2022-23

LiFE
Lifestyle for Environment

ANNUAL REPORT





INDIAN COUNCIL OF FORESTRY RESEARCH AND EDUCATION

(AN AUTONOMOUS COUNCIL OF MINISTRY OF ENVIRONMENT, FOREST AND CLIMATE CHANGE, GOVERNMENT OF INDIA)

ANNUAL REPORT 2022-23

INDIAN COUNCIL OF FORESTRY RESEARCH AND EDUCATION

(AN AUTONOMOUS COUNCIL OF MINISTRY OF ENVIRONMENT, FOREST AND CLIMATE CHANGE, GOVERNMENT OF INDIA)

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Published by:
Media and Extension Division
Directorate of Extension
Indian Council of Forestry Research and Education
P.O. New Forest, Dehradun- 248 006 (Uttarakhand), India

Printed at:
Shiva Offset Press, Dehradun

मंत्री
पर्यावरण, वन एवं जलवायु परिवर्तन,
भारत सरकार

सत्यमेव जयते

MINISTER
ENVIRONMENT, FOREST AND CLIMATE CHANGE
GOVERNMENT OF INDIA

भूपेन्द्र यादव
BHUPENDER YADAV

Message

Indian Council of Forestry Research and Education (ICFRE) has always maintained its steadfast commitment to the conservation and sustainable management of India's invaluable forests. The council is fulfilling its commitment to increase the productivity of forests through germplasm improvement of economically important trees, medicinal plants and bamboo. In this endeavor, five varieties of medicinal plants for hill temperate regions have been released in 2022-23. The preparation of the Forest Soil Health Card (FSHC) has furthered the cause of sustainability. A book titled "FAQs on Agroforestry" simplifying scientific work for the benefit of stakeholders was released.

ICFRE has been monitoring climate change effect by establishing permanent research plots in diverse forest types. A report on the Domestic Forest Carbon Market for India in conformity with UNFCCC decisions and objectives was prepared. ICFRE was also actively involved in the National Reporting to the UNCCD Secretariat and drafting the "Country Position Report" for COP-15. MoEF&CC initiated the Green Credit programme to incentivise green actions in which ICFRE played a central role as the administrator.

The Council has enthusiastically participated in Government flagship programmes and conducted 180 programmes under the Azadi ka Amrit Mahotsav (AKAM). Ten e-learning modules on forestry and allied fields, for the iGOT portal under "Mission Karmayogi" were prepared by ICFRE. The council was also an active implementer of the 'LiFE' campaign. The entire ICFRE team deserves commendation for their outstanding contributions, dedication, and high-quality research in enriching India's forestry sector.

Date: 23.07.2024

(Bhupender Yadav)

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MINISTER OF STATE
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EXTERNAL AFFAIRS
GOVERNMENT OF INDIA

Message

ICFRE has made notable strides in research, development and sustainable land management over the past year. This annual report 2022-23 highlights its dedication to forestry, biodiversity conservation and climate change. The noteworthy achievements made during this period include development of varieties of medicinal plants, tissue culture teak trials, degraded area restoration and issuance of a Standard Operating Procedures (SOP) for nursery management.

Agroforestry models prepared by the council to help double farmer's income and support "*Har Med Par Ped*" are also worth mentioning. The council has also secured a number of patents and enhanced public outreach through trainings, awareness programs and publications.

The Annual Report 2022-23 underscores the ICFRE's long standing commitment towards forest conservation and innovative research.

I am confident, that ICFRE will continue to inspire and take lead in the areas related to promotion of sustainable forestry, land management and environmental conservation, setting a laudable benchmark for future forestry research and development.

(Kirti Vardhan Singh)

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LEENA NANDAN

सत्यमेव जयते

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SECRETARY
GOVERNMENT OF INDIA
MINISTRY OF ENVIRONMENT, FOREST
& CLIMATE CHANGE

Message

Indian Council for Forestry Research and Education (ICFRE) is a premier forestry research institution working in various areas pertaining to forestry research, that range from biodiversity conservation and forest genetic resources to forest protection, forest management and agroforestry.

Significant achievements have been made by ICFRE in tree improvement research, through clonal and progeny trials conducted across various agro-climatic zones, for Teak, Casuarina, Tamarind, Eucalyptus, Gmelina, and Melia. The documentation of the population structure of 480 FGR species; preparation of eco-distribution maps of 208 species, pictorial guide of 200 species and herbarium specimens of 260 species; development of seed storage protocols for bamboo species, and the recording of flowering data for 43 bamboo species, are examples of ICFRE's commitment towards understanding the rich diversity of our forests and taking requisite steps for conserving them.

New products, instruments and technologies in diverse areas such as healthcare, natural dye production, bio-fertilizers, fire-fighting tool, and wood preservatives are the outcomes of various research projects, and as such are fully aligned with the priority accorded by Government to 'vocal for local' and Atmanirbhar Bharat.

The strides made in education, by awarding 227 MSc. degrees and 56 Ph.D. degrees, the development of e-learning modules under the iGOT portal, the widespread dissemination of Mission LiFE messages, and initiative with respect to Azadi ka Amrit Mahotsav, all illustrate ICFRE's dedication towards nurturing the next generation of forestry leaders.

I extend my greetings to the scientists and all personnel of ICFRE for the commendable work being done by organisation, I am confident that this report will serve as a knowledge repository for all readers, researchers and students who are interested in forestry research.

(Leena Nandan)

New Delhi

April 4, 2024

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LiFE Lifestyle for Environment

जितेंद्र कुमार
JITENDRA KUMAR

सत्यमेव जयते

वन महानिदेशक एवं विशेष सचिव
भारत सरकार
पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय
DIRECTOR GENERAL OF FORESTS & SPL. SECY.
GOVERNMENT OF INDIA
MINISTRY OF ENVIRONMENT, FOREST AND
CLIMATE CHANGE

Message

The Annual Report of the Indian Council of Forestry Research and Education (ICFRE) for the year 2022-23 reflects ICFRE's commitment to the conservation and sustainable management of our forest resources. Significant efforts were made in 2022-23 on tree improvement through coordinated research projects on germplasm improvement of important timber species and also, notable progress was observed on clonal field trials of teak and bamboo.

Innovative research results in the field of wood science like protective nano-coating for wood, development of cross laminated timber from plantation-grown hardwood, cement-bonded bamboo particle boards, plastic-bonded bamboo matt board and plywood utilizing waste plastic have found end users in the commercial wood-based industry.

Research in isolation cannot be relevant. Hence ICFRE has been strongly pushing forward in the field of extension. The establishment of extension centres like Van Vigyan Kendras, Demo Villages and Technology Facility Centres has been useful in disseminating the technologies developed to the grassroots level. Similarly, engagement with important stakeholders like Self Help Groups, Tree Grower and Forest Based Industries has been facilitated by the ICFRE to ensure field-level outreach of research. Production of multi-media material and holding trainings, conferences and workshops has further helped the cause of research extension to the stakeholders.

The efforts of ICFRE have been marked by resilience, innovation and a deep sense of responsibility towards our forests and the environment. I extend appreciation to the entire ICFRE family, partners and all those who share the common vision of a greener and more sustainable future. Together, we will continue to nurture and protect our forests as a priceless legacy for generations to come.

Place: New Delhi

(Jitendra Kumar)

Date: 4th April, 2024

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महानिदेशक

Kanchan Devi, IFS
Director General

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Director General
Indian Council of Forestry Research and Education
P.O. New Forest, Dehra Dun - 248006
(An ISO 9001 : 2008 Certified Organization)

Foreword

It is my pleasure to present the annual report of the Indian Council of Forestry Research and Education (ICFRE) for the year 2022-23. This report showcases the achievements and activities of ICFRE in various domains of forestry research, like tree improvement, forest genetic resources, forest management, agroforestry, wood science, forest protection, ecology and others.

The council has been working assiduously to develop and disseminate improved varieties, clones and germplasm of important tree and bamboo species for enhancing productivity, quality, and resilience of plantations and agroforestry systems. ICFRE Institutes have also established demonstration plots of clone/ varieties/ improved germplasm of Melia, Mahogany, Poplar, Eucalyptus, Shisham, Tamarind and medicinal plants in different states. In addition, ICFRE Institutes have produced and supplied quality planting material of casuarina, teak, eucalyptus, melia, agar, bamboo and other species to various stakeholders.

Council has also been implementing the National Programme for Conservation and Development of Forest Genetic Resources with the aim of documenting, conserving, and utilizing the rich forest genetic resources of the country. Council has also been promoting agroforestry as a viable land use option for enhancing income and livelihood security of farmers and established various trials across the country for Sandalwood, Gmelina, Leucaena and Flemingia species. A book has been published titled "FAQs on Agroforestry" in both Hindi and English. It provides valuable information for the farmers and other stakeholders on agroforestry aspects of 36 tree species including bamboo.

Council has also been working on forest management and in this endeavor, first Forest Soil Health Card (FSCH) has been released for Jharkhand and six more are ready for release for two states and four UTs. The form factors of teak and sal in different agro-climatic zones of Chhattisgarh have been revised, developed a new equation to calculate the more accurate volume of logs by reducing the error in volume loss estimated by the quarter girth formula, and developed training manuals on seed collection and handling and nursery techniques of 30 important plantation species of Odisha.

Research in Wood Science has led to the development of Nano coatings for wood protection against fungi and photo-degradation and synthesis of wood coatings using Cellulose Nano Crystals/Fibers (CNCs/CNFs) from dry leaves of fig tree. For utilizing waste recycled plastic, developed plastic bonded bamboo matt board and plastic bonded plywood. In the realm of Forest Protection, focus of council is to develop ecofriendly methods for boosting growth and for management of insect pests.

Climate change and its effect on environment and human beings are quite evident. In order to monitor the impact of climate change on Indian forests, permanent research plots have been established in different forest types. A draft report on Domestic Forest Carbon Market for India has been prepared in line with UNFCCC decisions and national policies.

In terms of products developed, we have made significant strides and have developed a formulation for treating diabetes mellitus, a topical herbal gel for pain treatment, a natural dye from *Soymida febrifuga* bark, an antibacterial wound healing cream from *Cassia tora* leaves extract, fire-fighting tool kit and fire safety clothing's kit.

Efforts in technology development and transfer have been equally fruitful. The Council has transferred technology on artificial induction of agarwood to the Department of Forest and Soil Conservation, Government of Nepal. Council has been granted two patents on an improved binding material for incense stick (Agarbatti) and on Technology for Medium Density Fibre Board (MDF) using Rice Straw and a Method of Manufacturing the same. In addition, 12 patent applications for various technologies developed have been filed. Council has developed Mobile Applications on Forest Seed Science & Technology, and Agroforestry.

On Sustainable Land and Ecosystem Management, trainings have been organized for members of local community for scaling up of SLEM best practices and improving livelihood opportunities in the states of Chhattisgarh and Madhya Pradesh. Energy saving devices such as improved cook-stoves have also been distributed.

Outreach Programme of the council has seen the establishment of new Van Vigyan Kendras (VVKs) and Demo Villages (DVs). For creating awareness and wider dissemination of research results, Council is regularly conducting Tree Growers' Mela (TGM).

ICFRE has implemented various initiatives to promote environmental awareness and education. Prakriti, a scientist-student connect program, has benefited over 14300 students through lectures, webinars, and other activities. ICFRE ardently implemented Government of India's flagship programme-AKAM, Mission LiFE and Mission Karmayogi.

Council has published 36 books, 58 Booklets/brochures/bulletins/pamphlets, 205 articles/abstracts, 166 popular articles, 441 research papers in international and national journals, and 130 chapters in books/proceedings in various fields of forestry. These publications reflect the high quality and diversity of research conducted by ICFRE and its institutes.

In Education front, 6th Convocation of FRI Deemed to be University was organized at ICFRE-FRI, Dehradun and 227 MSc. degrees and a total of 56 Ph.D. degrees have been awarded.

In the realm of Information Technology, Council has launched a new Recruitment Portal and developed the ICFRE Pension Portal, complete with a mobile application. These platforms have streamlined our processes and made them more accessible.

I would like to congratulate all the scientists and staff of ICFRE and its institutes for their commendable work and dedication in carrying out high quality forestry research for the benefit of the nation. I would also like to thank all the collaborators, partners, stakeholders, funding agencies, and policy makers for their valuable support and guidance to ICFRE. I hope that this report will provide useful information and insights to all the readers interested in forestry research.

I express my appreciation to Dr Sudhir Kumar, DDG (Extension), Dr Geeta Joshi, ADG (Media and Extension), Dr Vishwajeet Sharma, STO and the entire team of Media and Extension, Division for synthesizing and timely bringing out the Annual report 2022-23.

(Kanchan Devi)

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    Indian Council of Forestry Research and Education
    Dehradun - 248006

CONTENTS

Overview

OVERVIEW

Indian Council of Forestry Research and Education (ICFRE), Dehradun, an autonomous council under Ministry of Environment, Forest and Climate (MoEFandCC), Government of India (GoI) is mandated to conduct holistic research and impart education on forestry and environment, and extend solutions on emerging issues to various stakeholders. The annual report for the year 2022-23 provides an insight on the activities undertaken by ICFRE institutes and are presented into five chapters namely Introduction, Research Highlights, Education Vistas, Extension Panorama and Administration and Information Technology.

Projects	Completed	Ongoing	Initiated
Plan	21	58	23
Externally aided	40	88	29
Budget (in Crore)			
Plan			
Allotment	Rs. 252.25 Crore		
Expenditure	Rs. 235.75 Crore		
External aided			
Allotment	Rs. 183.60 Crore		
Expenditure	Rs. 156.19 Crore		

The broad area of research includes forest productivity, genetic improvement, biodiversity conservation, silviculture, agroforestry, climate change, forest products, protection, combating desertification, sustainable development, and ecology and environment. The significant outcomes in the form of technologies developed are extended from lab to land for the benefit of various stakeholders. The overview of activities during the fiscal year is as follows:

Popularization of clones and Varieties/ Germplasm

- For mass multiplication of clones/varieties/ germplasm 12 License agreement were signed: 01 for *Melia dubia* by ICFRE – FRI, Dehradun; 01 for *Tectona grandis* clones, 02 for *Casuarina junghuhniana* and *Casuarina* hybrid clones and 01 for *Eucalyptus camaldulensis* clones by ICFRE – IFGTB, Coimbatore; 07 for poplar clones by ICFRE – IFP, Ranchi. One MoU signed with Maharashtra Forest Department for supply of QPM of Bamboo by ICFRE-TFRI, Jabalpur.
- Established 13 Demo plots of improved germplasm; Mahogany (01) in Ranchi, Jharkhand, *Melia dubia* (05) in Jharkhand, Haryana, Punjab and Uttar Pradesh, Tamarind (01) in Tamil Nadu, Guggal, Eucalyptus and Shisham in Rajasthan, Poplar and medicinal plants in Jammu, Shisham in Haryana and Punjab.
- Produced Quality Planting material and supplied to different stakeholders: Bamboo species (13898) by ICFRE-FRI, Dehradun; Casuarina (27,830), Teak (1,36,103), Eucalyptus (14,623), bamboo (1053) and Melia (860) by ICFRE – IFGTB, Coimbatore; Bamboo (13000) and Agar (10,000) by ICFRE-RFRI, Jorhat, *Populus deltoides* (5000) by ICFRE-HFRI, Shimla and 10269 seedlings of different species viz. *D. strictus, Bambusa vulgaris* green*, Melia dubia* , *Dalbergia latifolia*, *Flemingia semialata* by ICFRE-IFP, Ranchi.

Tree Improvement

To develop improved varieties/clones selected CPTs/ CPCs of different tree species and established clonal trials, progeny trails:

- Established 100 ha clonal trials of Teak in Kerala, Tamil Nadu, Chhattisgarh, Maharashtra, Punjab, Gujarat, Karnataka, Jharkhand, West Bengal, Madhya Pradesh and Telangana using tissue culture plants.
- Established 15 clonal trials for: Casuarina-04 in Andhra Pradesh, Karnataka and Tamil Nadu; Tamarind-04 in Telangana and Gujarat; Eucalyptus-04 in Tamil Nadu, Telangana and Rajasthan; *Gmelina arborea* (02) in Assam and *Melia dubia* (01) in Kerala.
- Established 10 progeny trials for: Casuarina (05) Andhra Pradesh, Karnataka and Tamil Nadu; Eucalyptus (03) in Tamil Nadu and *Gmelina arborea* (02) in Jharkhand and Madhya Pradesh.

Bamboo

- Developed short to medium term seed storage protocols for *ex-situ* conservation of *Dendrocalamus strictus, Bambusa bambos, Dendrocalamus longispathus, Bambusa tulda and Bambusa vulgaris.*
- Flowering data of 43 bamboo species has been recorded across the country.
- 100 new CPCs of eight bamboo species were selected across the country and established rhizome banks of selected clumps.

National Programme for conservation and Development of Forest Genetic Resources

- Population structure of 408 selected FGR species recorded.
- Eco-distribution/Localized maps of 208 FGR species have been prepared and are in the process of up gradation.
- A pictorial guide of 200 prioritized species has been prepared.
- 260 herbarium specimens of different FGR species have been prepared.
- To overcome seed dormancy standardized pretreatment for 12 species and storage protocol for 14 species for germplasm conservation.

Managing Forest

- Standard Operating Procedures on seed collection and handling and nursery techniques of 30 important plantation species of Odisha were developed and compiled in the form of training manuals.
- Revised form factors of *Tectona grandis* (Teak) and *Shorea robusta* (Sal) in different agroclimatic zones of Chhattisgarh.
- To overcome the error in volume loss (21.5%) estimated by Quarter Girth Formula, three equations were tried to calculate the more accurate volume. Through the equation V_{exp} = 0.928 $G^2l/4\pi$ the approximate true volume loss of the log was estimated 7.2% of the actual assumed perfectly cylindrical shape of the log.

Agroforestry

- Established 12 sandalwood based agroforestry trials in Rajasthan (2), Gujarat (1), Madhya Pradesh (2), Tamil Nadu (3), Punjab (2) and Karnataka (2) with known seed sources.
- Established six Gmelina based agroforestry models in Madhya Pradesh and Telanaga.
- Established *Leucaena*-based agroforestry system by intercropping of Kharif crop viz. *Cymposistetra gonaloba* and rabi crop viz. *Brassica juncea* in Jalna district, Maharastra.
- Five agroforestry demo plots established in Khampti villages of Namsai district Arunachal Pradesh using Areca nut, Sasi, Jati Banh, Sisoo, litchi, Takow pat, Aam, *Machilus bombycina,* apple ber etc.
- Established *Flemingia* based agroforestry models with vegetables and flowering plants at Rero, Khunti, Jharkhand.
- Published a book "FAQs on Agroforestry" in question answer form for selected 36 tree species including bamboo in Hindi and English.

Trials for Fodder

For fodder species 18 field trials, laid in Dehradun, Uttarakhand; Prayagraj, Uttar Pradesh; Shimla and Sirmaur Himachal Pradesh; Banaskantha, Gujarat; Jaisalmer, Rajasthan; Katni and Raisen, Madhya Pradesh; Rajnandgaon, Chhattisgarh; Khunti and Latehar, Jharkhand; Sukna, West Bengal; Jorhat, Assam; Warangal, Telangana; Shivamogga, Karnataka; Erode and Tiruppur, Tamil Nadu.

Forest Protection

- For management of insect pests Cypermethrin +Chlorpyriphos was most effective for *Crypsiptya coclesalis* and *Hieroglyphus banian* in nursery and *Pionea flavofimbriata* in plantation.
- Light traps were found to be an eco-friendly method for control and management of infestation by red stem borer (*Zeuzera coffeae*) on sandalwood.
- Eco-friendly techniques developed for control of *Ypnomeuta padella* (A defoliator of Bird Cherry) by the use of plant extracts of *Boenninghausenia albiflora* and *Engelhardia roxburghiana*.
- Multilocational trials of biopesticides Tree PAL[H] across the country was effective against major insect pests of Teak, Shisham, Tecomella, Prosopis, Pterocarpus, and Gmelina.
- Identified highly antagonistic three *Trichoderma* isolates having around 90 per cent pathogen colony growth inhibition activity against virulent *Fusarium solani*. Seeds primed with *Trichoderma* sp. exhibited 70-82% germination in comparison to control with 45.33-50% germination.
- Clonal seed orchard of disease resistant and intermediate genotypes of *D. sissoo* was established in Uttar Pradesh.

Climate change

- ICFRE has established permanent research plots (Ten 10 ha plots; two 5 ha plots, one 4 ha plot; two 3 ha plots; Thirty-two1ha plots) in different forest types with an area of 152 ha, to monitor impact of climate change on Indian forests.
- A draft report on Domestic Forest Carbon Market for India has been prepared in conformity with UNFCCC decisions and objectives of the related national policies and programmes.
- Prepared Roadmap for Institutional and Policy Mainstreaming of Sustainable Land and Ecosystem Management in India.
- National Reporting to UNCCD Secretariat has been completed. Also prepared a "Country Position Report" of UNCCD for participation of Indian Delegation in COP-15.

Wood Science

- Developed a nano coating consisting of CNF incorporated with ZnO nanoparticles. The nano-emulsion was able to protect the integrity of internal structure of wood on exposure to fungi. The addition of nano-SiO_2 reduced the amount of formaldehyde emissions from the boards and was found to protect wood from photo-degradation.
- Synthesized wood coating prepared using Cellulose Nano Crystals/Fibers (CNCs/CNFs) from dry leaves of fig tree (*Ficus auriculata*) exhibited good mechanical, thermal and anti-bacterial activity. Commercially it can be used for the coating purpose of instruments used in hospitals.
- Developed Cross Laminated Timber (CLT) made from plantation grown hardwoods (*Hevea brasiliensis*, *Melia dubia, Grevillea robusta* and *Eucalyptus* hybrid) satisfies the European Standard (EN 16351 -2015) and meets the delamination requirements for delamination as well as block shear strength requirements as per the European Standard (EN 16351-2015).
- Developed plastic bonded bamboo matt board and plastic bonded plywood from waste recycled plastic.
- Developed cement bonded bamboo particle boards which met the requirement specified in IS:14276.
- The amendments on Indian Standards on Plywood for general purpose (IS 303), Marine (IS 710) and Shuttering (IS 4990) were submitted to BIS.

Restoration of Degraded/Mined out areas

- Prepared Detailed Project Report (DPR) for Greenbelt Development at HPCL Rajasthan Refinery Ltd. (HRRL), Pachpadra, Barmer, Rajasthan site and providing support during the plantation and maintenance period, and submitted to the HRRL.
- Developed package of practices for restoration of coal mined land and handed over to Ministry of Coal, Govt. of India.
- For restoration of degraded hills, hillslopes, sand dunes, ravines and saline in hot and cold desert and other parts of country and established field trials/plantation in total 74.68. ha area.

Ecosystem Services Improvement Project (ESIP)

Under scaling up of SLEM best practices distributed improved cookstoves, brood lac for inoculation on host trees, open top drums, vegetable seeds mini-kits, vermicomposting units, tall seedlings of fruit trees, installed drip irrigation systems and sprinkler irrigation systems to direct beneficiaries included about 25,000 people, comprising of forest dwellers, small landholders, marginal farmers in the states of Chhattisgarh and Madhya Pradesh. For scaling up of best practices on sustainable land and ecosystem management organized 223 trainings for about 18000 members of local communities.

Products and Instruments Developed

As an outcome of research projects a number of products, instruments etc. were developed:

- A formulation for treating and management of diabetes mellitus and complications.
- Topical herbal gel formulation for treatment of pain.
- Natural dye from *Soymida febrifuga* bark.
- Antibacterial Herbal Wound Healing Cream and Hand wash from *Cassia tora* leaves extract.
- Him Mrida Sanjeevani-1 (हिम मृदा संजीवनी–1) mycorrhizal biofertilizer formulation prepared and registered with Directorate of Agriculture, Shimla, Himachal Pradesh.
- Fire-fighting tool kit and fire safety clothing's kit.
- A new four-point bamboo bending testing machine designed, developed, installed and commissioned for testing large size bamboo pole (upto 30 feet long)) as per new Indian standard IS:6874(2008) and International standards ISO:22157 (2004/2019).
- Fabrication, testing and integration of "Microwave based moisture meter system" for wood.

Scientific Services

- Monitoring and Evaluation of Plantations raised by Delhi Development Authority, Delhi Forest Department, NDMC, Punjab Forest Department, Chandigarh Forest Department under CAMPA and other schemes was carried out by ICFRE and its institutes.
- Final report submitted for carrying capacity and biodiversity study of Daitari Iron Ore Mines of Odisha and Biodiversity assessment, Impact and Mitigation measures of Chakla Open Cast Coal Mine. Prepared Environment Management Plan for Reclamation and Rehabilitation of three iron ore mines.

Forest Soil Health Cards

First Forest Soil Health Card have been prepared and released for the state of Jharkhand. The FSHC has also been prepared for two states i.e., Madhya Pradesh and Haryana, and four UTs i.e., Delhi, Ladakh, Chandigarh and Puducherry and are ready for release.

Technology Developed/Transferred

- For transfer of technology four MoUs were signed for Fire Retardant Door (FRD) shutter through construction method; Developing standards, trainings, projects implementation and career management initiative; Development of Fire Retardant Door Shutter for 120mins rating and Evaluation of suitability of currency briquettes replacement with wood particles for the manufacture of particle board by ICRE-IWST, Bengaluru.
- Optimized method for recovery of reddish brown natural dye (yield, 16.06%) from the flowers of *W. fruticosa*. The dye was found to be suitable for coloring cotton textile and hairs.
- Optimized conditions for dyeing of silk, wool and cotton fabrics with the *P. granatum* peels derived dye, It can also be used for food and cosmetics products.

Information Technology

- New Recruitment Portal was made live in year 2022-23 and recruitment process of Scientists-B at ICFRE has been done using this portal. URL of the portal is https://recruitment.icfre.gov.in
- ICFRE Pension Portal has been developed, designed and implemented. Mobile application of the portal has also been designed and developed. URL of the portal is https://pensionportal.icfre.org.

Outreach Pragrammes

- Established one VVK in FCRI, Mulugu by ICFRE-IFB. Van Vigyan Kendras (VVKs) in Longni, Dharampur, Mandi, H.P by ICFRE-HFRI and Barapani, Umiam, Meghalaya by ICFRE-RFRI were inaugurated.
- Established new Demo Villages (DVs) at Mohangarh, Jaisalmer, Rajasthan by ICFRE-AFRI.
- Two Facility Centers with a Brick Kiln were created at Jilangso village and Thiolangso village of Karbi Anglong, Assam.
- For production of Tree Rich Biobooster, a machine was installed and handed over to WSHGs of Rayaroothpathi tribal settlement, Periyanaickanpalayam range, Coimbatore.
- A bamboo preservative treatment plant was established at Noney, Manipur and training on operation and maintenance of the system was imparted to the local operators.
- Organized five Tree Growers Melas one each at Dehradun by ICFRE-FRI; Longni Dharmpur, district Mandi, Himachal Pradesh by ICFRE-HFRI; Karaikudi, Sivaganga district, Tamil Nadu by ICFRE-IFGTB; Hajipur, Bihar by ICFRE-IFP; Jodhpur by ICFRE-AFRI, and in Prayagraj by ICFRE-ERC.
- Conducted four Institute–Industry meeting; 03 by ICFRE-IWST, Bengaluru and 01 by ICFRE-RFRI, Jorhat
- Produced 17 documentaries on Bamboo based products and its demonstration; Agroforestry models; Fungarium; Trichocard; Insectary; Fly ash; Bamboo; Bamboo flowering; Wild Edible Fruits; Extension of Vermicompost; *Melia dubia;* Ecology and Land Management; AFRI Contribution in the Conservation of Biodiversity; Traditional Agroforestry: Source of Research; Timber Identification; ICFRE-IWST Research Activities and on Bamboo Shoot and Value Addition.
- Organized 265 trainings for 9749 participants on various forestry related aspects by ICFRE institutes and 147 international and national workshops and conferences.

HRD Trainings

- For Human Resource Development of the Council, 17 trainings were organized for scientists, technical and administrative staff.

Repositories

- Inaugurated two TDCs at ICFRE-FRI and ICFRE-IFP, Ranchi and under TDC at ICFRE-RFRI Jorhat one Vacuum Pressure Impregnation Unit was leased under PPP mode.

Apps developed

- Mobile App on Forest Seed Science and Technology by ICFRE-IFGTB, Coimbatore
- Mobile App on Agroforestry by ICFRE-ERC, Prayagraj.

Patents

- ICFRE has been granted three patents, to ICFRE-FRI on, 'An improved binding material for incense stick (Agarbatti) to ICFRE-IWST on, 'Technology for Medium Density Fiber Board (MDF) using Rice Straw and a Method fo Manufacturing the same and to ICFRE-RFRI on 'Pyrolysis system for thermal decomposition of biomass'.

  In addition applied nine patents, one trademark and one copyright for various technologies developed applied.

Education

- 6th Convocation of FRI Deemed to be University was organized at ICFRE-FRI, Dehradun and 227 MSc. degrees and a total of 56 Ph.D. degrees have been awarded.

Prakriti

- Prakriti, a scientist – student connect programme, is operational across the ICFRE institutes/ centres throughout the country. During the year, 132 programmes were held and over 14300+ students belonging to various KVs, JNVs and other schools and colleges were benefitted through various programmes including lectures, webinars, awareness/training programmes, exposure visits, campaigns, plantation programmes, biodiversity and nature walks, quiz/declamation/essay/painting competitions, screening of documentaries, study tours, meetings etc. by ICFRE.

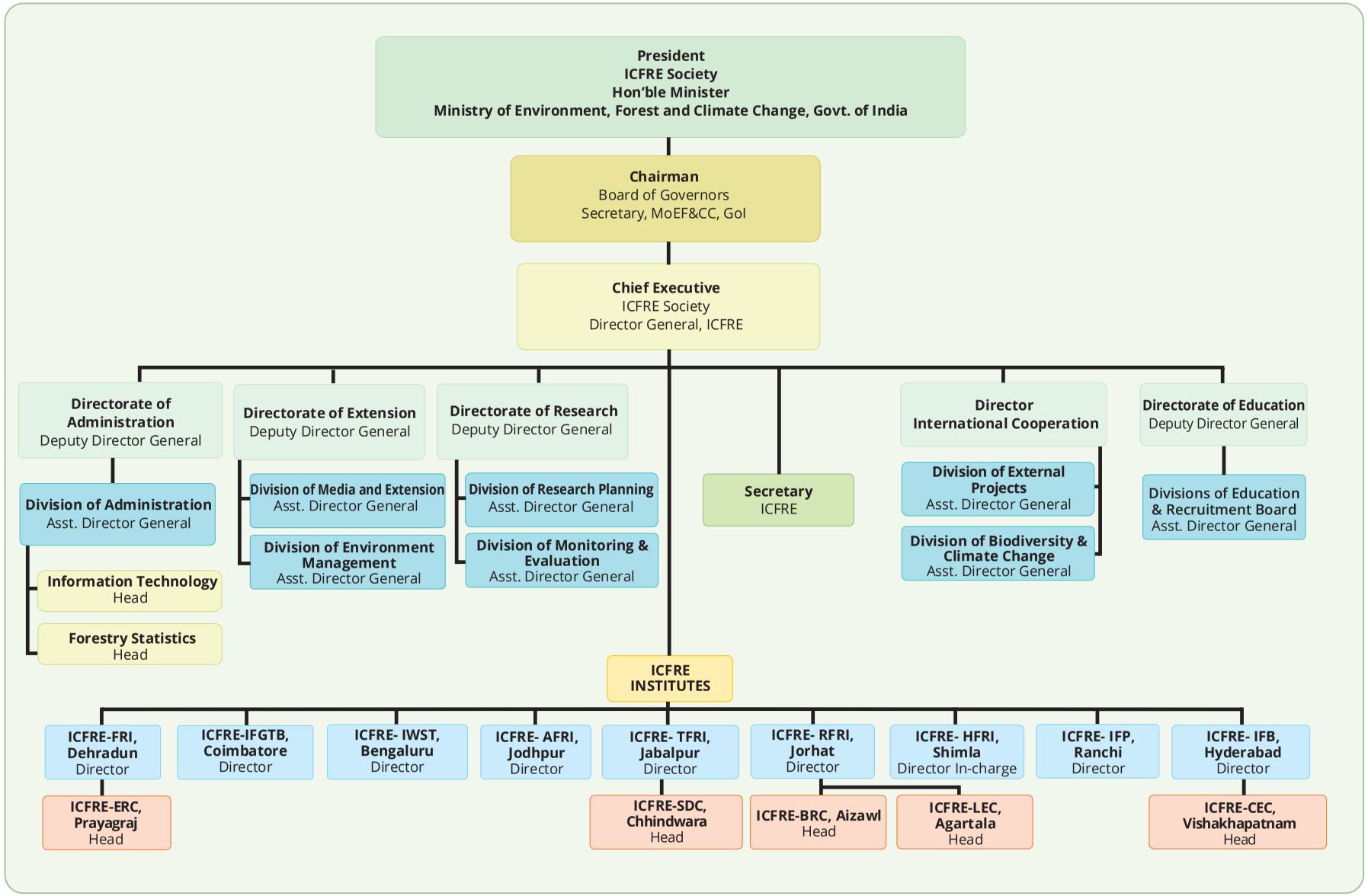
Azadi ka Amrit Mahotsav and Mission Life

- ICFRE carried out 180 different activities between 01 April 2022 and 31 March 2023 under Azadi ka Amirt Mahotsav. All of the ICFRE institutes carried out plantation programs, cleanliness campaigns, Fit India Run, awareness campaigns, trainings, workshops, seminars, and contests for awareness.
- Under Mission Life ICFRE and its institutes have conducted various activities like cleanliness drive, awareness campaigns, Drawing competitions, Quiz competitions, Bicycle rallies, Seminar, Conferences etc. A total of 58 activities were performed by ICFRE institutes till March 2023 and 14,745 people have participated in these events.

Mission Karmayogi

Ten e-learning modules were developed for iGOT portal under Mission Karmayogi by ICFRE viz. Nursery Techniques, Butterfly Diversity and Identification, Tree Improvement, Biodiversity Conservation, Bamboo Identification, Utilization and Modification, Plywood Manufacturing Technology, Bamboo Based Composite Technologies, Seed Handling and Nursery Technique for Sandalwood, Wood Seasoning and Preservation and Field Identification of Important Timbers.

ORGANIZATIONAL STRUCTURE OF ICFRE SOCIETY



01
CHAPTER

Introduction

INTRODUCTION

Indian Council of Forestry Research and Education (ICFRE) is an autonomous organization under the Ministry of Environment, Forest and Climate Change (MoEF&CC), Government of India (GoI) and is registered under the Societies Registration Act, 1860. The ICFRE Society, subject to guidelines as issued time to time by Government of India, has full authority to perform all acts and issues such directions as may be considered necessary incidental or conducive to the attainment of the objective of the Council. The General Body is the supreme authority of the ICFRE, headed by the Union Minister, MoEF&CC, GoI. The members consist of serving and retired senior officers from various state governments, central government, educational institutes, NGOs and national level scientific organizations. The Director General, ICFRE is the Member Secretary of the BoG. Board of Governors of ICFRE constituted under Rule 17 of ICFRE Society Rules. The Board of Governors, with the approval of Government of India, has the power to for the administration and management of the affairs and funds of the Council. Secretary, MoEF&CC is the Chairman of the BoG of ICFRE.

During the year Annual General Meeting of ICFRE Society & ICFRE Board of Governors Meeting were held.

Vision

To achieve long-term ecological stability, sustainable development and economic security through conservation and scientific management of forest ecosystems.

Mission

To generate, advance and disseminate scientific knowledge and technologies for ecological security, improved productivity, livelihoods enhancement and sustainable use of forest resources through forestry research and education.

28th ANNUAL
GENERAL MEETING

28th Annual General Meeting of ICFRE held on 28 April 2022 under the Chairmanship of Hon'ble Union Minister Shri Bhupender Yadav Ji. Hon'ble Minister of State Shri Ashwini Kr. Chowbey along with other dignitaries of MoEF&CC were present during the AGM. Ms. Leena Nandan (Secretary to GoI, MoEF&CC), Shri CP Goyal (DGF&SS, MoEF&CC), Shri A S Rawat (DG, ICFRE) and other members of ICFRE Society attended the meeting at ICFRE, Dehradun.

28th AGM of ICFRE Society

The AGM members confirmed the Minutes of 27th Annual General Meeting of the ICFRE held on 25 March 2021 and noted the action taken on the decisions of previous meeting. Annual Report and Annual Audited Accounts of ICFRE for the year 2020-21 were approved. A book on Butterfly-Forest Type Association in Uttarakhand was released by Hon'ble Union Minister.

60th MEETING
OF BOARD OF GOVERNORS

60th BoG Meeting of ICFRE

60th meeting of the Board of Governors (BoG) of Indian Council of Forestry Research and Education, Dehradun was held under the Chairmanship of Ms. Leena Nandan, Secretary (MoEF&CC), Government of India and Chairman, BoG of the ICFRE, on 13 December 2022 at MoEF&CC, New Delhi.

The Board confirmed the minutes of 59th meeting of BoG of ICFRE and the action taken on the decisions in the previous meeting of BoG. The Board recommended the Annual Report and Annual Audited Accounts of ICFRE for the year 2021-22 for approval of ICFRE Society. The Board also approved merger of Indian Plywood Industries Research and Training Institute (IPIRTI) with ICFRE-Institute of Wood Science and Technology (ICFRE-IWST), Bengaluru and ICFRE to adopt DoPT and Govt. of India guidelines for

promotion of scientific, technical, and administrative officials. The BoG also approved change in nomenclature of ICFRE institutes in line with other national councils. Book on Conservation of Forest Genetic Resources: State Report Uttarakhand 2022, Resource Manual on Capacity Building of State Forest Departments for Developing State REDD+ Action Plan (Hindi) and Roadmap for Institutional and Policy Mainstreaming of Sustainable Land and Ecosystem Management in India were released by the Secretary to GoI and Chairman BoG during the BoG.

REGIONAL RESEARCH CONFERENCES

During 2022-23 five RRCs were organized:

S.No.	Date	Conference	Organizing Institute
1.	25 May 2022	Assessment of Phyto-diversity and their sustainable utilization and the session on Agroforestry and clonal planting material	ICFRE-IFB, Hyderabad
2.	10 June 2022	Forestry Research and issues in the Southern region of India And the session on Agroforestry and clonal planting material	ICFRE-IWST, Bengaluru
3.	14 June 2022	RRC for North Eastern Region and the session on Agroforestry and clonal planting material	ICFRE-RFRI, Jorhat
4.	22 June 2022	Status of forestry research in special reference to agroforestry of dry regions and the session on Agroforestry and clonal planting material	ICFRE-AFRI, Jodhpur
5.	27 June 2022	Forestry Research and issues in the Northern region of India And the session on Agroforestry and Clonal planting material	ICFRE-HFRI, Shimla

RESEARCH ADVISORY GROUP (RAG) AND RESEARCH PLANNING COMMITTEE (RPC) MEETINGS

- RAG meetings of all nine ICFRE institutes were conducted between 19 September to 15 November 2022 for regional level approval of new projects for assessing the progress of ongoing projects.
- XXIII RPC of ICFRE was held on 13 and 14 February 2023. XXIII RPC approved 23 new and reviewed progress of 58 ongoing research projects.

PARLIAMENTARY
STANDING COMMITTEES

Parliamentary Standing Committee on Personnel Public Grievances, Law & Justice under the Chairmanship of Shri Sushil Kumar Modi, Honorable Member of Rajya Sabha visited ICFRE-FRI, Dehradun on 12 April 2022. DG, ICFRE presented activities of Council, vigilance and grievances.

Parliamentary Standing Committee on Personnel Public Grievances, Law & Justice visited ICFRE-FRI, Dehradun

Parliamentary Standing Committee on Science & Technology, Environment & Forests and Climate Change by Hon'ble members of Rajya Sabha Smt Vandana Chavan & Smt Rajani Ashokrao Patil visited ICFRE-FRI, Dehradun on 02 April 2022.

Parliamentary Standing Committee on Science & Technology visited ICFRE-FRI, Dehradun

ICFRE NATIONAL PRESENCE

CHINTAN SATRA

To formulate Research Road Map of Indian Council of Forestry Research and Education (ICFRE) for next 25 years "Chintan Satra" was organized on 30 June 2022 at ICFRE-FRI, Dehradun. Sh. Bharat Jyoti, IFS, Director, IGNFA, Dehradun was the chief guest for the occasion. The meeting was attended by DG, ICFRE, IG (RT), MoEF&CC, PCCFs, Directors of all institutes, senior forest officers, senior scientists from ICAR, NBPGR, ICFRE and FRI, researchers from different universities, Ph. D scholars, progressive farmers.

First Forest Soil Health Card of India was released for the State of Jharkhand on 02 December 2022.

Technology Demonstration Centre (TDC) at ICFRE-FRI, Dehradun was inaugurated by Shri C.P. Goyal, IFS, DGF&SS, MoEF&CC, New Delhi on 15 July 2022.

Released of Forest Soil Health Card

TDC inaugurated at ICFRE-FRI, Dehradun

ICFRE
PENSION PORTAL

ICFRE Pension Portal has been developed, designed and implemented. Mobile application of the portal has also been designed and developed. URL of the portal is https://pensionportal.icfre.org.

ICFRE IS ENTHUSIASTICALLY CONDUCTED FOLLOWING ACTIVITIES IN COMPLIANCE WITH GOVT. OF INDIA INITIATIVES

- ICFRE prepared and published 10 e-learning modules on iGOT portal under **Mission Karmayogi**.
- To commemorate and celebrate 75 years of Independence, 180 events were held under **Azadi Ka Amrit Mahotsav.**
- To nudge individual and community action to protect and preserve the environment, ICFRE initiated **Mission LiFE** activities from December, 2022 and conducted 58 activities including 14,745 people till 31 March 2023.
- Under the **Swachhta Campaign 2.0**, ICFRE achieved a remarkable feat by disposing of 317 units of e-waste and 14,393 units of scrap waste including weeding out of old files.

MoUs WITH NATIONAL AND INTERNATIONAL ORGANIZATION

MoUs Signed:

- Indian Institute of Remote Sensing (IIRS –ISRO), Dehradun
- National Cooperative Development Corporation (NCDC), New Delhi
- Uttar Pradesh Forest Department

MoUs in Progress:

- Alliance of Bioversity International and CIAT, Italy
- United States Department of Agriculture (USDA), Forest Service
- Millennium University, Blantyre, Republic of Malawi
- The Nature Conservancy, New Delhi
- Beijing Forestry University (BFU), Beijing with (FRI Deemed To be University)
- Forestry and Environment Research, Development and Innovation Agency (FOERDIA), Indonesia
- Brazilian Forest Services (BFS), Brazil
- Kasetsart University (KU), Thailand
- Chinese Academy of Forestry (CAF), China (Extension for another five years)
- Swedish Forest Agency (SFA), Sweden

MoU between UP Forest Deptt and ICFRE-FRI in presence of Hon'ble Forest & Environment Minister of UP. DG, ICFRE, Director, ICFRE-FRI, Dehradun

02
CHAPTER

Research Highlights

2.1 ECOSYSTEM CONSERVATION AND MANAGEMENT

A. PLAN

- Completed 04
- Ongoing 18
- New 05

B. EXTERNALLY AIDED

- Completed 11
- Ongoing 18
- New 06

2.1.1. Climate Change

Spatial and temporal dynamics of greenhouse gas emission from two wetland ecosystems in Himalayan Foothill (ICFRE-FRI)

Temporal and spatial GHGs fluxes (CO_2, CH_4, and N_2O) from various sub habitats of wetland ecosystem were characterized to understand patterns GHGs fluxes in relation to seasonal changes and identify their drivers in subtropical wetland of Indian Himalayan foothill. Wetland was divided into five sub-habitats (M1-sloppy surface at swamp forest; M2-plain surface at swamp forest; M3-swamp surface with small grasses; M4-marshy land with dense macrophytes and M5-marshy land with sparse macrophytes) for *in-situ* measurement of GHG fluxes, microclimate (air and soil temperature, soil moisture) and soil properties (pH, EC, N, P, K, and SOC) were measured. Habitats M3 & M5 exhibited higher GHG fluxes than counterpart habitats. Highest CO_2 fluxes were reported in summer (536.00mg m^{-2} h^{-1}), followed by spring, autumn, and winter (125.15 mg m^{-2} h^{-1}). Higher CH_4 and N_2O flux in summer (28.35 mg m^{-2} h^{-1} and 3.14 mg m^{-2} h^{-1}, respectively), followed by autumn, spring, and winter. Pearson correlation analysis displayed that soil temperature and SOC were crucial drivers in regulating CO_2 fluxes than soil moisture. Soil temperature and moisture equally regulated CH_4 and N_2O fluxes across habitats and N_2O fluxes were regulated by soil phosphorus and EC across the habitats.

Effect of elevated CO_2 with the varying nutrient regime on carbon sequestration and resource use efficiency of *Lagerstroemia speciosa* L. (ICFRE-FRI)

Elevated CO_2 (eCO_2; 800±15µmol $CO_2$$mol^{-1}$) and nutrient-enriched soils had significantly impacted functional traits associated with growth and development (plant height, collar diameter, leaf area, specific leaf area, leaves, etc.) of selected plant species. Plant height was reported higher (192.96±16.78cm) under elevated CO_2 than ambient CO_2 concentration (165.72±7.84cm). Further, higher plant height of 190.67±17.84cm was reported in high nutrient of 500 Kg N ha-1, 30 Kg P ha-1, and 500 Kg K ha^{-1}, Physiological response-related traits, particularly photosynthetic rate (15.35±0.98 µmol CO_2 $m^{-2}s^{-1}$), transpiration rate (10.83^a±0.63 m mol H_2O m^{-2} s^{-1}), stomatal conductance (0.314±0.030 mol m^{-2} s^{-1}), plant respiration (10.55±0.58 µmol CO_2 $m^{-2}s^{-1}$), and net primary productivity (4.80±0.42 µmol $m^{-2}s^{-1}$), were enhanced significantly under elevated CO_2 than ambient CO_2. Increasing nutrient application also induced an increment for the physiological traits. The higher water use efficiency was reported in elevated CO_2 (1.42±0.03) than in ambient CO_2 (1.38±0.03).

Development and deployment of *Rhizophora* species, hybrids to tackle hypersalinity: Solutions to climate change resilience, mitigation and improved productivity (ICFRE-IFGTB)

Application of micro and macronutrient through nutripits (1 x 1 x 1 m) at five-metre intervals on the landward side increased reproductive fitness and reproductive success in Rhizophora**.** Flowering to fruit ratio in a post *tsunami* plantation site (2004) with low soil nutrients (231kg/ha of N; 43 kg/ha of P) was enhanced from 0.01% to 0.06% (landward) and 0.08% (seaward) with supplementation of micro and macro nutrients. The combination controlled pollinations of *R.mucronata* x *R.apiculata* were attempted, and 8-10% fruit set was recorded. About 400 propagules of the hybrid have been raised in the nursery.

Spatial mapping and assessment of phenological responses of teak to changing climate (ICFRE-IFGTB)

Land use and land cover map, including the spatial extent of teak has been developed for Nilgiris, Coimbatore, Salem, Tenkasi in Tamil Nadu and Pathanamthitta in Kerala. Phenological responses of teak to changing climate were assessed from 2001 to 2019 using MODIS in TIMESAT. NDVI time series and phenological metrics like start of season, end of season and length of season were calculated. The average length of season was highest in Parambikulam (269 days) followed by Wayanad (230 days) and Malappuram (228 days). The phenological metrics correlated positive with annual mean temperature and annual cumulative rainfall. A WebGIS layer on teak plantations has been developed.

Quantifying resilience patterns in *Rhizophora* with reference to hypersalinity: Solutions to mitigation (ICFRE-IFGTB)

Rhizophora at Pichavaram exhibits both seasonal and around the year flowering patterns. *R. mucronata* and *R. apiculata* are wind pollinated with 1-5% success under open pollination**.** Studies indicate that *R. mucronata* exhibits higher pre-emergent reproductive success (0.062) compared to *R. apiculata* (0.037). With 25 and 40 ppt salinity levels seedlings gained 0.61 and 0.45g of root (@ 120 days) and 0.96 and 0.25 gms of shoot biomass. At 15 ppt salinity, seedlings gained higher biomass of shoot (1.38 gm) and root (1.20 gms). About three hundred propagules were planted in restoration and restocking sites at Pichavaram, Tamil Nadu. Clear phenotypic variation exists in propagule growth and rooting patterns. Seedlings with brown tinge on the stems with greater count of lenticels grow faster compared to the green tinged phenotype with lower count of lenticels. While the brown phenotype putforth secondary roots after 80-120 days of planting, the green phenotypes initiated secondary roots after 180 days of planting and continued beyond 240 days.

Six month old Rhizophora plantation raised through incubation nursery at Pichavaram, Cuddalore district

Mangrove nursery developed from hypersaline patch selections from Killai Reserve Forests, Pichavaram, Tamil Nadu

2.1.2. Ecology & Environment

Ecosystem Services Improvement Project

This project supports the goal of the Green India Mission by demonstrating models for adaptation-based mitigation through sustainable land and ecosystem management and livelihood benefits. Project is implemented in the selected landscapes of Madhya Pradesh and Chhattisgarh. Progress made under the project is as follows:

Forest carbon stocks measurement, monitoring and capacity building

- Report on 'Measurement of Carbon Fluxes in the Tropical Dry Deciduous Forests of Chhattisgarh and Madhya Pradesh' was prepared after analysis of the periodic data collected from eddy covariance-based carbon flux towers established at Budhni and Raghunathnagar Forest Ranges.
- A draft report on Domestic Forest Carbon Market for India has been prepared in conformity with UNFCCC decisions and objectives of the related national policies and programmes.

Scaling up of S L E M best practices

The activities undertaken for scaling up of SLEM best practices benifitted 25,000 forest dwellers and marginal farmers 20,000ha in Madhya Pradesh and Chattisgarah. Following activities were carried out:

- For restoration of degraded ecosystem distributed improved cookstoves to the 7845 number of local communities.
- For promotion of lac cultivation for livelihood generation and biodiversity conservation in the Marwahi and Pali Forest Ranges of Chhattisgarh distributed brood lac for inoculation on host trees to 816 beneficiaries
- For Integrated Farm Development, preparation and application of biofertilizers and biopesticides for productivity enhancement through distribution of 6520 numbers of open top drums to 13100 number of households. Prepared *neemastra, amritpani* and *dasparni* and applied in the crops for productivity enhancement.
- Distributed vegetable seeds mini-kits of Kharif season to the 13100 beneficiaries and vermicomposting units to the 5022 beneficiaries.
- For scaling up of WADI (a tree-based farming system), distributed tall seedlings of fruit trees (mango, lemon, amla, custard apple, guava and moringa) to 13009 beneficiaries.
- Conservation of water resources and enhancing productivity through installation of 4073 drip irrigation systems and 1216 sprinkler irrigation systems.
- Initiated Azolla cultivation.

Publication of Reports:

- Roadmap for Institutional and Policy Mainstreaming of Sustainable Land and Ecosystem Management in India.
- Report on Evaluation of the Working/ Effectiveness of Forestry Extension System through the Van Vigyan Kendras and Recommendations for its Strengthening.
- Proceedings of National Workshop on 'Agroforestry and Farm Forestry for Sustainable Land and Ecosystem Management'.

Evaluation of carbon regulating services and soil health of restored limestone mine overburden areas (ICFRE-FRI)

Study was conducted to assess ecosystem functions of a limestone mine area at Chunakhala situated on Dehradun-Mussoorie road, restored 30 years back, in comparison to its adjoining natural forest. Natural forest was dominated by broadleaf species (*Bauhinia semla, Sapium insigne*) whereas, restored area had *Boehmeria rugulosa*, *Cupressus torulosa, Bauhinia semla* as dominant tree species. Higher diversity with diversity index of 2.35, 2.55, and 2.81 respectively, for trees, shrubs, and herbs compared to 1.68, 2.05 and 2.26 in adjoining natural forest was recorded in restored mine area which reflects the ability of the system to provide stable forest functions, especially in the global climate change scenarios. Soil microbial biomass carbon was 0.18mg g^{-1} in restored area as compared to 0.13 mg g^{-1} in adjoining natural forest**.** Microbial activity in the top soil layer was found to have increased substantially in the restored mine site. Annual litter production (5020.25 kg $ha^{-1}y^{-1}$), soil respiration rate (9.75 mol m^{-2} s^{-1}), and soil microbial biomass (0.18 mg g^{-1}) in the restored mine area was comparable with that of the natural forest**.**

Assessment of hydrological services imparted by forests of Kempty watershed (Mussoorie) (ICFRE-FRI)

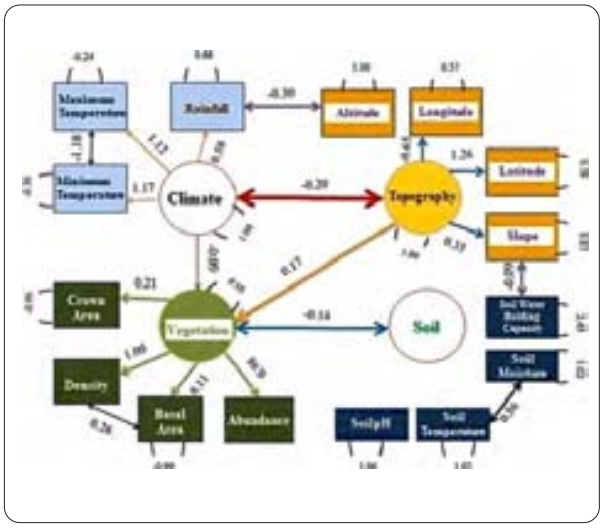
Maximum discharge was recorded at 0.76 m^3/s in August and the minimum was 0.04 m^3/s in July for H-Flume No.2. Similarly, for H-Flume No.1 maximum discharge was 5.40 m^3/s and the minimum were 0.03 m^3/s and 0.05 m^3/s for October and December month respectively. Water quality parameters were recorded on monthly basis and the average pH was 8.1, EC was 442 μScm^{-1}, TDS was 288 ppm, DO was 9.9 mg/L, turbidity was 0.3 NTU, sodium was 0.8 ppm, potassium was 0.8 ppm and calcium was 23.6 ppm. Whereas during October to December 2022, average pH was 7.76, EC was 391.36 μScm^{-1}, TDS was 259.51 ppm, DO was 10.36 mg/L, turbidity was 0.23 NTU, sodium was 0.99 ppm, potassium was 0.92 ppm and calcium was recorded 22.34 ppm. Volumetric soil moisture content was observed during entire months from different observation sites and it was maximum during April month for all observation sites at all three depths and varied from 38.5% to 32.7%. Maximum infiltration rate 1.29 cm/hr was observed during April and minimum infiltration rate 0.83 cm/hr was during June and it is inversely proportional to soil moisture.

Ecosystem functioning and services of himalayan temperate forest under anthropogenic change: A plant functional trait-based evaluation (ICFRE-FRI)

The present study estimated soil respiration (Rs) and identified different drivers of soil, vegetation, climate, and topography responsible for soil respiration by collecting data from twelve randomly selected sites (forest sub-types) of temperate forests of study region. *Cedrus deodara and Abies pindrow* were major species in six and five forest subtypes, respectively; and *Litsea umbrosa, Pinus wallichiana* and *Pinus gerardiana* were major tree species in two forest sub-types each among all the twelve forest sub-types. Total 432 data points were recorded from six individuals each for twelve sites at three locations below the crown across the selected sites. Structural Equation Modelling (SEM) of the temperate forest explains that Rs was positively influenced by soil temperature, maximum air temperature, and altitude, and negatively by abundance in the temperate forests. The study concludes that Rs varied differentially across the various forest sub-types of temperate forests and increases with increase in temperature and altitude.

Restoration of degraded coal mined land of Meghalaya through soil amendment and microbial technology for accelerated succession (ICFRE-RFRI)

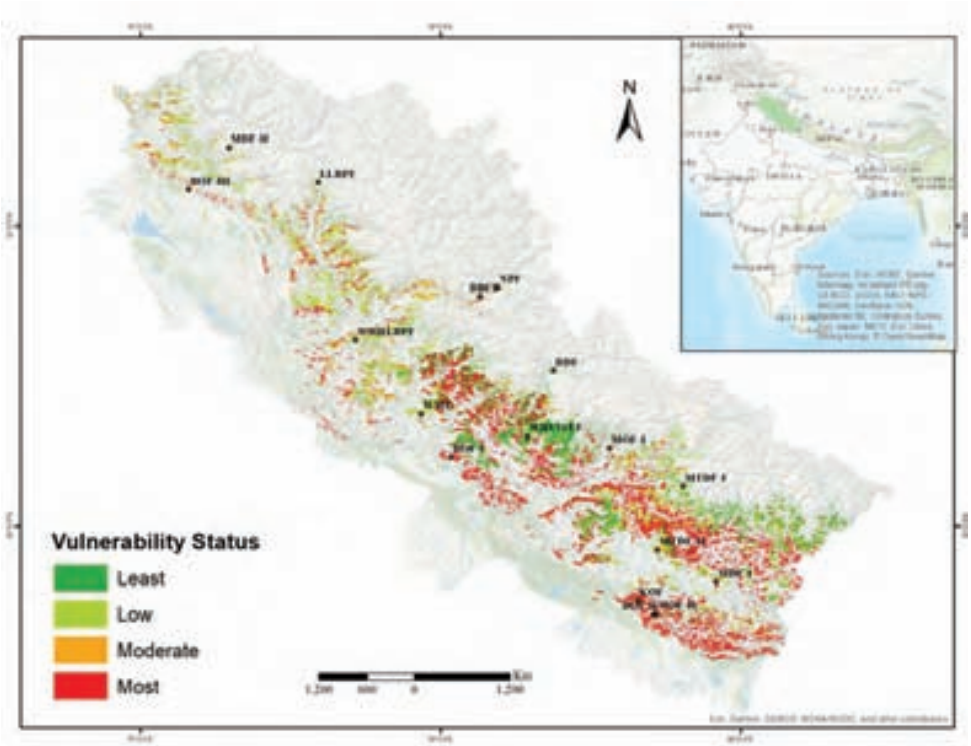
Established a plantation in 6.5ha in abandoned coal mined land, about 2.0 km from Latyrke and Moolamlylliang villages, Saipung block, East Jaintia Hills district, Meghalaya during 2022-2023. Prepared seed balls and sown in the area selected. Collected and analysed soil samples and cultured native PGPRs in different selective media and isolated *Arbuscular mycorrhizal* fungi (AMF); inoculated seedlings after mass culture. More than 9000 seedlings of native forestry species i.e. *Albizia lucidior, Alstonia scholaris, Aquilaria malaccensis, Bauhinia variegata, Chukrasia tabularis, Duabanga grandiflora, Exbucledia populnea, Magnolia champaka, Mangifera indica, Parkia roxburghii, Podocarpus* sp, *Swietenia mahagoni, Sterculia villosa, Thysanolaena maxima, Terminalia arjuna, Terminalia bellirica* etc. were planted.



Structural Equation Modelling results of the relationship between various latent variables with climatic, topographical, vegetation and soil parameters across the Temperate Forests of Himalaya

An attempt has been made to estimate the vulnerability of various temperate forests of Western Himalaya due to climate change. The vulnerability of the forests was assessed through the IPCC framework by suitably selecting indicators (taxonomy indices and climatic parameters) for the three dimensions of vulnerability

i.e., exposure, sensitivity and adaptive capacity. The field data were collected from 17 different temperate forests distributed at the elevation 1600 to 3500m in Uttarakhand and Himachal Pradesh, India. Abundance and richness for each forest were collected by randomly laying ten quadrats of size 0.1 ha each. The analysis revealed that the Neoza Pine; Moist Deodar; Ban Oak and Dry broadleaved and Coniferous Forest were the most vulnerable forests in the Himalayan temperate forests due to climate change.



Vulnerability status of the selected forests (BOF-I—Ban Oak Forest, Binog; BOF-II—Ban Oak Forest, Pangot; BOF-III—Ban Oak Forest, Mcleodganj; DBCF—Dry Broadleaved and Coniferous Forest, Kalpa; DDF—Dry Deodar Forest, Harshil; KOF—Kharsu Oak Forest, Kunjkharak; LLBPF—Low-Level Blue Pine Forest, Manali; MDF-I—Moist Deodar Forest, Jageshwar;MDF-II—Moist Deodar Forest, Dalhuosie; MOF-I—Moru Oak Forest, Deoria Tal; MOF-II—Moru Oak Forest,Kilbury; MTDF-I—Moist Temperate Deciduous Forest, Sutol; MTDF-II—Moist Temperate Deciduous Forest,Dunagiri; NPF—Neoza Pine Forest, Akpa; WHHLBPF– West Himalayan High Level Blue Pine Forest, Narkanda; WHUO/FF—West Himalayan Upper Oak/ fir Forest, Maid; WMC—Western Mixed Coniferous Forest, Deoban).

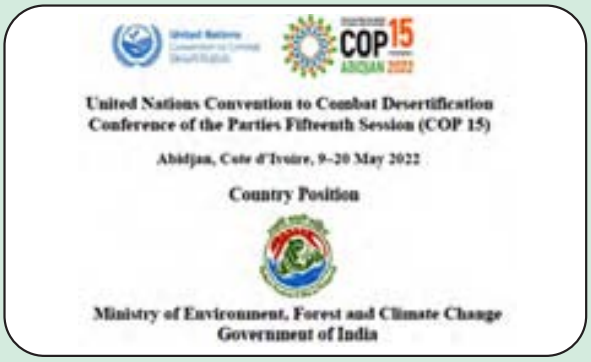
Impact of military firing and other associated activities on flora, fauna and bio-diversion of ASAN field firing range in Shivalik Forest Division of Saharanpur, Uttar Pradesh (ICFRE-FRI)

Study site ASAN Field Firing Range of Indian Army, lies in Shivalik Forest Division, Saharanpur, Uttar Pradesh. Adjoining forest area without military interventions was considered as reference or control site. The area was surveyed for preparing comprehensive checklist of floral and faunal composition. Ethno-botanical aspects of important floral species have been assessed. The effect of military firing and other activities includes frequency of noise on encounter rate, density, and activity patterns, identification of noise exploiters and noise avoider faunal taxon were carried out in selected area. Soil organic carbon was low (0.53) in the impact areas as compared to the adjoining unaffected areas (0.81), however no difference in availability of major nutrients and soil heavy metal contents was observed.

Study area site with camera trap installed

Preparation of national report for submission to the UNCCD Secretariat and documentation of SLEM best practices

The 'National Report-2022' for submission to the UNCCD Secretariat has been prepared and submitted. The "Country Position Report" was also prepared for the Indian delegation participating in UNCCD-COP15, Abidjan, Côte d'Ivoire.



Replenishment study of RBM for Ganga river and its tributaries at Haridwar (funded by Uttarakhand Forest Development Corporation) (ICFRE-FRI)

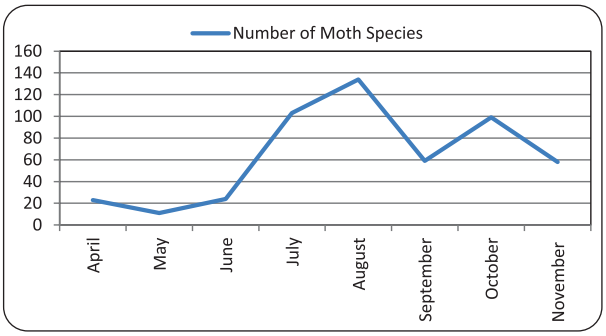
Study was conducted to estimate riverbed material (RBM) of river Ganga and its tributaries by measuring pre-monsoon and post-monsoon status with the help of a topographical survey and bathymetric survey. Report has been prepared and submitted to National Green Tribunal. Overall, total extractable RBM was estimated to be 191363.2m^3, 417905m^3, 455862.8m^3, 627275.5 m^3, 172208.1 m^3, 236296 m^3, and 209264 m^3 in the river Kotawali, Rawasan-I, Rawasan-II, Bishanpur, Shyampur, Chidiyapur and Bhogpur respectively for the year 2021.

2.1.3. Biodiversity

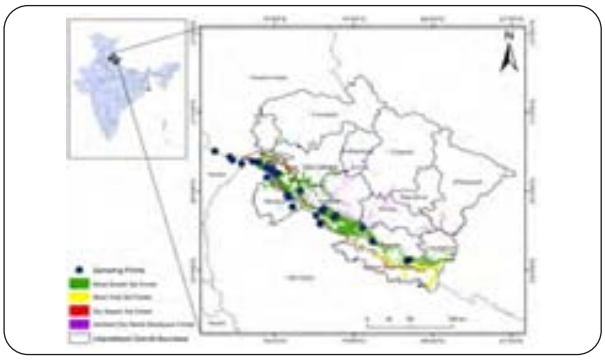
Assessment of species diversity of heterocera (moths) across the Shiwalik Landscape of northern India and development of a database (ICFRE-FRI)

Seasonality of moths was studied during pre-monsoon, monsoon, post-monsoon and autumn seasons in Shiwalik of the four states: Uttarakhand, Uttar Pradesh, Haryana and Himachal Pradesh. Field surveys revealed the presence of 320 species of moths belonging to 18 families and 49 sub-families from 20 locations. Seasonal trend of species richness shows two annual peaks, first peak occurring in August followed by a smaller peak in October.

Besides, six new range extensions into Shiwaliks of northern India from Central Nepal and Northeast India were identified.



Seasonality of moth species in Shiwaliks of northen India



Location of sampling sites (dark blue dots)

Sampling moths at night using moth screen

Diversity study of pteromalid parasitoids (Hymenoptera: Pteromalidae) of northern India with special emphasis to bio-efficacy study of some selected parasitoids database (ICFRE-FRI)

Pteromalid parasitoids diversity of northern India were studied and total 43 pteromalid parasitic species were recorded among 13 species viz: *Ammeia pulchella* Delucchi, *Briania kukensis* Boucek, *Chlorocytus formosus* Walker, *Halticopterafla vicornis* Spinola, *Mesopolobus minutus* Sureshan & Narendran, *Neocrytoptyx shangensis* Xiao & Yan, *Pachyneuron aeneum* Masi, *Pachyneuron pentatomivora* Mani, *Stictomischus obscurus*Walker, *Systasis longula* Boucek, *Systasis parvula* Thomson, *Trichomalus perfectus* Walker and *Trigonogastrella parasitica* Girault were recorded for the first time from the region. Bio-efficacy of three parasitoids were studied under laboratory and it was observed that *Anisopteromalus calandrae* was found to be the most effective parasitoid against *Sitophilus oryzae* followed by *Theocolax elegans* with their parasitization of 60.18 % and 25.24 % respectively. Though, *T. elegans* was more effective against *Rizopertha dominica* with 47.62 % parasitization as compared to *S. oryzae* with 25.24 % parasitization. Subsequently, effective parasitisation of *Dinarmus basalis* against *Callosobruchus maculatus* was recorded to be 42.62%.

Assessment of floristic diversity of Giri Khad watershed, Himachal Pradesh for developing conservation strategies (ICFRE-HFRI)

Reconnaissance surveys were conducted in the Upper Giri Khad Watershed. The plant samples were collected for preparation of herbarium. Floristic survey was carried out in 15 sites, Giriganga, Jhandoli, Tahu, Kalbog, Baghi in Kotkhai Forest Range, Chailla, Chambi, Khirki, Deha in Balson Forest Range, Sandhu, Sonarghatti, Fagu in Theog Forest Range, Narkanda, Hattu, Shilaru in Kotgarh Forest Range and 103 species were recorded. The observation of the natural regeneration of trees was also recorded during the survey. *Aconitum heterophyllum* (Patish), *Taxus wallichiana* (Rakhal) was found endangered and *Zanthoxylum armatum* (Tirmira) was found LC (Least concern) according to IUCN. The representative villages located in the Upper Giri watersheds was selected for the utilization pattern of economically important species. Socio-economic survey was carries out in Kot-Shilaru, Manan, Shaloha, Ghoond, Matiyana, Kandyali, Shari, Batlot, Sihal, Kyara, Mohri, Batiuda, Batlad and Annu villages. Information on agricultural and horticultural crops, fuel and fodder species was collected from these villages. Twenty two medicinal plant species,16 fuelwood tree species and seven fodder tree species were used by people of the villages.

Improvement of urban greenery, sustainable tree plantation and enhancing the biodiversity at Singanallur Lake, Coimbatore (ICFRE-IFGTB)

Native plant species were shortlisted for improving the urban greenery and enhance the biodiversity at Singanallur Lake, Coimbatore. Thirty native tree species were raised at the institute. Plantation following Miyawaki method was taken up around the lake involving public species like Palmyra palm, Barringtonia, *Acacia nilotica*, Ficus and other important fruit yielding tree saplings are being raised for future planting.

A view of planting at Singanallur Lake, Coimbatore

Students planting saplings at Singanallur Lake, Coimbatore

Assessment of plant biodiversity of Silent Valley Buffer Zone (ICFRE-IFGTB)

West Coast tropical Evergreen, Semi-evergreen and Deciduous forests, Eucalyptus and Teak plantations in the Silent Valley Buffer Zone were visited during various seasons for the collection of plant species in flowering, fruiting and vegetative conditions. All the collected 732 plants samples were processed into herbarium specimens. Documented 1014 plant species, belonging to 642 genera and 136 families. Among them, 70 species were red listed. The study also recorded 46 wild edible and 57 potential ornamental species. Fabaceae was the largest family with 98 species followed by Poaceae (53 species) and Asteraceae (52 species). The identified wild edible and ornamental species can be further domesticated for commercial uses.

Ardisia solanacea (Ornamantal) *Antistrophe serratifolia* (RET) *Alangium salviifolium* (Wild Edible)

Disperis neilgherrensis (RET) *Cochlospermum religiosum* (Ornamental) *Baccaurea courtallensis* (Wild edible)

Assessment of regeneration potential of native flora in *Acacia auriculiformis* plantations (ICFRE-IFGTB)

Regeneration potential of native flora in *Acacia auriculiformis* plantations in Nenmara, Mannarkad, Wayanad, Thiruvananthapuram, Walayar, Thenmala, Chalakudy and Malayattoor forest divisions of Kerala and adjacent natural forests were assessed previously. Data on ground flora diversity and soil samples were collected from 26 plantations of different age groups. Within these plantations, 274 species were recorded as ground flora which included invasives like *Chromolaena odorata* and *Lantana camara*. The soil seed bank comprised of *Acacia auriculiformis,* and pioneer tree species like *Macaranga peltata.*

Spring rejuvenation for water security in Himalaya (ICFRE-RFRI)

Selected a cluster of five springs in Lathao village, Namsai district, Arunachal Pradesh for spring rejuvenation. Delineation was done for springshed areas. Prepared maps, *viz.* Land Use/ Land Cover (LU/LC), Aspect, Forest cover, Forest type, Location, Soil type, Slope maps etc. Daily records of discharge rate along with pH, EC, TDS, temperature, etc. have been continuing. Completed household survey, installed three micro weather stations and recorded rainfall data. Interventions such as digging out twelve conical ponds and 10 cannal dams in the springshed areas were done. Seedlings were planted in the spring shed areas. Two batches of spring water samples were analyzed for chemical parameters and found within the permissible limit of WHO. Initial data revealed an increase in discharge rate from the springs after the interventions.

