordinator heads the academic programme of the Institute.



## Right to Information (RTI)

The RTI is an Act for implementing 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.

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## PROGRAMME DIVISIONS

### Sustainable Forest Management

The Programme Division comprises of Tree Physiology, Silviculture and Soil Science Departments. The study of physiological and biochemical aspects of recalcitrant seeds, developing protocols for clonal and seed propagation of Threatened trees/NTFPs/lesser known wild fruit trees, climate change impact on endemic and threatened trees, documentation of woody plants endemic to Kerala are the key domains of the Tree Physiology Department.

The key research areas and current research activities of the Soil Science Department include afforestation and eco-restoration of degraded sites, control of river bank erosion by planting, evaluation of factors affecting plantation productivity and soil nutrient management for important forestry species, composting and biochar technologies for soil amelioration as well as developing nanocomposites for soil applications. The Silviculture Department has made commendable contribution in conservation and sustainable utilisation of resources both in forest and non-forest areas. As part of facilitating conservation, the Department is implementing various programmes related to resource augmentation/ restoration in forest areas. In order to reduce pressure on forest and for increasing the availability of forest resources outside forest areas, several programmes are being implemented in collaboration with various other line





departments. These grassroots level activities help the farmers to get much higher income also. Current specific programmes include: eco-restoration, conservation of both species and habitats, resource augmentation and enhancement in both forest and non-forest areas, developing ecologically sustainable high density forest in urban areas, standardization of seed handling protocols and nursery techniques, production of Quality Planting Materials, Environment Impact Assessment studies and various environmental issues, growing stock estimation of commercially important species, promotion of medicinal plants and timber trees in non-forest areas to reduce the pressure on forest, developing conservation plan for the developmental projects, control and management of Invasive Alien Species. Moreover, the Department is working on the rejuvenation of vulnerable habitats like coastal and riparian ecosystems. Regional cum Facilitation Centre of the National Medicinal Plants Board is attached to Silviculture Department of KFRI. Two important facilities of the Institute, the Kerala Forest Seed Centre (a joint venture of Kerala Forest Department and KFRI) and Central Nursery are attached to the Department providing wide range of services to various Government Departments and the general public. The Department also maintains live collections of orchids and ferns.

## Forest Genetics and Biotechnology

The Programme Division includes Forest Genetics and Tree Breeding as well as Biotechnology Departments with plant propagation, plant tissue culture and molecular biology facilities. The major research areas of the Division are genetic improvement of teak, clonal propagation of forest trees and medicinal plants through vegetative 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, *Calamus* & dipterocarps and development of institutional capability for DNA barcoding of life forms, draft genome of teak, sandal, *Calamus brandisii* and *Korthalsia laciniosa*, among others. DNA barcoding facility caters to the DNA barcoding requirements of various academicians and researchers in the field.

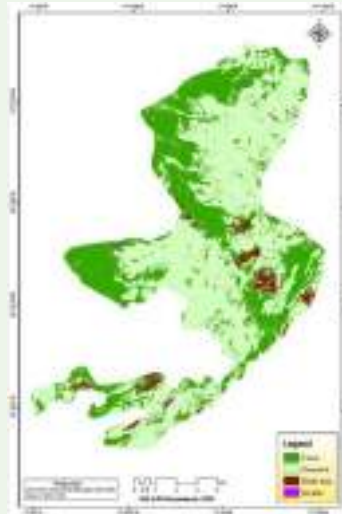




The current research activities of the Division include development of clonal propagation protocols through micro and macro propagation for important forest tree species, commercial bamboos and medicinal plants, plus tree selection and evaluation of selected clones of teak through multisite testing, genetic improvement and plus tree selection of selected tree species, establishment of seed orchard and clonal hedge garden, population genetic structure, adaptive genetics and transcriptomics for sustainable conservation and management of cane, teak and sandal genetic resources, molecular detection of sandal spike disease, conservation genetics of selected RET species in the Western Ghats as well as DNA barcoding for biosystematics, certification of bamboos, authentication of non-wood forest products (NWFPs) and timber forensics. The Division also undertakes DNA testing to trace the identity of seized logs in timber theft cases and offer consultancy services for various Government Departments.

## 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. The Division has been actively engaged in various research activities including forest mapping, biodiversity mapping, ecosystem analysis, resource mapping, and population analysis. The Division uses high spatial, spectral and temporal remote sensing data for characterizing the compositional and functional attributes of forests. The Division partners with various national and international organizations, and also actively involved in training on Remote Sensing and GIS.





## Forest Ecology and Biodiversity Conservation

The Programme Division comprises of Forest Botany, Forest Ecology, 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 the Forest Botany Department include floristic documentation of angiosperms and lower groups of plants with a focus on lichens and algae. The important ongoing activities include biosystematics studies on the genus *Terminalia* in India, phenology and seed dispersal of trees in moist deciduous and shola forests, standardization of propagation techniques and development of germplasm for mangrove and bamboo species, biogeography, phylogeny and e-monograph of Arthoniales. Forest Ecology Department works on long-term monitoring of forest ecosystems through permanent sample plots; biodiversity documentation; climate change responses of tropical trees through eco-physiology and plant functional traits studies.



The research activities of the Department of Wildlife Biology mainly focus on mapping and monitoring wildlife, biology and conservation of endangered species,



human-wildlife interactions, human dimensions of wildlife. The extension and outreach activities of the Department are operated through the Centre for Citizen Science & Biodiversity Informatics under various participatory science programmes and the Wildlife Museum which is an exhaustive collection of specimens for public engagement and education.

The NWFP Department works on phytochemical analysis of NWFPs and other medicinal plants, isolation, characterization and bioactivity studies of various biomolecules from medicinal plants of the Western Ghats, among others. Major projects of the Department include, identification of suitable alternates for jigat production in incense stick making, nutritional analysis and value addition of bamboo shoots and lesser known forest fruits. Studies on evaluation and efficacy studies of biopesticide formulations are also carried out in the Department.

## 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 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 establishment 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, impart training and create awareness amongst all relevant stakeholders about advances in forestry research.

## Forest Health

The Programme Division has Forest Entomology and Forest Pathology Departments. The Forest Entomology Department studies nature using insects. Currently, the Department focuses on the following major themes: (1) Revisiting forty-year-old insect collection sites: The Department holds an insect collection built up during the past four decades. The collection sites of these insects spread all forest types of Kerala. Supported by the Directorate of Environment and Climate Change, Govt. of Kerala, revisit of all the collection sites to undertake new collections using the same adopted methods are being carried out. A comparison of the insect assemblage at the sites across forty years so as to understand the changes especially in light of climate change is also in progress. Morphometry of the insects is also studied to detect drastic variations if any during this short time span. (2) As part of an all India coordinated project supported by ICAR, the genetic diversity of the Lac insects in Kerala, Tamil Nadu, Karnataka, Pondicherry and the Lakshadweep islands has been estimated. Efforts are in vogue to include lac cultivation in the homesteads of Kerala. (3) The Nodal Centre for Biological Invasions (NCBI) is an offshoot of the research on Invasive species conducted by the Entomology Department. The centre specialises on landscape level management of alien invasive plants, insects, snails and turtles. (4) The Department maintains a butterfly garden which helps close observations on





behaviour and natural enemies. The technique of establishing the garden has been shared to nearly hundred schools. Real time updates are happening through social media groups in which teachers and students are members. (5) The Department co-ordinates the Tree Health Helpline for KFRI which is a single window for the general public to address problems of pests, diseases, physiological issues etc. (6) First Question- a dedicated helpline to answer questions on science and nature from young kids is being run by the Department.

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 the 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 Food and Agricultural Organization (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 2021-22, KFRI has organized 6 training programmes and 2 Exhibitions. Twenty-three Institutions visited the Institute during the period.





## 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. The library has a core collection of more than 20,000 books and 2,000 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 interested. Online access to many of the core journals in forestry and allied subjects is made available, which includes both national and international journals. The library has also access to CAB's bibliographic database which covers the major subjects like agriculture, environment, forestry, etc. Its archives from 1939 are also possible to use. CAB abstracts now come with CABI full text and gives access to more than 220,000 journal articles, conference papers and reports. Online access to EBSCO database of Environment Complete is possible, which contains more than 2.4 million records from exceeding 2,200 national and international titles going back to 1888 as well as more than 190 monographs. The library collections include many of the valuable reference books, doctoral theses, publications of national and international bodies like Forest Research Institute (FRI), APAFRI, IRGWP, IUCN and IUFRO as well as databases in CDs and DVDs.

Online catalogue of books and back volume collections of the library



developed by using the software KOHA, open source Integrated Library Management software is made available to access. Digital collections of the library include research reports, scientific papers and other documents published by KFRI scientists, which is possible to access through the library intranet portal developed for the purpose. Digital resources of the library include KFRI Information Bulletins, Ph.D theses, Annual Reports and all the published issues of the Evergreen-KFRI Newsletter. Collections of Ebooks, Eprints, Indian Forest Records and Bulletins (publications of FRI) and the collections of bamboo, teak and cane literature are also possible to search and download. Digital resources of the library are organized by using the software Dspace, an open source repository software. This can be accessed by the scientists and research scholars from their desktops in the institute. The following are the important activities for creating fully fledged resource centre in tropical forestry.

#### Indian Forestry Abstracts (IFA)

Indian Forestry Abstracts (IFA) is a new venture of KFRI to present a comprehensive bibliography of current forestry literature published in India, along with an abstract for each citation. No such abstracting service exists for Indian forestry literature. The purpose of IFA is to ensure that Indian publications get their due attention from the national and international academic community. A large country like India, with its unique



forest types and practices need a country specific listing of research publications to make them more inclusive of Indian forestry, Indian institutions and independent researchers working in India. At present, Indian forestry doesn't have an exhaustive bibliographic information system and a single source or portal on forestry related topics where one can approach to have publications brought out by institutions in India. IFA is an endeavour to reach Indian forestry research to a wider national and international audience. The work undertaken by the library of compiling information for Indian Forestry Abstracts (IFA) and updating work of the website [www.ifa.org](http://www.ifa.org) is an on going process

### **Bamboo Information Centre - India (BIC)**

“Bamboo Information Centre - India” was established in 1989 with the financial support of the International Development Research Centre (IDRC), Canada with the

purpose of collection, documentation and dissemination of bamboo information for the easy access of users. Gathered information of published documents and information on bamboo species, researchers and artisans is consolidated and repackaged and brought to the public in different forms. Updating of the website developed for the purpose of achieving the ultimate aim of the project is progressing well. Our next attempt is to create a web portal for all the species of bamboo and collect comprehensive literature about each and every species.



## 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.



## FACILITIES

### Arboretum

KFRI Arboretum established in the Peechi campus in 2003 in an area of about 5 hectares, currently has 3400 accessions belonging to 195 species under 50 families and 130 genera, with more than 52 taxa endemic to southern Peninsular India. Arboretum is maintained with grid maps and markings of the location details of each of the live collection. Among the 195 taxa in the arboretum, there are 3 gymnosperms and 192 angiosperms. There are separate collections on Wild nutmegs, Dipterocarps, wild edible fruits etc., 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. The important trees include *Syzygium travancoricum* Gamble, *Vatica chinensis* L., *Dipterocarpus bourdillonii* Brandis, *Hopea racophloea* Dyer, etc. Various phenophases of trees species are regularly monitoring in the arboretum.

### Bambusetum

The KFRI-Bambusetum was established during 1988-95 as part of the IDRC Bamboo project at FRC campus Velupadam. The main objective is for the *ex situ* conservation of Indian bamboo species and to create awareness and promote the cultivation of bamboo and its products. A total of 75 species are growing well with 370 Accessions representing the Western Ghats, Northeastern States and Andaman & Nicobar Islands. The recent accessions include *Bambusa lako*, *Shibataea kumasaca*, *Teinostachyum wightii*, *Kuruna densifolia* etc., the collection also includes climbers (*Dinochloa andamanica*), monopodial or runner bamboos (*Melocanna baccifera*) and clump forming bamboos (*Bambusa bambos*), shrubs (*Ochlandra* species), among others.



## Bioresources Nature Park

The Western Ghats region of India is one of the hotspots of biodiversity in the world with rich plant and animal diversities, 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 Forest Research Institute, 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 Bioresource Nature Park at its Sub Centre in Nilambur. In this Park, plants are assembled in thematic areas such as, Orchid House, Fern House, Xerophytes and Succulent House, Medicinal Plants Garden, Herbal Garden, Palms and rattan Garden, Hydrophytes Garden, Butterfly Garden, Taxonomic Garden, RET Garden and Bambusetum. By having a rich plant diversity assembled in above mentioned theme areas, 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 values of the Bioresources Nature Park.



## Butterfly Garden

KFRI-Butterfly garden is one of the key attractions in KFRI campus. Recreation and maintenance of suitable habitats and the introduction of selected host plants are constantly assured in the facility. KFRI has



set up three butterfly parks- 1) in the KFRI main campus at Peechi, 2) in the KFRI Subcentre at Nilambur and 3) at Thenmala in the Ecotourism area. Attempts are also being made to establish such parks at Pathiramanal and Akkulam. Butterfly gardens have become very popular in recent years and are an attraction for school and college students from all over Kerala. Based on requests from appropriate authorities, we have established 86 Butterfly Gardens which offer the facility of researching in this group of insects. School students are interested in understanding the life cycle and metamorphosis of butterflies from these gardens. Research scholars monitor the population status of various butterflies in the garden, 3,890 sightings of

individuals belonging to 69 species were recorded during 2021-22.. Continuous monitoring and field observations noticed the incidence of various natural enemies, particularly parasitoids. A HI-FOCUS PTZ camera with a user-friendly mouse-driven interface with full remote network and mobile phone access has been placed in the centre of the garden to continuously observe and record the behaviour of the butterflies. 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.

### **Centre for Analytical Instrumentation - Kerala (CAI-K)**

The sophisticated analytical instrumentation facility; Centre for Analytical Instrumentation – Kerala (CAI-K) houses sophisticated analytical instruments required for chemical, environmental and life sciences research. The facility caters to a wide range of researchers, students, government and



non-governmental institutions and Research & Development labs in sophisticated analyses and instrumentation training. It was established as a state-of-art facility in a phase wise manner as a collaborative programme of Kerala State Council for Science Technology and Environment (KSCSTE) and Kerala Forest Research Institute (KFRI). It is included in the “Special Programmes of KSCSTE “and is a part of “impactful programmes Hon'ble Chief Minister of Kerala”. The Facility was inaugurated by Hon'ble Chief Minister of Kerala, Shri. Pinarayi Vijayan on 08 November 2018.

The overall performance of the Centre during 2021-22, can be categorized into two aspects, i) routine sample analysis and ii) training programmes. A total of 2055

samples were analyzed during the period from 01 March 2021 to 31 April 2022. The data clearly indicated an increase in the use of the facilities available in the Centre. The lockdowns and restrictions due to Covid-19 pandemic affected negatively on the routine functioning of the Centre in the initial months of 2021. Since the Centre conducts hands on training programmes, the lockdowns and restrictions made it impossible to conduct such programmes. A total of Rs. 9.06 Lakhs was generated during the period. The income generation was in the order, analytical charges - 73.93 %, Training programmes - 13.24 % and water quality analysis – 12.81 %. Among the users, 68.56 % were of internal users and 31.43 % were external users. Out of the total income generated, 61.26 % of income was from external sample analysis and 38.73 % from internal users. The major service of the Centre is sample analysis using different sophisticated analytical instruments. In some cases, pre-processing of the samples are also carried out by the Centre, wherever required. Three internship programmes were conducted during this period and the candidates were trained in operation,



handling, sample analysis, data evaluation, record keeping and maintenance of all the analytical instruments available at the Centre.

### Central Nursery

Located at the main campus of KFRI at Peechi, the Central Nursery houses one of the largest collections of propagules of native species in India. The collection includes around 200 high demanding species which comes under timber yielding, fruit bearing, avenue and medicinal plant categories. The nursery caters large number of stakeholders throughout India. The nursery has the facilities to grow plants in different habitats/climatic pattern also by various propagation methods. Hence along with Quality Planting Material production,



nursery is engaged in standardisation of nursery techniques of native, rare, habitat specific and economically important species. Moreover, the facility became an important unit with respect to large scale eco-restoration, resource augmentation and species recovery programmes, which are being implemented in collaboration with Forest Department, AYUSH Department, etc. As the nursery is functioning throughout the year it ensures the timely availability of planting material to the farmers, general public and other departments. Nursery also imparts training on nursery techniques of important forestry species including medicinal plants. Besides the above aspects, the nursery is engaged in handling a number of rare and threatened species from the Western Ghats, related to various research programmes conducted by the Institute. One of the important breakthrough in the research aspect of the nursery is the standardisation of Coir Root Trainers (CRT) in place of plastic containers and so far, the experiments showed promising results. The data generated in the nursery is highly valuable to the ongoing and future research activities. Apart from the above, nursery also provides employment



opportunities and income generation especially for the women. Over the period, the nursery has become a sustainable model of Quality Planting Material (QPM) production centre as well as a conservation oriented economically viable venture in forestry sector. During the financial year, more than 4 lakhs Quality Planting Materials of 235 native species were developed and distributed. In addition, nursery techniques for 12 commercially important species were standardized. The catalogue of propagules with details are available in the KFRI website.

### 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. The herbarium has over 18,000 specimens demonstrating more than 2,240 species from 203 families and is one of the major reference herbaria of forest plants. It has an 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 (203 spp.), Orchidaceae (185 spp.), Arecaceae (118 spp.), Fabaceae (115 spp.), Euphorbiaceae (108 spp.) and Rubiaceae (90 spp.). The herbarium is also represented with more than 96 species of pteridophytes and lichens representing shola forests of Kerala. 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.in/>. The website provides basic and advanced search capabilities. Default searches can be conducted in all fields of the herbarium database, while advanced search allows searches in specific fields.

### Insect Collection

The insect collection at KFRI is one of the best repositories of dry specimens of tropical insects, especially from the southern part of the Western Ghats. With around 50,500 specimens, which include representations from all major insect taxa, this facility opens not only wider research possibilities but also as a depository. Time-worn labels of specimens dating back from the year of the establishment of KFRI is under the process of re-labelling, and are under the process of revision. Studies on the inter and intra-specific morphological variations in insects can be carried out under this facility. Along with the vigilance and regular scrutiny of the specimens for the maintenance of the system, updation over the collection is also in progress. In the last financial year, around 14,500 specimens were included to the collection



from various projects handled in the Forest Entomology Department. Annually, many students from all tiers are often impressed to generate an inquest-attention to insects after their visit to KFRI-Insect collection. Specimens on loan are being shared with scientists and researchers from this facility to encourage partnership research.

### Kerala Forest Seed Centre (KFSC)

Kerala Forest Seed Centre (KFSC) established in 2003 as a collaborative venture of KFRI and Kerala Forest & Wildlife Department (KFD), is located in the main campus of the Institute at Peechi. The Centre caters the requirement of a wide range of stakeholders in forestry sector throughout India by providing certified seeds and seed handling





techniques as per the standards of International Seed Testing Association (ISTA). Though the major stakeholder is Forest Department, its service is being extensively utilized by various government and non-government departments, research institutions, universities, students, entrepreneurs, farmers, etc. KFSC has the storage facilities for tropical seeds, in addition has modern set of equipments to study seed science and technology. Recently, National Medicinal Plants Board, Government of India had sanctioned a megaproject to establish medicinal plant seed centre and seed museum in KFSC and on completion, it will become the first of its kind in India. KFSC is also engaged in developing branded seeds of important species like

Teak. This has helped to overcome the long unresolved issues related to the timely production of seedlings and plantation development. KFSC is working hand in hand with Forest Departments and Central Nurseries, hence able to develop viable seed handling and nursery techniques of many sensitive species/recalcitrant seeds, including rare and threatened taxa. In addition to supply of seeds, the facility is utilized for research in Seed Science and Technology on tropical forestry species and provides training to forestry professionals, researchers, students and others interested in seeds. The KFSC is also providing support to farmers, farmer clusters and farmers' cooperative societies to test, process and store the seeds developed by them for future use. On an average, KFSC is handling around 11-13 tons of seeds/year. During the financial year, 11.25 tons of 51 forestry species have been collected, processed and distributed to the stakeholders throughout India. The catalogue and timely availability of seeds are available in the website.