Quantitative assessment of land degradation in forests of three western districts of Madhya Pradesh and suggest mitigation measures (ICFRE-TFRI)

Three different land use types (i) OF-disturbed; (ii) OF-undisturbed (protected) and (iii) OF-grassland were selected in the category of 'Open Forest - OF' for understanding the land-use effects on carbon storage in vegetation and soil in three western districts viz. Dhar, Jhabua and Mandsaur of Madhya Pradesh. Species diversity and density were assessed by laying ten quadrats of 0.1 ha along with measuring soil organic carbon (SOC) at two depths 0-15 cm (surface) and 15-30 cm (sub-surface). The SOC in 'OF-disturbed' surface soils were lower than both 'OF-undisturbed' and 'OF-grassland'. The SOC stock in the surface (0–15 cm) soil constituted 6.95, 27.6 and 42.4 per cent of the total stock in the 1.05-m profile of OF-disturbed, OF-undisturbed (protected) and OF-grassland soils, respectively. The SOC stock in the 1.05-m soil profile was highest (83.5 Mg ha^{-1}) under 'OF-grassland' and lowest (55.6 Mg ha^{-1}) under 'OF-disturbed'. Carbon stock in vegetation and a spatial map on severity of degradation in forests of these three districts is being prepared.

Soil sampling in the Open Forest areas

Open Forest areas of Jhabua district Dhar district

Creation of North-East Indian Zingiberales biodiversity garden (Gene Bank) in RFRI (ICFRE-RFRI)

Total 36 live plant samples from seven families of the order Zingiberales have been collected from Assam, Arunachal Pradesh, Meghalaya and Nagaland; which includes the genus *Zingiber*, *Curcuma*, *Hedychium*, *Alpinia*, *Globba*, *Canna*, *Cheilocostus*, *Schummanianthus*, *Maranta*, *Phrynium* and *Musa*. In 0.5 hectare area earmarked in the Botanical Garden of ICFRE-RFRI, the proposed North-East Indian Zingiberales biodiversity garden (Gene Bank) was set up. The whole area was divided amongst the seven families of the plant order Zingiberales. Maximum area was allotted for Musaceae followed by Zingiberaceae. Data on the morphological, phenological, ecological characters and ethnomedicinal usage has been collected on-site.

Cheilocostus speciosus with a pollinator

Seedlings of *Musa velutina*

Ecological monitoring and GIS mapping of Microlepidoptera diversity of Deodar (*Cedrus deodara*) Forests of Himachal Pradesh (ICFRE-HFRI)

All 24 selected sites of Deodar inhabiting forests of Himachal Pradesh i.e.Shimla, Chopal, Theog, Joginder nagar, Gohar, Karsog, Barot, Chail, Shilaru, Charkhadi, Banethi, Renukaji Kharapather, Jhungi and Manali were visited to study the diversity of micromoths. A total of 1097 specimens of microlepidopteran moths were collected. The micro-moths were categorized into different taxa and families after identification. A total of 102 species of micro-moths belonging to 20 families were identified. Study of associated vegetation, environmental factors (Temperature, humidity, rainfall, & altitude) and pest incidence of micro-moths in the field was also recorded. Some of economically important identified species were *Stegasta variana* Meyr. *Parectopa bathracma* Meyr. *Plutella xylostella* Linn. *Stathmopoda auriferella* Walker, *Onebala hibisci* Staint, *Promalacti* sp., *Edosa strepsineura* Meyr., *Archips machlopis* Meyr., *Thisizima bubalopa* Meyr., *Edosa opsigona* Meyr., *Endotrichad enticostalis* etc.

Compsoctenadehrad unensis Rose & Path. *Edosa strepsineura* Meyr.

Preparation and updation of 376 People's Biodiversity Registers (PBRs) in different districts of Himachal Pradesh (ICFRE-HFRI)

Documented information on domesticated floral and faunal diversity, wild floral and faunal diversity, ITK, population, caste, occupation, landscape, crop area, insects & pests, livestock, fairs and festivals, deities, temples, traditional food, dresses, jewelry, etc., and prepared PBR draft reports of newly formed 122 gram panchayats of Kinnaur, Shimla, Solan, Bilaspur, Hamirpur and Sirmaur districts of Himachal Pradesh.

Data recording at Dubling Panchayat

Data recording at Kothi, Ahnog Panchayat

Data recording at Andra Panchayat

Documentation and assessment of plant diversity of sacred groves of major tribes in Jharkhand (ICFRE-IFP)

Survey was carried out to assess and document the sacred groves in 15 districts of Jharkhand namely, Simdega, Lohardaga, Hazaribagh, Ramgarh, Gumla, Khunti, West Singhbhum, East Singhbhum, Palamu, Garhwa, Pakur, Dumka, Sahibganj, Godda and Ranchi.

Geotagged information regarding 140 sacred groves have been documented, that consists of Munda (29), Santhal (78), Oraon (23) and other tribal (10) sacred groves. A total number of 66 plant families and 220 plant species, including trees (82), herbs (79), shrubs (26) and climbers/lianas (18) have been documented from the sacred groves. Density, frequency of occurrence of species, height and data at breast height are being calculated. Total area covered under above sacred groves is approximately 79.5 hectares.

Sacred Grove at Kurapurti village, Khunti district

Sacred Grove at Mutukham village, East Singhbhum district

Formulation of strategies for conservation of mangrove in Visakhapatnam district, Andhra Pradesh (ICFRE-IFB)

A total of 200 mangrove seedlings were planted in four block plantations at two locations 142 at Appikonda and 58 at Bheemili. Species composition was selected based on abiotic parameters. Survivability ratio is very low at Appikonda (22.85%) compared with Bheemili (60.34%). This must be due to high wave action and sandy sediment conditions prevailed in Appikonda. As per results of these experimental plantations and abiotic parameters it was decided to plant mangrove seedlings in a strategic manner by using Riley Encased Methodology (REM). Forty mangrove seedlings of different genus and species were planted to observe growth characteristics.

Map showing surveyed spots along coastline study region

Collection of mangrove propagules & raising of mangrove nursery

2.1.4. Forest Botany

Revision of Kanjilal's Forest Flora of the Chakrata, Dehradun and Saharanpur Forest Divisions, Uttar Pradesh for conservation and sustainable utilization (ICFRE-FRI)

Random sites of Chakrata Saharanpur, Kalsi Soil Conservation, Dehradun, Tons Forest Divisions, Mussoorie Forest Division, and Rajaji Tiger Reserve were surveyed for floristic composition. Distribution of species with geo-coordinate was recorded. Taxonomical description of 528 species under 146 Families and 372 Genera (Tree- 245, Shrub- 204, Climber- 40 and important herb- 39) have been completed. Phenological data (flowering and fruiting time) were recorded. Local names, uses and nomenclature (author citation, synonyms) of recorded species were updated. From the study area invasive species such as *Lantana camara*, *Phyllanthus niruri*, *Parthenium hysterophorus*, *Euparotium adenophorum*, *Argemone mexicana*, *Cassia tora*, *Cuscuta* spp. *Ipomea carnea*, *Leucaena leucocephala*, *Sida acuta*, *Tridax procumbens*, *Stevia ovata* etc, were not mentioned as invasive in the Kanjilal Flora.

Broussonetia papyrifera

Buxus wallichiana

Caesalpinia sepiaria

Aspidopterys wallichii

Revision of Osmaston's Forest Flora for Kumaon for Conservation and sustainable utilization (ICFRE-FRI)

Random sites of Nainital, Ramnagar, Pithoragarh, Haldwani, Bageshwar, Terai Central, Terai West and Almora Forest Divisions were surveyed till the year 2022-23. Taxonomical cum pictorial description of 580 species which includes 156 Families and 365 Genera (Tree- 281, Shrub – 191, Climber – 69 and important herbs -39) were carried out. Geo-coordinate points of the study area were recorded. Herbarium specimens collected were prepared. Local names, uses and nomenclature update of recorded species were updated.

Ilex pseudo-odorata

Ficus glaberrima

2.2
FOREST PRODUCTIVITY

A. PLAN

- Completed 02
- Ongoing 07
- New 01

B. EXTERNALLY AIDED

- Completed 01
- Ongoing 07
- New -

2.2.1. Silviculture

High-density plantation management for wood production and assessment of wood properties of coppiced material (ICFRE-FRI)

High-density plantation using coppiced material raised at a spacing of 1m x 1m produced better biomass and carbon stock than 1.2 m x 1.2 m and 1.5 m x 1.5 m spacings. The biomass produced at Prayagraj at the age of two years was highest in *Eucalyptus* hybrid followed by *Casuarina junghuhniana*, *Gmelina arborea* and *Melia dubia.* The performance in sandy soil at Raebareli was relatively poor. High-density plantation of *Eucalyptus* hybrid at 1 m x 1m spacing coppiced at a short rotation of 2 years may provide good returns, provided there is demand for small wood in such industries.

Investigation on factors responsible for Sal Mortality in Jharkhand State (ICFRE-IFP)

The suitable habitat of Sal (*Shorea robusta*) in Jharkhand using MaxEnt species distribution models have been identified and classified into four groups namely; highly; moderately, poorly and unsuitable habitat. MaxEnt results depict that a "Highly suitable area" in terms of sal mortality was predicted 9.50 % (7574.96 sq. km) of the total geographical area, which is a very good sign for forest health. Similarly, the model depicts moderate, poor and unsuitable habitats for sal mortality as 19.17 %, 23.93 % and 47.40 %, respectively. Field survey analysis depicted some of the significant factors that could be responsible for Sal mortality including staghead (dieback), lightning, waterlogging, anthropogenic stress, soil erosion and injury.

Assessment of population structure and regeneration status of *Magnolia gustavii* King. - A critically endangered tree species of Assam (ICFRE-RFRI)

Field surveys were conducted in different Reserve Forests of Assam and Namsai districts of Arunachal Pradesh. A total of 127 trees of *Magnolia* sp. were observed in their natural habitat, out of which only 25 trees, assessed in Dangori Reserve Forest were identified as *Magnolia gustavii*. The species identification was certified by the Botanical Survey of India (BSI), Gangtok, Sikkim. Based on the GPS coordinates of each individual, a distribution map of the species was prepared. During the survey, regeneration was not observed. The population structure of the species was assessed by classifying the mature individuals assigned to six dbh classes (5-15, 16-25, 26-35, 36-45, 46-55, 56-65) where the maximum number of trees belonged to 56-65 class. A total of 82 saplings of *M. gustavii* were planted in the RFRI campus for *ex-situ* conservation.

Development of Standard Operating Procedures for Developing Quality Planting material for State Forest Department, Odisha (ICFRE-FRI)

Standard Operating Procedures on seed collection and handling and nursery techniques of 30 important plantation species of Odisha were developed and compiled in the form of training manuals.

Ascertaining the impact of the error and loss in volume estimation of converted timber for major forestry species by using the quarter girth formula (QGF) and actual/ true volume calculations of timber logs (ICFRE-FRI)

The volume of felled logs using QGF is estimated based on only girth (g) and length (l) of the logs. This formula gives 78.5% of volume of the logs (when it is assumed to be a perfect cylindrical log) and show 21.5% loss in actual volume calculated by using this formula. Because of logs is neither perfectly cylinder nor ellipse being naturally tapering in tree form. Some queries were raised by many petitioners in the country to correct the QGF so that timber traders get actual volume of the logs instead of 78.5%.

QGF (V) = $(g/4)^2$ x l.

Where G= Girth of log (cm), l= Length of log (cm)

To overcome the error (volume loss, i.e. 21.5%) or estimate more accurate volume, more than a dozen logs of timber species viz. *Shorea robusta, Dalbergia sissoo, Peltophorum spp., Albizia procera, Cinnamomum camphora and Eucalyptus spp.*were minutely examined and volume was measured. Eccentricity of cross section and frustum of differential length (relative) cones which accounts for tapering nature of timber logs were duly and practically accounted for, during the volume calculation. Following three equations were used for calculating the volume:

1. $V_{cyl} = \pi r^2 l = \pi(G/2\ \pi)^2 l = G^2/4\pi^2 = G^2 l/4\pi$
2. $V_{QGF} = (G/4)^2 l = G^2 l/16$
3. $V_{exp} = 0.928\ G^2 l/4\pi$

where,

G= Girth of the log

L= Length of the log

V_{cyl}= Volume of the log/cylinder

V_{QGF}= Volume of the log measured through Quarter Girth Formula.

V_{exp}= Volume of the approximate true volume of the log (inferred from the experiment & analysis).

The volume calculated through $V_{cyl,}$ V_{QGF} and V_{exp} was 100, 78.5% and 92.8% respectively. After the statistical analysis and from the third equation (V_{exp}) it can be inferred that the approximate true volume of the log is 92.8% (7.2% volume loss) of the actual assumed perfectly cylindrical shape of the log.

Logs measurement at Bibiwala Wood Deport, Rishikesh

To study the reproductive potential of *Pistacia integerrima* and *Pittosporum eriocarpum* (ICFRE-FRI)

In nursery untreated seeds of *Pittosporum eriocarpum* had 52.65% seed germination. Seeds treated with gibberellins (500 ppm) for 45 minutes resulted in 82.74% germination. Air-layering was found to be a viable method of vegetative propagation for *Pistacia integerrima*.

Seed germination of *Pittosporum eriocarpum*

Rooting by air – layering in Kakarsinghi

Impact of Silviculture systems on the natural forests of Chhattisgarh with special reference to Sal and Bamboo (ICFRE-TFRI)

Surveyed and collected data from the Bamboo forest of Khairagarh division of Chhattisgarh under silviculture systems -RDF (Rehabilitation of the degraded forest) in compartments 260 and 319 and ANR (Assisted natural regeneration) in compartments 279 and 289. Prepared a roadmap for executing the work in the bamboo forest which includes trench making, bamboo clumps cleaning, Removing diseased culms, soil working, saucer making, adoption of bamboo regeneration etc. It was observed that ANR was better than that of RDF which had associated species including Bhondara / Seena *(Lagerstromia parviflora)*, Tendu, Saja (135 cm girth), Dhawda (81cm), Bija (147cm) and RDF was dominated by Teak, Bija, Tinsa, Saja species.

Bamboo ANR & RDF system in Khairagarh forest division, Chhattisgarh

Promoting Conservation of Declining Life Support Forest Tree Species in Himachal Pradesh (ICFRE-HFRI)

Seeds of *Corylus jacquemontii* (Thangi) were collected from Shoar, Purthi and Punto in Pangi Forest division and the germination trials of seeds were laid out in nursery beds at FRS, Manali and FRS Shillaru and germination of 26% was recorded. Collected cuttings of *Taxus wallichiana* (Rakhal) from Jalori Jot in Kullu district and planted 1500 cuttings pre-treated with IBA 1000 ppm at FRS Shillaru in polybags for rooting.

Seeds of *C. jacquemontii*

Vegetative propagation trial of *Taxus wallichiana* at FRS, Shillaru

2.2.2. Social Forestry, Agro-forestry/ Farm Forestry

Augmenting biodiversity and awareness about forest resources with special reference to medicinal and aromatic plants (ICFRE-FRI)

A medicinal and aromatic plants garden was established in FRI Campus on an area of 0.39 ha comprising 28 tree species (252 plants) and 20 shrub/small tree/ climber species (160 plants). An underground tank of 1.50 x 1.80 x 1.20 m size was provided to facilitate irrigation.

Establishment of Community Fodder Banks in forest fringe villages in Uttarakhand and Himachal Pradesh (ICFRE-FRI and ICFRE-HFRI)

A total of 8000 seedlings were planted in a 4 ha area i.e. 2500 plants each in village Mehergaon and village Thangaon, Uttarakhand.

To establish a community fodder bank, three fodder scarcity sites *viz.,* Rano, Padali in Solan Forest division and Maraog in Chopal Forest division, were selected. Also carried out socio-economic surveys in the selected sites and documented information regarding preferred fodder species. Keeping in view the local preference and nutritional values, high-density community fodder banks of different fodder species viz. *Grewia optiva* (Beul)*, Bauhinia variegata* (Kachnar)*, Leucaena leucocephala* (Leucaena)*, Morus alba* (Shatoot)*, Celtis australis* (Khidak)*, Quercus oblongata* (Ban)*, Quercus floribunda (Moru)* and *Drepanostachyum falcatum* (Nirgal) was established, at the selected sites. To enhance the fodder shelf-life, silage trials of grasses were carried out in the laboratory.

Growth performance of fodder species in the established community fodder bank at Padli and Rano, Solan, H.P.

Development of *Gmelina arborea* and *Emblica officinalis* based agroforestry models on fallow lands in Uttrakhand and Uttar Pradesh (ICFRE-FRI)

After three years planting of *G. arborea* and *E. officinalis* with agriculture crops on fallow lands for Gmelina based model, comparatively estimated economics as per net profit (Rs.19,15,320) and Cost Benefit ratio (3.29) confirms that the model-1 (Gamhar-Groundnut-Wheat-Millet-Urd+til at 4mx5m spacing) and model-7 (Gmelina-barley-mustard-wheat-vegetables on bund) were found more economic and viable to other models in expected 8 years rotation. While in case of *E.officinalis* based model, comparatively estimated economics as per net profit (Rs.7,84,992) and cost benefits (1.94) depicts that the models Aonla-Groundnut-Wheat-Millet-Til at 4mx5m spacing were economically viable. The timber yield of *G. arborea* is expected about 198.008 tons/ha at 4mx5m spacing having 400 trees and 178.56 tons/ha at 5mx5m spacing having 320 trees at 80% survival in 8th year rotation. Similarly, the total yield of *E. officinalis* is expected about 22.2 tons/ha at 4mx5m spacing having 400 trees and 17.8 tons/ha at 5mx5m spacing having 320 trees at 80% survival in 8th year.

Development of Kachnar, Bhimal and Kadam based agroforestry models on farmers land under rainfed conditions in Uttarakhand (ICFRE-FRI)

Kadam, Kachnar and Bhimal based 12 models were tried. Out of these, 2 models showed higher return in 3 years as per recorded data and a viable economic value expected at 8 year rotation. Model with Kadam+Wheat +Finger millet +Sesame (Model-I) at 8 years rotation, the yield of wheat, finger millet and sesame is estimated as 186.34q/ha, 435.00q/ha and 3.15q/ha while the expected timber from the Kadam at the same rotation is 2010.23q/ha from 280 trees from 1ha/ with spacing of 6mx6m. The expected economic value of the model at 8 years rotation showed total cultivation and management cost Rs. 5.51 Lakh/ha and sale value of Rs. 18.48 Lakh/ha with a profit of Rs. 12.97 Lakh/ha with B:C Ratio as 3.35. Model with Kadam+ Maize+ Sugarcane+ Wheat (Model-II) at 8 year rotation, the cumulative yield of maize, sugarcane and wheat grown on same pattern was estimated as 3.00q/ha, 1064.00q/ha and 46.75q/ha. The wood production of Kadam from this Model was similar to Model-I. The total cost on management of crops and trees was estimated as Rs. 5.24 Lakh/ha and the sale value of the produce obtained from crops and trees was Rs. 18.73 Lakh/ha. The net benefit at this rotation of 8 years was Rs. 13.49 Lakh/ha with B:C Ratio of 3.57.

Improving the traditional homestead to a viable agro-forestry system for biodiversity conservation and inclusive growth of Khampti tribe of Namsai district, Arunachal Pradesh (ICFRE-RFRI)

Five agroforestry demo plots were established in Khampti villages of Namsai district Arunachal Pradesh using species i.e. *Areca catechu* L. (Areca nut), *Aquilaria malaccensis* (Sasi), *Bambusa tulda* Roxb. (Jati Banh), *Citrus limon* (L.) Osbeck (Nemu/ Orange), *Cinnamomum zeylenicum* Br. (Dal Cheni); *Dalbergia sissoo* Roxb.(Sisoo); *Litchi sinensis* (litchi), *Livistona jenkinsiana* Griff. (Takow pat); *Mangifera indica* (Aam); *Machilus bombycina* King ex Hook. f., *Zizyphus mauritiana* (Apple Ber) etc. Socioeconomic survey revealed that about 44.88% Khampti households were below poverty line and only 23.12 % households had more than Rs 40,000 annual income. However, data of initial years indicated that agroforestry demo plots could enhance the economic status of the owners more than three times from the intercrops. The practice also improved soil conditions and increased plant diversity.

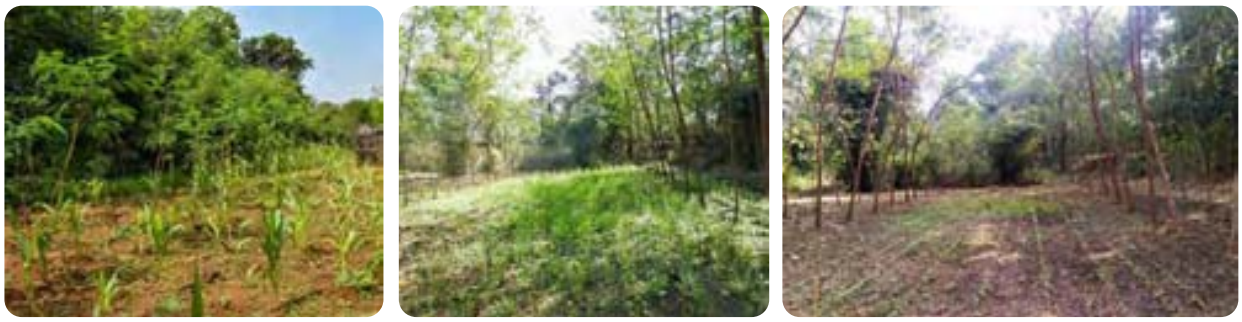
Development of suitable agroforestry models in Indira Gandhi Nahar Pariyojna (IGNP) command area of western Rajasthan (ICFRE-AFRI)

Block plantation of Agri-silvi (2 ha), Agri-horti (1.5 ha) and boundary plantation (300 RMM) trial were planted on farmer's field in IGNP command area, Bandha, Ramgarh, Jaisalmer in September 2021. Survival was 99% in *Prosopis cineraria* and *Tecomella undulata* in Agri-silvi model and 95%in *Cordia myxa* and 93% in grafted *Zizyphus mauritiana* in Agri-horti trial. The height and collar diameter of *Tecomella undulata* (Rohida) were significantly greater than *Prosopis cineraria* (Khejri) seedlings in the Agri-silvi trial. Average height and collar diameter were 150 cm and 3.68 cm of *T. undulata* seedling and 88 cm and 2.03 cm of *P. cineraria* seedling, respectively. The growth parameter did not differ significantly in the Agri-horti trial. Fruiting in 37 grafted plants of *Zizyphus mauritiana* was 0.60 -2.50 kg/plant and fruiting was observed in 12 grafted *Cordia myxa*. The growth performance of Shisham seedlings planted on boundary at Ramgarh, IGNP command area Jaisalmer was the highest. Crop yield reduction did not differ between tree species. Economic return was highest (Rs. 3076/ha) in the Agri-horti trial and it was lowest (Rs. 1000/ha) in the agri-Silvi trial for the Kharif season.

(A) Agri-silvi trial; **(B)** *Dalbergia sissoo* planted on Boundary; **(C)** Plantation of Agri-horti trial and **(D)** Fruiting in grafted *Zizyphus mauritiana* in Agri-horti model; at RMM, Ramgarh, IGNP command area, Jaisalmer

Popularization of improved variety of *Leucaena leucocephala* (Lam.) de Wit. based agroforestry system (ICFRE-TFRI)

Established *Leucaena*-based agroforestry system by intercropping of Kharif crop viz. *Cyamopsis tetragonoloba* and rabi crop viz. *Brassica juncea* and economics were worked out. The crop combination initially generated a net return of Rs.12450 only. Visited farmer's fields and interacted and motivated them to adopt the improved clone of *L. leucocephala* which is in demand by the wood-based industry like BILT, farmers have adopted the model as block and woodlot with Sorghum crop in Jalna district, Maharastra.



Leuceana + Maize + Mustard agroforestry model in Jabalpur district

Tree outside forests of India (TOFI) International Collaborative project ICRAF-USAID, Asia Continental programme (ICFRE-TFRI)

To expand the area under agroforestry outside the forests in seven states of India, organized workshops in Odisha, Tamil Nadu and Rajasthan and identified the promising species for the respective states**.** Participated in the National Launch of TOFI programme at Paryawaran Bhawan, MoEF& CC, New Delhi.

National Launch of TOFI programme at Paryawaran Bhawan, MoEF& CC, New Delhi

Statewise list of species to expand the area under agroforestry outside the forests in India

S.No.	Name of States	Promising agroforestry species
1	Andhra Pradesh	*Pterocarpus santalinus, Acacia mangium, Moringa oleifera, Phyllanthus emblica, Melia dubia, Azadirachta indica,* Bamboo*, Neolamarkia cadamba, Gmelina arborea, Swietenia mahagoni, Psidium guajva, Mangifera indica, Artocarpus heterophyllus, Areca catechu*
2	Assam	*Gmelina arborea, Aquilaria,* Bamboo*, Areca nut, Melia dubia, Acacia mangium, Neolamarkia cadamba, Cocos nucifera, Psidium guajava, Musa paradisiaca, Morus alba, Ananas cosmosus, Capsicum annuum (king chilli)*
3	Haryana	*Populus deltoides, Melia dubia, Azadirachta indica, Bamboos, Neolamarkia cadamba, Gmelina arborea Psidium guajava, Mangifera indica*
4	Orissa	*Acacia mangium, Anacardium occidentale, Gmelina arborea, Casuarina, Swietenia mahagoni, Moringa oleifera,Cocos nucifera, Banana, Phyllanthus emblica, Terminalia arjuna, Areca catechu, Sesbania grandiflora, Mangifera indica, Psidium guajava, Musa paradisiaca, Ananas cosmosus, Grevillea robusta Coffea arabica, Piper nigrum, Leucaena leucocephala*
5	Rajasthan	*Prosopis cineraria, Ailanthus excelsa, Phyllanthus emblica, Bambusa bamboos, Santalum album, Commiphora wightii, Acacia auriculiformis, Zizyphus mauritiana*
6	Tamil Nadu	*Melia dubia, Neolamarkia cadamba, Gmelina arborea, Swietenia mahagoni, Casuarina, Santalum album, Grevillea robusta, Tectona grandis, Ailanthus excelsa, Leucaena leucocephala, Cocos nucifera, Areca catechu, Artocarpus integrifolia, Musa paradisiaca, Coffea arabica, Azadirachta indica, Betel vine*
7	Uttar Pradesh	*Phyllanthus emblica, Populus deltoides, Melia dubia, Azadirachta indica, Bamboos, Neolamarkia cadamba, Gmelina arborea, Swietenia mahagoni, Psidium guajava ,Mangifera indica, Annona squamosa, Moringa oleifera*

Development of form factors for important tree species of Chhattisgarh (ICFRE-TFRI)

Revised Form factors for *Tectona grandis* (Teak) and *Shorea robusta* (Sal) in different agroclimatic zones of Chhattisgarh. The revision of form factor for other important tree species such as *Terminalia tomentosa* (Saja), *Pterocarpus marsupium* (Beeja Sal), *Dalbergia sissoo* (Shisham), *Adina cordifolia* (Haldu), *Terminalia arjuna* (Arjun), *Bridelia retusa* (Kasai), *Ougeinia dalbergioides* (Tinsa), *Gmelina arborea* (Khamhar), *Mitragyna parviflora* (Mundi), *Gardenia latifolia* (Papda), *Cleistanthus collinus* (Karra), *Lagerstroemia parviflora* (Lendia), *Diospyros melanoxylon* (Tendu) and *Chloroxylon swietenia* (Bhirra), is in progress.

Revised cumulative form factor of teak

Girth Class	Form Factor of Teak								
	Sound			Half Sound			Unsound		
	Timber	Fuel	Total	Timber	Fuel	Total	Timber	Fuel	Total
21-30	0.797	0.199	0.996	0.399	0.399	0.797	0.199	0.498	0.697
31-45	0.774	0.194	0.968	0.387	0.387	0.774	0.194	0.484	0.677
46-60	0.708	0.177	0.885	0.354	0.354	0.708	0.177	0.443	0.620
61-75	0.701	0.175	0.876	0.351	0.351	0.701	0.175	0.438	0.613
76-90	0.668	0.167	0.835	0.334	0.334	0.668	0.167	0.418	0.585
91-105	0.650	0.163	0.813	0.325	0.325	0.650	0.163	0.406	0.569
106-120	0.632	0.158	0.790	0.316	0.316	0.632	0.158	0.395	0.553
121-135	0.616	0.154	0.770	0.308	0.308	0.616	0.154	0.385	0.539
136-150	0.640	0.160	0.800	0.320	0.320	0.640	0.160	0.400	0.560
151-165	0.614	0.154	0.768	0.307	0.307	0.614	0.154	0.384	0.537
166-180	0.653	0.163	0.816	0.327	0.327	0.653	0.163	0.408	0.571
181 -above	0.544	0.136	0.680	0.272	0.272	0.544	0.136	0.340	0.476

Revised cumulative form factor of Sal

Girth Class	Sound			Half Sound			Unsound		
	Timber	Fuel	Total	Timber	Fuel	Total	Timber	Fuel	Total
46-60	0.754	0.188	0.942	0.377	0.377	0.754	0.188	0.471	0.659
61-90	0.718	0.180	0.898	0.359	0.359	0.718	0.180	0.449	0.628
91-120	0.650	0.163	0.813	0.325	0.325	0.650	0.163	0.406	0.569
121-150	0.637	0.159	0.796	0.319	0.319	0.637	0.159	0.398	0.557
151-180	0.590	0.148	0.738	0.295	0.295	0.590	0.148	0.369	0.516
181 -above	0.574	0.144	0.718	0.287	0.287	0.574	0.144	0.359	0.502

(A) Measurement of tree diameter at different height segments of *Bridelia retusa* at Dhamtari forest division using Basal Area Finder (BAF) Scope **(B)** Measurement of tree diameter at different height segments of *Adina cordifolia* at Bastar forest division using Basal Area Finder (BAF) Scope

Genetic diversity of plant growth promotory diazotrophs and fluorescent pseudomonades associated with traditionally distinct mountain agroecosystems of Nagaland (ICFRE-RFRI)

Soil samples, as well as crop yield data from the tree-based Jhum farming system in Mon districts of Nagaland were collected and analyzed for soil organic carbon, pH, EC and bulk density. Fourteen microelements were analyzed using ICP-OES including Iron (Fe), Manganese (Mn), zinc (Zn), Nickel (Ni), Molybdenum (Mo) and Silicon (Si). Soil microbiome analysis was also carried out and found that the soil ecosystem was dominated by Acidobacteriota (29%) followed by Alphaproteobacteria (26%), Actinobacteria (7%), Chloroflexi (6%).Cultivable target bacteria (diazotrophs and fluorescent pseudomonads) were isolated from soil samples and identified. Paddy yield data from selected farming systems was collected and assessed for productivity estimation based on the average of 10 sample plots per sampling site, paddy yield was found as 2.15 t/ha.

Assessment of socio-ecological vulnerability to climate change among agroforestry managers along an altitude gradient in the eastern Himalayas (ICFRE-RFRI)

Survey and data collection from 212 households in Jorhat, Sivasagar, Golaghat districts of Assam and Kohima, Wokha, Niuland districts of Nagaland were done. Out of 212 households, 20 households were surveyed in Golaghat and 10 households in Sivasagar district. Further, a total of 27 home garden households were surveyed along with data collection from the Jorhat, Sivasagar, Golaghat districts of Assam and Kohima, Niuland, Wokha districts of Nagaland. Soil samples collected from the fields and soils were more acidic in Nagaland (4.4 to 4.8pH) as comapare to Assam (5.6 to 6.4pH). The soil organic carbon content for Nagaland varied from 0.76 to 4.98 % and for Assam from 0.69 to 1.11%. The soil in Assam had higher bulk density (1.36 to 1.18gm/cc) as compared to Nagaland (0.82 to 1.56gm/cc), while available nitrogen was higher in Nagaland (183 to 551kg/ha.) as compared to Assam (232 to 247 kg/ha.).

Population assessment, ecological niche modelling and developing sustainable harvesting technique of *Pinus gerardiana* for conservation in Himachal Pradesh and Jammu & Kashmir (ICFRE-HFRI)

Two natural populations of Chilgoza Pine were recorded at Gulabgarh in Kishtwar Forest Division and Sounder in Marwah Forest Division. Maximum shrub density was recorded from Pangi (3447 ha^{-1}) in Kinnaur Forest Division whereas the highest herb density was recorded at Ribba-I (1600 ha^{-1}) in Kinnaur Forest Division. Based on analyzed data from 27 sites, maximum sapling density of 120 ha^{-1} was recorded from Rispa-I in Kinnaur Forest Division and the maximum seedling density of 90 ha^{-1} was recorded from Gulabgarh in Kishtwar Forest Division. Soil samples from 63 sites were analyzed and the maximum value of organic carbon (5.4 %) was recorded from Urni in Kinnaur Forest division. Chilgoza extraction trend data was documented from 12, 2, 1 and 3 villages of Kinnaur, Bharmour, Kishtwar and Marwah Forest divisions, respectively.

Documentation of extraction trend data of *P. gerardiana* at Tangling village, Kinnaur

Documentation of extraction trend data of *P. gerardiana* at Lopara village, Kishtwar

Assessment, ecological niche modelling and strengthening of agroforestry systems for securing the livelihoods of inhabitants in cold desert region of Himachal Pradesh and Ladakh (ICFRE-HFRI)

Assessed traditional agroforestry systems in three villages in Spiti Valley, H.P. and 14 villages in Kargil district of UT of Ladakh and also documented agroforestry species grown by local communities. The traditional agroforestry systems existing in Spiti Valley are Agri-silviculture, Agri-horticulture, Agri-horti-silviculture, and Silvipastoral and in Kargil district of Ladakh UT traditional agroforestry systems are Agri-silviculture, Agri-horticulture, Agri-Horti-silviculture, and Silvipastoral.

Prominent Agroforestry species grown in Spiti and Kargil Valley by local communities

Locality	Prominent Agroforestry Species
Spiti Valley	*Salix alba, Populus nigra, Malus pumila, Prunus armeniaca,Rosa webbiana, Ribes orientale, Hippophae salicifolia, Solanum tuberosum, Pisum sativum, Spinacia oleracea, Brassica oleracea, Brassica capitata, Hordeum vulgare, Triticum aestivum, Phaseolus vulgaris*
Kargil Valley	*Salix alba, Salix tetrasperma, Populus nigra, Populus ciliata, Juniperus polycarpos, Elaeagnus angustifolia. Malus pumila, Prunus armeniaca, Vitis vinifera, Juglans regia, Hordeum vulgare, Triticum aestivum, Zea mays, Pennisetum glaucum, Daucus carota, Raphanus sativus, Brassica rapa, Spinacia oleracea, Cucumis sativus, Allium cepa, Chenopodium album, Solanum lycopersicum, Solanum tuberosum, Solanum melongena, Pisum sativum, Brassica oleracea,Phaseolus vulgaris, Lens culinaris, Fagopyrum tataricum, Brassica campestris, Eleusine coracana* and *Medicago sativa*

Collected soil samples from the selected villages and analyzed soil parameters. From three villages of Spiti valley, soil pH varied from 6.90 to 8.05, E.C. varied from 12.03 to 26.02µS/m, organic carbon varied from 1.01 to 2.35%, and nitrogen varied from 120.02 to 155.25 Kg/ha. From 14 villages of Kargil district, pH of soil varied from 6.24 to 8.95, E.C. varied from 10.35 to 29.12µS/m organic carbon varied from 1.02% to 2.23% and nitrogen varied from 125.55 to 180.18 Kg/ha. Distributed 900 seedlings of *Prunus armeniaca* (Chuli), *Populus nigra* (Black Poplar), *Salix alba* (White Willow), and *Juniperus polycarpos*(Shukpa) to 20 farmers of Spiti Valley in HP. and 300 seedlings of *J. polycarpos* to 59 farmers of Leh and Kargil for plantations in their agriculture field bunds for strengthening of traditional agroforestry systems.

Agri- Horti-Silviculture System, Garkone Village, Aryan Valley, Kargil

Agri-Silviculture System, Mane Gogma Village, Spiti Valley, H.P.

Distribution of Plants to Farmers of Mane Gogma Village, Spiti Valley

Distribution of Juniper seedlings to Farmers of Galing Village, Suru Valley, Kargil

2.2.3. Forest Soils & Land Reclamation

Monitoring of soil organic carbon in agroforestry, natural and conventional farming systems in Tamil Nadu (ICFRE-IFGTB)

A total of 968 soil samples were collected from different farming systems in Tamil Nadu *viz.*, agroforestry (414 nos), non-agroforestry (414 nos.), natural farming (70 nos.) and conventional farming (70 nos.) at 30 cm depth, to monitor the dynamics of organic carbon status in soils. The samples were analyzed for pH, EC, bulk density, organic carbon and texture. The overall soil organic carbon content ranged between 0.06 to 1.57% with a mean value of 0.67 %. The lowest soil organic carbon of 0.06 % was recorded in Krishnagiri district while the highest soil organic carbon of 1.57 % was recorded in Tiruvarur district. Out of the 414 agroforestry samples, 22.95% of the samples were low, 38.65 % medium and 38.41% were high in organic carbon content. Agroforestry systems resulted in higher total mean soil organic carbon content than non-agroforestry systems.

Development and optimization of biochar enriched supercompost from forest necromass for enhanced soil carbon sequestration (ICFRE-RFRI)

A low-cost Pyrolysis System for Thermal Decomposition of Biomass was designed, indigenously developed and successfully tested. Test results showed that slow pyrolysis (5-6 hours) of composite necromass samples of tropical trees viz., *Tectona grandis, Gmelina arborea, Artocarpus chaplasa,* etc. resulted in slightly higher than 3:1 conversion/recovery ratio for feedstock to biochar which is at par with the Lambiotte double-reactor system. Valorisation of necromass through pyrolysis was experimentally demonstrated using the system and biochar with 65.71 to 68.21% total Carbon concentration was produced. Nine treatment mediums of biochar-enriched super-compost were further developed and tested for its efficacy on growth and development of *Tectona grandis, Gmelina arborea, Dipterocarpus turbinatus* and *Albizia procera* of which six mediums were finally optimized for application as soil amendment under tall nursery conditions with augmented potential for higher carbon sequestration in amended soils.

The novel design of the low-cost pyrolysis system developed under the project has been successfully registered (Design No. 375152-001 dt 06.12.2022) with the Patent Office, Department for Promotion of Industry and Internal Trade, Ministry of Commerce and Industry, Government of India under the provisions of Design Act, 2000.

2.3
GENETIC IMPROVEMENT

A. PLAN

- Completed 05
- Ongoing 21
- New 03

B. EXTERNALLY AIDED

- Completed 08
- Ongoing 25
- New 10

2.3.1. Conservation of Forest Genetic Resources

Diversity assessment of *Saraca asoca* (Roxb.) de Wilde for selection of superior chemotypes and mass propagation (ICFRE-IFGTB)

In *Saraca asoca*, variations in secondary metabolites were assessed for tannins, phenols, flavonoids, and terpenoids during seasons, from various locations, age of trees and varying heights. Phenols were the highest (1.1 mg/g) in aged trees, while flavanoids were the highest in young trees (0.24 mg/g). The presence of epicatechin, tannic acid and pyrogallol were documented only during autumn. New six unidentified compounds with antifungal and antiviral activities were also recorded.

Development of seed production systems of commercially exploited forest species-An initiative for continuous supply of quality seeds and se edlings (ICFRE-IFGTB)

Medicinal seed orchards serving as seed production systems (SPS) of several medicinal trees including *Aegle marmelos* (Bael), *Gmelina arborea* (Ghamar), *Oroxylum indicum* (Syonak), *Premna integrifolia* (Agnimantha), *Stereospermum suaveolens* (Pathiri); *Terminalila bellirica* (Thannikai), *Terminalia chebula* (Kadukkai), *Saraca asoca (*Ashoka), *Pterocarpus marsupium* (Vengai) have been established at two locations in Kerala (Pariyaram, Palakkad) and three locations (Madurai, Kodaikanal and Neyveli) in Tamil Nadu. Medicinal tree seedlings have been distributed to various agencies (CUBE, Adi Federation) to create awareness on medicinal plant cultivation. The success of the SPS has encouraged the agencies (at Madurai and Palakkad) to expand the area of cultivation and have sought the support of IFGTB for planting stock.

Assessment of *Melia dubia* for growth performance in multi-location in Kerala (ICFRE-IFGTB)

Twenty clones of *Melia dubia* have been mass produced and a clonal trial of *Melia dubia* in 0.27 ha raised in Mathilakam, Kerala.

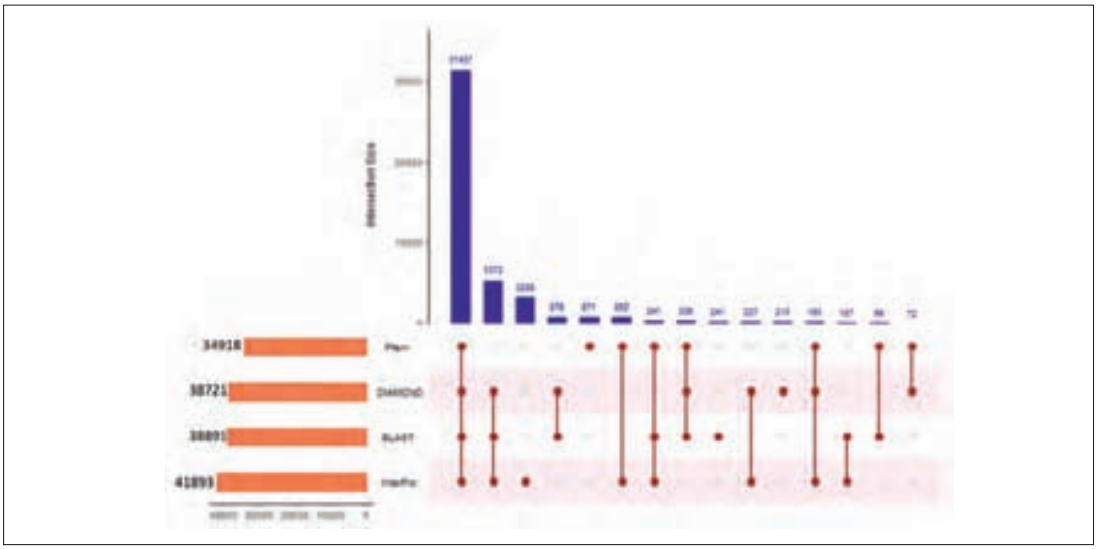
Clonal field trail of *Melia dubia* at Mathilakam, Kerala

Genome wide and geospatial approaches for enhancing the adaptive potential of threatened rattan resources in India (ICFRE-IFGTB)

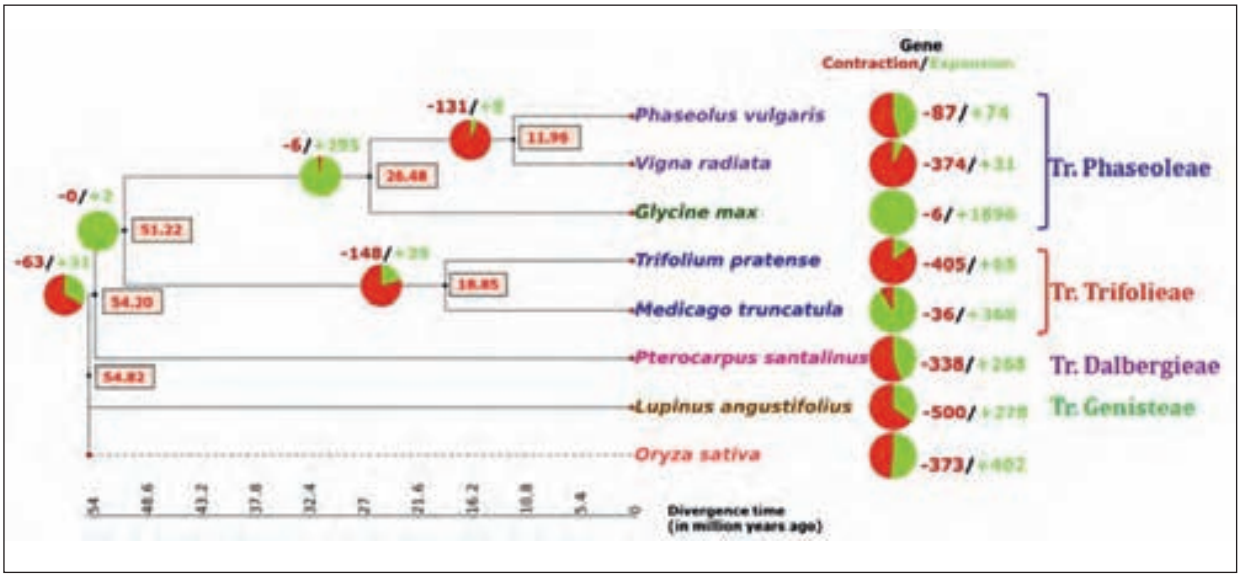
Genome-based studies were undertaken on gender-specific markers, cataloguing adaptive potential and identifying viable ecological niches in *Calamus brandisii* - a threatened rattan (Pirampu) species. Comparative genomics of both male and female genomes predicted 2,33,027 variants including 80,487 SNPs and 1,52,540 InDels. Ten gender-specific genes showing sequence variation across both genders were mined. Three genes namely FCMO, FCMO-3 and LOG-I were validated in male and female individuals.

Domestication, Sustainable Utilization and Conservation of *Pterocarpus santalinus* (Red Sanders) genetic resources (ICFRE-IFGTB)

The project aimed at understanding the population dynamics of *Pterocarpus santalinus* (Red Sanders) genetic resources. The natural populations in Chittoor and Kadappa forest divisions were enumerated and 420 genetic resources were shortlisted for seed collection and establishment of field gene bank. Further, refinement of micro and macro propagation protocols for identified superior germplasm was achieved. The project also aimed at deciphering the population structure in red sanders using microsatellite markers. A total of 288 individuals were genotyped through high put multiplex amplicon sequencing and 3586 alleles were deducted with 237 unique alleles. The first high quality reference genome of *P. santalinus* was also generated. The haploid genome size was estimated at 541 Mb and the hybrid assembly showed 99.60% genome completeness. A total of 51,713 consensus gene set was predicted and 31,437 genes were annotated using public databases. Whole genome duplication event was predicted at 30-39 million years ago. Gene family analysis revealed a significant expansion of drought responsive gene families. Re-sequencing of six diverse genotypes indicated a highly heterozygous genome with a frequency of one variant every 27 bases.



UpSet plot of 31,437 functionally annotated genes of *Pterocarpus santalinus* using four public databases



Maximum Likelihood (ML) phylogenetic tree based on orthologous single-copy gene families indicating divergence time and gene family expansions and contractions among seven Papilionoideae members

Evaluation of selected clones of teak through multi site testing to identify site specific clones for large scale plantations (ICFRE-IFGTB)

Performance of eight tissue culture raised teak clones was assessed in four locations in Kerala (Adikuzhi, Thavalappara, Peringamala and Nilambur) and interim results at six years revealed 70 per cent superiority of the clones over seed planting material used in plantations.

Tissue culture teak raised by Kerala Forest Department at Adikuzhi

Selection, evaluation, conservation and documentation of genetic resources of teak and other important tree species for enhancement of productivity (ICFRE-IFGTB)

The study was a consolidated effort assessing the seed production areas (SPAs), plantations and natural populations of teak in Kerala. Thirty-five SPAs were evaluated for identifying seed sources for quality seeds. Udayakkara SPA of Wayanad, Sankarankodu SPA of Nilambur and Kummannur-1 SPA of Konni are good seed sources with high genetic diversity and can be adopted for establishing plantations. The study also emphasized the need for thinning in SPAs identified so that these could be designated seed sources of teak for future plantations. Teak plantations at Pamba valley, Neeratu kavu-Neeratuthodu, Puzhukanam and Adukuzhy, Aruvapulam, Manja kadambu and Arikada muku-Appupangkavu can be accorded the status of gene conservation units. Forty-one teak clones are identified which could form a part of future planting programmes by Kerala Forest Department.

Spatio-temporal land use patterns at rural-urban interface and the relationship between green areas and biophysical features (I-C02) Phase II (ICFRE-IWST)

Growth data collected and analyzed for identifying changes in the structure, composition, density and diversity of species within the urban, rural and transition plots. Assessment of temporal change in composition, indicate species loss in the urban, transition and rural plots are 10, 9 and 13 in number respectively (total 32 species). However, temporal change on composition in southern transect over a span of three years indicates the gradual loss of trees from 2018 to 2021 with species loss of 7, 6 and 12 in urban, transition and rural plots respectively (total 25 species). As per the diversity analysis, the values for Shannon, Simpson, richness and evenness diversity indices express gradual decline in diversity values of 2021 compared to values of 2017 in both the transect which could be due to anthropogenic factors.

Assessment of adaptive genetic diversity in teak and sandalwood to guide conservation and genetic improvement efforts (ICFRE-IFGTB)

Adaptive diversity of *Tectona grandis* (teak) and *Santalum album* (sandal) was assessed to guide conservation programs. Stomatal density, relative water content, specific leaf area and differential gene expression distinguished 21 teak populations from Assam, Maharashtra, Chhattisgarh, Madhya Pradesh, Tripura, Jammu, Tamil Nadu, Gujarat, Karnataka, Mizoram, Odisha, and Kerala. Climatic conditions played a key role in delineating the natural populations of teak. The genotype-environment associations (GEA) analyses of teak resulted in outlier loci of 12 SNPs in the genic region that were associated with temperature and 244 SNPs in the genic region precipitation-related variables. Spatial genetic structure analysis in sandalwood revealed the uniqueness of Jawadhu hills population over others. A low-depth whole genome sequencing in 29 individuals of sandalwood from five states provided 1.1 million SNPs. Environmental Association Analysis predicted a significant association of outliers with bioclimatic variables. Transcriptional regulator SLK2, zinc finger protein ZAT10, and HMG-CoA synthase are identified as probable regulators of climate adaptation in sandalwood.

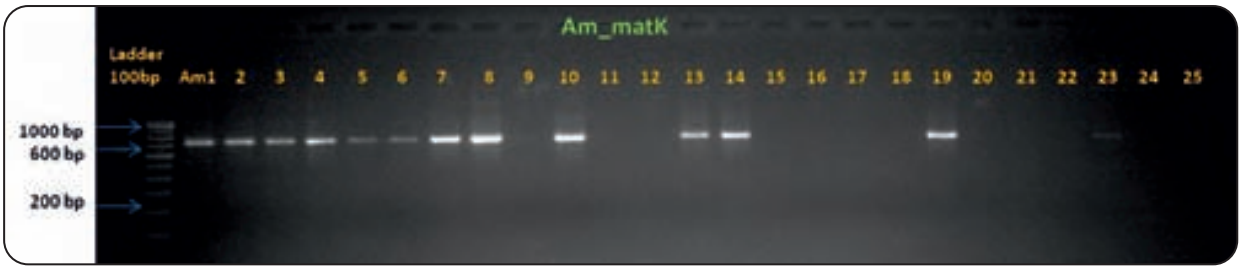
Taxonomy, silviculture and management practices of selected rattans of Karnataka (ICFRE-IWST)

Carried out field survey in BRT Hills, Charmadi Ghat, Somana Kadu, Balur State Forest, Gerusoppa, Jog falls, Talacauvery, Tadiandamol, Bhagamandala, Sampaje, Anshi, Dandeli Tiger Reserve and Kudremukh NP, etc., Recorded phenology and morphology of 12 species of rattans from Western Ghats of Karnataka viz., *C. dransfieldii*, *C. gamblei, C. karnatakensis*, *C. lacciferous, C. lakshmanae*, *C. nagabettai*, *C. prasinus*, *C. pseudotenuis*, *C. stolonifer*, *C. travancorious*, *C. thwaitesii*, *C. vattayila*. Wildlings were collected from Poomale Forests, Kodagu district and maintained in IWST Nursery. After 6 months seedlings were replanted in the forest areas suitable for the growth of species – in Sampaje, Makuta, Charmadi Ghat and also used for enriching rattan arboretum at Somankadu, Moodigere range, Chikmagalur Division. 200 wildlings collected from Kakkabe were provided to Dy RFO of Kalgundi Forest, Sullia Range for planting and conservation of RET species. 25 seedlings each of *Calamus vattayilla, C. gamblei C. prasinus, C. stolonifer* were provided to forest department at Moodigere for establishment rattan arboretum at Somanakadu, Karnataka. Carried out transplantation experiment of *C. gamblei* wildings collected from BRT hills in Halehalle and Kerematta location, survival was 25%. With phytogel application survival enhanced to 50%. *C. tenuis,* a species reported from North East India was observed in Kottigehara, Charmadi Ghat and Gerusoppa and is a new distributional record. *C. travancoricus* and *C. vattalyila* are rare species identified. These new localities will be helpful for conservation of species.

Rattans diversity: **(A)** *Calamus tenuis*-Habit; **(B)** *Calamus tenuis*-Stem; **(C)** *Calamus pseudotenuis* –Fruits; **(D)** *Calamus lakshmanae* –regeneration

Development of procedure for forensic identification of illegally cut mangrove trees using molecular marker techniques (ICFRE-IWST)

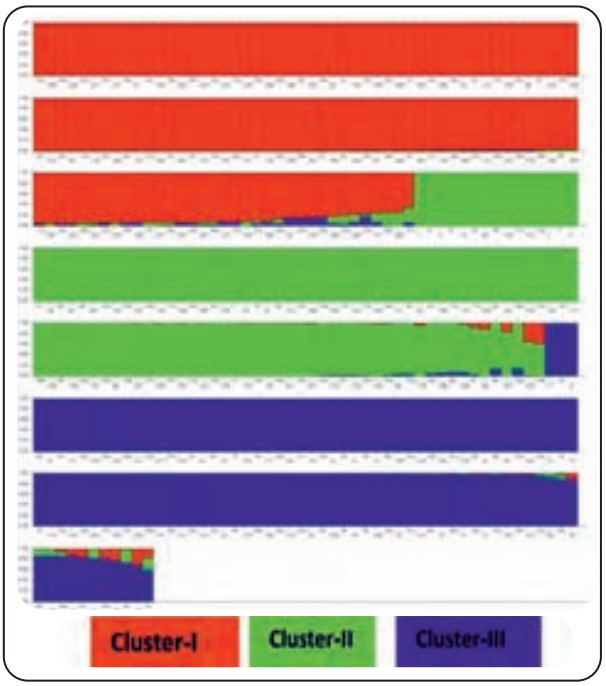
The methods for DNA extraction from leaf and wood samples were standardized and total genomic DNA was isolated from collected samples. Barcode regions were PCR amplified, sequenced and published in NCBI. However, the standard DNA barcoding approach did not result in exact identification of the mangrove species studied. Four species-specific primers were designed and synthesized for *matK* and *rbcL* regions of *Avicennia marina* and *Sonneratia alba* and validated. Am_matK primer pair was the most suitable for identification of *A. marina* wood samples without any false positives, and is a potential molecular marker for forensic identification of *A. marina* wood samples.



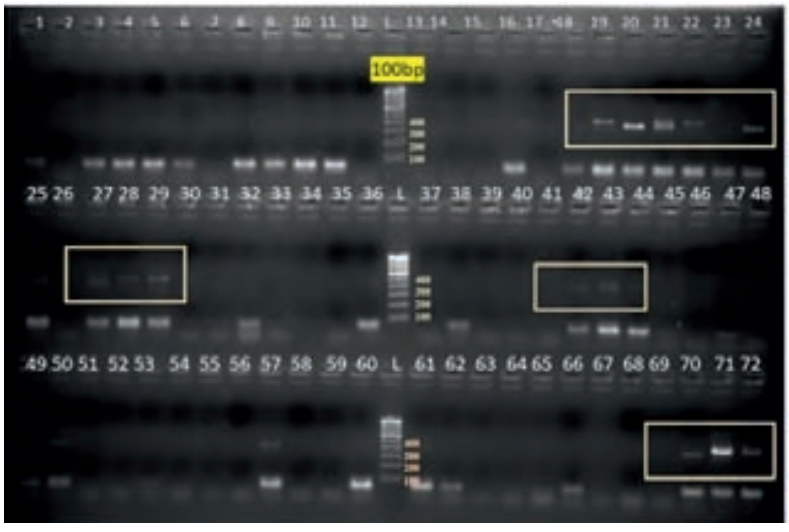
A. marina wood samples using Am_matK primer

Development of SSR markers and assessment of genetic diversity of natural populations of *Pterocarpus santalinus* L.f. distributed in the Eastern Ghats, India (ICFRE-IWST)

The screening of SSR markers was done by utilizing 33 SSR markers specific to *P. santalinus*, eight SSR primers from *P. erinaceus*, and seven primers from *P. indicus*. Polymorphism was observed in 34 (28 SSR primers from *P. santalinus* and two and four from *P. indicus* and *P. erinaceus*) SSR markers (PIC=0.57 to 0.95). For further analysis 16 highly polymorphic SSR markers having PIC>0.9 were selected. The statistical analysis for 16 microsatellite markers on 361 samples of *P. santalinus* was carried out, the maximum Na, Ne, He, and Ho was observed in locus PIN-82 (Na=12.82, Ne=8.85, He=0.87, and Ho=0.70) and lowest in PSSSR-2 (Na=3.77, Ne=2.34, He=0.36, and Ho=0.12). For 22 populations the highest Na was observed in population CVP (13.438) and the lowest in TCT (4.625). While across the populations, the highest Ne was observed in TTP (Ne=9.211) and the lowest in NRA (Ne=3.27). High population-specific (Private) alleles were observed in NAK, TTP, CSM, and CVP (2.12, 1.50, 1.44, and 1.31) populations, respectively. The structural analysis revealed a maximum ΔK=3. All 22 populations were grouped into three distinct genetic clusters.



Population structure distribution of 361 *Pterocarpus santalinus* individuals, when K=3. Each bar representing one individual. Each bar shows the individual's estimated ancestry proportion in different colored segments.



SSR marker (PIN-82) showing polymorphism among individuals on 4% agarose gel

Conservation of *Litsea glutinosa* (Lour.) C.B. Robinson through population establishment in Madhya Pradesh (ICFRE-TFRI)

Litsea glutinosa is an important multi-purpose forest species with a dwindling presence in the forests of central India. Two block plantations (each block 200 plants) were established in Dellakhari range (P-104 & P-97), Chhindwara West Forest Division. Saplings (1100 nos.) were supplied to the Maharashtra Bamboo Development Board, Nagpur and 200 saplings to the Tamia Range, Chhindwara West Forest Division.

Improvement of survival rate in kair (*Capparis decidua*) under field planting conditions by architecting root biomass and in situ moisture management (ICFRE-AFRI)

Field survey was carried out in various districts of Rajasthan for seed collection during 2022-23 namely Sikar, Churu, Jhunjhunu, Jodhpur, Nagour, Barmer, Jaisalmer, Pali and Jalore. Variation in fruit size, seed size and 100 seed weight were observed among collections. Plants of kair without thorns have also been identified and fruits have been collected. Seedlings are being raised in nursery from these collection. Nursery experiment with seven various sized containers was taken up during 2021-22 and continued up to 2022-23. The root trainers of size 500 cc and 300cc with extenders showed better survival (71% and 69% respectively) and growth of kair seedlings after one year compared to polybags (41% survival) in the nursery. The 30 cm extenders prepared using PVC pipes increased the length of root trainers and thereby more space for roots to grow. The experiment was repeated during 2022-23 also for the seeds collected during winter season. Initial results indicated larger and longer containers are better for *Capparis* seedling growth.

Thornless kair plants identified at Nagour, Rajasthan

Seedlings of *Capparis* raised in various sized containers

Assess variability in growth, heartwood color, oil yield and chemical profiling for Indian sandalwood (*Santalum album*) in Kerala. (ICFRE-IWST)

Study revealed that sandalwood populations were skewed in nature, with seedlings accounting for a mere 4%. The girth at breast height of 212 CPTs ranged from 28 to 144 cm, with a mean of 80.79 cm and the tree height ranged from 2.5 to 21.9 m. The average bark thickness was 0.74cm. The mean heartwood radius was 20.01 cm and ranged from 4.5 to 40.1cm. The average heartwood content was 88.39%, with no significant differences in heartwood colour. The average oil content was 4.72% and ranged from 1.3 to 6.9%. The α and β-santalol content varied from 41.1–55.9% and 17.9 – 30.6%, respectively. Oil content was the highest in sandalwood reserve VSR-II and the lowest in NSR-I in Marayoor population. Generally, oil yield and santalol content were high in the trees growing on hilly tracts. A molecular analysis study could not differentiate between genotypes with low and high oil content.

Conservation of RET species of Chhattisgarh – *Plumbago zeylanica* and *Celastrus paniculatus*, and production of quality planting material (ICFRE-TFRI)

Plants of *Plumbago zeylanica* (Chitrak) and *Celastrus paniculatus* (Malkangni) were multiplied through cuttings and tissue culture. Carbohydrate, flavonoids and tannins were estimated in roots of *P. zeylanica*. Carbohydrate was in the range of 0.379 - 1.610 %, flavonoids from 0.024 to 0.053 mg/g and tannin from 0.021 to 0.166 %. Germplasm bank of the two species was maintained and recorded 91% survival in *P. zeylanica* and 94% in *C. paniculatus*. In *P. zeylanica* maximum average plant height (150 cm) was obtained in plants of Keregaon, and in *C. paniculatus* maximum average plant height (110 cm) was obtained in plants of Bhatwatola,. Seed germination study in *C. paniculatus* seeds from different locations of Chhattisgarh showed maximum 43.13 % germination in seeds of Marwahi followed by 42.50 % in seeds of Dhamtari pretreated with 0.7 % H_2SO_4.

Assessment of diversity and natural regeneration status of *Sterculia urens* Roxb. for development of conservation strategy in Madhya Pradesh (ICFRE-TFRI)

Sterculia urens populations are shrinking in the natural ranges and suitable conservation strategy needs to be devised and deployed for this economically important non-timber forestry species. All the morphometric traits assessed showed a large amount of variation. Coefficient of variation (CV) was highest for GBH (63%) followed by clear bole height (54%), crown diameter (50%), tree height (48%) and number of branches (46%). The species' natural regeneration status at all the surveyed sites was observed to be very poor despite profuse flowering and fruiting. Mostly large, mature trees were found scattered on the hill tops and rocky crevices. Sand is the best medium for germination with 64% germination and faster rate. Assisted natural regeneration (ANR) activities are recommended in the natural ranges of *S. urens* to ensure regeneration and restoration.

Recording morphological data in Mundi range of Khandwa forest division

Recording of natural regeneration status in Gwalior forest division near Panihar village

Genetic improvement of *Pterocarpus marsupium* Roxb. through germplasm collection and conservation in eastern India (ICFRE-IFP)

The progeny trials are being maintained in two localities at Chandwa Research Station, Latehar district and Arid village, Ranchi comprising of 40 families and 22 families respectively. In the family collected from Arabari, West Bengal maximum height of 7 feet was recorded at progeny trial in Chandwa, Jharkhand. In the progeny trail at Arid village, Ranchi 56% survival and maximum height of 12 feet in Arabari family was recorded. The isolation of genomic DNA of 22 progenies has been checked using 0.8% Agarose gel and DNA isolation protocol has been standardized.

Pterocarpus progeny trial at Chandwa (Latehar)

Development of a value chain for bamboos for mass multiplication, popularization in farmer's field and industrial linkage in central India (ICFRE-TFRI)

A plantation of *Pseudoxytenanthera stocksii* was established at KVK, Umaria, Madhya Pradesh with the objective of introduction of a new species in central India. Macropropagation using culm cuttings and culm branch cuttings of *Bambusa nutans*, *Bambusa vulgaris* var. green and *Bambusa tulda* and micropropagation of different bamboo species was continued. Data analysis of species trials at Kundam and Jabalpur revealed maximum culm height 2.5 cm in *Bambusa vulgaris* (RAI-CL-1) at Kundam and 4.92 cm in *Bambusa balcooa* (BOT-CL-1) at Jabalpur. Recorded maximum number of culms (6.15) in *Dendrocalamus strictus* (BAL-CL-4) at Jabalpur and maximum number of culms (4) in *B. balcooa* (BOT-CL-1) and *Dendrocalamus strictus* (SL-CL-2) at Kundam. Maximum culm diameter 2.5 cm was recorded in *B.balcooa* (TCR-1) at Kundam and 4.80 cm in *B. nutans* (GEN-CL-1) at Jabalpur.

Bamboo plantation at KVK, Umaria


Bamboo species trial at Kundam in farmer's field


Plantation at Farmer's field at Naugaja, Chandia, Umariya

Genetic improvement and conservation of raktan (*Lophopetalum wightianum* Arn.) in North Bengal (ICFRE-IFP)

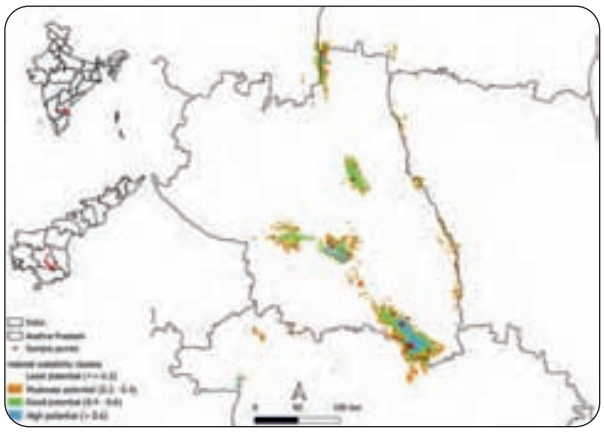
Nineteen populations were identified in North Bengal and regeneration studies were carried out, regeneration ranged from 43% to 61% in the populations. Seeds were collected from 10 populations and physical parameters were recorded (seed length (5.15 cm ± 0.38), seed width (1.74 cm ± 0.11) and 100-seed weight (14.87g ± 0.61)). The seedlings raised from 10 populations were planted in a field trial at Uday singh Jote, Darjeeling district using Randomized Block Design in 3 replications. Germination trial has been laid out using three different mediums: (i) Sand; (ii) Sand + Soil (1:1)& (iii) Sand+Soil+FYM (1:1:1). Data digitization for biodiversity analysis is under progress.



Field trial of Raktan at Udai singh Jote

Recovery programme for *Syzygium alternifolium* -an endangered species from Eastern Ghats (2017-2022) (ICFRE-IFB)

Field surveys were conducted to identify eight natural populations. The occurrence of *S. alternifolium* in the southern parts of Eastern Ghats can be attributed to a range of environmental factors, among which the annual mean temperature, annual precipitation, elevation, disturbance index and temperature seasonality contributed the most to the model building. Using these five predictor variables, potentially suitable habitat for *S. alternifolium* was identified The MaxEnt model has identified a couple of novel habitats in the periphery of the extant range where the species presence is not reported but the habitat conditions are potentially suitable for the species. The field gene bank established at Mulugu Research Station was enriched with 35 seedlings. For the genetic diversity study, 25 ISSR (Inter Simple Sequence Repeats) and one cross-species SSR primers were screened with 10 DNA samples of *S. alternifolium* and only two primers amplified monomorphic bands.



Potential habitat suitability map for *Syzygium alternifolium*

Enrichment planting in the Mulugu field gene bank of *Syzygium alternifolium*

Identification, Ecological assessments for selection and screening of superior and insect-pest resistant clones of *Salix* for their cultivation, production trends and conservation in the Cold Deserts of Himachal Pradesh and Jammu & Kashmir (ICFRE-HFRI)

Survival and growth data of the established germplasm banks at respective sites were recorded and survival of around 70% at Sushna and around 60% at FRS Tabo were documented, at Gue total mortality was observed. Analysis of growth data revealed that the performance of genotypes G1T2, G2T3, G2T13, PT1, PT2 and GU1T2 were significantly higher as compared to the check accession. Data related to various morphological characters of leaves such as leaf length, leaf breadth and petiole length of different populations were recorded to analyze the variability and distinctness in the populations. For, molecular characterization, seven SSR markers were selected. Further, *trnH–psbA* intergenic spacer region and *rbcL* were amplified in 12 and 4 genotypes respectively for authentication of *Salix* genotypes planted in the germplasm bank.

LADDER GLs GL2T4 GL1T4GL1T2 GL1T1 LT11 LT3 M6 M5 M4 M2 M1 TK5 TK4 TK2 TK1 LADDER

Germplasm Bank cum CSO of *Salix* plantation at Sushna, Spiti valley

Exploration, identification of genetic resources and strategies for sustainable management of *Paris polyphylla* in Arunachal Pradesh, Manipur, Mizoram and Nagaland in North East India (ICFRE-RFRI)

Extensive survey was carried out in different village/ community and Reserved forests, Wildlife Sanctuaries and National Parks in Arunachal Pradesh, Mizoram, Manipur and Nagaland to explore population distribution of *Paris polyphylla*. In Zote Community Forest, Champhai, Mizoram recorded maximum 880±100 individuals with regeneration potential of 520±60 and 440±70 flowering individuals per hectare and minimum 620±100 individuals in North Khawbung with regeneration potential 360±70 per hectare. In Mayudia Range, Lower Debang Valley, Arunachal Pradesh recorded a maximum 1060±110 individuals and minimum 500±110 individuals per hectare in Mehao Wildlife Sanctuary. In Tiwari village, Lower Debang valley, Arunachal Pradesh maximum regeneration of 520±70 per hectare was recorded.

Awareness programmes were conducted among the local communities and field staff of forest department of Manipur, Mizoram and Nagaland for conservation and sustainable management of *P. polyphylla* along with important indigenous plant species viz., *Travesia palmata, Oroxylum indicum, Litsaea cubeba, Amomum maximum, Embelia ribes,* etc. which are traditionally used by communities as vegetable and medicines and sold in local market.

Paris polyphylla

Discussion with communities for sustainable management of *P. polyphylla*

Conservation and evaluation of bamboo genetic resources of NE India (ICFRE-RFRI)

During 2022-23**,** four accessions of *Bambusa pallida* were collected and transplantation of offsets to newly established Germplasm Bank of 0.7 ha at ICFRE-RFRI, Jorhat was carried out. Fiber analysis of *B. nutans* (diameter-19.85µm); lumen diameter (3.71 µm); fibre length (2.6mm) and *Dendrocalamus hamiltonii* (diameter-18.04µm); lumen diameter (4.19µm); fibre length (2.8 mm) was also carried out. In *Bambusa balcooa,* alcohol-tolune solubility ranged from 2.50-4.62% while lignin and holocellulose content ranged from 15-21% and 50-60% respectively.

2.3.2. Tree Improvement

Study of structural dynamics and genetic improvement of *Grevillea robusta* A. Cunn (silver oak) (ICFRE-FRI)

The demographic stability of *Grevillea robusta* in northwestern Himalayas was established in this study and the frequency distribution of tree diameter class ranged from 0.24–0.44 m indicating that trees of young and adult age were more recurrent in the habitat. Genetic diversity estimates using genome-wide SSR markers revealed moderate genetic diversity (Ho=0.557 and He=0.388) and very low genetic differentiation (F_{ST}=0.075) among the sampled genotypes. The assessment of wood properties indicated that the species yielded fiber of Class II quality and the wood can also be used in veneer, and pulp and paper industries.

Genetic evaluation and characterization of *Toona ciliata* for productivity enhancement (ICFRE-FRI)

Two progeny trials of 45 selected plus trees were established at Baldiyakhan, Nainital and Haldwani. Variations in phenology, floral morphology, fruit, seed and leaf morphology were documented and digitized for all populations in Uttarakhand and Himachal Pradesh. Genetic diversity in 10 populations was assessed using ten SSRs mined from low depth genome sequence. Overall, a low level of genetic diversity (mean He=0.315, range=0.251–0.366) and high genetic differentiation (FST=0.338) were recorded for the analyzed populations. Pest and disease incidences in the populations of Uttarakhand were documented and shoot/ seed borer *Hypsipyla grandella*, *Psylla cedral*, Jassid, leaf minor, Lymantriidae – larvae have been recorded. DNA isolated from infected leaf samples were amplified with fungal universal primers ITS5 and ITS4 and two fungal pathogens, namely *Alternaria alternata* and *Colletotrichum gloeosporioides* were identified.

Screening of parents for clonal forestry and hybridization for higher productivity in *Eucalyptus*- (RSC-DCPPAI, Ministry of Industries, Govt. of India) (ICFRE-FRI)

Under the project, selection of fifteen most promising genotypes from established provenance and progeny trials using index method of selection method was completed, which were coppiced for clonal propagation and wood analysis. Accordingly, macro propagation was completed and multi-locational clonal trials across three locations were established with 13 clones and a seed source, as check, in the states of Uttar Pradesh (02) and Haryana (01). Though *Eucalyptus* has been considered to be a good coppicer, significantly as many as five genotypes were recorded to have no coppicing ability.

The evaluation of mid-term growth data revealed that three clones with some additional testing of wood parameters can be promoted for commercial release.

The kraft and pulping parameters for 15 mother trees were worked upon where 44.21 % pulp yield was recorded which varied from 40.50 to 49.66 %. Interestingly, kappa number varied from 13.50 (FCS2) to 22.15 (FCS30) with an average value of 18.73with standard deviation of 3.96. The brightness (ISO) was also found to vary significantly from 17.00 (FCS 3) to 26.10 (FCS11) with average value of 21.11 % and similarly viscosity (cm^3g^{-1}) varied significantly from 567 (FRI-35) to 782 (FCS1) with an average viscosity of 648 with standard deviation of 67.06.

Variation in coppicing ability of Eucalyptus clones

Screening and evaluation of *Mitragyna parvifolia* (Roxb.) Korth an indigenous timber species for genetic potential (ICFRE-IFGTB)

Through extensive surveys in the southern, western and northern agro-climatic zones of Tamil Nādu, 70 CPTs have been identified. Wood core samples were collected for wood analysis and wood parameter analysis is being carried out. Leaf samples have been collected for DNA extraction and transcriptomic sequencing has been done. A total of 63670 transcripts have been assembled and 41546 SSRs identified. Seeds were also collected from the selected CPTs for raising progeny trials. A half sib progeny trial has been established at Thuvarankurichi field Research Station of IFGTB.

Association mapping of quantitative disease resistance and identification of candidate wilt resistant genes in *Dalbergia sissoo* Roxb. (ICFRE-FRI)

Extensive survey in the states of Uttar Pradesh, Madhya Pradesh, Haryana, Punjab, Rajasthan, Himachal Pradesh and Uttarakhand was conducted and 150 new genotypes were added into existing germplasm of *D. sissoo*. Genomic DNA has been isolated from 73 individual genotypes for molecular characterization. A total of 64 genome-wide SSRs were validated and 13 were found polymorphic for subsequent genotyping. Six *Fusarium* isolates, namely A2, H5, A5, A3, H7 and A6, were identified as pathogenic and maintained in laboratory. A method of artificial inoculation in root and stem tissues was standardized. Concurrently, 70 selected genotypes were mass multiplied for screening for resistance against *Fusarium* isolates.

Maintenance of clonally propagated germplasm for *in vitro* screening against *Fusarium* isolates

Genetic improvements of *Azadirachta indica* to develop dwarf genotypes and neem products with enriched active constituents - (IFFCO funded) (ICFRE-FRI)

The field trials and gene banks established under Phase I and II across the locations were evaluated for field performance of different genotypes, and one acre of seed multiplication area (SMA) of two released varieties was established at Phulpur (Uttar Pradesh). A total of 29 selections have been carried out towards developing dwarf varieties with high seed and oil contents. Out of 6685 mined primers from whole genome sequencing data, a total of 150 primer pairs, including tri and tetra-nucleotides, were tested for PCR amplification and 35 were polymorphic. A new DNA isolation protocol was standardized, and isolated DNA was subjected to qualitative and quantitative analysis purity varied from 600 to 800µg/ml

A total of 35 seed samples from different seed sources were analyzed for Aza-A, Aza-B and Nimbin contents using HPLC, which revealed significant variation. The oil yield value varied from 18 to 28.8 %, and azdirachtin and nimbin content ranged from 300 to 2811 ppm and 903 to 3622 ppm, respectively. The optimization of conditions for extraction of bioactive compounds enriched fractions using as many as seven solvent systems was carried out. The azadirachtin contents in enriched fractions varied significantly from 1700 to 24007 ppm.

A training to IFFCO staff was also imparted on *A. indica* clonal propagation and general upkeep of Tissue Culture Laboratory for in-vitro multiplication of Neem.

Evaluation of multi-location clonal trials of *Thespesia populnea* (ICFRE-IFGTB)

Six-monthly biometric and qualitative data were collected from the three clonal trials established at Panampully, Gudalur and Thalavaipettai. During the second year at Panampully, tree height was found to be non-significant. However, collar diameter and biomass index were found to be significant at 5%. Total height varied from 101.6 (clone 2) to 143.4 cm (clone 5). Collar Diameter varied from 2.05 cm (clone 29) to 20.97 (clone 8). Biomass index ranged from 533.5 cm^3 (clone 12) to 1308 cm^3 (clone 11).The second-year data recorded from Gudalur indicated that, total height, collar diameter and biomass index were significant at 5% level. Total height varied from 75.93 cm (clone 6) to 149.2 cm (clone 30). Collar diameter ranged between 1.92 cm (clone 13) and 3.45 cm (clone 30). Biomass index varied from 333.7 cm^3 (clone 6) and 1879 cm^3 (clone 30).Total height, collar diameter and biomass index were found to be non-significant at Thalavaipettai.

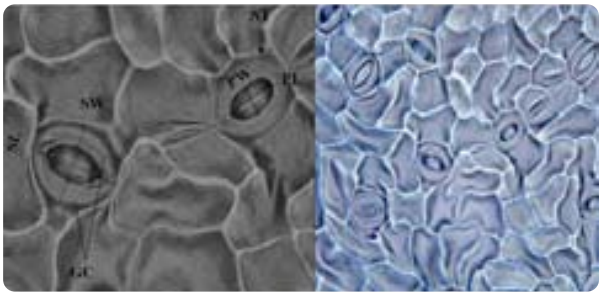
Clonal evaluation and establishing seed orchards for increasing productivity in *Ailanthus excelsa* (ICFRE-IFGTB)

Periodical biometrical data were collected from two field trials. The 50% of inferior trees were culled out and intensive silvicultural inputs provided to the trials to promote them as SSOs. Gap planting was carried out at Gudalur and Thuvarankurichi Field Research Stations. Paclobutrazol was applied for inducing flowering and fruiting in Kurumbapatti Field Station at Salem. Sporadic flowering was observed.

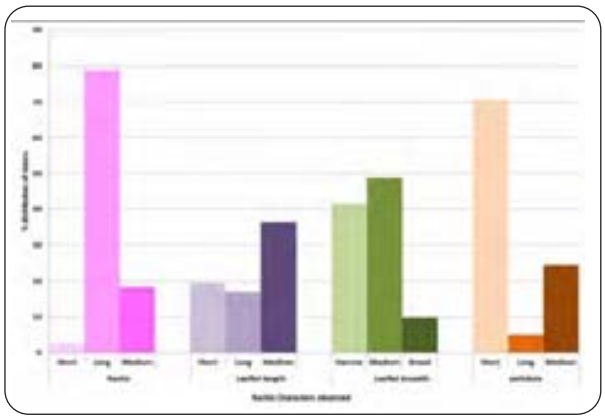
DUS Centre at ICFRE-IFGTB, Coimbatore

Melia dubia

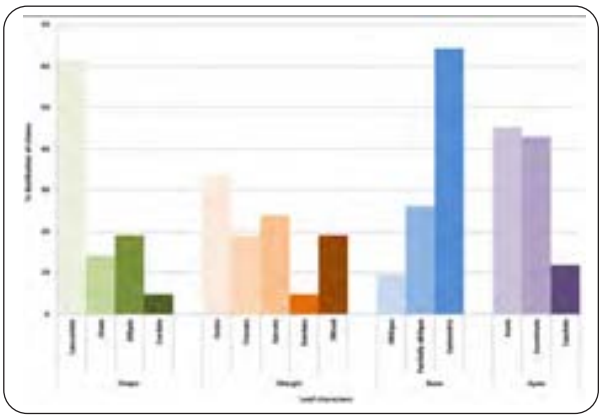
Characterization of *Melia dubia* clones was carried out for 10 reference clones planted at Panampalli, Kerala. Visual assessment and measurement of a group of plants or parts of plants for stem scar shape, bark colour, leaf waxiness, stem lenticels appearance, stem lenticels pattern, stem lenticels shape, bark peeling, bark peeled surface, rachis attitude, rachis number of leaflets, leaflet shape, margin, base, apex, anthocyanin presence, branch altitude were carried out using Image J software version1.53t. Stomatography of all the clones revealed scant stomata on the adaxial surfaces which could be a distinguishing character of the species.



Characteristics and morphometry of *M.dubia* stomata. SL and SW indicates stomatal length and stomatal width. PW and PL stands for pore width and pore length. GC represents guard cells and ST denotes stomata



Distribution of clones based on leaf characters



Distribution of clones based on rachis characters

Eucalyptus and *Casuarina*

Characterization of *Eucalyptus camaldulensis* clones was carried out for 20 reference clones present in Karunya Nagar, Coimbatore. As per the notified guidelines, 33 morphological characters were recorded. The qualitative assessment through visual observation was carried out for juvenile leaf shape, juvenile leaf anthocyanin coloration, mature bark peeling type, and trunk waxiness. The quantitative characters such as measurable traits like mature leaf area, length, breadth, fruit width, peduncle length, and pedicel length were assessed using Image analyser (Leica Qwin V_3) in laboratory. The inflorescence characters were recorded for 36 reference clones. In order to assemble the reference varieties in a separate garden, multiplication of the existing germplasm was carried out. In the DUS Centre at Coimbatore, 93 varieties are maintained as reference varieties in the form of vegetatively propagated clones and each clone is represented by 6-12 trees. All DUS characters are recorded from the assembled varieties twice a year during the flowering season. The paper industries were sensitized about the DUS testing procedure and also facilitated filling up of the applications for registration.

Eucalyptus clone 192 assessed for DUS characters for registration with PPV&FRA

Ailanthus excelsa Roxb.

Developed DUS testing guidelines for *Ailanthus excelsa* with essential characteristics of identification. The draft DUS test guidelines have been submitted to PPV&FRA, Ministry of Agriculture, Govt. of India for approval and notification. Second task force meeting organized to finalize DUS testing guidelines in co-ordination with PPV&FRA.

Fruit shape (Lanceolate straight) of *Ailanthus excelsa*

Fruit shape (Lanceolate twisted) of *Ailanthus excelsa*

Selection and Evaluation of *Haldina cordifolia* (Roxb.) Ridsdale for Higher Wood Productivity (ICFRE-IFGTB and ICFRE-TFRI)

Extensive field surveys were conducted in Kasaragod and Kannur districts of Kerala and 37 Candidate Plus Trees were identified. Wood property studies were conducted in selected 30 trees. Fiber length varied from 629.81 to 1212.81 µm with a mean of 933.01 µm and standard deviation of 123.62 µm. HC 28 ranked first with reference to fiber diameter (32.99 µm) and HC 11 recorded the minimum value (18.39 µm). Lumen diameter ranged between 11.24 µm (HC 03) and 25.04 µm (HC 28). Plus Trees HC 21, HC 23, HC 25 and HC 24 recorded superior values (4.89 µm) for fiber wall thickness. Wood specific gravity varied from 0.62 to 0.71.

A total 14 CPTs of *Haldina cordifolia* were selected from Katghora and Bilaspur Forest divisions of Chhattisgarh; Allapalli and Gondia forest divisions of Maharashtra; Balaghat forest division of Madhya Pradesh. Raised seedlings of all the selected CPTs and maintained in the nursery for further establishment of plantations.

A Plus Tree of *Haldina cordifolia* at Kozhikode

A Plus Tree of *Haldina cordifolia* at Palakkad

Seedlings of *Haldina cordifolia*

Evaluation of *Gmelina* genetic resources for enhancement of productivity and wood quality in Kerala (ICFRE-IFGTB)

Fifty five CPTs were selected through surveys in natural forest and plantations of *Gmelina arborea* in Tamil Nadu and Kerala based on growth superiority, clear bole, and pest and disease resistance. Variation in bio-metric, phenology and reproductive characters among the CPTs has been recorded. The total height of selected CPTs varied from 13 m to 35 m, DBH ranged from 122 cm to 324 cm, clear bole height differed from 4 m to 21 m and crown width varied from 4.5 m to 16 m. Wide variation recorded on 100 seed weight (39.62-123.14g), seed moisture (8.35% - 17.636%) seed area (0.8 to 1.8cm), seed length (1.43-1.97cm), seed breadth(1.23-1.27), germination percentage (12.5-92.50) and seedling vigor (2.54-42.53). Established a progeny trialat Sholayur, Attapadi Kerala with 30 families assembled from different parts of Tamil Nadu. Production of quality planting stock of shortlisted *Gmelina* clones is under progress.

Development of Seed Production Areas of important tree species of western Rajasthan (ICFRE-AFRI)

Exhaustive surveys were carried out in Jodhpur, Jalore, Pali, Sirohi, Nagaur, Jaisalmer, Barmer, Bikaner and Churu districts of Rajasthan for the identification of natural stands of *Prosopis cineraria, Tecomella undulata, Zizyphus mauritiana, Zizyphus nummularia, Salvadora persica* and *Salvadora oleoides.* Identified the natural stands of *T. undulata* (Paboosar, Nagaur, IGNP Bikaner and Mohangarh, Jaisalmer), *Salvadora persica* (Tal Chappar Churu), *Salvadora oleoides* (Leelki Beed, Churu and (Lakhetli) Bayatu, Barmer), *Prosopis cineraria* (Mohangarh, Jaisalmer and IGNP Bikaner), *Z.nummularia* (Sindhari, Barmer, Degraimataoran, Dabla Jaisalmer and Jorbed, Bikaner). Quadrants of 50x50 cm were laid down at each of the identified sites and recorded the morphological data for each of the trees.

Identified population of **(A)** *Tecomella undulata* at Paboosar; **(B)** Identified population of *Salvadora persica* at Tal Chappar, Churu; **(C)** Laying down of quadrant at Dandli, Sindari for *Zizyphus nummularia*; **(D)** Identified population of *Zizyphus nummularia* at Degrai Mata oran, Jaisalmer

Improvement of Teak for Higher Productivity in Central/Peninsular India (ICFRE-TFRI)

Sub project I: Selection of plus trees, raising their progeny trials and establishing germplasm bank

The candidate plus trees (CPTs) 191 numbers were selected following comparison tree method based on phenotypic traits and with more than 10% selection differential. In Madhya Pradesh, 118 CPTs from 16 forest divisions, in Chhattisgarh, 43 CPTs from Bilaspur and Raipur research circles, in Maharashtra, 17 CPTs from 8 divisions and in Odisha 13 CPTs from two forest divisions were selected. Most of the selections were made from the forest areas marked for seed production.

A progeny trial was established in 2019 within the TFRI campus representing 29 open pollinated half sib families from Madhya Pradesh, Chhattisgarh, Maharashtra and Odisha. At three years age, families from Madhya Pradesh viz. MPSSNR-2, MPSSNK-4, MPSBG-1, families of Chhattisgarh viz. CGBSPCB-3, CGBSPCB-6, CGBSPCB-12, CGBSPCB-4, families of Maharashtra viz. MHJMLG-1, MHALP-2, and families of Odisha viz. ORAGL-11 were found to have superior growth compared to other families. This early evaluation expresses high reproducibility of growth traits for further breeding of these families.

A germplasm bank with 31 accessions representing the four States was established in 2020 within the institute campus. Growth performance of five accessions of Madhya Pradesh, four each of Chhattisgarh and Odisha and three of Chhattisgarh were found superior over others after two years. Improved productivity of plantations will be secured by these new genetic resources for the future afforestation activities in central India.

Sub Project II. Development of management practices of Teak Seed Production Areas, Seedling Seed Orchards and Clonal Seed Orchards.

Surveyed Seed Production Areas (SPA), Clonal Seed Orchards (CSOs) and Seedling Seed Orchards (SSO) in Madhya Pradesh, Chhattisgarh and Maharashtra were assessed and height, GBH, crown diameter, spacing, flowering, fruiting, fertilizer application and other management practices were recorded. Some of the SPAs showed low seed productivity due to their age and closed canopy while many others were found producing good quantity of seeds. A synchronized flowering among clones in CSO and among families in SSO caused low to moderate seed production. Analysis of soil samples collected from surveyed fields revealed low level of Nitrogen, Phosphorus and Potash i.e. 70%, 25% and 54% respectively. Effect of NPK fertilizers was assessed on flowering and fruiting and found that treatment of urea with DAP/MoP enhanced inflorescence and fruit production.

Introduction and evaluation of *Melia dubia* in Central India (ICFRE-TFRI)

Evaluation trials of 18 months old *Melia dubia* (50 improved varieties/genotypes) were assessed for growth (height and collar diameter).Variety No. 2080, 2087, 2068, 2048, 2030 and 267 were found performing better in terms of height and collar diameter in Morena (Madhya Pradesh).Variety No. 2068, 2061, 2023, 2079 and 2093 performing better in terms of height and collar diameter in Nagpur, Maharashtra.

Genetic evaluation of *Schleichera oleosa* CPTs for oil and oil yielding traits (ICFRE-IFP)

Survey was conducted in different districts of Jharkhand and West Bengal and 49 CPTs of Kusum were selected. Fruits were collected from 15 CPTs and seed data were recorded. The statistical analysis of physio-parameters of seed data of selected CPTs is under progress. Oil extraction from all seed samples of CPTs documented an average of 32-35% oil content.

Variability for growth, wood traits and natural regeneration status of *Hardwickia binata*, a multipurpose tree species in Madhya Pradesh (ICFRE-TFRI)

A natural population of *Hardwickia binata* was selected from compartment number 161 and 162 of Narsinghpur range under Narsinghpur forests division of Madhya Pradesh for collection of seed, wood samples and regeneration study. No seed setting was observed and poor regeneration was recorded. Seeds/samara variation was recorded from compartment number 35 of Zirpa range under West forest division, Chhindwara. In total, 14 suitable populations of *H. binata* have been selected from Khandwa, Burhanpur, Barwah and West Chhindwara forest divisions of Madhya Pradesh for collection of seeds, wood samples and regeneration study.

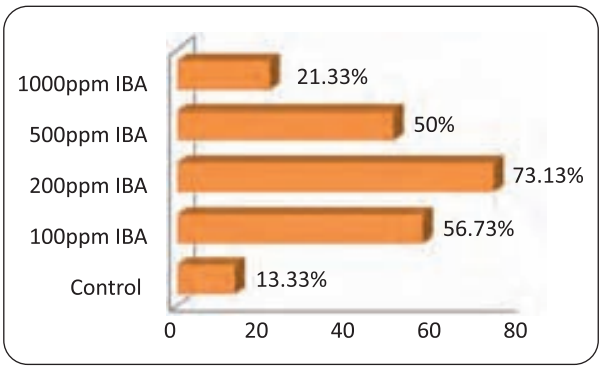
Evaluating the impact of tree improvement activities on seed quality of *Tectona grandis* in Madhya Pradesh and Chhattisgarh (ICFRE-TFRI)

Collected seeds from improved and unimproved sites and among the improved sites in Madhya Pradesh, seeds from SPA, Bahrai were superior in terms of length, diameter and seed weight. Emptiness was the lowest and the viability was the highest (72%) in seeds from SPA Bahrai. Among improved sites in Chhattisgarh, seeds from SPA, Pali were superior in morphological parameters like fruit length, diameter and fruit weight. Emptiness was the lowest and viability was the highest (85%) in seeds from SPA Pali. Seed germination was highest in seeds of SPA Pali (CG) and minimum was in seeds from SPA Tikaria (M.P.). Among unimproved sites, most of the parameters were superior in seeds from Bahrai area of M.P. and Pali area of Chhattisgarh. Seedling growth was initially high in seedlings from improved site of SPA Moyeanalaat M.P. and seedlings from SPA Amaruaat Chhattisgarh.

Growth performance of teak seedlings from different sites

Selection of pest and disease free CPTs of *Gmelina arborea* and production of clonal planting material (ICFRE-TFRI)

Surveys were carried out in different agro-climatic zones of Madhya Pradesh and selected 60 Candidate Plus Trees (CPTs) of *Gmelina arborea* from different locations including Betul (Sonaghati), Chhindwada, Sidhi (Dodaki), Singaruli (Badhura), Chourai, Shahpura, Katni (Saraswahi), Damoh (Nohta, Sanga) and Jabalpur (Barha, Deori, Moiyanala). The selection criteria included clear bole height, GBH, total height, crown diameter; crown length, number of primary branches and healthy trees free from pest and diseases. Flowering and fruiting status of selected trees was also recorded. Semi-hardwood branch cuttings were treated for 12 hours with control, 100 ppm, 500 ppm, 1000 ppm, 2000 ppm and 5000 ppm IBA and then planted in nursery. On treatment of 2000 ppm IBA solution, 60-70% rooting was achieved. Quick dip treatment in talcum powder paste (10gm) with different concentrations of IBA exhibited maximum rooting (73.13 %) with maximum root number (6.22) and root length (6.21 cm) in the cuttings treated with 2000 ppm IBA. Soft-wood cuttings after treatment with 500 ppm and 1000 ppm IBA planted in root trainers in vermiculite produced 50 % rooting in 1000 ppm IBA. Scions collected from selected trees were used for cleft grafting on rootstocks. One clonal seed orchard/clonal trial has been established at ICFRE-TFRI, Jabalpur with 34 clones.



Rooting percentage in semi hard wood cuttings of *Gmelina arborea*

Quality planting material, **(A)** plant after six months and **(B)** plantation site after six months of plantation

Development of productive clones and economic evaluation of Poplar based agroforestry for North Bihar (ICFRE-IFP)

The project is a follow up of works carried out under a previous project and aims to develop and release productive clones of Poplar for planting under agroforestry in Bihar. Seeing the narrow genetic base of the species, it was also targeted to study the genetic diversity present in breeding material and released clones by utilizing microsatellite markers. Under the project it was targeted to develop different agroforestry models and estimate their economics.

Leaf samples were collected and the genomic DNA was isolated from 85 different accessions. 210 SSR Primers were designed and synthesized for the study and based on production of polymorphic and scorable bands, 30 SSR primers were shortlisted. The amplification of genomic DNA has been completed with 23 SSR primers.

Two clonal trials were established in February, 2023 in Jhakhra village, Piprakothi, East Champaran, 35 poplar accessions were planted in 4 replications and three plants per clone per replication in border plantation and in Barnihar, Narkatiyaganj, West Champaran, 36 poplar accessions were planted in RBD fashion in block with four replications and three plants per clone per replication.

Poplar based agroforestry models viz. Poplar-Litchi, Poplar-Wheat, Poplar-Sugarcane and Poplar-Maize-Jute were established in Muzaffarpur, Narkatiyaganj and Araria for estimating the economics of the model.

The nursery has been raised through stem cuttings of released clones and other accessions for establishing field trial in next planting season and to provide plants to the stakeholders.

Five productive clones of Poplar and its hybrids were released by VRC for planting in Middle Gangetic Plain region of Bihar and non-exclusive Licenses were given to seven farmers and nursery growers for mass multiplication of the released clones and supplying to farmers of Bihar.

Poplar field trial at farmers field

Poplar –Sugarcane Agroforestry model

License Agreement with farmers

Varietal development of *Flemingia semialata* and *Flemingia macrophylla* used for lac cultivation from identified genotypes through progeny evaluation and mass selection (ICFRE-IFP)

The project is a followed up work of a previous project with the aim to develop productive varieties of *Flemingia semialata* and *F. macrophylla* for lac cultivation in Jharkhand. It also targets developing suitable agroforestry models to make *Flemingia* cultivation more profitable for the farmers.

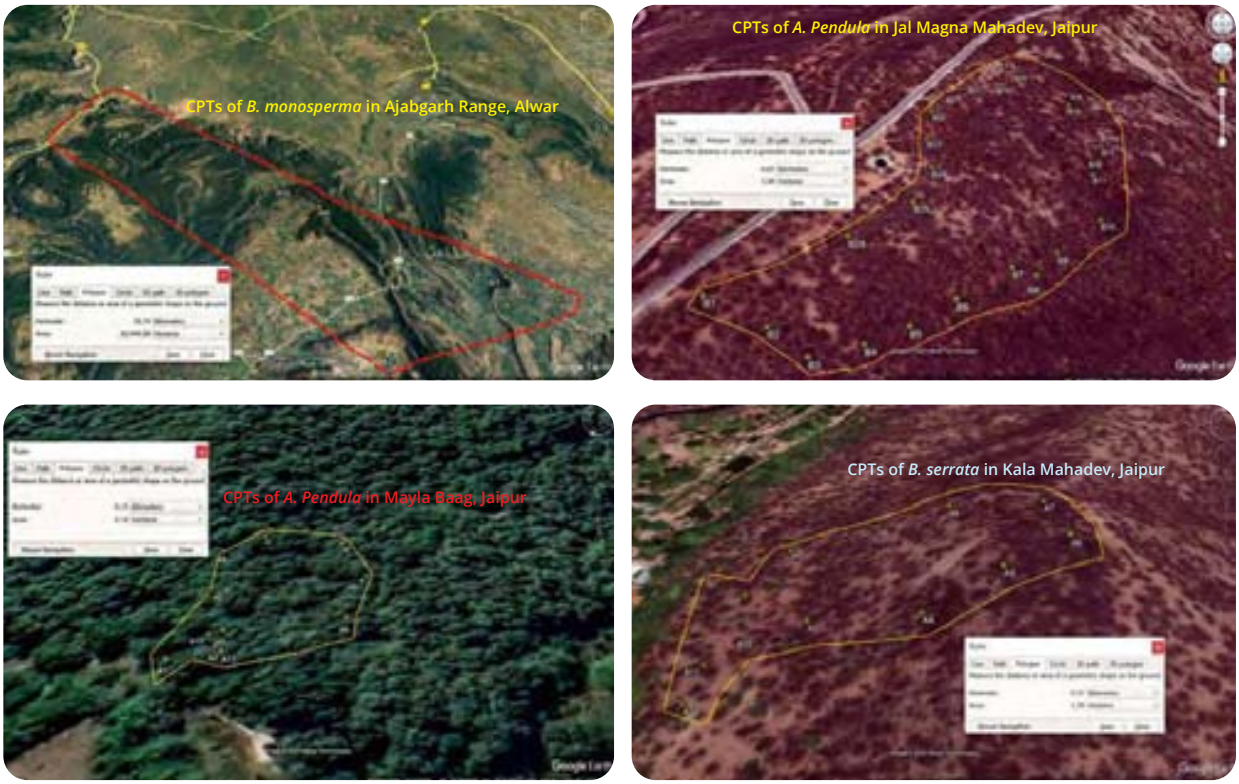
Flemingia marigold agroforestry model

Flemingia Onion Cabbage agroforestry Model

Collected seeds from the 11selected plants of *F. macrophylla* accession no. FMC-5 and 10 selected plants of *F. semialata* accession no. FSC-1. The collected seeds of both the species were processed and sown for germination. A total of 1541 plants of 10 plant families of FSC-1 and 1188 plants of 11 families of FMC-5 were raised for the establishment of progeny trials. Five progeny trials of FMC-5 and FSC-1 were established in Khunti (Roro village) and Ranchi district (New Bhusur and Lalgutwa). Based on plant architecture and growth performance, 25 individual plants of *F. semialata* were selected and seeds were collected individually. The Flemingia based agroforestry models viz. Flemingia-Marigold, Flemingia-Cabbage, Flemingia-Cauliflower, Flemingia-Chili, Flemingia-Tomato, Flemingia-Maize, Flemingia-Faba-bean have been established at Roro, Khunti.

Survey and selection of Candidate Plus Trees and identification of Seed Production Areas and Broad Leaved Species in Rajasthan (ICFRE-AFRI)

Identified and marked 13 CPTs of *Boswellia serrata,* 17 CPTs of *Butea monosperma* and 42 CPTs of *Anogeissus pendula* in Jaipur district of Rajasthan. Recorded passport data of each CPT. GPS Mapping of all CPTs was carried out.



GPS locations of the marked CPTs

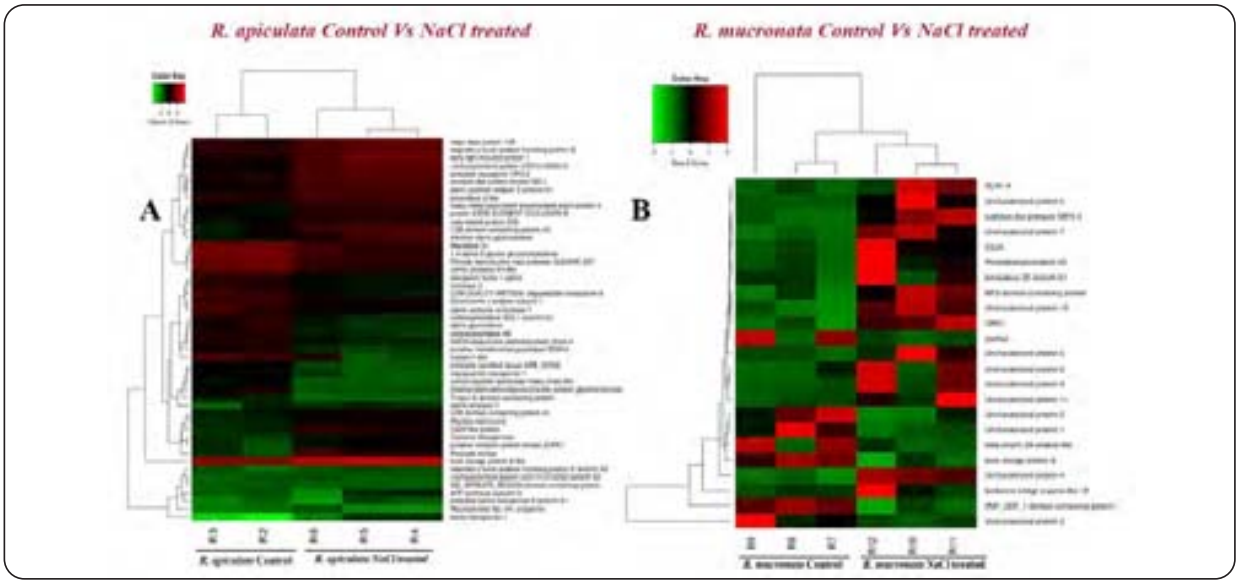
2.3.3. Biotechnology

Micropropagation of *Buxus wallichiana*- A multipurpose Himalayan tree (ICFRE-FRI)

Experiments were conducted to optimize shoot multiplication, elongation, and *in vitro* rooting in *Buxus wallichiana.* MS medium containing 1 mg L^{-1} BAP along with 0.5 mg L^{-1} NAA was found best in terms of minimum mean number of days required to achieve bud break and best bud break response of 85.71 per cent. Best treatment with respect to rate of shoot elongation was found to be MS medium containing 0.25mgL^{-1} BAP+0.2 mgL^{-1} NAA with 58.38 as rate of elongation. However, *in vitro* rooting could not be achieved. Poor shoot elongation and failure in root development were the major limitations observed in this species.

Transcriptome analysis of salt excluding roots of *Rhizophora mucronata* (ICFRE-IFGTB)

Comparative analysis of shoot/ root ratio in propagules subjected to 250 mM NaCl for 24h revealed higher (0.97) ratio for *R. apiculata* when compared to *R. mucronata* (0.83), indicating restricted Na^+ uptake by *R. mucronata*. RNA-sequencing and *de novo* assembly of salt-treated roots of *R. apiculata* and *R. mucronata* recorded 9216 differentially expressed genes (DEGs) with 3253 and 23 (DEGs) in *R. apiculata and R. mucronata* respectively. The gene enrichment analysis showed key functions and pathways modulated during salt stress in these mangrove species. This study provides insights into the salt stress response in *Rhizophora* species by generating a salt-induced root transcriptome resource. In addition, potential candidate genes conferring salt tolerance were identified for further characterization through ectopic expression in model plants.



Heat maps of salt-stress responsive genes differentially expressed in the roots of the salt-tolerant mangrove species of *R. mucronata* and the relatively salt-susceptible *R. apiculata*

Development of a genome editing platform for functional characterization of genes (ICFRE-IFGTB)

EcHKT1;1 gene-edited composite- transgenic plantlets were generated and hardened for evaluating enhanced salt tolerance. The gene-edited roots showed 2.73 times down-regulation of the gene when compared to the wild A4RS roots. The study established that composite plant strategy can be used for rapid evaluation of gene edits in *Eucalyptus*.

Evaluation of transgene-free genome engineering methods in *Eucalyptus* (ICFRE-IFGTB)

Agrobacterium tumefaciens mediated transformation experiments were carried out using AGL1 strain harboring the *EcHKT1;1*sgRNA gene editing construct. Forty-four plants were generated and multiplied for molecular characterization. Cell suspension cultures were generated for development of a regeneration system suitable for Cas9-gRNA RNP-mediated gene edits.

Evaluating genes of *Artemia* in *Eucalyptus* roots for enhancing salt tolerance (ICFRE-IFGTB)

Artemia is a crustacean animal found in hypersaline environments. The study was taken up to evaluate if *Artemia NaKA* and *ClC* genes directed by a root-preferential and salt-inducible promoter, MsPRP2 would improve salinity tolerance in *Eucalyptus* when heterologously expressed in GFP-tagged roots generated on non-transgenic seedlings. In this endeavour, a total of 76 composite transgenics were generated and 13.93 fold higher expression of *NaKA* was documented in the roots.

Composite transgenics of *Eucalyptus* expressing the synthetic sodium-potassium pump, NaKA, and Chloride channel, ClC, from the crustacean animal, *Artemia*

Assessment of genetic variability and development of gender specific DNA marker studies in *Canarium strictum* Roxb.- an economically important NTFP species (ICFRE-IFGTB)

Ten male and female Candidate Plus trees (CPTs) of *Canarium strictum* (Karukungilium) at Manampolli RF range, Valparai (Western Ghats) were selected for gender specific DNA marker development. Bark structure clearly discriminated male and female trees in the field, with the male trees exhibiting a higher peeling rate in the bark than the female tree.

Bark structure of male tree of *Canarium strictum*

Bark structure of female tree of *Canarium strictum*

Develop a working protocol for the micropropagation of mahogany (*Sweitenia macrophylla*) (ICFRE-IFGTB)

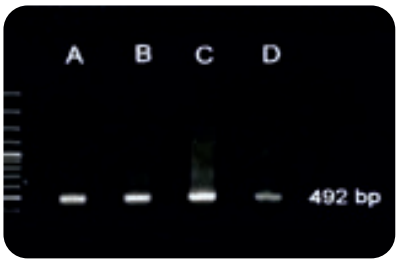
Swietenia macrophylla (Mahogany) is a high demand wood in the timber industry. In a project funded by Shivashakti Agritech Limited, Hyderabad, *in vitro* propagation of selected genotype has been initiated and challenges related to contamination of cultures and shoot growth have been circumvented and rooting has been initiated under culture conditions.

Identification of genetically superior germplasm of priority bamboo species of Mizoram (ICFRE-RFRI)

Survey was conducted in the Saiha, Lawngtlai and Lunglei district of Mizoram and 75 CPCs of the selected bamboo species viz. *Melocanna baccifera* (16), *Bambusa tulda* (15), *Dendrocalamus hamiltonii* (15), *Dendrocalamus longispathus* (19) and *Schizostachyum dullooa* (10) has been collected from the natural stand and planted in the Gene Bank at ICFRE-BRC. Weeding and maintenance of the CPCs in the gene bank were carried out. Vegetative and seed propagation of selected bamboo species were also carried out.

Cloning and characterization of salt tolerance conferring vacuolar Na^+/H^+ antiporter (*nhx*1) genes from *Prosopis juliflora* (Sw.) Dc. & *Salvadora persica* L. (ICFRE-AFRI)

RNA extraction from leaves of *Prosopis juliflora* and *Salvadora persica* have been achieved. Quantification of extracted RNA have been done, the yield of RNA ranged between 2 to 4 µg per 100 mg of fresh sample and the absorption ratio (A260/280) was 1.98 (close to ratio for pure RNA). cDNA have been prepared from RNA and stored for future objective. Actin primer were used as positive control and found to amplify the fragment of actin gene from *P. juliflora* and generated a band of 201 bp. Five specific gene primer optimization have been done using Primer Blast. The designed primers were found specific for NHX1 gene of *Prosopis juliflora*. These primers have been tested on cDNA of *P. juliflora* performing PCR. Out of five, four primer were found to amplify the fragment of *nhx1* gene, after agarose gel electrophoresis generated expected size specific band.



Amplicon of *nhx1* gene expressed in *P. juliflora*

Genomic selection for superior heartwood formation in two commercial timber species: teak (*Tectona grandis*) and European oak (*Quercus robur*) – FASTWOOD (ICFRE-IFGTB)

Under the India-Denmark bilateral project, variability in morphological traits and wood chemistry of 150 genotypes of teak were documented. Significant variations for heartwood: sapwood ratio were found within populations of teak. Analysis of germplasm from Andhra Pradesh, Gujarat, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Tamil Nadu and Uttar Pradesh revealed that the heartwood content varied from 42 – 95% among the clones.

Shoot initiation in mahogany under *in vitro* conditions

2.3.4. Vegetative Propagation

Standardization of silvicultural practices for clones of *Calophyllum inophyllum* to increase productivity and popularization in farm lands (ICFRE-IFGTB)

Vegetative propagation of six high yielding clones of *Calophyllum inophyllum* was carried out and an experimental plot was established at Thalamalai to assess the effect of manure on performance of the clones. A potted VMG of released clones of *C. inophyllum* was established for controlled pollination studies. Time of flower opening, pollen collection, stigma receptivity duration were recorded to understand crossing compatibility between clones.

Potted VMG of *Calophyllum inophyllum*

Successful controlled pollination in *Calophyllum inophyllum* clones

2.4 FOREST MANAGEMENT

A. PLAN

- Completed 03
- Ongoing 06
- New -

B. EXTERNALLY AIDED

- Completed 11
- Ongoing 17
- New 04

2.4.1. Sustainable Forest Management (SFM)

Supervising and assessing the survival rate of transplanted trees carried out by Public Work Department, Rishikesh, Dehradun (ICFRE-FRI)

Public Work Department, Rishikesh-Dehradun is widening the existing road where there is need to transplant 644 more trees from their origin place. Tree transplanting work is going on under the supervision of ICFRE- FRI, Dehradun. All the tree transplantation sites, where trees have been transplanted by the hired agency was visited by ICFRE-FRI team to collect the site wise observations.

Out of 644 targeted trees, 282 trees have been translocated at five different sites:

Trees translocated at different sites in Rishikesh-Dehradun, UK

Location	GPS Coordinates	No. of trees trans planted
Maharana Pratap Road-1	30° 17′ 56″ N, 78° 4′ 7″ E	109
Maharana Pratap Road-2	30° 17′ 56″ N, 78° 4′ 7″ E	043
Harrawala	30° 15′ 17.0″ N, 78° 06′ 09.3″ E	053
Balawala	30° 15′ 17.0″ N, 78° 06′ 09.3″ E	072
Krishali chaouk	30° 22′ 01″ N, 78° 06′ 21.9″ E	005
	Total	**282**

Process of tree transplantation

Sprouting in transplanted trees at Thano Road, UK

Study of Trees Health Status under NDMC area New Delhi (ICFRE-FRI)

To assess the tree health status of the New Delhi Municipal Council fifteen sites viz. Connaught Place (Outer circle), Bangla Sahib Road, Krishna Marg, Talkatora Road, Firozshah Road, Akbar Road, Sansad Road, Janpath Road, Coppernicus Road, Tilak Road, Maulana Azad Road, Oval Park, Jai Singh Road, Mann Singh Road and Sikandar Lodhi Road and Tomb were extensively surveyed. It was recommended to remove decayed trees and plant wind-sheltered or conical shape trees. Species like *Tamarindus indica* can be planted in the urban areas because of its wind infiltration properties, as it has a lower leaf area index. The best time to prune trees is in late winter when the trees are in their dormant stage. Construction around the tree perimeter should be avoided. Preferably mulch the trees with organic material (wood shavings) not greater than four inches with regular irrigation and fertilization. Filling of tree cavities should be discouraged as filling doesn't support the mechanical strength of the tree.

Restricted root space and progressive decay. Such trees are at risk of failure (Residential colony Ramakrishna Marg)

Cavity filled by cement (Talkatora Garden)

Monitoring and Evaluation of plantations raised by NDMC Delhi (ICFRE-FRI)

Conducted monitoring and evaluation of plantations raised by New Delhi Municipal Corporation (NDMC) New Delhi during the year 2016-17, 2017-18 and 2018-19. The zone-wise overall survival per cent of the plantations was determined and the results are as follows:

Survival percent of plantations in New Delhi

S.No.	Name of Zone	2016-17	2017-18	2018-19
1.	Keshavapuram	83.42	81.03	79.88
2.	Narela	69.82	70.43	77.99
3.	Rohini	80.11	74.61	77.38
4.	City S.P.	63.18	73.31	74.21
5.	Civil Line	70.41	72.83	71.17
6.	Karolbagh	79.04	75.32	78.65

Monitoring and Evaluation of plantations raised under the CAMPA Scheme by Chandigarh Forest Department (ICFRE-FRI)

The monitoring and evaluation of plantations raised during the period 2014-15, 2015-16, and 2016-17 under CAMPA schemes and its components viz. CA (Compensatory Afforestation) and NPV (Net Present Value) was carried out in Chandigarh Forest Division. A total of twenty-five plantation sites were monitored by adopting a random sampling method with a total plantation area of 78.48 ha approx. and overall survival of plants was observed to be 88.17%.

Monitoring and Evaluation of plantations of CAMPA Delhi Forest Department (ICFRE-FRI)

For the plantations raised by Delhi Forest Department a total 176.07 ha plantation area was monitored and overall plant survival was 90.24%. The project activities will result in positive environmental impacts and in enhancing biological richness.

Monitoring and Evaluation of plantations raised by the Punjab Forest Department (ICFRE-FRI)

Data was collected on the survival and growth of plantations raised during the years 2019-20, 2020-21 and 2021-22 under the scheme of CAMPA & Compensatory Afforestation. A total of 3664 ha area was covered for monitoring of plantations in Ropar, Garhshankar and Gurdaspur forest divisions. The average survival percentage of the above three division was ranged from 65-68%.

Monitoring and evaluation of the plantation carried out by Delhi Development Authority (DDA), New Delhi

Delhi Development Authority planted a total of 5.76 lakh plants in the year 2020-21 in 11 Horticulture Divisions and Biodiversity Parks in Delhi. Monitoring and evaluation of the plantations raised by Delhi Development Authority in the year 2020-21 is carried out by ICFRE- FRI, Dehradun. Data collection work has been completed and preparation of final report including survival percentage, site wise observation and suggestions for improvement etc. is being prepared. The average survival percentage of the plantation ranged from 60-65%.

Assessing the success and survival rate of transplanted trees carried out by Delhi Forest Department in Delhi (ICFRE-FRI)

In Delhi, a total of 12,852 trees were transplanted by the four empanelled agencies at 23 sites. Transplanted sites were located at Yamuna River front, DND Flyway on Western Bank of River Yamuna, Bharat Vandana Park and New Parliament Complex etc. Success and survival rate of transplanted trees was assessed and factors responsible for success and survival of transplanted trees such as girth of each transplanted tree, suitability of site, method of pruning, after care of trees included watering, weeding and soil working etc. were recorded. The average survival percentage of transplanted trees was ranging from 40 to 45 %.

Transplanted trees survival and growth

Transplanted trees found dead at site

Compendium on Indigenous knowledge and traditional practices of Forest Fire Management in India (ICFRE-FRI)

To collect the data on indigenous and technical knowledge for the management of forest fire in India, a total of 824 villages and 157 Forest Divisions of 27 States and two Union Territories (UTs) were covered. In several parts of country, there is a common traditional practice of appointing one or few people to act as forest watcher for the prevention and mitigation of forest fire. Indigenous tools used by local people to control forest fire were fire broom, fire rakes, fire beater, panja, sickle and dao. Some of the important Indigenous and traditional practices to control forest fire includes:

- Use of Pine needles for mulching and other purposes
- Beating out fire using green branches/bushes
- Use of soil and natural water bodies
- Preparation of temporary fire lines and trenches
- Use of Wet Jute Bags
- Traditional fire system and rules by Van Samiti or Village Samiti for grazing, fire prohibition, collection of NTFPs and fuel wood
- Prohibition of resin collection
- Practices of counter fire by the local people
- Plantation of fire resistant species i.e., kusum, banyan, jamun, neem, toon and other evergreen species
- Organize folk awareness programmes in the form of 'folk songs' and 'nukkad natak' regarding forest fire

Indigenous tool 'Kuttu'

Indigenous tool 'Fire Beater'

Beating fire with date palm leaf

Dousing fire with leaf blower leaf

Working Plan of Chandigarh (ICFRE-FRI)

For collection and enumeration of data in the study area of Chandigarh 374 samples plot were laid. Based on vegetation type different sizes of plots were laid for enumeration of data- for trees plots of 31.62mx31.62m, for litter, shrubs, climbers and tree regeneration 3mx3m, for shrubs and dead wood collections 5mx5m for density of herbs 1mx1m. Tree species found in the Chandigarh were: Khair, Eucalyptus, Mesquite, Arjun, Drek, Shisham, Subabool, Gulmohar, Kachnar, Amaltas, Amrood, False white teak, Karanj, Mulberry, Amla, Neem, Babool, Teak, Jamun, Kala siris, Baheda, Katha etc. The most abundant species of trees were Karanj, Mulburry, Mesquite, Eucalyptus, Drek, Katha; shrubs were Lantana, Jatropha, Athadoa, Pampas grass and herbs were Ageratum, Parthenium, Sorghum, Caesarweed, Antbush etc. Draft working plan report was prepared and submitted to Chandigarh Forest Department.

Working Plan of NCT-Delhi

Delhi forest Department assigned the task of preparation of Working Plan of Delhi as per National Working Plan Code-2014 to ICFRE-FRI, Dehradun. Data collection for Reserved Forest (RF) and Protected Forest (PF) has been completed. Whereas, data collection for Tree Outside Forest (TOF) are under progress. Preliminary Working Plan Report (PWPR) has been submitted to Delhi Forest Department earlier for their comments and approval. Drafting of Working Plan is under progress.

Data collection of Protected Forest in Delhi

2.4.2. Forest Economics

Assessment of demand of wood-based industries and availability of timber in Assam under State CAMPA as per APO 2021-22 (ICFRE-RFRI)

Conducted household level survey to record the harvesting pattern of timber in rural areas and vegetation survey at different cover density classes to assess the stock and harvestable timber. The wood based industries were surveyed to collect the data of demand and supply of wood to Industries. A total of 130 quadrates for vegetation, 787 household, 71 timber depots, 30 sawmills and eight plywood industries of 12 divisions of Assam were surveyed. The report of Jorhat and Sivasagar have been submitted to Assam Forest Department. The summary of the finding are given in Table. Based on the data gathered from the household survey regarding possibilities of contract tree farming, a projection was made to predict the availability of timber for next 40 years in Jorhat and Sivasagar. Through this projection 0.32 million cum timber from Jorhat and 0.55 million cum timber from Sivasagar can be harvested from Tree outside forest in next 40 years.

Utilization pattern of Timber

Particulars	Forest depart-ment	Villagers and Tea garden	Forest depart-ment	Villagers and Tea garden
Construction (cum)		47369		26791
Furniture (cum)		1445		12097
Firewood (cum)		13261		19093
Others (cum)		229		3642
Sale (cum)	99	16563	17.24	42028

Demand and supply of timber in Jorhat and Sivasagar division of Assam

Particulars	Jorhat Division			Sivasagar Division		
	Types of Wood based Industries			Types of Wood based Industries		
	Sawmills	Plywoods	Timber depots (Band/ without Band sawmills)	Sawmills	Plywoods	Timber depot (Band/without Band sawmills)
Number of Industries	2	1	70	2	-	32
Demand of timber (cum)	4500	16353	5695	5000		2870.66
Supply of timber (cum)	60.08	11253	3136	99.36		903.52
Gap (cum)	-4439.92	-4898.92	-2558.16	-4872.80		-1966.34

Wood based industries that can be supported by timber from TOF and Forest Division

Particulars	Sawmills	Plywoods	Timber depot	Sawmills	Plywoods	Timber depot
Through Maximum supply (As per the sustainable harvestable timber)	44	5	839	61	10	1221
Current harvested timber scenario	20	3	403	27	4	538
Through Minimum supply (As per the past sale history)	3	-	59	13	2	257

2.4.3. Forest Biometrics

Quantification of ecological and economic services of eco-tourism as a livelihood option for sustainability of the Rhino population in Manas Tiger Reserve (MTR) (ICFRE-RFRI)

To assess the socioeconomic status and their dependency of forest resources of MTR, a total of 758 households comprising of population of 3687 persons in 40 forest fringe villages were surveyed. Observation showed that traditional habit of forest resource collection is there but practically there is very minimal dependency on Manas National Park. 47% of surveyed households revealed that they are collecting part of their fuelwood from Manas Tiger Reserve. There are 16.22% of households which either are sending their cattle inside the boundary of Manas Tiger Reserve for grazing or collecting fodder. Only 5% of total households were getting their partial livelihood from tourism activities as it is mainly confined to the Bhuiyanpara, Bansbari and Panbari areas only.

The rhino population increased from 3 in 2006 to 40 in 2021 after translocation of 18 rhinos to MNP between 2008-12 under the Rhino translocation project. After reallocation of rhinos number of tourists visiting MNP/ MTR has increased. The WTP survey shows that if the facilities like approach, communication, more sighting of wild animal especially rhinos, tigers and elephants increased, tourist will also be increased in MTR.

Genome wide and geospatial approaches for enhancing the adaptive potential of threatened rattan resources in India (ICFRE-RFRI)

Extensive survey was carried out in different localities (Community/Reserve forests/ Wildlife Sanctuaries and National Parks) of Assam, Mizoram, and Nagaland to explore population of threatened rattans (*Calamus acanthospathus*, *C. nambariensis* and *Plectocomia assamica*). Ten populations of *C. acanthospathus* and eight populations of *C. nambariensis* were explored from Mizoram and one population of *C. nambariensis* was explored from Longkhum community forest, Mokokchung district, Nagaland. Eight populations of *Plectocomia assamica* and three populations of *C. nambariensis* were explored from different Wildlife Sanctuaries of Assam. Studied the population structure, regeneration potentials and calculated the sex ratio of the species. Seedlings of threatened rattans- *Plectocomia assamica* (50 nos) and *Calamus nambariensis* (200 nos) were grown at RFRI nursery, Jorhat for enrichment plantation in natural habitats.

2.4.4. Information and Communication Technology (ICT)

Developing and popularizing digital interactive platform for tree growers and other stakeholders of Tamil Nadu (ICFRE-IFGTB)

A digital platform was launched by converging all the stakeholders' *viz.,* tree growers, planting stock suppliers, wood-based industries, research institutions and State Forest Departments in a common platform and integrating information flow on research and wood markets for the benefit of the tree growers with more than 120 functionalities. The 'Tree Genie' mobile App (Android & iOS) connects farmers directly with scientists to receive real-time solutions. This new digital platform would serve as a single window service and data pool of available commercial technologies, plantation technologies, yield calculators for different species, availability of quality planting material, plantation area under different tree species and its location, details of tree growers and prevailing market prices of wood/timber as offered by the wood-based industries. Tree Genie App in Android and iOS versions is available in the Play store for easy download.

Tree Genie App

Growth estimation of standing trees using image data and artificial intelligence (ICFRE-IFGTB)

The project was proposed to develop an artificial intelligence (AI) based tool using image data for growth assessment. To standardize the use of the tool, a line scanner and a camera, digital maps and images from a 40 m radius area in a teak plantation were collected. Line scanner captured the diameter at breast height of individual trees and the distance among the trees using laser. The ground truth data was collected in 200 trees using a tree caliper and measuring tape. The images taken using the camera as well the digital maps from the scanner are being processed for segmenting individual trees.

2.5
WOOD PRODUCTS

A. PLAN

- Completed 15
- Ongoing 06
- New 22

B. EXTERNALLY AIDED

- Completed 04
- Ongoing 03
- New 01

2.5.1. Wood and other Lignocellulosic Composites

Development of Oriented Natural Fiber Reinforced Wood Plastic Composite panels (ICFRE-IWST)

A hybrid wood veneer panel product was developed using natural fiber reinforced thermoplastic in granular or extruded sheet form as one component and wood veneers as the other component. It was characterized for physical and mechanical properties and found to have superior strength than traditional adhesive bonded plywood. Oriented long natural fiber panel products were also developed using short natural fiber reinforced thermoplastic (NFRT) as a binder for long woven natural fibers like jute, banana, sisal. The developed composite exhibits excellent bonding and improved mechanical properties. Panel products with superior mechanical properties and with no formaldehyde emission is the key benefit of the technology. It also provides opportunity to use recycle thermoplastics as a binder.

Hybrid WPC bonded wood veneer panels

Oriented fiber panel product

Transparent Wood Composite - Upscaling for Industrial Applications (ICFRE-IWST)

Transparent wood composite (TWC) and fluorescent transparent wood (FTPW) were prepared from *Melia dubia* (Melia), *Grevillea robusta* (Silver oak) and *Populus deltoides* (Poplar) wood with synthetic and biodegradable polymers. TWC exhibited low density, good mechanical properties, low thermal conductivity and good thermal stability. The extent of yellowing and discoloration occurred due to photo-initiated degradation was measured and it was observed that, the total transmittance loss in TWC prepared from Poplar and Melia wood was around 33% and 31%, respectively. High optical transmittance of ~83.5%, ~76.7% and ~72.8% was obtained at 550 nm wavelength for TWC prepared using 2 mm thick veneers of Poplar, Melia and Silver oak, respectively. The thermal conductivity of poplar wood was found to be 0.27 W/mK while, the thermal conductivity of TPW was obtained to be 0.37 W/mK room temperature, which is much lower than that of glass (~1 W/mK). The optical transmittance of TWC exposed to natural weathering for five months showed a transmittance loss of ~ 31-33%.

Properties of Cross Laminated Timber from plantation grown hardwoods (ICFRE-IWST)

Cross Laminated Timber (CLT) made from plantation grown hardwoods (*Hevea brasiliensis, Melia dubia, Grevillea robusta* and *Eucalyptus* hybrid) satisfies the European Standard (EN 16351 -2015) and meets the delamination requirements as well as block shear strength requirements. In comparison to softwoods, the block shear strength values obtained with the hardwood CLTs were higher. Other mechanical properties of hardwood CLTs were on par with or superior to those of softwoods. The delamination and block shear test showed that species mix had no impact on the bonding behavior of the lamellas. It provides opportunities to maximize resource utilization and control the density as well as mechanical properties of CLT. Bifenthrin was found to be very effective against both fungus and termite attack without having any negative detrimental effect on bonding efficiency of adhesives. The study revealed that short rotation plantation grown hardwoods can be used to prepare CLT and can find application in construction sector.

Mixed species CLT (Eucalyptus + Malabar Neem)

Development of medium and high-density plywood using plantation species of eucalyptus and poplar (ICFRE-IWST)

Optimized appropriate thickness of veneer requirements on the surfaces required to achieve the shuttering grade Mechanical properties viz., Modulus of rupture and Modulus of elasticity in along and across direction. The test results indicate that the density of the veneer/timber used plays very important role on the physical and mechanical properties for shuttering grade panels. The total thickness in along direction including the face veneer should be equal or 90% thickness as that assembled in across direction. The CCB treated panels yielded a retention of 4-8 kgs per m^3 for veneers treated with CCB by dip diffusion method and 4 to 6 kgs per m^3 of panels treated by pressure impregnation. The samples exposed (20 months) to termite test with 6 kgs per m^3 was not attacked. Based on the research findings the amendment in IS:303, IS:710, IS:4990 has been proposed to BIS and same has been approved.

CCB treated poplar panels

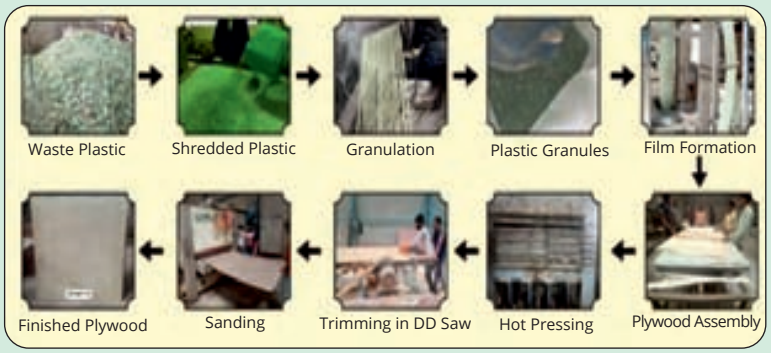
Study on process optimization and the performance of cross laminated timber (CLT) using plantation species (ICFRE-IWST)

Cross laminated timber construction using *Grevillea robusta* and *Melia dubia* were studied using Phenol formaldehyde resin. Pressure of 13-15kg/cm^2 was required for the manufacturing of CLT. 2ft x 4ft samples made were evaluated for Physical and Mechanical Properties viz. density, moisture content, water absorption and thickness swelling, Modulus of rupture, (MoR) modulus of elasticity (MoE) and Block shear strength. CLT made from *G. robusta* species has shown higher bending strength of 50.9N/mm^2 even when compared to the results reported by other researchers, whereas *M. dubia* CLT has shown higher MOE of 6500 N/mm^2. Bonding shear strength of *G. robusta* and *M. dubia* is found to be 5.23 N/mm^2 and 4 N/mm^2 respectively. These plantation species are found suitable for the manufacture of Cross laminated timber. However, it is evident from study that silver oak species of 8-10 year age group was more practically feasible in aspects with less knots, easy processing in sawing or dimensioning of timber and drying of timber.

CLT from silver oak

Development of plastic bonded bamboo mat board and plastic bonded plywood from waste recycled plastic material for construction and packaging units (ICFRE-IWST)

Waste plastic, milk as well as oil pouches was procured from local agencies and converted in to shredded particles. Initial trials were carried out to use these shredded plastics as binder without any coupling agents. The granules from waste plastic were converted into thin films using suitable coupling agent and the films were used as binder for veneers/bamboo mats for preparing plastic bonded plywood and bamboo mat board.



Steps for production of plywood from plastic films

The properties of the composite were assessed as per Indian standard. The boards of thickness 9 mm with density of 710 kgs/m^3 were evaluated for physical and mechanical properties for Moisture resistance (MR grade) as per IS 303; Specification for general purpose plywood. It is evident from the result that the boards have conformed to all the properties viz, water resistance property for MR grade, Modulus of rupture and Modulus of elasticity for Moisture Resistance grade (MR) as per IS 303. Industrial trial was also carried out at Yamuna Nagar, Haryana to demonstrate the technology.

2.5.2. Wood Processing

Study the Tree Biomechanics behaviour with respect to the hollowness (decay) of urban trees in wind affected area (ICFRE-FRI)

In order to study tree biomechanics during high wind/cyclones, field data was collected for 72 hollowed trees which broke during cyclone at Odisha (Bhubaneswar), West Bengal, Daman, Diu, Gujarat, Tamil Nadu and Puducherry. Out of these 43 hollowed tree logs of different girth and size were tested for breaking load in lab for prediction of minimum wind speeds responsible for falling of trees. Again data was collected for 65 hollowed trees which broke during cyclone at Chennai and FRI. Based on the data analysis initial conclusions were as follows:

- In the urban area, the trees having hollowness and having trunk thickness <10cm, should be replaced with healthy saplings
- The trees having higher wood density should be planted so that tree can withstand the maximum wind velocity.
- Tall and heavy broad canopy trees should not be planted in urban areas. Only wind resistant trees like Casuarina, Eucalyptus or otherwise cone shape crown trees should be preferred.
- Trees having less leaf area index may be planted so that infiltration of wind through the tree canopy will be more, example- *Tamarindus indica.*

2.5.3. Value Addition and Utilization

Evaluation of Coconut Shell Pyrolytic Oil Distillate (CSPOD) as wood preservative for industrial applications (ICFRE-IWST)

Raw CSPO distilled at two temperatures (85^0 C and 100^{0}C) and distillates formulated with Copper sulphate, Boric acid, and $ZnCl_2$ and the formulations evaluated for bio-efficacy studies at six agro climatic conditions. All the formulations were found effective upto one year after treatment in graveyard conditions. The developed formulations were found to have miscibility, solubility and stability characteristics for one year. Percentage leachability was determined for all the preservatives and CSPOD had 6.33% leachability. For plywood purposes the formulations were found ineffective.

Development of draft standard for wood from the agro forestry – "Agri Wood" (ICFRE-IWST)

Study was carried out to develop a draft standard for wood from the agro forestry to allow trading of Agro forestry wood species. There is a need for simplified procedure by certification of timber coming from agroforestry to sale the same in market without much unnecessary transit. The relevant clauses viz. quality system requirement, legality compliance, raw material supply and production sale of wood, risk assessment and mitigation program etc. were identified and drafted to provide a framework for implementing "Agri-Wood" certification scheme for the purpose of passing on information regarding wood and wood-based products, lignified materials other than wood, such as bamboo and the agro forestry. The clauses of "Agri-Wood" certification system were drafted to provide process by which information about materials can be tracked throughout the entire or parts of the supply chain. The draft standard is designed to provide a consistent basis against which wood from the agro forestry can be assessed.

Technology Transfer of FRD (Fire Resistant Doors) shutter through construction method (ICFRE-IWST)

Manufacturing process of FRD shutters with a combination of materials such as timber, calcium silicate boards and ceramic blankets etc was demonstrated along with training to M/s United plywood industries, Gujarat. Both the door leaf and the door frame met the requirements of IS-3614/ BS-476 standards for 120mins fire rating.

Study on the development of Cement-bonded Bamboo particle board (ICFRE-IWST)

Study was carried out to examine for developing cement bonded bamboo particle board. The physical properties of board such as moisture content and water absorption (2hr and 24hrs) decreases with increase in cement: bamboo particle ratio. The mechanical properties of the boards such as modulus of rupture (MOR), modulus of elasticity (MOE), internal bonding, and screw withdrawal also increased with increase in cement: bamboo particle ratio. The 2.5:1.0 and 3.0:1.0 cement: bamboo particle ratios performed best for cement bonded bamboo particle board and also met the requirement specified in IS: 14276.

Cement Bonded Bamboo Board

Development of Bamboo Mat Ridge Cap (BMRC) for Bamboo Mat Trafford sheets (BM) (ICFRE-IWST)

Design and development of drawings for BMRC Dies was completed. Based on the design dies for BMRC were fabricated and installed through E-tendering. Optimization of process parameters for manufacture of BMRC were carried out. Subjected for testing the properties of BMRC as per IS 15476(2004) and product conforms to the requirements as specified in the standard.

Bamboo Mat Ridge Cap Dies

Bamboo Mat Ridge Cap

2.5.4. Wood Chemistry

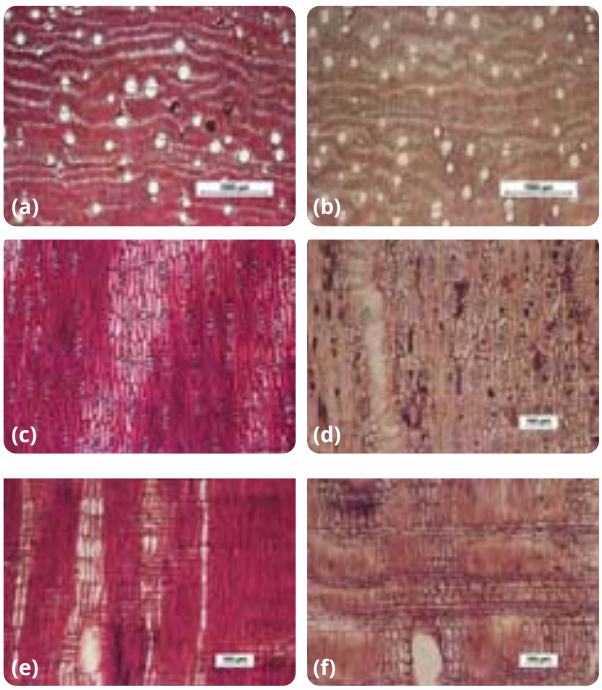
Distinguishing *Dalbergia latifolia* Roxb. and *D. sissoo* DC. woods using anatomy, chromatography, near infrared spectroscopy and molecular marker techniques. (ICFRE-IWST)

Distinguishing *D. latifolia* from *D. sissoo* on the basis of physical (density and colour) and anatomical features is not possible. Fibre, vessel and ray characteristics do not show significant variation between these two species. Therefore, it is appropriate to integrate other tools for of identification such as chemical finger printing using TLC, UV-Vis. as well as NIR spectroscopy and DNA barcoding along with anatomy to distinguish *D. latifolia* and *D. sissoo* wood. The current investigations using these techniques showed that these analytical tools are suitable for distinguishing the two species.

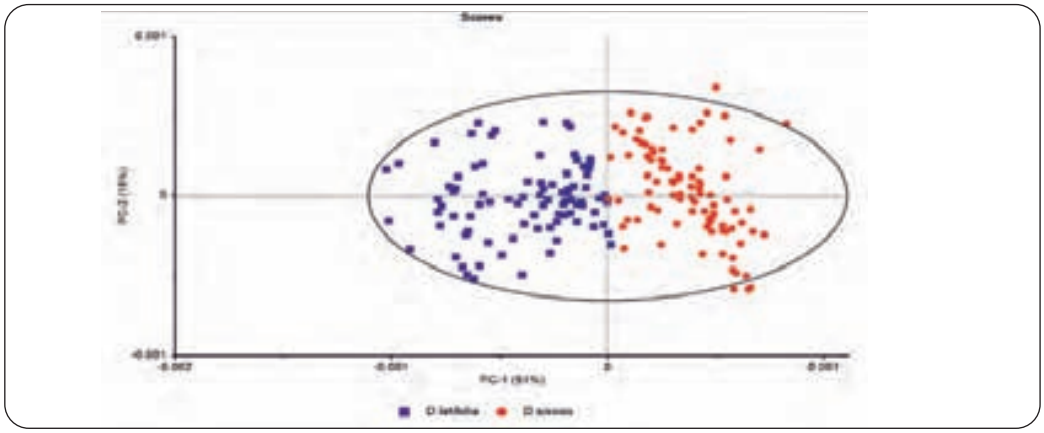
In *D. latifolia* the density of the wood samples varied between 0.715 to 1.074 g/cm^3 which makes the wood heavier than *D. sissoo* (0.595 to 0.871 g/cm^3) which is considered as moderately heavy timber. *D. latifolia* was difficult to distinguish from *D. sissoo* on the basis of anatomical features only as most of the features are overlapping. Variation in only Ray parameters was observed, Ray frequency was more in *D. latifolia* (11-19/mm) as compared to *D. sissoo* (10-16/mm), *D. latifolia* had 39% uniseriate rays, 52% biseriate rays and 9% triseriate rays whereas *D. sissoo* had 21%, uniseriate rays 52%biseriate rays and 27% triseriate rays. Triseriates ray width was up to 80 µm in *D. sissoo* and was up to 64 µm in *D. latifolia*.

From the TLC study it was observed that extract of *D. latifolia* shows yellow prominent spot which is completely absent in *D. sissoo*. From the UV study, a common peak was observed at ~290nm in both *D. latifolia* and *D. sissoo* where as a peak at around 350nm was only observed in *D. sissoo* which is a distinguishable character. The multivariate analysis (PCA and PLS-DA) of NIR spectra of *D. latifolia* and *D. sissoo* wood samples confirmed the potential of NIRS technique in distinguishing the two look-alike wood species

For molecular analysis PCR amplification was performed for the extracted DNA for *matK* and *rbcL* regions, and amplicons were sequenced and analysed *in silico*. Species-specific nucleotide variations were observed in both the *matK* as well as *rbcL* regions. Phylogenetic analysis revealed that the sequences of the two species were claded separately for *matK* region, but not for *rbcL* region, implying that the *matK* nucleotide sequences can be used for discriminating between the two species by phylogenetic analysis, and this was also validated with random samples of *D. latifolia, D. sissoo* and other tree species.



(a, b) Cross, **(c, d)** Tangential longitudinal, and (e, f) Radial longitudinal sections showing anatomical structure of *D. latifolia* and *D. sissoo* wood samples



PCA analysis of NIR spectra of *D. latifolia* and *D. sissoo* wood samples

Effect of scavenger and moisture content of veneer on emission of formaldehyde from urea formaldehyde bonded wood based panels (ICFRE-IWST)

The performance of formaldehyde scavengers compatability with Urea formaldehyde (UF) resin for wood-based panels were explored. UF resin was prepared by incorporating Caprolactum and sodium bisulphite (1:1 ratio) of concentration ranging from 0.5 -2.0 %. The free formaldehyde content in the resin were analyzed and found to be less. The panels made were evaluated for bond integrity and formaldehyde emission. The results indicated that the scavenger used by combination of sodium metabisulphite and caprolactum having 1% concentration yields the requisite Moisture resistance grade bond quality with E1 formaldehyde emission class for the products.

Investigating the performance of resins made using glyoxal (ICFRE-IWST)

Glyoxylated methylol urea resin was developed for the manufacturing plywood. Optimised the process parameters for the manufacture of plywood at laboratory scale and the plywood confirming to MR grade plywood as per IS: 848 :2006. Further trials at pilot scale is in progress. Glyoxylated Lignin tannin adhesives of different ratios were also developed. 12 mm thick of 300mm x 300mm particle board using glycosylated resin adhesives were manufactured and evaluated the properties as per IS:3087, boards satisfying mechanical properties as per the standards. Formaldehyde emission criteria of E0 as per JIS 1460 has been achieved. Further trials at pilot scale is in progress.