## Medicinal Plants Garden

The medicinal garden at Peechi campus spreads over in 0.6 hectares, consisting of more than 400 species of medicinal plants including herbs, shrubs, climbers and trees. It is maintained as a reference collection of authentic medicinal plants of Kerala forests. The collection of garden is enriched by bringing plants from wild or through exchange with other botanical gardens. In 2021-22, 248 accessions of 148 spp. were collected, of which 33 species were new introductions. As part of labelling the potted and field plants, 80 labels for 68 species and for 3 special groups were displayed. As part of plant multiplication, 50 species covering 677 medicinal plants were raised and maintained for supply on demand. As part of QR code preparation of plants, detailed



information of 120 species along with videos and images were prepared. During the period, 140 individuals comprising 9 groups covering school/college students, researchers and general public were visited the garden.

## Orchidarium and Fernery

Orchids and ferns are peculiar group of plants with wide range of economic and conservation importance. The Orchidarium and Fernery are meant to provide artificial habitats for orchids and ferns and helps in the *ex-situ* conservation, multiplication, besides providing materials for study purposes. Though there are about 265 species of orchids and 298 species of pteridophytes recorded from Kerala, some species are known only by their type collections and a few are presumed to be extinct.



At present, the Orchidarium/Fernery of KFRI conserves 245 species including Rare, Threatened, Terrestrial, Epiphytic species of Orchids and Ferns, also maintaining some rare ornamental orchids and Ferns. During 2021-22, eight rare and threatened species of orchids and ferns were added to the Orchidarium. Apart from conservation, popularisation of few native orchids and ferns as wild ornamental are also going on with the facility.

### Palmetum

Palmetum is a live collection of indigenous and exotic palms. KFRI Palmetum was established in the year 2000. The collection includes a total of more than 320 accessions representing 160 species of palms under 57 genera with 8 species critically endangered, 9 endangered, 8 vulnerable and 23 near threatened categories as per IUCN standards. The species like *Pinanga manii*, *P. gracilis*, *Bentinckia condapanna*, *Bentinckia nicobarica*, *Rhopaloblaste augusta*, *Calamus andamanicus*, *C. brandisii*, *C. vattayila*, *Wallichia disticha*, *W. nana*, *Korthalsia laciniosa*, *Korthalsia rogersii*, *Licuala spinosa* as well as mangrove species like *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. Recent accessions include *Chamaedorea metallica* O. F. Cook ex H. E. Moore.

### 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 Department of Science & Technology (DST) in 1999 [presently funded by Ministry of Earth Sciences (MoES)] for strengthening earthquake monitoring in the Peninsular India and for improving the location of earthquakes as well as azimuthal coverage in the shield region.



The observatory is functioning well and generating high quality data. The data recorded at Peechi observatory is used for detailed studies of local and regional earthquakes and is also useful for evaluating the seismogenic potential of Peninsular India and especially in the Western Ghats region in Kerala. The data is systematically archived on hard disks/DVDs. The observatory provides data to government agencies as well as other research institutes, which are used for the disaster management planning and various research works. The observatory plays host to a remarkable number of visitors including students and serves as a good educational facility to the public. The 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 including 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. This observatory is also used for training and education purposes.

### 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 ecosystems 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. 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. The museum has a collection of soil monoliths featuring the soils in different types of forests *viz.* shola, grasslands, evergreen, semi-evergreen, moist and dry deciduous, bamboo, teak plantations, degraded forests and agroforestry systems in Kerala. Currently, there are 15 soil monoliths in the museum which depict the variation in morphological properties of soil beneath different forest ecosystems in the Kerala part of the Western Ghats.

## Teak Museum



Teak holds a special position in the world of timber. Kerala has always had a deep involvement with its cultivation and trade. Nilambur, located in Malappuram District of Kerala State, is the place where India's first Teak plantation was raised during the 1840s, paving the way to ensure the steady supply of teak timber in the face of dwindling resources in natural forests. Thus, Nilambur is now globally known as the home to the earliest plantations of the world and also as the region where finest quality teak is cultivated. 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, KSCSTE-Kerala Forest





Research Institute has established a Teak Museum in its Sub Centre campus and it was opened to the public on 21<sup>st</sup> 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 and exhibits in the Museum explain the numerous facets of teak research that KFRI has undertaken and offer a glimpse of the multifarious uses of teak timber. The artefacts include traditional household objects like the granary, swing cot, cloth-chest, among others. 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, etc.

### Tree Health Helpline

Tree health helpline as its name implies,

attends queries related to all aspects of tree, like species–site matching, planting, species identification, soil testing, fertilizer application, physiological problems, pest & disease management and invasive species management. It also provides consultancy services for landscape-level afforestation programmes. The services are provided by a team of scientists from the Entomology, Pathology, Soil Science, Silviculture, Botany, Wood Science and Physiology Departments. During 2021-2022, a total of 98 queries were recorded in tree health helpline. The problems were multidisciplinary comprising of Tree status enquiry (23), tree management (15), pest attack (9), fungal problems (8), species–site matching (2), species identification (1), species information (23), fertilizer application (1), planting techniques (4), wood quality (2), parasitic issues (2), seeds & seedling availability (1), *Ambrosia* beetle issue (3), etc. *Ambrosia* beetle – wood borers made pinholes in fuel pipes in cars and caused damage. Cases were reported from Pathanamthitta, Kannur, Palakkad and Thrissur districts. Sample collection and identification were executed and management aspects are currently underway. The facility assisted in transplanting custard apple tree in Alappuzha and assessed health status of various trees such as *Tectona grandis*, *Artocarpus heterophyllus*, *Ficus benghalensis*, *Pterocarpus santalinus*, *Mangifera indica*, and *Alstonia scholaris*.



## Wildlife Museum



The wildlife museum, attached to the Department of Wildlife Biology has a comprehensive collection of specimens belonging to various taxa from different parts of the Western Ghats, collected as part of the projects undertaken by the department since 1978. The collection includes more than 1000 specimens of invertebrates, mammals, birds, fishes, reptiles and amphibians. The collection has 76 amphibians including rare and endangered living fossil, *Nasikabatrachus sahyadrensis*, 95 reptiles including rare coral snakes, “big four” venomous snakes, their mimics and many rare and elusive species, 49 mammals include rare little Indian porpoise, flying squirrels, spiny dormouse, and 8 aves. The collection at the



museum is used for graduate and undergraduate training, species identification workshops and educational programs by the national, state and local agencies. The major objective is to support and encourage morphology based taxonomy research and education, which will establish KFRI as a key reference facility in Kerala addressing issues, such as, wildlife conservation, endangered species recovery, native fish decline, landscape ecology, systematics and biodiversity studies, participatory science. The Wildlife Museum also act as a major resource for conservation awareness for wildlife and zoology students and trainees from the forest departments across India.



## Xylarium



Xylarium is a collection of authenticated wood specimens that is well-curated and accessible to the scientific community. Xylarium is mainly intended to display the wood collections for scientific research, teaching, environmental education and other xylarium programmes. KFRI xylarium was established in the year 1979 and has a collection of 815 specimens (154 timbers from Kerala, India and the rest are obtained on a mutual exchange basis from



herbarium specimen is deposited in the KFRI Herbarium with the same accession number except for the foreign wood samples collected on an exchange basis. The Xylarium of KFRI has been indexed in the *IAWA Index Xylariorum 4.1 (2016)* - a directory of Institutional Wood Collections from around the World.

14 foreign countries. The collection includes representing from countries like Australia (53), China (55), Canada (31), Germany (34), Japan (53), Philippines (30), Brazil (27), Netherlands (47), United Kingdom (30), Myanmar (23), Portugal (38), United States (75), Bangladesh (52), lesser known timbers of Kerala (92), other miscellaneous (21). The xylarium database has detailed records, family name, species name, original wood specimen no. (for specimens obtained from other xylarium), collection date, collector(s) name, herbarium no. of the voucher specimen, country, altitude, latitude, longitude, habit, habitat, various notes, and note on collection or accession. For every wood specimen, a corresponding voucher

## REGIONAL CENTRES



### **Bamboo Technical Support Group - South Zone (BTSG)**

The Bamboo Technical Support Group (BTSG) South Zone is hosted at KFRI and supported by the National Bamboo Mission of the Ministry of Agriculture and Cooperation to serve as a unit providing support to the National Bamboo Cell in technical and research matters. BTSG-KFRI has been conducting training programs for field workers in various southern states for the last several years. Our training support includes resource enhancement through propagation technology, establishment and management of plantations, value addition of bamboo produce through preservative treatment and proper utilization for various end uses, advice to farmers and State Bamboo Missions on the suitability of species for different regions and land types etc. Currently BTSG has the following facilities (1) Bamboo Bazar: For marketing bamboo Products, (2) Bamboo Processing Centre: For working artisans & developing innovative products through training programmes, (3) Bamboo Waste

Management Unit: For production of Biochar & Compost, (4) Bamboo Agro-Forestry Trails: For promoting bamboo in homesteads cultivation, (5) Bamboo Nurseries: Production of quality planting materials, (5) Germplasm Collections: Identification of superior genotypes, molecular characterisation and establishment of germplasm, (6) Bamboo Edible Shoot Processing Unit: For standardising and production of value added products from bamboo shoots and (7) Tissue Culture facility: Standardisation of commercially important species.

In addition to this, a website is being prepared by BTSG for bamboos including prepared by BTSG for bamboos including species database, bamboo cultivation details and forming a network of bamboo farmers, nurseries, artisans and researchers, etc. The information in these directories is collected from both primary data and open access online sources and also from direct submission from the participants. The collected information from the various sources is cross-verified by contacting the concerned person through telephone and hope this directory will immensely help the stakeholders.

### **Regional Cum Facilitation Centre - Southern Region (RCFC-SR)**

The Regional cum Facilitation Centre-Southern Region (RCFC-SR), one of the seven RCFCs of the National Medicinal Plants Board (NMPB) was established in KFRI in October 2017 to serve as a one stop shop for all matters related to the medicinal plants in the southern region of India. The RCFC-SR provides technical

inputs to stakeholders for enhancing their managerial and technical skills, developing agro-technology of medicinal plants, facilitating production and distribution of quality planting materials (QPMs) apart from providing technical assistance to various organizations in formulating project proposals in the priority areas identified by NMPB, and attending to field assessment/evaluation of NMPB projects and other works assigned by NMPB from time to time. The overall objective is to streamline and strengthen the activities of NMPB in five states (Andhra Pradesh, Karnataka, Kerala, Tamil Nadu, Telangana) and three Union Territories (Puducherry, Lakshadweep, and Andaman & Nicobar Islands). The activities of the RCFC (SR) are monitored periodically by NMPB. RCFC-SR maintains strong linkages with several government and non-government organizations, and farmers' groups for effective implementation of its activities. Close interactions with Departments of Forest, Agriculture and PWD help in implementation of several programmes. For effective implementation of various programmes, RCFC-SR associates with financial agencies such as NABARD and other commercial banks; agencies such as Kerala Forest Development Corporation (KFDC), Kerala State Tribal Welfare Department, Kerala Institute of Local Administration (KILA), Ayurvedic Medicine Manufacturers Organization of India (AMMOI); various Universities and research institutions like Tamil Nadu Agricultural University (TNAU), Centre

for Medicinal Plants Research (CMPR) of Arya Vaidya Sala, Kottakkal (AVS), CSIR-Central Institute of Medicinal and Aromatic Plants (CSIR-CIMAP), etc.

During the financial year 2021-22, a total of 13 trainings were organized in different states and UTs of southern region, and 552 farmers were given training in medicinal plants farming and exposure to the activities of NMPB and RCFC (SR). With respect to QPM Network, one of the successful initiatives to facilitate sustainable cultivation, 8 new QPM projects were implemented for production of 4,59,000 QPMs of 27 species of the Medicinal plants in the five southern States. Apart from trainings, 4 seminar/workshops were organized. The RCFC-SR team members also participated as resource persons in 15 seminars/ workshops organized by other institutions/ agencies. As part of monitoring and evaluation, 16 NMPB projects were monitored in Andhra Pradesh, Karnataka, Kerala, Tamil Nadu and Telangana and the reports were submitted to NMPB. The centre expedited submission of 9 Utilization Certificates by various project implementing agencies to NMPB. Collection of market price from the southern region and its trend analysis for the period April 2021 to March 2022 were carried out. It also assisted 5 stakeholders to establish linkages. A documentary entitled *Saraca asoca* (Ashoka): A tree for sorrow-free life' was prepared. The Centre to its credit has seven scientific papers, an information bulletin and an IEC brochure. During the reporting period, the Centre organized 7 meetings

and the team members participated in 28 meetings. Overall, 66 extension works and expert services were taken up, apart from providing inputs to NMPB on Parliament Questions.

## GLOBAL NETWORKS

### TEAKNET (International Teak - Information Network)

TEAKNET is continuing to foster the exchange of information on teak in 2021-2022 through compilation teak market information, updating of its website and dissemination through periodic release of the online TEAKNET Bulletin. In addition, TEAKNET is organizing the 4<sup>th</sup> World Teak Conference in Accra, Ghana from 05-08 September 2022. This is for the first time that the WTC will be held in an African nation. In Ghana, teak is reported to have been introduced as early as in 1905 and constitutes 70 % of all plantation species in the country.

The total area of teak plantation is estimated 180,000 ha, of which 60 % is owned by the public sector with the remaining by the private sector. The 4<sup>th</sup> World Teak Conference (WTC) is being organized by the International Teak Information Network (TEAKNET) in collaboration with Forestry Commission, Ghana, Africa with the support of the Food and Agriculture Organization of the United Nations (FAO), International Tropical Timber Organisation (ITTO), and the



IUFRO Teakwood Working Party. The WTC will focus on the current state of knowledge and future challenges for the sustainable development of the global teak sector in a changing world. The events/activities organized by TEAKNET during 2021-22 include (1) TEAKNET organized a side event virtually during the IUFRO World Day during 28<sup>th</sup>-29<sup>th</sup> September 2021, (2) Four issues of quarterly electronic Newsletter-*TEAKNET Bulletin* prepared and disseminated, (3) Published six bi-monthly ITTO Teak Mekong Newsletters, (4) Conducted two webinars on different themes related to teak by experts in the specific topics and disseminated the information through the website, (4) A dedicated website was launched for the 4<sup>th</sup> World Teak Conference (<https://www.worldteakconference2020.com>) and undertook preparatory works for World Teak Conference in 2022.

### TreeWatch.net

TreeWatch.net is a global network for monitoring tree hydraulics and carbon sequestration in the context of Climate Change. This is a unique tool to understand hydraulic functioning and growth of trees. Dendrometers and sap flow sensors have the potential to detect stress from individual trees (and subsequently forests) in real-time. At a time, when climate change is posing a serious challenge, Kerala Forest Research Institute (KFRI) and Ghent University, Belgium joined hands to study the consequences of climate change on different forest ecosystems, especially mangroves on the coastal areas of the State. With this, KFRI has become the first and only collaborative institution in this network from outside Europe. <https://treewatch.net/in-ashtamudi/>

## RESEARCH AND EXTENSION

### Completed Research Projects

#### KFRI Research Report No: 575

#### Bamboo Technical Support Group (BTSG) Training.

##### Raveendran VP

The National Bamboo Mission (NBM) has set up three Technical Support Groups in three regions of the country, which include (i) Cane and Bamboo Technology Centre (CBTC), Guwahati (ii) Indian Council of Forest Research & Education (ICFRE), Dehradun and (iii) Kerala Forest Research Institute (KFRI), Peechi. The Bamboo Technical Support Group (BTSG) - KFRI covers six southern states *viz.*, Kerala, Karnataka, Tamil Nadu, Andhra Pradesh, Goa and Maharashtra. The BTSG hosted at KFRI is to serve as a unit providing support to the National Bamboo Cell in technical and research matters. The BTSG also offers training in resource enhancement through standardization of propagation technology, establishment and management of plantations, value addition of bamboo produce through preservative

treatment and proper utilization for various end uses, advice to farmers and State Bamboo Missions on suitability of species for different regions and land types, etc. BTSG-KFRI has been involved in training of field functionaries of the various southern States for the past several years. As per the objectives of the action plan 2021-2022, five training programmes were organized.

#### KFRI Research Report No: 576

#### Impacts of bioshields on carbon sequestration along the coastal areas of Kerala

##### Balagopal M | Raveendran VP | Sandeep S | Seetha Lakshmi KK | Soman C

Tsunami, which struck on the Indian Ocean on 26<sup>th</sup> December 2004, was one of the worst disasters in terms of the loss of human life and damage to property in coastal areas of Kerala State. Scientific investigations have been carried out by different agencies to understand the impact of Tsunami on various aspects such as marine ecosystem, fisheries, water quality, soil status and vegetation including mangroves, etc. The Disaster Management Department, Government of Kerala, had



Participants of the training



Bioshield Established along the coastal areas

launched several short and long term projects. KSCSTE had been entrusted with the responsibility of establishment of shelterbelt (bioshield) plantations in the coastal areas of Thrissur District. Shelter belts with trees act as a remedy to combat global climate change. Trees can capture atmospheric CO<sub>2</sub> through photosynthesis and store it in biomass with a turnover time of several decades. The present project evaluated the post establishment monitoring of the bioshield established by KFRI during 2009-10 and assessed the carbon storage in these green shelter belts. The initial bioshield project had experimented with fifteen species and major area was planted with *Casuarina equisetifolia*. The present study is hence confined to this particular genus. Samples of *C. equisetifolia* (branchlets, branches, stems and fine roots) at each individual plot were collected and analyzed for their relative carbon concentration. *C. equisetifolia* plantations (5 years old) was found to rapidly accumulate large quantities of biomass, which was relatively higher than other tropical trees of the same age. Out of the 65.07 ha planted with *C. equisetifolia* as bioshield in 2009-10, only 18.96 ha survived after four years. The above ground biomass, below ground biomass and total biomass analysed showed  $35.39 \pm 10.67$ ,  $7.25 \pm 1.45$  and  $42.61 \pm 12.11$  mg/ha, respectively. The estimated carbon stocks in the soil was  $100.62 \pm 19.01$  kg/ha and was found to decrease with depth.

#### **KFRI Research Report No: 577**

#### **Restoration and reassessment of selected IUCN listed endangered trees in the Western Ghats**

**Jose PA | Sreekumar VB | Sujanapal P**

Distribution, ecology, biology, and conservation aspects of three endemic and endangered dipterocarps viz. *Hopea sasidharanii* Robi & Sujanapal, *Vatica chinensis* L. (Western Ghats, Sri Lanka) and *Vateria macrocarpa* Gupta. of the Western Ghats, Kerala were studied, to understand the causes of rarity and develop vegetative propagation as well as seed germplasm storage methods for conservation of these species. Attempts were also made to enhance the existing natural resources through augmented seedling planting. The study further assessed the post-restoration survival and growth of the seedlings in the earlier restoration projects of the Institute. An important outcome of the project is the identification of a single population comprising six adult individuals and three seedlings (>1m) of *H. sasidharanii* at Sankhili forests. Based on the population ecology and diversity analysis, the species is suggested to be placed under Critically Endangered category as per IUCN guidelines. *Vateria macrocarpa* is a critically endangered species with restricted distribution in the evergreen forests of Varadimala, Siruvani and Muthikulam of Palakkad district, Kerala. Extremely low extent of occurrence, long intervals of flowering, recalcitrant nature of seeds and unscientific extraction of

stem bark were observed in the species. Vegetative propagation through air layering (NAA, 1000 ppm) in young stands registered 75 % success within 2-3 months. *Vatica chinensis* is another sparsely distributed species, confined to west coast regions of Kerala especially in sacred groves of northern Kerala and eleven populations were identified. Irregular flowering, insect pollination, recalcitrant seeds and habitat loss were noticed in the species. Vegetative propagation through branch cutting and air layering were hundred per cent successful. Among the 15 species already reintroduced during 2010-2020, the survival percentage of 13 spp. viz. *Dipterocarpus bourdillonii*, *Humboldtia bourdillonii*, *Drypetes malabarica*, *Gymnacranthera farquhariana*, *Hopea erosa*, *Hydnocarpus macrocarpa*, *Kingiodendron pinnatum*, *Knema attenuata*, *Myristica beddomei*, *Myristica*

*malabarica*, *Myristica fatua* var. *magnifica*, *Coscinium fenestratum* and *Dysoxylum malabaricum* were above 40 per cent, while species such as *Cynometra beddomei* and *Hopea racophloea* recorded poor survival.