Smoke density properties of fire retardant wood composites (ICFRE-IWST)

Smoke density of fire retardant wood based panel materials such as plywood, Medium Density Fibre Board (MDF), Pre-laminated Particle Board (PPB), block boards etc., were measured using chamber method (ASTM D 2843-70). Two sets (20 No.) of samples were tested for smoke density properties and identified the smoke production levels of those tested samples. The results indicated the smoke density of plywood was 65.17% at 7.30 minutes of time, for fire retardant MDF smoke density was 24.88% at time 7.00 minutes, for fire retardant block board was 46.88% at time of 5.15 minutes, for fire retardant particle board the smoke density was 56.22% at time of 8.15 minutes. From this study it is found the smoke density of MDF is less compared to all the other fire retardant panel products. The plywood and particle board has high hazardous level of smoke density.

Evaluation of lignin for its suitability in the manufacture of Phenol Lignin Formaldehyde Resin/Adhesive for Boiling Water Resistance grade Plywood (ICFRE-IWST)

Rice straw lignin can be a suitable raw material for partial replacement of phenol in phenolics resin. Rice straw lignin with a lignin content of 96% and ash of less than 2% with 26% phenolics can be effectively replaced by 30% to 50% for phenol for the manufacture of Boiling water resistance grade plywood. The resin formulation and the cooking process parameters is similar to that adopted for the manufacture of conventional phenolic resin which makes any industry to adopt this technology. The PLF resin bonded panels have yielded excellent bond quality with predominant wood failure when tested in accordance with IS 848:2006- for 30% and 40% replacement of lignin. However, for 50% replacement the bond quality conformed only to pass standard. The physical and mechanical properties of the panels made conformed to all the test requirements of IS 303 for boiling water resistance grade plywood.

The adhesive formulation for making panels have been optimized for the manufacture of Boiling water resistance grade panels using Phenol Lignin formaldehyde resin with 30%, 40% and 50% lignin replacement on the phenol. Pilot scale upgradation completed.

Unloading plywood made using Phenol lignin formaldehyde resin

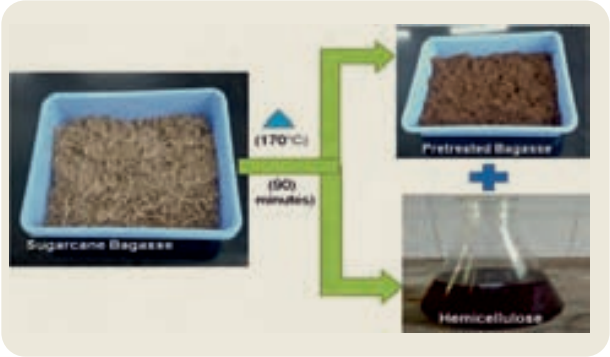
2.5.5. Pulp and paper

Assessment of Indian bamboo species for dissolving grade pulp (ICFRE-FRI)

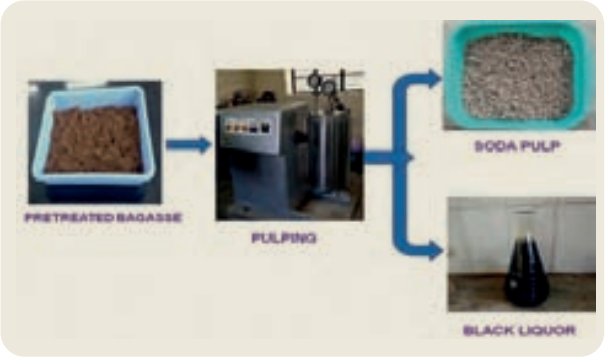
Six species of bamboo viz. *Bambusa balcooa*, *Bambusa polymorpha*, *Dendrocalamus somdevae*, *Dendrocalamus asper*, *Bambusa tulda* and *Bambusa vulgaris* were processed for pre-extraction followed by kraft pulping. Aqueous pre-treatment of bamboo samples was done in at 150ºC for variable time intervals. 94.10% yield was obtained after pre-extraction of bamboo samples. Kraft pulping of pre-extracted samples and un-extracted samples of each species was conducted. Pulp yield within a range of 42.93-49.17% having Kappa no. in a range of 16.61-22.12 with pulp silica content (0.37-1.46%) has been observed.

Preparation and evaluation of dissolving grade pulp and nanocellulose from sugarcane bagasse (ICFRE-FRI)

For the preparation of dissolving grade pulp from sugarcane bagasse, sample has auto-hydrolysed at 170°C for 90 minutes with 1:10 bath followed by pre-hydrolizationat 12%, 14% and 16% chemical charge at 160°C for 60 minutes for soda pulping. The pulp yield 55.60% were obtained at 16% of chemical charge with Kappa number 23.25.



Autohydrolysis



Soda Pulping

Studies on fiber morphology of Indian hardwoods and development of database for their efficient utilization by industry (ICFRE-FRI)

The study on fibre morphology of 354 indigenous species revealed that various lesser-known woods more suited for paper and pulp industry than the ones used conventionally. Of the 354 species studied, 189 species were found to be having runkel ratio ≤1, and hence their fibres are suitable to produce pulp of reasonable quality. Among these 189 species, as per Rachman and Siagian (1976) species having Runkel ratio <0.25 are classified as Class-I i.e. best pulp and paper making species; 0.25 -0.50 as Class-II and 0.50-1.00 as Class-III. Six species were found to produce best class-I pulp as per our study. *Eucalyptus* is the most favoured species by the paper and pulp industries of India and its Runkel ratio varies from 0.50 to 1.15. Hence, our study shows that from fibre morphology point of view there are much more suitable species for paper than *Eucalyptus*.

2.5.6. Plywood and Panels

Suitability of *Melia dubia* for face quality veneer (ICFRE-IWST)

Melia dubia logs were utilized to produce thin veneers by rotary peeling and slicing techniques. It was s found that older logs (age above 16 years) and girth above 1 meter can yield veneers which can be graded as type 1 face veneer as per IS:1328. Veneer from *M. dubia* has good gluing and bonding properties when used in combination with other species, the plywood produced using *M. dubia* as face veneer confirms to the properties as specified in the relevant standard IS:303. Hence *M. dubia* can be advocated to be added to the list of species that are recommended to produce face quality veneers.

Laboratory testing methodologies for panel products against termite resistance (ICFRE-IWST)

A non-destructive and quantitative approach of X-Ray analysis was adopted for result evaluation giving a more reliable result. Based upon the findings, test method for Lab testing Method was developed for plywood and blockboard with both the termite species was formulated. From the results, it is concluded that the maximum vigorous activity of *Heterotermes indicola* was at population density of 0.004 g/ml, whose test parameters were incorporated in the developed method and the maximum vigorous activity of *Coptotermes heimi* was at population density of 0.0008 g/ml, whose test parameters were incorporated in the developed method. Sample size and time period of 24 days were determined.

Study on suitability of *Simarouba glauca* for Particle board manufacture-Phase II (ICFRE-IWST)

Study was carried out to find out the suitability of making three layered particle board from *Simarouba glauca*. Three layered particle boards were produced by optimizing process parameters for particle preparation, gluing and hot pressing by using urea formaldehyde and Phenol Formaldehyde resin. The panels made were subjected for evaluation of physical and mechanical properties as per relevant specifications. The results showed that the physical and mechanical properties of the panels conform to the requirements as specified in IS:3087-2005 standards for producing grade I and grade II medium density particle boards. Tests on formaldehyde content shows Particle boards conforming Formaldehyde class E1 norms. These results indicate that Particle board can be made using *S. glauca.*

Three layered Particle board

Review of Indian standards on Plywood for general purpose (IS 303), Marine (IS 710) and Shuttering (IS 4990) for suggesting amendments to the Indian standards (ICFRE-IWST)

Evaluated and analysed test data collected w.r.t different Indian standards of Plywood viz. general purpose (IS 303), Marine (IS 710) and Shuttering (IS 4990). Report was submitted to the M/s. Greenply Industries Ltd., Kolkota and proposed amendment to BIS. The draft amendments were circulated by BIS for comments.

Development of innovative additive composition for plywood panels manufactured from veneers having high moisture content (ICFRE-IWST)

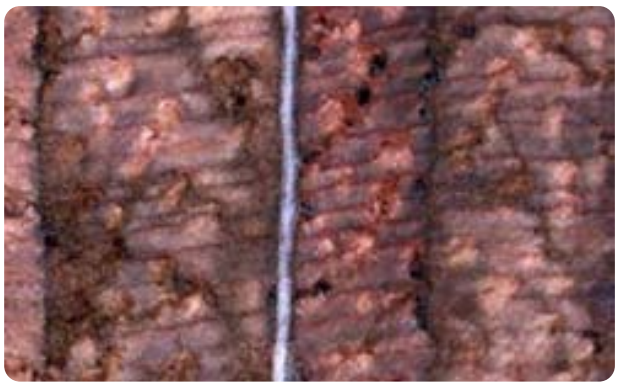
To achieve higher solid contents and high moisture tolerance modifications of phenol-formaldehyde resin was carried out using paraformaldehyde. Additive composition was formulated by using speciality chemicals like water absorbing polymer, polysacarides, polyanionic cellulose materials and conventionally used fillers. 12mm thick plywood was prepared using core veneer of Eucalyptus sp. having moisture content ranging from 12 to 16% at laboratory scale. The plywood panels were subjected to cyclic test was carried as per IS 848. Properties of plywood show that mainly UF glue compositions are most appropriate for the gluing of veneer with higher moisture content. The outcomes of the project will have a direct impact on wood based panel industries to manufacture of plywood by using core veneer having high moisture content and hence manufacturing cost saving.

Evaluation of suitability of currency briquettes replacement with wood particles for the manufacture of particle board (ICFRE-IWST)

The currency briquettes received and the poplar particles were dried to requisite moisture content for the manufacture of particle board. Urea formaldehyde resin of weight ratio 1: 2.3 (Urea to Formalin) was synthesized in the laboratory. The flow properties of the resin were characterized. The currency briquettes were replaced by 30%, 40% and 50% for wood particles in the particle board making. Single layered and multilayered particle board with varying combination of the currency briquettes and wood particles were made. Panels are being evaluated for physical and mechanical properties as per IS 3087.

Experimental study on performance of fibre-Reinforced laminated veneer lumber (RLVL) from *Melia dubia* for structural applications (ICFRE-IWST)

Three types of reinforcement materials, a glass chopped glass fiber mat (CGM), a glass fiber mesh (GM) sheet, and bamboo mat (BM), were considered for reinforcing laminated veneer lumber (LVL). The results indicated that LVL reinforced with CGM, GM, and bamboo mat had improved the properties and mechanical performance i.e, Bamboo mat > GM > CSM. Placing the reinforcement layers closer to the surface veneer layer in the assembly yielded the best mechanical properties for the RLVL. The Modulus of rigidity (MOR) and Modulus of Elasticity (MOE) of reinforced LVL from *Melia dubia* was found to be 73.79 MPa and 11024 MPa respectively, which falls in group B (ordinary timber) grade as per BIS 883:1994. The performance of RLVL was superior when compared to solid wood of the same wood species.



Interface of glass fiber and veneers

Interface of bamboo fiber and veneers

2.6
NON-WOOD FOREST PRODUCTS (NWFPs)

A. PLAN

- Completed 01
- Ongoing 01
- New -

B. EXTERNALLY AIDED

- Completed 07
- Ongoing 15
- New 04

2.6.1. Resource Development of NWFPs

Development of Germplasm Repository of Endangered Medicinal Tree *Oroxylum indicum* (Shyonak) (ICFRE-FRI)

The superior germplasm of *O. indicum* was collected from 21 identified locations (Uttarakhand - 08, Haryana - 04, Punjab - 03 and Uttar Pradesh - 06) and assembled in germplasm repository at ICFRE-FRI, Dehradun. Survival percentage and growth data were taken at regular intervals to evaluate the growth performance of the planted seedlings and plantlets. For the germplasm repository established through vegetative propagules survival ranged from 66 to 91% and for the germplasm repository established through seed survival ranged from 83 to 100%. Technical assistance was provided to State Silviculture Research Area at Thano range, Dehradun (Uttarakhand) for the development of germplasm repository and provided 252 seedlings.

Casualty replacement and planting stock of *Oroxylum indicum*

Evaluation studies on contribution of NTFPs to the state economy of Tripura (ICFRE-RFRI)

NTFPs with an estimated market value of Rs. 68.35 Crore were observed to be collected and/or traded in the FY 2021-22 in the entire state of Tripura of which bamboos (28.61%) and broom grass (23.84%) contributed the most. More than 400 JFMCs covering all the 08 Forest Divisions of Tripura were studied to capture the quantum and trends of NTFP collection and trade. A total of 85 nos. of NTFP species under the categories of bamboos, bamboo seeds, bamboo shoots, canes and rattans, fuelwood, thatch grass, mushrooms, medicinal plants, wild edible vegetables and fruits, small aquatic animals/fauna, wild honey etc. were inventoried through the study. In most of the forest divisions, NTFPs viz., Broom grass (*Thysanolaena maxima*) @ Rs. 41.43/Kg., Sugandhmantri (*Homalomena aromatic*) roots/tubers @ Rs. 29.66/Kg. and Amla (*Phyllanthus emblica*) @ Rs. 33.99/Kg. were sold below the revised minimum support price (MSP) as notified by the Ministry of Tribal Affairs, Govt. of India in the year 2020.

Establishment of a Bamboo Hi-Tech Nursery at ICFRE-IFGTB, Coimbatore (ICFRE-IFGTB)

Bamboo Hi-Tech Nursery (BHTN) was established at the Institute for the production and maintenance of quality planting stock of bamboo for different end users. Ten commercially important bamboo species- *Bambusa bambos* (Mulmoongil), *Dendrocalamus strictus* (Kalmoongil), *Bambusa balcooa* (Mullilamoongil), *Bambusa tulda, Bambusa nutans, Dendrocalamus asper, Dendrocalamus stocksii, Bambusa vulgaris* (G), *Bambusa pallida, Dendrocalamus giganteus, Bambusa vulgaris* (Y), *Bambusa vulgaris* wamin and ornamental species were produced and maintained with identity. Quality planting stock (9,363 number) of 13 species of bamboos were raised and maintained with identity. Planting stock, 1,582 number was distributed to different stakeholders, 1,053 number was utilized for in-house planting operations. The nursery facility is being utilized to maintain 43 number of Candidate Plus Clumps belonging to 28 species, and 142 germplasm accessions representing 58 species under various bamboo-related projects handled by the institute. A rhizome bank consisting of 13 accessions belonging to five species was established at Bamboo Hi-Tech Nursery, Forest Campus during 2022 for vegetative propagation activities.

Large-scale production of various bamboo species

Establishment of Small Bamboo and Hi-tech Bamboo Nursery (ICFRE-FRI)

The small bamboo and hi-tech bamboo nursery is being maintained by ICFRE-FRI, Dehradun. During the year 48,000 bamboo plants of different species were raised and sold for raising plantation in different areas. Revenue of about sixteen lakh rupees was earned by selling plants.

Establishment of Bamboo Demo Plantations in Agro and Urban Ecosystems (ICFRE-IFGTB)

For demo plantations of Bamboo (11 species, 23 accessions, 5,058 plants in 20 ha area at five locations) established during 2020-21 data on survival and growth was recorded. Survival was 75% at Musiri Institute of Technology - College of Agriculture and Technology (MIT-CAT), Musiri and *Bambusa balcooa* had better growth performance. Survival was 86% at Iduvai village, Palladam Taluk, Tirpur District and *Bambusa nutans* showed better growth performance. At farmer's land at Nanjundapuram, Coimbatore survival was 20% and *Bambusa balcooa* showed better growth performance. At Agricultural Research Station-Tamil Nadu Agricultural University (ARS-TNAU), Bhavanisagar survival was 90% and *Bambusa nutans and Bambusa balcooa* had better growth performance. At Kumaraguru Institute of Agriculture (KIA), Sakthinagar, Erode survival was 74% and *Bambusa nutans* had better growth performance.

Bamboo Park in urban ecosystems, Iduvai village, Palladam Taluk, Tirupur district

Bamboo Demo Plantations at Kumaraguru Institute of Agriculture, Sakthi Nagar, Erode district

Characterization and utilization of fatty liver curing medicinal plants and its assemblage (ICFRE-IFGTB)

Five fatty liver curing medicinal plants - *Phyllanthus reticulatus* (Karu Nelli), *Ficus racemosa* (Aththi), *Entada scandens* (Irikki Yanaikozhinji), *Securinega virosa (Karumpula, Aduthinnichedi)* and *Breynia retusa (Mullu Vengai)* were collected from 12 different locations in Western and Eastern Ghats areas. The germplasm was assembled at KVK, MYRADA, Thalamalai (0.722 acre with spacing of 3 x 3.65m) and Pethikuttai, Mettupalayam (0.5 acre). Biochemical analysis of alpha amyrin (9.05 to 15.14 mg/g) and sitosterol (8.33 to 20.76 mg/g) have been completed.

Germplasm assemblage of medicinal plants, *Caesalpinia bonduc* and *Annona muricata* – their characterization and utilization (ICFRE-IFGTB)

Annona muricata and *Caesalpinia bonduc* seeds, leaves and stem cuttings were collected from 20 different locations of Tamil Nadu. Vegetative propagation was standardised. In *Annona muricata* the soft stem with apical bud (20-25mm) showed good response with IBA 1500 ppm, the shoot proliferation started after two weeks and root proliferation within 60 days. Cuttings collected from Peechi showed maximum survival rate of 48.3±1.15% and minimum in cutting from Allatuchira (41.0±2.00%). In *C. bonduc,* the cuttings treated with 1500 ppm IAA showed better shoot proliferation in two weeks and root initiation after four weeks. As the survival percentage was very low, seeds were pretreated by mechanical scarification followed by seeds soaked in water for 48 hours to 50% H_2SO_4 for one hour and germination of 70% to 80% was obtained. In seeds treated with 50% H_2SO_4 germination varied across locations viz. Themanoor (78 %), Eraviputhoorkadai (75%), Marthandam (74%), Puliancholai (73%), Thenmala (72%), Nagercoil (72%)**.** Qualitative and quantitative analysis of ACGs (acetogenins) in *A. muricata* fruits revealed a range of 2.49 to 16.47 mg per kg while bonducin content in *C. bonduc seeds* ranged between 0.155 to 0.788 %. The germplasm was assembled at KVK, MYRADA, Thalamalai.

Caesalpinia bonduc collection

Annona muricata collection

Standardization of inoculation technique for agarwood formation in *Aquilaria malaccensis* Lamk. in Khasi and Garo Hills of Meghalaya (ICFRE-RFRI)

Inoculation of 184 trees of *Aquilaria malaccensis* for Agarwood formation with three different types of fungal cultures viz., $RFRI_2$, $RFRI_3$, $RFRI_4$ was completed in seven districts *viz.* Kharkutta (North Garo Hills), Goiragre (West Garo Hills), Katuligre (South West Garo Hills), Danakgre (West Garo Hills), Anangpara (South West Garo Hills), Umsaw Reserve Forest (Ri-bhoi), Seju (South Garo hills), Dapokgre and Singwegre (East Garo Hills)of Meghalaya. Formation of agarwood in the inoculated trees was observed. 200 farmers have also sold the agarwood trees.

Co-ordinated research programme on agar (*Aquilaria malaccensis* Lamk.) (ICFRE-RFRI)

Artificial inoculation of 45 agar trees were carried out at South Garo Hills, Meghalaya. Growth of upto 8 inches and collar girth upto 13.6 cm has been recorded for agar trees in PRS at RFRI campus.

Standardization of nursery techniques for mass multiplication of *Polygonatum cirrhifolium* (Wall.) Royle (Mahameda) and its extension among local communities (ICFRE-HFRI)

Seeds and vegetative propagation trials were established under nursery conditions at FRS Brundhar, Shillaru and Model Nursery Baragaon. Maximum seed germination (80 %) have been observed in seeds treated with GA_3-1000 ppm and mulching with Oak leaves in the nursery beds.

Medium sized rhizome cuttings (7-9 cms) have been found to be most suitable for vegetative propagation of *P. cirrhifolium* with maximum survival percentage (80%). The cultivation technique of *P. cirrhifolium* has been standardized. Maximum survival of 95% and yield approx 210g/m^2were observed with spacing of 25X25cm, 75 % shade condition, oak leaf muching of 2kg m^{-2}, 500g m^{-2} vermicompost and irrigation on 4th day. Organized training program on 'Cultivation of Mahameda and other important temperate medicinal plants' at VVK, Jagatsukh, Manali for about 35 farmers of Kullu region.

Harvesting of Cultivation trials

Recording of growth data for cultivation trials

Harvesting of Vegetative Propagation trials

Training Programme on cultivation on Mahameda

Germplasm evaluation of *Cinnamomum tamala* and development of appropriate agro-techniques for higher productivity in sub- himalayan tracts of Darjeeling district (ICFRE-IFP)

Survey was carried in Darjeeling, Alipurduar, Jalpaiguri and Kalimpong areas and 50 Candidate Plus Trees of *C. tamala* were selected on the basis of the leaf size, number of branches and the number of leaves. For air layering different treatments were tried (treatment with IAA, IBA and NAA) and very good success rate was obtained in IBA @ 2000 PPM. For stem cutting different auxins were tried and IAA @ 2000 ppm gave 70% success.

Established field trial at Experimental Research Plot, Udai Singh Jote, Darjeeling with spacing of 2mx2m, 2.5mx2.5m and 3mx3m. The plant with the spacing with 3mx3m gave a better growth. In the fertilization trials with five treatments (i) Control (ii) NPK (iii) NPK+ Vermicompost (iv) NPK+FYM and (v) FYM, the combination of NPK+Vermicompost gave the best results in terms of collar girth, leaf size and number of leaves produced. The net income from one hectare of land was estimated to be Rs. 1.50 Lakhs per annum.

Experimental trial of *C. tamala*

Survey, mapping, development of cultivation techniques, evaluation of selected germplasm and economics of *Fritillaria roylei* Hook.f. (Kakoli) an important plant of the Ashtavarga Group of Medicinal and Aromatic Plants (ICFRE-HFRI)

Standardised propagation technique of *F. roylei*. Experiments were conducted with six different potting media, containing different composition of sand, soil and FYM at Brundhar Nursery, Kullu. Maximum germination 62.5% recorded in Sand + Soil + FYM (1:1:1) and minimum germination of 25% recorded in Soil + Sand (2:1). In terms of irrigation schedule maximum sprouting of 92% in treatment with irrigation at three days interval followed by at five days interval (88%) and minimum sprouting 66% was recorded in irrigation at seven days interval. Evaluated growth and survival of selected germplasm of 17 populations and 81.18% average sprouting in the bulbs was recorded. Maximum sprouting per cent was recorded in the bulbs collected from Churdhar (94%) followed by Chhitkul (92%) and minimum sprouting of 68% was recorded in bulbs collected from Loharta.

Collection of seed and bulbs from Churdhar, Sirmaur for nursery trials

Growth data recording of *F. roylei*

Diversity assessment and promotion of *Cinnamomum glaucescens* (Malagiri) an important NTFP species for livelihood support in the northern part of West Bengal (ICFRE-IFP)

Stem-cutting for vegetative propagation has been carried out and cutting treated with IBA @2000 ppm was found to be 10% successful. Vegetative propagation by air layering was not successful.

Survey of 1000 stakeholder including forest fringe villagers, forest department staff were carried out to understand the depletion of the species. The major cause was found to be over exploitation of the species in this region for development of value added products.

Three Workshops cum Training had been carried for the popularization of the species in the areas of Sukna, Chenga and Nepania villages on importance of the species, nursery techniques, plantation techniques and need for the conservation of the species for 121 villagers.

Training on Malagiri importance, cultivation and conservation

2.6.2. Sustainable Harvesting and Management

Selection of CPTs, standardization of collection practices and quality evaluation of Gum karaya (*Sterculia urens*) in Chhattisgarh state (ICFRE-TFRI)

Rich pockets of *Sterculia urens* were identified in three different agroclimatic regions of Chhattisgarh state and 63 CPTs were selected. Quality of Grade -I gum samples collected from Kanker area was of superior quality in terms of viscosity (1182±2.08cps).

A validated HPTLC method was developed for quantitative evaluation of glucuronic acid in gum samples. The highest glucuronic acid content was found in gum sample of Bijapur (0.888 ± 0.01%). The developed method can be used for quality standardization of gum Karaya.

Technical bulletins and extension leaflets were prepared and trainings on sustainable harvesting and processing of gum karaya was imparted to gum collectors in Bijapur, Sukma and Dantewada forest divisions of Chhattisgarh state.\

Technical bulleting and Leaflet on *Sterculia urens*

Training programme on sustainable harvesting of gum Karaya (*Sterculia urens*) in Bijapur forest division (C.G.)

Impact Assessment of *Lantana camara* removal in Chhattisgarh State (ICFRE-TFRI)

State Forest Department of Chhattisgarh employed manual and mechanical grubbing process to remove *Lantana camara* from infested forests. It is observed that *Lantana* eradication created a positive impact on regeneration of native trees, shrubs and medicinal plant on site and improved soil microbial dynamics and soil P status.

Shannon-Weiner Species Diversity Index of the understory vegetation was found to be higher in treated forests (2.04 -2.60) irrespective of agro climatic zones and density of lantana infestation against the plots laid in control (lantana not-removed) forests (1.37-2.17). Regeneration status (density ha^{-1}) was found to be higher in treated forests (532 -1116 individual ha^{-1}) irrespective of agro climatic zones and density of lantana infestation against the plots laid in control (lantana non-removed) forests 236-880 individual ha^{-1}. Analysis of soil samples collected from Chhattisgarh Plains (Marwahi Forest Division) revealed that pH of the soil improved to near neutral values (5.98-6.41) for all the three soil depths (0-15 cm, 15-30 cm, 30-45 cm) in three density plots, while corresponding values in control forests varied between 4.96 - 5.99.

Method of *Lantana camara* removal – 'Manual Grubbing' followed by Chhattisgarh SFD

Investigations on active chemical ingredients and propagation of critically endangered species *Dillenia pentagyna* Roxb. for its conservation in Madhya Pradesh (ICFRE-TFRI)

Populations of critically endangered *Dillenia pentagyna* were identified in seven forest divisions (South Balaghat, Panna, East Chhindwara, Alirajpur, North Balaghat & Sagar) of Madhya Pradesh. Total secondary metabolites i.e. alkaloids, flavonoids, phenols, tannin and terpenoids were estimated in stem and root bark of the species. A wide variation in quantity of alkaloid (0.87±0.20 - 3.06±0.11 mg CE/g), flavonoid (8.01±0.09-15.83±0.01 mg QE/g), phenol (l44.34±0.12 - 64.14±0.25 mg GAE/g), tannin (44.34±0.12 - 64.14±0.25 mg GAE/g) and terpenoid (8.48±0.12 - 9.92±0.03 %) contents in root bark was observed. Active chemical ingredients betulinic acid, β-sitosterol and lupeol varied 0.365 ± 0.09 to 0.920 ± 0.02%, 0.220 ± 0.04 to1.555 ± 0.07% and 0.100 ± 0.03 to 0.369 ± 0.01% in different plant parts, respectively. Experiments for vegetative propagation revealed 44% rooting with IBA 250 ppm + BA 50 ppm (2hr).

Adventitious rooting in *Dillenia pentagyna*

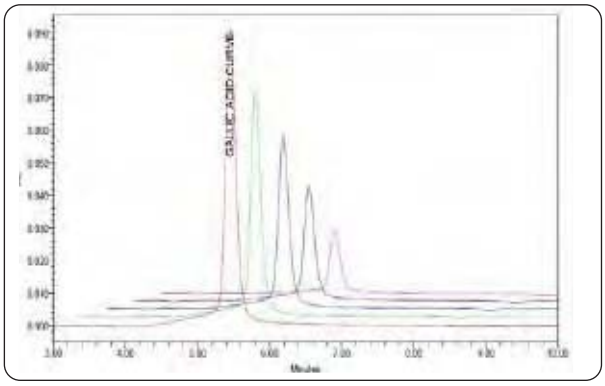
Investigation on variations and domestication of *Curculigo orchioides* Gaertn. (*Kali Musli*) in Madhya Pradesh (ICFRE-TFRI)

Tubers of *Curculigo orchioides* (*Kali Musli*) were collected from 11 MPCAs (Medicinal Plants Conservation Areas) of Madhya Pradesh and morphological data (rhizome length, rhizome thickness, number of rootlets, length of rootlets and rootlet thickness) were recorded. Tubers were screened for curculigoside content through HPLC which showed the tubers from had Budhni, Sehore, M.P. with high curculigoside content (0.372±0.017%). The results of germination indicated that the apical buds of tubers had the highest germination percentage than the segments. *C. orchoides* is a shade loving crop, the experiments were laid out under three shade levels (0, 50 &75%) by applying 20 ton/ha FYM and 03 ton/ha poultry manure to study the growth performance of the tubers. Better growth and yield of rhizome (970 kg/ ha, fresh weight and 370kg/ ha, dry weight) was observed under 50% shade with 20 ton/ ha FYM.

Growth of apical bud of *C. orchoides*

Identification of prominent locations and best populations of *Terminalia chebula* (Harra) and *Anogeissus latifolia* (Dhawda) in Madhya Pradesh in terms of their active chemical ingredients (ICFRE-TFRI)

Fruits of *Terminalia chebula* (Harra) were collected from seven beats of three forest divisions i.e., Uamriya, Chhatarpur and Katni (Madhya Pradesh). Morphological data (length, width and weight) of Harra fruits were recorded. Fruits were processed and evaluated for tannin and gallic acid content using UV-Visible spectrophotometer and HPLC respectively. Maximum tannin content (35±8.47%) was found in Narwaha beat of Umariya and minimum (25.188±1.4%) in Karela beat of Katni. Similarly, highest gallic acid content (1.261±0.01%) was observed in Amoda beat of Chhatarpur and lowest (0.539±0.01%) in Kuwan beat of Katni.



HPLC chromatogram for gallic acid

Standardize hydroponic systems suitable for cultivation of medicianl plants under soil less condition with species - *Bacopa monnieri, Centella asiatica, Acorus calamus* and *Stevia rebaudiana* (ICFRE-TFRI)

Established two hydroponic systems, Nutrient film (NFT) and Deep Merge technique(DMT), with different potting media in outdoor and indoor conditions. The growth kinetics of different species were observed. The growth (height/length) of *B. monnieri, C. asiatica, A. calamus* and *S. rebaudiana* varied from 2 to 12 cm, 4 to 75 cm, 17.5 to 40 cm, and 23 to 50 cm, while number of leaves varied 3 to 20, 150 to 680, 32 to 140, 5 to 7 leaves, respectively in different hydroponic systems and nutrient solutions. Variation was also observed in thickness of *B. monnieri* (0.26-0.59 mm), *C. asiatica* (0.23-0.31mm), *S. rebaudiana* (0.25-0.36 mm) leaves and *A. calamus* rhizomes thickness varied 5.38- 9.38 mm. Ethanol extractives and total phenolic contents in different species grown in different system varied from 0.9 to 3.8% and 1.1 to 5.2%, respectively.

Acorus calamus in NFT system

Bacopa monnieri growth in NFT system

Hydroponics systems established at ICFRE-TFRI, Jabalpur

Ecological assessment, niche modeling, phytochemical investigation and standardization of propagation protocol of some important himalayan medicinal plants for mass multiplication of elite germplasm (ICFRE-HFRI)

Twenty three wild populations of *Cinnamomum tamala* (tej patta) were identfied from, Mandi district of Himachal Pradesh (09 populations), Nainital district of Uttarakhand (10 populations), and Kathua and Udhampur districts of Jammu & Kashmir Union Territory (04 populations). Population data of C. *tamala* recorded from 23 sites and associated herbs, shrubs and tree species were recorded. Maximum species richness was recorded at Khaddi (46 species) while minimum was recorded at Kaladungi (9). Density of *C. tamala* ranged from 20 (Mandi) to 120 individuals/hectare (Keya).

Natural populations of *C. tamala* in the Nainital district of Uttarakhand

Measuring diameter of *C. tamala*

Collection of leaves of *C. tamala* from Nanital, Uttarakhand

Shade drying of collected germplasm

2.6.3. Chemistry of NWFPs, Value Addition and Utilization

Natural dyes study of *Stevia ovata* (Candy leaf) and *Eupatorium adenophorum* (Kalobanmara) (ICFRE-FRI)

Aerial parts of *Stevia ovata* and *Eupatorium adenophorum* were collected from Mussoorie, Dhanolti and Buranskhanda in the month of August and September 2022 and shade dried material was sequentially extracted with petroleum ether, chloroform, methanol and 25% aqueous methanol, respective extracts were isolated and their yields were determined. Yield obtained for *Eupatorium adenophorum* and *Stevia ovata*, with petroleum-ether extract was 0.72% and 0.70%, Chloroform extract was 1.84% and 1.24%, Methanol extract was 1.11% and 1.86% and with aqueous Methanol extract was 1.51% and 1.94% respectively. Dyeing trials using individual dyes isolated from *S. ovata* and *E. adenophorum* were tested and trials on silk and wool fabrics were performed. Golden to dark brown, grey and black shades were obtained on the dyed fabrics. Blends of extracted dyes were developed through mixing varied proportions of the dyes and mordants and more shades were produced.

Shades of *Stevia Ovata*

Shades of *Eupatorium adenophorum*

Shades of Blends

Phytochemical examination of *Eupatorium adenophorum* (ICFRE-FRI)

In *Eupatorium adenophorum* the yield of essential oil was 1.065% on dry weight basis. GC-MS analysis of essential oil led to identification of 24 components, of which amorph-4-en-7-ol (28.25%), was the major constituent. This finding revealed that the herb under study is of amorph-4-en-7-ol chemotype.

Bioprospecting for industrial utilization of invasive weed *Hyptis suaveolens* (L.) Poit (ICFRE-FRI)

Aerial parts of *Hyptis suaveolens* were collected from Maldevta (Dehradun), Aamwala, Uparla village (Raipur Block), Dehradun and Budhavan Forest nursery in Mohand, shade dried, hydro-distilled and their light green colored essential oils were isolated with yield of 0.3%, 0.45%, and 0.15%, respectively. GC-MS analysis of the essential oils of Aamwala, Uparla village and Budhavan Forest nursery led to establish their chemical compositions. The oil of Aamwala, Uparla village was rich in monoterpenoids (75.21%) with β-sabinene (19.86%), α-phellandrene (9.33%), β- phellandrene (7.94), terpinen-4-ol (7.5%) and γ- terpinene (4.68%) as major constituents while the oil from Budhavan Forest nursery was dominated by sesquiterpenoids (59.52%) represented by β- caryophyllene (10.71%), 4 (10) thujene (9.83%), spathulenol (7.63%), β-terpinolene (5.82%) and *trans* –(α)- bergamotol (4.57%) as the main compounds.

Bioprospecting potential of Red sanders, *Pterocarpus santalinus* Linn.f., with special reference to health care and skin care properties (ICFRE-IFGTB)

Molecular docking studies of the phytocompounds identified in the heartwood samples of *Pterocarpus santalinus* against the targeted ligand proteins showed a higher docking score of 2.48 to -8.47 (varies with ligands) - a very negative score corresponds to a strong binding and a less negative or even positive score corresponds to a weak or non-existing binding for anti-diabetic activity and anti-microbial activity, providing a positive signal for the development of healthcare products. A natural handmade soap named **'Royalseema ICFRE-Red Sanders Soap'** has been developed from Red sanders extract containing 33 % active agent 'Hydnocarpic acid'and Marotti seed oil (*Hydnocarpus pentandra*) compounds, soap possessed anti-microbial, anti-inflammatory and antibiotic properties. An application was filed to obtain trade mark for the soap.

BIOCURE: A medicinal plant perspective for potential viral inhibitors for severe SARS-CoV2 acute infection (ICFRE-IFGTB)

GC-MS/MS analysis of plant extracts of *Asparagus racemosus*, *Boerhavia diffusa*, *Cassia occidentalis*, *Cissus quadrangularis*, *Clerodendrum inerme*, *Wrightia tinctoria, Stereospermum suaveolens*, *Salacia chinensis, Sphaeranthus indicus* and *Strobilanthes callosa* revealed the presence of Phytol, a ligand against the SARS-CoV-2 in plant samples. Other anti-viral compounds -Campesterol, Stigmasterol, Gamma Sitosterol, Lupeol, Quinine, α-amyrin, Bufotalin, Colchicine, Scillarenin were also recorded. Bioactive compounds of the plant extracts were reported to show more than 50% anti-inflammatory activity showing that the species selected has potential for development of herbal products.

2.7
FOREST PROTECTION

A. PLAN

- Completed 02
- Ongoing 04
- New 02

B. EXTERNALLY AIDED

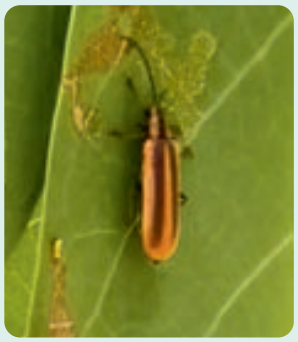
- Completed 01
- Ongoing 06
- New 04

2.7.1. Insects pests, diseases and control

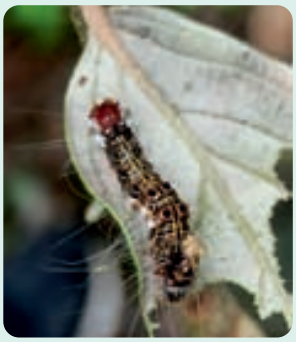
Insect pests of Western Himalayan Oaks and their Control (ICFRE-HFRI)

In the Oak forests (five species of oaks) of Himachal Pradesh, a total of 102 species of insect pests were recorded. Life cycles of serious insect pests i.e., *Heterocrasa expansalis*, *Trabala vishnou*, *Cerace stipatana*, *Curculio glandium*, *Somena scintillans* and *Cynips* sp. were studied in the lab. Field trials were conducted to check the efficacy of various management practices (treatments) against serious insect pests of oaks. Among the management practices, mechanical method was successfully applied to control the population of defoliator infesting *Quercus flouribunda* (Moru Oak) at Bhrundhar site (Manali). Selected treatments of Insecticide (Chlorpyriphos), commercial biopesticide (Nimbicidine), native plant formulations (Pisssumar, *Boenninghausenia albiflora* and Sama, *Engelhardia roxburghiana*), parasitoides/predators and HMOs were applied to check their efficacy against the serious insect pests of Oaks. It was observed that 2% aqueous extract of *B. albiflora* caused 72% mortality of *Heterocrasa expansalis* (pest of *Q. floribunda*) after 72 hours of application. The LD_{50} values of formulations of *B. albiflora* (0.31% w/v, 0.79% w/v and 0.79% w/v) and *E. roxburghiana* (0.19% w/v, 0.12% w/v and 0.12% w/v) were calculated after 24 hrs, 48 hrs and 72 hrs to find the applicable dose. The average mortality of insect pests was found to be 99.5%, 79%, 72% and 65% respectively with treatments chloropyrophos (0.5ml), Neem oil (1.5%), Pissumar (2%) and *Engelhardia roxburghiana* (3%). The results indicated that these treatments differ significantly ($p \geq 0.05$) and have potential to manage the insect pests of forest nurseries and plantations.

Natural enemies like predators and parasitoids were isolated and tried to evaluate their efficacy against the selected insect pests of Oaks. Maximum mortality of 47% was found in the order Lepidoptera when treated with parasitoids whereas, minimum mortality of 13% was recorded in the order Orthoptera.



Purpuricenus montanus (Defoliator of Ban Oak)



Lepidopteran Larva (Defoliator of Ban Oak)

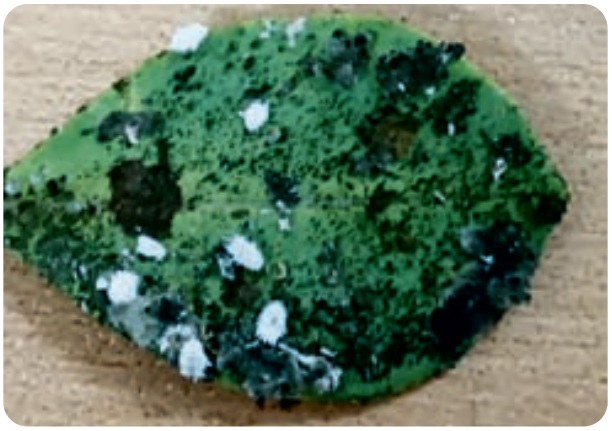
Insect pest management of poplar using bio-pesticides. (2020-2024) (ICFRE-FRI)

Insect pest management of poplar was targeted and bioefficacy experiments were undertaken under laboratory condition. Bio-pesticide preparated from ethanol leaf extract of *Tegetes patula* (Marigold), *Azadirachta indica* (Neem), *Catharanthus roseus* (sadabahar); *Pongamia pinnata* (Karanj) exhibited 36.45%, 8.67%, 27.6% and 52.75% mortality, respectively against *Clostera cupreata*. Market based bio-formulations NCS-F16, and 'Minchu' has shown about 61.34 % and 16.25 % mortality respectively under lab study. Additionally, bio-efficacy of entomopathogenic nematode was also conducted on larval and pupal stages of *Clostera* species and *Phalantha phalantha* species exhibited 89.8% and 68.46% mortality, respectively.

Studies on the mealy bug *Dysmicoccus brevipes* Cockerell (Hemiptera: Pseudococcidae) and the bark feeding borer *Indarbela quadrinotata* Walker (Lepidoptera: Cossidae/ Indarbelidae) on Mangroves (ICFRE-IWST)

Conducted extensive field visits to Airoli, Mumbai for monitoring and collecting the pests of mangroves. Laboratory experiments were conducted to study the efficacy of entomopathogenic fungi and neem based product Neemazal against *Indarbela quadrinotata* and *Dysmicoccus brevipes.* It was found that application of Neemazal (0.5%) caused 100 % mortality (7 DAT). Whereas, formulations of entomopathogenic fungi *Lecanicillium lecanii* and *Beauveria bassiana* resulted in 65.85 and 58.54 % mortality, respectively of *D. brevipes* compared to other treatments under laboratory conditions. Under field conditions, Neemazal resulted in highest mealybug mortality percent of 76.11 and 75.64 on *Avicennia marina* and *Sonneratia apetala*, respectively. Neemazal and *B. bassiana* was found to be effective in causing 88.89 and 77.78% larval mortality of *I. quadrinotata* larvae under laboratory conditions. Various predators of *D. brevipes* like *Cryptolaemus montrouzieri*, *Chrysoperla* sp., *Scymnus* sp., *Leptomastix dactylopii*, *Spalgisepeus* and a variety of spiders, were recorded from mangroves during the study.

Indarbela quadrinotata infestation



Leaf infested with *D. brevipes*

Studies on semiochemicals for management of Sal heartwood borer, *Hoplocerambyx spinicornis* Newman (Coleoptera: Cerambycidae) (ICFRE-FRI)

Bast samples collected from Timli and Jhajra range, and New Forest FRI, Dehradun and were subjected to chemical extraction and biologically active bio-efficacy studies. Biologically active kairomonal compound identified in and fresh bast were tested for attractancy at different doses ranging from 50 to 200 micro liter at three times of a day. Attractancy potential were worked out in the laboratory and B-6 and S-8 fraction exhibited highest attractancy for beetle at 1500 micro liter. Among these two fractions (B-6 and S-8) four pure compounds i.e. ALPIN, MA, HXD and (R+LIM) were identified as attractant for the beetles at 25, 50,75 and 100 micro liter doses. Constituent identified for kairomonal activities were: Alkane hydrocarbons, fatty acids and their esters, monoterpenoid and an aromatic compound.

Screening of poplar clones for tolerance against poplar leaf defoliator, *Clostera cupreata* But. Assessment of defoliation effect in poplar tree and selection of superior clone of poplar against insect defoliator for farmers use (ICFRE-FRI)

Clostera spp. are major defoliators of poplar (*Populus deltoides*) and they defoliate about 50-100% trees in India. Study was undertaken to assess the effect of artificial defoliation on poplar growth under field conditions and four defoliation from 25% to 100%, were done in addition to control. It was recorded that tree height decreased with increase in defoliation level. Loss in height increment was recorded to be 18.41 to 60.01%, loss in DBH increment was 20.49 to 60.84%, and loss is tree volume increment was 24.84 to 65.57% as compared to control, due to defoliation done manually during July to October.

Study on pathosystem of phytoplasma disease associated with Bamboo based agroforestry system (ICFRE-IWST)

The project aims to study the prevalence of symptoms associated with phytoplasma disease in *Dendrocalamus stocksii* and *Dendrocalamus strictus* plantations across the state of Karnataka. The disease symptoms were observed in the bamboo plantations in Mandur-Jyothipura reserve forest, Bengaluru Circle, Karnataka Forest Department and in some parts of Urban Bengaluru. The incidence of the Witches Broom symptoms were more prominent in *Dendrocalamus stocksii* and *Dendrocalamus strictus* species growing in dry zones.

Witches Broom symptoms associated with Phytoplasma in *Dendrocalamus strictus* surviving in dry zones of the state of Karnataka, depicting the destruction of culms

Studies on changing forest insect pest status of High Altitudinal Transitional Zone and their management in Himachal Pradesh (Phase II) (ICFRE-HFRI)

A defoliating insect *Yponomeuta padella* (Ermine moth) belonging to the family Yponomeutidae (Lepidoptera) was recorded for the first time attacking heavily on trees of Birdcherry (*Prunus cornuta*) in the high altitude transition zones (HATZ) of NW Himalaya. So far 62 Insect-pests species belonging to the orders viz., Lepidoptera, Orthoptera, Hymnoptera, Dermaptera, Coleoptera were collected from different sites inhabiting plant species like *Abies pindrow,* Kharshu oak*, Rhododendron* (spp.,) *Acer* (spp.,) Birdcherry etc.

Different control measures attempted in the lab and field to control the serious insect pests of HATZ. The study revealed that Nimbicidine treatment on insect pests of *Abies pindrow* (*Dioryctria abietella*), *Betula utilis* (*Aphis gossypii*), *Quercus leucotrichophora* (*Heterocrasa expansalis*), *Rhododendron* spp. (*Lyctus* sp.) resulted in mortality of insect pests like *Dioryctria abietella* (79.8 %), *Heterocrasa expansalis* (75%) and *Lyctus* sp. (85%). The LD_{50} values of formualtions of *B. albiflora* (0.31% w/v, 0.79% w/v and 0.79% w/v) and *Engelhardia roxburghiana* (0.19% w/v, 0.12% w/v and 0.12% w/v) were calculated after 24 hrs, 48 hrs, and 72 hrs respectively. The data analysis revealed that the average mortality of insect pest was found to be 98%, 79%, 72% and 65% respectively. The studies further indicated that these selected formulation have potential to be developed as commercial biopesticides and can be a suitable alternate to toxic insecticides. Eco-friendly techniques were developed for control of *Ypnomeuta padella* (Ermine moth) (A defoliator of Bird Cherry) by the use of plant extracts of *Boenninghausenia albiflora* and *Engelhardia roxburghiana.*

2.7.2. Mycorrhizae, rhizobia and other useful microbes

Effect of elevated CO_2 on agroforestry tree species (*Eucalyptus tereticornis* and *Populus deltoides*) associated with beneficial microbes (ICFRE-FRI)

Isolation of 237 bacterial isolates has been done and out of these 60 bacterial isolates showing PGPR activity have been maintained on the basis of their plant growth activity. The parameters related to growth such as plant height, collar diameter, number of leaves, number of branches was measured and physiological traits were recorded in *Eucalyptus*. The seedlings were treated with four treatments consisting of bacterial isolates (T1 and T2), *Tricoderma* sp. (T3) and control (T4). Under elevated CO_2 conditions growth was more in plants inoculated with T3 viz., height (95.49 cm), number of leaves (84.6) and branches (3.8) and average collar diameter (3.18).

Under elevated CO_2 conditions, Photosynthetic rate was higher in T1 (6.11A-µmol $CO_2 m^{-2} s^{-1}$) and T3 (5.26 A-µmol $CO_2 m^{-2} s^{-1}$) , Stomatal conductance was higher in T1 (0.32Gs-mol H_2O m-2 s^{-1}) and T3 (0.38 Gs-mol H_2O m-2 s^{-1}). T2 showed reduced transpiration rate in both ambient (2.77 E- mmol H_2O $m^{-2}S^{-1}$) as well as in elevated CO_2 condition (2.99 E-mmol H_2O $m^{-2}S^{-1}$). T1 (1.96) showed higher water use efficiency in elevated CO_2 condition.

In vitro mass propagation of *Angelica glauca* Edgew. rootlet biomass for the production of bioactive phytocompounds using bio-inoculation technology (ICFRE-FRI)

Endophytic and endomycorrhizal strains isolated from the roots and soil samples of *Angelica galuca* respectively. Two elite/dominant strains of endomycorrhizal fungi were screened and mass multiplied. A bioinoculation nursery experiment was setup in collaboration with High Altitude Plant Physiology Research Centre (HAPPRC), HNB Garhwal University at High altitude Nursery in Baniykund, Chopta. The growth data of the bioinoculation experiment was collected at 180 days and 360 days after inoculation. Maximum shoot height was observed in the treatment T2 (AM_1) at both 180 days (13.2 ± 3.72 cm) and 360 days (38.16 ± 6.72 cm) of inoculation followed by treatment T3 (AM_1+AM_2) at both 180 (10.2 ± 3.60 cm) and 360 (32.86 ± 8.94 cm) days of inoculation. Fresh shoot and root biomass was highest in treatment T2 (AM_1) (shoot biomass 28.21 ± 7.68 g; root biomass 47.16 ± 15.77 g) followed by treatment T4 (AM_1+AM_2) (shoot biomass 26.17 ± 6.36 g; root biomass 46.19 ± 9.74 g).

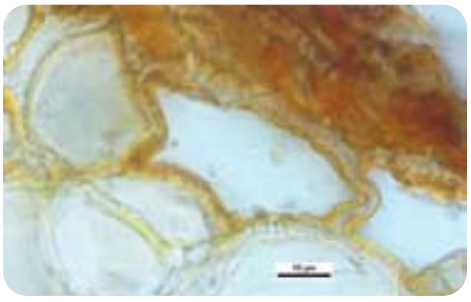
Bioinoculation effect on *Angelica galuca* seedlings and data recording

Study on impact of mycorrhizal inoculations on the growth and field performance of *Abies pindrow* and *Picea smithiana* (ICFRE-HFRI)

Identified 38 mycorrhizal associates of *A. pindrow* and *P. smithiana*. Morphoanatomical characterization of mycorrhizal roots revealed 11 and 6 mycorrhizal morphotypes in *A. pindrow* and *P. smithiana*, respectively. In *A. pindrow*, mantle sheath was 8-15µm thick and Hartig net was recorded up to 3 cortical layers. In *P. smithiana*, mantle sheath was 5-14 µm thick and Hartig net was recorded up to 2 cortical layers; cortical cells also showed coils of fungal hyphae. Nursery stock was raised by artificial inoculation with mycorrhizal fungi. Meta-genomics analysis of mycorrhizal roots of *A. pindrow* revealed association of 188 fungal genera; among these 26 were ectomycorrhizal. Mass inoculum of *Geastrum, Ramaria,* and *Boletus* sp. was prepared on wheat grains and utilized for artificial inoculation during seed sowing. Nursery of both conifers was established by artificial inoculations of mycorrhizal fungi and recorded the growth parameters. Mycorrhizal structures were observed in roots of the inoculated seedlings. The observation on the growth parameters of seedlings revealed 0.5- 12.5 per cent higher growth in inoculated seedlings.

A. pindrow seedlings in polybags at FRS Shilaru

Mycorrhizal roots of *P. Smithiana*



T.S. of *A. pindrow* root

12 months old seedlings of *P. smithiana*

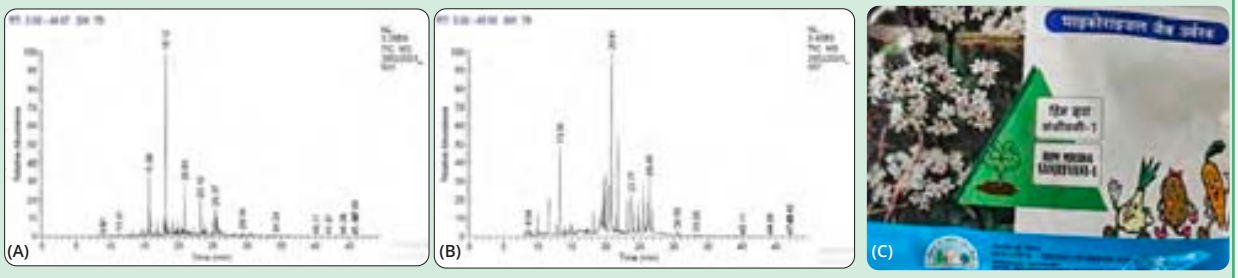
Studies on effect of AM inoculations on the active ingredient contents and biomass production in *Angelica glauca* Edgew. and *Valeriana jatamansi* Jones (ICFRE-HFRI)

A. glauca and *V. jatamansi* cultivated by artificial inoculation with mycorrhizal fungi were harvested. The observation on growth parameters revealed higher growth metrics in the inoculated treatments in nursery as well in apple orchard. In two years old *V. jatamansi*, the shoot dry weight and root dry weight were recorded maximum in inoculated treatments as compared to control. The HPLC analysis of rhizomes of *V. jatamansi* revealed high content of Valepotriates in the plants cultivated by mycorrhizal inoculations. The content of Valepotriates viz. Valtrate, Acevaltrate, Didrovaltrate and IV+Didrovaltrate was recorded 1.68%, 0.14%, 0.17% and 0.43% respectively in the inoculated plants while it was recorded as 1.51%, 0.08%, 0.11% and 0.34% in control treatment. The GC-MS analysis of rhizome extracts of *V. jatamansi* and *A. glauca* revealed the presence of unique compounds in the inoculated plants. AMF biofertilizer formulation was prepared and registered with Directorate of Agriculture, Himachal Pradesh. Capacity building training on production and application of AMF biofertilizers was conducted for farmers.

Him MridaSanjeevani -1

Mycorrhizae play a major role in the absorption of phosphorus. It increases the availability of phosphorus from the soil by 60-80%. It also increases the activity of nitrogen absorption and other minerals. Mycorrhizae increase the concentration of secondary metabolites in plants and also protect them from pathogen attack.

Him MridaSanjeevani -1 AMF formulation contain over 100 viable propagule of native strains of *Funneliformis mosseae* syn. *Glomus mosseae* (arbuscular mycorrhizal fungi-AMF) per gram of the formulation was developed. The efficacy of formulation was evaluated for the cultivation of two temperate medicinal plants viz. *Angelica glauca* and *Valeriana jatamansi* in the nursery of ICFRE-HFRI Shimla located at Shillaru, Narkanda, district Shimla. More than 20% increase in the fresh and dry biomass of these medicinal plants was recorded. HPLC analysis of rhizomes of *V. jatamansi* revealed higher content of Valepotriates viz. Valtrate, Acevaltrate, Didrovaltrate, IVHD valtrate in the inoculated plants. GCMS analysis of both plants revealed presence of more compounds in the inoculated plants.



(A, B) GC-MS spectra of root extracts of *A. glauca* and *V. jatamansi*; (C) AMF Biofertilizer formulation

Isolation and characterization of *Rhizobium* strains from leguminous trees and their evaluation in biological nitrogen fixation (ICFRE-FRI)

The different sites in Rudarprayag and Chamoli districts of Uttarakhand were visited for collection of root nodules from the rhizosphere of *Acacia catechu, Erythrina variegata, Bauhinia variegata* and *Erythrina blackei* in Uttarakhand during last year. In all, total 10 *Rhizobium* isolates/strains were isolated from collected nodules samples. Isolates/strains gave positive results for Congo red test, Ammonia production test, methyl red test and VP test. However, two strains *e.g.* FRI/ASR/EV-1 and FRI/NT/EV-3, were unable to produce acid in BTB.

All *Rhizobium* strains/isolates were well grown in *p*H range 7.0 and 9.0 but sensitive for *p*H 5.0. All of the isolates grew in the presence of 2 % NaCl concentration but strain FRI/DB/AC-2 was highly sensitive whereas FRI/RAI/AC-4 was slightly sensitive.

The bacteria isolated from *Acacia catechu* like *Rhizobium* isolates no. FRI/TR/AC-6 had more leghemoglobin content (2.17mg/g of nodules), followed by FRI/ASR/AC-1, (2.45 mg/g of nodules).

A colorimetric method (Acetylene Reduction Assay) was also used to estimate nitrogenase activity in *Rhizobium* isolates/strains. The *Rhizobium* strain FRI/RAI/AC-4 had fixed the maximum nitrogen fixation (precipitation) *i.e.* 1293 µM C_2H_2 /g while the minimum nitrogen fixation of isolate from *Acacia*

catechu was by isolate/strain *e.g.* FRI/DB/AC-2 (503.3 µM C_2H_2 /g). On the other hand, *Rhizobium* isolate/strain isolated from *Erythrina variegata*, the isolate no. FRI/RBS/EV-2 had more nitrogen fixation (573.3 µM C_2H_2 /g) and minimum nitrogen was fixed by strain no. FRI/NT/EV-3 *i.e.* 363.3 µM C_2H_2 /g. Cross inoculation study in Leonard jar assembly with sterilized soil was conducted and it revealed that some of the isolated strains/isolates possess the ability to produced nodules when they are cross inoculated with other seedlings. In *Dalbergia sissoo, Bauhinia variegata* and *Peltophorum pterocarpum* without any inoculants have minimum shoot length than inoculated seedlings. The control seedlings even did not have any nodules whereas inoculated seedlings had good number of nodules in case of *D. sissoo.* The more shoot length (15.2cm) in *D. sissoo* was found in treatment T_3 (consortium of FRI/AC-1 to AC-6). Similarly, more shoot length (13.1cm) in *B. variegata* was found in same treatment T3 (consortium of FRI/AC-1 to AC-6). Whereas more shoot length (23cm) in *P. pterocarpum* was found in treatment T_2 (FRI/RAI/AC-4). The highest number of nodules count (22±0.57) was observed in treatment T_2 (FRI/RAI/AC-4) in root of *Dalbergia sissoo* seedlings.

Dalberia sissoo seedlings inoculated with different Rizobium isolates/strains

Identification of suitable biofertilizers for stumps and rooted stem cuttings of *Tectona grandis* for successful establishment in the territorial divisions of Kerala (ICFRE-IFGTB)

Among the 15 treatments of VAM, Phosphobacterium, *Azotobacter*, *Trichoderma* and *Azospirillum* inoculated in the stumps of *Tectona grandis,* combinations of biofertilizers improved the growth and biomass of seedlings than individual or control seedlings and best growth was recorded in seedlings treated with *Azospirillum* and *Azotobacter*. It was observed that *Azotobacter* sp. and *A. brasilense* combinations showed better performance in the planting stocks maintained for planting in the territorial division of Konni, Kerala.

Teak stumps inoculated with biofertilizers

Growth and biomass of teak stumps under different biofertilizer treatments

Code	Biofertilizer treatments	Shoot Length (cm) seedling $^{-1}$	Girth (mm) seedling^{-1}
T1	Control	21.9(±0.04)	2.26(±0.01)
T2	VAM	22(±0.04)	3.07(±0.17)
T3	*Azospirillum*	21.2(±0.37)	2.89(±0.18)
T4	*Azotobacter*	19(±0.04)	3.01(±0.09)
T5	Phosphate Solubilizing Bacteria (PSB)	19(±0.36)	2.01(±0.23)
T6	*Azospirillum* + *Azotobacter*	42(±0.04)	4.56(±0.18)
T7	*Azospirillum* + PSB	37(±0.023)	3.06(±0.17)
T8	*Azotobacter* + PSB	30(±0.03)	3.64(±0.26)
T9	*Azotobacter* + VAM	27(±0.03)	3.98(±0.39)
T10	*Azospirillum* + VAM	29(±0.04)	3.73(±0.05)
T11	PSB+VAM	33(±0.046)	1.90(±0.67)
T12	PSB+VAM+*Azospirillum*	31(±0.03)	3.01(±0.28)
T13	PSB+VAM+*Azotobacter*	26(±0.02)	3.37(±0.02)
T14	PSB+VAM+*Azotobacter*+*Azospirillum*	29(±0.05)	3.23(±0.34)
T15	PSB+VAM+*Azotobacter*+*Azospirillium*	33(±0.04)	3.33(±0.29)

2.7.3. Weeds and Invasive species

Studies on exploration of Biological Control of *Ageratina adenophora* (Sprengel) (Asteraceae) in Uttarakhand Entomological aspect (ICFRE-FRI)

Field surveys carried out in Dehradun, Uttarkashi, Benog WLS, Chopta, Chamoli, Tehri and Rudraprayag to record insect fauna infesting *A. adenophora.* Infestation by Gall fly, *Procecidochares utilis* (Major), Thrips, grass hoppers, flower beetles was observed. Out of these insect fauna, only Gall fly (*Procecidochares utilis*) was found as a major biocontrol agent of this weed.

Gall fly infestation in *A. adenophora* at different locations in Uttarakhand

Study area	Average no. of galls/ plant	Average no. of larvae /gall	Gall fly infestation
Dehradun	1.38±0.12	2.00	Low
Badrinath	3.67±0.84	3.80	Moderate
Uttarkashi	4.89±1.03	4.40	Moderate to high
Benog	5.15±1.42	4.30	Moderate to high
Chamoli	7.26±1.58	4.80	High
Tehri	6.43±1.14	3.90	High
Rudraprayag	6.76±1.28	4.20	High

2.8
SCHEMES FUNDED BY NATIONAL AUTHORITY CAMPA

SCHEME-1

"Strengthening Forestry Research for Ecological Sustainability and Productivity Enhancement" (SFRESPE)

ICFRE is implementing a dedicated scheme entitled "Strengthening Forestry Research for Ecological sustainability and Productivity Enhancement" funded by National Authority, CAMPA, MoEF&CC, New Delhi. Under this scheme ICFRE is bringing in synergy in research by through collaboration amongst ICFRE institutes and also institutes outside ICFRE by implementing. 31 All India Coordinated Research Projects (AICRPs) and also undertaken studies of on Forest Genetic Resources. In a bid to equip the planners and managers with inputs to make suitable changes to the policies and to take informed decisions, ICFRE is undertaking studies in different areas of forestry sector on short term basis. The scheme is also implementing capacity building programmes to create awareness on REDD+ related issues, key concepts analysis of COP decisions on REDD+ and their relevance to India. The Council has developed an Extension Strategy which shall take care of the awareness to masses, taking technology to stakeholders, establishing pilot plantations, nurseries etc. To achieve the target of updating the knowledge of its scientists, technical and administrative staff, ICFRE has prepared an HRD plan under this scheme.

Through this scheme ICFRE aims to deliver patents, technologies and all possible technological know-how to stakeholders. ICFRE being primarily a research organization will provide an extensive base data for many economically and ecologically important issues for MoEF&CC. The scheme is for 5 years with budget of Rs. 313.67 crores and was initiated in February 2019.

Component-1: All India Coordinated Research Projects (AICRPs)

Testing and deployment of clones and seed sources of Casuarina for different planting environments and end-use applications

The main objective of study is to identify site and end-use specific planting material of *Casuarina* species and their hybrids for deploying in commercial plantations to benefit farmers with higher income and securing the raw material availability to wood-based industries. During 2022-23, four clonal trials and five progeny trials were established in Andhra Pradesh, Karnataka and Tamil Nadu. Early evaluation of clonal trials (established in previous two years) for survival and growth showed the best performance of clones CH1, CH2 and CH5 in most of the planting locations. The Navsari Agricultural University has recommended the cultivation of clone CH5 in the State of Gujarat.

Clonal trials established during 2022-23

Location of clonal trials	No. of trials	Month & year of planting
Katrambakkam and Mondipatti, Tamil Nadu	2	September 2022
Cudappah, Andhra Pradesh	1	December 2022
Attivata, Hoskotte, Karnataka	1	August 2022

Progeny trials established during 2022-23

Location of areas identified for planting	No. of trials	Month & year of planting	Remarks
Pugalur and Mondipatti, TN	2	December 2022	126 families
Kavali, Nellore, AP	1	July 2022	98 families
Gotipura, Karnataka	2	January 2023	45 families; 70 families

Survival of 82% in one-year old *Casuarina junghuhniana* families in a semi-arid site (Chettinad, Tamil Nadu; annual rainfall: 700 mm)

Superior growth performance of clone CH-5 in Navsari, Gujarat State. Two year old trees showed 10m height and 20 cm GBH.

Survival of 93% and fast growth of one-year old *Casuarina junghuhniana* families in Mulugu, Telangana State

Conservation, Improvement, Management and Promotion of Sandalwood (*Santalum album* Linn.) cultivation in India

Surveyed 30 natural/ naturalized populations of sandalwood from Rajasthan, Tamil Nadu and Karnataka and selected 556 trees for seed collection. Nursery was raised with 136 and 105 seed lots from single tree selections at ICFRE-IWST and ICFRE-IFGTB, respectively for establishing the base population of sandalwood.

The first set of 42 genome-wide SSR markers and 12 EST-SSRs were short-listed and validated in 50 individuals representing diverse sandalwood populations from Kerala, Tamil Nadu, Madhya Pradesh, Karnataka and Odisha. The population from Chikkanahalli Sandal Reserve, Mysore had highest genetic diversity index with highest number of private alleles and showed maximum genetic distance from Marayoor Sandal reserve, Kerala. Further, 90% genetic diversity was distributed within populations while 10% was recorded among populations.

Established 12 sandalwood based agroforestry trials in Rajasthan (2), Gujarat (1), Madhya Pradesh (2), Tamil Nadu (3), Punjab (2) and Karnataka (2) with known seed sources. Survival varied from 31 to 95%. The net economic return from the intercrops in Sandalwood–Shisham-Guava agroforestry trial at Punjab was estimated at Rs. 62,724.00/ha from groundnut and Rs. 29,583.00/ha from cowpea. The economic return of finger millet from the trial established at H.D. Kote, Karnataka was Rs. 80,000.00/ ha.

For control and management of infestation by red stem borer (*Zeuzera coffeae*) on sandalwood, light traps were found to be an eco-friendly method. The incidence of stem borer infestation was reduced from 16.8% to 3.5% after installation of light traps in 1-2 year old sandalwood plantations.

Sandalwood nursery with single tree selections

Sandalwood-cowpea agroforestry system at Ludhiana, Punjab

Eucalyptus improvement

The project aims at establishment of Multi Locational Trials (MLTs) for clonal testing across the country. About 200 selected clones were mass multiplied individually numbered and transported to IFB, IFP, TFRI, CSFER, FRI, AFRI for establishment of MLTs and germplasm bank. During the current year, established four MLTs viz., at Thyagadurgam by IFGTB, Bigahiyaby FRCER, Jaheerabad by IFB and Jaisalmer by AFRI. The previously established nine MLTs were maintained and growth data collected.

Inter and intra specific hybrids in eucalypts were produced for generating vigorous hybrid combinations and heterotic individuals. Totally about 4000 hybrid plants produced from 12 hybrid crosses and three hybrid progeny evaluation trials established at Thiyagadurgam, Salem and Kunathurin Tamil Nadu. Six growth performance would be recorded every year to identify the individuals with hybrid vigour.

Maintenance and management activities were carried out in the established CSO at Gudalur, Chennai and field trial of 25 seed lots of 5 species of Eucalyptus (*E. pellita*, *E. urophylla*, *E. longirostrata*, *E. moluccana* and *E. sideroxylon*).

Agrobacterium-mediated transformation experiments were carried out. Generated eight plantlets under hygromycin selection from callusing explants co-cultivated with AGL1 strain harbouring pCAMBIA1305.1::CaMV: *EcHKT1;1* hpRNA construct. Four Eucalyptus transgenic events B5, B6, B9 and B10 were PCR confirmed. Putative transgenics were generated using root-preferential and salt-inducible MsPRP2 promoter driven *EcHKT1;1*hpRNAi construct and confirmed by PCR analysis. The PCR confirmed transgenic plantlets were multiplied. The Li hpRNAi putative transgenics were PCR confirmed using the T-DNA specific primers. The PCR confirmed Li transgenics were rooted and is being hardened in transgenic greenhouse for further characterization.

For identification of secondary development specific miRNAs in *E. tereticornis,* association analysis was conducted with the 120 SNPs and wood phenotypes of 10 individuals. A total of 84 SNPs were associated with holocellulose and 36 SNPs were associated with lignin.

MLT of Eucalyptus at Chandwa established by IFB (1 years old)

MLT at TFRI Campus, Jabalpur by TFRI (2 years old)

Maintenance work in MLT at Pudukottai by IFGTB (2 years old)

Planting of grafted seed orchard of Eucalyptus at Gudalur, Chennai

All India Coordinated project on Bamboos

More than 100 new CPCs of eight bamboo species were selected across the country and the superior clumps were mass propagated for their dissemination to the users. Established Rhizome banks of selected clumps at FRI, IFGTB, HFRI and IFP. *In vitro* starter cultures for four species (*B. tulda*, *D. asper, D. stocksii* and *D. brandisii*) were produced and made available to the users. Produced 10,000 hardened plants of eight species (*B. balcooa*, *B. bambos, B. tulda*, *B. vulgaris, D. stocksii*, *D. brandisii, D. strictus, D. hamiltonii* and *D. asper*).

Kraft pulping of 12 collected CPCs of *D. strictus* at 16%, 18% and 20% alkalinity analysed and total pulp yield and kappa number were estimated. Pulp yield varied from 46-54% and kappa number varied from 17-44. Maximum Kraft pulp yield was recorded for two CPCs viz. FRI-DS-6-16 and FRI-DS-10-4.

Management protocols of insect pests in nursery (against *Crypsiptya coclesalis, Hieroglyphus banian*) and in plantations (against *Pioneaflavo fimbriata*) worked out effectively. For the chemical control of the defoliators, Cypermethrin+Chlorpyriphos was most effective at 0.04 per cent concentration with 71.63% control of *C. coclesalis* and 71.03% control of *H. banian*. Same combination was effective at 0.08 per cent concentration with 76.20% control of *Pioneaflavo fimbriata.*

A new four-point bamboo bending testing machine designed, developed, installed and commissioned for testing large size bamboo pole (upto 30 feet long) as per new Indian standard IS:6874(2008) and International standards ISO:22157 (2004/2019).

Soil Block bioassay of *B. balcooa, D. strictus and B. tulda* fumigated with Neem seed oil showed upto 60% less weight loss over control samples against *Pycnoporus sanguineus* and *Poria monticola* fungus. Results of petri plate bioassay showed complete inhibition of stain and rot fungus at 1% concentration of Neem seed oil.

Estimation of genetic diversity of *B. balcooa* using EST-SSR marker in Northeast India completed and identified three distinct populations. A comprehensive set of 21596 novel SSR markers developed and 36 SSRs were validated in *D. longispathus*, which can be utilized for their application in population genetic analysis.

Developed short to medium term seed storage protocols for ex-situ conservation of five bamboo species. Effect of seed storage condition on germination percentage and storage period for different bamboo species are as follows:

Species	Storage condition	Storage Period	Gemination %
Dendrocalamus strictus	5°C with 8% seed moisture content MC	17 months	92%
Bambusa bambos	5°C temperature for at 10% MC	20 months	90%
Dendrocalamus longispathus	cloth bag at 5°C with 10% MC	12 months	42%
Bambusa tulda	cloth bag at 5°C with 10% MC	12 months	67%
Bambusa vulgaris	cloth bag at 5°C with 10% MC	19 months	38%

All India Bamboo Flowering Database is under development. Information on the flowering records across the country is being collected**.** Flowering data of 42 Bamboo sps. has been collected.

Conducted five skill development training on bamboo handicraft. Technical Bulletins on 'Propagation and Management of different species of Bamboos' was published in English and Hindi languages.

Skill development training on bamboo handicrafts

A new four-point bamboo bending testing machinedesigned

Bambusa bambos seed germinationa and transplanted seedlings

Technical Bulletins on 'Propagation and Management of different species of Bamboos'

Development of dielectric heating-based processing technologies for solid-wood, bamboo, and their composites

Designed, fabricated and installed a "pilot scale microwave vacuum dryer". Microwave vacuum drying characteristics of two bamboo species *Bambusa tulda* and *D. asper* and three wood species poplar, eucalyptus and *Melia dubia* were evaluated and furniture and turned handicraft products were developed.

Table legs developed from *D. asper*

Turned handicrafts developed from *D. asper*

Carved pillars developed from *D. asper*

Water-proof bamboo roof and turnery suitable for high quality furniture and joinery from *B. tulda*

Products from Eucalyptus tree trunk and branches

Products from Poplar tree trunk

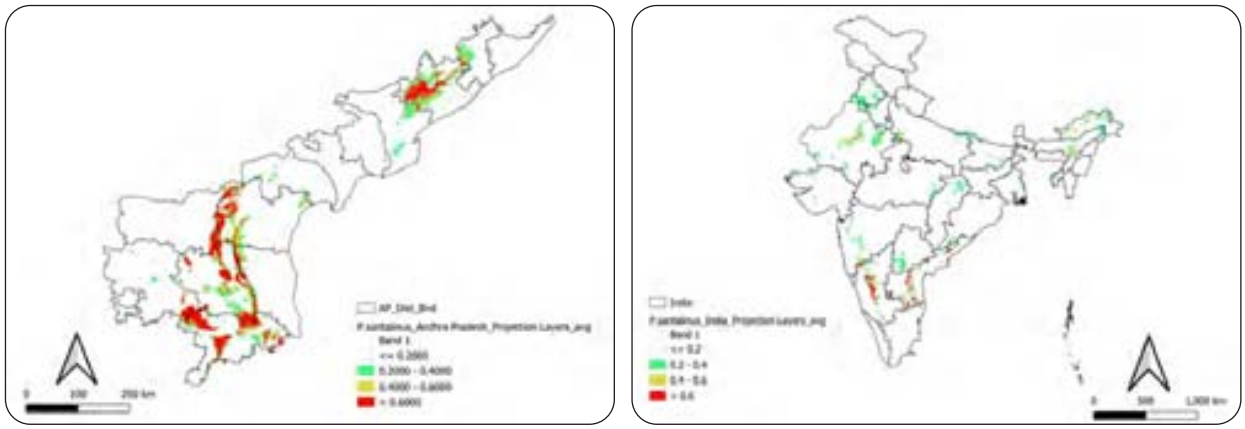
Fabrication, testing and integration of "Microwave based moisture meter system" for wood is completed. The calibration of developed Microwave based moisture meter system is being carried out.

In the green wood turning, *Melia dubia* and eucalyptus green wood were turned to expose the end grain all along around the wood in order to increase drying rate from end grain surface during conventional drying. Results of these studies showed that within the short period moisture content reached below FSP (fiber saturation point) as compare to unturned green wood. Provisional patent applied for "End grain drying of green turned timber" (patent No.62188 dated 16-06-2022).

MW based wood moisture measurement system

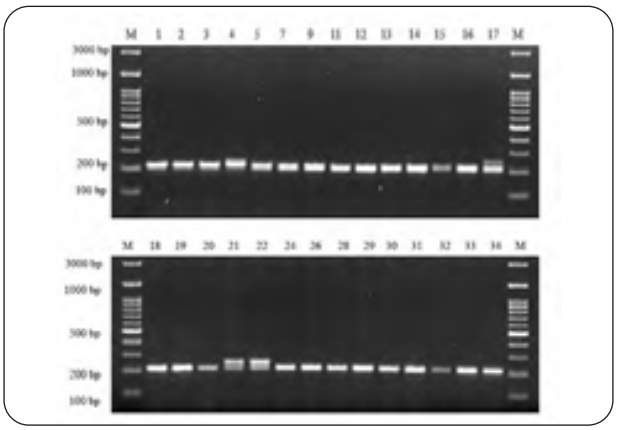
Conservation and Productivity Improvement of Red Sanders

The six delineated provenances, spread over 36 forest beats in Andhra Pradesh were surveyed and seeds were collected from 145 trees during 2022. The seeds were put for germination at IFB Hyderabad and BIOTRIM, Tirupati. Altogether, 3724 seedlings have been raised at BIOTRIM and IFB. Fresh seeds were collected from 58 plus trees and were used for raising 1733 half-sib progenies at IFB and BIOTRIM. Environmental niche modelling was performed with 1259 presence locations, 19 bioclimatic variables and elevation raster layers with Maxent modelling software. Bioclimatic variables with maximum loading were identified through their contribution to model building and jackknife test of variable importance. Potential habitat suitability maps were generated for Andhra Pradesh and whole of India. Cutting treated with NAA 3000 ppm in combination with IBA 3000 ppm gave 70% rooting success and qualitatively better roots. *In-vitro* shoot multiplication, the combination of BAP 2.5 mg/lit and TDZ 2.0 mg/lit on MS medium resulted in single shoot with small branches, which were further sub cultured to induce multiple shoots. A field trial was established at Dharmapuri, Tamil Nadu with Red sanders seedlings inoculated with AM fungi, Rhizobium and Phosphobacteria alone, in six different combinations along with control. 43 EST-SSR primers were screened, out of which 28 were found to be monomorphic and 15 were polymorphic. Polymorphic EST-SSRs were used to generate marker data for the genetic diversity and plus tree characterization studies. Electric Resonance tomography (ERT) data and actual heart wood cores were collected from plantations in Tamil Nadu and Andhra Pradesh and the tomogram library was updated. A linear regression model was fitted ($Y=0.8579x+2.4357$, $R^2=0.9756$) for standardizing functional relationship between actual and ERT heartwood data. For stable carbon isotope composition ($^{13}C/^{12}C$)592 Red sanders heart wood cores were analysed, however, no geographic variation was detected. Stable carbon isotope composition ($^{13}C/^{12}C$) of α-cellulose component was explored to further refine the process.



Potentially suitable habitats for cultivation of Red sanders in Andhra Pradesh and India

Adventitious root formation in air layering of coppice shoots of Red sanders



EST-SSR profile of UoHPNR3 flanking the SSR motif (TTTCT)5 on genomic DNA samples from Nellore region of Andhra Pradesh

Quality Teak Production: Capitalizing on Cloning

Short rotation teak is grown in plantations worldwide. However, it has not taken off in India due to technical, biological and marketing constraints. This AICRP aimed to introduce micropropagation for the large-scale production of teak clones and popularising among farmers/tree growers. The clones are established in ~100 ha in Kerala, Tamil Nadu, Chhattisgarh, Maharashtra, Punjab, Gujarat, Karnataka, Jharkhand, West Bengal, Madhya Pradesh and Telangana and their performance is under evaluation. Interim results reveal that at the end of 4 years, the plants have attained a height of 10-12 m and a girth of 40-45 cm. About 50 per cent of the trials are raised with the support of the Forest Departments / Forest Development Corporations of Maharashtra, Kerala and Chattisgarh.

Encouraged by the initial results, West Bengal, Madhya Pradesh, Andhra Pradesh, Maharashtra, and Gujarat forest departments have requested further demonstration trials in the department lands. The Chattisgarh forest department has ordered 6.5 lakh teak plants from IFGTB for their green plantation programme for the year 2023-24.

ICFRE-IFGTB, Coimbatore, had entered a license agreement with HU Gugle Biotech, Bangalore, for mass production and supply of three teak clones TG1, TG5 and TG11. For transfer of technology and assessing success of adaptaion for commercial production of teak. IFGTB had entered into MoU with two more commercial tissue culture laboratories - Jagadamba Bio plants, Bengaluru, and Meristem Biotech, Bengaluru.

Successful multiplication of IFGTB Clones at TFRI, Jabalpur

Three month old TC teak at Pollachi, Kerala

Six month old TC teak at Ranchi, Jharkhand

Five year old TC teak in Naharpur, Chattisgarh

Four year old TC teak in Puducherry

Valuation of forests for GDP, green GDP and payment of eco-system goods and services

Forests provide a natural pollution abatement strategy by acting as a surface area for the deposition of Particulate Matter (PM). Deposition flux and total PM removal across sixteen forest type groups of India were estimated based on 2019 dataset of PM using reanalysis models. Deposition of PM was high in Littoral and Swamp forests, Tropical Semi Evergreen forests, Tropical Moist Deciduous forests and Subtropical Pine forests.

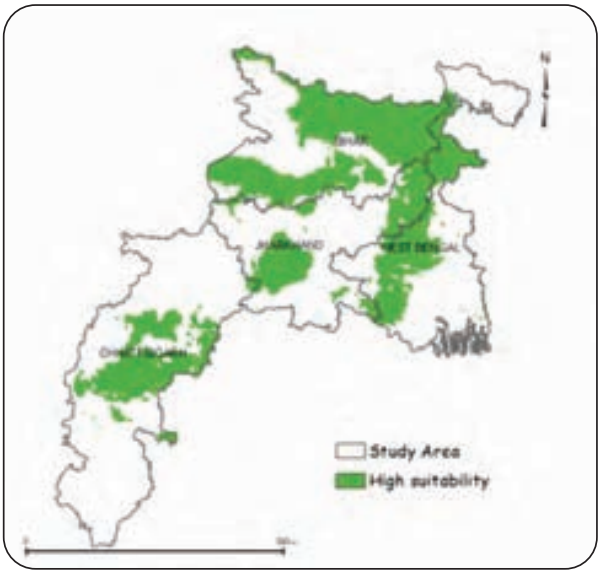
The air pollution abatement service by forests for PM removal was 188 M US Dollars (USD) and with externality-based removal service including pollution control device by forests of 2009 M USD.

The net PM removed by all forests of India was approximately worth 59-81 million dollars for $PM^{2.5}$ and worth 7093-15327 million dollars for PM^{10} based on valuation using value transfer method.

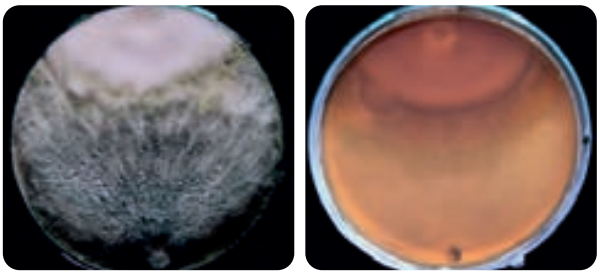
All India coordinated project on *Dalbergia sissoo* mortality

The project was envisaged to identify the vulnerable areas and, pathogen responsible for large-scale mortality in *Dalbergia sissoo* plantations, screen disease resistant host germplasm and potential *Trichoderma* sp. isolates as biological control agent. In the experiments conducted to identify organic wastes for the artificial culturing of *Trichoderma* species as biological control agent, *Eupatorium perfoliatum,* rice husk, neem leaf compost, sorghum chaff and *Trichosanthes dioica* peel showed promising results. Highly antagonistic three *Trichoderma* isolates in *in vitro* conditions having around 90 per cent pathogen colony growth inhibition activity against virulent *Fusarium solani* were identified. Mass culture of *Trichoderma* isolate was inoculated in rhizosphere of diseased trees at Nalagarh, Solan for evaluating health recovery potential in plantation. Seeds from selected CPTs primed with *Trichoderma* sp. exhibited 70-82% germination in comparison to control with 45-50% germination. For hazard mapping of areas under *D. sissoo* plantations, field survey for Himachal Pradesh, Jammu & Kashmir, Jharkhand, West Bengal and Bihar was conducted. All the desired GIS layers for modelling species distribution, climate models representing climate scenarios climate model MIROC5, IPSL_5A_LR, IPSL-CM6A-LR and MIROC6 were downloaded and digitised for the Indian administrative boundary. The distribution data collected from Himachal Pradesh and Jammu & Kashmir were compiled for preparation of distribution maps and will be used as the input layers for the habitat and hazard modelling. The point distribution map of eastern region, Himachal Pradesh and Jammu & Kashmir depicting affected and non-affected samples were prepared. The habitat suitability map for eastern region of India has been prepared.

For *in vitro* screening and multiplication of *D. sissoo* genotypes against *Fusarium solani* and *Ganoderma lucidum* infection, nodal explants of 25 *D. sissoo* genotypes, callogenesis using leaf and root explants of two genotypes and Cell suspension culture of six genotypes was prepared. Cuttings of 29 selected CPTs were subjected to rooting and raised in net houses for the establishment of VMGs. Pathogenicity testing of pathogen cultures was conducted to identify virulent isolates and three isolates showing high virulence were identified. MoU for addressing *D. sissoo* mortality in Uttar Pradesh was signed and clonal seed orchard of resistant and intermediate genotypes of *D. sissoo* was established. These genotypes were selected for productivity and later for disease resistance.



Map depicting the potential habitat suitable sites of *Dalbergia sissoo* in eastern India



Ninety per cent *Fusarium* sp. colony growth inhibition by *Trichoderma* sp. isolate in dual culture assay

Mass multiplication of *Trichoderma* sp. isolate on sorghum chaff substrate

Dalbergia sissoo inoculated with *Fusarium solani* showing wilt symptoms, control remained healthy

Developing seed testing and seed storage protocols of selected forestry species from diverse forest types

Population survey for seed source identification was done for 11 species in Uttarakhand; 03 species in Himachal Pradesh; 06 species in Tamil Nadu; 06 species in Karnataka, 04 species in Madhya Pradesh; 12 species in northeast India (Assam, Arunachal Pradesh and Manipur); 02 species in Rajasthan.

Location	Species
Uttarakhand	*Pterospermum acerifolium, Diospyros tomentosa, Machilus odoratissima, Salix tetrasperma, Heteropanax fragrans, Acer pictum, Litsea chinensis, Tsuga dumosa, Quercus glauca, Toona serrata* and *Alnus nitida*
Himachal Pradesh	*Betula alnoides, Prunus cerasoides* and *Sorbus lanata*
Tamil Nadu	*Elaeocarpus serratus, Bischofia javanica, Symplocos cochinchinensis, Murraya paniculata, Aphanamixis polystachya* and *Memecylon umbellatum*
Karnataka	*Dipterocarpus indicus, Knema attenuata, Kingiodendron pinnatum, Lophopetalum wightianum, Dimocarpus longan* and *Hopea parviflora*
Madhya Pradesh	*Pterospermum acerifolium, Cochlospermum religiosum, Feronia limonia* and *Commiphora wightii*
Northeast India (Assam, Arunachal Pradesh and Manipur)	*Mesua ferrea, Magnolia champaca* var. *pubinervius, Dipterocarpus macrocarpus, Elaeocarpus serratus, Shorea robusta, Duabanga grandiflora, Morus laevigata, Phoebe goalparensis, Pinus kesiya, P. merkussi* and *Schima wallichi*
Rajasthan	*Capparis decidua* and *Salvadora persica*

Seed germination behavior of various species was studied and pretreatments to overcome dormancy were standardized

Species	Pretreatment	Germination (%)
Litsea chinensis	GA_3 0.02% for 24 hours	65
Tsuga dumosa	GA_3 0.01% for 24 hours	32
Alnus nitida	After 6 weeks of moist chilling	65
Diospyros tomentosa	-	95
Heteropanax fragrans	-	85
Pterospermum acerifolium	-	94
Betula utilis	100ppm GA_3 for 24 hours	75
Betula alnoides	100ppm GA_3 for 24 hours	76
Vateria indica	-	68
Garcinia indica	-	100
G. gummi gutta	-	30
Prunus cerasoides	Scarification	93

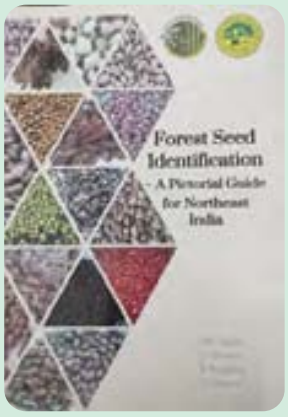
Desiccation trials of seeds of *Semacarpus anacardium, Sterculia villosa, Butea monosperma, Stereospermum chelonoides, Kydia calycina, Hymenodictyon excelsum, Nyctanthes arbor-tristis, Putranjiva roxburghii* and *Mallotus philippensis* confirmed their orthodox storage physiology. To develop seed storage protocols of various species for conservation of their germplasm, the seeds were stored at various temperatures and their germinability was evaluated periodically and duration of storage period was determined.

Fruit-laden tree of *S. chelonoides* at Balaghat, Madhya Pradesh

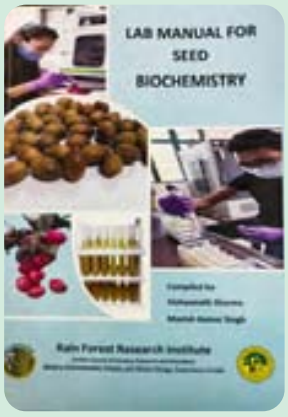
Fruits of *D. tomentosa*

Seed germination in *H. fragrans*

Nursery trial of *B. utilis*



Forest Seed Identification- A Pictorial Guide for Northeast India



Lab Manual for seed Biochemistry

Species	Storage Condition	Germination (%)	Duration of Storage
Bischofia javanica, Cipadesa baccifera and *Leea indica*	20°C , 15°C	00	06 months
Albizia julibrissin	5°C	85	27 months
Albizia odoratissima	5°C	95	18 months
Sterculia villosa	5°C	64	15 months
Pterospermum acerifolium	5°C	91	06 months
Chukrasia tabularis	5°C	65	24 months
Betula utilis	-10°C	53	30 months
Rhododendron campanulatum	-10°C	54	30 months
Sorbus lanata	-10°C	61	30 months
Prunus cerasoides	2°C	52	21 months
Vateria indica	20°C	80	65 days
Garcinia indica	10°C and 15°C	30	01 month

Nursery trials wrt., the effect of potting media, time of sowing, depth of sowing, container, effect of growth regulators on rooting, etc. for *Prunus cerasoides*, *Betula utilis* and *Sorbus lanata* were laid in the nursery and observations taken on growth of seedlings. In *Capparis decidua*, highest germination (60%) was observed in soil: sand: compost (1:2:1) potting mixture followed by 49% in soil: sand: neem manure (1:2:1) in nursery conditions.

ICFRE-RFRI, Jorhat published, Forest Seed Identification- A Pictorial Guide for Northeast India and Laboratory Manual for Seed Biochemistry.

Assessment of demand and supply of timber, fuel-wood and fooder in India

The total quantity of wood products traded internationally in financial year 2021-22 was approximately 60 Million cum RWE with 46 m cum Round wood equivalent (RWE) under import and 14 m cum RWE under export. The percentage share of Indian wood products export has increased from 0.2% in 2001 to 1.2% in 2021, whereas the percentage share of Indian wood products import in total value of Indian imports is anchoring around 1.5% during the period. In India the import and export value for wood products in India during FY 2021-22 was 7344 M US$ and 4948 M US$ respectively.

Percentage increase in growth in terms of quantity and value of RWE import in 2021-22 as compared to 2005-06, 2010-11, 2015-16 and 2020-21

Years	2005-06	2010-11	2015-16	2020-21
Growth in quantity %	326	211	138	17
Growth in Value%	471	227	127	148

Percentage increase in growth in terms of quantity and value RWE export in 2021-22 as compared to 2005-06, 2010-11, 2015-16 and 2020-21

Years	2005-06	2010-11	2015-16	2020-21
Growth in quantity %	919	488	393	142
Growth in Value%	1063	544	236	161

Value addition of wood and wood based composites using nanomaterials

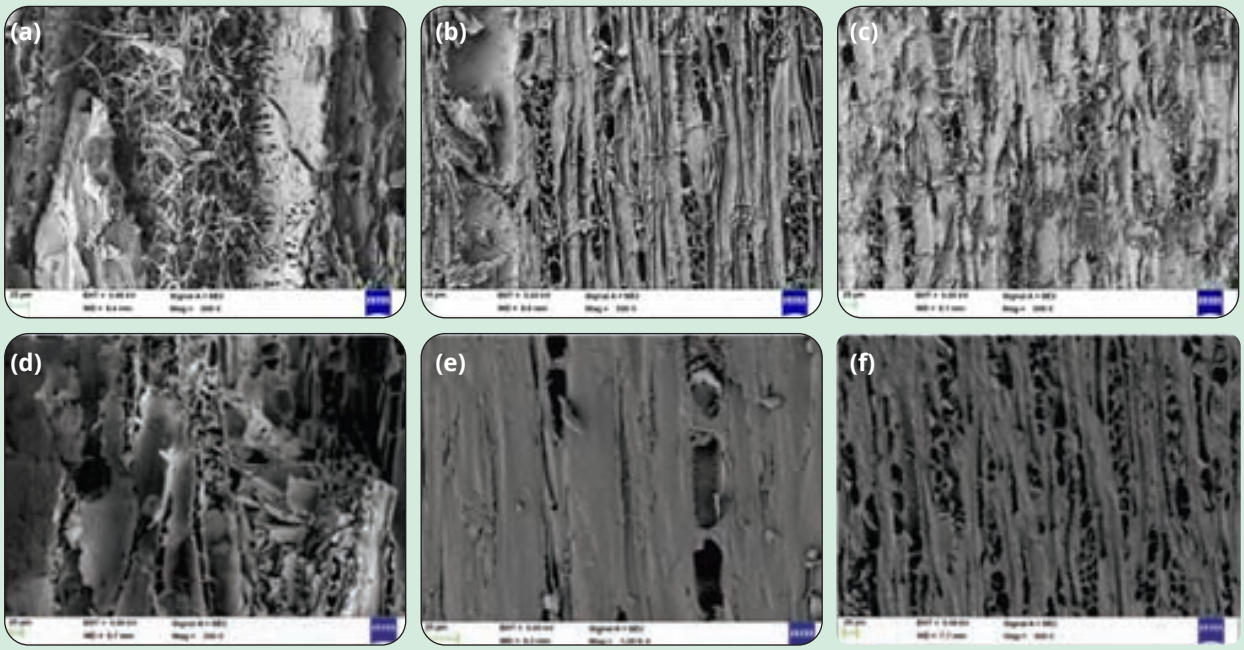
In order to develop nano-material embedded ecofriendly wood preservatives/coatings, stable and homogenous linseed oil nano-emulsions were formed with Zinc oxide (ZnO), cerium oxide (CeO_2) and copper oxide (CuO) nanoparticles and the efficacy of the nano-emulsions was assessed for UV resistance and decay resistance of wood. Addition of ZnO and CeO_2 nanoparticles into the nano-emulsion significantly improved UV resistance of coated wood. Rubberwood impregnated with linseed oil nano-emulsions loaded with ZnO and CuO nanoparticles exhibited improved resistance against both brown rot and white rot fungi. The nano-emulsion was able to protect the integrity of internal structure of wood on exposure to fungi as revealed by SEM studies.

For improving quality of low density wood, Nano-Wood Composites (NWC) were prepared by impregnating nano particles (Boron Nitride and ZnO) fortified poly vinyl acetate and furfuryl alcohol resin systems. Higher concentration of boron nitride nanoparticles (5%) resulted in agglomeration which is evident from SEM image. Melia and Poplar wood with higher loading of zinc nanoparticle (3% and 5%) fortified PVAc exhibited excellent resistance against brown rot fungus.

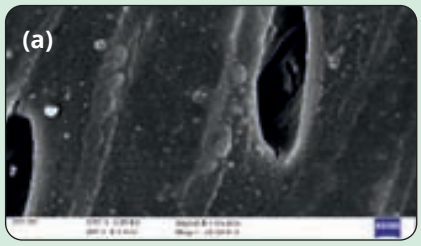
To improve the properties of wood composites using nanoparticles, resin formulations were prepared with urea formaldehyde and SiO_2 nano-particles. It was observed that addition of nano-SiO_2 reduced the amount of formaldehyde emissions from the boards. Mycological testing of 1% and 2% nano-SiO2 loaded boards exhibited improved resistance against fungal attacks.

For development of nano-cellulose fiber filled composites, Cellulose Nano Fibrils (CNFs) were synthesized from bamboo, eucalyptus, bagasse and waste paper pulp. The CNF suspensions (0.1%) prepared with different number of passes exhibited long term stability in nano form (upto 30 days). Addition of CNF in PVAc adhesive resulted in nearly 70% increase in tensile shear strength (TSS) as compared to PVAc alone in *M. dubia* ply board suggesting the improvement in adhesive properties. Water absorption in the boards with CNF based adhesive was also significantly lower. The coating of CNF incorporated with ZnO nanoparticles was found to protect wood from photo-degradation.

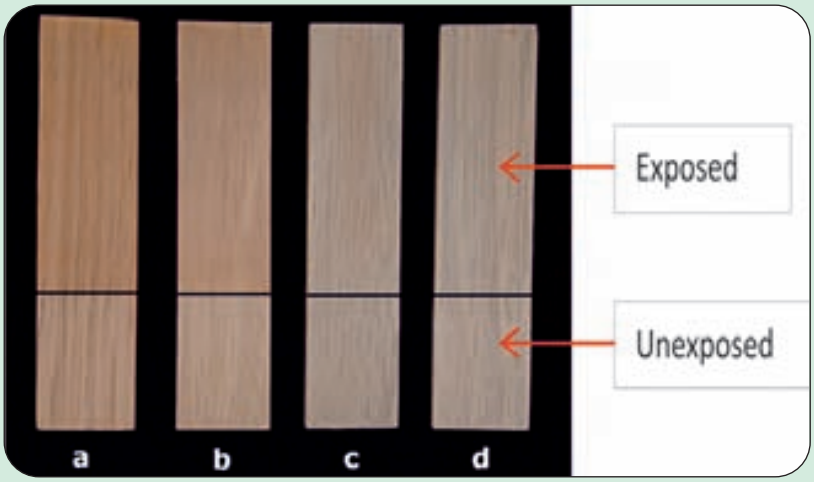
Cellulose Nano Crystals/Fibers (CNCs/CNFs) were synthesized from dry leaves of fig tree (*Ficus auriculata*) followed by preparation of wood coating material using polyvinyl alcohol with variable concentration of CNFs and methanolic extract of fruits of the trees. The coating material having 0.7% fruit extract concentration and 3% nanocellulose exhibited good mechanical, thermal and anti-bacterial activity. So, it can be used commercially for the coating purpose of instruments used in hospitals.



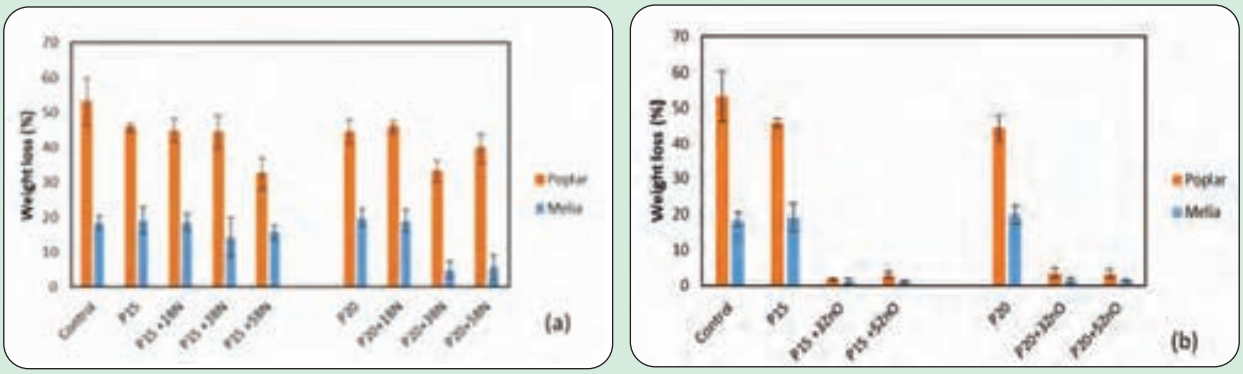
SEM images of untreated and nanoemulsion treated specimens after exposure to white rot fungi (a-c): **(a)** untreated wood, **(b)** NE with nanoZnO treated wood, and **(c)** NE with nanoCuO treated wood; specimens exposed to brown rot fungi (d-e): **(d)** untreated wood, **(e)** NE with nanoZnO treated wood, and **(f)** NE with nanoCuO treated wood.



SEM images of (a) NWC : PVAc + ZnO and (b)PVAc + Nano boron nitride



Effect of light irradiation on color after 500h exposure for rubber wood: (a) uncoated (b) coated with CNF without ZnO, (c) coated with CNF + 0.5% ZnO, (d) coated with CNF + 1.0% ZnO



Decay resistance of wood and NWC against brown rot fungus **(a)** PVAc with boron nitride; **(b)** PVAc with ZnO

Assessment and monitoring of Invasive Alien Plant Species in India and formulation of strategies for management of key Invasive Alien Plant Species in different regions of the country

The project aims to map the spatial extent of selected Invasive Alien Plant Species, their impact on native plant diversity, their future invasion/spread potential using Species Distribution Models, their utilization potential with a view to come up with species specific management strategies. Information on the occurrence of *Prosopis juliflora, Lantana camara, Acacia mearnsii* and *Mikania micrantha* have been collected in different parts of the country. Spatial mapping studies showed that *Prosopis juliflora* occupied 7.39 Lakh ha area in thirty districts of Tamil Nadu. About 31% of the study area in the states of Chhattisgarh, Jharkhand, and West Bengal is presently susceptible to invasion by *Lantana camara*. By 2050, the very high suitability habitat in the country for *P. juliflora* has been predicted to increase by 24% (584,499 sq.km) and 28% (602,603 sq.km) under RCP 2.6 and RCP 8.5, respectively. However, by 2050, the very high suitability habitat for *Acacia mearnsii* has been predicted to decrease by 48% (2255.80 sq.km) and 52% (1927.61 sq.km) under RCP 2.6 and RCP 8.5, respectively.

Studies on impact of Prosopis on the native plant diversity in different habitats showed decreased species diversity (Herbs 2.72; Shrubs 0.14; Trees 0.12) in the invaded site than the control site (Herbs 3.04; Shrubs 1.09; Trees 0.97). The Prosopis invaded sites showed higher soil nitrogen content (from 221 to 340 kg/ha) than the control sites (from 203 to 261 kg/ha). In the Lantana invaded habitats in Himachal Pradesh, the available nitrogen per hectare ranged from 263.41 to 288.76 kg/ ha. Release of bioagent *Teleonemia scrupolosa* for biological control of Lantana under net house conditions did not cause any damage during October to March.

Restoration studies in *Lantana camara* affected forest in Himachal Pradesh

Bioprospecting for industrial utilization of lesser-known forest plants

Surveys were conducted and identified 87 populations of 16 lesser known forest plants (LKFPs) in the states of Gujarat, Rajasthan, Uttarakhand, Himachal Pradesh, Uttar Pradesh, Telangana, Tamilnadu, Madhya Pradesh, and Chattisgarh for chemical screening, and their geo coordinates were recorded.

Populations of lesser known forest plants in different states

Species	Populations
Balanites aegyptiaca	13
Buchanania axillaris	4
Careya arborea	11
Cassine glauca	5
Cupressus torulosa	1
Cyperus rotundus	5
Gardenia resinifera	5
Mallotus philippensis	1
Neolitsea pallens	1
Pithecellobium dulce	5
Prinsepia utilis	9
Punica granatum	7
Soymida febrifuga	2
Sterculia urens	2
Vitex negundo	5
Woodfordia fruticosa	4
Xanthium strumarium	7

Chemical screening of 173 populations of *X. strumarium* (11), *B. aegyptiaca* (10 from Rajasthan and 3 from Tamilnadu), *Citrullus colocynthis* (3),*Vitex negundo* (12), *P. utilis* (14), *S. febrifuga* (31), *Vitex altissima* (1), *Cinnamomum cecidodaphne* (17), *Schima wallichi* (16), *Litsea cubeba* (16), *B. axillaris* (16), *Carallia brachiata* (18) and *W. fruticosa* (5) was completed. For fatty oils, essential oils, and natural dyes, chemically superior populations were identified for industrial applications.

Qualitative and quantitative chemical compositions of four chemically superior populations of *P. utilis* were established using GC-FID and GC-MS techniques which were indicative of their use in food and non food applications. GC-FID and GC-MS assisted chemical compositions of the essential oils isolated from the needles of chemically superior populations of *C. torulosa* located in Ogla, Bhatwari and Gopeshwar of Uttarakhand were established. Chemical compositions coupled with sensory evaluation of these essential oils revealed the suitability of the oils from Ogla and Bhatwari for making the perfume blends. The essential oils of Ogla and Munsyari origin displayed excellent *in-vitro* insecticidal activity (LC_{50}, 0.23 ppm and 0.30 ppm; LC_{90}, 0.58 ppm, and 0.62 ppm, respectively) against stored grain pest *Sitophilus oryzae* (Rice weevil) and validated the traditional claim of the insecticidal property of the needles. Examination of the essential oil from Dehradun origin in *in vitro* and *in vivo* assays showed promising anti-inflammatory activity thus supported the traditionally accepted use of the needles in treatment of inflammation. Evaluation of hydro-methanolic extract of the needles of *C.torulosa* in *in vitro* anti-oxidant and in *in vitro* and *in vivo* anti-hyperglycemic assays demonstrated its efficacy in reversal of diabetes and in preventing liver and kidney complications associated with the diabetes.

Chemically superior populations identified for industrial application

Tree Species	Populations	Locations	Fatty oil (%) / Essential oil (%) / natural dye (%)
For Fatty Oils			
Prinsepia utilis	04	Chakrata	41.08
		Kanasar	43.34
		Sukki	39.37
		Shillaru	38.45
Balanites aegyptiaca	04	Alagapuri-Virudhunagar	48.57
		Thalamalai-Sathyamangalam Tiger Reserve	47.60
		Bannari-Sathyamangalam Tiger Reserve	46.72
		Palavanatham- Virudunagar	46.81
For Essential Oils			
Litsea cubeba	2	Mebo	6.43
		Pasighat	5.73
For Natural Dyes			
Soymida febrifuga	7	Kondapur c-329	32.11
		Narsapur urban park	31.67
		Mosra	30.92
		Kondapur c-328	30.17
		Eklaspur	30.17
		Rudraram	29.83
		Medambanda	29.13
Careya arborea	2	Kalakad Mundanthurai Tiger Reserve- II	18.48
		Topslip-Anamalai Tiger Reserve-I	22.08
Buchanania axillaris	1	Lenkagadda	30.83

A topical herbal gel formulation containing *P. utilis* seed oil was developed which was found to exhibit analgesic effect in rats equal to the effects of commercially available diclofenac gel, with no adverse effects, thus validated the traditional claims of

use of the oil in treatment of pain encountered in rheumatism, arthritis and bone disorders.

Sensory assessment of the leaves derived essential oils isolated from two chemically superior populations of *N. pallens* located in Dalhousie and Khajjiar (Himachal Pradesh) showed the suitability of the oil from Dalhousie for fine fragrances and other perfumery applications; and that from Khajjiar for oil based products. A method for recovery of reddish brown natural dye (yield, 16.06%) from the flowers of *W. fruticosa* was optimized. The dye was found to be suitable for coloring cotton textile and hairs. Using Box Behnken design, conditions for dyeing of silk, wool and cotton fabrics with the *P. granatum* peels derived dye were optimized. The dye was found to be promising for incorporation into food and cosmetics products.

Analytical methods for UPLC-QTOF-MS assisted chemical profiling of 25% aqueous methanolic (AM) extracts isolated from the leaves of *P. utilis* and *N. pallens* and needles of *C. torulosa* were developed. Chemical profiles of the AM extracts of the three species from the populations grown in Munsyari, Majhrana, and Gopeshwar, respectively, were unveiled, and 68, 30 and 62 compounds, respectively, belonging to classes of organic acids, esters, flavonoids, phenolic acids and their derivatives, lignans, phenylpropanoid glucosides, alkaloids, terpenoids, glycosides, fatty acids and their derivatives, heterocyclic compounds, and quinones were identified.

Enhancement of fodder availability and quality to reduce unsustainable grazing in the forest

The major focus of the project is on conducting field trials in the mandated regions of nine institutes of ICFRE. The tree species were selected as per the site conditions and were planted in high density spacing (1m x 1m, 1.25m x 1.25m and 1.5m x 1.5m) and managed with different frequency of coppicing. 18 field trials were laid out during 2021 and 2022; in Dehradun, Uttarakhand; Prayagraj, Uttar Pradesh; Shimla and Sirmaur Himachal Pradesh; Banaskantha, Gujarat; Jaisalmer, Rajasthan; Katni and Raisen, Madhya Pradesh; Rajnandgaon, Chhattisgarh; Khunti and Latehar, Jharkhand; Sukna, West Bengal; Jorhat, Assam; Warangal, Telangana; Shivamogga, Karnataka; Erode and Tiruppur, Tamil Nadu. Fodder harvest frequencies being tested are once/year, twice/year and thrice/year. Grass species are also being tested in the field trials.

Fodder trees and grasses planted in field

Institute	Tree Species	Grasses
ICFRE-AFRI, Jodhpur	*Ailanthus excelsa*, *Ziziphus mauritiana*, *Moringa oleifera Azadirachta indica*, *Prosopis cineraria* and *Ziziphus nummularia*	*Cenchrus ciliaris, Panicum turgidum* and *Lasiurus scindicus*
ICFRE-HFRI, Shimla	*Grewia optiva, Bauhinia variegata, Morus alba,* and *Celtis australis*	*Tall fescue, Setaria sphacelata* and *Pennisetum purpureum*
ICFRE-FRI, Dehradun	*Morus alba, Bauhinia variegata, Grewia optiva, Ficus racemosa* and *Gmelina arborea*	*Pennisetum purpurmum, Pennisetum typhoides, Brachiaria mutica*, *Stylosanthes hamata*
ICFRE-IFB, Hyderabad	*Sesbania grandiflora, Albizia lebbeck, Albizia procera* and *Moringa oleifera*	*Panicum maximum, Cenchrus ciliaris* and *Chloris gayana*
ICFRE-IFGTB, Coimbatore	*Glyricidia sepium*, *Albizia lebbeck, Hardwickia binata* and *Leucaena leucocephala*	-
ICFRE-IFP, Ranchi	*Melia azedarach*, *Moringa oleifera, Bauhinia variegata, Sesbania grandiflora* and *Morus alba*	*Pennisetum purpureum, Megathyrsus maximus,* and *Stylosanthes hamata*
ICFRE-IWST, Bengaluru	*Moringa oleifera, Sesbania grandiflora, Leucaena leucocephala* and *Gliricidia sepium*	*Setaria sphacelata, Pennisetum purpureum, Panicum maximum* and *Brachiaria decumbens*
ICFRE-TFRI, Jabalpur	*Sesbania grandiflora, Morus alba, Moringa oleifera* and *Melia azedarach*	*Cenchrus ciliaris, Dichanthium annulatum* and *Pennisetum purpureum*
ICFRE-RFRI, Jorhat	-	*Megathyrsus maximus*, *Setaria sphacelata* and *Pennisetum purpureum*

Field trial at Teliarganj, Prayagraj, Uttar Pradesh

Field trial at Chandwa, Ranchi, Jharkhand

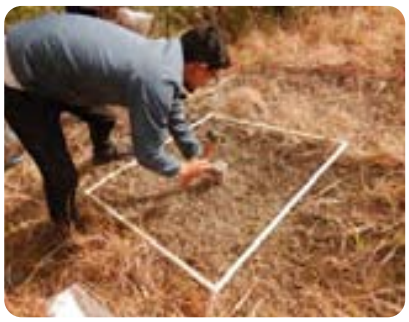
Harvesting of grass in field trial at Mangatta, Chhattisgarh

Forest Fire Research and Knowledge Management

Baseline data on timber, fuelwood, fodder, NTFP, floral biodiversity (including Invasive alien species), carbon storage, carbon sequestration, soil nutrients from burnt and unburnt forest areas of five forest types viz., Tropical Semi Evergreen Forest, Tropical Wet Evergreen Forest, Tropical Moist Deciduous Forest, Tropical Dry Deciduous Forest, Sub-Tropical Pine Forest covering 15 states viz., Uttarakhand, Himachal Pradesh, Madhya Pradesh, Maharashtra, Chhattisgarh, Odisha, Andhra Pradesh, Telangana, Karnataka, Tamil Nadu, Kerala, Assam, Meghalaya, Mizoram, Nagaland is being collected. ICFRE-FRI has developed fire-fighting tool kit and fire safety clothing's kit in collaboration with University of Petroleum and Energy Studies, Dehradun. The kits were sent to Kerala, Uttarakhand and Odisha State Forest Departments and were also tested in Dehradun Forest Division by FRI. The feedback on utility of fire-fighting tools and safety clothing's after testing in actual field condition have been received from Kerala, Uttarakhand and Odisha State Forest Department. Based on feedback received from SFDs and headquarters the fire-fighting tools are being modified. Mapping and categorization of fire prone areas in five pilot districts viz., Amravati, Aizwal, Kadapa, Pauri Garhwal and Idukki based on historical fire data and ecological model is under progress.

Plot Layout

Socio economic survey



Soil sample collection

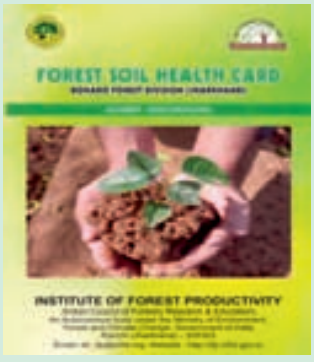
Fire safety clothing

Fire fighting tools

Preparation of Forest Soil Health Cards under different Forest Vegetation in all the Forest Divisions of India

A total of 19126 soil samples were collected across the country and 167291 samples were analysed for 12 comprehensive parameters *i.e.*, Basic parameters - pH, EC and OC; Major nutrients - Av. nitrogen (N), Av. phosphorus (P) and Av. potassium (K); Secondary nutrients- Av. Sulphur (S); Micronutrients (Av) - Zinc (Zn), boron (B), iron (Fe), manganese (Mn) and copper (Cu).

Statewise results of soil samples analyzed so far have been tabulated for drawing Forest Soil Health Cards (FSHC) for about 788 forest divisions of the country. Reference ranges for drawing inorganic and organic recommendations are not available for Indian forest soils for said 12 parameters. Therefore, based on state wise reference ranges, the forest soil health cards have been prepared and released for the state of Jharkhand. Pre-release consultation for FSHC with State forest Departments has been organized for two states i.e., Madhya Pradesh, Haryana, and four UTs i.e., Delhi, Ladakh, Chandigarh and Puducherry. The FSHC has been prepared for the six states/UTs and are ready for release. So far, overall, 46 per cent sampling and 34 per cent analysis have been accomplished. FSHC web portal is under development in collaboration with National Informatics Centre, Dehradun for easy access to State Forest Departments and other stakeholders.



Forest Soil Health Card of Bokaro forest division, Jharkhand

Genetic improvement and value addition of *Madhuca longifolia*

The process of producing grafted quality planting material of *Madhuca longifolia* (mahua) for the purpose of domestication was standardized. Cleft grafting was carried out using scions of selected phenotypically superior trees with 40-50 % success. Vegetative Multiplication Gardens have been successfully established with grafted Mahua plants at TFRI campus, Jabalpur, Madhya Pradesh at IFP Campus, Ranchi, Jharkand and at KVK, Myrada, Thalamalai, Tamil Nadu. On the basis of criteria of flower yield, 1188 phenotypically superior trees of Mahua have been selected throughout its natural distribution range in India; 460 from 23 different locations of Chhattisgarh, Madhya Pradesh and Maharashtra; 100 from 16 different locations of Tamil Nadu and two locations in Kerala; 160 from Uttar Pradesh; 186 from 30 different locations of Jharkhand, Bihar and West Bengal; 282 from nine locations in Odisha, Telangana and Andhra Pradesh. Sugar was estimated in flowers of 573 trees (Range 23- 75%) and oil was estimated in seeds of 341 trees (Range 22-71 %). DNA was isolated from leaves of 258 trees for genetic diversity assessment. Application was filed for FSSAI licensing of Mahua chocolate bars developed from dried flowers. Development of wine, wound healing cream and herbal hand wash utilizing mahua flower and the underutilized plant parts like leaves and bark is underway. Leaflet entitled "*Madhuca longifolia* (Mahua): A useful NTFP Species of Madhya Pradesh" has been published in Hindi.





Collection of scions from selected phenotypically superior trees, Grafting and Grafted plants of Mahua

VMG at TFRI, Jabalpur


VMG at IFGTB, Coimbatore

VMG at IFP, Ranchi

M. longifolia Herbal Hand Wash

Mahua Leaflet

Combating desertification by enhancing vegetation cover and people livelihoods in degraded dry lands and deserts of India

Various types of degraded areas have been targeted under this project for restoration like degraded hills, hillslopes, sand dunes, ravines and saline in hot and cold desert and other parts of country and field trials/plantation established in total 74.68 ha area. For restoration of degraded hillslopes in cold arid region plantation of *Juniperus polycarpos* in 1.0 ha. area has been done at Badami Bag, Leh. The plantation of *Populus nigra, Salix alba, Juniperus polycarpos, Hippophaer hamnoides* and *Elaeagnus angustifolia* has been carried out in 5.0 ha area at Sushna, Spiti area of Himachal Pradesh. For restoration of ravines plantation has been done at two sites. One plantation of five trees species in

Live hedge fencing at Khet Singh Nagar in Setrawa, Jodhpur, Rajasthan

Farmers planting *C. carandas* (Karondha) saplings for raising live-fencing in the boundaries of their fields. (Esah Haveli Village, near Ambah, Morena, Madhya Pradesh)

Neem seedlings planted as boundary plantations in cluster of farmers' field in the Cauvery delta zone at Kammanallur village, Tamil Nadu

Nursery stock of Salix at Tabo, H.P.

J. polycarpos Plantation at Tabo, H.P

Plantation work at Lunawas, Jodhpur (degraded hill site) Rajasthan

Thespesia populnea planted as Block Plantation at Rathinampillai Pudur, Tamil Nadu

Plantation activities at Sand Dune, Udasar site, Nokha, Bikaner, Rajasthan

Plantation at Kiriburu Iron Ore Mine, Jharkhand

Plantation activities at KarahJohad, Jaisalmer site

Plantation in Chambal ravines of Beat Useth of Morena Forest.

Tending operations at Central University of Punjab (CUP), Bathinda,Punjab

an area of 16.20 ha near Ambah in Morena forest division and second plantation at Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya (RVSKVV) land covering an area of 6.48 ha. For rehabilitation of degraded hill in hot arid region an area of about 12 ha has been selected at Lunawas, Jodhpur. Plantation of six species has been done with three types of soil amendments (Farmyard manure, Sewage sludge and Hydrogel) and trenches were made to harvest rainwater in the area. To identify best species for restoration of salt-affected lands in Tamil Nadu field trial was established in 2 ha of salt affected farmer's field in the Cauvery delta zone at Rathinampillai Pudur village, Karur. For effectively stabilizing reactivated sand dune with suitable surface cover species in hot arid region plantation has been done on 10 ha land at reactivated sand dune at Udasar, Nokha in Bikaner district. Six shrub species were planted at 3 m × 3 m spacing. Seed of *Cassia aungustifolia* and *Lasiuruss indicus* were also sown as cover species. For restoration of degraded sandy plain plantation has been done at KarahJod, Jaisalmer in 15 ha area. Five tree species and five shrub species were planted along with different soil amendments treatment like biochar, hydrogel, neempati, sewage sludge and biofertilizers. For rehabilitation of mine overburden area, plantation of screened species with recommended soil amendment was done in 7.0 hectare of area at Kiriburu site.

Live fencing around selected sites of Rajasthan, Madhya Pradesh, Himachal Pradesh and Tamil Nadu has been done for soil and water conservation and enhancing farm production and people livelihoods. Total 3640 seedlings *of A. senegal* were planted as live hedge fencing on boundary of two group of farmer's land at Chouradia (seven farmer's land of 4.5 ha) and Khet Singh Nagar (three farmer's land of 25.0 ha), Jodhpur. Total three clusters of farmers were selected in four districts of Madhya Pradesh (Nayapura Useth, Bheelpur, Esah Haveli, Morena) for erecting live fencing around clusters of farms, 1900 seedlings of *Carissa carandas* with a spacing of 1m were planted on farmers' field boundaries. 400 Neem seedlings planted as boundary plantations in cluster of farmers' field in the Cauvery delta zone at Kammanallur village in 0.5 ha in Tamil Nadu. The plantation of Seabuckthorn (300), Rosa (300), Salix (400) and Poplar (400) was carried out along the field boundaries of five villages in Himachal Pradesh.

Silvicultural interventions for productivity enhancement and carbon sequestration in plantations of important tree species

In the study, information were collected on growth of important tree species under varied site conditions and different management regimes. Growth assessment has been completed in 265 plantations of Teak, Gmelina and Haldina under different irrigation and planting configurations and also in 60 plantations of Ailanthus, Neem and Pungam under rainfed conditions and different planting configurations. Salient findings were, that growth performance and wood quality in terms of heartwood production in teak varied in different site conditions. On an average, teak in western zone recorded maximum clear bole volume (0.4102 m^3), mid diameter (0.48 m) and total volume (2.8207 m^3) under 15-20 age classes. Wood density also recorded maximum value of 0.80 g cm^{-3} in boundary plantations of teak in western zone in the age class of 15-20 years. Further, western zone also registered the maximum heartwood volume (0.433 m^3 per tree). On the contrary, teak in Cauvery Delta zone registered lesser growth as well as lesser wood quality in terms of density and heartwood formation. These results emphasize on matching sites for quantitative and qualitative improvement in teak wood production.

5-10 years

10-15 years

Wood samples collected from teak plantations in Western zone of Tamil Nadu

5-10 years

10-15 years

Wood samples collected from teak plantations in Cauvery Delta zone of Tamil Nadu

Conservation and sustainable management of wild edible fruiting species

Seed germination studies revealed that in *Semecarpus anacardium* chemical scarification using concentrated sulfuric acid for 15 minutes, increased seed germination (70% in treated while 40% in control), and also reduced germination period (15-20 days in treated while 25-40 days in control). *Myrica esculenta* seeds collected from Chailchowk, Mandi resulted in maximum seed germination (70%) in polyhouse nursery bed and minimum in Kotmoras (28%). In *Prunus cornuta* maximum germination of 76% was recorded in winter sown seeds collected from Kothi, Manali in polyhouse conditions. The fresh seeds of *Limonia acidissima* (5.7% moisture content (MC) and *Pithecellobium dulce* (54.4% MC) showed good germination and not require any special treatment for germination. Seed propagation has been found to be the best method over vegetative propagation in *Limonia*. In *P. dulce* at 45% seed moisture, germination was 92.5% which drastically declined at 10% moisture to 55% and further to lesser at 5% moisture indicating it as a short-lived seed. Fruit maturity studies in *P. dulce* showed that pink fruits recorded highest germination of 92.5% while greenish pink showed 67.5% and green fruits recorded 50% germination. In vegetative propagation studies stem cutting of *Flacourtia indica* pretreated with 1000 ppm IBA produced maximum shoot and root and girth of 0.4-0.5cm was suitable for rooting. In *Semecarpus anacardium* air-layering was found suitable. 1:2:1 ratio of sand, soil and FYM was found best for seedlings. Rooting studies on *Pithecellobium dulce* showed that 5-7mm diameter thick stem cuttings are suitable for vegetative propagation than 8-10 mm of stem cuttings. Distribution studies of *Spondias pinnata* and *Prunus jenkinsii* in different RFs/ WLS (Gibbon WLS, Jorhat and Nambor-Doigrung WLS, Golaghat, DihingPatkai National Park, Dibrugarh, and Poba RF, Dhemeji, Kakoi RF, Lakhimpur, and Sonai-Rupai WLS, Sonitpur district and different areas of Majuli district, Assam and recorded the regeneration status of the species which revealed that maximum regeneration of 90 seedlings per hectare of *Prunus jenkinsii* at Kakoi RF, Lakhimpur, Assam and minimum 70 seedlings per hectare at Nambor Doigrung WLS and maximum 140 seedlings per hectare of *Spondias pinnata* at Nambor Doigrung WLS, and minimum 100 seedlings per hectare at Dihing Patkai National Park was recorded. In case of *Prunus cornuta* maximum carbohydrate content found in Rupi (6.54%), protein in Kufri (3.88%) and crude fat in Rakchham (5.4%) seed sources.

Seven value added products of *Carissa carandas* (i.e. Karonda chips, Energy drink, Karonda Powder, Khatmithgoli, Karonda Candy, Karonda Pickle and Cherry Karonda) prepared and nutritional analysis of products was done as per the protocol of AOAC International, (2016). Nutritional analysis of the value added products was analyzed:

Value Added Product	Moisture %	Carbohydrates %	Protein %	Fiber %	Vitamin C mg/100mg	Oil %	Iron mg/10mg	Calcium mg/100mg
Karonda chips	21.0	45	0	3	40	0	9.5	8.5
Karonda Powder	7.0	92	9	4.5	35	4	10	9
Energy drink	91	6	0	0	35	0	12	3
Khatmithgoli	21.0	39	1.5	2	30	2	8	9
Karonda Candy	26.0	79	0.0	3.5	22.2	0	9	8
Karonda Pickle	46	38.15	3	2	28.90	30	7.5	8
Cherry Karonda	19.0	80	1.69	2	50	0	8	8

Value added products of *Pyrus pashia* (Molu candy, Molu Jam, Molu pickle, Molu Murabba) and three value added products of *Ficus palmate* (Himalayan Fig Jam, Himalayan Fig Candy, Dried Himalayan Fig) prepared. Testing of these products as per AOAC protocol is under process.


Cherry Karonda


Karonda pickle

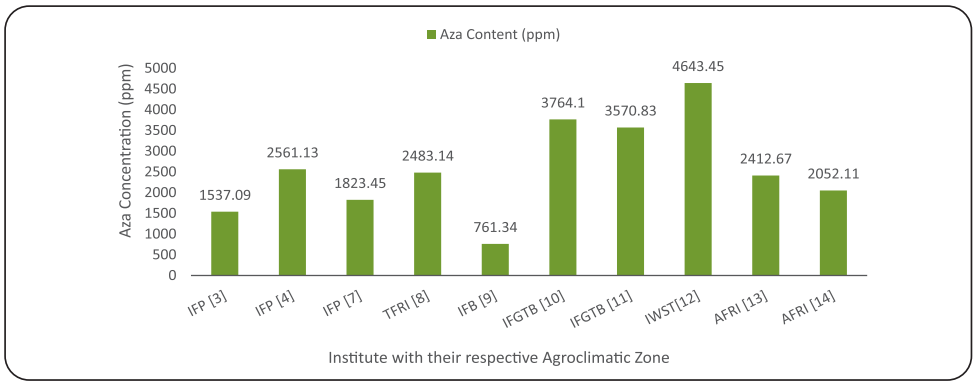

Karonda Candy


Karonda Energy Drink

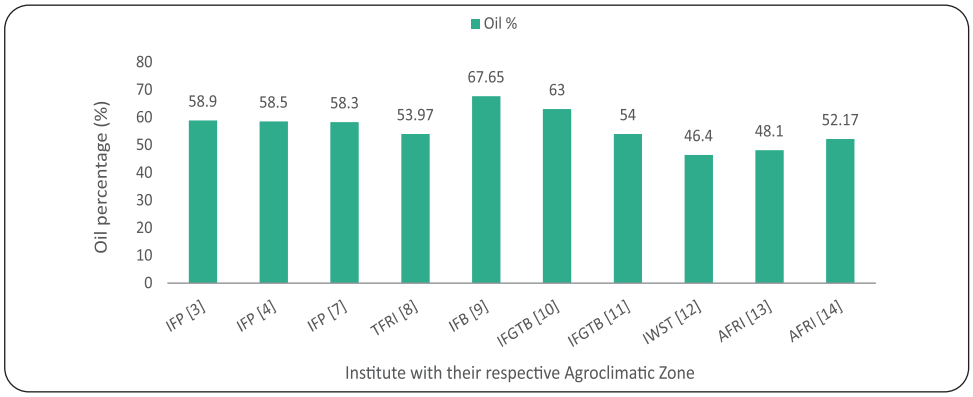
Genetic improvement of *Azadirachta indica* A. Juss. (Neem)

The core component of the project is evaluation of Neem under nine different agroclimatic zones for Azadirachtin and oil content. Selections of 1000 seed sources was completed from the nine zones. Seeds were collected from all the selected 1000 seed sources during the fruiting season (May-July) in the year 2022. These seeds were de-pulped, dried and used for quantification of Azadirachtin (using HPLC) and oil content. Overall, Oil Concentration ranged showed vide variation from 14.5% (ACZ12) to 67.65% (ACZ 9). Highest Aza content of 4643.45 PPM was reported from zone 10 and lowest 12.84 PPM was reported from zone seven, with average Aza content of 2534.85 PPM. Initial results indicate trees from Agroclimatic zones 10 (Southern Plateau & Hills) and 11 (East Coast Plains & Hills), both from southern India to be having higher azadirachtin content.

Information on flowering and fruiting phases were collected in different accessions of Neem. Long time pollen storage technique of Neem was standardized and found that storing of Neem pollen at -4° C maintained viability upto six months. Data collected on different pheno-phases such as leaf fall, leaf fleshing, initiation of flowering, peak-flowering and initiation of fruit. Wide variation on flowering (March to May) and fruit setting (June to August) was recorded among Neem population. The data on level of Tea Mosquito bug infection from different district of Tamil Nadu was recorded and found that the western zones had heavier infestation than the coastal region and younger tress were found to be more susceptible than the older trees. Around 80 per cent of trees infected recovered back and initiated new leaves and flowering. Genetically transformed cell lines were further sub-cultured as callus. Co-cultivation experiments were conducted for double gene transfer, which was achieved by the re-transformation approach, in which previously transformed and confirmed *glyIII* gene carrying calliwere re-transformed by co-cultivation with *cdh* gene. Putative double gene transformed cultures are growing well and are being maintained by regular sub-culturing.



Aza Content (ppm) in different Agro-climatic zones



Oil Content (%) in different Agro-climatic zones

Grinding of kernel, extraction of oil through Soxhlet apparatus and neem oil from all selections of ACZ 13

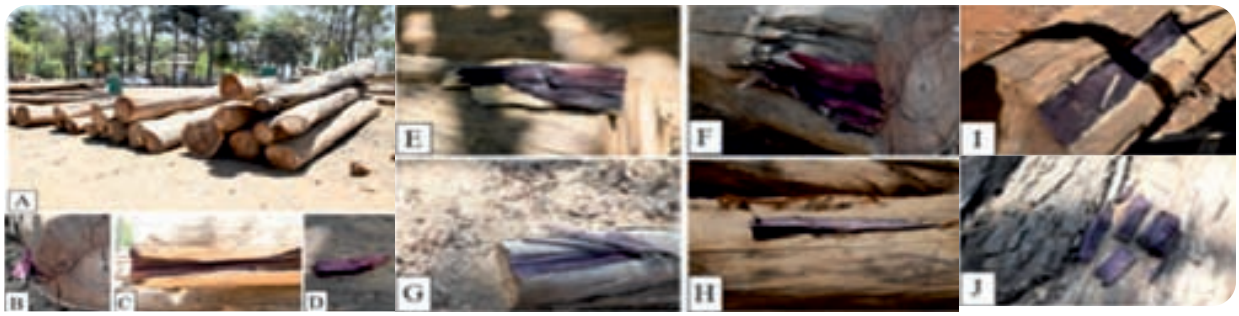
Population status, collection, conservation, characterization and evaluation of genetic resources of *Dalbergia latifolia* Roxb.

Through field survey in different forest divisions of Tamil Nadu, Karnataka and Kerala viz., Coimbatore, Gudalur, Erode, Salem, Dharmapuri, Theni, Thirunelveli (Tamil Nadu); Ranni, Konni, Thenmala, Parambikulam tiger reserve, Nemmara, Wayanad, Nilambur (Kerala) Haliyal, Dharwad, Shimoga, Bhadra Tiger Reserve (Karnataka) continued selection of plus trees. During 2022-2023, 16 plus trees of *D. latifolia* were identified. Collected seeds from the 17 selected plus trees and were shared among different institutes for further raising progeny trials. Progeny trials cum germplasm banks (03) have been established using RBD at Chandwa, Latehar (Jarkhand), Mohabata Chapra village, East Champaran (Bihar), Jabalbur (MP). Further maintenance of established field germplasm bank have been carried out.

The SSR primers synthesized through cross species amplification has been screened for high polymorphism. The amplification of isolated genomic DNA of 165 plants is being done using 13 primers and the genotyping through eight SSR primers has been completed.

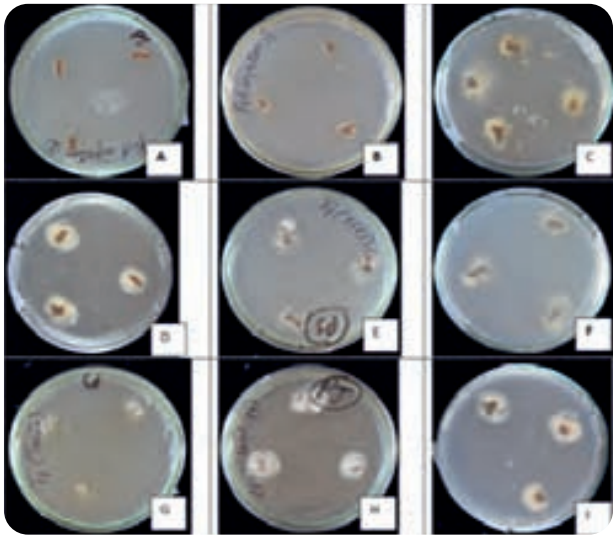
Wood samples from 26 logs of varying colours were collected from Dandeli Timber Depot, and Kushalnagar Timber Depot. For the logs collected from Dandeli Timber Depot, the log colour varied from purple, pinkish, pinkish purple, pink to wine red. While for the logs from Kushalnagar depot the colours observed were light purple, pink and brownish. Information on receipt and sale of rosewood timbers were collected from Dandeli and Thithimati timber Depot.

Disease surveys were conducted in *D. latifolia* nurseries/plantations. Thirty-five fungal isolates (*Colletotrichum* sp. (7), *Alternaria* sp. (03), *Pestolotiopsis* sp. (02), *Neopestolotiopsis* sp. (01), and *Fusarium* sp. (01)) were obtained in pure culture from the infected leaf samples. Twenty insect species of different groups: defoliators, sap-sucker leaf-folder have been observed. *D. latifolia* trees infested with *Viscum nepalense* (family Santalaceae) an stem parasite leading to tree mortality was recorded in Cauaveri Wild Life Sanctuary and Bhadra Tiger Reserve. Infestation of pinhole borer *Euplatypus parallelus* on living trees of *D. latifolia* was observed in Chitradurga, Karnataka. This was a first report from India and elsewhere.



Wood samples of *D. latifolia* collected from Dandeli Timber Depot showing variation in the colour of heartwood

Infected leaves samples of *D. latifolia* (A-F) Madhya Pradesh plantation (G-I) Germplasm bank at FRI, Dehradun



Isolation of infected leaf samples on PDA Petri dishes (A-B), Emerging fungal colonies 4-5 days after inoculation (C-I)

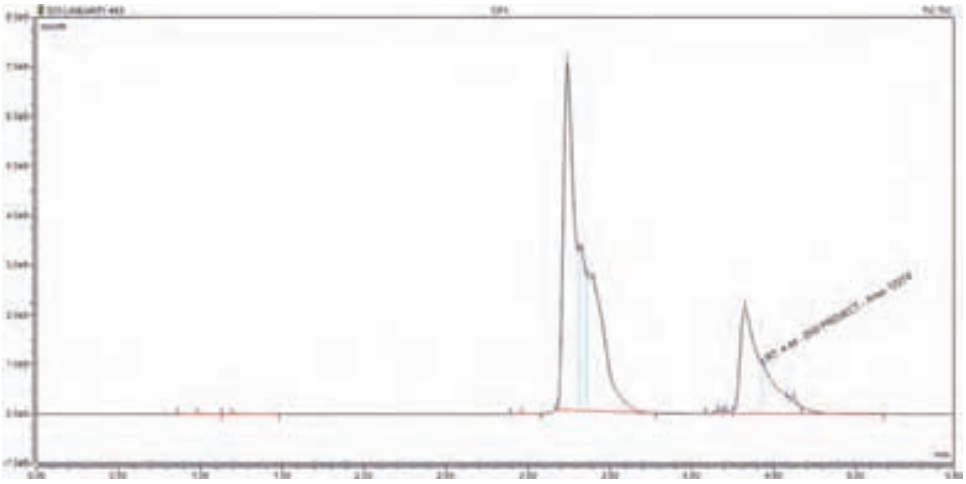
Sustainable management of NTFPs through conservation and value addition

Surveyed, identified the locations and collected germplasm of three Rare and Threatened species (*Thymus serpyllum, Rheum australe, Diploknema butyracea*), 10 Endangered species (*Taxus wallichiana, Aconitum heterophyllum, Pimpinella tirupatiensis, Schumannianthus dichotoma, Tacca integrifolia, Aoprosa octandra, Hydnocarpus kurzii, Mesua ferrea, Oroxylum indicum, Curcuma angustifolia*), two Critically Endangered species (*Embelia tsjeriam-cottam*, *Gentiana kurroo*), three Vulnerable species (*Desmodium gangeticum, Terminalia pallida, Dioscorea deltoidea*), one Near threatened species (*Costus speciosus*). The quality of collected germplasm were assessed and established in germplasm bank by the respective institutes. The content of baicalein in 60 samples from M.P., C.G. and Maharashtra samples of *O. Indicum* varied from 0.0349±0.00 - 0.1597±0.00 %. Total alkaloid content in root samples of *D. gangeticum* varied from 0.026±0.003 - 0.392±0.03 %, minimum in Sogda (Jashpur, CG) and maximum in Chanda (Dindori, MP) respectively. Theemblien and phenolic contents in samples of *Embelia tsjeriam-cottam* fruits varied 0.885±0.053 - 5.488±0.317 % and 1.23±0.23 - 4.68±0.81 %, respectively. The lupeol content in samples of *Uraria picta* roots was found maximum in Butigad Dhamtari, CG (0.280±0.01%) and minimum in Tikariya West Mandla, MP (0.119±0.01%). The flavonoid content in *R. austral* and *T. serpyllum* varied from 1.87 mg - 9.15 mg and 1.30 mg - 5.81 mg respectively. The nutritional evaluation of *Phyllanthus acidus* fruits was carried out, 100g of edible fresh fruit contains moisture: 84.5±1.9, protein: 0.24±0.97 and carbohydrate: 4.7 ± 0.68. The rhizomes of *C. speciosus* (15 population) and *G. superba* (16 population) were analysed for diosgen in and colchicine content it, ranged from 2.25% - 0.04% and 0.03-0.55%, respectively from different geographical location in Telangana. The propagation trails with 20 species were carried out for the establishment of different targeted species. By value addition developed pickle and candy from *P. acidus* fruits and herbal chocolates were developed using *M. oleifera* leaves, evaluation of nutritional value and shelf life studies were conducted. The shelf life of Moringa chocolates, Moringa noodles and *Cassia tora* wound healing cream was found to be 3 months, 6 months and 6 months, respectively. Herbal Wound healing Cream and Hand wash were formulated from *Cassia tora* leaves extract and were found to have antibacterial activity.

Taxus wallichiana vegetative propagation through stem cuttings

Measurement of regenerated bark of *Oroxylum indicum* in field

Germplasm of *D. deltoidea*



HPLC Chromatogram showing diosgenin peak in *C. speciosus* sample

Tamarind (*Tamarindus indica* Linn.): Domestication, conservation and deployment of genetic resources for sustenance and livelihood amelioration

Characterization of tamarind genetic resources was carried out through morphological and biochemical traits with the clones available at Tamil Nadu, Telangana, Andhra Pradesh and Gujarat.

Morphometric, phenological and biochemical data were recorded from 100 tamarind clones for developing National Tamarind Registry. Studied floral biology and pollinator visitations in Tamarind and observed that Honey bees served as the major pollinators. Evaluated variation in different qualitative and quantitative traits from different Tamarind resources and shortlisted 20 tamarind clones with higher productivity and high tamarind seed gum value for value additions, processing and deploying large scale plantation programme.

Established vegetative multiplication garden at Forest campus Coimbatore with 10 high productive tamarind clones and produced 5,000 grafts of quality planting material. The grafts of 15 high productive tamarind clones were shared with AICRP partner institutions for establishing pan India multilocation clonal trials. Produced 2500 quality planting stocks of tamarind seedlings for establishing plantations with people participation. Observed survival and growth of Tamarind plantations established in panchayat, temples, schools, avenues and village roads for their stocking of TGRs towards the livelihood improvement of the rural population. About 60-75% survival was recorded in the plantation established through the people participation.

Established multi-location clonal trials of tamarind using selected high productive clones of Red, Sweet and Sour tamarind, at Mulugu, Hyderabad in Telengana, Centre for Crop Improvement Station, SDAU, Sardarkrushinagar , Banaskantha, Agricultural research Station, SDAU, Ladol, Mehsana, Cotton Research Station, SDAU, Talod, Sabarkantha in Gujarat. Established Tamarind clonal demonstration trials in collaboration with ICAR-KVK Myrada, Erode district.

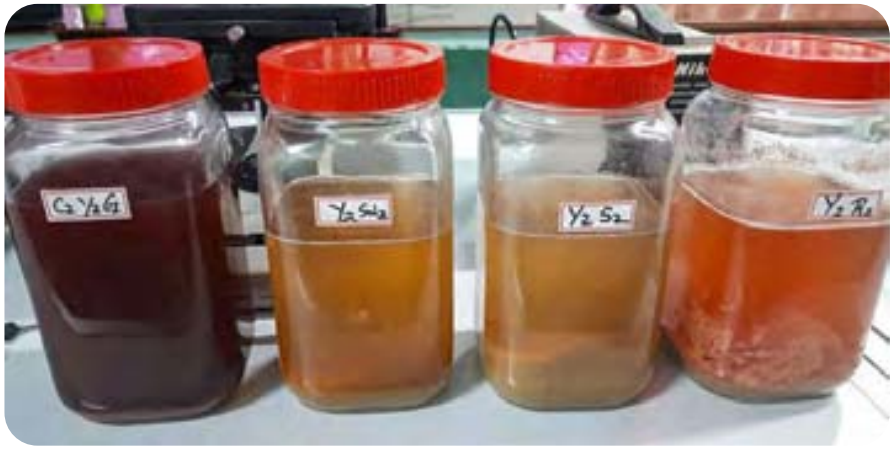
Maintained Tamarind MLTs located at IFGTB field research station, Neyveli, Cuddalore district, Kangeyam, Tirupur district, and Melur, Madurai district in Tamil Nadu; Bayala, Thumkkuru in Karnataka, through application of precision silvicultural inputs.

Developed value added products from tender tamarind unripe fruits, tamarind flower, tamarind seeds and fully ripened fruits. Standardized the protocol for production of Tamarind pickle, Jam, Gulkand, Squash and Wine.