#### **KFRI Research Report No: 578**

#### **Pilot scale micro-propagation of important forestry species.**

#### **Muralidharan EM**

Micropropagation of teak (*Tectona grandis*), three species of bamboo viz. *Bambusa balcooa*, *Dendrocalamus longispathus*, *Pseudoxycanthanthera stockii* and a medicinal plant *Embelia tsjeriamcottam* was carried out with the objective of developing protocols for scaling-up the laboratory protocols. The present study aimed to develop procedures that improve efficiency of regeneration as well as low cost of multiplication and plantlet production. In teak, establishment of multiple shoots from epicormic shoots induced on branch cuttings was preferred over dormant shoot tips. After washing of explants for one hour, shoot initiation was carried out on a medium consisting of WPM + BAP 1  $\mu$ M + Sucrose 2 % (w/v) and shoot multiplication on medium consisting of WPM + BA (2.5  $\mu$ M) + Kin (0.25  $\mu$ M) and sucrose 2 % (w/v). *Ex vitro* rooting of microshoots using a 10 min. dip in 100  $\mu$ M IBA was successful which saved time, effort and costs involved. Plantlets could be shifted to nursery after a 4-week hardening period with 100 % survival. Procedures for *in vitro* culture of



Post restoration monitoring *in situ* : *Drypetes malabarica*



selected bamboo species were developed using explants collected from mature clumps of *Bambusa balcooa* and *Pseudoxytenanthera stocksii* and using seeds of *D. longispathus*. Nodal explants taken from branches of the current year culms were used as explants and shoot cultures were established in *B. balcooa* and *P. stocksii* through sprouting of axillary buds and multiple shoot formation in liquid media. In *Embelia tsjeriam-cottam*, a medicinal plant of great importance to Ayurveda, shoot cultures were established from nodal explants collected on solid MS media with IBA (0.49  $\mu\text{M}$ ) and BAP (22.20  $\mu\text{M}$ ) or TDZ (1.13  $\mu\text{M}$ ) and sprouted explants were transferred to solid or liquid medium of same composition for shoot multiplication. Shoot cultures grew well on polyurethane foam floats on liquid medium with their lower portion immersed in the media. Higher biomass as well and shoot numbers were obtained in liquid medium using a simple bioreactor with aeration as well as pH regulation. *Ex vitro* rooting was obtained in 98.02 % shoots treated with IBA (4.93  $\mu\text{M}$ ) for 30 min. Eighty per cent of the plantlets which survived hardening were shifted to a mixture of soil, sand and brick pieces and showed a survival rate of 98.3 %.



Shoots cultures of *E. tsjeriam-cottam* on solid multiplication medium and liquid medium

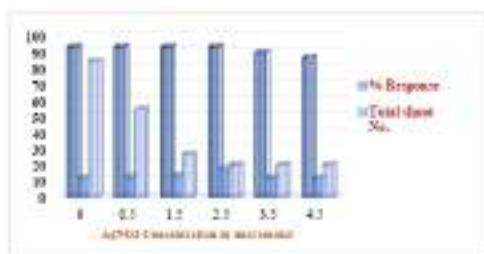
## KFRI Research Report No: 579

### Forestry programme for KFD in teak, bamboo and other important forestry species.

#### Muralidharan EM

Tissue culture of Andaman padauk (*Pterocarpus dalbergoides*), teak (*Tectona grandis*), rosewood (*Dalbergia latifolia*) and selected bamboo species was carried out with the objective of developing micropropagation protocols. In *P. dalbergoides* and teak, best results were obtained for shoot tips and nodal explants collected from epicormic shoots, induced on branch cuttings of mature trees and maintained in the greenhouse. Highest establishment of shoots in *P. dalbergoides* was obtained on Woody Plant Media (WPM) supplemented with 4.40  $\mu\text{M}$  of BAP and activated charcoal (2 g/l). In teak, shoot initiation was carried out on WPM + BAP 1  $\mu\text{M}$  + sucrose 2 % and shoot multiplication on WPM + BA (2.5  $\mu\text{M}$ ) + Kin (0.25  $\mu\text{M}$ ) + sucrose 2 %. *Ex vitro* rooting of microshoots using a 10 min. dip in 100  $\mu\text{M}$  IBA was successful with a percentage of  $85 \pm 9.6$  % rooting and plantlets showed 100 % survival. In rosewood (*Dalbergia latifolia*), axillary buds from mature plants and root suckers were used as the explants to initiate cultures. Axillary buds from root suckers at BAP 2  $\mu\text{M}$  in MS medium along with 1.5 to 4.5  $\mu\text{M}$   $\text{AgNO}_3$  (to prevent leaf fall) gave a better response in terms of per cent of shoot initiation, shoot number and shoot length. Rooting in microshoots was achieved with 0.5 to 2.0  $\mu\text{M}$  of IBA

followed by transfer to  $\frac{1}{2}$  MS for further root development. Plantlets were hardened by transfer to vermiculite and was kept under mist for 3 weeks. Shoot cultures were established in six selected bamboo species through sprouting of axillary buds and multiple shoot formation from nodal explants. The buds at the 4-7<sup>th</sup> position from the base was the best in all the parameters. MS medium supplemented with BAP elicited a better response at 10 and 15  $\mu\text{M}$ . Best initiation was obtained when seeds were used as explants in *D. asper* and *D. giganteus* at 10  $\mu\text{M}$  of BAP or Kinetin. March to May was the best season in the year for collection of explants and to initiate the cultures in all the six species.



Effect of AgNO<sub>3</sub> in combination with 2.5  $\mu\text{M}$  BA supplemented MS medium on shoot multiplication of *D. latifolia*

## KFRI Research Report No: 580

### Exploring the potential for hybridization in flowering bamboo species in KFRI Bambusetum.

Muralidharan EM

Simultaneous gregarious flowering of five species of bamboo in the Bambusetum of the Institute and adjoining areas occurred during the period November 2013 to May 2017. The flowering clumps included introduced species and natural populations

of *Bambusa bambos*, *Dendrocalamus asper*, *D. giganteus*, *Pseudoxytenanthera stocksii*, *D. strictus* and *Ochlandra travancorica*. Studies on the floral biology and early hybridization attempts of the species are presented. Reciprocal crosses between the flowering species were undertaken after ascertaining the anthesis and stigma receptivity duration. Methods were tested to obtain viable pollen from excised anthers. Among the variety of bagging devices tried to prevent undesired pollination, non-woven cloth bags were better than any other adopted methods. Sterility in *P. stocksii* was confirmed due to the low pollen germination and mismatch in pollen tube length and the style length. To circumvent the barrier, a cut-style technique was tested but fungal contamination hampered the results. Pollen storage methods were also tested using organic solvents for viability at different time intervals. Untreated pollen lost viability in 4 days. Solvents that gave best results were petroleum ether > acetone > petroleum benzene/benzene > chloroform while benzyl alcohol, methanol and ethanol gave very poor results. Pollens stored in petroleum ether maintained its



Fresh sprouts in flowered clump of *P. stocksii* subjected to light fire treatment

germination up to 240 days of storage at 4°C. Putative hybrid embryos were generated in crosses between *D. giganteus* × *D. asper* and *D. strictus* × *D. asper*. The *D. giganteus* × *D. asper* seeds (4 nos.) germinated to form plants. The difficulties encountered in hybridization include the lack of a reliable method to ensure controlled cross-pollination, problems of fungal and insect infestation and lack of tools to rapidly confirm hybrids.

### **KFRI Research Report No: 581**

### **BTSG - Tools for management and harvesting operations in bamboo.**

#### **Muralidharan EM**

Management of bamboo clumps and harvesting operations have been traditionally done by skilled workers using simple tools like knives. With the increase in large-scale bamboo plantations, it has become necessary to improve the efficiency of the tools and the procedures. In this study, the development of simple and appropriate tools for management and harvesting operations in bamboo plantations was attempted with minimum modifications to the existing hand tools and powered hand held tools. Trimming of branches of some species of bamboo like *Bambusa bambos*, *B. balcooa* and *D. nutans* with dense entangled mass of lower branches requires a tool with a narrow profile. Two devices were tested for the purpose 1) An improvised light weight and simple pruning tool for trimming the lighter branches that are beyond the reach from the ground. The developed tool with a

pair of secateurs or pruners, the handles of which are inserted and fixed into a pair of grooved aluminium tubes, is convenient for unskilled workers to operate. 2) For the branches, which are beyond the reach from the ground, a petrol-powered pole pruner with a small chain saw fixed at the end of a telescopic shaft (extendable pole) and with controls at the handle, was found more suitable. Appropriate tools for extraction of rhizome offsets as well as harvesting of culms were evaluated. The electrically powered demolition (impact) hammer with a modified chisel tipped bit was tested for removal of rhizome offsets without damage. A modified knife design with a curved cutting edge and a thick upper edge was evaluated for efficiency in harvesting of bamboo culms. For extraction of young bamboo edible shoots, a trowel with a curved cutting edge and handle was found suitable when used with a mallet. Use of soil augers and small earth moving equipment for pitting during establishment



Powered diggers with a choice of digger heads

of bamboo plantations is recommended in large scale ventures. Use of mechanical pulverizer /shredders for processing of the harvest residue and conversion to pellets for downstream processing for specific applications or composting for better nutrient cycling is suggested for overall profitability of bamboo plantations.

### **KFRI Research Report No: 582**

#### **Fire as a Management Tool: A case study from selected forest ecosystems in Kerala.**

**Sreejith KA | Easa PS | Sandeep S | Sujatha MP | Sreekumar VB | Mallikarjuna Swamy GE | Mohandas K**

Habitat management strategies across the globe often focuses on flagship species, especially large threatened mammals. Prescribed burning for habitat management is a controversially debated method to manage open habitat types by natural resource managers to accomplish specific management objectives like wildfire hazard reduction, ecosystem restoration, maintain natural succession, increase forage for wildlife, reduce fuel loads by managing weeds, disease management, wildlife habitat improvement, etc. In Eravikulam National Park of the Western Ghats (Kerala, India), this method is practiced as a tool to manage the habitat of the endangered Nilgiri tahr, *Nilgiritragus hylocrius* (an endemic goat) at a large scale (50 ha. grids). In this regard, a scientific study was carried out to assess the impact of frequent fires at two forest ecosystems, Parambikulam Tiger Reserve (PKLMTR) and Eravikulam National Park



Prescribed Burning in Eravikulam

(ENP) in Kerala. Soil analysis indicated that frequent fires can deplete the soil health due to the accumulation of transformed minerals like metakaolins and inert resistant minerals like hematites. Soil microbial analysis showed a gradual recolonization of microbes with varied effects of fire on species composition, frequency, and density, depending on factors like soil moisture, sampling depth, fire intensity, and timing of post-fire soil sampling. The impact of the fire management practices on insect (grasshopper) abundances was compared using large-scale burning prescribed in ENP and with small-scale burning in PKLMTR. After the fire events, grasshopper abundance was higher in smaller grasslands of PKLMTR than in larger grasslands of ENP. PKLMTR and ENP with diverse habitat and species composition also displayed varied impact of fires. In ENP, amphibians and reptiles were also found impacted due to the burning practice. Slow recovery of amphibian populations was also observed through controlled burning experiments in small patches at Kambipalam and

Sambamala. Thus, burning of larger contiguous areas resulted in poor recovery of insects and amphibians after the fire events, whereas burning small patches in a mosaic pattern facilitated the rapid recovery of the species communities. Our results suggest that burning management can be optimized to benefit both the flagship vertebrate species as well as species-rich invertebrate communities. The large-scale burning practice in ENP can be reviewed based upon the findings of the study, particularly, the impact of burning on soil, microbes, flora and fauna.

### **Research Report No: 583**

### **Bamboo Technical Support Group (South Zone) Coordination**

#### **Muralidharan EM**

The Annual Action Plan (AAP) for 2015 of the Bamboo Technical Support Group (BTSG-KFRI) was approved by the National Bamboo Mission (NBM), New Delhi for a total budget of Rs. 81.31 lakhs. Activities approved by NBM included training of farmers, artisans and field functionaries of State Bamboo Mission, upgradation of the Bamboo Primary Processing Centre (BPPC), development of database for the BIC-India and research and development projects on development of DNA barcodes for bamboo (2<sup>nd</sup> year), plant growth enhancing microbes and on development of harvesting tools for bamboo. Each of 11 activities approved under the AAP were given separate KFRI Research Project numbers with a Principal investigator and associate investigators.

The activities undertaken in the component on Coordination of the BTSG included liaison with the NBM headquarters and interaction with the officials of various state missions and other organizations in the bamboo sector. Meetings were attended at NBM, New Delhi, queries from Lok Sabha or from other agencies were answered or technical advices were offered to the DDG (NBM) regarding policy issues. Interaction with the Kerala State Bamboo Mission and the Kerala State Bamboo Corporation was continued in the form of technical advice on cultivation of bamboo and other aspects and as member of various committees set up during the period. One of the most important functions of BTSG coordination was catering to information requirements of the bamboo stakeholders. The queries received through personal visits, phone calls and emails were attended. Advice on the selection of suitable bamboo species for various locations and end uses were given. Field visits were also undertaken to the sites.



The BPPC Workshed at Velupadam      Products exhibited in Bamboo Fest

**Research Report No: 584****Bioactivity guided fractionation and mechanistic elucidation of biomolecules from *Cocculus laurifolius* DC. of southern Western Ghats****Jayaraj R | Sujanapal P**

Exploration, extraction and screening of biological diversity and indigenous knowledge for commercially valuable genetic and biochemical resources is a continuous ongoing process. One such major activity is the identification of novel bioactive molecules from plants for drug development along with their diverse applications including fragrance extraction, pest control, extraction of essential oils, cosmetic applications and in food industry. The current project was formulated with the objectives to identify the biologically active molecules from *Cocculus laurifolius* DC., to study the bioactivities and understand the mechanistic aspects of the bioactivities. The bark and leaves of *C. laurifolius* were extracted using different solvents and chloroform extract contained the maximum number of phytochemicals including alkaloids, anthocyanin, isoflavones, flavonoids, tannins, saponins, lignins, phenols and coumarins. The extracts were fractionated based on bioassays and the most active fraction is found to be cytotoxic to human cervical cancer cells and murine macrophage cells with an IC<sub>50</sub> of 35 µg/ml and 200 µg/ml, respectively. The cells showed typical apoptotic morphology including cell shrinkage, blebbing and destruction of

actin filaments and cellular structure. The bark chloroform extract had shown potential antimicrobial activity against *Staphylococcus aureus* and *Klebsiella pneumoniae*. The methanolic extract of both leaf and bark of *C. laurifolius* showed anti-feedant, repellent activities and contact toxicity at varying degrees. The present study had brought out the cytotoxic, anti-microbial and pesticidal properties of *C. laurifolius*. Among this, the cytotoxic and pesticidal properties were reported for the first time. Exploring the pesticidal properties of crude extract and developing appropriate formulations may help in developing cost-effective and eco-friendly technologies for pest control in agriculture and related fields.

*Klebsiella pneumoniae***Research Report No: 585****Pedogenic influences on vegetation in the mangrove ecosystems of Kerala****Sandeep S | Sreejith KA | Sreekumar VB**

Mapping of mangrove vegetation showed that the extent of mangrove in the coast of Kerala is about 921.29 ha. Kannur (424.31 ha) is the district with highest amount of mangrove vegetation followed by Ernakulum (191.61 ha). For the present study, the entire mangrove area in Kerala

was classified into three zones: (i) north of Palakkad gap (northern zone); (ii) between Palakkad gap and Chenkotta gap (central zone) and (iii) south of Chenkotta gap (southern zone). The soil physico-chemical properties of the mangrove systems in Kerala indicated two textural classes: a relatively finer sandy clay loam and a coarser sandy loam. Out of the three zones of Kerala with slightly neutral pH, the central zone, can be considered highly nutrient rich and high in organic carbon. However, free exchange of mangrove water (along with nutrients and heavy metals) with the adjacent coastal area would have influenced the hydrodynamic nature of the mangrove-fringed tidal channel. Heavy metal level of all zones exceeded the permissible limits. After six months of incubation study, the pH of mangrove soils approached neutrality within 14 weeks of continuous submergence and stabilized at 8.1 by the 24<sup>th</sup> week. Redox potential of the soil, was found to vary from an aerated condition (+100 mV) during the initial stages to a highly reduced state (-215.1 mV) by the end of the incubation period. The electrochemical properties (Ph and Eh) with significant correlation were found to affect all the chemical transformations in mangrove soil. Sequential and non-sequential chemical extraction and path coefficient analysis of primary and secondary nutrients gave better understanding of the transformations of N, P, K, Ca, Mg and S in these submerged soils. A Geochemical Quality Index (GQI) was developed to integrate eight different



Mangrove distribution in Thrissur District

physical and chemical properties into a single index, which could be used to assess the health of mangrove soils in Kerala. Percentage of sand, percentage of silt, percentage of clay, Cu, EC, Fe and K were identified as most representative indicators of mangrove ecosystem health. The Relative GQI (RGQI) derived from the study can be used for assessing the health of existing mangrove sites and mangrove species-site matching, when new plantings are being taken up. As for the management of mangroves, poor and medium RGQI mangrove area should be maintained through strict monitoring, as further pollution in these sites could have adverse effects on the adjoining systems linked to it. Further research is needed for the development of successful restoration strategies based on degradation level in these areas.

#### **Research Report No: 586**

#### **Popularization of weed composting technology for soil carbon sequestration and livelihood improvement of rural poor**

#### **Sujatha MP**

Carbon sequestration in soil has been recognized by the Intergovernmental Panel on Climate Change (IPCC) and the European Commission as one of the

possible measures to mitigate the greenhouse gas emissions. Composting restores the soil quality and sequester carbon in soils. The technology for converting weeds to good quality organic manure using 'jeevamrutham', a farm derived liquid organic formulation as inoculum, has been previously standardized in the Institute. The present study is a follow up of the earlier study to popularize the production of *jeevamrutham* enriched weed compost through participatory approach. Popularization of composting technology was accomplished through awareness programmes and field level demonstrations. The change in soil carbon through weed compost application was evaluated by conducting field trial at farmer's field. The feasibility of composting urban organic wastes using 'jeevamrutham' as microbial consortium was also looked into by conducting experiments at the waste processing Centre, Chalakkudy. The significant achievements were the transfer of green technology for the production of quality organic manure from weeds using 'jeevamrutham'. The results of the study also could prove that higher dose of weed compost application can elevate the level of labile carbon along with productivity enhancement in the long run. The non-labile fraction of carbon, derived from composts, makes the soil as a sink of carbon. The practice of composting of weed biomass also lead to revenue and livelihood opportunities for resource-poor families especially women. The results of



Composting of urban organic waste using jeevamrutham



General view of experimental plot

the study also highlighted that composted urban waste using 'jeevamrutham' as microbial consortium through aerobic windrow method, led to the production of good quality compost within 35 days. A multi chamber and drum based composting units were fabricated for composting of kitchen waste at small scale.

#### **Research Report No: 587**

#### **Regeneration dynamics propagation and restoration of selected rare and threatened rattans in the Kerala parts of Western Ghats**

**Sreekumar VB**

Rattans are spiny climbing palms occurring in the Old World tropics and subtropics belonging to the subfamily Calamoideae of Areaceae. The study was carried out to develop suitable restoration



strategies, regeneration potential, seed storage techniques and ecological niche modelling for four threatened rattan species endemic to the Western Ghats. The result of regeneration potential revealed that the species like *C. delessertianus* and *C. nagbettai* showed very low regeneration pattern. In the case of *C. pseudotenuis* and *C. gamblei*, sufficient numbers of seedlings were observed during the monsoon season; however, gradual decrease was observed during subsequent months. The study could find out cotton/polythene bags as the best container for storing rattan seeds and sawdust as the storage media which could prevent the loss

of seed moisture, and the optimum storage temperature standardized is 4°C. The accurate maps produced by ecological niche modelling can be effectively utilized to understand the geographical spread of these threatened species and also to plan restoration activities. Generally, uprooting the entire plant and extraction of immature stem are the major threats for the decline of rattan populations in the wild. The identified populations of these narrow endemics through the present study can be declared as local reserves for *in situ* conservation.