Flower Visitor

Morphometric variations of fruits among Tamarind clones

Tamarind Squash



Wine made from Red, Sweet and Sour Tamarind

Development of superior biofertilizers for enhanced plant productivity

The bio-fertilizer products (Commercial and IFGTB biofertilizers) such as *Azospirillum brasilense* (10 ml), phosphobacteria (10 ml), AM fungi (20 gm), and Potassium mobilizer (10 ml), are used for bio-inoculation experiments in *Gmelina aborea*, *Santalum album,* and *Melia dubia*. *In-vitro* detection of siderophore formation in *Azospirillum brasilense (nitrogen*-fixing bacteria), phosphobacteria, and potash mobilizers was observed. In *G. arborea,* after 12 months of planting, the consortium of biofertilizers (*AM fungi, Phospho bacterium, and Azospirillum)* increased the height up to 220 cm and the girth by more than 2.5 cm.

Pure culturing and mass multiplication of pathogenic cultures under *in vitro conditions were* tested for efficacy to control the pathogens (*Fusarium oxyporum, Alternaria alternata, Diploidia sp., and Colletotrichum gleosporoides). Santalum album* seedlings with host plant *Alternanthera sessilis were* planted with suitable biofertilizers (AM fungi, PSB, *A. brasilense*, and K mobilizer) in the field, and 90.3% survival was recorded. In Sotai village and JIST campus near RFRI, biofertilizers inoculated (AM fungi + Phosphbacterium + Azospirillum + Potassium solubilizer) seedlings of *S. album* had improved growth and biomass rather than the control. Plantations of *Santalum album*, *Melia dubia and Gmelina arborea* at Attivatta, Hoskote taluk, Karnataka, showed 95% survival with inoculations of biofertilizers (AM + *Azospirillum* + *Azotobacter* + Phosphobacteria + Potassium mobilizer). The *Dalbergia sissoo* and *Santalum album seedlings* inoculated with biofertilizers from IFGTB (AM fungi + Phosphbacterium + *Azospirillum*) and commercial sources were planted at Jaisalmer and Jodhpur, respectively, and showed 60 to 70% survival in the IFGTB-applied biofertilizers whereas the commercial source showed only 20% survival. These field experiments showed that biofertilizers are improving the growth of plants through nutrient transportation from the soil.

Anatagonistic activity of *A. brasilense*

S. album with biofertilizers

Gmelina arborea with AM fungal biofertilizers

Melia dubia plantation with biofertilizers

All India coordinated research project on *Gmelina arborea* Roxb.

Extensive survey work was carried out in the selected agro-climatic zones of India including northern, eastern, central Indian regions for selection of CPTs of *Gmelina arborea* and total of 340 CPTs were selected for the study (210 in Jharkhand & Bihar, 70 in CG, 15 in Dapoli, Maharashtra and 45 in Madhya Pradesh). Established five progeny trials in the selected sites i.e. two in Haryana (Seothi and Bithmara) two in eastern region i.e. one in NB farm Chandwa, Bihar and another at Ukdimadi village, Torpa, Khunti, Jharkhand and one at TFRI campus, Jabalpur (MP). In southern region Vegetative Multiplication Garden was established with 10 shortlisted high productive clones and produced 1000 cuttings at Coimbatore, 2000 cuttings from 30 best CPTs at Ranchi, 5000 from 25 clones and 3000 planting stock for QPM . Established two CSOs i.e. one at Horticultural Research Station, Kahikuchi; one at Regional Research Station, Diphu and one SSO at Sugarcane Research Station, Buralikson (Golghat) Assam. Observations on survival percentage of different progenies have been recorded in established field trials and found 95- 97 % survival, growth traits including plant height ranged from 1.5 to 2.2m and collar diameter from 12-22cm. Half sib progeny trials established by IFGTB at Kurumbampatti, Salem and at Neyveli.

Established six Gmelina based agroforestry models in the selected agroclimatic region of India vi.z Gmelina + Banana at Vadakadu, Pudhukottai, T.N. and Gmelina + Papaya at Kangeyam, Thiruppur, T. N., Gmelina + Casuarina + Ground nut at Sulakkal, Pollachi, Kerala; *Gmelina* + Mustard and *Gmelina*-Gram at Jabalpur, M.P. and *Gmelina*-chilly at Hyderabad and recorded growth and yield data and calculated economics of the systems and found that each models are site specific models and are economically viable during initial stage.

Genomic DNA isolation protocol has been standardized and isolated DNA for 135 CPTs at Ranchi and 68 at Coimbatore for SSR profiling 20 no. of Microsatellite markers (SSR primers) at Ranchi and Coimbatore were synthesized for molecular characterization of selected CPTs, Twenty new SSR primer sequences have been shared with ICFRE institutes.

Insect-pests of the species was also observed through the survey in nursery and plantation and recorded leaf webber *Pagyda* spp, *Megalurothrips peculiaris* and *Oxya nitidula, Ectropis bhurmitra, Odontotermes* spp., *Macrotoma fisheri* and *Inderbela quadrinotata* and *Phyllocnistis amydropa.* Laboratory bioassay was conducted to test the effect of biopesticides against leaf webber, results revealed that Spinosad 45% (0.0125%), Azadiractin 10000 PPM (0.02%), NSKE (5%) was found effective with maximum mortality of 83.33,75.0, and 66.66 per cent of larvae at 72 hours after treatment (HAT) respectively.

Survey was initiated in the plantation site existing at Hoskotte, Karnataka and Vellore, Tamil Nadu for wood traits analysis and GBH ranged from 33 to 53 cm for eight year old plantation at Nallah and 80-105 cm for 15 year old plantation at Vellore. Pilodyn penetration depth ranged from 26 mm to 34 mm in Nallah Plantation, basic density ranged from 0.39 g/cm^3 to 0.47 g/cm^3, Stress wave velocity ranges from 2725 m/s to 3345 m/s, the dynamic modulus of elasticity ranged from 6.6GPa to 10.1GPa. Physical and mechanical properties of Gmelina wood was recorded at both fresh and dry condition which will serve as the benchmark for comparison.

Value chain study was carried out in Tamil Nadu, Kerala, Chhattisgarh and Madhya Pradesh to assess the market potential of Gmelina wood and its products and recorded that in Kerala and Coimbatore, 25 small cottage industries are using its wood for making articles.

a, b, c: Progeny trials of *Gmelina arborea* established at IFP, Ranchi, TFRI, Jabalpur and Bithmara, Haryana

Study of climate driven effects on Indian forests through long term monitoring

ICFRE has established permanent research plots (Ten 10 ha plots; two 5 ha plots, one 4 ha plot; two 3 ha plots; Thirty-two 1 ha plots) in different forest types in an area of 152 ha, to monitor impact of climate change on Indian forests through its nine institutes and four outside institutes [Indian Institute of Science (IISc), Bangalore; French Institute of Pondicherry (IFP); Ashoka Trust for Research in Ecology and the Environment (ATREE), Bangalore and Kerala Forest Research Institute (KFRI)]. A total of 2921 individuals of trees and shrubs belonging to 264 species have been geo-tagged for periodic phenological observation. Data recorded so far suggest that *Ageratum conyzoides*, *Lantana camara*, *Chromolaena odorata, Eupatorium adenophorum* are the most common among 37 invasive species recorded across different forest types. In dry and moist deciduous and dry thorn forest (Mudumalai) seedlings of dominant canopy species were found to be under represented. However, in Himalayan moist temperate deciduous forest (Binog wildlife sanctuary) the canopy species (*Q. leucotrichophora*) dominated the regeneration count. A total of 1,38,667 woody individuals above 1 cm DBH have been measured, mapped and tagged with unique numbers so far covering 64 ha following CTFS (Center for Tropical Forest Science) protocol.

Enumeration and tagging at Binog wildlife sanctuary, Mussoorie

Development of Biopesticides products/ formulations from extracts of tree borne oil seeds and different tissues of wild plants for management of insect pests

To tests the efficacy of the biopesticide formulations at multi locations across the country against various forest pests raw materials for Tree PAL^{H} and Crawl clean collected, processed and supplied to participating ICFRE institutes for nursery and field evaluation against key forest pests. Three Lab and three field trials against major insect pests of Teak (*Tectona grandis*), defoliator *Hyblaea puera* and skeletonizer *Eutectona machaeralis* and white grubs, *Holotrichia* spp.; Ailanthus *(Ailanthus excelsa*) defoliators *Eligma narcissus* and *Atteva fabriciella,* Shisham (*Dalbergia sissoo*) defoliator *Plecoptera reflexa, Agrotis ipsilon* (cutworm) and insect pests of *Tecomella undulata* (*Patialus tecomella*)*, Dalbergia sissoo* (*Plecoptera reflexa*)*, Prosopis cineraria* (*Caryedon serratus*)*, Pterocarpus santailinus* and *Gmelina arborea,* shoot borer *Hypsipyla robusta* of *Swietenia macrophylla* at multi locations across the country showed significant results with Tree PAL^{H}.

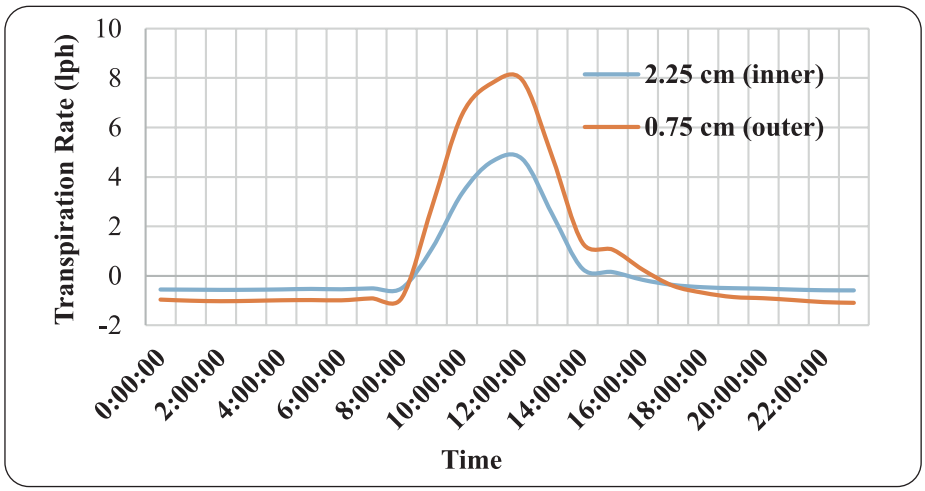
Potential sources of *Simarouba glauca* and *Pongamia pinnata* in Tamil Nadu; *Jatropha curcas* and *Madhuca indica* in Madhya Pradesh; *Boeninghausenia albifora* (Pissumaar), *Cedrus deodara* and *Abies pindrow* (Silver Fir) in Himachal Pradesh; *Balanites aegyptiaca* and *Capparis decidua* in Jodhpur; *Chlorxylon weietenia* and *Sphearanthus indicus* in Telangana were identified through surveys. Geographical attributes of the identified sources were marked. Extraction of oil from seeds and plant parts with different solvents and studies on their physiochemical properties carried out. Various secondary metabolites were identified from different plant extracts which could be potential active principles for pest management. Bio assay for insecticidal activity of active compounds for determination of LC &LD-50 values on target insect pests showed significant mortality.

Bio safety tests indicated the safety of varying concentration of seed oil of Mahua and Jatropha on natural enemies like egg parasitoids *Trichogramma raoi* and *T. chilonis* with little impact on adult emergence as well as least adverse effect on parasitisation. Low adult mortality was also recorded with predator *Canthecona furcellata.*

Assessment of water requirement of different forest tree species and its impact on subsoil moisture

The project aims at identifying the best suitable forest species for plantation under different rainfall conditions in the country with an objective to maximise water yield from a catchment. Under the study, nine forest tree species (*Prosopis juliflora, Azadirachta indica, Anogeissus latifolia*, *Tectona grandis, Pinus roxburghii, Quercus leucotrichophora, Shorea robusta, Terminalia tomentosa, Melia dubia*) are being studied by the participating institutes at nine experimental sites in Champion Block, FRI, Dehradun, Mussoorie watershed, Dehradun, Sanjay Van, New Delhi, Sitamata Wildlife Sanctuary, Rajasthan, AFRI expt. area, Jodhpur, IFGTB, Coimbatore, TFRI experimental area, Jabalpur, Mawai Forest Range, MP and Kanha National Park, MP.

Total water requirement for transpiration of a particular tree species is measured with the help of sap flow monitoring systems. Initial data on sap flow reveals that there is a distinct variation in sap flow rate recorded from the inner and outer areas of sapwood with a significantly higher flow rate in the outer area. Peak sap flow was observed around 1.0 PM in oak trees at Mussoorie watershed**.** Water use/ transpiration in oak varied between 27.46 and 68.68 l/day during December 2022, with a sap velocity of 2.1 to 5.2 cm/hour. Transpiration rate of 20-60 liter per day was recorded in *Prosopis juliflora* at Sanjay Van, New Delhi.



Diurnal transpiration rate in Oak tree

Data acquisition from sap flow meter

Domestication, genetic characterization, improvement and diversified utilization of poplars

Field trials of 16 clones of *Populus deltoides* were laid out during January-February 2022 at six sites: Sippiyan Kalan, Yamunanagar district (Haryana); Satpura, Saharanpur district (Uttar Pradesh) and Dasuya, Hoshiarpur district (Punjab) by ICFRE-FRI Dehradun, at Tamkuhi Raj, Kushinagar district (Uttar Pradesh) by ICFRE-ERC, Prayagraj, at Bir Plassi, Nalagarh, Solan district (Himachal Pradesh) by ICFRE-HFRI Shimla and at Nathpur, Araria (Bihar) by ICFRE-IFP Ranchi. The same set of clones has been planted in randomized complete block design. Data was recorded at one year age and growth was found to vary significantly in Punjab, Haryana and Uttar Pradesh. Tree height of different clones ranged 5.2 to 9.6 m, 3.5 to 9.2 m, 5.4 to 11.7 m and 6.13 to 10 m at Sippiyan Kalan, Yamunanagar district (Haryana); Satpura, Saharanpur district (Uttar Pradesh); Dasuya, Hoshiarpur district (Punjab) and Tamkuhi Raj, Kushinagar district (Uttar Pradesh) respectively. Variation in gbh of different clones ranged 18.5 to 36 cm, 10.5 to 30.5 cm, 10.4 to 31.6 cm and 18.7 to 33.6 cm for the above sites respectively. The field trials are being maintained. Data on survival and growth parameter has been analysed for the provenance trial of *Populus ciliata* at Brundhar, Kullu, Himachal Pradesh.

Cuttings of *Populus alba* along with *Populus ciliata*, *Populus nigra* and *Salix alba* have been planted in the nursery for introduction trials by ICFRE-FRI, Dehradun and ICFRE-RFRI, Jorhat in their respective regions. The germplasm of the four species was supplied by ICFRE-HFRI Shimla.

Studies on DNA extraction and standardisation of DNA markers are in progress at ICFRE-FRI, Dehradun; ICFRE-HFRI, Shimla and ICFRE-RFRI, Jorhat.

Surveillance of insect pests and diseases has been completed by all the four institutes in their respective regions. Fulfilment of Koch's postulates established *Calonectria* sp. as an incitant of blight disease of *P. deltoides.* Natural biocontrol agents of different insect pests of *P. deltoides* were recorded belonging to Braconidae, Inchnomonidae, Mucidae and Eupelmidae family. Bio-efficacy experiments of entomo-pathogenic nematodes were conducted for management of leaf defoliator *Clostera* sp.

Data of provenance trial of *Populus ciliata* at age of 21 years

Sr. No.	Provenance	GBH (cm)	Total height (m)	Clean bole height (m)	Crown width (m)	Survival (%)
1	Khanola	56.01	16.82	5.54	3.93	66.67
2	Pahnala	54.25	17.04	5.99	3.99	52.78
3	Nashala	47.64	17.31	5.27	4.95	43.52
4	Solangnala	55.00	17.81	5.98	5.60	75.00
5	Gaganshil	52.39	19.04	6.34	3.30	50.00

Clonal trial of *P.deltoides* in district Kushinagar, Uttar Pradesh

Calonectria leaf blight, a new disease of *P. deltoides*

Component-2: National Program for Conservation and Development of Forest Genetic Resources

Nodal centre-ICFRE-IFGTB (Partner institutes ICFRE-IFGTB, ICFRE-TFRI, ICFRE-IWST & ICFRE-IFB)

Localized distribution maps were prepared for 158 FGR species; 79 species by ICFRE-IFGTB, 30 species by ICFRE-TFRI, 27 species by ICFRE-IWST and 21 species by ICFRE-IFB. Field surveys and population density studies conducted and selected seed sources for 159 FGR species; 77 by ICFRE-IFGTB, 36 by ICFRE-TFRI, 27 by ICFRE-IWST and 19 by ICFRE-IFB. Regeneration studies for *in-situ* conservation was conducted for 17 species by ICFRE-IFGTB and 10 by ICFRE-TFRI. For seed germplasm storage, standardized processing and extraction of seeds for 96 species; 44 species by ICFRE-IFGTB, 35 by ICFRE-TFRI, seven by ICFRE-IWST and 10 by ICFRE-IFB. Characterization by image analysis of fruit /seed characters have been done for 34 species by ICFRE-IFGTB, six by ICFRE-TFRI, 11 by ICFRE-IWST and eight by ICFRE-IFB. For molecular/ biochemical characterization of selected species/ populations, the DNA extraction protocol was standardized for five species (*Myristica malabarica, Cullenia exarillata , Dysoxylum malabaricum, Mesua ferrea & Kingiodendron pinnatum)* by ICFRE-IFGTB, three species *(Oroxylum indicum, Dillenia pentagyna & Cordia macleodii)* by ICFRE-TFRI and three species (*Lagerstroemia macrocarpa , Barringtonia racemosa* & *Dillenia indica*) by ICFRE-IWST.

For FGR Conservation in Field Gene bank, ICFRE-IFGTB raised seedlings, transplanted, and initiated hardening of seven species- *Artocarpus heterophyllus, Sapindus emarginatus, Oroxylum indicum*, *Artocarpus hirsutus, Strychnos nux vomica, Swietenia mahagoni* and *Aegle marmelos* while ICFRE-TFRI maintained the nursery of four species-*Pterocarpus marsupium, Mitragyna parvifolia, Buchnania cochinensis, Haldina cordifolia,* and *Ailanthus excelsa.*

Regeneration studies at Silent valley

Selection of seed source of *Anogeissus latifolia*, Yellapur, Karnataka

X ray equipment for seed analysis

X-ray imaging for seed analysis

Germination of *Wrightia tinctoria*

Accessions of *Strychnos nux-vomica* from Tamil Nadu

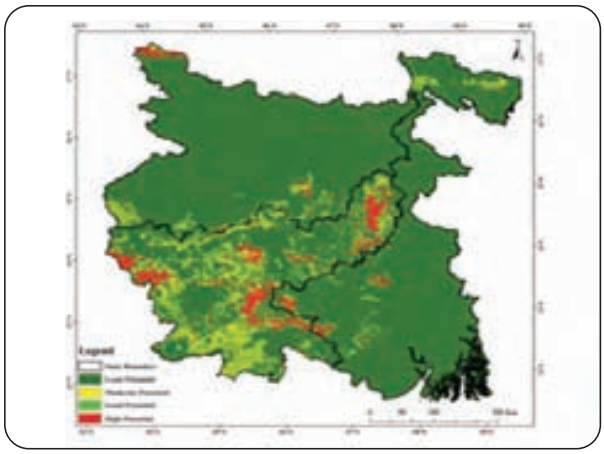
Seed source selection of *Stereospermum chelonoides*, Rayagada

Nodal centre- ICFRE-FRI (Partner institutes ICFRE-FRI, ICFRE-AFRI, ICFRE-HFRI, ICFRE-IFP, ICFRE-RFRI)

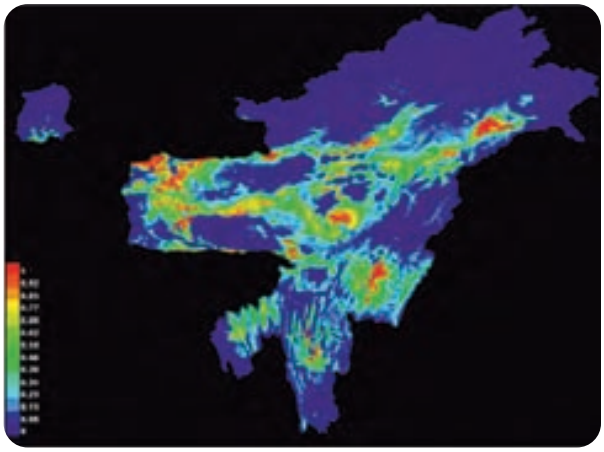
Population structure/Regeneration status of 250 selected FGR species recorded in different Forest Divisions of Haryana, Himachal Pradesh, Uttar Pradesh, Rajasthan, Gujarat, Jharkhand, Bihar, Assam and Meghalaya. A pictorial guide of 200 prioritized species has been prepared for field working staff for authentic identification of the species. A total of 260 herbarium specimens of different FGR species have been prepared. Draft Eco-distribution maps of 50 FGR species has been prepared and are in the process of up gradation. Prediction map of 3 species (*Shorea robusta, Magnolia champaca* and *Duabanga grandiflora*) prepared. Eco-distribution mapping of *Buchanania cochinchinensis* completed and *Madhuca longifolia* done for Jharkhand.

Seeds of total 103 FGR species were collected from different forest divisions of Haryana, Uttar Pradesh, Punjab, Rajasthan, Jharkhand, Gujarat and North Eastern States and processed for medium term storage. 132 seed samples of 52 species have been deposited and stored with complete passport data at Seed bank of ICAR-NBPGR New Delhi for *ex-situ* conservation. National Forest Seed and Referral Centre is being developed.

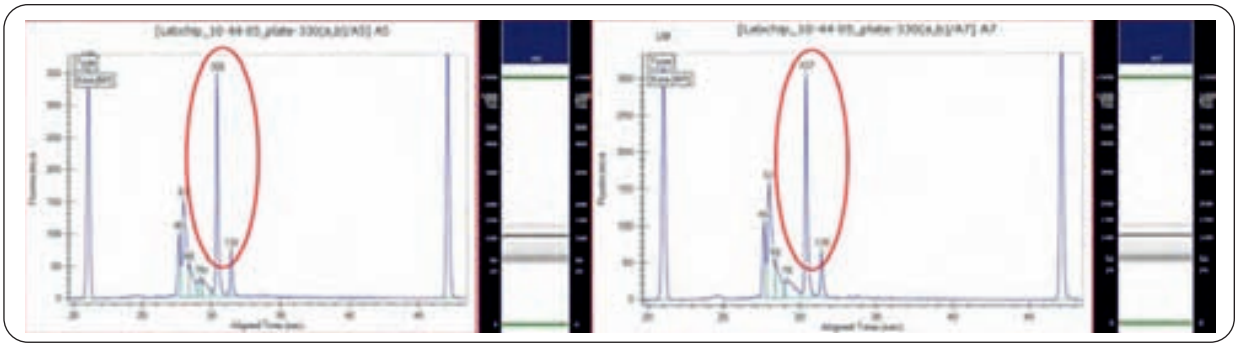
Aseptic slow growth cultures have been established successfully for eleven species – *Embelia ribes, Embelia tsjeriumcottam, Litsea glutinosa, Tinospora cordifolia, Vitex peduncularis, Phlogacanthus thyrsiflorus, Zanthoxylum armatum, Celastrus peniculatus, Pterocarpus marsupium, Premna latifolia, Rauwolfia serpentina.* Synthetic seeds of *Catamixis baccharoides* and *Rhamnus triquetra* have been developed. DNA isolation protocols for eleven selected species (*Acacia catechu, Shorea robusta, Terminalia arjuna, Terminalia bellerica, Pterocarpus marsupium, Madhuca longifolia, Prosopis cineraria, Tecomella undulata, Magnolia champaca, Pinus wallichiana, Buchanania cochinchinensis*) has been standardized. Genetic diversity analysis of populations of *Shorea robusta* with 10 selected highly polymorphic primers completed for Uttarakhand, Uttar Pradesh and Jharkhand. Germplasm of 15 species collected and raised for establishment of Field Gene Bank. A field gene bank of 21 germplasm of *T. arjuna* established at Bithmera, Haryana. Nursery techniques standardized for *Bridelia retusa, Careya arborea, Capparis decidua, Butea monosperma, Tecomella undulata, Salvadora persica, Commiphora wightii.*



Eco distribution Mapping of *Buchanania cochinchinensis* using Maxent Model



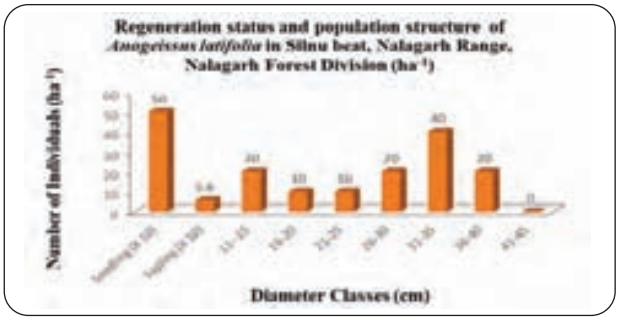
Prediction map of *M. champaca*

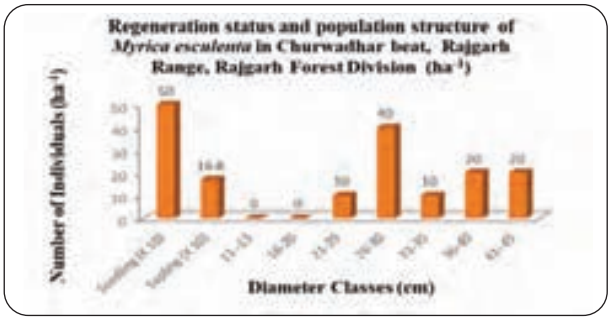


Electropherogram of genotyping of *Shorea robusta*

Commiphora wightii seed collection and raising of seedlings in nursery

Propagation of FGR species : **a.** Air layering on *B. cochinchinensis*; **b.** Air layering on *P. marsupium*; **c.** Air layering on *L. glutinosa*





Component-4 : Capacity Buildings of State Forest Departments for Developing State REDD+ Action Plans

- Workshops on "Developing State REDD+ Action Plan for the States" for capacity building of State Forest Department of Goa and Telangana were conducted.
- Multi-Stakeholders consultation workshop and expert consultation meeting for developing Divisional REDD+ Action Plan for Rohru Forest Division of Himachal Pradesh was organized in collaboration with Himachal Pradesh State Forest Department at Rohru District Shimla, HP.
- A resource manual in Hindi for capacity building of State Forest Departments for developing State REDD+ Action Plan was published.

SCHEME-3

Execution of Readiness Activities for Implementation of REDD+ in India

- Safeguard Information System for REDD+ in India was published and submitted to the UNFCCC. Development of REDD+ Knowledge Sharing and Safeguards Information System is under progress.

03
CHAPTER

Education Vistas/Activities

EDUCATION VISTAS/ ACTIVITIES

3.1. FRI UNIVERSITY

Establishment of Forest Research Institute (Deemed to be) University, Dehradun has been a major mile stone in the field of Forestry Education in India. It was established to promote forestry education in the country. After the conferment of (Deemed) University status, academic activities of the Institute have increased tremendously and it has been fostering Research and Education in forestry, environment and other allied disciplines in a more meaningful and productive way. The University has been fostering pioneering research in specialized areas under Ph. D. Programme.

The FRI (Deemed to be) University has been offering the following academic courses on a regular basis:-

M.Sc. Forestry:
M.Sc. Wood Science & Technology:
M.Sc. Environment Management:
M.Sc. in Cellulose & Paper Technology:

Activities carried out

- 6th Convocation of FRI Deemed to be University was held on 26 November 2022 at FRI, Dehradun and 227 MSc. Degrees and a total of 56 Ph.D. degrees have been awarded.
- Admissions to M.Sc. courses are made on the basis of all India Competitive Entrance Test. In the current academic year, 65 Research Scholars are registered for Ph.D. at the FRI Deemed to be University.
- Annual sports meet was held on 11 to 14 October 2022.

Some glimpses of the activities held in FRIDU during the year

Sixth Convocation held on 26th Nov, 2022 in ICFRE-FRI

Industrial visit of students pursuing degree in Wood Science & Technology discipline

Interaction of students with Sansad TV

Annual sports meet of FRIDU held in the month of October, 2022

Visit of Cellulose & Paper Technology discipline students at paper mill Industries

3.2. TRAINING PROGRAMMES ORGANIZED (HRD)

3.2.1. Trainings under Forestry Training and Capacity Building (FTCB)

Training programmes organized by ICFRE institutes under Forestry Training and Capacity Building (FTCB) Scheme of Ministry:

S. No.	Name of Institute	One week training for IFS officers	Three days trainings for IFS officers	Trainings for other stakeholders	Trainings for personnel of other services
1.	ICFRE-FRI, Dehradun	1	1	1	-
2.	ICFRE-IFGTB, Coimbatore	1	-	2	1
3.	ICFRE-IWST, Bengaluru	1	1	1	-
4.	ICFRE-TFRI, Jabalpur	-	1	-	-
5.	ICFRE-AFRI, Jodhpur	1	-	-	-
6.	ICFRE-RFRI, Jorhat	1	1	1	-
7.	ICFRE-HFRI, Shimla	1	-	2	-
8.	ICFRE-IFP, Ranchi	1	-	-	-
9.	ICFRE-IFB, Hyderabad	-	-	1	-
10.	ICFRE-ERC, Prayagraj	-	-	-	1
	Total	7	4	8	2

Training on Livelihood enhancement strategies for forest fringe villages at ICFRE-IFP, Ranchi

Training on Advances in wood production and utilization at ICFRE-IWST, Bengaluru

Training on Sandalwood cultivation and its prospects at ICFRE-IWST, Bengaluru

3.2.2. Trainings under CAMPA Component-5 Operationalization of Human Resource Development Plan of ICFRE

Under HRD plan total 17 trainings have been organized, in which six each were organized for scientists and technical officers/staff of the council covering 72 scientists and 105 technical personnel. Three training programmes have been organized for administrative staff covering 109 individuals. Apart from this, two induction trainings one each for Administrative staff and executive staff have been organized.

S. No.	Name of HQ/Institute	No. of Trainings	Duration (in days)	No. of participants
1.	ICFRE (HQ), Dehradun	10	44	183
2.	ICFRE-FRI, Dehradun	3	13	63
3.	ICFRE-AFRI, Jodhpur	1	90	1
4.	ICFRE-IFP, Ranchi	3	13	61
	Total	17	165	308

Training on Invasive weed management at ICAR-DWR, Jabalpur

Training on Advance techniques in soil, plant and water analysis at ICAR-IISS, Bhopal

3.3. PARTICIPATION IN SEMINARS/SYMPOSIA/WORKSHOPS/TRAININGS

S.No.	Name of HQ/ Institute	No of Seminars/Symposia/ Workshops/Trainings	Duration (in days)	No. of participants
1.	ICFRE (HQ), Dehradun	21	86	48
2.	ICFRE-FRI, Dehradun	103	291	829
3.	ICFRE-IFGTB, Coimbatore	56	114	157
4.	ICFRE-IWST, Bengaluru	75	126	237
5.	ICFRE-TFRI, Jabalpur	141	304	1063
6.	ICFRE-AFRI, Jodhpur	19	60	57
7.	ICFRE-RFRI, Jorhat	25	71	56
8.	ICFRE-HFRI, Shimla	126	227	257
9.	ICFRE-IFP, Ranchi	68	159	216
10.	ICFRE-IFB, Hyderabad	18	52	31

3.4. AWARDS

3.4.1. ICFRE Awards

To promote and motivate the professional competence of the employees, council has instituted the ICFRE level Awards

3.4.1.1. ICFRE Lifetime Meritorious Service Award

- Sh. Ramakant Mishra, CTO, ICFRE (Hq.), Dehradun

3.4.1.2. ICFRE Outstanding Employee Award

- Sh. Sanjeev Sachdeva, Assistant, ICFRE (Hq.), Dehradun
- Sh. Badri Sain Negi, Assistant, ICFRE-HFRI, Shimla
- Sh. Manoj Chouhan, CTO, ICFRE-AFRI, Jodhpur
- Smt. Kusum Lata Parihar, STO, ICFRE-AFRI, Jodhpur

3.5. VISITS ABROAD

ICFRE-IFGTB, Coimbatore

Dr. Rekha R. Warrier and Dr. R. Anandalakshmi, Scientist attended the 20th Anniversary and Strategy Review Meeting as co-chair of the APFORGEN to work out a new strategy for 2023-2027 for the implementation of APFORGEN activities in the Asia Pacific Region. The one week meeting was held from 13 to 17 March 2023 at Kuala Lumpur, Malaysia

ICFRE-IWST, Bengaluru

Shri Amitava Sil and Dr. S.C. Sahoo Scientist, erstwhile IPIRTI Field Station Kolkata visited M/s Century Plywood Industries Pvt. Ltd., Birat Nagar, Nepal for giving guidance in testing, specifications and plywood manufacturing.

ICFRE-RFRI, Jorhat

Dr. Rajib Kumar Borah, Scientist visited Kathmandu, Nepal from 17-20 June, 2022 as per request of the Director General, Department of Forest and Soil Conservation, Ministry of Forest and Environment, Government of Nepal. A hands on training on cultivation and artificial inoculation of *Aquilaria malaccensis* was imparted to 25 Nepalese professionals and farmers at Damauli in Tanaho District of Nepal.

3.6. Mission Karmayogi e-learning modules published by ICFRE institutes on iGOT portal

ICFRE actively participated in the initiative of government of India i.e. Mission Karmayogi by publishing forestry e-learning modules on iGOT portal. Ten e-learning modules have been published by the ICFRE institutes on iGOT portal under Mission Karmayogi.

Name of Institute	Name of Module	Name of Content Creator
ICFRE-FRI, Dehradun	Nursery Techniques	Dr. Manisha Thapliyal and Dr. Dinesh Kumar
	Butterfly Diversity and Identification	Dr. Arun Pratap Singh
ICFRE-IFGTB, Coimbatore	Tree Improvement	Dr. V. Sivakumar
	Biodiversity Conservation	Dr. A. Rajasekaran
ICFRE-RFRI, Jorhat	Bamboo Identification, Utilization and Management	Dr. R. K. Borah
ICFRE-IWST, Bengaluru	Plywood Manufacturing Technology-I Plywood Manufacturing Technology-II	Sh. Uday D Nagammanavar D, Sh. Prakash V. and Ms. Sujatha D., Dr. Mamatha B.S.
	Bamboo Composites	Dr. Vipin Chawla
	Seed Handling and Nursery Technique for Sandalwood	Dr. N. Ravi
	Wood Seasoning and Preservation	Ms. C.N. Vani
	Field Identification of Important Timbers	Ms. S. Shashikala

04
CHAPTER

Extension Panorama

EXTENSION PANORAMA

04 Chapter

4.1. LAB TO LAND

Promotion of bamboo based agroforestry system for economic upliftment and livelihood security of farmers in Madhya Pradesh (ICFRE-TFRI)

Organized two trainings on bamboo-based agroforestry systems at the farmer's field for the NABARD beneficiaries and demonstrated the harvesting and management techniques of bamboo culms. Provided the agricultural tools to beneficiaries for management of bamboo culms like pruning and inter-culture operations. A team of NABARD officials visited farmer's field and interacted with farmers (beneficiaries) to know about the benefits of the system.

Training program on bamboo based agroforestry system at Vasan village, Jabalpur (MP)

Interaction of NABARD team with farmers in the field

High altitude transition zones in Himachal Pradesh: Long-term studies to assess the effects of global warming

Capacity Building Training Programme organized for frontline staff of HPSFD to upgrade basic taxonomic skills and nursery management techniques. A total of 40 participants including research staff participated in the programme.

Capacity building on seed and nursery technology and plantation techniques for prioritized species of Chhattisgarh state (ICFRE-TFRI)

Field manuals on *Phyllanthus emblica*, *Haldina cordifolia, Gmelina arborea, Acacia auriculiformis, Terminalia chebula* and *Pterocarpous marsupium* were prepared and provided to the CCF, Raipur (CG). Interacted with the field officials, and shared information regarding hi-tech plantation of sandalwood and *Melia dubia.* Organized training for 25 field functionaries of the Chhattisgarh forest department.

Capacity building of nursery staffs on preparation of biofertilizers, organic fertilizers & its application in Teak and Bamboo (ICFRE-TFRI)

Four trainings on biofertilizers/organic fertilizers were organized for SFDs and method of preparation of Jivamrut were demonstrated to 100 participants including scientific personnel/executives of SFDs/ NGOs. Bacterial populations were isolated from Jivamrut. Value additions of Jivamrut were carried out.

Imparted trainings on "Biofertilizers and Organic fertilizers" to participants

Capacity building on promoting practices for conservation of native pollinators and their food plants through community based approach in the selected forest ranges of Kinnaur district, Himachal Pradesh (ICFRE-HFRI)

Three field demonstration cum training programmes on Capacity Building in promoting practices for conservation of native pollinators and their food plants through community based approach were organized with support of NABARD at Kalpa, Pooh and Bhawanagar range of Kinnaur Forest Division to create awareness among local communities on pollinators conservation and native flora. 255 participants including front line field functionaries of Kinnaur Forest Division, DDM, Kinnaur, officials from KVK, Kinnaur, local panchayat members and progressive farmers participated in these training programmes. Surveys were also conducted for establishment of nurseries for raising native species (2000 seedlings) at forest nurseries in Bhavanagar, Kalpa and Pooh ranges for distribution among the local community. Meetings were also conducted with members of local civil bodies at Bhawanagar, Kalpa and Pooh for bee colony distribution among the local community.

Participants of training at NABARD training at Kalpa

Participants of NABARD training at Pooh

Participants of NABARD training at Bhavanagar

Skill Development in parataxonomy for local communities of Gangotri – Govind and Darma - Byans Valley of Uttarakhand (ICFRE-FRI)

Parataxonomy training programme was organized for local communities at Darma-Byans Landscape in Dharchula (Pithoragarh). The training was imparted by Forest Botany Division on Parataxonomy and UNDP resource persons on identification of different species (*Bombax ceiba*, *Bridelia retusa*, *Engelhardia spicata*, *Pinus roxburghii, Alnus nepalensis, Berberis aristata, Princepia utilis* etc.) present in the subtropical and temperate forests. 50 Herbarium specimens have been prepared and handed over to Tirupati Medicare Ltd., Himachal Pradesh.

Herbarium specimen of *Terminalia arjuna*

Herbarium specimen of *Andrographis paniculata*

Establishment of Small Nursery Under the AYUSH Mission (ICFRE-HFRI)

Developed nurseries at different Field Research Stations (FRS) viz., Model Nursery Badagaon, FRS Shilly, FRS Brundhar and, FRS Shillaru. Raised 1.18 lakhs plants of targeted medicinal plants species – *Valeriana jatamansi*, *Ocimum tenuiflorum*, *Picrorhiza kurroa* at Model Nursery Badagaon, and FRS Jagatsukh. About 37 thousands of these medicinal plants were distributed among stakeholders.

Raising of Selected Medicinal plants and their maintenance at different FRS

Conservation status, germplasm collection and resource augmentation of priority medicinal plants in the cold deserts of Ladakh (ICFRE-HFRI)

Surveyed 13 villages of Kargil district and collected ethnobotanical information from 215 respondents. Interacted with Amchi community at Choglamsar. Collected information on raw drugs of *Podophyllum hexandrum*, *Datura stramonium*, *Allium* spp., *Salvia* spp., *Cicer microphyllum*, *Inular racemosa* and *Saussurea costus* etc., from Igoo & Sapi villages, Kargil. Awareness programme on medicinal plants was organised at Sapi village and 44 villagers participated in this consultative meeting. Under PRAKRITI - the Student Scientist Connect Programme, delivered an interactive talk on the theme "Right to Clean Environment & Social Responsibility" to students of Kendriya Vidyalaya (KV), Leh (Ladakh UT) and Jawahar Navodaya Vidyalaya (JNV), Leh (Ladakh UT).

Community awareness at Sapi, Kargil

Raw Drugs Samples of *Inular racemosa* and *Saussurea costus*

Promoting livelihood by bamboo charcoal production and briquetting to the selected forest fringe villages of Karbi Anglong district, Assam. (ICFRE-RFRI)

For strengthening the income of the communities, eight capacity building programmes and one workshop for 242 villagers for producing bamboo charcoal and briquetting were conducted. During the project period two Facility Centers with a Brick Kiln each were created under this project at Jilangso Village and Thiolangso Village of Karbi Anglong, Assam.

Skill Development Training on production of bamboo charcoal production and briquetting

Establishment of Centre of Excellence on Coir Composites (CECC) for utilization of coirfibres for transforming into high value coir composites (ICFRE-IWST)

All the technical details for the manufacture of quality products from initial coir, felt density requirement to the final trimming and storage section were demonstrated in three coir cluster units. 11 candidates from CICT and M/s. TNKSS, GUBI were provided training for period of one week on Manufacturing and Testing of Coir Composite for High End Applications.

Development of compost out of waste involving tribal for their livelihood support: a part of Swachh Bharat Mission (ICFRE-IFGTB)

The efficacy of Tree Rich Biobooster (TRB), coir pith based organic potting mixture in comparison with paddy straw, sugarcane bagasse, Casuarina needles and *Zea mays* straw was evaluated against agriculture crops and forestry plant species. TRB exhibited a high growth rate (92%) in comparison to other base materials. Nine new tribal Women Self Help Groups (WSHG) were formed in Pattisalai, Rayaroothpathi and Kallarpudhur settlements and registered with the Tamil Nadu State Rural Livelihood Mission (TNSRLM), Government of Tamil Nadu. Trainings were imparted to 350 tribal women. A 5 Kg TRB production machine was installed and handed over to WSHGs of Rayaroothpathi tribal settlement, Periyanaickanpalayam range, Coimbatore. An application for obtaining Copy rights was filed for the short film on 'Recycling waste and supporting livelihood-A tribal development initiative of ICFRE-IFGTB'. Obtained "Organic Certificate" from Tamil Nadu Organic Certification Department.

Establishment of micro/medium processing units for bamboo product development and processing at FRCBR, Aizawl (ICFRE-RFRI)

Established bamboo workshop cum training hall and procured tools, boucherie and sanders for bamboo product development and treatments. Two days training on bamboo treatment and value addition of bamboo handicrafts and one on bamboo and rattan based handicrafts for 40 farmers conducted.

Participants of training on bamboo treatment and value addition of bamboo

Establishment of Bamboo Treatment Plant in Manipur- Phase-II (ICFRE-IWST)

A bamboo preservative treatment plant was established at Noney, Manipur and training on operation and maintenance of the system was imparted to the local operators.

Primary processing machines at seven CFCs for bamboo processing in NE states (ICFRE-IWST)

Sets of primary bamboo processing machines has been delivered to Meghalaya and Tripura. Installation of machineries and training on operation of machineries is being carried out.

Sustainable pulpwood production through high yielding varieties of nitrogen fixing and drought tolerant trees- A collaborative project between IFGTB and Tamil Nadu Newsprint and Papers Ltd (TNPL). (Component: Bioinoculants for improving growth and health in Casuarina clones) (ICFRE-IFGTB)

Bacterial wilt occurrence in the TNPL nursery and plantation of *Casuarina* hybrids was controlled by pre-inoculation with MONA- 20, Frankia and Tichoderma. Due to the pre inoculation the clones showed improved growth and further infestation was controlled. As per TNPL reports improved growth and reduction in further infestation was observed in the clones.

The World Bank funded Ecosystem Services Improvement Project (ESIP)

- Two trainings on Measurement of Forest Carbon Stocks was organized for the SFDs of Chhattisgarh and Madhya Pradesh.
- Training on Measurement of Forest Carbon Exchange through Eddy Covariance System were organized for the SFDs of Chhattisgarh and Madhya Pradesh.
- 27 trainings for capacity building of the Joint Forest Management Committees on Environmental and Social Safeguards w.r.t. scaling up of SLEM best practices and measurement of forest carbon stocks were organized in the project areas of Chhattisgarh and Madhya Pradesh.
- Two training programmes on Measurement of Forest Carbon Stocks through Eddy Covariance in India were organized at Hyderabad for scientists from ICFRE Hqs., ICFRE institutes and other organizations (NRSC, IIRS, GBPHIED, IIT Madras, NIH Roorkee, Uttarakhand Watershed Management Directorate etc.).
- 65 trainings for capacity building of the local communities on scaling up of SLEM best practices were organized in the 69 villages of Chhattisgarh and Madhya Pradesh.
- Scaled up the SLEM best practice related to restoration of degraded ecosystem through:
  a. Distribution of improved cookstoves to the 7845 number of local communities
  b. Lac cultivation for livelihood generation and biodiversity conservation in the Marwahi and Pali Forest Ranges of Chhattisgarh through distribution of brood lac for inoculation on host trees of 816 beneficiaries.
  c. Integrated farm development by preparation and application of biofertilizers and biopesticides for productivity enhancement through distribution of 6520 numbers of open top drums to 13100 number of households. Prepared *neemastra, amritpani* and *dasparni* and applied in the crops for productivity enhancement.
  d. Distributed vegetable seeds mini-kits of Kharif season to the 13100 beneficiaries and vermicomposting units to the 5022 beneficiaries on integrated farm development.
  e. Distributed tall seedlings of fruit trees (Mango, Lemon, Amla, Custard apple, Guava and Moringa) to 13009 beneficiaries for scaling up of WADI: a tree-based farming system.
  f. Initiated conservation of water resources and enhancing productivity through installation of 4073 drip irrigation systems and 1216 sprinkler irrigation systems.
  g. Initiated Azolla cultivation.

Improved Cook stoves

Vermicomposting

Establishment of new Van Vigyan Kendras (VVKs)

ICFRE has initiated establishment of VVKs with the objective of dissemination of various technologies developed by the Council and its institutes to the user groups including farmers, forest based industries and other stakeholders. At present, 40 Van Vigyan Kendras (VVKs) have been established and maintained by ICFRE. Following VVKs were inaugrated/established during 2022-23:

- VVK Longni, Dharampur, Mandi, H.P. building was inaugurated on 18 September 2022. Sh. Mohinder Singh Thakur, Honourable Jal Shakti Minister, Govt. of Himachal Pradesh was Chief Guest of the occasion and Sh. Arun Singh Rawat, DG, ICFRE was Guest of Honour.
- VVK Barapani, Umiam, Meghalaya was inaugurated by Shri S. M. Sahai, IFS, Principal Chief Conservator of Forests (Biodiversity and Wildlife) and Chief Wildlife Warden, Government of Meghalaya.
- ICFRE-IFB, Hyderabad established a new VVK at FCRI, Mulugu.
- ICFRE-IFP, Ranchi signed MoU with SFD, Bihar for establishment of new VVK at Supaha, Banka, Bihar.


Inauguration of Van Vigyan Kendra at Dharampur, Mandi, H.P.

Inauguration of Van Vigyan Kendra for Meghalaya and training of forest field functionaries

Maintenance of VVKs including networking with KVKs

ICFRE-IFGTB, Coimbatore

- Organized two-day hands-on training on "Vegetative Propagation Techniques" for 27 officials of Tamil Nadu Forest Department.
- Organized one day training for 45 participants to cater the needs of the banana growers in Pollachi and farmers from bordering areas in Kerala, with Vanavarayar Institute of Agriculture, Pollachi. Demonstrated trial of Casuarina windbreak clones and popularized Tree Genie mobile app.

Training on windbreak clones of Casuarina at Pollachi, Tamil Nadu by ICFRE-IFGTB

ICFRE-AFRI, Jodhpur

- Organized two three-days training on "Agroforestry, Soil and Water Conservation in dry land" for 50 participants at ICFRE-AFRI, Jodhpur and "Biodiversity in Gujarat" for 46 participants at KVK Rajkot, Gujarat.


Training on "Agroforestry, Soil and Water Conservation in Dry Land" by ICFRE-AFRI

ICFRE-RFRI, Jorhat

- Two trainings on "Bamboo & Agarwood Cultivation" at Cachar College, Silchar for 70 participants.
- Two trainings on 'Bamboo Made Eco-Friendly Utility Products for Livelihood Development' for 15 Tribal women and for 22 unemployed artisans including 18 women from different localities in West Tripura.
- Training on Biological Control of Invasive Species at VVK, Umkhuti, Meghalaya for 30 forest field functionaries.
- Two days training programme on Post-Harvest Management and Value Addition (Handicrafts) of Bamboo and Rattan at Lengte village for 21 participants.
- Training on Value Addition of Bamboo Shoot under Van Vigyan Kendra (VVK), Mizoram. 25 SHG's participants from Sihphir village, Aizawl attended the programme.
- Training on Low Cost Vermicomposting Techniques and Livelihood Generation at ICFRE-LEC for beneficiaries of different parts of South Tripura District for 120 participants.
- Training cum workshop programme on "Establishment of Herbal Home Gardens and Traditional Health Care" at ICFRE-LEC, Gandhigram campus for 30 participants.
- Three trainings on "Bamboo and Rattan Architecture" for 60 participants at ICFRE-BRC, Aizwal.
- Two-days Skill Development Training for 25 participants including Frontline staff, farmers, students at State Environment & Forestry Training Institute, Dimapur (Nagaland).

Training on Skill Development on Bamboo Utility Products by ICFRE-RFRI, Jorhat

ICFRE-HFRI, Shimla

- One day training programme on Forest technologies for productivity enhancement and Livelihood at VVK Leh for 40 farmers and frontline staff.
- Training programme on "Cultivation of important temperate medicinal plants" at VVK Manali for 30 farmers of Kullu region.

Training programme on "Cultivation of important temperate medicinal plants" at VVK Manali by ICFRE-HFRI, Shimla

ICFRE-IFP, Ranchi

- Training on "Income-addition through Beekeeping" for 60 villagers/farmers at Sibar, Rakhjot, Darjeeling, WB.
- Training on "*Flemingia semialata* plantation technique and lac pest farming" for 30 villagers/ farmers at Ukrimari, Torpa, Khunti.
- Training on "Role of Farmers in Conservation, Cultivation, Harvesting and Marketing of Medicinal and Aromatic Plants" for 40 farmers at Chopra district, Uttar Dinajpur, West Bengal.
- Training on "Livelihood generation through lac cultivation" for 45 villagers/farmers at Ukrimari, Torpa.
- Training on "Bamboo Propagation, Management and Handicraft making" for 40 villagers/farmers at Hansbera, Karra, Khunti.

- Training on Production and processing of lac for 45 farmers at Chandwa, Latehar.
- Training on Non-Timber Forest Produce Collection and Value addition for 43 villagers/ farmers at Uday Singh Jote, Dagapur, Darjeeling.
- Training on Production of *Cinnamomum tamala* and its value addition for 40 farmers at Nepania Mirik Block, Darjeeling, West Bengal.
- Training on Promoting cultivation of Medicinal and Aromatic plants and development of Medicinal Plant Nursery for 37 farmers at Mainaguri, Kharibari block, Darjeeling, West Bengal.
- Training on "Improvement of livelihood through NTFP" for 81 farmers at Van Vigyan Kendra, Sukna, West Bengal.

Trainings by ICFRE-IFP, Ranchi under VVK

ICFRE-IFB, Hyderabad

- One-day training programme on "Integrated Pest Mangement" at FCRI, Mulugu, Telangana for 26 farmers and officials from Telangana and Andhra Pradesh.
- One-day training programme on "Industrial Agroforestry" at FCRI, Mulugu, Telangana for 40 students from FCRI, Mulugu.
- One-day training programme on "Biodiversity & Conservation" at FCRI, Mulugu, Telangana for 80 students from FCRI, Mulugu.
- One-day training programme on "Cultivation Techniques of Red sanders" at IFB-ICFRE, Hyderabad for 30 farmers and officials from Telangana and Andhra Pradesh.
- One-day training programme on "Sandalwood Cultivation & Management Techniques" at FCRI, Mulugu, Telangana for 26 farmers and officials from Telangana and Andhra Pradesh.

ICFRE-FRI, Dehradun

- Training programme on 'Livelihood Opportunity from Bamboo Resources' was conducted at CFC-Campierganj, Gorakhpur. 53 participants attended the programme.
- Training on 'Bamboo and Ringal Handicrafts' for 55 farmers and artisans at ICFRE-FRI, Dehradun.
- Training on 'Wood Seasoning' for 18 wood based technologists at ICFRE-FRI, Dehradun.

Training on Bamboo and Ringal Handicrafts

Training on Wood Seasoning

ICFRE-TFRI, Jabalpur

- Four days training programme on bamboo handicraft for artisans at ICFRE-TFRI for 35 participants.
- One day training programme on 'Agroforestry, Seed Technology and Biofertilizer' at VVK-CG, Jagdalpur. 60 field functionaries attended the programme.
- Training Programme on "Agroforestry Models for Maharashtra State" for 70 forest officials and farmers at Melghat, Maharashtra.
- Training programmes on "Agroforestry and Bio fertilizer" for 60 forest officials and farmers of Mandla, Jabalpur, Dindori and Kundam, divisions.

- Training Program on "Sustainable Harvesting Methods of NTFPs" for 54 participants of JFMCs and SFDs of Chhindi Range, Chhindwara.
- Two training programmes on "Nursery Techniques of Important Forestry species" for 58 officials of SFDs of Seoni, MP and another for 29 officials of SFDs of Nagpur, Maharashtra.

ICFRE-IWST, Benglauru

- A workshop jointly organized with Velankani Information Systems Limited, Bengaluru and Quercus Space, Bengaluru on integration of wood and wood based products in green building in hybrid mode for 140 stakeholders.
- Sensitization programme on "Forestry and Wood Science" for 23 Audit officers from Regional Training Centre of Indian Audit and Accounts Department (IA&AD), Bengaluru.
- Training programme on "Bamboo cultivation and livelihood" at Kortagere, Tumkur for 125 tribals from HakiPikki community and farmers.
- Training programme on "Sandalwood based Agroforestry Models and Spike Disease" jointly with Karnataka Forest Department, Chikkamangaluru and Akhila Karnataka Sandalwood Growers Association for 80 farmers.

Networking of VVKs with KVKs

ICFRE-FRI, Dehradun

- Training on "Agroforestry and Land Management" to the farmers under VVK-KVK net working at KVK, Dhanouri Haridwar (Uttarakhand) for 41 farmers.

Training on Agroforestry and Land Management at KVK, Dhanouri, Haridwar, (Uttarakhand)

ICFRE-IFGTB

- Van Vigyan Kendra (VVK), Coimbatore in collaboration with TNAU ICAR - KVKs of Tamil Nadu district had organized training programme on "Tree Cultivation Techniques of important tree species" for 13 KVK Personnel's.
- Seminar on "Red Sander Cultivation" at ICFRE-IFGTB for 60 farmers.
- One day training programme on "Agroforestry Models" was organized at VVK, Thalamalai in collaboration with ICAR-KVK- MYRADA, Erode for 52 farmers and seven staff from ICAR- KVK-MYRADA, QPM of Casuarina windbreak clone, TC-Teak and Cadamba were distributed to farmers.

ICFRE-AFRI, Jodhpur

- Dr. R.R.Meghwal, S.M.S. KVK, Jodhpur along with 05 farmers attended "Tree Grower Mela-2023" under VVK-KVK linkage programme.
- MoU was signed between KVK, Vyara, (Navsari Agriculture University, Navsari, Gujarat) with ICFRE-AFRI on 12 September 2022 for the Clonal trial of teak under agroforestry. The object of the MoU is to compare performance of collected all over teak clone with Valsadi teak (Gujarat).

ICFRE-RFRI, Jorhat

- Delivered lecture on "Integrated Nutrient Management (INM) to improve Soil Health" on the workshop organized by Darjeeling Krishi Vigyan Kendra (UBKV, Kalimpong, Darjeeling) at Salbari Farm in Agricultural Extension Services for Input Dealers (DAESI) of West Bengal for 40 participants.

Training on tree cultivation techniques of important tree species

Signing of MOU with KVK, Vyara

ICFRE-IWST, Bengaluru

Organized 10 training on Sandalwood based agroforestry models in collaboration with different KVKs including KVK Kolar, Karnataka for 45 farmers, KVK Suthur (Mysuru) for 90 farmers, KVK Hirehalli for 115 farmers, KVK Konnehalli, Tiptur for 150 farmers, KVK Chamarajanagar, Karnataka for 100 farmers, KVK Hiriyur, (Tumkur) for 150 farmers, KVK Bidar, for 100 farmers, KVK Kalaburgi for 124 farmers, KVK Kalikiri, Chitoor District, Andhra Pradesh for 95 farmers and KVK Nellore district, Andhra Pradesh for 80 farmers.

ICFRE-HFRI, Shimla

- Training programme on "Cultivation of Important Temperate Medicinal Plants: An option for Enhancing the Income of Local Communities" was organized in collaboration with KVK Rohru and Tridev medicinal plant society Chirgaon at Taganu, Chirgaon, Rohru district, Shimla for 40 members of mahilamandal, youth club, farmers etc.
- Training programme on "Nursery and Plantation Techniques of *Juniperus polycarpos*" at KVK-Reckong Peo. 75 participants attended the programme.

Demo Village (DV)

ICFRE has initiated establishment of Demo Village with the objective of dissemination of various technologies developed by the Council and its institutes to the user groups including farmers. The activities and technologies shown are mainly, high tech-nurseries. Technologies demonstrated are vermicomposting, biofertilizer, agroforestry models, mushroom cultivation etc. At present, 11 Demo Villages have been established and maintained by ICFRE. Following activities were conducted during 2022-23:

- ICFRE-AFRI, Jodhpur established a new demo village at Mohangarh, Jaisalmer, Rajasthan.
- In Demo Village at Attivatta, Hoskote, Bengaluru organized training on Bamboo cultivation, Seasoning, Preservation and Utilization for 50 farmers.
- ICFRE-HFRI, Shimla conducted following activities at DV, Badagaon:
  - Raised important agroforestry species viz. *Celtis australis, Morus alba, Grewia optiva, Bauhinia variegata* and bamboo species as per the demands of villagers of DV-Badagaon, Shimla, Himachal Pradesh.
  - Established demonstration nursery of 15 medicinal plants and 02 grass species for the benefit of DV stakeholders.
  - Organized a camp workshop at DV. During the occasion, seedlings of improved grass species viz., *Setaria* spp. and *Napier* spp. were distributed among the farmers.
  - Organized exposure visit of villagers of DV Badagaon to Nauni Panchayat Solan and Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan. Farmers were taken to farm of Floriculture, vegetable, Dairy & Silviculture and to the museum of the university.
  - Organized awareness programme cum-workshop on "Agro-forestry" for 40 villagers and training and demonstration programme on "Grafting Technique of Horticultural Plants" for 15 villagers.
- ICFRE-IFP, Ranchi organized four trainings on vermi-compost production, income generation through beekeeping' and eco-friendly honey bee & honey production. Distributed 08 vermi-beds and honey bee boxes to farmers at DV Kutam, Topra, Khunti, Jharkhand.

Different programmes under DV by ICFRE-IFP, Ranchi

Demonstration Plots

- ICFRE-IFP, Ranchi established demo plot with approx 675 plants of Mahogany in Ramgarh (approx area: 1ha) and *Melia dubia* in Khunti and Ranchi district (approx area: 2ha)
- ICFRE-AFRI, Jodhpur established demo plot of Guggal (43 clones) in 1 ha, Eucalyptus (200 clones) in 1.02 ha and 864 biofertilizer treated seedlings of *Dalbergia sissoo* planted in 1.08 ha.
- ICFRE-AFRI, Jodhpur established two Vegetative Multiplication Gardens (VMGs) of the newly released clones of *Dalbergia sissoo* viz., ICFRE-AFRI-DS-1, ICFRE-AFRI-DS-2 and ICFRE-AFRI-DS-4 (0.1 ha each) in Model Nursery at ICFRE-AFRI Campus.
- ICFRE-HFRI, Shimla established agroforestry models (01 ha) of ten Poplar clones in farmer fields at Trewa, Arnia, Jammu in collaboration with KVK Jammu.
- ICFRE-HFRI, Shimla established demo plot of different medicinal plant species viz., Amla, Harad, Bahera, and Arjun etc. at demo nursery at Nagbani, Jammu in collaboration with KVK RS Pura, Jammu.
- ICFRE-HFRI established demonstration plot of medicinal herbs (20 species) at Shivdwala nursery.
- ICFRE-FRI, Dehradun established four agroforestry demo plot of *Melia dubia* at Sambhalkha, Ambala (Harayana), Birampur, Garhshankar (Punjab) in 1.872 ha and at Baro, Prayagraj (Uttar Pradesh) in 1 ha.
- ICFRE-FRI supplied material of *Dalbergia sissoo* (including potential disease resistant clones FRI DS-9, FRI DS-14, FRI DS-66, FRI DS-103, FRI DS-51, FRI DS-113, FRI DS-201, FRI DS-239) to Haryana Forest Department for establishment of trials in 10 acres land of Bhitmera CSO and Meerpur CSO, Haryana.
- ICFRE-IFGTB, Coimbatore established Tamarind clonal demonstration trials in collaboration with ICAR-KVK Myrada, Erode district.

VMGs established by ICFRE-AFRI, Jodhpur

Tree Growers Mela (TGM)/Kisan Mela/Industry-Farmers Meet

- ICFRE-FRI, Dehradun organized a Kisan Mela at FRI, Dehradun for 600 participants including farmers, NGO, SHGs and other stakeholders along with officers and scientists of the institute.

ICFRE-FRI, Dehradun organized Kisan Mela

- ICFRE-HFRI Shimla organized a Kisan Mela at Longni Dharmpur, district Mandi, Himachal Pradesh for 300 farmers from seven Panchayats of Dharampur.

Glimpses of Kisan Mela at Longni Dharmpur, Himachal Pradesh

- ICFRE-IFGTB organized a Tree Growers Mela at Karaikudi, Sivagangai district, Tamil Nadu for 502 tree growers/farmers from Sivagangai, Pudukottai and Trichy districts of Tamil Nadu. Director ICFRE-IFGTB released, a book ***'Maramvalarpu Mulam Makathana Varumanam'*** (Tamil) and the iOS Platform of 'TreeGenie Mobile App' - digital interactive platform developed by ICFRE-IFGTB for tree growers were also released.
- ICFRE-IFP, Ranchi organized Tree Growers Mela at Hajipur, Bihar for 130 participants including farmers, representatives of Wood Industries, expert scientists and forest officials.

ICFRE-IFGTB, Coimbatore organized Tree Growers Mela (TGM) at Sivagangai district Tamil Nadu

ICFRE-IFP, Ranchi organized Tree Growers Mela (TGM)

- ICFRE-AFRI, Jodhpur organized Tree Growers Mela for 400 farmers, environmentalist and tree growers.

ICFRE-AFRI, Jodhpur organized Tree Growers Mela

- ICFRE-ERC, Prayagraj organized Tree Growers Mela in Magh Mela-2023 from 14 January to 18 February 2023. Around 50,000 visitors visited the exhibition stall.
- ICFRE-IWST, Bengaluru organized three Institute-Industry Meetings. More than 90 participants attended the programme.
- ICFRE-FRI, Dehradun and Indian Industries Association (IIA) organized research outreach programme to wood based industries of Uttar Pradesh. 25 participants attended the programme.

Participation at Magh Mela 2023 by ICFRE-ERC, Prayagraj


ICFRE-FRI organized Research outreach programme to wood based industries of Uttar Pradesh

Technology Demonstration Centre (TDC)

To disseminate ICFRE technologies and research achievements and to create awareness about the green technologies and sensitizing people towards the environmental issues, ICFRE has established seven TDCs including Marine Interpretation Unit and Photogallery. During this period following activities were conducted:

- TDC was inaugurated by Shri C. P. Goyal, IFS, DGF&SS, MoEF&CC at ICFRE-FRI, Dehradun in the presence of Shri Arun Singh Rawat, IFS, DG, ICFRE and Dr. Renu Singh, IFS, Director, ICFRE-FRI.
- TDC cum Interpretation Centre was inaugurated by Shri Arun Singh Rawat, IFS, Director General, ICFRE at ICFRE-IFP, Ranchi.
- Vacuum Pressure Impregnation Unit which was installed under TDC at ICFRE-RFRI, Jorhat for preservative treatment of Bamboo has been given for lease to Kraftinn Home Décor India Pvt. Limited, Jorhat under PPP mode.


TDC at ICFRE-FRI

Signing of lease agreement for VPI unit under PPP mode


TDC at IFP, Ranchi

4.2. POPULARIZATION OF CLONES/VARIETIES/IMPROVED GERMPLASM

ICFRE-FRI, Derhadun

- ICFRE-FRI supplied 880kg of seeds and 3.0 lakh seedlings of *Melia dubia* varieties to State Forest Departments and State Forest Corporations of Haryana, Chhattisgarh, Madhya Pradesh and Uttar Pradesh. In addition supplied 1.0 lakh seedlings and 100 kg seed to the Indian Farm Forestry Development Corporation (a subsidiary of IFFCO).

QPM of Melia

- A seed multiplication area of 1.50 ha has been established for six varieties of Neem at Phoolpur in the State of Uttar Pradesh.
- Produced 13898 QPM of different Bamboo species in Genetics Division, ICFRE-FRI and Khirsu nursery, Uttarakhand, 730 plants supplied to stakeholders.

ICFRE-IFGTB, Coimbatore

- A total of 1,79,421 QPM including Casuarina (27,830), Teak (1,36,103), Eucalyptus (14,623), bamboo (1053) and Melia (860) was produced and supplied to different stakeholders including Chhattisgarh Forest department and farmers.

QPM of Teak

- Five superior clones of *Casuarina junghuhniana* were developed for windbreak agroforestry systems. Around 20,540 ramets of windbreak clonal plants have been produced and supplied to the farmers, from South India and a farmer in Haryana.
- Supplied 39.180 kg quality seeds of different tree species, Seed pellets and quality seedlings to various stakeholders including, SFDs, farmers, industries and NGOs. This include seeds of *Casuarina junghuhniana*- 11.150 kg, *Eucalyptus camaldulensis*- 8.310 kg, *Eucalyptus tereticornis*- 2.0 kg, *Ailanthus* spp.- 0.150 kg, *Gmelina arborea*- 9.950 kg, *Santalum album*- 2.450kg, *Sapindus emarginatus*- 4.85kg, Teak - 0.40kg, *Melia dubia* -0.550 kg.

ICFRE-IWST, Bengaluru

- Supplied base cultures of *D. asper* (2 TC bottles) to M/s Seema Biotech, Maharashtra.

ICFRE-AFRI, Jodhpur

- Forty thousand saplings viz. *Azadirachta indica, Prosopis cineraria, Tecomella undulata, Acacia senegal, Salvadora persica, Salvadora oleioides, Cordia myxa, Cordia gharaf, Pongamia pinnata, Holoptelea integrifolia, Zizyphus* spp., *Moringa oleiflora, Senegalia catechu, Ailanthus excelsa, Commiphora wightii, Santalum album, Syzygium cumini, Vachellia nilotica, Dalbergia sissoo, Terminalia arjuna, Anogeissus pendula* were produced in ICFRE-AFRI nursery and supplied to various stakeholders and further ICFRE-AFRI provided nursery techniques to them.

ICFRE-RFRI, Jorhat

- A total of 70,166 QPM of Bamboo was produced out of which 13000 plants were sold.
- 10,000 QPM of *Aquilaria maleccensis* (Agar) were produced in ICFRE-RFRI Nursery, out of which 4353 were supplied to stakeholders

ICFRE-HFRI, Shimla

- At VVK Jagatsukh, Manali, HP, raised about 94100 QPM of important temperate medicinal plants viz., *Picrorhiza kurroa, Podophyllum hexandrum*, *Angelica gluaca* and *Trillium govanianum*, sold 25800 and also distributed 7475 different medicinal plants species viz. amongst progressive farmers.
- At FRS, Shillaru raised 15763 QPM of various forestry species viz. *Aconitum hetrophyllum*(Atish), *Angelica gluaca* (Chaura), *Valeriana jatamansi* (Mushakbala), *Thymus serphyllum* (Jangliajwain), *Berginia cilata* (Patharchatta), *Roscoea alpina* (Lily), *Dioscorea deltoidea (Singlimingli), Picrorhiza kurroa* (Karu), *Plantago major* (Isabgol), *Populus cilata* (Poplar), *Picea smithiana* (Spruce), *Juniperus polycarpos* (Juniper), *Prunus cornuta* (Bird Cherry), *Polygonatum sp.* (Mahameda), *Corylus*

jacquemontii (Thangi), *Taxus buccata* (Rakhaal), *Quercus semecarpifolia* (kharsu Oak) & *Cedrus deodara* (Deodar).

- At VVK, Longni, Dharampur, Mandi, HP, as per demand of local farmers raised about 4000 different agroforestry and forestry species viz. *Bauhinia variegata* (Kachnar), *Bauhinia vahlii* (Taur), *Tectona grandis* (Teak), *Santalum album* (Chandan), *Dalbergia sissoo* (Shisham) and *Phyllanthus emblica* (Amla). Seeds of different tree species viz. *Grewia optiva* (Bheul), *Pyrus pashia* (Kainth), *Acacia catechu* (Kher) and *Terminalia chebula* (Harad) at Shivdwala demo nursery for distribution amongst farmers.
- At VVK, Janipur, Jammu, J&K, UT, raised and supplied quality planting material of different clones of *Populus deltoides* (5000) for integration in agroforestry systems of Jammu region.
- At VVK, BadamiBagh, Leh, Ladakh, UT, raised 600 QPM of various forestry species viz. *Juniperous polycarpos* (Dhoop), *Salix* sp., *Betula utilis* (Bhojpatra) & *Hippophae rhamnoides* (sea buckthorn).

ICFRE-IFP, Ranchi

- Total of 10269 seedlings of different species were distributed among different stakeholders out of which 4879 were of different Bamboo species; *D. strictus, Vulgaris green,* Hedge bamboo and 5390 were of other species; *Melia dubia* , *Dalbergia latifolia*, *Flemingia semialata* etc.

Bauhinia vahlii seedlings at nursery under VVK Longni, Dharampur

ICFRE-HFRI nursery under VVK Longni, Dharampur

Technology transferred

ICFRE-IWST transferred technology for Fire Retardant Door (FRD) shutter through construction method to M/s United Plywood Industries, Gujarat.

4.3. LICENSE/MATERIAL TRANSFER AGREEMENT/MoU SIGNED

License Agreement

- ICFRE-FRI, Dehradun with Bebzini Seedlings, Saharanpur, Uttar Pradesh for extending propagation rights of released varieites of *Melia dubia*.
- ICFRE-IFGTB, Coimbatore with HU Gugle Biotech, Bengaluru for mass multiplicaton of *Tectona grandis* clones.
- ICFRE-IFGTB entered into a License Agreement with M/s Voluntary Organisation For People Empowerment of Rural Areas By Youth (VETRY), Tiruppur, Tamil Nadu for commercial propagation and supply/sale of windbreak clones of *Casuarina junghuhniana* developed by IFGTB.
- ICFRE-IFGTB, Coimbatore with Pothigai Woods Decor LLP, Tirunelveli, Tamil Nadu for mass multiplication of *Casuarina junghuhniana,* Casuarina hybrid and *Eucalyptus camaldulensis* clones.
- ICFRE-IFP, Ranchi with seven farmers/nursery growers of Bihar for mass multiplication of poplar clones.