#### Research Report No: 588

#### Systematics, phylogeny and biogeography of dipterocarps in the Western Ghats.

Sreekumar VB | Suma Arun Dev | Sreejith KA

Dipterocarps are one of the ecologically and economically dominant groups. In the Western Ghats, the family is represented by 14 species belong to 5 genera, distributed mainly to the southern part of the Western Ghats (Kerala, Karnataka, and Tamil Nadu). At present the dipterocarps dominate the international tropical timber market because of its high wood quality. Overexploitation, illegal settlements, railway lines and lack of conservation activities are the main reasons for the decline of the population. Rare and endangered species are increasingly being accorded high priority by world conservation agencies to envisage long-term goals for conservation. Most of the species in danger of getting extinct are



Seedlings raised for restoration programmes



Restoration programmes at Nelliampathy and Vazhachal

either ecologically unique or highly habitat restricted. Thus, identifying potential distribution of endemic and endangered species becomes essential in tropical region of the Western Ghats, where vast areas remain unexplored. The phylogenetic analysis using DNA sequence data showed that the family Dipterocarpaceae originated in Africa and from there moved on to Madagascar-India-Sri Lanka-Seychelles block and finally to Asia through repetitive vicariance as well as dispersal events, before and after collision, affirming Gondwanan origin. India served as a raft transporting Dipterocarpaceae to Asia, had undergone severe climatic variations resulting in rapid diversification as well as extinction of lineages as evidenced by fossil records. Similarity, the ecological niche modelling was done using 19 "bioclimatic" variables (from globally interpolated datasets of monthly temperature and precipitation of the Worldclim dataset) and elevation, slope, aspect, and compound topographic index from the USGS Hydro-1K dataset. The simple probability test conducted from the jackknife test confirmed that the prediction is significantly better than at random ( $P \ll 0.05$ ) and the test and training Area under Curve (AUC) values were also higher which implies the model accuracy and justifies the construction of final niche model with all the available points. The predicted distribution areas identified for each species can be used to assess the impact of changing land use, and also to detect important areas for restoration programs. A total of 57

accessions of 8 dipterocarps species were planted at Arboretum of KFRI main Campus, FRC Velupadam and KFRI sub Centre Nilambur.



*Dipterocarpus bourdillonii* Brandis in Hook.

*Dipterocarpus indicus* Bedd.

### Research Report No: 589

#### Impact of flood on floral elements and soil biota in Pamba, Periyar, Bharathapuzha and Chalakkudy Rivers in Kerala

**Sreekumar VB | Mallikarjuna Swamy GE | Raghu AV | Sreejith KA | Sandeep S | Sajeev TV**

The state of Kerala was impacted by an extreme flooding event in August 2018, considered to be the worst in 100 years, resulting in close to 400 human mortalities and displacement of several hundred thousand people. While the socio-economic and anthropogenic impacts of the floods have been discussed widely, there has been little focus on the impacts to soil structure and biodiversity, especially on flora and fauna. In the present study, four rivers *viz.*, Chalakkudy, Pamba, Periyar and Bharathapuzha were selected. A rapid assessment was done on floristics of selected areas in Chalakkudy river

based on pre-flood data and post flood analysis of soil properties and soil microbes. The flood has drastically affected riparian patches of Chalakkudy River including dominant species like *Syzigium occidentale*, *Barringtonia acutangula*, *Cinnamomum riparium*, *Madhuca neriifolia*, *Humboldtia vahliana*, *Mallotus aureo-punctatus*, *Homonoia riparia*, *Ochlandra travancorica*, *Ochlandra scriptoria*, etc. The comparison of post-flood data on population structure of *Cinnamomum riparium* showed that only four surviving individuals in place of 64 in 2016, covering a total area of 5445 sq.m. The results of soil elements showed that soils are generally silty clay in texture along the river banks with acidic pH, except in Bharathapuzha, where neutral to alkaline pH was observed. All the rivers had soils with low organic carbon and nitrogen contents. The four-river basin Bharathapuzha, Chalakkudy, Pamba, Periyar have the common bacteria and fungi while actinomycetes could not be recorded from any of the samples. The bacterial genera and species found in the four river basins were *Bacillus* sp., *Lysinibacillus* sp., *Enterobacter asburiae*, *Micrococcus luteus*, *Chrysobacterium taiwanense*,

*Chrysobacterium shandongense*, *Stenotrophomonas maltophilia*, *Aquamicrobium* and fungi were *Paecilomyces lilacinus*, *Penicillium corylophilum* and *Penicillium discolor*.



Flood affected area of Vettilappara region

### Research Report No: 590

#### Taxonomic manual on Indian Palms

Sreekumar VB

The palm family (Palmae or more recently Arecaceae), one of the multi-use monocots comprising about 2321 species under 175 genera, is the world's third most useful plant family, after grasses and legumes. India is represented by 22 genera and 105 species of palms distributed mainly in three geographical regions *viz.*, the Peninsular India (Western Ghats, Eastern Ghats and Deccan Peninsula), forest areas of Northern India (Indo-Gangetic Plain, Himalayan Foothills and Assam ranges) and Andaman and Nicobar Islands. This manual includes general morphology, systematic treatment, cytology, palynology, fossil biology, early documentation and uses of Indian Palms.



Flood affected riparian area in Vazhachal

**Research Report No: 591****Mapping, biodiversity inventory and tree health assessment of KFRI campuses**

**Sreejith KA | Shijo Joseph | Sreekumar VB | Sajeev TV | Mallikarjuna Swamy GE**

The flora includes both natural and introduced or cultivated species. Out of the 2390 plant species documented from the campuses, 145 were RET (Rare, Endemic and Threatened). Among them, 36 were endangered as per IUCN status. A campus-wise analysis of the flora indicates that Nilambur campus has the highest number of species (1715) followed by Peechi (908), Velupadam (675), Kottappara (196) and Devikulam (21). A total of 140 spiders belonging to 81 genera and 21 families were listed during the study period. Main campus at Peechi has the highest diversity of spiders (97 species) followed by Nilambur (60), Velupadam (58), Kottappara (43) and Devikulam (68). Forty-four species of ants belonging to 24 genera and 6 sub families were listed from the campuses. The main campus at Peechi has 40 species followed by Nilambur (38), velupadam (33), Kottappara (21) and

Devikulam (13). The five campuses of KFRI which are located in different districts also harbour a vast variety of vertebrate fauna. During this study, four different classes of vertebrates (amphibians, reptiles, birds and mammals) were taken into account for the survey. A total of 44 species of amphibians, 55 species of reptiles, 188 species of birds and 45 species of mammals were identified from KFRI campuses. During the study period, 29 species of amphibians from Peechi, 25 species from Nilambur, 31 species from Velupadam, 41 species from Kottappara and 24 species from Devikulam were recorded. During bird inventory, 188 species belonging to 20 orders and 59 families were recorded from the 5 campuses of KFRI. Highest number of bird species were recorded from Kottappara (120), followed by Nilambur (114), Peechi (110), velupadam (94) and Devikulam. Among the 45 mammals recorded, Devikulam campus had the highest number of mammal species (27), followed by Nilambur (21), Kottappara and Velupadam and Peechi (18 species each).



Arboratum KFRI Peechi campus



*Mantis crassicaudata*

*Cuon alpinus*

*Parawixia dehaani*

*Nasikabatrachus sahyadrensis*

*Anthus nilghiriensis*

**Research Report No: 592****Introducing biochar for enhancing the quality of degraded soils of plantation Forestry Sector in Kerala****Sujatha MP | Sandeep S | Mallikarjuna Swamy GE**

This study was launched with the objectives to characterize the properties of biochar produced from different feed stocks, and evaluate the potential of biochar in enhancing soil quality and the growth of teak seedlings. For this, a biochar production unit was fabricated, and the biochar from different feed stocks such as saw dust, herbal medicinal waste, sugarcane waste, tender coconut husk, medicinal wastes from koovalam and turpeth shoots were produced and characterized for various properties. Efficacy of biochar on soil quality and growth of teak seedlings were tested through nursery and field trials. Results in general revealed that higher yield of biochar from sugarcane waste (33.0 %) followed by herbal medicinal waste (30.9 %), medicinal waste from koovalam (26.5 %), tender coconut husk (26.2 %), turpeth shoots (22.0 %) and lowest from saw dust (8.8 %). Higher duration for the production of biochar was noted in herbal medicinal waste (4 hrs.) followed by saw dust (2.30 hrs.), tender coconut husk (2.00 hrs.), medicinal waste from koovalam (2.00 hrs.), sugar cane waste (1.30 hrs.) and turpeth shoot (1.30 hrs). The biochar produced from various feed stocks were alkaline in reaction with pH ranging from 7.31 to 10.97. Higher content of moisture



Charcoal produced after burning

(11.07 %) and ash (19.29 %) were observed in the biochar from turpeth shoots. The loss of labile carbon as indicated by the volatile matter was relatively higher in sugarcane waste followed by koovalam, coconut husk, turpeth shoot, herbal medicinal waste and the least in saw dust. But higher content of fixed carbon was observed in the biochar from sugar cane waste (65.07 %) and herbal medicinal waste (61.51 %). Biochar from most of the feed stocks also had major plant nutrients, but those from saw dust and herbal medicinal wastes had poor sources of N and P. In the nursery trial, all the seedlings wherein biochar alone was applied by replacing the organic manure in the ratio 2:1:1, failed to show any improvement in the growth, and did not survive beyond three weeks. Compared to the conventional methods, no pronounced effect was observed in shoot length of teak seedlings due to the combined application of biochar and compost, but the biomass at the end of third month was remarkably higher in the treatment, where compost was in higher proportion (0.75) than biochar (0.25). Application of biochar was

found to enhance the pH and carbon content of soil in all the combinations with compost. The total microbial population in the third month isolate revealed that, the one which had biochar and compost at 0.25+0.75 combination was most effective. In the field trial, growth measurements of both root trainer and stump plants also indicated a significant and positive response to the combined application of biochar and compost in the ratio 0.25: 0.75 compared to control. A conclusive finding based on the field trial can be arrived only after monitoring the growth in the successive years.

#### Research Report No: 593

#### Long term monitoring of *Strobilanthes kunthianus* in Eravikulam National Park - Phase I

Sreejith KA | Sreekumar VB | Jayaraj R | HrideekTK

Mass flowering of *Strobilanthes kunthianus*, in 2018 provided once-in-a-decade opportunity to conduct field inventory and mapping of populations in and around the Eravikulam National Park (ENP). The study mapped gregarious flowering of the species in 32 locations comprising 300 ha area, of which 11 locations are found inside the ENP. A total of 100 permanent quadrats were also laid for long-term monitoring of the species. Phenological observations at regular intervals revealed production of natural regeneration from seeds in the succeeding year. The study on seed characteristics indicated high percentage of germination

(upto 96 %). Experiments were also done for vegetative propagation of the species and more than 95 % rooting could be observed when treated with IBA (10000 ppm).



*Strobilanthes kunthianus* mass blooming at Kattumala in 2018

#### Research Report No: 594

#### Influence of fungal diseases on phytochemical composition of selected medicinal plants with special reference to secondary metabolites

Mallikarjuna Swamy GE | Sujanalal P | Jayaraj R

Plant pathogens cause the majority of plant diseases compared to abiotic factors. Fungal disease survey of ten selected medicinal plants - *Centella asiatica*, *Cyclea peltata*, *Desmodium gangeticum*, *Hemidesmus indicus*, *Ichnocarpus frutescens*, *Pseudothria viscida*, *Rauwolfia serpentina*, *Rubia cordifolia*, *Solanum violaceum*, and *Strobilanthes ciliatus* has been carried out in eight locations of northern Kerala part of Western Ghats which included Kakkayam, Kuruva, Muthanga, Nadukani, Sulthan Bathery, Thamarassery, Thirunelli and Tholpetty during three different seasons. A total 185

fungal cultures were isolated and 43 fungal species belong to 10 genera were found to be associated with the surfaces of diseased samples of selected medicinal species. The dominant fungal genera were *Alternaria*, *Colletotrichum*, *Cladosporium*, *Curvularia*, *Fusarium*, *Myrothecium*, *Pestalotia*, *Pestalotiopsis*, *Phoma* and *Phomopsis*. The disease symptoms were manifested mainly as leaf spots and blight. Among the dominating species, *Colletotrichum gloeosporioides* was found associated with disease samples of four medicinal plants *Centella asiatica*, *Desmodium gangeticum*, *Pseudarthria viscida* and *Solanum violaceum*. *Phomopsis* sp. was found associated with leaf infection in *Hemidesmus indicus* and *Ichnocarpus frutescens*. In case of, *Alternaria alternata* and *Pestalotiopsis versicolor* were found associated with leaf spot and blight disease on *Rauvolfia serpentina* and *Cyclea peltata*, respectively. *Rubia cordifolia* and *Solanum violaceum* were found affected by foliar disease caused by *Fusarium oxysporum* and *Fusarium* sp., respectively. Pathogenicity tests have been conducted for dominant fungal species and all dominant fungal species produced symptoms of disease similar to plants growing in nature. The disease incidence in selected medicinal plants was high during the rainy season followed by winter and summer seasons. The preliminary screening of secondary metabolites suggested the presence of alkaloids, phenols and flavonoids in most of the medicinal plants. This further indicated

that the secondary metabolites could be estimated quantitatively by standard analytical methods. The quantitative estimation of alkaloids in leaves indicated an increase in both partially infected and totally diseased samples as compared to the healthy leaf samples of all the plant species tested. But, for *S. violaceum* and *S. ciliatus*, the alkaloid content decreased in infected leaves. However, the content of flavonoids and phenols differed in infected and healthy samples in different plant species.



*Centella asiatica* showing leaf spot disease symptoms caused by *Colletotrichum gloeosporioides*



*Rubia cordifolia* showing leaf spot and blight disease symptoms and severity caused drying of stem by *Fusarium oxysporum*



*Strobilanthes ciliatus* showing leaf spot and blight disease caused by *Fusarium* sp.

## 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, Dr. S. Sandeep) - United Nations Development Programme.
2. Conservation of critically endangered cycad, *Cycas annaikalensis* in India - (Dr. P. Balakrishnan) - Zayed Species Conservation Fund, Abudhabi.
3. Developing a report with photographic documentation on species in the home gardens of Kochi - (Dr. TV. Sajeev, Dr. P. Sujanapal, Dr. AV. Raghu)- International Council for Local Environmental Initiatives (ICLEI) South Asia.
4. Demonstration model for utilizing the potential of bamboo and other bioengineering measures for landslide risk reduction and mitigation and riverbank stabilization, under IHRML project - (Dr. S. Sandeep, Dr. VB. Sreekumar) - United Nations Development Programme.
5. Development of tool for timber traceability from private land - (Dr. Sandeep, Dr. V. Anitha, Dr. VB. Sreekumar, Dr. Suma Arun Dev) - Insight Development Consulting Group, India (IDCG).

### NATIONAL

1. Network project on conservation of lac insect genetic resources (Dr. TV. Sajeev, Dr. TK. Hrideek, Dr. M. Amruth, Dr. AV. Raghu) - Ministry of Agriculture, Govt. of India.
2. Establishment of a Herbal Garden as a peri-urban green space of Nilambur, Malappuram District, Kerala (Dr. P. Sujanapal) - National Medicinal Plants Board, Ministry of AYUSH, Govt. of India.
3. Facilitating the establishment of Bamboo and Cane Enterprises through training and technology transfer (Dr. KV. Mohammed Kunhi, Dr. EM. Muralidharan, Dr. V. Anitha, Dr. AV. Raghu, Mr. VP. Raveendran, CA. K. Satheesakumar) - Dept. of Science and Technology, Govt. of India.
4. Demographic survey and restoration of two endangered variants of 'Daruharidra', *Berberis tinctoria* Lesch. and *Cosciniium fenestratum* (Gaertn.) Colebr. in the Western Ghats (Dr. P. Sujanapal, Dr. VB. Sreekumar) - National



- Medicinal Plants Board, Govt. of India.
5. Biodiversity characterization at community level in India using Earth observation data (Dr. KA. Sreejith) - Dept. of Biotechnology, Govt. of India.
  6. Management of destructive invasive alien species in the high range mountain landscape of Munnar in the Western Ghats of Kerala (Dr. TV. Sajeew, Dr. TK. Hrideek, Dr. K. Vijayakumar (KSCSTE) - Dept. of Science and Technology, Govt. of India.
  7. 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, Dr. KA. Sreejith) - Dept. of Biotechnology, Govt. of India.
  8. 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, Dr. GE. Mallikarjuna Swamy) - Dept. of Biotechnology, Govt. of India.
  9. *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. GE. Mallikarjuna Swamy) - Ministry of Environment, Forests and climate Change, Govt. of India.
  10. 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 Plants Board, Ministry of AYUSH, Govt. of India.
  11. Genome wide and geospatial approaches for enhancing the adaptive potential of threatened rattan resources in India (Dr. Suma Arun Dev, Dr. VB. Sreekumar) - Dept. of Biotechnology, Govt. of India.
  12. Assessment of adaptive genetic diversity in teak and sandalwood to guide conservation and genetic improvement efforts (Dr. Suma Arun Dev, Dr. R. Jayaraj) - Dept. of Biotechnology, Govt. of India.
  13. Annual Action Plan – BTSG - Coordination (Dr. VB. Sreekumar, Dr. V. Anitha) – National Bamboo Mission, Govt. of India
  14. Bamboo shoot processing facility (Dr. R. Jayaraj, Dr. EM. Muralidharan) -

- National Bamboo Mission, Govt. of India.
15. Establishment of bamboo bazaar (Dr. AV. Raghu, Dr. KV. Mohammed Kunhi) National Bamboo Mission, Govt. of India.
  16. Training of farmers/artisans/field functionaries (Dr. AV. Raghu, Dr. EM. Muralidharan) - National Bamboo Mission, Govt. of India.
  17. Organizing workshops and seminars (Dr. V. Anitha, Dr. VB. Sreekumar) - National Bamboo Mission, Govt. of India
  18. Identification of genetically superior bamboo species (Dr. VB. Sreekumar, Dr. Suma Arun Dev) - National Bamboo Mission, Govt. of India
  19. DNA barcoding of bamboos - Phase 2 (Dr. Suma Arun Dev, Dr. VB. Sreekumar, Dr. EM. Muralidharan) - National Bamboo Mission, Govt. of India.
  20. Plant growth promoting and biocontrol microbes for high quality bamboo planting stock production (Dr. GE. Mallikarjuna Swamy, Dr. EM. Muralidharan, Dr. Shambu Kumar) - National Bamboo Mission, Govt. of India.
  21. Germplasm collection of *Litsea* and *Persea* (Jiggat) species (Dr. VB. Sreekumar, Dr. P. Sujanapal, Dr. PA. Jose, Dr. Suma Arun Dev) - National Bamboo Mission, Govt. of India
  22. Evaluation of alternative species for Jiggat production, characterization of accessions for growth, adaptability and gum production (Dr. VB. Sreekumar, Dr. R. Jayaraj, Dr. EM. Muralidharan, Dr. V. Anitha) - National Bamboo Mission, Govt. of India.
  23. Characterization and quality assessment of bark/gum of alternative species for Jiggat production (Dr. R. Jayaraj, Dr. VB. Sreekumar, Dr. EM. Muralidharan) - National Bamboo Mission, Govt. of India.
  24. Plantation technology for Jiggat species (Dr. PA. Jose, Dr. P. Sujanapal) - National Bamboo Mission, Govt. of India.
  25. Standardization of sustainable harvesting methods for Jiggat species (Dr. PA. Jose, Dr. P. Sujanapal, Dr. VB. Sreekumar) - National Bamboo Mission, Govt. of India.
  26. Studies on diversity, distribution and morpho-molecular taxonomy of *foliicolous hyphomycetous* fungi of Peechi-Vazhani Wildlife Sanctuary Kerala (Dr. Shambhu Kumar) - Science and Engineering Research Board, (SERB) – Dept. of Science and Technology, Govt. of India.

27. Conservation, improvement, management and promotion of sandalwood (*Santalum album* Linn.) cultivation in India (AICRP-3) (Dr. Suma Arun Dev) - Compensatory Afforestation Fund Management and Planning Authority (CAMPA) – Indian Council of Forestry Research and Education (ICFRE), Govt. of India.
28. Quantification of the bird hazard to aircraft in the Naval Air Station (INS Garuda), Kochi to develop mitigation strategies (Dr. P. Balakrishnan, Dr. EA. Jayson) - INS Garuda (Indian Navy), Govt. of India.
29. Developing Bamboo Agroforestry Models. (Dr. VB. Sreekumar, Dr. AV. Raghu) - National Bamboo Mission, Govt. of India.
30. Tropical ecosystem vulnerability to the changing climate: An Eco-physiological study from Forests of Southern Western Ghats. (Dr. KA. Sreejith) - Science and Engineering Research Board (SERB) - Dept. of Science and Technology, Govt. of India.
31. Establishment of a Medicinal Plant Seed Centre cum Seed Museum at Kerala Forest Research Institute, Peechi, Thrissur, Kerala (Dr. P. Sujanal, Ms. Shilpa V Kumar IFS, Deputy Conservator of Forests, Research North Division, Kerala Forest Department) - National Medicinal Plant Board, Ministry of AYUSH, Govt. of India.
32. Molecular systematics, geospatial modelling and conservation of the genus *Terminalia* L. in India (Dr. VB. Sreekumar, Dr. KA. Sreejith, Dr. Suma Arun Dev) - Science and Engineering Research Board (SERB) – Dept. of Science and Technology, Govt. of India.
33. Modelling forest phenological parameters from time series remote sensing data (Dr. KA. Sreejith) - Indian Space Research Organization (ISRO) - International Geosphere-Biosphere Programme (IGBP), Govt. of India.
34. Developing organo-lime nanocomposites on graphene microstructures extracted from humic acid (Dr. S. Sandeep, Dr. VB. Sreekumar) - Dept. of Biotechnology, Govt. of India.