MoU Signed

- ICFRE-IWST, Bengaluru with M/s United Plywood industries, Gujarat for Fire Retardant Door (FRD) shutter through construction method for 90 mins rating.
- ICFRE-IWST, Bengaluru with Furniture & Fittings Skill Council (FFSC), Gurgaon for developing standards, trainings, projects implementation and career management initiative.
- ICFRE-IWST, Bengaluru with M/s Indian Timber Products Pvt. Ltd., Hyderabad in implementation of project "Development of Fire Retardant Door Shutter for 120mins rating".
- ICFRE-IWST, Bengaluru with Reserve Bank of India (RBI), Department of Currency Management, Mumbai for evaluation of suitability of currency briquettes replacement with wood particles for the manufacture of particle board.
- ICFRE-IFGTB, Coimbatore with Meristem Biotech, Bengaluru and Jagadamba Bioplants, Bengaluru for mass production of identified teak genotypes through TC.
- ICFRE-RFRI, Jorhat with M/s. Kraftinn Home Décor India Pvt. Limited, Kenduguri, Jorhat, Assam for operationalization of the Vacuum Pressure Impregnation Plant of ICFRE-RFRI, Jorhat.
- ICFRE-TFRI, Jabalpur with Maharashtra Forest Department for supplying QPM of bamboo.

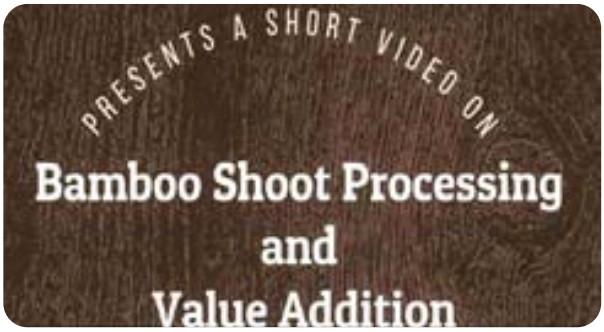
4.4. PRODUCTS/APPS DEVELOPED

- ICFRE-HFRI, Shimla developed HIM MRIDA SANJEEVANI-1 (हिम मृदा संजीवनी-1) mycorrhizal biofertilizer and the product got registered with Directorate of Agriculture, Himachal Pradesh for production and sale.
- ICFRE-FRI has developed a topical gel formulation containing *P. utilis* seed oil which was found to exhibit analgesic properties.
- 8,000 kg of Compost is prepared in ICFRE-AFRI main campus, value-added and supplied to stakeholders.
- Mobile App on Forest Seed Science & Technology by ICFRE-IFGTB, Coimbatore
- Mobile App on Agroforestry by ICFRE-ERC, Prayagraj.

4.5. DOCUMENTARIES

During 2022-23 17 documentaries were produced:

- Seven documentaries on "Bamboo based products and its demonstration", "Agroforestry models", "Fungarium", "Trichocard", "Insectary", "Fly ash" and "Bamboo" by ICFRE-TFRI, Jabalpur.
- Five documentaries on "Bamboo flowering", "Wild Edible Fruits", "Extension of Vermicompost", "*Melia dubia*", "Ecology and Land Management" by ICFRE-IFP, Ranchi.
- Two documentaries on "AFRI Contribution in the Conservation of Biodiversity" and "Traditional Agroforestry: Source of Research" by ICFRE-AFRI, Jodhpur.
- Two documentaries on "Timber Identification" and "ICFRE-IWST Research Activities" by ICFRE-IWST, Bengaluru.
- One documentary on "Bamboo Shoot and Value Addition" by ICFRE-RFRI, Jorhat.



Documentary on Bamboo shoot and Value Addition by ICFRE-RFRI, Jorhat

Documentary on Traditional Agroforestry Source of Research by ICFRE-AFRI, Jodhpur

4.6. INTELLECTUAL PROPERTY- PATENTS GRANTED/ APPLIED

Patent Granted

- An improved binding material for incense stick (Agarbatti) (Patent No. 397895) (ICFRE-FRI)
- Technology for Medium Density Fibre Board (MDF) using Rice Straw and a Method of Manufacturing the same (Patent No. 405564) (ICFRE-IWST)
- The design for 'Pyrolysis system for thermal decomposition of biomass' has been registered vide no. 375152-001 (ICFRE-RFRI)

Patent Applied

ICFRE-FRI, Dehradun

- A formulation for treating and management of diabetes mellitus and complications. (Application No.202311010779; Dated 17/02/2023)
- Topical herbal gel formulation for pain and method for preparation thereof (Application No. 202311013393; Dated 28/02/2023)
- Herbal hair coloring composition and method for preparation thereof (Application No. 202341023759; Dated 30/03/2023)
- A process for recovery of natural dye from *Soymida febrifuga* bark (Application No. 202341007697; Dated 07/02/2023)
- End grain drying of green turned timber (Application No. 202211034512; Dated 16/06/2022)

ICFRE-IWST, Bengaluru

- Oriented natural fiber reinforced hybrid wood plastic composite panels (Application No. 202141054020; Dated 23/11/2022)

ICFRE-TFRI, Jabalpur

- A Box based trap for trapping longhorn beetles (Application No. 202221045727; Dated 10/08/2022)
- A funnel based trap for trapping longhorn beetles (Application No. 202221045676; Dated 10/08/2022)

ICFRE-AFRI, Jodhpur

- A Fed-Batch solid culture Bio-reactor for growing cell biomass of medicinal plant Guggal (Application No. 202311020537; Dated 23/03/2023).

ICFRE-IFGTB, Coimbatore

- Copy right application has been filed for the short film on "Recycling waste & supporting livelihood-A tribal development initiative of IFGTB".
- Trademark application has been filed for the natural handmade soap named "Royalseema ICFRE-Red Sanders Soap".

4.7. OTHER TECHNICAL SERVICES

ICFRE-IWST, Bengaluru

Standardization related activities (BIS)

- Draft Indian Standard for draft Indian Standard Prelaminated Medium Density Fibre Board – Specification (First Revision of IS 14587); CED 20 (19613) WC
- Proposed amendment on IS 1734 pt 3 to BIS
- ISO ballot on Laminated Products Made of Bamboo Strips for Indoor Furniture Purposes (ISO/NP 6128) to BIS on 15/9/22
- Indian Standards IS 2191 (Part 1): 2022, IS 2191 (Part 2): 2022 (part 1) & IS 2202 (Part 2): 2022 were revised and new revision was bought by BIS
- On working draft standards IS303, 710, 4990
- On draft minutes of CED 20 meeting and incorporated necessary corrections/ inclusion to working draft standards IS303, 710, 4990, 14576, 1734, 5509, 3087, 12406 etc.
- BIS CED 9 committee on IS 656, regarding size of log and use of wood other than forests
- Inputs on ISO 8375:2017 (Ed 3) - Timber structures — Glued laminated timber — Test methods for determination of physical and mechanical properties to BIS, New Delhi, CED 13 on 30th August, 2022 as principal member.

4.8. PRAKRITI

Prakriti, a scientist – student connect programme, is operational across the ICFRE institutes/centres throughout the country. During the year over 14300+ students belonging to various KVs, JNVs and other schools and colleges were benefitted through various programmes including lectures, webinars, awareness/training programmes, exposure visits, campaigns, plantation programmes, biodiversity & nature walks, quiz/declamation/essay/painting competitions, screening of documentaries, study tours, meetings etc. conducted by ICFRE.

Demonstration of 'Planting Techniques' to the students at ICFRE-IFGTB

Programme at Jawahar Navodaya Vidyalaya, Ranchi by ICFRE-IFP, Ranchi

Golkonda-II- KV Sangathan students visited ICFRE-IFB, Hyderabad

Interactive and Awareness programme at GSSS, Beolia, Shimla by ICFRE-HFRI, Shimla

Painting and slogan writing competition under Prakriti programme at ICFRE-FRI, Dehradun

Students of Impact School of Architecture, Bangalore visited at ICFRE-IWST

Various tree species planted at school ground by ICFRE-AFRI, Jodhpur

Students visited Bamboo Nursery, Botanical Garden, Bambusetum, Bamboo Composite Centre, VPI Unit etc. at ICFRE-RFRI, Jorhat

Exposure visit of students of Stemfield International School, Jabalpur at ICFRE-TFRI

4.9. OTHERS EXTENSION ACTIVITIES

Participation in Melas/ Exhibition

- ICFRE-IWST, Bengaluru participated in India Wood Exhibition 2022 organized by Nurnberg Messe India Pvt. Ltd at Bangalore International Exhibition Centre, Bengaluru.
- ICFRE-IWST, Bengaluru has participated in Krishi Mela at University of Agricultural Sciences, Bengaluru.
- ICFRE-IWST, Bengaluru participated in North East Expo at Guwahati.
- ICFRE-IWST, Bengaluru participated in International Cultural Jamboree 2022 – Science Mela at Alva's Education Foundation, Moodubidire, Dakshina Kannada District, Karnataka.
- ICFRE-HFRI, Shimla as a special invitee participated in "Apple Kisan Mela" organized by Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan at Mashobara, Shimla.
- ICFRE-HFRI, Shimla participated in the "Diwali Utsav Mela - Exhibition of Products of Self-Help Groups (SHGs), Farmers and Producer Association organized at the famous Ridge, Shimla.
- ICFRE-HFRI, Shimla participated in 'KRISHAK MELA-2022' on the theme 'Diversification in Agriculture for Self-Reliant India' organized by SKUAST, Jammu.
- ICFRE-HFRI, Shimla participated in Exhibition on NTFPs, organized by department of Forest, Ecology, & Environment, Govt. of J&K, UT at Convention Centre, Jammu.
- ICFRE-TFRI, Jabalpur and ICFRE-SDC, Chhindwara participated in the 5th AadiUtsav (Tribal Fair) organized by Ministry of Tribal Affairs at Ramnagar in Mandla district of Madhya Pradesh.
- ICFRE-IFB, Hyderabad participated in farmers' meet organized by IFFCO.
- ICFRE-RFRI, Jorhat participated in the "Farmers' Fair" organized by Regional Agricultural Research Station, Titabar.
- ICFRE-IFGTB, Coimbatore participated in South India`s Prime Fair - Agri Intex 2022 at Coimbatore.
- ICFRE -IFGTB participated in the 33rd AGR-HORTI FARM FEST, 2023 at Pudhucherry.
- ICFRE-IFP, Ranchi participated in Tasar Silk Agriculture Fair 2023 at CTRTI, Ranchi.
- ICFRE-IFP, Ranchi participated in two days Kisan Mela-cum-Agriculture Exhibition-2023 at ICAR-National Institute of Secondary Agriculture, Namkum, Ranchi.
- ICFRE-AFRI, Jodhpur participated in 'Western Rajasthan Hastshilp Utsav-2023' at Jodhpur.

Exhibitions on NTFP's by ICFRE-HFRI, Shimla at Jammu


Participation in international Cultural Jamboree 2022 – Science Mela at Karnataka by ICFRE-IWST, Bengaluru


Participation in Krishi Mela at Bengaluru by ICFRE-IWST, Bengaluru


Participation in North East Expo at Guwahati by ICFRE-IWST, Bengaluru

4.10. TRAININGS ORGANIZED

S. No.	Name of HQ/Institute	No. of Trainings	Duration (in days)	No. of participants
1.	ICFRE (HQ), Dehradun	103	124	8586
2.	ICFRE-FRI, Dehradun	46	122	1641
3.	ICFRE-IFGTB, Coimbatore	26	67	1432
4.	ICFRE-IWST, Bengaluru	80	258	2256
5.	ICFRE-TFRI, Jabalpur	24	55	855
6.	ICFRE-AFRI, Jodhpur	04	13	186
7.	ICFRE-RFRI, Jorhat	36	156	988
8.	ICFRE-HFRI, Shimla	17	25	734
9.	ICFRE-IFP, Ranchi	66	-	2720
10.	ICFRE-IFB, Hyderabad	07	10	256
	Total	**409**	**830**	**19654**

- For department of Forest and Soil Conservation, Government of Nepal training conducted on artificial induction of agarwood by ICFRE-RFRI, Jorhat.
- Guidance on testing, specification and plywood manufacturing provided to Century Plywood Industries Pvt. Ltd., Nepal by ICFRE-IWST, Bengaluru.

Training on Upscaling of SLEM best practices and Environment and Social Safeguards for the local communities of Salai village, Madhya Pradesh organized by ICFRE, Dehradun

Training on Wood Seasoning at ICFRE-FRI, Dehradun

Training on Cultivation of Important Temperate Medicinal Plants: An option for enhancing the Income Local Communities organized by ICFRE-HFRI, Shimla

Training on Cultivation of Mahameda and other Important temperate Medicinal Plants at VVK Jagatsukh, Manali, H.P.

Training on Sandalwood Cultivation & Management Techniques for farmers under VVK at FCRI, Mulugu organized by ICFRE-IFB

ICFRE-CEC organized training on Mangrove Propagation and Livelihood Development Techniques for fishermen's at Visakhapatnam

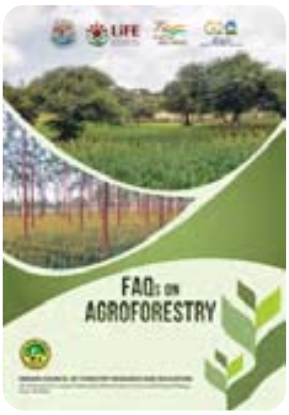
Training on Vegetative Propagation Techniques at ICFRE-IFGTB, Coimbatore

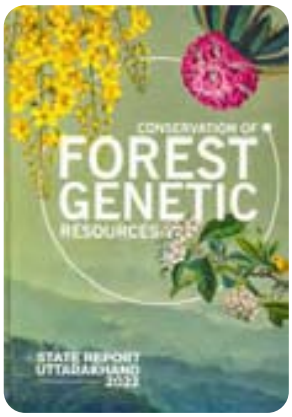
ICFRE-IFP, Ranchi organized training on Lac Cultivation

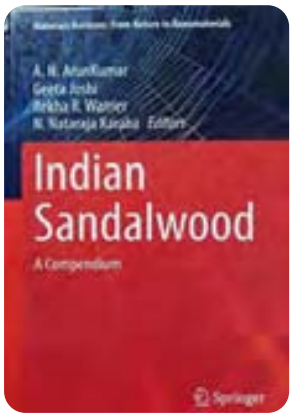
Training on Bamboo Handicraft at ICFRE-TFRI, Jabalpur

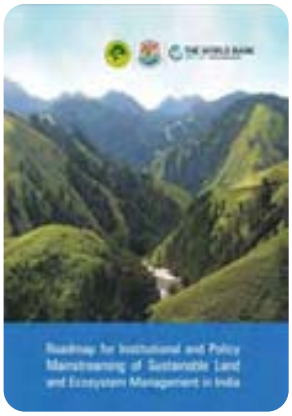
4.11. RESEARCH PUBLICATIONS

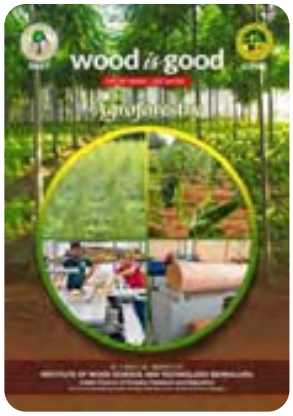
HQ/ Institute	Books	Booklets/ Brochure/Bulletins /Phamphlets	Article in Seminars/ Conferences/ Workshops etc.		Popular Article	Research Papers in Journals		Chapters in Books/ Proceedings
			Articles	Abstracts		Foreign	Indian	
ICFRE HQ	10	02	-	-	-	33	12	11
ICFRE-FRI	07	06	12	34	12	46	69	24
ICFRE-IFGTB	04	-	07	27	02	25	32	30
ICFRE-IWST	01	07	-	21	41	32	42	24
ICFRE-TFRI	02	09	-	26	49	07	36	08
ICFRE-AFRI	03	02	08	08	24	11	15	14
ICFRE-RFRI	02	03	-	05	14	03	7	03
ICFRE-HFRI	-	15	-	47	24	15	16	07
ICFRE-IFP	5	4	-	02	-	17	08	04
ICFRE-IFB	02	10	02	06	-	10	05	05
Total	**36**	**58**	**29**	**176**	**166**	**199**	**242**	**130**

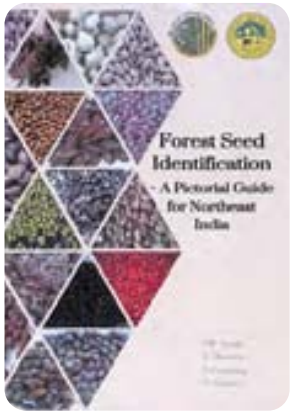






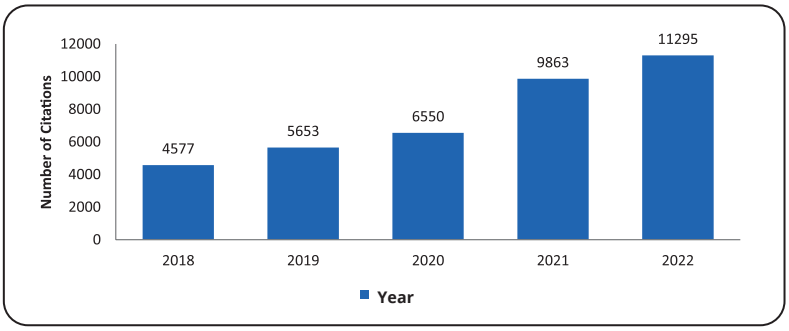






Citation Analysis of Research paper, in last five years:

For the research papers published by ICFRE analysis was carried out for the status of citations of research papers from 2018 to 2023. The number citations increased almost 2.5 times from 2018 to 2023.



Trend of citations over the last five years for ICFRE

4.12. SEMINARS/SYMPOSIA/WORKSHOPS ORGANIZED

HQ/ Institute	No. of Seminars/ Symposia/Workshops / meetings organized	No. of days	No. of participants
ICFRE HQ	18	30	933
ICFRE-FRI	22	33	1209
ICFRE-IFGTB	09	18	437
ICFRE-IWST	18	24	1343
ICFRE-TFRI	11	14	578
ICFRE-AFRI	02	06	157
ICFRE-RFRI	22	22	2156
ICFRE-HFRI	26	26	1313
ICFRE-IFP	17	27	1257
ICFRE-IFB	02	02	75
Total	**147**	**202**	**9458**

Seminar on Agroforestry for wood production: Issues & Challenges at ICFRE-FRI, Dehradun

Regional Research Conference at ICFRE-HFRI, Shimla

Workshop on Forestry Research Prioritization with Special Emphasis on Agroforestry at ICFRE-IFGTB, Coimbatore

Workshop on DPR for Rejuvenation of Damodar and Subarnrekha Rivers through Forestry Interventions at ICFRE-IFP, Ranchi

Workshop on Standard operating procedures for forestry plantation at ICFRE-TFRI, Jabalpur

International Workshop on "Enhancing Ecosystem Services by Improving Forest Quality & Productivity and SLEM Knowledge Dissemination" at ICFRE, Dehradun

Workshop on Mainstreaming landscape thinking in natural resources management education for restoration impact in BIMSTEC Region: The way forward

4.13. AWARENESS /DEMONSTRATION PROGRAMMES ORGANIZED

HQ/ Institute	No. of Awareness/ Demonstration programmes organized	No. of days	No. of participants
ICFRE-FRI	45	61	905
ICFRE-IFGTB	23	86	3386
ICFRE-IWST	29	34	1287
ICFRE-TFRI	23	32	924
ICFRE-AFRI	39	39	1443
ICFRE-RFRI	61	66	2473
ICFRE-HFRI	24	21	889
ICFRE-IFP	13	13	1531
ICFRE-IFB	30	30	1124
Total	**287**	**382**	**13962**

Awareness programme on Hill Bamboo A means of livelihood at Mashobra, Shimla

Trainees Forest Trainee batch visited at ICFRE-RFRI, Jorhat

Demonstration programme for students Guru Ramdas Khalsa College at ICFRE-TFRI, Jabalpur

ICFRE-IFP, Ranchi organized Parthenium Awareness week

Awareness programme on Insect Biodiversity to Forest range officers from Telangana State Forest Academy - organized by ICFRE-IFB, Hyderabad

Awareness session and Nature walk on the occasion of flagoff of Mission life organized by ICFRE-IWST, Bengaluru

Awareness campaign to commemorate the World Soil Day 2022 organized by ICFRE-IFGTB, Coimbatore

4.14. CONSULTANCIES

ICFRE, Dehradun

Reports submitted

- Carrying Capacity and Biodiversity study report of Daitari Iron Ore Mine of Odisha Mining Corporation, Odisha submitted to Forest, Environment and Climate Change Department, Government of Odisha.
- Updation of Biodiversity Conservation and Wildlife Management Plan of Kutehr HEP (240MW). (M/s JSW Energy Limited, Chamba, Himachal Pradesh).
- Biodiversity Assessment, Impact and Mitigation Measures of Chakla Opencast Coal Block Mine in North Karanpura Coalfield, Chakla, Latehar, Jharkhand. (M/s Hindalco Industries Limited).
- First Year Report on Environmental Monitoring & Evaluation of Reclamation and Rehabilitation plan activities at John Mine of M/s R. Praveen Chandra (ML No. 2294), Chitradurga District, Karnataka.
- Environmental Audit reports of 29 coal mines of different subsidiary to Coal India Limited (CIL), Kolkata.
- Ecological Studies related to Umrer OC Coal Mine and Niljay OC Coal Mine of Western Coalfield Limited in Maharashtra.
- Preparation of Environmental Management Plan and Reclamation and Rehabilitation of three iron ore mining leases of BIOM, Kirandul Complex, Bacheli, South Bastar, Dantewada district, Chhattisgarh. (M/s. NMDC Ltd., Hyderabad).
- Third Party Assessment of EC Conditions Compliance in respect of Manikpur OC mine of SECL, Korba Area, Bilaspur, Chhattisgarh.
- Environmental Audit in respect of Gevra Open cast project of South Eastern Coalfields Limited, Gevra, Korba, Chhattisgarh.
- Final Annual Report submitted for the Year 2020-21 on Monitoring of Plantations under Accelerated Afforestation Programme of NTPC Ltd- 10 million trees planted in different seven states of India.
- Tenth Six Monthly Report of 3rd Party Monitoring of Activities Implemented under CAT Plan of Vishnugad Pipalkoti Hydroelectric project in Chamoli district, Uttarakhand. (M/s. THDC India Ltd, Rishikesh)
- Preparation of R& R Plan for KK Kaval iron ore mine ML 2631, Chitradurga. M/s. RBSSN Pvt. Ltd. (Government of Karnataka)
- Preparation of R & R Plan for Doddabyaladakere iron ore mine ML 2585, Chitradurga. M/s. Smt. Blrani Samyuktha. (Government of Karnataka)
- Preparation of Revised Reclamation and Rehabilitation Plan for Ramandurga iron ore mine ML 2141, Bellary district, Karnataka. M/s. Srikumarswamy mineral exports (Government of Karnataka)

Overview of hilltop (Daitari) mines

Retaining wall at John mine of R. Praveen Chandra

Ongoing Consultancy Projects during 2022-23

ICFRE, Dehradun

- Reclamation and Rehabilitation Plan for 166 mine affected areas of Bellary, Chitradurga and Tumkur Districts, Karnataka and preparation of comprehensive SMP of these three districts of Karnataka. (Karnataka State Official Authority)
- Third Party Monitoring of Catchment Area Treatment Plan of Vishnugad Pipalkoti Hydro Electric Power Project (444 MW), District Chamoli, Uttarakhand. (THDCIL)
- Environmental Audit and Environmental performance Index Ranking of 35 mines of CIL. (M/s Coal India Limited, Kolkata)
- Environmental Monitoring & Evaluation of Reclamation and Rehabilitation plan activities at John Mine of R. Praveen Chandra (ML No. 2294), Chitradurga District, Karnataka. (M/s. R. Praveen Chandra (ML No. 2294), Jayanagar, Bangaluru)
- Assessment of reclamation and Rehabilitation Activities carried out for Eco-restoration of mined out and surrounding areas of Gouthamkhani OC Coal Mine Project under Sustainable Development Activities in Singreni Collieries Company Limited, Kothagudem, Telangana. (SCCL)
- Third Party Auditing of Environmental Clearance Compliance of 04 Coal Mines of Singareni Collieries Company Limited, Kothagudem Collieries, Bhadradri Kothagudem district, Telangana. (SCCL)
- Carrying out Environmental Audit in respect of Kusmunda Opencast Project of SECL (A subsidiary of Coal India Ltd.), Kusmunda Area, district Korba, Chhattisgarh. (M/s.South Eastern Coalfields Limited)
- Study on impact of implementing various environmental protection measures in respect of mining lease No. 2678 of the Sandur Manganese & Iron Ores Limited (SMIORE). (The Sandur Manganese & Iron Ores Limited)
- Third Party Assessment of Compliance of Environemntal clearance condition imposed by MoEF&CC, GoI to Kahiraha UG coal mine of South Eastern Coalfields Limited (SECL) (A subsidiary of Coal India Ltd.), Sohagpur Area, District Shahdol (MP)'. (M/s.South Eastern Coalfields Limited.)

ICFRE-FRI, Dehradun

- Studied the tree biomechanics behavior with respect to the hollowness (decay) of urban trees in wind affected area.
- Health assessment of heritage trees of Chandigarh.
- Testing of wood and wood products received from 22 different organizations for materials

ICFRE-IFGTB, Coimbatore

- Securing Pulpwood Raw Material Availability: Developing High Yielding Clones and Breeding Orchards of Casuarina and Leucaena to Increase Plantation Productivity in Andhra Pradesh.
- Sustainable Pulpwood Production through High-Yielding Varieties of Nitrogen Fixing and Drought Tolerant Trees.

ICFRE-IWST, Bengaluru

Provided consultancy services to/for

- Improve the quality of resin during manufacturing and to minimize the formaldehyde content of resin to M/s. Real Ply Industries Pvt. Ltd., Haryana
- Manufacture of plywood to meet E0 emission standard to M/s Austin Plywood Industries Ltd., Kolkata.
- Attend the issue of warping of plywood to M/s. Kanara wood and Plywood industries Pvt Ltd., Mangalore.
- Improve the quality of the plywood and to attend the floor level problems during the manufacturing of plywood to M/s. Maa Bairakali Plywood Industries, West Bengal.
- Attend the floor level problems during the manufacturing of plywood to M/s. Nishant Wood Craft, Purnia, Bihar.
- Improve the quality of plywood and to manufacture plywood as per E1/E0 standard to M/s. Afayun Plywood Industries, Coimbatore, Tamil Nadu.
- Assess the process of production of laminates as per M/s. Deco metal request to M/s. J.K Laminates.
- Rectify the floor level problems during the manufacturing of plywood and reduce the manufacturing cost to M/s. Vibhakar Plywood Industries, Yamunanagar, Haryana.
- Solve the wooden pallets insect damage problem to ZF wind power Industry Coimbatore.
- Demonstration, Training and Manufacturing of FRD shutter through construction method to M/s United Plywood Industries, Gujarat.
- Provide technical consultancy for CARB plywood and also in other areas like veneer drying,

conditioning and adhesive quality during production to M/s. Rajdhani Crafts Industries Pvt. Ltd.

- Provided guidance on the amino adhesives used for making the buttons using wood wastes to M/s. Hansraj Impex, Delhi.
- Provided guidance in testing, specifications and plywood manufacturing to M/s. Century Plywood Industries Pvt. Ltd., Birat Nagar, Nepal.
- Provided technical consultancy for the manufacture Flush door shutters as per IS 2202 PART 3 with special reference to the adhesives quality, assembly patterns requirements and the hot pressing parameters to M/s. DEC Industries Pvt ltd., Hyderabad
- Improve the quality of particle board to make E1 Grade emission level to M/s Greenland particle board Pvt. Ltd., Perambavoor, Kerala
- Manufacturing of Fire-Retardant Door (FRD) shutter for 120mins rating under External Aided Project (EAP) to M/s. Indian Timber products Pvt. Ltd, Hyderabad
- Improvement of the quality of pre –press bonding and adhesive used for manufacturing of plywood to M/s Avenger Panel and Wood products Pvt. Ltd, West Bengal.
- Evaluation of Plantation established by Goa State Biodiversity Board, Goa; and report submitted to Goa Forest Department, GSDB.
- Third party monitoring and evaluation of CAMPA activities of Goa.
- Development and standardization of non-destructive method for detection of internal defects and evaluation of strength of wooden utility poles (Phase II) consultancy to WIPRO Pvt. Ltd.

ICFRE-AFRI, Jodhpur

- DPR on "Scientific Study on Green Belt Development Work for HRRL at Pachpadra, Rajasthan" has been prepared and submitted to HRRL.

ICFRE-TFRI, Jabalpur

- Implementable forestry research for ash utilization promotion and development of research park at APML, Gondia for Adani Power Maharashtra Limited (APML), Maharashtra.
- Pilot study on Raising short rotation forestry crops for intermittent periods at Dubna-Sakradhi Iron and manganese ore mines in Keonjhar district of Odisha" for Odisha Mining Corporation Limited (OMCL), Odisha.
- Wildlife Conservation Plan for endangered species found in and around the Dhelwadih UG, Bagdeva UG and Singhali UG mines of DSB Sub Area of SECL, Korba Area for South Eastern Coalfields Limited (SECL).

ICFRE-RFRI, Jorhat

- "Feasibility study on entreprenurship model of muga food plantation through vegetative nurseries" to be carried out under an ongoing World Bank project-APART (Assam Agribusiness and Rural Transformation Project) for Department of Sericulture, Govt. of Assam.
- Augmentation of Agarwood production in *Aquilaria malaccensis* Lamk. in Tripura through fungal technology for Tripura Forest Department under CAMPA scheme.
- Artificial induction of agarwood in 500 agar trees of North Bengal.
- Preparation of the State Action Plan on Forest Fire for Arunachal Pradesh.
- ICFRE-RFRI developed a package of practices for restoration of coal mined land at Tikak Colliery, Margherita, which was handed over to Ministry of Coal, Govt. of India.

ICFRE-IFP, Ranchi

- Technical Assistance for setting up of Tissue Culture Laboratory at Garkhatanga, Ranchi (SFD, Jharkhand).
- Eco-restoration on mined out areas and waste dumps at Meghahatuburu iron ore mines, SAIL, in Saranda Forest Division, West Singhbhum, Districts of Jharkhand (SAIL, Kolkata).
- Top Soil Conservation and Eco-Rehabilitation of Selected Degraded Coal Mines of Central Coalfield Limited, Jharkhand through Forestry Intervention. (Central Coalfields Limited, Jharkhand).
- Preparation of 'Detailed Project Report (DPR) for rejuvenation of Subarnarekha and Damodar rivers through forestry interventions' (NAEB, MoEF&CC, Govt. of India).
- Preparation of specific wildlife conservation plan in complain a stage-II clearance for Pachhwara (North) Coal block in Pakur District (West Bengal Power Development Corporation Limited).

ICFRE-IFB, Hyderabad

- Detailed Project Report on Rejuvenation of River Godavari through forestry intervention project.
- "Study of assessment of ecological damage including cost of river bed material, cost of ecological restoration and NPV of future ecosystem services foregone on account of illegal mining sites in Subarnarekha River".

4.15. TECHNICAL SERVICES

Identification and testing services

ICFRE-FRI, Dehradun

- Identification of illegally harvested raw samples of NTFP provided to stakeholders.
- Identification of *Ophiocordyceps sinensis* (keedajadi) received from Hon'ble Courts.
- 111 wood samples received from government and various pvt. firms.
- 27 plant samples received from different organization/universities were identified.

ICFRE-IFGTB, Coimbatore

- Issued 12 nos of species authentication/ identification certificates to different institutions.

ICFRE-IWST, Bengaluru

- Total 612 wood samples were tested and analyzed.

ICFRE-HFRI, Shimla

- Contributed to preparation of Global Index of Vegetation- Plot Databases (GIVD). Vegetation Database of Doon Valley, India, covering 185 sites with 555 relevés. http://www.givd.info/ID/AS-IN-003.\.
- Assisted the DFO, Nalagarh for Technical help and Plant identification in the video story on YouTube entitled "First Smart Forest of Himachal Pradesh".
- Identified 64 plant samples for students and public.

4.16. ADVISORIES GIVEN TO SFDs AND OTHER STAKEHOLDERS

ICFRE-FRI, Derhadun

- Advisory given to Department of Forests, Uttarakhand, on propagation of QPM of endangered medicinal tree *Oroxylum indicum*.

ICFRE-IFGTB, Coimbatore

- Screened ITC clones of *Leucaena leucocephala* against pathogen infection.
- Provided biofertilizers and bio control products to TNPL and other stake holders including 30 persons across Tamil Nadu.

ICFRE-HFRI, Shimla

- Detailed study report on factors influencing drying and mortality of conifers in Marwah Forest Division (J&K, UT).
- Visited the affected sites in Suket Forest Division to investigate and identify the major factors influencing the drying and moratlity of deodar trees in the region.
- A team of Experts from ICFRE-HFRI, Shimla visited, Tandi site, in Mandi District to investigate and identify the major factors contributing to drying of *Ficus religiosa* (Pipal) tree in the area. A detailed report on cause of drying and possible management strategies was submitted.

ICFRE-HFRI team with officials of J&K Forest Department at diseased site

Affected Conifer Forests

ICFRE-HFRI team with officials of State Forest Department at Diseased site

Investigation of dried Peepal Tree

ICFRE-TFRI, Jabalpur

- Attended field enquiry and provided scientific advisories to forest officials, nursery staffs regarding production of pests and diseases free Teak seedlings at Oberi forest nursery, Sidhi Forest Division, (MPRVVNL) M.P.

4.17. ACTIVITIES OF RAJBHASHA

ICFRE is actively engaged in promoting Rajbhasha Hindi across the ICFRE Headquarter and its Institutes. Following are the regular activities conducted pertaining to implementation of Rajbhasha Hindi:

- 36 Quarterly meeting of official language Implementation Committees.
- 24 Quarterly training workshops on implementation of official language Hindi.
- Rajbhasha inspections of subordinate offices.

ICFRE and its institutes enthusiastically observed Hindi Day/Week/ Fortnight during the month of September 2022. Shri Subhash Pant, an eminent Author of Hindi, was honored in the opening ceremony at ICFRE, HQ. Besides this, the Directorates/Divisions who are doing commendable work in Hindi at the Headquarter level are awarded in Hindi fortnight. These awards are conferred to Directorate of Extension, Directorate of Education and Internal Audit Cell.

The best performance in implementation of Rajbhasha Hindi amongst the institutes during a year was awarded with "ICFRE Rajbhasha Puraskar". The award for the year 2021-2022 was conferred to ICFRE-FRI, Dehradun amongst the institute situated in "A" region and to ICFRE-RFRI, Jorhat, amongst the institute situated in "C" region. Apart from institutes & offices, individual awards along with cash prizes and certificates were distributed to 10 numbers of personnel working in the council.

In addition to R&D publications, periodicals such as ICFRE Annual Hindi magazine Taruchintan, monthly 'Vaniki Samachar', E- magazine 'Van Anusandhan', 'AFRI Darpan' and Hindi – Asamese bilingual magazine 'Varsharanyam' were also published regularly.

Meetings attended:

During the year, ICFRE participated in the Hindi Advisory Committee meeting conducted by MoEF&CC held on 4 January 2023 and was also present in the 2nd All India Official Language Conference held in Surat, Gujrat from 14-15 September, 2022.

TOLIC, Dehradun Award

ICFRE was awarded with consolation prize and certificate for doing excellent work in implementation of official Language by Town Official Language Implementation committee (Office-1), Dehradun for the year 2021-22.


ICFRE celebrate Hindi Fortnight

ICFRE-FRI, Dehradun


ICFRE-IFGTB, Coimbatore


ICFRE-HFRI, Shimla


ICFRE-IFP, Ranchi


ICFRE-TFRI, Jabalpur

ICFRE-RFRI, Jorhat

ICFRE-IFB, Hyderabad


ICFRE-AFRI, Jodhpur

ICFRE-IWST, Bengaluru

Glimpses of Hindi Day/ Week/ Fortnight celebrations across the ICFRE institutes

4.18. AZADI KA AMRIT MAHOTSAV

Institute	Events Conducted
ICFRE-FRI	25
ICFRE-HFRI	14
ICFRE-TFRI	31
ICFRE-AFRI	12
ICFRE-RFRI	21
ICFRE-IWST	18
ICFRE-IFGTB	17
ICFRE-IFP	21
ICFRE-IFB	21

Azadi Ka Amrit Mahotsav is an initiative of the Government of India to celebrate and commemorate 75 years of independence and the glorious history of it's people, culture and achievements. The official journey of Azadi Ka Amrit Mahotsav commenced on 12 March 2021 and is still going on. During 2022-23 Institutes of ICFRE conducted **180** events like, Celebration of Important days, Awareness programmes, Tree plantation campaigns, Cleanliness drives, lectures, training, webinars, competition, FiT India Run 3.0, Van Mahotsava etc.

Total No. of Activities Performed from April 2022-March 2023: 180

Webinar/Seminar	–	72
Training/Skill Development	–	45
Competition (Quiz/Painting / Poster/Essay/Elocution)	–	05
Awareness Programme (/Plantation/Visit/Sensitization)	–	46
Conference/Workshop	–	03
FiT India Run	–	08
Birsa Munda Jayanti	-	01

India @75 Conclave at ICFRE-ERC Prayagraj


Painting competition at ICFRE-TFRI


Training on paper manufacturing at ICFRE-FRI


Plantation of 75 species at ICFRE-TFRI


Training on Bamboo production and uses at Ranchi


Celebrating World Day to Combat Desertification and Drought at ICFRE-AFRI

Tree plantation on Van Mahotsav by ICFRE-IFGTB, Coimbatore

Awareness programme on Biodiversity Conservation by ICFRE-IFB, Hyderabad

Poster making competition on the occasion of Independence day by ICFRE-IWST, Bengaluru

Visit of Students of DPS, Nazira at ICFRE-RFRI, Jorhat

FiT India Freedom Run 3.0

FiT India Freedom Run 3.0 campaign organized across the ICFRE and its institutes/Centres during the month of October 2022 under the celebration of Azadi ka Amrit Mahotsav.

FiT India Freedom Run campaign at ICFRE-FRI, Dehradun

FiT India Freedom Run campaign at ICFRE-AFRI, Jodhpur

FiT India Freedom Run campaign at ICFRE-HFRI, Shimla

FiT India Freedom Run 3.0 at ICFRE-TFRI, Jabalpur

4.19. RADIO/TV TALKS

- ICFRE-FRI delivered 14 Radio Talks on All India Radio.
- ICFRE-HFRI delivered 03 TV talks on Doordarshan and ETV.
- ICFRE-IFP 03 TV talks on Doordarshan and News-18.
- ICFRE-TFRI 02 Radio talks on AIR, Jabalpur.

4.20. VISIT OF DIGNITARIES

ICFRE-IFGTB, Coimbatore

- Shri Bhupender Yadav, Hon'ble Minister of Environment, Forest and Climate Change, Govt. of India, New Delhi paid a visit to ICFRE-IFGTB, Coimbatore on 8 October 2022. Hon'ble Minister visited the laboratories and nursery production facilities.

ICFRE-FRI, Dehradun

- Shri C. P. Goyal, DGF & Special Secretary, MoEF& CC, Govt. of India visited DD Herbarium and Xylarium on 15 July 2022.
- Dr. K. N. Gandhi, Senior Nomenclature Registrar and Bibliography at Harvard University in the Department of Botany at Harvard University Herbaria & Libraries, USA visited DD Herbarium on 11 February 2023.

ICFRE-IWST, Bengaluru

- Shri Prem Kumar Jha, IFS, Inspector General of Forest (NAEB), Ministry of Environment Forest and Climate Change, New Delhi visited during 6 to 8 April 2022 to review the functioning of erstwhile IPIRTI.
- Shri K. Rajeshwar Rao, Principal Advisor, Central Vista Oversight Committee, Government of India visited ICFRE-IWST on 21 October 2022 and interacted about the prospects of promoting sandalwood cultivation in India and about way forward.
- Hon'ble Justice Shri. Sandeep Kumar, High Court of Patna inaugurated newly fabricated 'Automated Mist Chamber' on 27 December 2022 and had an interaction with the scientists.

ICFRE-AFRI, Jodhpur

- Shri Jogeshwar Garg, MLA - Jalore (Rajasthan) visited ICFRE-AFRI on 11 May 2022.
- Mr. Naohiro Matsui, from Japan International Cooperation Agency (JICA) visited ICFRE-AFRI on 27 January 2023.
- Padamshree Himtaram Bhaambu visited ICFRE-AFRI on 17 March 2023.
- Mr. Gyanendra Nepal, Chief Attorney, Bagmati Province, Nepal and delegates visited ICFRE-AFRI on 29 March 2023.

ICFRE-TFRI, Jabalpur

- Shri Arun Singh Rawat, Director General, ICFRE, Dehradun visited ICFRE-TFRI, Jabalpur on 29 September 2022.

ICFRE-RFRI, Jorhat

- Shri Rupjyoti Kurmi, Hon'ble MLA, Mariani visited ICFRE-RFRI on 4 May 2022.
- Nine delegates from JICA Mission, New Delhi, India and their Head of Office, Tokyo, Japan visited the bamboo museum and tissue culture laboratory of FRC-BR, Bethlehem Vengthlang, Aizawl, Mizoram, which was led by the Minister of Environment, Forest and Climate change (EF&CC), Shri. T.J. Lalnuntluanga, Govt. of Mizoram on 24 May 2022.
- Shri Kamakhya Prasad Tasa, Hon'ble Member of Parliament (Rajya Sabha) visited ICFRE-RFRI on 14 September 2022.
- Shri A.S. Rawat, Director General, ICFRE, Dehradun visited ICFRE-RFRI, Jorhat on 27 December 2022.

ICFRE-HFRI, Shimla

- Shri A.S. Rawat, IFS, Director General, ICFRE, Dehradun visited ICFRE-HFRI, Shimla on 4 and 5 April 2022.
- National Youth Environment Parliament Team from Ministry of Environment & Climate Change, New Delhi visited ICFRE-HFRI Shimla on 23 July 2022 to 25 July 2022.

ICFRE-IFP, Ranchi

- Director General, ICFRE, Dehradun Shri Arun Singh, IFS visited ICFRE-IFP, Ranchi on 31 May 2022.

4.21. MISSION LIFE (LIFESTYLE FOR ENVIRONMENT)

At the 2021 UN Climate Change Conference (UNFCCC COP26), Hon'ble Prime Minister of India Shri Narendra Modi announced Mission LiFE, to bring individual behaviours at the forefront of the global climate action narrative. It is an India-led global mass movement to nudge individual and community action to protect and preserve the environment.

Under Mission Life, ICFRE and its institutes have conducted various activities like cleanliness drive, awareness campaigns, Drawing competitions, Quiz competitions, Bicycle rallies, Seminar, Conferences and also observed World Environment day. ICFRE has done 58 activities till 31st March 2023 and 14,745 people have pariticipated in these events.

Sensitization programme on LiFE at ICFRE-RFRI, Jorhat


Beach cleanup programme at Visakhapatnam


Awareness programme for students under LiFE at Coimbatore

Cleanliness campaign by ICFRE and its Institutes/Centres

ICFRE and its institutes/centres are regularly conducting Swachh Bharat Abhiyan. Special drive for Swachh Bharat Abhiyan was conducted during the month of October 2022. The cleanliness drive was started with taking pledge for cleanliness and activities like cleaning of the campuses and nearby areas, e-waste disposal, awareness programmes etc. were conducted.

ICFRE participated in the Swachhta Campaign 2.0 and achieved remarkable feat in clearing waste and clutter. Under the Campaign 2.0, ICFRE cleared 13846 units of scrap waste, 5565 record and files and 317 units of e-waste. The scrap waste included old wooden furniture's, metallic items, papers, etc. The record and files include paper documents, registers, books, etc. The e-waste included computers, printers, scanners, keyboards, photocopier etc.


DG, ICFRE administering the cleanliness pledge at ICFRE, Dehradun


Cleanliness drive at ICFRE-HFRI, Shimla


Cleanliness drive at ICFRE-FRI, Dehradun


Cleanliness drive at ICFRE-IWST, Bengaluru

4.22. SPECIAL ACTIVITIES

ICFRE and its Institutes/Centres observed national days i.e. Independence Day, Republic Day, Gandhi Jayanti with great enthusiasm. In addition, other important Days were also observed by the Council such as National Technology Day, National Forest Martyrs Day, Sardar Vallabhbhai Patel Jyanti, National Unity Day, Constitution Day, Ambedkar Jyanti, International Day of Biological Diversity, World Environment Day-2022, International Day of Yoga, Van Mahotsava, Himalayan day, Fit India Freedom Run 3.0, International Day of Forests, International Museum Day, International Mangrove Day, World Wetland Day, World Earth Day, Anti-Terrorism Day, Vigilance Awareness Week, International Women's Day, World Wildlife day, World Soil Day, World Health Day, World Zoonosis Day, Quit India Movement Day, International Day of World's Indigenous People etc.

DG, ICFRE offering floral tribute at Forester Memorial at ICFRE-FRI, Dehradun

ICFRE celebrate Sardar Vallabhbhai Patel Jyanti

ICFRE-AFRI, Jodhpur celebrate World Day to Combat Desertification & Drought

International Mountain Day celebration at ICFRE-HFRI, Shimla

ICFRE-TFRI, Jabalpur celebrated the International Day of Forests

Van Mahotsav at ICFRE-TFRI, Jabalpur

Van Mahotsav at ICFRE-HFRI, Shimla

International Yoga Day at ICFRE-TFRI, Jabalpur

International Yoga Day at ICFRE-IFP, Ranchi

ICFRE-HFRI, Shimla observed Constitution Day

International Museum Day celebration at ICFRE-IFGTB, Coimbatore

4.23. VIGILANCE AWARENESS WEEK

Vigilance Awareness Week was celebrated across the ICFRE and its Institutes/Centres from 26 October to 01 November 2022. The celebrations initiated with Integrity Pledge administered to all ICFRE personnel followed by other activities.

Vigilance Awareness Week at ICFRE, Dehradun

Vigilance Awareness Week at ICFRE-HFRI, Shimla

Vigilance Awareness Week at ICFRE-TFRI, Jabalpur

Vigilance Awareness Week at ICFRE-IFP, Ranchi

4.24. NATIONAL FOREST LIBRARY AND INFORMATION CENTRE (NFLIC)

The National Forest Library and Information Centre (NFLIC) is richest in document collection on forestry and allied sciences in South and Southeast Asia. The NFLIC has been providing all types of library and information services, *viz*, reference, referral, lending, reprography, current awareness, inter-library loan, retrieval of information from Online Public Access Catalogue, etc. to its users. During the year (2022-23), 23449 books were loaned to the users for outside reading. Besides 25264 documents consulted inside the library.

The document collection of the NFLIC was enriched by the addition of 870 latest books and other documents. The NFLIC subscribed 26 Indian periodical titles and 322 issues of the periodicals were received as gratis.

During the year 772 books and 14 DVD were sold to the State Forest Departments, universities, etc. and generated revenue of Rs. 141271.

The NFLIC has started monthly paid membership for outsiders. Collection of NFLIC monthly paid membership is Rs. 44000 (October 2022-March 2023).

NFLIC started user orientation programme for M.Sc. students. In this programme lectures were delivered on various services of NFLIC and various information sources available free of cost in digital environment.

4.25. ENVIRONMENTAL INFORMATION SYSTEM (ENVIS)

Details of the Tree genetic resources established and maintained in the form of *in situ* conservation stands and *ex situ* field trials maintained by SFDs were collected and incorporated into the FGR database. A database on the available forest genetic resources with various stake holders in south India is maintained in the website www.ifgtbenvis.in. Published the quarterly newsletter *"Van Vigyan"* (ISSN: 2394-7543, Volume 9, 4 issues). Various awareness programmes were organized under Azadi Ka Amrit Mahotsav on the Green Days. Theme related awareness posters and handouts were disseminated to students and various stakeholders digitally. In addition, online awareness programmes like webinars, quiz programmes, elocution competitions, photography competitions, and painting competitions were organized for students and public. Prizes were awarded to the winners and certificates to all the participants. These awareness programmes were also registered in the respective global networks. All the awareness activities carried out by ICFRE-IFGTB Environmental Information, Awareness, Capacity Building and Livelihood Programme Resource Partner (ICFRE-IFGTB-EIACP PC RP) have been covered in leading national dailies. ICFRE-IFGTB EIACP PC RP also organized an awareness programme to spread the message on celebration of Green Deepavali. Greetings on Green Deepavali celebrations containing information on its need and the tips for celebrating the festival in a green way was released and disseminated. News related to the theme were uploaded in the website on daily basis. A mobile app 'Forest Seed Science and Technology', an android based interactive mobile App was released by the honourable Director General, ICFRE. Periodical updates were done in the Mobile Apps released by ICFRE –IFGTB EIACP PC RP, Tree Pests of India and Forest Tree Diseases (English and Tamil versions). Mass tree planting drive and tree sapling planting challenge were also organized. Organized various awareness campaigns on Mission LiFE to school & college students and to the general public on a regular basis. ICFRE-IFGTB EIACP PC RP has participated in the National Workshop on Mission LiFE and National Level Exhibition on GSDP products at the Union Ministry of Environment, Forest and Climate Change, New Delhi on 30 January 2023. The honorable Union Minister has released various knowledge products on environmental awareness conceived by the EIACP PC RP.

05
CHAPTER

Administration and Information Technology

ADMINISTRATION AND INFORMATION TECHNOLOGY

5.1. INFORMATION TECHNOLOGY

ICFRE, HQ

5.1.1. Information Technology Division, ICFRE

Information Technology Division at ICFRE HQ plays an important role in supporting research, administration and other activities. ICFRE is using Information Communication Technology, progressively providing the users 24X7 services to their satisfaction. IT Division caters to the Information Communication Technology needs of all institutes under ICFRE and ICFRE HQ. It is keeping pace with the technological advancement of ICT within the allocated budget to the best possible extent. Apart from providing the regular services, new initiatives are also being taken time to time.

New initiatives taken during 2022-23:

1. ICFRE Data Centre (Server Farm)

ICFRE Data Centre services are available 24*7*365 at ICFRE Head Qtr, ICFRE Institutes and Centres across the country since 01.02.2010. Some of services provided by Data Centre are Mail, Internet, Web, Videoconferencing, Antivirus, FTP, Network Security System, Databases, Building Management System (BMS), Virtual Private Network (VPN) services, Push Mail Service, Web casting etc. Seventy one (71) web applications/websites are hosted on Data Centre. One thousand eight hundred thirty (1830) active email accounts are on Mail server. Service Desk and IFRISDESK are Institutional framework for the resolution of issues across ICFRE.

ICFRE Data Centre

2. New applications/ websites developed / implemented

A. Hindi website of ICFRE-TFRI, Jabalpur: Hindi website of ICFRE-TFRI, Jabalpur was designed, developed and implemented on live server. URL of the website is https://tfrihindi.icfre.org/

Screenshot of ICFRE-TFRI Hindi website

B. Hindi website of ICFRE-RFRI, Jorhat: Hindi website of ICFRE-RFRI, Jorhat was designed, developed and implemented on live server. URL of the website is https://rfrihindi.icfre.org/

Screenshot of ICFRE-RFRI Hindi website

C. Hindi website of ICFRE-IFB, Hyderabad: Hindi website of ICFRE-IFB, Hyderabad was designed, developed and implemented on live server. URL of the website is https://ifbhindi.icfre.org/

Screenshot of ICFRE-IFB Hindi website

D. English website of ICFRE-IFGTB Coimbatore: English website of ICFRE-IFGTB Coimbatore was designed, developed and implemented on live server. URL of the website is https://ifgtb.icfre.org/

Screenshot of ICFRE-IFGTB English website

E. Implementation of ICFRE Recruitment Portal: New Recruitment Portal was made live in year 2022-23 and recruitment process of Scientists-B at ICFRE is going through this portal. URL of the portal is https://recruitment.icfre.gov.in

Screenshot of ICFRE Recruitment Portal

F. Development of ICFRE Pensioners' Portal: ICFRE Pension Portal has been designed, developed and implemented. Mobile application of the portal has also been designed and developed. URL of the portal is https://pesionportal.icfre.org. Data of all the old pensioners has been uploaded on the Portal and the Pensioner registration, Pension Application approval and PPO generation of new pensioners is being done on the ICFRE Pension Portal since December 2022.

Screenshot of ICFRE Pension Portal

3. Security Audit of following websites/applications was completed

S.No	Description	URL of Website/ Application
1	English website of ICFRE-IFGTB Coimbatore	https://ifgtb.icfre.org
2	Hindi website of ICFRE-TFRI, Jabalpur	https://tfrihindi.icfre.org
3	Hindi website of ICFRE-RFRI, Jorhat	https://rfrihindi.icfre.org
4	Hindi website of ICFRE-IFB, Hyderabad	https://ifbhindi.icfre.org
5	Hindi website of ICFRE	https://hindi.icfre.gov.in
6	English website of ICFRE-TFRI, Jabalpur	https://tfri.icfre.org
7	English website of ICFRE-RFRI, Jorhat	https://rfri.icfre.org
8	English website of ICFRE-IFB, Hyderabad	https://ifb.icfre.org
9	English website of ICFRE-ERC, Prayagraj	https://frcer.icfre.org
10	Ecosystem Services Improvement Project (ESIP) website	https://esip.icfre.org

4. Maintenance of Software Applications/ websites

Already developed applications/websites are being maintained and updated time to time. Following applications/websites developed by IT Division, ICFRE are also being maintained and updated time to time.

1. Video Conferencing Booking Portal
2. Complaint Management System
3. Guest House Booking Portal
4. Pensioner database
5. Information System for Secretary Office (Men-in-Position.
6. Online Office Records (Orders/MoM/Agendas etc.) System.
7. Annual Property Returns Portal
8. GPF Application
9. Fixed Assets Database and Application
10. Database of Research Projects
11. Interactive Portal: Interface with stakeholders
12. ICFRE websites (Bilingual)
13. ICFRE-TFRI websites (Bilingual)
14. ICFRE-HFRI Shimla website (Bilingual)
15. ICFRE-IFB Hyderabad Website (Bilingual)
16. ICFRE-AFRI Jodhpur Website (Bilingual)
17. ICFRE-TFRI, Jabalpur website (Bilingual)
18. ICFRE-RFRI, Jorhat website(Bilingual)
19. ICFRE-IFGTB website
20. ICFRE-ERC, Prayagraj website
21. Ecosystem Services Improvement Project (ESIP) website.

Seventy One websites/Database/CMSs/applications including applications and websites of ICFRE institutes which are on live server are being maintained.

5. Updation of websites of ICFRE (http://icfre.gov.in and https://hindi.icfre.gov.in):

ICFRE's websites **(http://icfre.gov.in and https://hindi.icfre.gov.in)** are promptly updated. Details of updations made in the English and Hindi Websites of ICFRE during 1 April 2022 to 31 March 2023 is as below:

Sl. No.	Period	Nos. of updations
1.	1 April 2022 to 30 June 2022	410
2.	1 July 2022 to 30 September 2022	379
3.	1 October 2022 to 31 December 2022	450
4.	1 January 2023 to 31 March 2023	450
	Total	**1689**

6. **Social Media:** Twitter, Facebook, Instagram, Koo, Youtube, Flickr accounts of ICFRE are in operation and links are provided on the Home page of ICFRE website.

7. **Maintenance of LAN:** The Operation & Maintenance (O&M) of existing and upgraded hardware/ software of LAN at ICFRE Head Qtr, nine Institutes and three centres have been done successfully during the year 2022-23.

8. **National Knowledge Network (NKN) connectivity:** NKN connectivity has been provided to 12 locations of ICFRE. The National Knowledge Network (NKN) connectivity availability is more than 99% at ICFRE Head Qtr. The 1 Gbps internet leased line is provided by NKN through RailTel India at ICFRE Head Qtr and media for 1 Gbps internet leased line through BSNL is also provided at ICFRE Head Qtr. The internet services are extended across ICFRE locations throughout the country.

9. **Organizing Video Conferencing Meetings:** Two Hundred Sixty Seven (267) Video Conferencing sessions were organised by IT Division, ICFRE during 2022-23.
10. **Maintenance Contract of IT Hardware (Computers, laptop, Printer, Scanner and Franking machine) at ICFRE Head Qtr.:** Computers, Printers, Scanners, Laptop and Franking Machine were maintained in time bound manner during the year 2022-23.
11. **Handling of Government Land Information System Portal (GLIS) and iGoT Mission Karmayogi Portal:** The land and building records of ICFRE Hq. and its institutes were updated in the GLIS portal of Govt. of India and compliance was made to the directions of MoEF&CC, GoI. Also the iGoT portal under Mission Karmayogi Bharat was made operational at ICFRE.
12. **Up gradation of Infrastructure of Auditorium and Conference Room of ICFRE HQ:** IT infrastructure of Auditorium and Conference Room of ICFRE HQ was upgraded. New Projectors and Screens were installed at Auditorium.

5.1.2. At ICFRE institutes

Institutes' websites, databases, hardware/software is being looked after and maintained at Institute level by IT Division of respective institutes. Apart from this, following activities are also carried out at Institutes.

- Web designing completed for National Forest Insect Collection using HTML and digitization of 731 specimens from Gass Forest Museum by ICFRE-IFGTB, Coimbatore.
- The web site of institute's satellite centre, ICFRE-SDC, Chhindwara has been designed in new format and published over ICFRE server. The social media accounts like YouTube, Facebook, Twitter, Instagram, Koo have been created and integrated with website by all institutes.
- Online Guest House Booking System of ICFRE-RFRI, Jorhat has been started.

5.2. ADMINISTRATION

Directorate of Administration of ICFRE deals with all financial matter of Council including preparation of budget estimates, allocation of budget and preparing annual mandatory financial statements; filing of mandatory financial and administrative returns of ICFRE; stores including inventory management and procurement. It also deals with disbursement of payment and TDS and maintains support services and official infrastructure. Besides handling general administration, the Directorate looks after civil and technical works of the Council and its Institutes. Besides, Pensioners of the Council have their centralized record at Headquarters and their payment is centrally done from Administration Directorate.

5.2.1. Activities relating to the Citizens/Clients Charter

Sevottam:

It deals with solution based forestry research with the larger objective of providing improved services and opportunities for the peoples. Sevottam' is an assessment improvement framework targeted to improve the quality of services to the citizens. The Council using the framework of "Sevottam' is committed to continuously improve quality of service in ICFRE (Hqtrs.) and its Institutes. The "Sevottam' frameworks consists of three components viz. the Citizens Charter, Public Grievance lodging and redressal mechanisms and service delivery capability.

Based on the guidelines issued by Government and, as a part of the Performance Monitoring and Evaluation System (PMES) for Government Departments, ICFRE has formulated the Citizen Charter for the Council. It is a document, which represents systematic efforts to focus on the commitment of the organization towards its citizens/clients in respect of standard of services, information, choice and consultation, non-discrimination and accessibility, grievance redressal, courtesy and value for money. It also includes expectations of the organization from the citizens/ clients for fulfilling the commitment of organization.

5.2.1.1. Action taken to formulate the Charter for the Department and its subordinate formation

The Citizen's Charter is drafted and implemented by all the Institutes and Centres of ICFRE with a provision for annual review of the Charter services provided. It is available on the website of the ICFRE (www.icfre.gov.in). For providing information to the public and clients, the Council largely relies on the web-based tools, dissemination of information through a variety of means- including IT interface, Citizens' Charter, responses to citizens by way of the tolls that come under the purview of Right to Information Act and through workshop and seminars conducted by the organization.

5.2.1.2. Action taken to implement the Charter

As stated earlier, the Citizen's Charter is on the website of ICFRE. It provides the bird's eye view of ICFRE including its vision, mission, objectives, functions, services and service standards. The Charter also provides the grievance redressal mechanism and contact information of persons who should be approached for mechanism and contact information of persons who should be approached for registering, and receiving responses on, specific grievances in each Institutes of ICFRE. With the aim of implementing the Charter, the ICFRE Institutes and Centres direct and implement their research endeavors after assessing the need of the user/ stakeholders. Also, in accordance with the need, up-gradation of the skills and knowledge of the staff, as also upgrading infrastructure of the Institutes/ Centres with state of art facilities and their proper maintenance is also taken up to meet the upcoming challenges.

Services provided are regularly monitored by the Head of the Division/Group Co-coordinator (Research)/Director of each Institute and also by the officials of ICFRE as per norms. The instruments are standardized with set procedures. Getting an unbiased feedback from the stakeholders is given due importance. Based on feedback, necessary changes in the training programmes are incorporated.

5.2.1.3. Details of training programmes, workshops, etc. held for proper implementation of the Charter

In an endeavor to create awareness and, as a part of extension activity, trainings and workshops are organized at regular intervals in the ICFRE Institutes and Centres. Besides, the RAG Committee meetings, stakeholders' meet, 'Melas' for interaction with end users', diverse trainings etc. are held from time to time.

5.2.2. Welfare measures for the SC/ST/backward/minority communities

The Grievance Redressal Cell for SC/ST/OBC employees of ICFRE (Hqtrs.) was formed vide Secretary, ICFRE, order no.63-37/2010-ICFRE dated 23.02.2011. The Deputy Director General (Education) functions as the Chief Liaison officer for SC/ST/OBC. Similarly, all the Institutes of ICFRE have their own Grievance Redressal Cells.

Birsa Munda Jayanti

On the occasion of birth anniversary of Birsa Munda ICFRE-TFRI, Jabalpur celebrated Birsa Munda Jyanti on 15 November 2022 at Rani Durgawati Samadhi Sthal, Gram Narrai, Jabalpur, Madhya Pradesh to commemorate his contribution in the tribal freedom struggle.

ICFRE-TFRI celebrated Birsa Munda Jayanti

Ambedkar Jayanti

ICFRE-AFRI, Jodhpur and ICFRE-IWST, Bengaluru celebrated Ambedkar Jayanti on 14 April 2022.

ICFRE-AFRI, Jodhpur celebrated Ambedkar Jayanti

Tribal Welfare

For production of Tree Rich Biobooster a 5 Kg TRB production machine was installed and handed over to WSHGs of Rayaroothpathi Tribal settlement, Periyanaickanpalayam Range, Coimbatore.

Installation of TRB production machine at tribal settlement, Periyanaickanpalayam Range, Coimbatore

5.2.3. Welfare measures for women

- ICFRE, Dehradun conducted Awareness and Sensitization programme on 5 December 2022. A talk was also delivered on Elimination of all forms of Violence and Discrepancies against Women at Workplace. ICFRE and ICFRE-FRI, Dehradun officials attended the programme.
- ICFRE-RFRI, Jorhat, organized a Programme on 'Sexual harassment of women at work Place' (Prevention, Prohibition, Redressal Act, 2013) on 12 December, 2022 at RFRI, Jorhat.
- ICFRE-HFRI, Shimla organized one day awareness programme on Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Act, 2013 on 8 December 2022. Scientists, officers, technical, non-technical and research support staff participated in the programme.

ICFRE, Dehradun conducted Sensitization Programme on Elimination of all forms of Violence and Discrepancies against Women at Workplace

- ICFRE-IWST, Bengaluru, ICFRE-IFGTB, Coimbatore, ICFRE-HFRI, Shimla and ICFRE-AFRI, Jodhpur celebrated International Women's Day 2023 on 8 March 2023.

Women's Day celebration at:

ICFRE-IFGTB, Coimatore

ICFRE-AFRI, Jodhpur

ICFRE-IWST, Bengaluru

ICFRE-HFRI, Shimla

- Four trainings were conducted, three at Nagaur district and one at ICFRE-AFRI Jodhpur for 90 rural women farmers on biofertilizer application and mass multiplication and to guide the women farmers for generation of income. The trainees/ participants were provided packets of *Piriformospora indica* prepared by Amity University, Noida and *Trichoderma harzianum* prepared by ICFRE-AFRI, Jodhpur as test samples.


Trainings given to rural women of Rajasthan on use of biofertilizers

5.2.4. Statistical Support

Forestry Statistic India, biennial publication, is being published by the division along with evaluation of Performance of ICFRE as per Government note to review the Autonomous Body at every five years. The Scientific Ranking of ICFRE Institutes is an annual exercise being conducted. The Ranking is based on the TOPSIS approach where 104 indicators distributed in three criteria as Research, Research Products for Societal Target Groups and Institutional Achievements are considered for evaluation of the Institute.

5.2.5. Information on the status of activities under "The Rights of person with disabilities Act 2016" during the year 2022-23

The information in respect of ICFRE-Dehradun is as under:

i. Information about the total budget provision of the Ministry/ Department for persons with disabilities –

No separate budget provision is made for persons with disabilities.

ii Allocation under various schemes for the benefit of persons with disabilities, the amount released and the amount utilized-

Rs. 2150334/- has been paid to persons with disabilities as double TPT.

iii The number of beneficiaries with disabilities and their percentage in relation to the total number to beneficiaries-

No. of beneficiaries with disabilities-24 out of 1450 employees i.e. 1.66%.

Balance Sheet

BALANCE SHEET

INDIAN COUNCIL OF FORESTRY RESEARCH AND EDUCATION

DEHRADUN

BALANCE SHEET
2022-23

PARMITA & COMPANY
Chartered Accountants
Mob.: 9837176237
Email: caparmitaandco@gmail.com
72, Haridwar Road, Opp. C.M.I. Hospital
(Above H.R. Bhatt Optical Co.)
Dehradun - 248 001 (Uttarakhand)

Dated 25.10.2023

To
The Members
Indian Council of Forestry Research and Education
PO: New Forest, Dehra Dun – 248006
Uttarakhand

INDEPENDENT AUDIT REPORT

1. REPORT OF FINANCIAL STATEMENTS

We have audited the attached BalanceSheet of the "**Indian Council of Forestry Research and Education, (ICFRE)** a society registered under the Societies Registration Act 1860, **Post New Forest, DEHRADUN - 248006** as 31ST March 2023 and also the annexed Income & Expenditure Account for the year ended 31-3-2023 on that date. These Financial statements are the responsibility of the management of society. Our responsibility is to express an opinion on thesefinancialstatements based on our audit.

2. RESPONSIBILITIES OF MANAGEMENT AND THOSE CHARGED WITH GOVERNANCE FOR FINANCIAL STATEMENTS

Management is responsible for the preparation and presentation of these financial statements that give atrue and fair view of the financial position and financial performance of the entity in accordance with the accounting principles generally accepted in India.

3. AUDITOR'S RESPONSIBILITY

We conducted the audit in accordance with auditing standards generally accepted in India. These standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of materialmisstatement. An audit includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statement.An audit also includes assessing the accounting principles used and significant estimates made by the management, as well as evaluating the overall financial statement presentation. We believe that our audit provides a reasonable basis for our opinion.

PARMITA AND COMPANY Dehradun Chartered Accountants

4. OPINION & IT'S BASIS

We enclose in the Annexure a statement on the matters specified in paragraph 5 of the report.

5. FURTHER TO OUR COMMENTS IN THE ANNEXURE REFERRED TO ABOVE, WE REPORT THAT

(i) We have obtained all the information and explanations which to the best of our knowledge and belief were necessary for the purpose of our audit;

(ii) The Balance Sheet, Profit and Loss Account and the Cash Flow Statement dealt with by this report are in agreement with the books of account kept by Society.

(iii) Without qualifying our opinion, we invite attention to the following notes to Annexure

(iv) In our opinion and to the best of our information and according to the explanations given to us, the said accounts give the information required as per applicable law, in the manner so required and give true and fair view in conformity with the accounting principles generally accepted in India:

a. In the case of Balance Sheet, of the state of Society affairs, as at 31.03.2023 and;

b. In the case of the Income & Expenditure Account of the Society, Excess of Income over Expenditure of the society for the year ended 31.03.2023.

FOR PARMITA & COMPANY
Chartered Accountant

PARMITA AND COMPANY • Dehradun • Chartered Accountants

(CA PARMITA BHATT)
Prop.
Membership No. 078018

DATE: 25.10.2023
PLACE: DEHRADUN

NOTES ON ACCOUNT

These notes form an integral part of and should be read in conjunction with the accompanying financial statements.

GENERAL

The Indian Council of Forestry Research and Education (the "Society") is incorporated under The Societies Registration Act,1860. The address of its registered office is at Post New Forest, Dehra Dun, Uttarakhand-248006.The Society has 18 Branches/Sections across India and works under different trade names but is governed by the Society.

1. ACCOUNTING CONVENTION

These financial statements are prepared on an accrual basis of accounting under historical cost convention in accordance with generally accepted accounting principles in India.

Receipts from user charges are sometimes on the cash basis, the cash is deposited into bank and cash receipts also include the petty balances left with advances to employees for expenses.

The preparation of financial statements requires estimates and assumptions that affect the reported amounts of assets, liabilities revenue and expenses during the reporting period.Although such estimates and assumptions are made on a reasonable and prudent basis taking into account all available information , actual results could differ from these estimates & assumptions and such differences are recognized in the period in which the result are crystallized.

2. BASIS OF ACCOUNTING

The financial statements have been prepared under the historical cost convention, except as disclosed in the accounting policies below.Society has adopted an accrual system of accounting during the year.

3. PROPERTY PLANT & EQUIPMENT

a. Tangible assets are carried at historical cost less accumulated depreciation /amortization.

b. Society is maintaining fixed assets at its branch level and fixed assets register is duly maintained at the branch level. The fixed assets register carries the

PARMITA AND COMPANY Dehradun Chartered Accountants

original value, there is no system to show depreciation in that register. Due to the non-maintenance of the ledger book by the branches, the written down value could not be verified from the books of account of the branch. The depreciation is continuously charged at the consolidation level and the value of depreciation is not put in the books of account.

c. Society has purchased various capital assets in Externally Aided Projects, which the society did not recognize as capital assets of the society till ownership lies with the funding agency.

d. Further any record of sale of old and discarded fixed assets through auction is not provided and executed for during the year.

4. DEPRECIATION

a. Society has charged depreciation on the "Written Down Value" method and adopted the current rate of depreciation as applicable under Income Tax Act 1961.
The society follows the practice of showing depreciation in Income & Expenditure Account apart from being the capital expenditure claimed in Income & Expenditure Account as application.

b. Since assets purchased under EAP are put separate and did not include fixed assets of Society, therefore depreciation in respect of such assets is kept outside of the purview of depreciation.

5. REVENUE RECOGNITION

Revenue for the Society comprises the fair value of the consideration received or receivable for the sale of goods and rendering of services, net of goods and services tax, rebates and discounts, Government Grants, and externally aided projects.

Revenue is recognised as follows:

(a) Sale of goods Revenue from the sale of goods is recognized when a entity has delivered the products to the customer, and the customer has accepted.

(b) Rendering of Consultancy Services is recognized over the period in which the services are rendered, by reference to the completion of the specific transaction assessed on the basis of the actual service provided as a proportion of the total services to be performed. Accrued Interest Certificate could not be collected from all the Institutes/Centres.