## STATE

1. 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. AV. Raghu, Dr. EM. Muralidharan, Dr. PKC. Pillai, One senior official from KFD) – Kerala Forests and Wildlife Dept.

2. Economic valuation of ecosystem services in the moist deciduous forests of Kerala (Dr. V. Anitha, Dr. KA. Sreejith, Dr. S. Sandeep, Dr. VB. Sreekumar) - Kerala Forests and Wildlife Dept.
3. Chemistry and transformation of clay minerals under continuous teak rotations of Kerala Western Ghats (Dr. S. Sandeep, Dr. MP. Sujatha) - Kerala State Council for Science, Technology & Environment.
4. Evaluation of selected clones of teak through multisite testing to identify site specific clones for large scale plantation (Dr. M. Amruth, Dr. AV. Raghu) - Kerala Forests and Wildlife Dept.
5. Developing a conservatory of palms and bamboo in the proposed Zoological Park at Puthur, Thrissur (Dr. VB. Sreekumar, Shri. VP. Raveendran, Dr. P. Sujanapal, Dr. KA. Sreejith) - Thrissur Zoological Park Wildlife Conservation & Research Centre.
6. Reassessing insect assemblage after three decades to decipher climate change induced impact in southern Western Ghats-(Dr. TV. Sajeev)-Dept. of Environment and Climate Change, Govt. of Kerala.
7. Medicinal Plants - On Call Help Centre and Farm Library (A SMPB, Kerala initiative) (Dr. AV. Raghu) - State Medicinal Plants Board. Govt. of Kerala.
8. Production of organic manure from weeds and organic wastes (Dr. S. Sandeep) - Kerala Forests and Wildlife Dept.
9. Establishment of a Model Nursery of medicinal plants at KFRI Field Research Station, Devikulam, Munnar (Dr. P. Sujanapal, Dr. TK. Hrideek) - State Medicinal Plants Board
10. Scoping study to develop people inclusive livelihood based governance strategy for the long term conservation of mangrove forests of Kerala (Dr. S. Sandeep, Dr. V. Anitha, Dr. KA. Sreejith, Dr. AV. Raghu, Dr. VB. Sreekumar, Dr. P. Sujanapal, Dr. M. Amruth) - Kerala Forests and Wildlife Dept.
11. Triparty action plan for the reintroduction of RET plants of Kerala (Dr. PA. Jose, Dr. P. Sujanapal) - Kerala Forests and Wildlife Dept.

## PLAN GRANTS

1. Compilation of Indian Forestry Abstracts (IFA) Phase III (Dr. KF. George).
2. Evaluation of clonal teak plantations with particular reference to growth and

- wood properties (Dr. AV. Raghu, Dr. TK. Hrideek).
3. Establishment of Nodal Centre of alien invasive species research and management (Dr. TV. Sajeev, Dr. V. Anitha, Dr. TK. Hrideek, Dr. AV. Raghu).
  4. 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, Dr. EM. Muralidharan, Dr. TK. Hrideek).
  5. Sophisticated Analytical Instrumentation Facility (Dr. R. Jayaraj).
  6. Development of a protocol for rapid detection of *Ganoderma* disease in plantations and agroforestry systems of Kerala (Dr. GE. Mallikarjuna Swamy, Dr. R. Jayaraj).
  7. Assessing landslide vulnerability of forest systems in Kerala and developing restoration protocols (Dr. S Sandeep, Dr. MP Sujatha, Dr. KA. Sreejith, Dr. P. Sujanapal).
  8. Development of nanocomposite organic manure from weed compost (Dr. MP. Sujatha, Dr. S. Sandeep, Dr. GE. Mallikarjuna Swamy).
  9. Study on plant functional traits of selected tree species of Kerala (Dr. KA. Sreejith, Dr. VB. Sreekumar).
  10. Diversity and dynamics of a tropical forest ecosystem in Southern Western Ghats in the context of changing climate (Dr. KA. Sreejith, Dr. Syam Viswanath, Dr. TV. Sajeev, Dr. VB. Sreekumar, Dr. S. Sandeep, Dr. PA. Jose, Dr. TK. Hrideek, Dr. GE. Mallikarjuna Swamy, Dr. Shambu Kumar).
  11. Scaling up of protocol for *in vitro* tuberization 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, Dr. KV. Mohammed Kunhi, Dr. V. Anitha, Dr. M. Amruth, Dr. S. Sandeep, Dr. TK. Hrideek).
  12. Developing long term monitoring tools and strategies for mitigating human-wildlife conflicts in Kerala (Phase I) (Dr. P. Balakrishnan, Dr. TV. Sajeev, Dr. BN. Anjan Kumar IFS, Dr. Arun Zacharia).
  13. Standardization of vegetative propagation techniques of selected bamboo species and its field performance evaluation in different agro climatic region of Kerala- Phase- I [Dr. VB. Sreekumar, Dr. Syam Viswanath, Dr. AV. Raghu, Dr. CM. Jijeesh, (Asst. Professor, College of Forestry, KAU)].
  14. Genetic Improvement of Teak - Phase II: locating plus trees, establishment of

- clonal multiplication area and clonal evaluation trials [Dr. AV. Raghu, Dr. P. Sujanapal, Dr. PK. Thulasidas (Retd.)].
15. National Children's Science Congress (NCSC) Assessing goals' impacts after 25 years in Kerala-[Dr. AV. Raghu, Dr. M. Amruth, Dr. P. Harinarayanan (Principal Scientist, KSCSTE)].
  16. Identification of gender specific SNPs in *Coscinium fenestratum* through comparative transcriptomics (Dr. Suma Arun Dev, Dr. P. Sujanapal).
  17. Community structure, habitat associations and conservation of bats along the land-use gradients in Kerala in the context of climate change and emerging zoonotic diseases (Dr. P. Balakrishnan, Dr. TV. Sajeev).
  18. Kannadipaya (special bamboo weaved mat product)- Studies on physio-chemical and microstructure properties of special bamboos used in weaving by tribal communities in Idukki District, Kerala (Dr. AV. Raghu, Dr. VB. Sreekumar).
  19. Ecological studies on post restoration success of threatened plants *in situ* (Dr. PA. Jose, Dr. P. Sujanapal, Dr. VB. Sreekumar).
  20. Investigating growth impact of *Epipremnum pinnatum* cv. Aureum on host trees: A case study in *Tectona grandis* at KFRI, Peechi Campus (Dr. PA. Jose, Dr. R. Jayaraj, Dr. KA. Sreejith, Dr. Shambhu Kumar).
  21. Wildlife friendly and organic certification for cash crop plantations of KFDC. (Dr. P. Balakrishnan, Dr. V. Anitha, Dr. R. Jayaraj, Dr. P. Sujanapal, Dr. TV. Sajeev).
  22. Socioeconomic assessment of the plantation workers of KFDC-Gavi. (Dr. V. Anitha).
  23. Evaluating carbons sinks of selected KFDC plantations for availing carbon credits (Dr. S. Sandeep).
  24. Scientific support to an Interpretation Centre on Shola grassland ecosystem at KFDC, Munnar (Dr. KA. Sreejith, Dr. S. Sandeep).
  25. Removing *Eucalyptus* and wattle by native tree plantation developing site specific species choice (Dr. VB. Sreekumar, Dr. S. Sandeep).
  26. Diversity and seasonal variation of fresh water algae in the selected water bodies of degraded and non-degraded evergreen forests of Kerala [Dr. VB. Sreekumar, Dr. R. Jayaraj, Dr. Tessa Paul (Associate professor Christ College)].

27. Assessment of socio-economic and cultural uses and potential for popularization of *Dendrocalamus stocksii* and *Munrochloa ritchei*, two bamboo species endemic to the Western Ghats (Dr. M. Amruth, Dr. V. Anitha, Dr. VB. Sreekumar, Dr. AV. Raghu)
28. Establishment and maintenance of the Centre for Citizen Science & Biodiversity Informatics (Dr. P. Balakrishnan, Dr. TV. Sajeev, Dr. AV. Raghu).
29. Micro plastics and phthalate esters in urban water bodies occurrence, distribution and seasonal variation in selected urban areas of Kerala [Dr. R. Jayaraj, Dr. S. Sandeep, Dr. T. Geetha (Assistant Professor, St. Mary's College, Thrissur)].
30. Synthesis, characterization and analysis of activated spherical carbon derived from lignocellulosic biomass (Dr. R. Jayaraj, Dr. S. Sandeep, Dr. VB. Sreekumar).
31. Diversity and distribution of myxomycetes in a tropical wet evergreen forest ecosystem and their response to climate change (Dr. KA. Sreejith, Dr. VB. Sreekumar).

### ONGOING EXTENSION PROJECTS

1. Regional-Cum-Facilitation Centre for sustainable development of medical plants (Southern Region) (Dr. P. Sujanalal) - NMPB, Ministry of AYUSH, Govt. of India.
2. Kerala Development and Innovation Strategic Council (K-DISC) – Mazhavillu (Dr. TV. Sajeev) - Kerala Development and Innovation Strategic Council (K-DISC).
3. Design and conduct of forestry training programmes. (Dr. AV. Raghu, Dr. KV. Mohammed Kunhi, Mr. VP. Raveendran) - KFRI Plan Grants.
4. Design and conduct of Extramural & Outreach Programmes (Dr. KV. Mohammed Kunhi, Dr. AV. Raghu, Mr. VP. Raveendran) - KFRI Plan Grants.
5. Forestry Extension and Conservation Education Programmes (Dr. AV. Raghu, Dr. KV. Mohammed Kunhi, Mr. VP. Raveendran) - KFRI Plan Grants.
6. Establishment of a Block Bamboo Plantation at Kozhikode Dermatology hospital campus (Dr. KV. Mohammed Kunhi, Dr. VB. Sreekumar) - Kerala State Bamboo Mission.

7. Urban forestry Interventions to mitigate heat islands in Kochi (Dr. TV. Sajeev, Dr. P. Sujanapal) - India Resource Trust.
8. Registration of Kannadipaya (special bamboo Weaved mat product) for geographical indication Tag (Dr. AV. Raghu, Dr. M. Amruth, Dr. VB. Sreekumar) -KFRI Plan Grants.
9. Vigyan Sarvathrapujyathe (Dr. Syam Viswanath, Dr. TV. Sajeev, Dr. V. Anitha) – KSCSTE.
10. Production and supply of quality seedlings of selected medicinal plants (Dr. AV. Raghu, Dr. VB. Sreekumar, Dr. M. Amruth, Sri. Jinesh VC) – SMPB.
11. Video documentation and production of a short video on the activities of Kerala State Council for Science and technology and its R & D centers (Dr. AV. Raghu, Dr. M. Amruth) – KSCSTE.
12. Upscaling of *in vitro* plantlet production Facility at Kuzhur for teak and selected species of bamboos (Dr. Suma Arun Dev, Dr. VB. Sreekumar) - Kerala Biotechnology Commission.
13. Maintenance of Butterfly Garden at KFRI campus and establishment of new gardens in schools (Dr. TV. Sajeev) - Plan Grants.

### ONGOING CONSULTANCY PROJECTS

1. Preparation of compensatory mangrove afforestation and conservation plan related to the widening and improvement of NH17 (now NH 66) from Vengalam to Edappally (Package II NHDP Phase III in the State of Kerala) (Dr. P. Sujanapal) -National Highway Authority of India (NHAI).
2. Establishment of a Butterfly Garden at KFDC Plot at Kottayam (Dr. TV. Sajeev) - Plan Grants.
3. Assessment of vegetation and ecology of 8.0937 ha. land under OA No. 18/2019 of Palakkayam village, Mannarkkad Taluk, Palakkad, Kerala. (Dr. P. Sujanapal) - Mannarkkad Forest Division, Palakkad, Kerala.
4. Assessment of vegetation and ecology of 1.214 ha. Land under OA No. 2/2019 of Vazhikkadavu village, Nilambur Taluk, Malappuram, Kerala. (Dr. P. Sujanapal) - The Hon. Forest Tribunal (Vesting and Management of Ecologically Fragile Lands), Palakkad.
5. Prioritising mangrove areas of Kannur and Malappuram Districts for long term



conservation and compensatory acquisition under section-4 of Ecologically Fragile Land Act 2003. (Dr. P. Sujanalal) - Principal Chief Conservator of Forest & Head of Forest Force, Kerala Forest Department.

6. DNA testing of teak wood samples to trace illegal extraction. (Dr. Suma Arun Dev) - Office of the Enquiry Commissioner and Special judge (Vigilance), Thrissur.
7. DNA testing of rose wood samples to trace illegal extraction. (Dr. Suma Arun Dev) - Range Officer, Pattikkad, Thrissur.
8. DNA testing of wood samples to trace illegal extraction (Dr. Suma Arun Dev) - Court of the Judicial First Class Magistrate, Irinjalakuda, Thrissur.
9. DNA testing of rose wood samples to trace illegal extraction (Dr. Suma Arun Dev) - Judicial First Class Magistrate Court-1, Sultan Bathery.

### **ESTABLISHMENT AND MAINTENANCE PROJECTS**

1. Maintaining Permanent Plots (Malakkapara) – Phase II (Dr. KA. Sreejith, Dr. VB. Sreekumar).
2. Maintenance and Enrichment of Microbial Collection (Dr. GE. Mallikarjuna Swamy, Dr. TV. Sajeev).
3. Maintenance of Herbarium (Dr. VB. Sreekumar).
4. Maintenance of Wildlife Museum (Dr. P. Balakrishnan).
5. Maintenance of Soil Museum (Dr. S. Sandeep).
6. Enrichment of Insect Collection (Dr. TV. Sajeev).
7. Maintenance of Live collections at KFRI-Peechi campus (Dr. PA. Jose).
8. Maintenance of Live collections at FRC Palappilly (Dr. VB. Sreekumar).
9. Tree Health Help Line (Dr. TV. Sajeev)
10. Strengthening and Enriching Institute Central Nursery (Dr. P. Sujanalal).
11. Commercial Nursery, Palappilly (Dr. AV. Raghu).
12. LAN, Internet and Website (Dr. P. Balakrishnan).
13. Research Monitoring and Evaluation (RME) Unit (Research Coordinator).
14. Digital Archiving of Administration Records and Multimedia Services for

- Public Relations (Registrar).
15. Strengthening and Capacity Building in Administration and research (Registrar).
  16. Mathrubasha - Facilitating/Strengthening the Application of Mathrubasha (Malayalam) in Office Use (Registrar).
  17. Monitoring of Teak Experimental plots, Clonal Multiplication Area (CMA) and Production of Superior Clonal Plants (Dr. AV. Raghu).
  18. Maintenance of Forest Seed Processing Unit (Dr. P. Sujanapal).
  19. Bamboo Processing Centre (Dr. AV. Raghu).
  20. Maintenance and Enrichment of Bio-Resources Nature Park (Dr. GE. Mallikarjuna Swamy).
  21. Maintenance of Field Research Station at Devikulam (Dr. KA. Sreejith).
  22. Maintenance of Field Research Station at Kottapara, Ernakulam (Dr. AV. Raghu).
  23. Soil Health Restoration Programmes Through Participatory Approach (Dr. S. Sandeep).
  24. Campus Garden Development (Dr. PA. Jose).
  25. Research Management (Registrar).
  26. Updation of KFRI Library Portal (Dr. KF. George).
  27. Field Research Centre (FRC), Palappilly - Eco Tourism and Conservation Awareness Programmes (Dr. AV. Raghu).
  28. Academic Coordination Cell (Dr. V. Anitha).
  29. Maintenance of Malakkappara Field Station (Dr. KA. Sreejith).
  30. Maintenance of Plant Tissue Culture Facility (Dr. Suma Arun Dev).
  31. Journal of Bamboo and Rattan (Dr. S. Sandeep).

## TRAINING PROGRAMMES

1. One week compulsory training course for IFS officers on Pharmaceutical Industries, Local Communities and Forest Medicinal Resources: Developing Synergy for Co-development, 06<sup>th</sup> to 10<sup>th</sup> September 2021, Ministry of

Environment, Forest and Climate Change (MOEF & CC), Government of India. 19 Participants completed the programme (Raghu AV, Amruth M and Mohammed Kunhi KV).

2. Three-days training course on: Plus Tree Selection for officers of Technical Staff of ICFRE, 28<sup>th</sup> to 30<sup>th</sup> September, Indian Council of Forestry Research and Education (ICFRE), Government of India. 39 Participants completed the programme (Raghu AV, Amruth M and Mohammed Kunhi KV).
3. Training programme for Artisans on Bamboo Craft, 22<sup>nd</sup> November to 02<sup>nd</sup> December, supported by National Bamboo Mission (NBM), Govt. of India. 20 participants completed the programme (Raghu AV and Sreekumar VB).
4. One-day training programme on NCSC-District level, 27<sup>th</sup> November 2021 supported by Kerala State Council for Science, Technology and Environment (KSCSTE), Govt. of Kerala. 100 participants completed the programme (Raghu AV and Amruth M).
5. GSDP-certificate course on Propagation & Management of Bamboo, 16<sup>th</sup> March 2022 to 27<sup>th</sup> April 2022, Ministry of Environment, Forest and Climate Change (MOEF & CC), Government of India. 9 participants completed the programme (Raghu AV).
6. GSDP-certificate course on Value addition & Marketing of NTFPs (Plant Origin)-Bamboo Craft, 16<sup>th</sup> March 2022 to 25<sup>th</sup> May 2022, Ministry of Environment, Forest and Climate Change (MOEF & CC), Government of India. 5 participants completed the programme (Raghu AV and Mohammed Kunhi KV).
7. One-day training programme for primary stakeholders including tribal VSS Members of the three Forest Ranges in the north Wayanad Forest Division on the Standardization of Sustainable Harvesting Methods of Jigat species, 23<sup>rd</sup> December 2021 supported by National Bamboo Mission (NBM), Govt. of India. 23 participants completed the programme (Jose PA and Kanagaraj R).
8. One day praining programme for primary stakeholders including tribal VSS Members of the three Forest Ranges in the Vazhachal Forest Division on the 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. 20<sup>th</sup> December 2021 supported by National Medicinal Plant Board (NMPB), Govt. of India. 45 participants completed the programme (Jose PA and Jithin Jose).



## ENDOWMENT AWARDS

### Dr. C. Chandrasekharan Memorial Endowment award

The 11<sup>th</sup> Dr. C. Chandrasekharan Memorial award of the year 2020 was awarded to Mr. Rajesh TP, Research Scholar, Central University, Kasargod, through an online function held on 10<sup>th</sup> September 2021, coinciding with the death anniversary of Dr. C. Chandrasekharan. The award instituted by the family of Dr. Chandrasekharan, in memory of KFR I'S



first Director, an expert in tropical forestry, carries a purse of Rs. 20,000/-, a gold medal and a certificate. Dr. Kunhamu TK., Professor & Head, Dept. of Silviculture & Agroforestry, College of Forestry, Kerala Agricultural University, Thrissur, delivered the Dr. Chandrasekharan memorial lecture at KFR I and gave away the award to the winner.

### Dr. KM. Bhat Memorial Endowment award

The Dr. KM. Bhat Endowment was instituted by the family of late Dr. Bhat for the best doctoral work carried out at KFR I. The 11th Dr. KM. Bhat Endowment carrying a gold medal, certificate of merit and cash prize of Rs. 5,000/- was awarded to Dr. Dhaneesh Bhaskar, Research Scholar of KFR I, for the best Ph.D. Thesis of the year 2021. Dr. Dhaneesh's



work was on "Diversity and fire induced behavioural dynamics of short-horned grasshoppers (Insecta : Orthoptera : Caelifera) in Eravikulam National Park and Parambikulam Tiger Reserve, Western Ghats. The award was presented by Dr. KK. Pandey, Scientist G, Institute of Wood Science and Technology (IWST), Bangalore on 3<sup>rd</sup> January 2022.

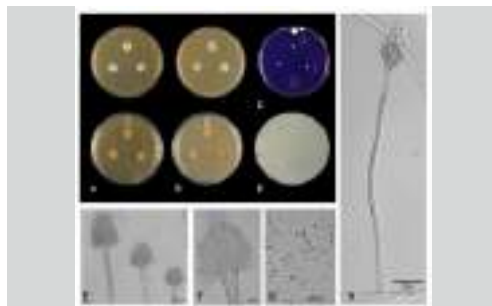

**SPECIES NEW TO SCIENCE**
**1. *Ambrosia* species.**

A beetle (*Ambrosia* species), causing fuel leakage in vehicles have been reported from many places such as Pathanamthitta, Ottapalam in January 2022. Specimens were collected from the reported localities to study the issue and prepare a management protocol - Dr. TV. Sajeev



**2. *Aspergillus miraensis*** (L.C. Zhang, Juan Chen & S.X. Guo) Hubka, S.W. Peterson & M. Kolařík Plant Systematics and Evolution 302 (9): 1288 (2016) - Dr. KA. Sreejith

This rare fungus is a new record to India from KFRI permanent plot at Sholayar, rather a second record to the world (First report was from China).


**Websites of KRFI**

KSCSTE – Kerala Forest Research Institute	- <a href="http://www.kfri.res.in">www.kfri.res.in</a>
Indian forestry abstracts	- <a href="http://ifa.kfri.res.in">ifa.kfri.res.in</a>
RET Plants	- <a href="http://retplants.kfri.res.in">retplants.kfri.res.in</a>
Invasive Alien Species Nodal Centre	- <a href="http://iasnodalcentre.kfri.res.in">iasnodalcentre.kfri.res.in</a>
Invasive plants	- <a href="http://invasiveplants.kfri.res.in">invasiveplants.kfri.res.in</a>
i-STED-KFRI Bamboo/Cane Entrepreneurship Development Programme	- <a href="http://bamboo-cane.kfri.res.in">bamboo-cane.kfri.res.in</a>
Centre for Analytical Instrumentation - Kerala (CAI-K)	- <a href="http://www.caik.res.in">www.caik.res.in</a>
Journal of Bamboo and Rattan	- <a href="http://www.jbronline.org">www.jbronline.org</a>
KFRI Herbarium	- <a href="http://www.kfriherbarium.in">www.kfriherbarium.in</a>



## PUBLICATIONS

### Books

1. Viswanath S, Sreekumar VB and Sruthi S (2021) *Bambusa balcooa* Roxb: A multi-utility bamboo for domestication. KSCSTE-Kerala Forest Research Institute, Peechi (ISBN: 81-85041-98-9).
2. Raghu AV (2022) Chandruvinte Yathra (Environment based Malayalam Novel for Children) ISBN 978-93-91112-50-9, Published by Kerala State Institute of Children's Literature.
3. Raghu AV *et.al.* (2022) 34<sup>th</sup> Kerala Science Congress - Proceedings (Abstracts)- ISBN 978-81-953863-1-4.

### Chapters in Books

1. Rao HCY, Parthasarathy R, Mondal S, Sundararaj R, Kumar S (2021) Exploring the molecular signatures of host-pathogen interactions in plant diseases: conflict and cooperation (Chapter-4). In: Food Security and Plant Disease Management (Eds. Kumar A, Droby S), Woodhead Publishing, Elsevier [ISBN 9780128218433].
2. Yadav S, Mishra AP, Kumar S, Asha AN, Maurya VK (2021) Herbal wound healing agents. . In: Preparation of Phytopharmaceuticals for the Management of Disorders: The Development of Nutraceuticals and Traditional Medicine. (Eds. Egbuna C, Mishra A, Goyal M), Academic Press, Elsevier [ISBN 9780128202845].
3. Sreejith KA, Balakrishnan P, Amruth M (2022) Forest and Wildlife: Conservation and Challenges (*in Malayalam*). In: Manorama Year Book. pp. 346-363.
4. Madan PS, Manohara TN, Sukumar R, Suresh HS, Ayyappan N, Ganesan R, Sreejith KA (2021) In: Forest Vegetation and Dynamics Studies in India. Vegetation Index and Dynamics. ISBN: 978-1-83969-385-4, Intech Open Publishers.
5. Sanil MS, Sreekumar VB, Dev SA, Sreejith KA, Balakrishnan S (2021) Status of Dipterocarps in the Western Ghats, India. In: Plant Genetic Resource Utilization: An Appraisal (Swapna *et al.* eds.), Dept. of Botany, Kerala University, ISBN: 978-81-951912-4-6.
6. Sandeep S, Ramasamy Y (2021). Teak: The King of Timbers. In: The Teak Genome (Yasodha R, Galeano E, Win TT. eds), Springer - Nature, Singapore.
7. Sandeep S (2021) Teak Plantations and Wood Production. In: The Teak Genome (Yasodha R, Galeano E, Win TT. eds), Springer - Nature, Singapore.

8. Suma Arun Dev, Yasodha R (2021) Teak Genome: Structure and Features. In: Teak Genome (Eds. Yasodha R, Galeano E, Win TT. eds), Springer - Nature, Switzerland
9. Hrideek TK, Suby, Aswaja P, Amruth M, Sabu A (2022) Implications of plant invasion on the soil microbial diversity and ecosystem sustainability: Evidence from a tropical biodiversity hot spot. In: Microbial Biodiversity, Biotechnology and Ecosystem Sustainability (Aitorsuilar CN, Abdulhameed S, Rodríguez-Herrera R, Sugathan S. eds), Apple Academic Press, CRC Press, Taylor & Francis Group.
10. Viswanath S, Chakraborty S (2022). Indian sandalwood cultivation prospects in India. In: Indian Sandalwood. Materials Horizons: From Nature to Nanomaterials (Arunkumar AN, Joshi G, Warriar RR, Karaba NN. eds), Springer, Singapore. Pp. 281-292. [https://doi.org/10.1007/978-981-16-6565-3\\_19](https://doi.org/10.1007/978-981-16-6565-3_19).
11. Sruthi S, Viswanath S (2022) Above-ground biomass and carbon content in select bamboo species across humid and semiarid zones of Karnataka, India. In: Forest Resources Resilience and Conflicts (Shit PK, Pourghasemi HR, Adhikary PP, Bhunia GS, Sati VP. eds), Pp 153-163. [doi.org/10.1016/B978-0-12-822931-6.00011-3](https://doi.org/10.1016/B978-0-12-822931-6.00011-3).

### Research Papers in Journals-Research Articles

1. Anaz KM, Sasidharan N, Remakanthan A, Dilsha MV (2021) ITS 2 and RNA secondary structure-based analysis reveals a clear picture on phylogeny of south Indian *Salacia* spp. Computational biology and chemistry 91: 107438. <https://doi.org/10.1016/j.compbiolchem.2021.107438>. (Thompson Reuter's Impact Factor 2.877)
2. Aparna CR, Nishi S, Kumar A, Maushumi D, Tony G, Dev SA, Yadav VP, Ghosh I (2021) Exploring prevalence of potential pathogens and fecal indicators in geographically distinct river systems through comparative metagenomics. Environmental Pollution 282 (Article No.117003), <https://doi.org/10.1016/j.envpol.2021.117003>. (Thompson Reuter's Impact Factor 8.07)
3. Balakrishnan S, Dev SA, Sakthi AR, Vikashini B, Bhasker R, Magesh BS, Ramasamy R (2021) Gene-ecological zonation and population genetic structure of *Tectona grandis* L.f. in India revealed by genome-wide SSR markers. Tree Genetics and Genomes 17: 33. <https://doi.org/10.1007/s11295-021-01514-x>. (Thompson Reuter's Impact Factor 2.297)
4. Das S, Easa PS, Divakar N, Thomas A Tapley B (2021) Predators of the purple frog *Nasikabatrachus sahyadrensis* Biju and Bossuyt, 2003. Herpetology Notes 14: 247-249. (Thompson Reuter's Impact Factor 0.68)

5. Dasguptha M, Dev SA, Parveen AM, Sarath P, Sreekumar VB (2021) Draft genome of *Korthalsia laciniosa* (Griff.) Mart, a climbing rattan elucidated its phylogenetic position. *Genomics* 113: 2010-2022. (Thompson Reuter's Impact Factor 5.736)
6. Garg S, Suyesh R, Das S, Bee MA, Biju SD (2021) An integrative approach to infer systematic relationships and define species groups in the shrub frog genus *Raorchestes*, with description of five new species from the Western Ghats, India. *Peer J* 9:e10791. <https://doi.org/10.7717/peerj.10791>. (Thompson Reuter's Impact Factor 2.984)
7. Hassan MAE, Santhoshkumar AV, Hrideek TK, Jijeesh CM, Joseph H (2021) Variability in drought response among the plus tree accessions of *Tectona grandis* (Linn f.) from the provenances of Kerala, South India. *Acta Physiologiae Plantarum*. 43: 47 (<https://doi.org/10.1007/s11738-021-03215-3>). (Thompson Reuter's Impact Factor 2.354)
8. Hime PM, Lemmon AR, Lemmon ECM, Prendini E, Brown JM, Thomson RC, Kratovil JD, Noonan BP, Pyron RA, Peloso PLV, Kortyna ML, Keogh JS, Donnellan SC, Mueller RL, Raxworthy CJ, Kunte K, Ron S, Das S, Gaitonde N, Green DM, Labisko J, Che J, Weisrock DW (2021) Phylogenomics reveals ancient gene tree discordance in the Amphibian Tree of Life. *Systematic Biology* 70 (1): 49–66. <https://doi.org/10.1093/sysbio/syaa034> (Thompson Reuter's Impact Factor 10.40)
9. Hrideek TK, Jijeesh CM, Suby (2021) Adventitious root induction in *Cinnamomum heyneanum* and *C. riparium*: the endemic tree species of the Western Ghats. *Proc. Natl. Acad. Sci., India, Sect. B Biol. Sci.* (9). <https://doi.org/10.1007/s40011-020-01222-x>. (Thompson Reuter's Impact Factor 0.396)
10. John CJ, Bibishna AV, Mallikarjunaswamy GE (2021) Antimycotic effects of a prodigiosin producing *Serratia marcescens* rhizobacteria. *Rhizosphere* 18. 100336. [10.1016/j.rhisph](https://doi.org/10.1016/j.rhisph.2021.100336). Elsevier. (Thompson Reuter's Impact Factor 3.129)
11. Jimtha JC, Mallikarjunaswamy GE, Najiya Noushad (2021). Probiotic rhizospheric *Bacillus* sp. from *Zingiber officinale* Rosc. displays antifungal activity against soft rot pathogen *Pythium* sp. *Current Plant Biology*. 27. [doi.org/10.1016/j.cpb.2021.100217](https://doi.org/10.1016/j.cpb.2021.100217). Elsevier. (Thompson Reuter's Impact Factor 2.145).
12. Lalnunpuia J, Santhoshkumar AV, Hrideek TK, Anoop EV, Elizabeth PM (2021) Diversity assessment and selection of candidate plus trees of *Ailanthus triphysa* (Dennst.) Alston in Kerala. *Electronic Journal of Plant Breeding*. 12(1): 188–194. <https://doi.org/10.37992/2021.1201.028>. (Thompson Reuter's Impact Factor 0.36)
13. Patel B (2021) Parasitoid tachinidfly on lobster moth *Neostauropus alternus* – an observation from the forests near Peechi-Vazhani Wildlife Sanctuary, Thrissur



- district, Kerala, India. J. Bombay Nat. Hist. Soc. 118 (2).
14. Patel B, Sivraman S, Balakrishnan P (2021) Use of tree cavities by Indian vertebrates: status of research, knowledge gaps and future conservation perspectives. *Current Science* 121 (4): 490-501. (Thompson Reuter's Impact Factor 1.102)
  15. Raghu AV, Viswanath S (2021) 'Kannadipaya' – role of geographical indication in brand-making and Conservation. *Current Science* 121(1): 19-20. (Thompson Reuter's Impact Factor 1.102)
  16. Ramírez F, Kallarackal J (2021) The phenology of the endangered nogal (*Juglans neotropica* Diels) in Bogota and its conservation implications in the urban forest. *Urban Ecosystems* <https://doi.org/10.1007/s11252-021-01117-3>. (Thompson Reuter's Impact Factor 2.547)
  17. Ramvilas G, Dhyani S, Kumar B, Sinha N, Raghavan R, Selvaraj G, Divakar N, Anoop VK, Shalu K, Sinha A, Kulkarni A, Das S, Molur S (2021) Insights on COVID-19 impacts, challenges and opportunities for India's biodiversity research: From complexity to building adaptations. *Biological Conservation*, 255(3): 109003. doi.org/10.1016/j.biocon.2021.109003. (Thompson Reuter's Impact Factor 5.99)
  18. Sreelakshmi VP, Kumar S, Rekha R, Nair B, Mathew GN, Singh R (2021) First report of leaf spots disease on *Woodfordia fruticosa* caused by *Corynespora cassiicola* in Kerala, India. *Plant Pathology and Quarantine* 11(1): 9–14.
  19. Subin K, Jose PA, Tom B, Nair B, Manju CN (2021) GC-MS analysis of *Leptolejeunea balansae*: a fragrant liverwort from southern Western Ghats, India. *Research Journal of Pharmacognosy and Phytochemistry* 13 (3): 115-118.
  20. Unnikrishnan R, Sumod M, Jayaraj R, Sujanalal P, Dev SA (2021) The efficacy of machine learning algorithm for raw drug authentication in *Coscinium fenestratum* (Gaertn.) Colebr. employing a DNA barcode database. *Physiology and Molecular Biology of Plants* 27: 605-617. (Thompson Reuter's Impact Factor 2.391)
  21. Verma SK, Yadav S, Singh R, Chaurasia B, Kumar S (2021) *Pseudodeightonella indicagen.* and sp. nov., a hyphomycete from India. *Mycotaxon*, 136 (4): 769–778. <https://doi.org/10.5248/136.769>. (Thompson Reuter's Impact Factor 0.821)
  22. Yadav S, Verma SK, Singh VK, Singh R, Singh A, Kumar S (2021). Morphology and phylogeny of a new species, *Pseudocercospora haldinae* (Mycosphaerellaceae) on *Haldina cordifolia* from India. *Phytotaxa* 501(2): 281-292. (Thompson Reuter's Impact Factor 1.171)

23. Vijayan KR, Raghu AV (2021) Embelin: an HPTLC method for quantitative estimation in five species of genus *Embelia* Burm. f. *Future Journal of Pharmaceutical Sciences* 7(1): 1-11.
24. Bindu TN, Balakrishnan P, Sajeev TV, Sudheendrakumar VV (2022)- Seeding baculovirus HpNPV in the epicentre populations of teak defoliator, *Hyblaea puera* to prevent large scale outbreaks. *Current Science* 122 (7): 812-818. (Thompson Reuter's Impact Factor 1.102)
25. Chandrashekara UM, Sujanal P (2021)- Visitors' satisfaction in service quality of herbal garden, Nilambur, Kerala. *Medicinal Plants-International Journal of Phytomedicines and Related industries* 13 (4): 572-577.
26. Chandrashekara UM, Sujanal P, Chacko KC (2022) Tree girth increment pattern in three medicinally important *Pterocarpus* species in Kerala, India. *Medicinal Plants Journal* 14(1): 149-152.
27. Rini Vijayan, Raghu AV (2021) Embelin: an HPTLC method for quantitative estimation in five species of genus *Embelia* Burm f. *Future Journal of Pharmaceutical Sciences* 7:55. <https://doi.org/10.1186/s43094-021-00210-w>.
28. Krishnasree PS, Jose PA, Subin K, Sarath TV (2022) Reproductive biology of *Salacia gambleana* Whiting & Kauland and *Salacia oblonga* Wall. ex wight & Arn. - two threatened and high valued medicinal plants of the Western Ghats, India. *Journal of Threatened Taxa* 14 (4): 8953-8969. (Thompson Reuter's Impact Factor 0.50)
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31. Unnikrishnan R, Sumod M, Jayaraj R, Sujanal P, Dev SA (2021) The efficacy of machine learning algorithm for raw drug authentication in *Coscinium fenestratum* (Gaertn.) Colebr. Employing a DNA barcode database. *Physiology and Molecular Biology of Plants* 27: 605-617. (Thompson Reuter's Impact Factor 3.023)
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33. Verma SK, Yadav S, Singh R, Chaurasia B, Kumar S (2021). *Pseudodeightonella indica* gen. & sp. nov., from India. Mycotaxon 136 (4): 769–778. (Thompson Reuter's Impact Factor 0.821)
34. Shukla SR, Viswanath S (2021) Comparative financial analysis of plantation teak (*Tectona grandis* L.f.) under different management practices in farmlands. Indian Journal of Agroforestry 23(2): 107-117.
35. Dev SA, Unnikrishnan R, Jayaraj R, Sujanalal P, Anitha V (2021) Quantification of adulteration in traded Ayurvedic raw drugs employing machine learning approaches with DNA barcode database. 3 Biotech 11: 463 <https://doi.org/10.1007/s13205-021-03001-5>. (Thompson Reuter's Impact Factor 2.893)
36. Vishnu PS, Sandeep S (2021) Variations in taxonomy and soil pedon characters of two contrasting forest systems in the Southern Western Ghats, India. Green Farming, 11(6): 7-12.
37. Vishnu PS, Sandeep S (2021) Variations in weathering of natural and man-made forest systems in the Southern Western Ghats, India. International Research Journal of Environmental Sciences 10(4): 1 - 7.

### Seminar/ Conference Proceedings

1. Anuraj K, Jose PA, Gokul KG (2021) Climate change implications on phenological records and adaptive strategies of *Perseamacrantha* (Nees) Kosterm. - An endemic tree of the Western Ghats. In: Proceedings of international conference on 'New Horizons in Plant Science' organized by Dept. of Botany, University of Kerala, Kariavattom, Thiruvananthapuram, (online). pp. 213-214.
2. Balakrishnan P (2021) Faunal Diversity of south Indian Forests. In: Proceedings of national Webinar on 'Biosphere Reserves of India - Identification, Conservation and Management' M.S Golwalkar College, Rewa.
3. Balakrishnan P, Kocherry A (2021) Bird-hazard survey in INS Garuda. 1<sup>st</sup> Quarterly Report submitted to INS Garuda.
4. Balakrishnan S, Sanil MS, Dev SA, Ramasamy Y (2021) Prediction of potential distribution of *Tectona grandis* populations in south India. In: Proceedings of International Conference 'New Horizons in Plant Science' organized by Dept. of Botany, University of Kerala, Kariavattom, Thiruvananthapuram, pp. 84-86. ISBN No. 978-81-940888-3-7.

5. Jithin J, Jose PA (2021) Vegetative propagation studies of *Canarium strictum* Roxb. and *Hydnocarpus pentandrus* (Buch.-Ham.) Oken, two threatened and high demanding NTFP yielding medicinal trees of the Western Ghats. In: Proceedings of international conference on 'New Horizons in Plant Science' organized by Dept. of Botany, University of Kerala, Kariavattom, Thiruvananthapuram, (Online). pp 10-12. . ISBN No. 978-81-940888-3-7.
6. Jose PA, Sujanalal P, Sreekumar VB, Subin K, Ancy V (2021) A study on woody plants endemic to Kerala: Taxonomy, distribution and population ecological information for conservation and management. In: Proceedings of 33rd Kerala Science Congress, 25<sup>th</sup> to 30<sup>th</sup> January (online). p. 28.
7. Kanagaraj R, Jose PA (2021) Preliminary studies on sustainable harvesting of *Persea macrantha* (Nees) Kosterm. - A jigar species of south India. In: Proceedings of 33<sup>rd</sup> Kerala Science Congress 25<sup>th</sup> to 30<sup>th</sup> January (online). p. 29
8. Patel B, Hrideek TK, Balakrishnan P (2021) Tree-microhabitats in tropical forests of the southern Western Ghats. In: Proceedings of the international conference on 'New Horizons in Plant Sciences', Department of Botany, University of Kerala, Kariavattom, Thiruvananthapuram (online). . ISBN No. 978-81-940888-3-7.
9. Rasmi CK, Jose PA (2021) Preliminary seed studies of *Baccaurea courtallensis* (Wight) Mull. Arg. - A wild edible fruit tree endemic to the Western Ghats, India. In: Proceedings of international conference on 'New Horizons in Plant Science', Dept. of Botany, University of Kerala, Kariavattom, Thiruvananthapuram, (online). pp. 206-208. . ISBN No. 978-81-940888-3-7.
10. Sanil MS, Sreekumar VB, Balakrishnan S, Dev SA (2021) DNA barcoding of the genus *Vateria* (Dipterocarpaceae) towards species confirmation. IN: Proceedings of international conference 'New Horizons in Plant Science' organized by Dept. of Botany, University of Kerala, Kariavattom, Thiruvananthapuram, pp. 52-54. ISBN No. 978-81-940888-3-7.
11. Unnikrishnan R, Jayaraj R, Sujanalal P, Dev SA (2021) Machine learning algorithm – an alternative data analysis approach for authentication of medicinal plants. In: Proceedings of international conference 'New Horizons in Plant Science' organized by Dept. of Botany, University of Kerala, Kariavattom, Thiruvananthapuram, ISBN No. 978-81-940888-3-7.
12. Sajeev TV (2021) How colonialism made pests: the case of *Hyblaea puera* Cramer. Animals and South Asian History International Symposium.
13. Anitha V, Soman D (2021) An Assessment of recreational services and ecotourism development of Athirappilly - Vazhachal waterfalls in the natural forests of

- southern Western Ghats, India. In: International Conference on “Natural and cultural heritage in forests - contemporary challenges”, held online from December 9-10, virtually hosted by Warsaw University of Life Sciences, Poland.
14. Soman D, Viswanath S, Anitha V (2021) The Economics of endangered species protection in a Protected Area: The case of Parambikulam Tiger Reserve, Kerala, India. In: International Commonwealth Forestry Conference, Canada, held online from 16-18 August 2021, virtually hosted by the Faculty of Forestry at the University of British Columbia Vancouver, British Columbia, Canada.
  15. Soman D, Anitha V, Viswanath S (2021) An embodied perspective on the existence value of a heritage tree in Parambikulam Tiger Reserve, Kerala, India. In: International Conference on Natural and Cultural Heritage in Forests - Contemporary Challenges. 9-10 December, Forest Culture Centre in Goluchow.
  16. Soman D, Anitha V, Viswanath S, Sandeep S (2021) Insurance value of an ecosystem function provided by the natural forest in Parambikulam Tiger Reserve, India. In: 11<sup>th</sup> International Conference on Ecological Informatics conducted online 9-13 November, Digital University, Kerala.
  17. Sarada Devi D, Anitha V (2021) Forest dependence of tribal communities in Western Ghats, Kerala. In: International Multidisciplinary Conference on Recent Trends in Environmental Science and Management (IMCRTSM 2021). August 6-7, Conducted online by KTHM College, Maharashtra, India, UGC - STRIDE Cell and Brazil Chapter - International Youth Society, Australia.
  18. Sarada Devi D, Anitha V (2021) Nudge: On enhancing adaptive capacity and reducing vulnerability levels. In: Conference Proceedings (IUFRO Div 6). 20<sup>th</sup> International Commonwealth Forestry Conference. Virtually hosted by the Commonwealth Forestry Association, the Faculty of Forestry, University of British Columbia, the International Union of Forest Research organizations, at Vancouver, Canada.
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  20. Sarada Devi D, Anitha V (2021) Climate Change and Forest Management: On Reduced Community Based Vulnerability Levels. In: International Conference

- on Natural and cultural heritage in forests – contemporary challenges. December 9-10, Virtually hosted by IUFRO and Institute of Forest Sciences, Warsaw University of Life Sciences, Poland.
21. Sarada Devi D, Anitha V (2021) Vulnerability assessment of forest dependent tribal community towards the impacts of drought. In: INSEE-IIITD International Conference. December 15-17. Conducted online by Indian Society for Ecological Economics, India.
  22. Rasmi CK, Ajay R, Jose PA (2021) Preparation and evaluation of functionally enriched squash from *Flacourtia montana*: An underutilized wild edible fruit for commercialization. In: Compendium of invited lectures and abstracts. National Online Training Programme on “Conservation, Management and Utilization of Horticultural Genetic Resources for Livelihood and Nutritional Security”, November, 22-26, ICAR-IIHR, Bengaluru, pp. 89.
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  24. Jithin Jose, Jose PA (2022) Conservation and management studies of selected NTFP plants of Western Ghats: a participatory approach. In: Proceedings of 34<sup>th</sup> Kerala Science congress, Kerala State Council for Science, Technology and Environment. p. 242.
  25. Anuraj K, Jose PA, Gokul KG (2022) A study on climate change impact on selected three endemic and threatened trees: Implications and adaptive strategies. In: Proceedings of 34<sup>th</sup> Kerala Science Congress 10<sup>th</sup> to 12<sup>th</sup> February, KSCSTE. pp. 394-395.
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  27. Vidya PR, Jose PA (2022) Development of improved seed harvesting practices of *Dysoxylum malabaricum* Bedd. ex C. DC.: A physiological approach. International Conference on sustainable utilization of Bioresources, 10<sup>th</sup>-15<sup>th</sup> January, Dept. of Botany, University of Kerala, Thiruvananthapuram. p.165.
  28. Vidya PR, Jose PA (2022) Preliminary physiological studies on improved seed shelf life of *Machilus macrantha* Nees. 19<sup>th</sup> -20<sup>th</sup> January, Dept. of Botany, Fatima Mata National College, Kollam.

29. Subin K, Jose PA (2022) Unravelling reproductive constraints of two endangered tree species in Southern Western Ghats, India. In: International Conference on sustainable utilization of Bioresources. 10<sup>th</sup>-15<sup>th</sup> January, Dept. of Botany, University of Kerala, Thiruvananthapuram. p.65.
30. Kumar S, Raju R (2022). Morpho-molecular characterization and pathological investigation of *Fusarium solani* associated with leaf spot disease of *Callicarpa tomentosa*: First record from India. MSI virtual Conference held on March 8<sup>th</sup> -10<sup>th</sup>, ICAR Research Complex for NEH Region, Umiam, Meghalaya.
31. Kripa TS, Johnson M, Mufeeda KT, Kumar S (2022). Assessment of fungicidal potential of rhizosphere fungus *Talaromyces muroii* (KFRIMCC 088) isolated from *Hopea erosa* (Bedd.) Slooten – a critically endangered tree. MSI virtual Conference held on March 8<sup>th</sup> -10<sup>th</sup>, ICAR Research Complex for NEH Region, Umiam, Meghalaya.
32. Unnikrishnan R, Dev SA, Jayaraj R, Sujanapal P (2021) An alternative data analysis approach for authentication of medicinal plants. In: Proceedings of International Conference NHPS.
33. Dev SA, Sarath P, Dasgupta M (2021) Genomic strategies for enhancing adaptive potential of threatened cane genetic resources in India. In: virtual Conference on 29<sup>th</sup> September, IUFRO World Day Session: Population Genetics and Genomics Research for Conservation, Climate Adaptation, Sustainable Management and Breeding of Tropical Trees.
34. K. A. Sreejith, V.B. Sreekumar, M. P. Prejith, M.S. Sanil, T.S. Prasad & Akhil Murali. (2021) Diversity, stand structure and biomass of a tropical wet evergreen forest of Southern Western Ghats, India. 11th International Conference on Ecological Informatics (ICEI 2020+1) Kerala Digital University.
35. Amritha K.S, T. X Alan, K. A. Sreejith, V.B. Sreekumar, T. Mayamanikandan, C. Sudhakar. 2021. Reddy. Inventory of trees and Remote sensing-based estimation of the above-ground biomass in the tropical wet evergreen forest of southern Western Ghats. 11th International Conference on Ecological Informatics (ICEI 2020+1), Kerala Digital University.
36. Muhammed Afsal A, K.A. Sreejith, N. Parthasarathy. 2021. Temporal and spatial analysis of mangrove vegetation from selected patches of Western Coast, India. 11<sup>th</sup> International Conference on Ecological Informatics (ICEI 2020+1) Kerala Digital University.
37. Abdulla Naseef S A, Deepak Barua, Kausal A K and Sreejith K A . 2021. Leaf thermotolerance in mangrove plants: variation across species and relationship with

leaf traits. INTROMET 2021; Changing Climate: Consequences and Challenges; National Seminar, CUSAT November 23-28,2021.

38. Aarathi.M.S.; Abdulla Naseef, S.A and Sreejith.K.A. 2022. Understanding mangrove salt tolerant strategies using anatomical traits, Kerala Science Congress, 2022.
39. Sreejith.K.A; Sreekumar V.B; Sanil, M.S. and Akhil Murali 2022. Investigation on temporal dynamics of two populations of *Hopea racophloea* Dyer, Western Ghats, Kerala Science Congress, 2022.

### Popular Articles

1. Balakrishnan P (2021) Roots of human-wildlife conflict (in Malayalam) *Sasthra Keralam* 52 (12): 22-24.
2. Bindu TN, Balakrishnan P (2021) International decade of ecosystem restoration (in Malayalam) *Deshabhimani - Kilivathil*. May 16<sup>th</sup>. P.4.
3. Dev SA (2021) Genomics offer clues to how forest trees responded to the last ice age (MONGABAY, March) ([www.india.mongabay.com/2021.03](http://www.india.mongabay.com/2021.03)).
4. Jose PA (2021) Vanapunasthapanam sasyasamrakshanathilud. *Aaranyam* (March Issue), pp 34-36.
5. Maheswari P, Kumar NK, Dev SA, Ulaganthan K, Yasodha R (2021) Transcriptomics for unravelling adaptive genetic diversity in teak. *IFGTB News* 2(4) (January Issue). (<http://ifgtb.icfre.gov.in/>).
6. Sandhwana KS, Sujanapal P, Dantas KJ (2021) Keezhatanghattha Adhinivesha Patarppukal (Unbeatable Invasive Species) *Aranyam* (May - June Issue), pp. 12-15.
7. Teak Museum and Bio-resources Nature Park (Travel story article) (2021) in *Fast track Magazine - Thekinde Naatilek* (March Issue).
8. Viswanath S, Raghu AV (2021) Scientific methods of bamboo planting (In Malayalam) *Deshabhimani Daily*, 11<sup>th</sup> July.
9. Balakrishnan P, Bindu TN (2021) Zoonotic diseases (in Malayalam). *Aranyam*. (October Issue), pp. 24-27.
10. Balakrishnan P (2021) Challenges of Wildlife Conservation (in Malayalam). *Deshabhimani- Kilivathil*. 10<sup>th</sup> October, P. 4.
11. Balakrishnan P (2022) Evolution of locomotion in dinosaurs (in Malayalam).



*Deshabhimani-Kilivathil*. 6<sup>th</sup> February, P. 4.

12. Sandhwana KS, Sujanal P, Dantas KJ (2021) Keezhatangatha Adhinivesa Patarppukal (Unbeatable Invasive Species). Aranyam. (May – June Issue), pp.12-15.
13. Sreejith KA, Balakrishnan P, Amruth M (2022) Forest and Wildlife: Conservation and Challenges (in Malayalam). In: Manorama Year Book, pp. 346-363.

### **Training Manual Published**

1. Jose PA, Jithin Jose 2021. Thadiyithara vanavibhava sasyangalude prajanana margangalum susthira upayogareethikalum: Pariseelanaparipadi. Kerala Forest Research Institute, Peechi. pp.12.
2. Jayaraj R, Sandeep S (Eds) (2022) Training Manual for Training Programme in Analytical Instrumentation – Edition-I, January 2022, Centre for Analytical Instrumentation – Kerala (CAI-K), KSCSTE - Kerala Forest Research Institute.
3. Jayaraj R, Sandeep S (Eds) (2021) Training Manual for Training Programme in Analytical Instrumentation – Edition-II, October 2021, Centre for Analytical Instrumentation – Kerala (CAI-K), KSCSTE - Kerala Forest Research Institute.

### **Training Brochure Published**

1. Jose PA, Kanagaraj R (2021) Kulamavu- Sasthreeya vibhavasekharanam: Vruksha samrakshanathinum Susthiraupayogathinum. Kerala Forest Research Institute, Peechi.

## ACADEMIC PROGRAMMES

### Doctoral Degree awarded



#### **Greeshma P**

(Notification No. CUSAT/EXAM (T). A3/8339/2021, Dated:20/07/2021). Foraging ecology of selected birds in the kole wetlands of Thrissur, Kerala, India

Degree of Doctor of Philosophy under School of Environmental Studies, Cochin University of Science and Technology, 12.07.2021, Supervising Guide – Dr. EA. Jayson



#### **Renuka R.**

(Notification No. CUSAT/EXAM(T). A3/27223/2020, Dated:17.09.2021). Chemistry of mangrove soils in Kerala.

Degree of Doctor of Philosophy under School of Environmental Studies, Cochin University of Science and Technology, 07.09.2021, Supervising Guide – Dr. S. Sandeep



#### **Bharath Nair**

(Notification No.142468/RESEARCH-C-ASST-1/2021/Admn Dated 21.12.2021) Biocontrol potential of rhizosphere and rhizoplane fungi of selected grasses against certain fungal diseases of forest nursery seedlings.

Degree of Doctor of Philosophy in Botany under the Faculty of Science, University of Calicut, 11.11.2021, Supervising Guide – Dr. GE. Mallikarjuna Swamy

## ONGOING DOCTORAL PROGRAMMES

### FOREST RESEARCH INSTITUTE - Deemed to be University

1. Diversity and abundance of tree-microhabitats and its potential as indicators of vertebrate diversity in tropical rainforests of the Western Ghats (Bharati Patel)
2. Geochemistry of carbon storage under continuous teak rotation in Southern Western Ghats. (Panchami Jaya)
3. Integrative taxonomic studies on skippers (Lepidoptera:Hesperidae) of Southern Western Ghats (Athulya C)

4. Unravelling phenotypic plasticity, local adaptation and population genetics divergence of *Korthalsia laciniosa* (Griff.) and *Korthalsia rogersii* Becc. In Andaman & Nicobar Islands. (Sarath P)

## COCHIN UNIVERSITY OF SCIENCE AND TECHNOLOGY

1. Assessment of ecosystem services from Parambikulam Tiger Reserve, (Divya Soman)
2. Pedogenesis and geochemical transformations in forest ecosystems of the Western Ghats of Kerala. (Vishnu PS)
3. Carbon dynamics in mangrove systems of Kerala. (Harishma KM)
4. Molecular fingerprints and geochemical interaction of organo-nano composite from Forest floor humic acid in the Western Ghats, Kerala. (Ninu Jose M)
5. Seasonal influence on phenology of woody species in a tropical wet evergreen forest of Southern Western Ghats, India. (Thasini VM)
6. Molecular diagnostic markers for authentication and early sexing of *Coscinium fenestratum* (Gaertn) Colebr. (Remya Unnikrishnan)
7. Genomic characterization and gene-ecological zonation for sustainable management of teak genetic resources. (Swathi Balakrishnan)
8. Bioactivity and mechanistic studies of certain botanical extracts for their potential application as biopesticides. (Alina Paul)
9. Soil carbon pool and its dynamics in the systems of Kerala Western Ghats, (Binsiya TK)
10. Invasive alien plants in tourist locations of Kerala: pathways, spread and impact. (Karthika MNair)
11. Exploring the antioxidant activity of humic substances in composts and development of nanocomposites for environmental and health benefits. (Faniya Toby)
12. Temporal analysis of distribution and morphometry of Coleoptera in Kerala part of Western Ghats. (Thushar Naduvalloor)
13. Faunal interactions of invasive alien plants: case studies on *Lantana camara* L., *Mimosa diplotricha* Sauvalle, and *Mikania micrantha* Kunth in Kerala. (Premdas S)
14. Chemistry and geochemical interactions of organo-clay nano composites developed

on humic acid microstructures (Navya M)

15. Effects of drought on forest dependent communities: an economic analysis based on ecosystem services of the Western Ghats in Kerala. (Sarada Devi D)
16. Phthalate release from plastic fragments and microplastics degradation in Kole Wetlands of Thrissur and its role in fresh water contamination. (Blaise Jose K)
17. Population genetics and genomic approaches for conservation and management of *Santalum album* Linn- (Reshma Bhasker T)

## UNIVERSITY OF CALICUT

1. Ecology and behaviour of amphibians of Eravikulam National Park, with special reference to bush frogs. (Sandeep Das)
2. Herpetofaunal diversity in swamp (Vayal) ecosystems in Periyar Tiger Reserve, Western Ghats. (Rajkumar K.P.)
3. *In vitro* studies for production of secondary metabolites and phytochemical characterization in medicinally important genus *Embelia* Burm.f. (Rini Vijayan KP)
4. Studies on plus tree selection, variability and seed biology of *Terminalia paniculata* Roth (Combretaceae) in Kerala part of peninsular India. (Sanal C Viswanath)
5. Studies on variability, phenology and management methods of the alien invasive tree, *Senna spectabilis* (D.C.) Irwin & Barneby in Kerala, India. (Muraleekrishnan K)
6. Conservation biology of *Atuna indica* (bedd.) Kosterm. and *Hydnocarpus longipedunculatus* Robi et al., two endemic tree species of the Western Ghats of Kerala. (Subin K)
7. Study on the impact of allelochemicals of *Senna spectabilis* (DC.) Irwin and Barneby invasion in Wayanad, Kerala. (Suby)
8. Ecophysiology of mangroves in Kerala: An enquiry through plant functional traits. (Abdulla Naseef)
9. Plant - frugivore interaction and seed dispersal syndromes in Shola forests of the Western Ghats, India. (Nimisha ES)
10. Effect of elicitation and precursor feeding on the production of Oroxylin A, Chrysin and Baicalein in *in vitro* cultures of *Oroxylum indicum* (L.) Kurz. (Sreeja CS)
11. Ecophysiological and biochemical studies on seed viability loss in *Dysoxylum*

- malabaricum* Bedd. and *Persea macrantha* (Nees.) Kosterm.- Two threatened tree species of Western Ghats, Kerala- (Vidya R)
12. A study on population dynamics of two threatened *Myristica* species of Western Ghats, Kerala in the context of climate change- (Anuraj K)
  13. Studies on plus tree selection, genetic variability and wood properties of the endemic tree species *Artocarpus hirsutus* Lamk. (Moraceae) in Kerala- (Sinny Francis)
  14. Studies on variability, growth performance and wood properties of selected clones and plus trees of teak (*Tectona grandis* L.f.) in Kerala- (Preetha B)
  15. Morphological and molecular taxonomy of skippers (Lepidoptera: Hesperidae) in Kerala- (Rakhi KR)
  16. Studies on clonal propagation and seed germplasm storage with reference to domestication of *Baccaurea courtallensis* (Wight) Mull.Arg. and *Flacourtia montana* J.Graham - two wild edible fruit trees of Western Ghats, Kerala- (Rasmi CK)
  17. Ecology of Troidini butterflies (Lepidoptera; Papilionidae) in Kerala- (Anju MS)
  18. Investigation on application of nanobionics on accumulation of biomass and biosynthesis of compounds in *Holostemma adakodien* K.schum in *In vitro*- (Sangeeth Chandran)
  19. Community structure and habitat use of rodents in a tropical forest of the southern Western Ghats, India- (Sreejith Sivaraman)
  20. Foraging ecology of Bonnet Macaque along the anthropogenic gradients : Food traits perspective- (Sheheer TA)
  21. Investigation on physio-chemical, microstructure properties and molecular characterization of special bamboos used in weaving by tribal communities in Idukki district, Kerala- (Anjana N)
  22. Distribution diversity and properties of two endemic bamboo species *Dendrocalamus stocksii* (Munro) M.Kumar, Remesh & Unnikrishnan and *Munrochloa Ritchie* (Munro) M. Kumar & Remesh in Kerala- (Muhsina Moosa)

## ACADEMIC ATTACHMENT PROGRAMMES

Total Number of 45 attachments covering Biotechnology, Botany, Ecology, Environmental Studies, Environmental Science, Forestry, Geology, Library Science, Post Graduate Diploma in Forest Management, Microbiology and Zoology students

from different Universities and Colleges - Malayalam University, M.G. University, Bharathidasan University, Central University of Karnataka, Pondicherry University and Pazhassiraja College, Sacred Heart College, Christ College, Vimala College, St. Josephs College, Indian Institute of Forest Management, Bhopal, Amity School of Natural Resources and Sustainable Development (ASNRSD) Amity University, Noida, have been completed during the reporting period. The academic programme also has 26 Internships covering B-Arch, Biotechnology, Botany, Environmental Science, Microbiology from students of Nehru Arts & Science College, St. Thomas College, MES School of Engineering, Sree Sankara College, St. Josephs College and S.N College.

**KSCSTE- Kerala Forest Research Institute, Peechi – 680 653**

(A unit of Kerala State Council for Science, Technology & Environment, Govt. of Kerala)  
**INCOME & EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31<sup>st</sup> MARCH, 2022**

in (₹)

Expenditure	Sch No.	Year ended 31 March 2022	Year ended 31 March 2021	Income	Sch No.	Year ended 31 March 2022	Year ended 31 March 2021
Infrastructure Strengthening (Non Plan)	15	2,23,76,918	1,72,63,712	Grant from Government of Kerala	12	11,49,90,644	10,03,63,588
Salaries and Allowances (Non Plan)	16	5,31,87,055	7,23,42,250	Other Receipts	13	1,50,12,945	1,73,76,091
Depreciation	8	2,80,68,483	2,70,70,159	Depreciation transferred to Capital Reserve	8	2,80,68,483	2,70,70,159
Other Project Expenses		5,52,90,879	6,11,39,186	Income from other Project	14	5,52,90,879	6,11,39,186
Project Expenses under Plan scheme		5,44,39,615	2,81,33,717				
<b>TOTAL</b>		<b>21,33,62,951</b>	<b>20,59,49,024</b>	<b>TOTAL</b>		<b>21,33,62,951</b>	<b>20,59,49,024</b>

**KSCSTE - Kerala Forest Research Institute Peechi, Thrissur - 680653**

(A unit of Kerala State Council for Science, Technology & Environment. Govt. of Kerala)  
**BALANCE SHEET AS ON 31 March 2022**

**in (₹)**

Liabilities	Sch No	As at 31 March 2022	As at 31 March 2021	Assets	Sch No	As at 31 March 2022	As at 31 March 2021
<b>Reserves and Surplus</b>	2	23,37,07,596	23,62,13,529	Plant property & equipment	8	20,47,89,302	20,72,95,235
<b>Current Liabilities &amp; Provisions</b>				<b>Current Assets, Loans and Advances</b>			
Creditors for Expenses	3	65,90,288	75,47,960	Cash & Bank balance	9	26,68,64,658	27,36,85,425
Creditors for Fixed Assets	4	-	1,83,38,100	Loans and Advances	10	1,74,41,029	1,17,21,888
Other Liabilities	5	1,27,56,399	1,28,38,088	Other Current Assets	11	43,35,289	-
Provisions	6	7,53,00,000	10,32,21,050				
Unspent Balance of Grant-in-Aid(Net)	7	16,50,75,996	11,45,43,821				
<b>TOTAL</b>		<b>49,34,30,278</b>	<b>49,27,02,548</b>	<b>TOTAL</b>		<b>49,34,30,278</b>	<b>49,27,02,548</b>



## INSTITUTIONAL COMMITTEES

### 1. NEW RESEARCH COUNCIL

(Council (M) Order No.83/2020/KSCSTE, Thiruvananthapuram,  
Dated: 03 /11/ 2020

#### Chairman



**Dr. N. Krishnakumar IFS**  
(Rtd.) and Former Head of Forest Force  
Tamil Nadu Forest Dept.  
G/03/01, TAISHA (AIS quarters)  
Natesan Nagar West, 3rd Main Road  
Virugambakkam, Chennai 600 092

#### Members



**Dr. C. Kunhikannan**  
Director,  
Institute of Forest Genetics &  
Tree Breeding,  
Indian Council of Forestry  
Research & Education,  
PB No.1061, RS Puram P O, Coimbatore – 641 002



**Dr. Kavil Veettil Sankaran**  
Former Director, KFRI,  
TCDC Expert FAO,  
'Manasi', Convent Road,  
Shornur, Palakkad – 679 121



**Shri. P.K. Kesavan, IFS**  
Principal Chief Conservator of Forests  
(Head of Forest Force), Forest Headquarters  
Vazhuthacaud,  
Thiruvananthapuram - 695 014 (Permanent invitee)



**Dr. S. Pradeep Kumar**  
Member Secretary,  
Kerala State Council for Science  
Technology & Environment,  
Sasthra Bhavan, Pattom P.O,  
Thiruvananthapuram - 695 004 (Permanent invitee)



**Prof. Dr. Raman Sukumar**

Centre for Ecological Sciences  
Third Floor, Biological Sciences Building,  
Indian Institute of Science,  
Bangalore 560 012



**Dr. RV. Varma**

Former Chief Scientist KSCSTE - KFRI  
Former Chairman, Kerala State  
Biodiversity Board,  
Lakshmipuram, Royal Avenue,  
Thrissur – 680 020



**Dr. AJT. Johnsingh**

Former Dean, Wildlife Institute of India  
Magnolia 101, Easter Gardenia  
Apartments,  
Sahakara Nagar,  
Bangalore – 560 092



**Dr. Syam Viswanath**

Director,  
KSCSTE-KFRI  
Member & Ex-Officio Convener

## 2. MANAGEMENT COMMITTEE

(Council (M) Order No. 37/2020/KSCSTE, Thiruvananthapuram,  
Dated 04/03/2020)

### Chairman



**Dr. Syam Viswanath**  
Director,  
KSCSTE – KFRI

### Members



**Dr. Samson Mathew**  
Director,  
KSCSTE - National Transportation Planning &  
Research Centre - NATPAC



**Dr. S Pradeep Kumar**  
Member Secretary,  
Kerala State Council for Science  
Technology & Environment (KSCSTE)



**Dr. MP. Sujatha**  
Senior Principal Scientist,  
KSCSTE - KFRI



**Additional Secretary**  
Science & Technology Department,  
Govt. of Kerala



**Shri. B. Biju**  
Registrar,  
KSCSTE - KFRI  
Convener (Member)

### 3. 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
7. The Additional PCCF (Administration)	.....	Member
8. The Additional PCCF(Southern Region)	.....	Member
9. The Additional PCCF (Protection)	.....	Member
10. The Additional PCCF (Vigilance)	.....	Member
11. The Additional PCCF (Northern Region)	.....	Member
12. The Additional PCCF (BDC)	.....	Member
13. The Additional PCCF (IHRD)	.....	Member
14. The Additional PCCF (SA&NO)	.....	Member
15. The Principal Chief Conservator of Forests Wildlife & Chief Wildlife Warden	.....	Member
16. The Principal Chief Conservator of Forests (Social Forestry)	.....	Member
17. The Principal Chief Conservator of Forests (Vigilance)	.....	Member
18. The Principal Chief Conservator of Forests (Dev. & PFM)	.....	Member
19. The Chief Conservator of Forests (Protection)	.....	Member
20. The Chief Conservator of Forests (FMIS)	.....	Member
21. The Chief Conservator of Forests (HRD)	.....	Member
22. The Chief Conservator of Forests (Administration)	.....	Member
23. The Chief Conservator of Forests (Vigilance)	.....	Member
24. The Chief Conservator of Forests (Social Forestry)	.....	Member
25. The Regional Chief Conservator of Forests (North)	.....	Member
26. The Regional Chief Conservator of Forests (South)	.....	Member
27. The Conservator of Forests (Biodiversity)	.....	Member
28. The Deputy Conservator of Forests (Research) North	.....	Member
29. The Deputy Conservator of Forests (Research) South	.....	Member

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

**4. INTERNAL RESEARCH GROUP (IRG)**

Director	: Chairperson
Research Coordinator	: Convener
Dr. Suma Arun Dev	: Assoc. Convener
All Scientific staffs	: Members

**5. FINANCE COMMITTEE**

Director	: Chairperson
Research Coordinator	: Member
Two elected members from IRG	: Member
Section Officer (Accounts)	: Member
Registrar	: Convener

**6. PURCHASE COMMITTEE**

Dr. V. Anitha	: Chairperson
Dr. P. Balakrishnan	: Member
Dy. Registrar (Accounts)	: Member
Section Officer (Purchase)	: Member
Registrar	: Convener

**7. ACADEMIC PROGRAMME ADVISORY COMMITTEE**

Dr. V. Anitha	: Chairperson
Dr. TV. Sajeew	: Member
Dr. R. Jayaraj	: Member
Dr. M. Amruth	: Member
Dr. Suma Arun Dev	: Convener
Respective Research Guides	: Invitees

**8. EQUIPMENT / INFRASTRUCTURE DEVELOPMENT COMMITTEE**

Dr. Suma Arun Dev	: Chairperson
Dr. S. Sandeep	: Member
Dr. KA. Sreejith	: Member
Mr. PI. Shareef	: Member
Superintendent (Stores)	: Member
Section Officer (Purchase)	: Convener

**9. LIBRARY ADVISORY COMMITTEE**

Librarian	: Chairperson
Dr. TV. Sajeew	: Member
Dr. M. Amruth	: Member
Section Officer (Purchase)	: Member
Section Officer (Accounts)	: Member
Dr. VB. Sreekumar	: Convener

**10. WEBSITE & SOFTWARE HARDWARE COMMITTEE LAN**

Dr. P. Balakrishnan	: Chairperson
Dr. AV. Raghu	: Member
Dr. M. Amruth	: Member
Dr. KF. George	: Member
Mr. KM. Shiju	: Member
Smt. Ricy Eliner Varkey	: Convener

**11. KERALA FOREST SEED CENTRE ADVISORY COMMITTEE****(Vide (Proceedings G53/KFRI/79 dated 11 Feb 2004 -Modified here)**

Director, KFRI	: Chairperson
PCCF (WP & Research), KFD	: Member
CCF (Central Circle), KFD	: Member
SRO (North), KFD	: Member
SRO (South), KFD	: Member
Dr. V. Anitha, Research Co-ordinator	: Member
Dr. GE. Mallikarjuna Swamy	: Member
Dr. VB. Sreekumar	: Member
Dr. P. Sujanapal	: Convener

**12. NILAMBUR SUB-CENTRE ADVISORY COMMITTEE**

Director	: Chairperson
Registrar	: Co-Chairman
Research Co-ordinator	: Member
Dr. VB. Sreekumar	: Member
Dy. Registrar (Accounts)	: Member
Dy. Registrar (Admin)	: Member
Dr. KV. Mohammed Kunhi	: Member
Dr. P. Sujanapal	: Member
Dr. GE. Mallikarjuna Swamy, Sub-Centre In-charge	: Convener

**13. CAMPUS/GARDEN DEVELOPMENT COMMITTEE**

Dr. PA. Jose	: Chairperson
Dr. VB. Sreekumar	: Member
Dr. P. Sujanapal	: Member
Smt. Anuja Prasanna	: Member
Smt. MK. Raji, Engineering Division	: Convener

**14. JOURNAL OF BAMBOO AND RATTAN -EDITORIAL COMMITTEE**

Director	:	Chief-Editor
Dr. S. Sandeep	:	Executive Editor
Dr. R. Jayaraj	:	Editor
Dr. V. Anitha	:	Editor
Dr. AV. Raghu	:	Editor
Dr. Suma Arun Dev	:	Editor
Dr. VB. Sreekumar	:	Editor & Convener

**15. ANNUAL REPORT COMMITTEE**

Dr. R. Jayaraj	:	Chairperson
Research Coordinator	:	Member
Dy. Registrar (Admin)	:	Member
Dy. Registrar (Accounts)	:	Member
Dr. KA. Sreejith	:	Member
Dr. S. Sandeep	:	Member
Dr. Suma Arun Dev	:	Convener

**16. EVERGREEN NEWSLETTER COMMITTEE**

Dr. AV. Raghu	:	Chief Editor
Dr. M. Amruth	:	Associate Editor
Dr. P. Sujanapal	:	Associate Editor
Dr. P. Balakrishnan	:	Associate Editor

**17. STORES AUCTION AND DISPOSAL COMMITTEE**

Dr. VB. Sreekumar	:	Chairperson
Dr. R. Jayaraj	:	Member
Mr. K. Kamalakaran	:	Member
Smt. Anuja Prasannan	:	Member
Smt. MK. Raji	:	Member
Smt. Ricy Eliner Varkey	:	Member
Mr. PI. Shareef	:	Member
Smt. A. Aneesamole	:	Member
Stores-in-Charge	:	Convener

**18. SPORTS COMMITTEE**

Mr. PI. Shareef	:	Chairperson
Mr. K. Kamalakaran	:	Member
Smt. Anupa Vasu	:	Member



Smt. K. Keerthi	: Member
Mr. VC. Jinesh	: Convener

### **19.COMMITTEE FOR TRANSFORMATION OF OFFICIAL LANGUAGE TO MALAYALAM**

Registrar	: Chairperson
Dr. KV. Mohammed Kunhi	: Member
Dy. Registrar (Admin)	: Member
Smt. PS. Manju	: Member
Smt. CK. Sindhumol	: Member
Smt. Shirly Issac	: Convener

### **20.EXHIBITION ADVISORY COMMITTEE**

Dr. S. Sandeep	: Chairperson
Dr. AV. Raghu	: Member
Dr. M. Amruth	: Member
Mr. VC. Jines	: Member
Dr. Mohammed Kunhi	: Convener

### **21.SEMINAR COMMITTEE**

Dr. KA. Sreejith	: Chairperson
Dr. AV. Raghu	: Member
Dr. V. Anitha	: Member
Dr. M. Amruth	: Member
Dr. P. Balakrishnan	: Convener

### **22.IGH CAFETERIA ADVISORY COMMITTEE**

Dr. AV. Raghu	: Chairperson
Mr. KP. Manoj	: Member
Smt. Sabitha Balakrishnan	: Member
Mr. KM. Shiju	: Member
Mr. PI. Shareef - Guest House in charge	: Convener

### **23.BUILDING COMMITTEE**

Dr. PA. Jose	: Chairperson
Smt. MK. Raji	: Member
Mr. PI. Shareef	: Member
Dy. Registrar (Accounts)	: Member
Registrar	: Convener

**24.VEHICLE ADVISORY COMMITTEE**

Dr. P. Sujanapal	:	Chairperson
Dr. KA. Sreejith	:	Member
Dy. Registrar (Admn)	:	Member
Mr. KM Shiju	:	Member
Vehicle - in Charge (Mr. VS Krishnanunni)	:	Convener

**25.ENDOWMENT COMMITTEE**

Director	:	Chairperson
Dr. TV. Sajeev	:	Member
Dr. VB. Sreekumar	:	Member
Dr. P. Sujanapal	:	Member
Dr. Suma Arun Dev	:	Member
Dr. PA. Jose	:	Convener

**26.KFRI QUARTERS ALLOTMENT COMMITTEE**

Registrar	:	Chairperson
Dy. Registrar (Admin)	:	Member
Dr. S. Sandeep	:	Member
Smt. MK. Raji	:	Member
Mr. PI. Shareef	:	Convener

**27.RESEARCH SCHOLAR'S HOSTEL ADVISORY COMMITTEE**

Registrar	:	Chairperson
Mr. PI. Shareef.	:	Member
Smt. MK. Raji	:	Member
Smt. P. Anupa Vasu, Asst. Warden, Ladies Hostel	:	Member
Dr. Suma Arun Dev, Warden, Ladies Hostel	:	Member
Dr. P. Balakrishnan, Warden, Men's Hostel	:	Convener

**28.GRIEVANCE REDRESSAL COMMITTEE**

Director	:	Chairperson & Convener
Registrar	:	Member
Dr. TK. Kunjamu, Professor, KAU	:	Member
Smt. Sabitha Balakrishnan, Asst. Registrar (Admin)	:	Member
Smt. MK. Raji	:	Member

**29. INTERNAL COMPLAINTS COMMITTEE (ICC) -  
COMMITTEE TO PREVENT SEXUAL HARASSMENT  
ON WOMEN AT WORKPLACE**

Dr. Suma Arun Dev	:	Chairperson
Registrar	:	Member
Smt. Maymol Joseph	:	Member
Smt. K. Keerthy	:	Member
Dr. Uma Maheswari, Retd. Addl. Director of Health Services, Govt. of Kerala	:	Member
Smt. Sabitha Balakrishnan	:	Convener

**30. PROGRAMMER'S COMMITTEE**

Registrar	:	Chairperson
Smt. P. Anupa Vasu	:	Member
Shri. KM. Shiju	:	Member
Smt. Ricy Eliner Varkey	:	Co-Convener
Shri. K. Kamalakaran	:	Convener

**31. NURSERY MANAGEMENT COMMITTEE**

Director	:	Chairperson
Registrar	:	Member
Dr. PA. Jose	:	Member
Dr. P. Sujanapal	:	Member
Dr. AV. Raghu	:	Member
Dr. VB. Sreekumar	:	Convener

**STAFF LIST (As on 31 March 2022)**

<b>SI No</b>	<b>SCIENTIST</b>	<b>DESIGNATION</b>
1.	Dr. Syam Viswanath	Chief Scientist (Director-on deputation)
2.	Dr. MP. Sujatha	Senior Principal Scientist (Retd. in 31 <sup>st</sup> May 2021)
3.	Dr. TV. Sajeev	Senior Principal Scientist
4.	Dr. KV. Mohammed Kunhi	Principal Scientist
5.	Dr. V. Anitha	Senior Principal Scientist
6.	Dr. PA. Jose	Principal Scientist
7.	Dr. Suma Arun Dev	Senior Scientist
8.	Dr. Shambu Kumar	Senior Scientist
9.	Shri.VP. Raveendran	Senior Scientist (Retd. in 31 <sup>st</sup> May 2021)
10.	Dr. KF. George	Senior Scientist
11.	Dr. AV. Raghu	Senior Scientist
12.	Dr. TK. Hrideek	Senior Scientist (Deputation to SMPB)
13.	Dr. P. Sujanapal	Senior Scientist
14.	Dr. GE. Mallikarjuna Swamy	Senior Scientist
15.	Dr. VB. Sreekumar	Senior Scientist
16.	Dr. S. Sandeep	Senior Scientist
17.	Dr. R. Jayaraj	Senior Scientist
18.	Dr. KA. Sreejith	Senior Scientist
19.	Dr. P. Balakrishnan	Scientist
20.	Dr. M. Amruth	Scientist

**Administrative staff**

1. Group captain Biju B Dr. T. V. Sajeev	Registrar (Passed away on 12 <sup>th</sup> April 2021) Registrar in Charge
2. Sri. K. Satheesakumar	Dy. Registrar (Accts) (Retd. in 31 <sup>st</sup> July 2021)
3. Smt. Geetha Parakkott	Dy. Registrar (Admin.) (Retd. in 31 <sup>st</sup> July 2021)
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
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. Rajeeesh	Clerical Assistant Gr.II (Nilambur)
20. Sri. TM. Abdul Vahab	Word Processing Assistant
21. Sri. PK. Rajendran	Driver Gr. II
22. Sri. EO. Mathai	Driver Gr. II (Retd. in 31 <sup>st</sup> July 2021)
23. Sri. CH. Herald Wilson	Driver Gr.II
24. Smt. AM. Lalitha	Office Attendant Gr. V
25. Smt. TG. Chandrika	Office Attendant Gr. IV (Retd. in 30 <sup>th</sup> April 2021)

26. Sri. VK. Mohandas	Office Attendant Gr. IV
27. Sri. EP. Ulahannan	Office Attendant Gr. IV
28. Smt. K. Aparna	Office Attendant Gr.III
29. Sri. K. Abdul Jaleel	Office Attendant Gr.II
30. Smt. S. Ashamole	Office Attendant Gr.II
31. Smt. C. Sujatha	Office Attendant Gr.II
32. Sri. E. Hamsa	Office Attendant Gr.II
33. Sri. TP. Valsan	Office Attendant Gr.II
34. Smt. P. Deepa	Office Attendant Gr.II (Nilambur)
35. Sri. K. Mohammed	Helper Gr. IV (Nilambur) (Retd. in 31 <sup>st</sup> May 2021)
36. Sri. KK. Mohammed	Helper Gr. IV (Nilambur)
37. Sri. AV. Chamy	Helper Gr.II
38. Sri. TS. Prakash	Helper Gr.II
39. Sri. MS. SanthoshKumar	Helper Gr.II
40. Sri. TO. Simon	Helper Gr.II
41. Sri. MK. Suresh	Helper Gr.II
42. Sri. IO. Thomas	Helper Gr.II (Retd. in 30 <sup>th</sup> June 2021)
43. Sri. N. Rajan	Helper Gr.II (Nilambur)
44. Sri. CP. Ummer	Helper Gr.II (Nilambur)
45. Smt. PS. Kadeeja	Helper Gr.II (Palappilly)
46. Sri. KA. Thankachan	Helper Gr.II (Kottappara)
47. Sri. CB. Sajy	Helper
48. Sri. PV. Santhosh Kumar	Helper
49. Sri. K. Rajan	Nursery Man Gr.II
50. Smt. S. Padmavathy	Nursery Man Gr.II (Retd. in 28 <sup>th</sup> February 2022)
51. Sri. NK. Rajan	Nursery Man Gr.II (Palappilly)

### Technical Staff

- |                            |  |
|----------------------------|--|
| 1. Sri. PI. Shereef        | Technical Officer (Electrical) Gr.II       |
| 2. Smt. MK. Raji           | Technical Officer (Civil) Gr.II            |
| 3. Smt. Ricy Eliner Varkey | Technical Officer (IT)Gr.II                |
| 4. Sri. VC. Jinesh         | Technical Officer(Mechanical) (palappilly) |
| 5. Sri. MR. Anilkumar      | Technical Assistant Gr. IV                 |
| 6. Sri. OP. Ranjith        | Technical Assistant(Binder) Gr.II          |