PARMITA AND COMPANY Dehradun Chartered Accountants

(c) Interest Income: Interest income is recognized on a time- proportion basis using the effective interest method.

(d) Rental income Rental/House License Fees are recognized on a cash basis.

(e) Government Grant is recognized only after approval from Central Government. The nature of the grant received from the Central Governmentis of an assistance nature.

6. RESEARCH AND DEVELOPMENT

The main object of Society is research and development in Forestry. The principles and methods of determining the Research and Development Costs and their classification are not found in the financial accounting of the society.

7. RETIREMENT BENEFITS

Society has adopted various schemes for benefit of retired employees. It is governed by the Pension Rules as adopted by ICFRE.

8. PRIOR PERIOD ADJUSTMENT

Since the society has adopted an accrual system of accounting during the year, the expenses related to the prior period were set off against Capital Fund. Further, some of the bank accounts were left to be incorporated during the last financial year which would mark an effect of Rs. 6871000.41/- (Rupees Sixty Eight Lakhs Seventy One Thousand and Forty One Paisa Only) in bank balances which has been incorporated with Capital Account and subsequently mirrored in Receipts & Payments Account. Further, any income or expenses passed through these bank accounts related to various projects have not been incorporated in any prior period adjustments.

9. CONTINGENT LIABILITIES

Society did not recognize contingent liability during the year.

10. TAXATION

Society is registered u/s 12A(B) under Income Tax Act 1961, which allows an institution exemption from Income Tax on complying with requirements stated u/s 12A(B) of the Income Tax Act 1961. The society has duly complied provision of Section 12A(B) during the year.

PARMITA AND COMPANY Dehradun Chartered Accountants

ANNEXURE – KEY AUDIT MATTERS:

1. COMPLIANCE UNDER GST ACT 2017

The society is registered under GST Act 2017 and the society has taken multiple registrations at the locations of institutes of the Society. The society is providing Consultancy Services to various organizations, but they showing them as a Supply of Service at the time of receipt of money, whereas the same should be kept under advance money, till the supply of service is progressively completed. Improvement and legal updates and time-to-time monitoring GST return filing system of all the branches is required.

2. POST- EMPLOYMENT BENEFITS TO RETIRED EMPLOYEES

The Society is running a separate wing under name of Pension Cell for the schemes applicable to benefits of retired employees. The society is running the following schemes under Pension Cell.

There are six major Pension & Employment welfare funds attached with ICFRE; previously they were merged with ICFRE consolidated financial statements. Since 2010 - 2011, it has become a regular practice to show and prepare these funds separately. So, it is to be pointed out here that these funds share the same PAN as of the ICFRE. We have also followed the same practice and hence shown the five different Balance Sheets separately. Books are maintained separately of all these funds.

Hence it is advisable to consolidate the Balance Sheets of these pension and fund with that of ICFRE.

(i) General Provident Fund Cum Pension Scheme (EPF)
(ii) Pension Employee ICFRE
(iii) Pension Central Government Employee
(iv) NPS – National Pension Scheme
(v) ICFRE PHS SCHEME
(vi) Pension Fund Account (Prior to NPS)

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3. ACTUARIAL VALUATIONS

Society did not recognize the retirement benefits of employees towards obligation in the future. Society should estimate the amount of obligation and make provisions according to future requirements, which is not done by Society.

4. METHOD OF ACCOUNTING

Society has prepared its financial statements on an accrual basis but there is an immense need to aware their institutes about the correct method of accounting under the accrual system, which some receipts are recognised on cash basis.

5. CONTINGENT LIABILITY

The GST department may raise liability of taxes, interest, late fees and penalties due to the filing of incorrect returns/compliances.

6. GENERAL

(a) Out of the foreign delegate fee received during the year, an amount of Rs.2252682/- (Rupees Twenty Two Lakhs Fifty Two Thousand Six Hundred Eighty Two only) has been transferred to Foreign Contribution Utilization Account Union Bank of India, FRI branch, Account no. 496902250000002. Further the amount of Rs. 6,07,000/- (Rupees Six Lakhs Seven Thousand only) has been transferred from FCRA Utilization Account to Domestic Account, which should be strictly avoided. Letter has been issued by the management to the Ministry of Home Affairs in this regard.

(b) Some project Receipts and Payments are not taken in preceding previous year financial statement of the ICFRE, the balance of the same have been considered in the books of account as an addition to bank accounts, and also there were some opening balance differences found during the year which were subsequently shown in the Bank accounts introduced and capital account subsequently. (See Point – 8 Notes on Accounts).

(c) Externally Aided Projects – These project grants are received and executed at the Institutes/Centres level only. There is no separate record of the consolidated EAPs received by different Institutes/Centres maintained by the ICFRE Headquarter. Hence, we had to rely on the Financial Statements and relevant documents provided by the Institutes/Centres at their level.

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(d) Since revenue has been taken on cash basis, TDS for the year is never reflected in books of account. It is accumulated for only when it is received.

(e) During the year IPIRTI (Indian Plywood Industries Research and Training Institute), Bengaluru got merged with IWST (Institute of Wood Science and Technology), Bengaluru from the date 1-11-2022. All the assets and liabilities were subsequently transferred to IWST (Institute of Wood Science and Technology), Bengaluru, which is reflected in the consolidated financial statements.

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION

P.O. New Forest, Dehradun

CONSOLIDATE BALANCE SHEET AS AT 31ST MARCH, 2023

CORPUS/CAPITAL FUND AND LIABILITIES	SCHEDULE	CURRENT YEAR 31.03.2023		PREVIOUS YEAR 31.03.2022
		RS.	RS.	RS.
CORPUS/CAPITAL FUND	1		1,39,02,09,368.23	89,49,87,668.12
RESERVES AND SURPLUS	2			
EARMARKED/ENDOWMENT FUNDS :				
> Grant Plan	3A	8,76,40,452.98		10,74,83,544.23
> Project (Externally Aided)	3B	81,65,45,612.90		64,64,28,200.21
> Others	3C	16,85,76,432.67	1,07,27,62,498.55	16,82,51,929.73
(A) Running Projects		2,74,91,166.70		
(B) Deposit received		53,99,483.00	3,28,90,649.70	
CURRENT LIABILITIES AND PROVISIONS				
(A) CURRENT LIABILITY:	4A	22,97,19,901.79		15,81,97,029.01
(B) PROVISIONS:	4B	-	22,97,19,901.79	-
TOTAL			2,72,55,82,418.27	1,97,53,48,371.30

ASSETS	SCHEDULE	CURRENT YEAR 31.03.2023		Total
		RS.	RS.	RS.
FIXED ASSETS	5		99,42,24,683.42	96,90,68,171.65
INVESTMENTS-FROM				
> F.D.R.(For One Time Special Grant)	6	17,47,70,000.00		16,76,98,000.00
> F.D.R.(With Institutes)		-		-
Transferred from IPIRTI		-		
1. Corpus Fund(Fixed Deposits)		46,13,01,000.00		
2. Statutory Deposits with various Govt		5,33,093.27	63,66,04,093.27	
CURRENT ASSETS, LOANS, ADVANCES ETC.				
> CURRENT ASSETS	7A	93,54,47,083.55		78,46,19,000.39
> LOANS,ADVANCES ETC	7B	10,26,98,290.45		5,39,63,199.26
> LOANS, ADVANCES- IPRITI, ETC		5,66,08,267.58	1,09,47,53,641.58	
		-		-
TOTAL			2,72,55,82,418.27	1,97,53,48,371.30

SH. BHARAT JYOTI (DIRECTOR GENERAL, ICFRE)

SH. VINAY KUMAR (DEPUTY DIRECTOR GENERAL, ADMIN, ICFRE)

SH. SUSHANT KUMAR (ASSISTANT DIRECTOR GENERAL, ADMIN, ICFRE)

SH. BRIJESH KUMAR SHARMA, (SECTION OFFICER, BUDGET SECTION ICFRE)

"AS PER OUR SEPARATE REPORT OF EVEN DATE ANNEXED"
FOR M/S PARMITA & COMPANY,
CHARTERED ACCOUNTANTS

PARMITA AND COMPANY Dehradun Chartered Accountants

(CA PARMITA BHATT)
PROP., M. NO. 078018, FRN 0008751C

DATED:25.10.2023
PLACE: DEHRADUN

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION

P.O. New Forest, Dehradun
DEHRADUN

CONSOLIDATED INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2023

INCOME	Schedule	Current Year 31.03.2023	Previous Year 31.03.2022
		Rs.	Rs.
SUPPLY OF SERVICE AND GOODS	8	13,29,87,679.64	12,02,74,001.69
FCRA RECEIPTS		22,72,635.00	
GRANT INCOME			
(A) Grant EAP/Consultancy applied during the year	9A	1,58,53,60,079.50	73,32,27,937.91
(B) Grant Under Plan alloted during the year	9B	2,47,64,00,000.00	2,42,88,63,000.00
(C) Grant for IPIRTI alloted during the year	9B	4,61,25,000.00	
INCOME FROM INVESTMENT			
Interest earned on OTGS Grant invested with Bank	10A	72,95,704.00	76,91,781.00
INTEREST EARNED	10B	2,80,93,669.57	2,36,71,665.03
OTHER RECEIPTS	11	3,19,155.00	5,78,015.00
DEPRECIATION FUND			
Total(A)		4,27,88,53,922.71	3,31,43,06,400.63

EXPENDITURE	Schedule	Current Year 31.03.2023	Previous Year 31.03.2022
		Rs.	Rs.
EXPENDITURE ON GRANTS			
(A) GRANT - PLAN		**2,52,25,25,000.00**	**2,42,88,63,000.00**
Establishment Expenses	12A	2,07,84,80,621.58	1,92,36,00,630.00
Administrative Expenses	12B	39,60,60,086.56	38,77,27,686.88
Capital Expenditure	12C	6,55,08,865.11	1,00,38,398.40
Unutilized Grant (Being Utilised from Opening Balance)	12D	(1,75,24,573.25)	10,74,96,284.72
Grant Transferred to Other Units			
(B) GRANT- EXTERNALY AIDED PROJECT		**1,58,53,60,079.44**	**73,32,27,937.91**
Grant Utilized During the Year	13	1,58,53,60,079.44	73,32,27,937.91
EXPENSES ON SUPPLY OF SERVICE & GOODS	14	23,08,55,716.14	13,90,00,228.28
DEPRECIATION	5	12,73,34,825.08	13,88,61,399.48
TOTAL(B)		4,46,60,75,620.66	3,43,99,52,565.67
Balance being excess of Expenditure over Income (A-B)		(18,72,21,697.95)	(12,56,46,165.04)

"AS PER OUR SEPARATE REPORT OF EVEN ANNEXED"
FOR M/S PARMITA & COMPANY,
CHARTERED ACCOUNTANTS

PARMITA AND COMPANY • Dehradun • Chartered Accountants

(CA PARMITA BHATT)
Prop., M. NO. 078018, FRN 0008751C

DATED:25.10.2023
PLACE: DEHRADUN

SH. BHARAT JYOTI (DIRECTOR GENERAL, ICFRE)

SH. VINAY KUMAR (DEPUTY DIRECTOR GENERAL, ADMIN, ICFRE)

SH. SUSHANT KUMAR (ASISTANT DIRECTOR GENERAL, ADMIN, ICFRE)

SH. BRIJESH KUMAR SHARMA, (SECTION OFFICER, BUDGET SECTION ICFRE)

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION

P.O. New Forest, Dehradun

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH, 2023

Schedule 1	CORPUS/CAPITAL FUND:	CURRENT YEAR 31.03.2023		PREVIOUS YEAR 31.03.2022	
		RS	RS	RS	RS
	Opening Balance	-			
	Op.Balance of Capital Fund Account	89,49,87,668.12		1,08,44,07,492.19	
	Add: Fund Transfer from Other Unit-IPIRTI	51,86,88,691.80			
	Add: Prior Period Adjustment-TDS of FY 20-21 received	42,55,435.00			
	Add: Fixed Assets Expended From Grant	15,24,91,336.85			
	Add: Balance of net income/expenditure transferred from the Income and Expenditure Account (Deficit)	(18,72,21,697.95)		(12,56,46,165.04)	
	Add: Banks left to be considered in Preceeding Previous year	68,71,000.41		-	
	Add: Prior Period Items	1,36,934.00		(1,68,25,669.77)	
		1,39,02,09,368.23		94,19,35,657.38	-
	Less: Amount Remitted/Appropriated to HQ	-	1,39,02,09,368.23	4,69,47,989.26	89,49,87,668.12
	BALANCE AS AT THE YEAR-END		1,39,02,09,368.23	89,49,87,668.12	89,49,87,668.12

Schedule 2	RESERVES AND SURPLUS:	CURRENT YEAR 31.03.2023		PREVIOUS YEAR 31.03.2022	
		Rs.	Rs.	Rs.	Rs.
	TOTAL				

PARMITA AND COMPANY Dehradun Chartered Accountants

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION

P.O. New Forest, Dehradun
DEHRADUN

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH, 2023

Schedule 3 (A & B)	EARMARKED/ENDOWMENT FUNDS	CURRENT YEAR 31.03.2023		PREVIOUS YEAR 31.03.2022	
		PLAN	PROJECT ACCOUNTS (EAP)	PLAN	PROJECT ACCOUNTS (EAP)
	a) Opening balance of the funds	10,58,39,509.23	64,64,28,200.21		95,91,56,825.31
	b) Additions to the Funds (Primary)				
	Project Receipts	-	1,83,60,37,861.58		53,56,45,308.11
	Plan (General,Salary & Capital)	2,47,64,00,000.00	-	2,42,88,63,000.00	
	IPIRTI (General, Salary & Capital) From MOEF	4,61,25,000.00	-		
	Interest earned during the year	-	-		2,72,84,211.00
	TOTAL.....	2,52,25,25,000.00	1,83,60,37,861.58	2,42,88,63,000.00	56,29,29,519.11
	C) Additions to the Funds (Alloted/Secondry)		-		
	Plan (General, Salary & Capital)	2,47,64,00,000.00	-	2,42,88,63,000.00	
		-	-		
	Pension Cell ICFRE	-	-		
	Grant PHS	-	-		
	Excess Expense Incurred	-	-	3,26,809.07	
	funds	-	-	9,10,874.00	18,22,589.00
	TOTAL.....	2,47,64,00,000.00	-	2,43,01,00,683.07	18,22,589.00
	TOTAL(a+b+c)	5,10,47,64,509.23	2,48,24,66,061.79	4,85,89,63,683.07	1,52,39,08,933.42
	d) Utilisation/Expenditure towards objectives of funds		-		
	i) Capital Expenditure		-		
	Others	6,55,08,865.11	-	1,00,38,398.40	
	TOTAL.....	6,55,08,865.11	-	1,00,38,398.40	-
	ii) Revenue Expenditure				
	Salaries, Wages and allowances etc.	1,89,58,94,621.58	-	1,92,36,00,630.00	
	Transferred To Pension Cell ICFRE	18,25,86,000.00	-		
	PHS Expenditure	-	-		
	Other Administrative expenses	39,60,60,086.56	-	38,77,27,686.88	
	Project Payments	-	1,56,19,43,990.44		69,46,27,542.69
	TOTAL.....	2,47,45,40,708.14	1,56,19,43,990.44	2,31,13,28,316.88	69,46,27,542.69
	e) Grant Refund & Transfer		-		
	Interest Transfer	-	-	3,56,457.56	85,99,740.00
	Grant Laps	1,03,167.00	-	6,305.00	20,531.00
	Transfer to Reserve & Surplus	-	-		8,41,77,583.16
	Grant Refunded to Funding Agency	-	3,47,14,103.88		
	Grant Refunded to OTHER Units/Centre	5,71,316.00	5,92,98,285.39	8,87,661.00	5,14,54,941.14
	Grant Trf to Pension cell	-	-		
	Grant Refunded to ICFRE	-	99,64,069.18		
	Fund Transfer	-	-		
		-	-		
	f) Disbursement of Primary Grant to Units	-	-		
	Project Payments	-	-		3,86,00,395.22
	General, Salary & Capital	2,47,64,00,000.00	-	2,42,88,63,000.00	
	To Plan (GC-Capital)	-	-		
	Plan (GC-Salary)	-	-		
	TOTAL(d+e+f)	5,01,71,24,056.25	1,66,59,20,448.89	4,75,14,90,138.84	87,74,80,733.21
	NET BALANCE AS AT THE YEAR END(a+b+c-d-e-f)	8,76,40,452.98	81,65,45,612.90	10,74,83,544.23	64,64,28,200.21

PARMITA AND COMPANY * Chartered Accountants * Dehradun

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION

P.O. New Forest, Dehradun

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH, 2023

Schedule 4A	CURRENT LIABILITIES AND PROVISIONS	CURRENT YEAR 31.03.2023		PREVIOUS YEAR	31.03.2022
		RS	RS	RS	RS
	A.CURRENT LIABILITIES				
1	Sundry Creditors:				
	a) For Goods & Services (Trfd from IPIRTI)	1,67,741.00			
	b) Others	1,77,33,969.49	1,79,01,710.49	2,77,32,578.49	2,77,32,578.49
2	Advances Received	3,33,61,837.78	3,33,61,837.78		
3	Other Current Liabilities				
	a) Security & EMD Account	3,62,40,678.52	3,62,40,678.52	2,97,72,336.52	2,97,72,336.52
	b) Amount Payable to Controller, Pension Cell, ICFRE				
	Pensioh Medical Claim Payable	14,557.00		14,557.00	
	New Pension Scheme		14,557.00	-	14,557.00
	c) Amount Payable to PAO (F), NEW DELHI				
	Any Other Recovery	4,09,374.00	4,09,374.00	4,09,374.00	4,09,374.00
	e) Amount Payable to Others				
	FA/TA Payable	3,82,523.00		3,02,873.00	
	GST Payable	4,26,782.00		4,26,782.00	
	Interest Payable to MOEF	1,669.00		1,669.00	
	Salary Payable Account	14,01,90,694.00		9,87,46,783.00	
	Other Expenses Payable				
	Other Deduction (Staff)	7,90,076.00	14,17,91,744.00	7,90,076.00	
	Non Technical				10,02,68,183.00
	TOTAL(A)		22,97,19,901.79		15,81,97,029.01
Schedule 4B	**B.PROVISIONS**				
	TOTAL(B)				
	TOTAL(A+B)		22,97,19,901.79		15,81,97,029.01

PARMITA AND COMPANY Dehradun Chartered Accountants

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION

P.O. New Forest, Dehradun

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH, 2023

SCHEDULE 5 -FIXED ASSETS											
	GROSS BLOCK					DEPRICIATION				NET BLOCK	
DESCRIPTION	Cost valuation As at beginning of the year	Addition during the year before 30.09.2022	Addition during the year after 30.09.2022	Cost/valuation at the year-end	Rate of depreci-ation	As at the beginning of the year	During the year(op +addition) before 30.09.2022(full dep)	Addition during the year after 30.09.2022	Total up to the Year-end	As at the Current year-end	As at the previous year-end
	RS.	RS.	RS.	RS.	RS.	RS.	RS.	RS.	RS.	RS.	RS.
A. Fixed Assets:	0						-				
1.LAND:							-				
a)Freehold	1,08,84,921.00		2,24,228.00	1,11,09,149.00	0%		-	-	-	1,11,09,149.00	1,08,84,921.00
b)Leasehold			-	-	0%		-	-	-	-	
			-	-			-			-	
2.BUILDINGS			-	-			-			-	
a)On Freehold Land	1,27,18,64,560.00	96,440.00	8,17,42,478.54	1,35,37,03,478.54	10%	59,36,58,930.25	6,78,30,206.98	40,87,123.93	66,55,76,261.15	68,81,27,217.39	67,82,05,629.75
b)On Leasehold Land			-	-			-			-	
			-	-			-			-	
3.PLANT MACHINERY & EQUIPMENT			-	-			-			-	
a) Scientific Equipment	39,86,77,018.99	26,41,387.00	2,14,07,634.27	42,27,26,040.26	15%	22,34,97,227.85	2,66,73,176.72	16,05,572.57	25,17,75,977.14	17,09,50,063.12	17,51,79,791.14
b) I.T.Equipment	13,96,25,220.80	9,30,306.00	20,33,592.62	14,25,89,119.42	40%	11,27,73,578.95	1,11,12,779.14	4,06,718.52	12,42,93,076.61	1,82,96,042.81	2,68,51,641.85
			-	-			-			-	
4.VEHICLES	1,58,73,110.00		5,32,911.02	1,64,06,021.02	15%	1,01,04,852.45	8,65,238.63	39,968.33	1,10,10,059.41	53,95,961.61	57,68,257.55
			-	-			-			-	
5.FURNITURE,FIXTURES	3,10,77,083.00	3,29,630.00	9,68,142.22	3,23,74,855.22	10%	1,50,73,826.55	16,33,288.65	48,407.11	1,67,55,522.31	1,56,19,332.91	1,60,03,256.45
			-	-			-			-	
6.OFFICE EQUIPMENT	11,86,85,766.72	4,83,254.66	20,16,157.57	12,11,85,178.95	15%	7,90,20,689.43	60,22,249.79	1,51,211.82	8,51,94,151.04	3,59,91,027.91	3,96,65,077.30
			-	-			-			-	
7.ELECTRIC INSTALLATIONS	22,03,690.00		13,81,699.85	35,85,389.85	15%	16,83,675.05	78,002.24	1,03,627.49	18,65,304.78	17,20,085.07	5,20,014.95
			-	-			-			-	
8.LIBRARY BOOKS	9,00,56,218.00	67,532.00	4,99,729.41	9,06,23,479.41	40%	8,27,14,392.28	29,63,743.09	99,945.88	8,57,78,081.25	48,45,398.16	73,41,825.72
			-	-			-			-	
9.TUBEWELLS & W.SUPPLY	9,23,616.00			9,23,616.00	0%	-	-	-	-	9,23,616.00	9,23,616.00
				-			-			-	
10.MUSEUM	79,24,238.00			79,24,238.00	10%	12,87,010.12	6,63,722.79	-	19,50,732.91	59,73,505.09	66,37,227.89
				-			-			-	
11.TOOLS & EQUIPMENTS	37,98,950.00	21,181.00	3,55,10,157.89	3,93,30,288.89	15%	27,12,037.93	1,66,213.96	26,63,261.84	55,41,513.73	3,37,88,775.16	10,86,912.07
			-	-			-			-	
12. KITCHEN EQUIPMENTS	-		32,400.56	32,400.56	15%	-	-	2,430.04	2,430.04	29,970.52	-
			-	-			-			-	
13. NON EXPENDABLE EQUIPMENT (UNDP)	-		14,97,109.13	14,97,109.13	15%	-	-	1,12,283.18	1,12,283.18	13,84,825.95	-
			-	-			-			-	
14. NON EXPENDABLE EQUIPMENT (IC\	-		75,365.11	75,365.11	15%	-	-	5,652.38	5,652.38	69,712.73	-
			-	-			-			-	
TOTAL OF CURRENT YEAR	2,09,15,94,392.51	45,69,730.66	14,79,21,606.19	2,24,40,85,729.36		1,12,25,26,220.86	11,80,08,621.99	93,26,203.10	1,24,98,61,045.94	99,42,24,683.42	96,90,68,171.67
PREVIOUS YEAR											
B.CAPITAL WORK-IN-PROGRESS	4,46,023.00										
TOTAL	2,09,20,40,415.51	45,69,730.66	14,79,21,606.19	2,24,40,85,729.36		1,12,25,26,220.86	11,80,08,621.99	93,26,203.10	1,24,98,61,045.94	99,42,24,683.42	96,90,68,171.67

(Note to be given as to cost of assets on hire purchase basis included above)

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INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION

P.O. New Forest, Dehradun

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH, 2023

Schedule 6	INVESTMENTS FROM EARMARKED/ENDOWMENT FUNDS	CURRENT YEAR 31.03.2023	PREVIOUS YEAR 31.03.2022
		RS	RS
	1. In Government Securities	-	
	> F.D.R.(For One Time Special Grant)	17,47,70,000.00	16,76,98,000.00
	> F.D.R.(With Institutes)	-	
	2. Other Approved Securities	-	
	3. Shares	-	
	4. Debentures and Bonds	-	
	5. Subsidiaries and Joint Ventures	-	
	6. Others(to be specified)	-	
	7. Transferred from IPIRTI	-	
	1. Corpus Fund(Fixed Deposits)	46,13,01,000.00	
	2. Statutory Deposits with various Govt	5,33,093.27	
	TOTAL	63,66,04,093.27	16,76,98,000.00

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INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION

P.O. New Forest, Dehradun

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH, 2023

Schedule 7A	CURRENT ASSETS,LOANS, ADVANCES ETC.	CURRENT YEAR RS	31.03.2023 RS	PREVIOUS YEAR 31.03.2022 RS	RS
	A.CURRENT ASSETS:	-			
1	INVENTORIES:	-			
	> Stores and Spares	1,51,310.00		1,51,310.00	
	> Postage, Stamps & Stationery in Hand	1,40,220.00		1,40,220.00	
	> Raw Materials	-	2,91,530.00		2,91,530.00
2	Others	14,12,524.00	14,12,524.00		
		-			
3	Sundry Debtors:	-			
	> Debts Outstanding for a period exceeding	-			
	> Others	-	-		
		-			
	Cash balances in hand(including	-			
4	cheques/drafts and imprest)				
	> Cash (Plan General)	4,350.00		60.00	
	> Cash (EMD)	-		1,48,000.00	
	> Cash (EAP)1	1,00,248.00		94,870.00	
	> Cash (EAP)2	-		11,077.00	
	> Cash (Revenue A/c)	45,383.00		1,08,809.00	3,62,816.00
	>Cash (Others)	15,150.00	1,65,131.00		
		-			
	Trfd from IPIRTI - Cash	5,688.00	5,688.00		
		-			
5	Bank Balances:	-			
	a)With Scheduled Banks:	-			
	> On Savings Bank Accounts	-			
	Bank EAP	60,31,50,659.68		49,43,14,183.77	
	Bank AIRCP	7,57,92,315.81		6,17,94,597.83	
	Bank EAP II	1,62,29,035.46		2,09,57,680.34	
	Bank EAP III	-		5,17,789.19	
	Bank EAP Campa	-		54,82,073.60	
	Bank EAP Other	-		2,400.50	
	Bank EMD	1,88,63,673.20		1,81,05,071.52	
	Bank Plan Capital	1,22,478.53		1,14,966.35	
	Bank Plan 2	26,02,271.12		25,07,507.12	
	Bank Plan Capital II	0.70		0.70	
	Bank Plan General	14,78,257.95		14,00,489.74	
	Bank Plan Salary	15,71,88,424.32		14,04,24,225.91	
	Bank Income Tax	993.00		1,000.00	
	UBI FRI	1,000.00		1,000.00	
	Bank FRI Deemed University	92,218.00		1,04,400.00	
	Bank Service charges	38,36,921.92		68,52,369.82	
	Bank Student Service Charges	4,47,259.00		3,25,359.00	
	Bank-Chair of Excellance	6,98,559.73		6,90,491.73	
	Bank Testing Account	4,84,749.00		29,94,593.00	
	Bank FCRA	17,383.00			
	Bank Pension Account	3,89,390.60		18,63,586.00	
	Cheq in Hand	-		6,21,603.00	
	Bank Recruitment	4,50,186.84			
	Bank TDS & GST	98,049.23			
	Bank FRS	62,453.00			
	Bank PhD	1,30,330.00			
	Bank Revenue Account	65,82,094.44		2,31,62,917.27	
	Bank RBI Account	65,069.00			
	Bank IPIRTI	3,57,91,486.65			
	Bank Guest House Service Charges	27,707.37			
	FDR	35,00,000.00	92,81,02,967.55		78,22,38,306.39
		-			
	> On Current Accounts	-			
	ICFRE Recruitment Fund	54,69,243.00	54,69,243.00	17,26,348.00	17,26,348.00
		-			
	TOTAL (A)		93,54,47,083.55		78,46,19,000.39

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INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION

P.O. New Forest, Dehradun

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH,2023

Schedule 7B	(A) CURRENT ASSETS,LOANS,ADVANCES ETC.	CURRENT YEAR 31.03.2023	RS	PREVIOUS YEAR 31.03.2022	RS
	B.LOANS,ADVANCES AND OTHER ASSETS				
1	**Loans:**				
	a) Staff Advance	70,087.00		4,32,608.50	
	Etc. (Please Specify)	3,25,10,446.84	3,25,80,533.84	3,07,29,455.45	3,11,62,063.95
	Loan & Others	3,21,57,636.30	3,21,57,636.30		
	b)Other Entities engaged in activities/objectives similar to that of the Entity				
	c)Other(Specify)				
	Grant Receivable	17,89,838.07		21,16,170.07	
	Chair Of Excellance		17,89,838.07		21,16,170.07
2	**Advances and other amounts recoverable in cash or in kind or for value to be received:**				
	a)On Capital Account				
	CCU -(Plan Account)	11,48,000.00		11,48,000.00	
	SCIENTIFIC EQUIPMENTS		11,48,000.00		11,48,000.00
	b)Prepayments				
	Advance for Construction of Wall	14,97,200.00	14,97,200.00	14,97,200.00	14,97,200.00
3	**Income Accrued:**				
	a)On Investments fromEarmarked/Endowments Funds				
	b)On Investments-Others				
	c)On Loans and Advances				
	Loan EAP	2,26,361.00		1,361.00	
	Advance for Building Maintenance	61,07,887.00		61,07,887.00	
	Other Receivable	1,94,06,087.24		1,18,98,588.24	
	Advance for Other Maintenance	21,08,369.00	2,78,48,704.24		1,80,07,836.24
	d)Others (includes income due unrealized - Rs.....)				
4	**Claims Receivable**				
	TDS EAP	1,29,923.00	1,29,923.00	31,929.00	31,929.00
5	**Transferred From IPIRTI**				
	1. Inventories				
	Store & Spairs	1,10,835.00			
	2. Sundry Debtors				
	a) Debts o/s for a period exceeding more than 6 months	52,36,435.00			
6	**GST Cash Ledger**	1,99,185.00	55,46,455.00		
	TOTAL(B)		10,26,98,290.45		5,39,63,199.26

PARMITA AND COMPANY Dehradun Chartered Accountants

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION

P.O. New Forest, Dehradun

SCHEDULES FORMING PART OF INCOME EXPENDITURE ACCOUNT FOR THE YEAR ENDING 31ST MARCH 2023

Schedule #	INCOME FROM SALES/SERVICES	CURRENT YEAR 31.03.2023		PREVIOUS YEAR 31.03.2022
		RS	RS	RS
A	**SUPPLY OF GOODS**			
1	Sale of Product	1,34,515.00		77,100.00
2	Sale of Publication	3,64,022.00		1,07,479.00
3	Sale of Museum Ticket & Gate Pass	1,22,87,689.00		25,55,459.00
4	Sale of Scraps	-		8,30,956.00
5	Sale of Tender Documents	2,36,925.05		4,32,728.00
6	Sale of Timber	45,30,876.00		8,67,200.00
7	Sale of Unservicable Stores	9,76,096.00		49,04,649.40
8	Sale of Plants & Timber	1,43,29,522.20		48,79,314.00
9	Sale of Grass	-		3,600.00
10	Sale of Fire Wood	-	3,28,59,645.25	6,500.00
		-		-
B	**SUPPLY OF SERVICE**	-		-
1	Conference Hall	2,20,030.19		65,587.00
2	Forfieted of Security Money	98,495.00		86,185.00
3	Forfieted of Bank Guarantee	83,88,632.00		-
4	Income Earned from EAP	-		13,26,411.00
5	Licence Agreement Fees	-		3,62,080.00
6	Institutional Charges	1,29,11,165.00		2,59,02,711.00
7	Other Income	11,87,447.00		45,48,942.55
8	Mandap Fees	43,76,329.14		28,79,619.08
9	Professional /Consultancy Services	56,37,826.00		62,45,435.00
10	Rent Received (staff other than ICFRI)	38,375.00		30,375.00
11	Photocopy Charges	1,450.00		-
13	Testing Fees	25,29,385.00		52,89,120.00
14	Unutilized Fund & Balance of Projects	99,04,002.24		2,47,50,818.89
15	Application & Other Fees for Recruitment	74,74,345.00		91,250.00
16	Application Fees	4,64,500.00		-
17	Charges for Issuance of Identity cards	-		1,890.00
18	Dessartarion Charges	2,32,000.00		12,00,000.00
19	Electricity & Water Charges	7,02,608.00		37,28,254.00
20	Telephone Exp	24,426.00		-
21	Internship Fees & Overdue Charges	-		10,958.00
22	Guest House Rent	40,69,819.89		29,16,287.00
23	House Licence Fees	2,29,35,574.48		2,22,12,930.67
24	Maintenance Services(Equipment/Property)	13,000.00		9,95,546.10
25	Lab Charges & Library Charges	1,99,000.00		2,48,000.00
26	Bid Fee	23,600.00		-
27	Accrediation Fee	8,50,000.00		-
28	House Rent Allowance	2,94,304.00		-
29	Internship Fee & Overdue Charges	43,851.00		-
30	Rent	2,87,677.00		-
31	Library Charges	9,000.00		84,611.00
32	Private Use of Govt. Vehicles	8,014.00		20,681.00
33	Other Fees	8,49,131.00		2,02,000.00
34	Staff Bus Fare	3,40,727.00		2,10,914.00
35	Penalty Charges	42,478.00		14,858.00
36	Photography Charges	-		1,194.00
37	Received from FRI Deemed University	2,49,200.00		2,52,000.00
38	Receipts from PHD Students	1,73,000.00		1,10,000.00
39	Registration Fees & Penal Interest	10,89,374.34		1,04,558.00
40	Miscelllaneous Income	1,64,990.00		-
41	Sale of Waste Wood/Timber/Fire Wood/Bamboo	1,62,575.00		-
42	Charges for issuance of Identity Cards	400.00		-
43	Other Income (if any please specify) Penalty	37.00		-
44	Sale of Publication /old news paper	1,605.00		-
45	Interest on HBA	33,559.00		-
46	Interest on FA	3,340.00		-
47	Private use of Government Vehicles	12,651.00		-
48	Sale of News papers/Over due charges of Lib.	123.00		-
49	Vendor Pass	4,250.00		-
50	Penal Instt. On FA/TA	3,408.00		-
51	Other sources	13,938.00		-
52	Interest on Loan to Employee	3,19,949.00		-
53	Course fees	16,000.00		-
54	Library Fees	75,000.00		-
55	Laboratory Fees	41,000.00		-
56	Mess usage charge	1,09,660.00		-
57	Library & Miscellenous Charges	56,57,770.00		-
58	Right to Information	710.00		330.00
59	Room Service Charges	-		85,000.00
60	Room Rent Income	15,900.00		9,500.00
61	Security & Caution Money	-		66,000.00
62	Service Charges- Revenue	55,70,285.30		8,56,734.00
63	Student Service Charges	60,000.00		1,35,500.00
64	Service Charges	19,48,139.81		82,150.00
65	Training Fees	25,16,613.00	10,24,00,669.39	4,80,586.00
	TOTAL		13,52,60,314.64	12,02,74,001.69

PARMITA AND COMPANY Dehradun Chartered Accountants

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION

P.O. New Forest, Dehradun

SCHEDULES FORMING PART OF INCOME EXPENDITURE ACCOUNT FOR THE YEAR ENDING 31ST MARCH 2023

Schedule 9	GRANTS/SUBSIDIES		CURRENT YEAR 31.03.2023 RS	PREVIOUS YEAR 31.03.2022 RS
A	**SECONDARY GRANTS**			
1	**E.A.P.**			
	Opening of Unutilized Grant	64,64,28,200.21		
	Add: Grant Received during the year	1,83,60,37,861.58		
	Less: Interest Transferred to funding agency	55,770.41		
	Less Grant Transfer to Other Unuts	1,82,35,447.39		
	Less: Grant Transferred to ICFRE	1,24,86,871.01		
	Less: Grant Refund to funding agency	3,50,82,831.64		
	Less: Transfer to Other Units	3,81,15,538.00		
	Less: Unutilized Grant	81,65,45,612.90	1,56,19,43,990.44	73,32,27,937.91
B	**PRIMARY GRANTS**			
1	**PLAN**			
	Opening of Unutilized Grant	10,58,39,509.23		
	Add: Grant Alloted during the year	2,47,64,00,000.00		
	Add: Grant Alloted during the year-IPIRTI	4,61,25,000.00		
	Less: Transferred to Other Units/Centre	5,71,316.00		
	Less: Grant Lapsed	1,03,167.00		
	Less: Unutilized Grant	8,76,40,452.98	2,54,00,49,573.25	2,32,13,66,715.28
C	**OTHERS**			
1	**PHS**			
	Opening of Unutilized Grants	17,12,646.00		
	Add: Grant Alloted during the year	1,71,70,000.00		
	Add: Medical Advance received	4,95,057.00		
	Less: Unspent Balance	2,38,279.60	1,91,39,423.40	
2	**Chair of Excellence**			
	Opening of Unutilized Grants	16,77,83,318.73		
	Add: Grant Alloted during the year	4,00,000.00		
	Less: Unspent Balance	16,79,59,259.73	2,24,059.00	
3	**DPR - Swarnrekha & Damodar**			
	Opening of Unutilized Grants	-		
	Add: Grant Alloted during the year	40,00,000.00		
	Less: Unspent Balance	73,913.00	39,26,087.00	
4	**Forest Fire Project Fund**			
	Opening of Unutilized Grants	-		
	Add: Grant Alloted during the year	75,000.00		
	Less: Unspent Balance	(51,519.66)	1,26,519.66	
	TOTAL		4,12,54,09,652.75	3,05,45,94,653.19

PARMITA AND COMPANY Dehradun Chartered Accountants

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION

P.O. New Forest, Dehradun

SCHEDULES FORMING PART OF INCOME EXPENDITURE ACCOUNT FOR THE YEAR ENDING 31ST MARCH 2023

Schedule 10A	INCOME FROM INVESTMENT	CURRENT YEAR 31.03.2023	PREVIOUS YEAR 31.03.2022
		RS	RS
	With Scheduled Banks	72,95,704.00	76,91,781.00
	Total...	72,95,704.00	76,91,781.00

Schedule 10B	INTEREST EARNED	CURRENT YEAR 31.03.2023	PREVIOUS YEAR 31.03.2022
		RS	RS
1	On Saving Accounts:	-	
	With Scheduled Banks	2,79,56,393.57	2,35,46,454.03
		-	
2	On Loans:	-	
	Employees/Staff	26,400.00	1,25,211.00
		-	
3	Interest on Debtors and Other Receivables	1,10,876.00	
	TOTAL	2,80,93,669.57	2,36,71,665.03

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION

P.O. New Forest, Dehradun

SCHEDULES FORMING PART OF INCOME EXPENDITURE ACCOUNT FOR THE YEAR ENDING 31ST MARCH, 2023

Schedule 11	OTHER INCOME /PRIOR PERIOD ITEMS		CURRENT YEAR 31.03.2023	PREVIOUS YEAR 31.03.2022
			RS	RS
1	Grant Chair of Excellance	-		5,78,015.00
2	Other Income	-		
3	Interest on TDS of FY 20-21	3,19,155.00	3,19,155.00	
	TOTAL			5,78,015.00

Schedule 12A	ESTABLISHMENT EXPENSES		CURRENT YEAR 31.03.2023	PREVIOUS YEAR 31.03.2022
			RS	RS
1	**Expenses Salary Grant**			
	Estblishment Expenses - Research			
	Salary & Allowances	1,14,74,68,574.58		1,03,26,67,207.90
	Medical	1,54,57,543.00		1,71,93,143.00
	10% Pension of ICFRE Employees	3,37,45,664.00		3,46,07,081.00
	> Honorarium	42,600.00		55,000.00
	> LTC	1,00,86,200.00		25,84,668.00
	> Children Education Allowance	6,48,000.00		4,58,368.00
	> LSPC	8,91,616.00		10,54,003.00
	> RBI	-		7,44,58,841.00
	> New Pension Scheme	3,15,91,863.00	1,23,99,32,060.58	2,13,94,204.00
2	**Estblishment Expenses - Non-Research**			
	Salary & Allowances	38,03,40,403.00		37,32,67,882.00
	Medical	1,21,54,211.00		1,10,87,857.00
	10% Pension of ICFRE Employees	1,18,62,324.00		66,66,179.00
	> Honorarium	6,000.00		18,000.00
	> LTC	27,77,425.00		9,13,559.00
	> Children Education Allowance	5,12,550.00		4,59,000.00
	> LSPC	-		2,55,60,894.00
	> RBI	-		33,80,150.00
	> New Pension Scheme	1,16,06,954.00	41,92,59,867.00	
3	Other (specify) Shairing cost			
	> Expenses on K.V.S.	9,65,12,000.00	9,65,12,000.00	8,62,13,483.00
4	Bank Charges			820.10
5	Contribution to Pension Cell	18,25,86,000.00	18,25,86,000.00	20,72,07,000.00
	TOTAL		1,93,82,89,927.58	1,89,92,47,340.00
	Less: Prior Period Expenses		-	7,39,96,656.00
	Add: Salary Payable As on 31.3.23		14,01,90,694.00	9,83,49,946.00
	TOTAL		2,07,84,80,621.58	1,92,36,00,630.00

PARMIA AND COMPANY Dehradun Chartered Accountants

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION

P.O. New Forest, Dehradun

SCHEDULES FORMING PART OF INCOME EXPENDITURE ACCOUNT FOR THE YEAR ENDING 31ST MARCH, 2023

Schedule 12B	ADMINISTRATIVE EXPENSES		CURRENT YEAR 31.03.2023 RS	PREVIOUS YEAR 31.03.2022 RS
	Expenses General Grant			
1	**Infrastructure**			
	Rent & Taxes	2,55,62,887.00		20,86,787.00
	Electricity & Water Charges	5,15,08,402.32		4,30,09,399.00
	Vehicles Running Expenses (Fuel)	34,20,266.00		40,90,606.00
	Insurance	9,12,788.00		10,50,966.00
	TDS under GST	16,454.00		(1,774.00)
	Others	-	8,14,20,797.32	20,11,770.00
2	**Repairs/Maintenance of Infrastructure of Assets**			
	Roads/Buildings (Minor Works)	6,30,73,224.64		3,30,11,775.00
	Plant & Machinery (Scientific Equipment)	8,10,597.00		4,91,822.00
	Furniture & Fixtures	1,74,346.00		1,52,483.00
	Vehicles (Repair)	21,46,621.00		27,41,059.00
	Office/IT Equipment	74,04,021.00		1,03,91,835.00
	Transfer and rehabilitation of Mohali wiid Testing Centre at FRI	9,22,388.00		
	RBI	-	7,45,31,197.64	3,59,253.00
3	**Communication**			
	Postage & Telephone	34,45,053.49		30,34,543.72
	RBI	-	34,45,053.49	34,574.00
4	**Others**			
	Newspapers & Periodicals	37,52,963.00		39,26,775.00
	Stationery	21,22,659.00		21,11,871.00
	Travel Expenses -- Domestic-Non-Research (T.E.)	85,48,780.00		49,82,261.00
	Legal & Professional Charges	31,80,560.00		10,74,670.00
	Auditor's Remuneration	4,52,738.00		2,35,935.00
	Hospitality Expenses	1,47,165.00		1,08,635.00
	Medicines & Medical Consumables	30,70,712.00		25,97,842.00
	Liveries	80,000.00		4,73,314.00
	Contingency	18,21,61,728.11		19,30,70,739.32
	Direct Recruitment	92,015.00		
	MSME	26,010.00		
	Caution Money return	-		10,000.00
	RBI	-	20,36,35,330.11	46,39,361.00
5	**Research Expenses**			
	Travel & Conveyance -- Domestic-Research (T.E.)	41,45,975.00		71,62,458.00
	Other Consumables (M&S)	32,34,762.00		80,10,201.00
	Other Research Expenditure (FRE)	97,99,491.00		1,80,06,540.84
	Fellowship/ Scholarship/ Cash Award	1,14,29,218.00		2,75,87,953.00
	Maint. of Equipment	12,53,640.00		25,92,343.00
	RBI	-		15,23,894.00
	Others (RAG/RPC Meetings)	6,36,498.00	3,04,99,584.00	9,68,501.00
6	**Extension**			
	> Normal	3,64,426.00		15,96,804.00
	> VVK	34,438.00		12,17,587.00
	Advertisement & Publicity	7,95,917.00		7,79,523.00
	RBI	-		30,915.00
	Printing & Publication	10,69,338.00	22,64,119.00	22,23,395.00
7	**Education Expenses**			
	Seminar/ Conferences	1,29,377.00		10,52,234.00
	Human Resource Development	3,580.00		
	ICFRE Awards	1,29,340.00		2,20,636.00
	Subsidies given to Inst./Sci Socities/Other Organisations	-	2,62,297.00	7,42,000.00
		-		
8	**Bank Charges**	1,708.00	1,708.00	1,416.00
	TOTAL		39,60,60,086.56	38,94,12,902.88
	Less: Prior Period Expenses			36,44,334.00
	Add: Expenses Payable As on 31.3.23			19,59,118.00
	TOTAL		39,60,60,086.56	38,77,27,686.88

PARMITA AND COMPANY Dehradun Chartered Accountants

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION

P.O. New Forest, Dehradun

SCHEDULES FORMING PART OF INCOME EXPENDITURE ACCOUNT FOR THE YEAR ENDING 31ST MARCH, 2023

Schedule 12C	EXPENSES ON CAPITAL GOODS		CURRENT YEAR 31.03.2023 RS	PREVIOUS YEAR 31.03.2022 RS
	Purchase Scientific Equipment	37,48,532.83		38,68,440.00
	Purchase Office Equipment	22,79,394.66		10,00,610.00
	Purchase IT Equipment	28,76,938.62		42,99,585.40
	Purchase Furniture	3,44,630.00		5,42,410.00
	Tools	18,25,967.00		-
	Books & Journal	3,36,962.00		3,25,782.00
	Building	5,40,96,440.00	6,55,08,865.11	-
	TOTAL		6,55,08,865.11	1,00,36,827.40
	Less: Prior Period Expenses			
	Add: Expenses Payable As on 31.3.23			1,571.00
	TOTAL		6,55,08,865.11	1,00,38,398.40

Schedule 12D	UTILIZED GRANT & OTHERS OF PLAN		CURRENT YEAR 31.03.2023 RS	PREVIOUS YEAR 31.03.2022 RS
	Unspent Grant For Next Year	8,76,40,452.98		
	Add: Grant Lapsed	1,03,167.00		
	Add: Transferred to Other Units/Centre	5,71,316.00		
		8,83,14,935.98		
	Less: Opening Balance of Grant	10,58,39,509.23	(1,75,24,573.25)	10,74,96,284.72
	TOTAL		(1,75,24,573.25)	10,74,96,284.72

PARMITA AND COMPANY Dehradun Chartered Accountants

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION

P.O. New Forest, Dehradun

SCHEDULES FORMING PART OF INCOME EXPENDITURE ACCOUNT FOR THE YEAR ENDING 31ST MARCH, 2023

Schedule 13	EXPENDITURE ON GRANTS (EXTERNALLY AIDID PROJECT)	CURRENT YEAR 31.03.2023 RS	PREVIOUS YEAR 31.03.2022 RS
1	**Grants given to Institutions/Organisations**	-	
		-	
		-	
2	**Expenditure of External Aided Project**		
	Capital Expenditure- EAP	9,20,91,941.81	16,43,00,283.66
	Revenue Expenditure -EAP	1,46,98,52,048.63	56,81,67,418.25
	Other Expenses	-	7,60,236.00
	TOTAL	1,56,19,43,990.44	73,32,27,937.91

Schedule 14	OTHER EXPENSES	CURRENT YEAR 31.03.2023 RS	PREVIOUS YEAR 31.03.2022 RS
1	Expenses on Services	56,06,909.09	15,08,114.95
2	Other expenses	3,00,427.00	
3	Expenses Deemed University	1,31,784.00	2,10,213.00
4	Other Expenses- RANCHI	342.02	
5	Bank Charges	10,272.71	51,804.36
6	Contribution PHS Scheme	1,00,00,000.00	1,00,00,000.00
7	Contribution to Pension Cell	18,96,16,982.62	9,90,02,128.52
8	Revenue trf to to MOEF- AO ICFRE DDO	1,04,466.00	
9	Expenses on PHS-ICFRI HQ Pension	94,866.00	9,374.00
10	Expenses on Maint. Of Rest House- SHIMLA	5,65,267.00	
11	Interest Transfer to HO (MOEF)	1,51,37,891.00	1,18,36,304.00
12	Bank Interest transferred to D/FRI- PRAYAGRAJ	13,474.00	
13	Interest Transferred to Funding Agency (EAP)	-	31,741.00
14	Expenses on Testing Charges	6,76,502.00	32,221.00
15	Refund of Testing Charges	-	23,600.00
16	Recruitment Expenses	14,60,569.87	10,34,861.58
17	Interest Transfer to Funding Agency	30,40,181.77	1,11,39,054.87
18	Interest sent to Strenthening CAMPA in **FRI Main Project**	14,96,864.00	
19	Interest Transfer to ICFRE	26,86,456.00	
20	Remitting amt. of bank int. - DEHRADUN PROJECT	7,327.00	
21	Interest Transfer to EAP	-	6,81,792.00
22	Medical Claim ICFREPHS	1,90,44,557.40	
23	Other Expenses	-	27,97,706.00
24	Expenses -Student Service Account	-	1,260.00
25	Expenses on Chair of Excellance Fund	2,24,059.00	6,40,053.00
26	Expenses DPR - Swarnrekha & Damodar -RANCHI	39,26,087.00	
27	Expenses Forest Fire Project Fund -RANCHI	1,26,519.66	
		-	
	TOTAL	25,42,71,805.14	13,90,00,228.28

PARMITA AND COMPANY Dehradun Chartered Accountants

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION

P.O. New Forest, Dehradun

CONSOLIDATED RECEIPT AND PAYMENT ACCOUNT FOR THE F.Y. 2022-23

RECEIPTS	AMOUNT RS.	T.AMOUNT RS.	PAYMENTS	AMOUNT RS.	T.AMOUNT RS.
Opening Balances					
Cash in hand	3,80,049.00		FDR Made During the Year		17,47,70,000.00
Savings Account	77,80,99,470.39				
Current Account	17,26,348.00		**Payment Under EAP**		
Deposits Account	35,00,000.00		a) Fixed Assets Purchased -EAP	9,00,38,598.81	
Cheque in hand	6,21,603.00		b) Revenue Expenditure -EAP	1,47,12,19,317.13	
Banks left to be considered in Preceeding Previous year			c) Other Expenses EAP	-	
	68,71,000.41	79,11,98,470.80			
			d) Payment to MOEF	1,42,49,778.00	
Maturity of Fixed Deposits			e) Fund Transfer to Funding Agency EAP		
		16,76,98,000.00		10,36,61,927.45	
			f) Interest Transfer to Funding Agency EAP		1,68,55,09,820.16
				63,40,198.77	
Receipts of Grant Money					
PLAN	2,52,25,25,000.00				
EAP	1,83,60,37,861.58		**Payment Under Plan**		
Others Funds	2,14,45,000.00	4,38,00,07,861.58	a) Establishment Expenses	1,85,40,70,354.58	
			b) Administrative Expenses	40,47,21,603.56	
Transferred from IPIRTI			c) Capital Expenses	6,55,08,865.11	
Savings Account	3,03,67,690.65		d) Interst Transferred to MOEF	9,92,579.00	
Deposits Account	46,13,01,000.00	49,16,68,690.65	e) Interest Transfer to Funding Agency	9,24,323.00	
			f) Other exp	1,51,57,173.05	
Receipts of Interest			g) Grant Lapsed	1,03,167.00	
Interest received on Plan Grant & Revenue Account	25,79,973.34		h) Transfer to Pension Cell		
				18,25,86,000.00	2,52,40,64,065.30
Interest on FDR (OTSG)	72,95,704.00				
Interest received on EAP Grant	2,44,09,927.03				
Interest Received Income Tax Department	3,19,155.00		**Other Payments**		
Forfeiture of Bank Guarantee	83,88,632.00		EMD Payment	61,33,833.00	
Interest Received- Other Account- EMD etc	10,35,269.00		Loan Refund (Plan)	2,58,08,369.00	
Interest Received on Loan to Staff	4,57,670.00	4,44,86,330.37	Loan Refund (EAP)	49,19,679.80	
			Other Payment & Advances	24,75,70,802.08	28,44,32,683.88
Receipts from Sale & Services					
Supply of Goods	1,73,33,446.55				
Supply of Services	10,66,90,554.36	12,40,24,000.91	**Closing Balances**		
			Cash in hand	1,70,819.00	
Other Receipts			Cash in hand & at Bank	92,45,97,286.65	
FCRA Receipts	22,72,635.00		Current Account	54,69,243.00	
EMD Receipts	1,06,46,615.00		Deposits Account	46,48,01,000.00	1,39,50,38,348.65
Loan Received (Plan)	2,58,49,422.00				
Loan Received (EAP)	22,18,515.50				
Other Recoveries & Advance	2,37,44,376.18	6,47,31,563.68			
TOTAL		**6,06,38,14,917.99**	**TOTAL**		**6,06,38,14,917.99**

SH. BHARAT JYOTI (DIRECTOR GENERAL, ICFRE)

SH. VINAY KUMAR (DEPUTY DIRECTOR GENERAL, ADMIN, ICFRE)

SH. SUSHANT KUMAR (ASISTANT DIRECTOR GENERAL, ADMIN, ICFRE)

SH. BRIJESH KUMAR SHARMA (SECTION OFFICER, BUDGET SECTION ICFRE)

"AS PER OUR SEPARATE REPORT OF EVEN ANNEXED"
FOR M/S PARMITA & COMPANY,
CHARTERED ACCOUNTANTS

(CA PARMITA BHATT)
Prop., M. NO. 078018, FRN 0008751C
DATED:25.10.2023
PLACE: DEHRADUN

CENTRAL GOVERNMENT EMPLOYEE PENSION ACCOUNT

ICFRE, P.O NEW FOREST

DEHRADUN

BALANCE SHEET AS AT 31st MARCH, 2023

CORPUS/CAPITAL FUND AND LIABILITIES	SCHEDULE	CURRENT YEAR 31.03.2023		PREVIOUS YEAR 31.03.2022
		Rs.	Rs.	Rs.
CENTRAL GOVERNMENT PENSION ACCOUNT	1	10,20,64,729.00		-
UNSECURED LOANS AND BORROWINGS				
Loan From General Pension Fund Account	2	1,61,20,68,148.80	1,71,41,32,877.80	1,15,68,22,488.80
TOTAL			1,71,41,32,877.80	1,15,68,22,488.80

ASSETS	SCHEDULE	CURRENT YEAR AS ON 31.03.2023		PREVIOUS YEAR 31.03.2022
		Rs.	Rs.	Rs.
CURRENT ASSETS & LOANS & ADVANCES				
(a) Current Assets				
> CASH & BANK BALANCES & FDR	3	10,20,64,729.00		
> Amount Receivable from Central Government	4	1,61,20,68,148.80	1,71,41,32,877.80	1,15,68,22,488.80
TOTAL			1,71,41,32,877.80	1,15,68,22,488.80

FOR M/S PARMITA & COMPANY,
CHARTERED ACCOUNTANTS

PARMITA AND COMPANY Dehradun Chartered Accountants

(CA PARMITA BHATT)
PROP., M. NO. 078018, FRN 0008751C

DATED:25.10.2023
PLACE: DEHRADUN

Under Secretary Pension Cell, ICFRE

Under Secretary
Pension Cell
ICFRE, Dehradun

CENTRAL GOVERNMENT EMPLOYEE PENSION ACCOUNT

ICFRE, P.O NEW FOREST

DEHRADUN

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31st MARCH, 2023

INCOME	SCHEDULE	CURRENT YEAR 31.03.2023	PREVIOUS YEAR 31.03.2022
		Rs.	R.s
INTEREST EARNED	4	2,01,527.00	1,53,369.00
TOTAL (A)		2,01,527.00	1,53,369.00

EXPENDITURE	SCHEDULE	CURRENT YEAR 31.03.2023	PREVIOUS YEAR 31.03.2022
		Rs.	R.s
OTHER EXPENSES		-	-
TOTAL(B)			-
EXCESS OF INCOME OVER EXPENDITURE TFD		2,01,527.00	1,53,369.00

FOR M/S PARMITA & COMPANY,
CHARTERED ACCOUNTANTS

Under Secretary Pension Cell, ICFRE

(CA PARMITA BHATT)
PROP., M. NO. 078018, FRN 0008751C

DATED:25.10.2023
PLACE: DEHRADUN

CENTRAL GOVERNMENT EMPLOYEE PENSION ACCOUNT

ICFRE, P.O NEW FOREST
DEHRADUN

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31st MARCH, 2023

Schedule 1	CENTRAL GOVERNMENT PENSION ACCOUNT	CURRENT YEAR 31.03.2023		PREVIOUS YEAR 31.03.2022	
		RS.	RS.	RS.	RS.
	Opening Balance	-		-	
	Add: Excess of Income and Expenditure Account	2,01,527.00		1,53,369.00	
	Add: Pension Contribution -Employer	18,25,86,494.00		20,72,07,000.00	
	Add: Recovery of Excess Pension paid	3,87,759.00		2,61,057.00	
	Add: Loan taken from General Pension Cell	45,52,45,660.00		29,38,35,488.80	
	Add: Amount Received from Central	-		1,37,330.20	
			63,84,21,440.00		50,15,94,245.00
	Less: Application of Fund				
	Less: Pension paid to Pensioners	39,62,71,778.00		38,43,74,603.00	
	Less: Commutation of Pension	5,86,65,881.00		5,70,20,895.00	
	Less: Gratuity	8,14,19,052.00	53,63,56,711.00	6,01,98,747.00	50,15,94,245.00
	BALANCE AS AT THE YEAR - END		10,20,64,729.00		-

Schedule 2	UNSECURED LOANS AND BORROWINGS	CURRENT YEAR 31.03.2023		PREVIOUS YEAR 31.03.2022	
		RS.	RS.	RS.	RS.
	Loan From General Pension Cell ICFRE	1,61,20,68,148.80	1,61,20,68,148.80	1,15,68,22,488.80	1,15,68,22,488.80
	TOTAL		1,61,20,68,148.80		1,15,68,22,488.80

Schedule 3	CASH & BANK BALANCES & FDR	CURRENT YEAR 31.03.2023		PREVIOUS YEAR 31.03.2022	
		RS.	RS.	RS.	RS.
1	Bank A/c no-822	9,80,14,729.00		-	-
2	Cheque in transit	40,50,000.00	10,20,64,729.00		
	TOTAL		10,20,64,729.00		-

Schedule 4	AMOUNT RECEIVABLE	CURRENT YEAR 31.03.2023		PREVIOUS YEAR 31.03.2022	
		RS.	RS.	RS.	RS.
	Amount Receivable from Central Government	1,61,20,68,148.80	1,61,20,68,148.80	1,15,68,22,488.80	1,15,68,22,488.80
	TOTAL		1,61,20,68,148.80		1,15,68,22,488.80

SCHEDULES FORMING PART OF INCOME EXPENDITURE ACCOUNT FOR THE YEAR ENDING 31st MARCH, 2023

Schedule 5	INTEREST EARNED ETC.	CURRENT YEAR 31.03.2023		PREVIOUS YEAR 31.03.2022	
		RS.	RS.	RS.	RS.
	On Term Deposits: With Scheduled Banks			-	
	On Savings Accounts: With Scheduled Banks	2,01,527.00	2,01,527.00	1,53,369.00	1,53,369.00
	TOTAL		2,01,527.00		1,53,369.00

PRAMOD AND COMPANY Dehradun Chartered Accountants

PENSION FUND ACCOUNT(PRIOR TO NPS)

ICFRE, P.O NEW FOREST
DEHRADUN

BALANCE SHEET AS AT 31st MARCH, 2023

CORPUS/CAPITAL FUND AND LIABILITIES	SCHEDULE	CURRENT YEAR 31.03.2023		PREVIOUS YEAR 31.03.2022
		Rs.	Rs.	Rs.
PENSION FUND ACCOUNT	1		1,72,93,91,477.83	1,64,40,24,709.21
TOTAL			1,72,93,91,477.83	1,64,40,24,709.21

ASSETS	SCHEDULE	CURRENT YEAR AS ON 31.03.2023		PREVIOUS YEAR 31.03.2022
		Rs.	Rs.	Rs.
INVESTMENTS	2		6,35,00,000.00	40,00,00,000.00
CURRENT ASSETS & LOANS & ADVANCES				
(a) Current Assets				
> CASH & BANK BALANCES & FDR	3	5,38,23,329.03		8,72,02,220.41
(b)Loans & Advances				
> LOANS, ADVANCES ETC	4	1,61,20,68,148.80	1,66,58,91,477.83	1,15,68,22,488.80
TOTAL			1,72,93,91,477.83	1,64,40,24,709.21

FOR M/S PARMITA & COMPANY,
CHARTERED ACCOUNTANTS

PARMITA AND COMPANY Dehradun Chartered Accountants

(CA PARMITA BHATT)
PROP., M. NO. 078018, FRN 0008751C

DATED:25.10.2023
PLACE: DEHRADUN

Under Secretary Pension Cell, ICFRE

Under Secretary
Pension Cell
ICFRE. Dehradun

PENSION FUND ACCOUNT(PRIOR TO NPS)

ICFRE, P.O NEW FOREST
DEHRADUN

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31st MARCH, 2023

INCOME	SCHEDULE	CURRENT YEAR 31.03.2023	PREVIOUS YEAR 31.03.2022
		Rs.	R.s
INTEREST EARNED	4	14,99,207.00	3,94,21,150.00
TOTAL (A)		14,99,207.00	3,94,21,150.00

EXPENDITURE	SCHEDULE	CURRENT YEAR 31.03.2023	PREVIOUS YEAR 31.03.2022
		Rs.	R.s
OTHER EXPENSES		-	-
TOTAL(B)		-	-
EXCESS OF INCOME OVER EXPENDITURE TFD		14,99,207.00	3,94,21,150.00

FOR M/S PARMITA & COMPANY,
CHARTERED ACCOUNTANTS

PARMITA & COMPANY Dehradun Chartered Accountants

(CA PARMITA BHATT)
PROP., M. NO. 078018, FRN 0008751C

DATED:25.10.2023
PLACE: DEHRADUN

Under Secretary Pension Cell, ICFRE

PENSION FUND ACCOUNT(PRIOR TO NPS)

ICFRE, P.O NEW FOREST
DEHRADUN

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31st MARCH, 2023

Schedule 1	NATIONAL PENSION SCHEME FUND ACCOUNT	CURRENT YEAR 31.03.2023		PREVIOUS YEAR 31.03.2022	
		RS.	RS.	RS.	RS.
	Opening Balance	1,64,40,24,709.21		1,61,26,78,753.69	
	Add: Excess of Income and Expenditure Account	14,99,207.00		3,94,21,150.00	
	Add: Contribution from Employer	18,96,16,982.62		9,90,02,128.52	
	Add: Recovery from Pensioner	5,000.00		2,26,146.00	
	Add: Contribution from Employee	5,24,20,278.00		4,93,72,818.00	
	Add: Recovery of excess payment		1,88,75,66,176.83		1,80,07,00,996.21
	Less: Disbursement of Pension	8,19,32,053.00		7,00,35,666.00	
	Less: Commutation of Pension	4,75,32,235.00		1,47,53,139.00	
	Less: Contribution towards GPF Cell			3,60,72,608.00	
	Less: Gratuity paid during the year	2,87,10,411.00	15,81,74,699.00	3,58,14,874.00	15,66,76,287.00
	BALANCE AS AT THE YEAR - END		1,72,93,91,477.83		1,64,40,24,709.21

Schedule 2	INVESTMENT	CURRENT YEAR 31.03.2023		PREVIOUS YEAR 31.03.2022	
		RS.	RS.	RS.	RS.
	Investment with LIC				
	Opening Balance	40,00,00,000.00		40,00,00,000.00	40,00,00,000.00
	Less: Matured	33,65,00,000.00	6,35,00,000.00		
	TOTAL		6,35,00,000.00		40,00,00,000.00

Schedule 3	CASH & BANK BALANCES & FDR	CURRENT YEAR 31.03.2023		PREVIOUS YEAR 31.03.2022	
		RS.	RS.	RS.	RS.
	FDR			-	
	Bank A/c no-3660	5,38,23,329.03	5,38,23,329.03	8,72,02,220.41	8,72,02,220.41
	TOTAL		5,38,23,329.03		8,72,02,220.41

Schedule 3	LOANS AND ADVANCES	CURRENT YEAR 31.03.2023		PREVIOUS YEAR 31.03.2022	
		RS.	RS.	RS.	RS.
	B. LOANS & ADVANCES				
	Loan to Central Government, Pension A/C, ICFRE	1,61,20,68,148.80	1,61,20,68,148.80	1,15,68,22,488.80	1,15,68,22,488.80
	TOTAL		1,61,20,68,148.80		1,15,68,22,488.80

SCHEDULES FORMING PART OF INCOME EXPENDITURE ACCOUNT FOR THE YEAR ENDING 31st MARCH, 2023

Schedule 5	INTEREST EARNED ETC.	CURRENT YEAR 31.03.2023		PREVIOUS YEAR 31.03.2022	
		RS.	RS.	RS.	RS.
	On Term Deposits:				
	With Scheduled Banks			3,63,04,267.00	
	On Savings Accounts:				
	With Scheduled Banks	14,99,207.00	14,99,207.00	31,16,883.00	3,94,21,150.00
	TOTAL		14,99,207.00		3,94,21,150.00

NATIONAL PENSION SCHEME (NPS)

ICFRE, P.O NEW FOREST
DEHRADUN

BALANCE SHEET AS AT 31st MARCH, 2023

CORPUS/CAPITAL FUND AND LIABILITIES	SCHEDULE	CURRENT YEAR 31.03.2023		PREVIOUS YEAR 31.03.2022
		Rs.	Rs.	R.s
NATIONAL PENSION SCHEME FUND ACCOUNT	1		90,06,612.00	77,01,684.00
TOTAL			90,06,612.00	77,01,684.00

ASSETS	SCHEDULE	CURRENT YEAR AS ON 31.03.2023		PREVIOUS YEAR 31.03.2022
		Rs.	Rs.	Rs.
CURRENT ASSETS & LOANS & ADVANCES (a) Current Assets > CASH & BANK BALANCES & FDR > LOANS, ADVANCES ETC	2	90,06,612.00 -	90,06,612.00	77,01,684.00
TOTAL			90,06,612.00	77,01,684.00

FOR M/S PARMITA & COMPANY,
CHARTERED ACCOUNTANTS

Under Secretary Pension Cell, ICFRE

Under Secretary
Pension Cell
ICFRE, Dehradun

(CA PARMITA BHATT)
PROP., M. NO. 078018, FRN 0008751C

DATED:25.10.2023
PLACE: DEHRADUN

NATIONAL PENSION SCHEME (NPS)

ICFRE, P.O NEW FOREST
DEHRADUN

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31st MARCH, 2023

INCOME	SCHEDULE	CURRENT YEAR 31.03.2023	PREVIOUS YEAR 31.03.2022
		Rs.	R.s
INTEREST EARNED	3	3,96,494.00	4,45,911.00
TOTAL (A)		3,96,494.00	4,45,911.00

EXPENDITURE	SCHEDULE	CURRENT YEAR 31.03.2023	PREVIOUS YEAR 31.03.2022
		Rs.	R.s
OTHER EXPENSES		1,003.00	-
TOTAL(B)		1,003.00	-
EXCESS OF INCOME OVER EXPENDITURE TFD		3,95,491.00	4,45,911.00

FOR M/S PARMITA & COMPANY,
CHARTERED ACCOUNTANTS

PARMITA AND COMPANY Dehradun Chartered Accountants

(CA PARMITA BHATT)
PROP., M. NO. 078018, FRN 0008751C

DATED:25.10.2023
PLACE: DEHRADUN

Under Secretary Pension Cell, ICFRE

NATIONAL PENSION SCHEME (NPS)

ICFRE, P.O NEW FOREST

DEHRADUN

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31st MARCH, 2023

Schedule 1	NATIONAL PENSION SCHEME FUND ACCOUNT	CURRENT YEAR 31.03.2023		PREVIOUS YEAR 31.03.2022	
		RS.	RS.	RS.	RS.
	Opening Balance	77,01,684.00		82,97,720.00	
	Add: Excess of Income and Expenditure Account	3,95,491.00		4,45,911.00	
	Add: Contribution from Employer	6,91,78,024.00		4,78,42,027.00	
	Add: Contribution from Employee	4,94,12,874.00		3,41,64,635.00	
		12,66,88,073.00		9,07,50,293.00	
	Less : NPS Premium paid to NSDL	11,59,78,344.00		8,30,48,609.00	77,01,684.00
	Less: Refund to FRCBR	2,30,710.00			
	Less: Refund to AO FRI	1,12,125.00			
	Refund of GPF	13,58,603.00			
	Refund of GSLIS	1,679.00	90,06,612.00		
	BALANCE AS AT THE YEAR - END		90,06,612.00		77,01,684.00

Schedule 2	CASH & BANK BALANCES & FDR	CURRENT YEAR 31.03.2023		PREVIOUS YEAR 31.03.2022	
		RS.	RS.	RS.	RS.
	Cash in Hand	-		-	
	FDR	75,00,000.00		60,00,000.00	
	Bank Account No-84994	15,06,612.00	90,06,612.00	17,01,684.00	77,01,684.00
	TOTAL (A)		90,06,612.00		77,01,684.00

SCHEDULES FORMING PART OF INCOME EXPENDITURE ACCOUNT FOR THE YEAR ENDING 31st MARCH, 2023

Schedule 3	INTEREST EARNED ETC.	CURRENT YEAR 31.03.2023		PREVIOUS YEAR 31.03.2022	
		RS.	RS.	RS.	RS.
	On Term Deposits:				
	With Scheduled Banks			-	
	On Savings Accounts:				
	With Scheduled Banks	3,96,494.00	3,96,494.00	4,45,911.00	4,45,911.00
	TOTAL		3,96,494.00		4,45,911.00

General Provident Fund Cum Pension Scheme (GPF)

ICFRE, P.O NEW FOREST
DEHRADUN

BALANCE SHEET AS AT 31st MARCH, 2023

CORPUS/CAPITAL FUND AND LIABILITIES	SCHEDULE	CURRENT YEAR 31.03.2023		PREVIOUS YEAR 31.03.2022
		Rs.	Rs.	Rs.
EMPLOYEES PROVIDENT FUND ACCOUNT	1		97,40,43,465.40	96,66,16,658.89
CURRENT LIABILITIES AND PROVISIONS				
(A) CURRENT LIABILITY :	2	-		
(B) PROVISIONS :		-	-	
TOTAL			97,40,43,465.40	96,66,16,658.89

ASSETS	SCHEDULE	CURRENT YEAR AS ON 31.03.2023		PREVIOUS YEAR 31.03.2022
		Rs.	Rs.	Rs.
INVESTMENTS	3		50,82,62,367.07	25,37,11,472.22
CURRENT ASSETS & LOANS & ADVANCES				
(a) Current Assets				
> CASH & BANK BALANCES & FDR	4	44,52,50,932.33		70,80,93,797.67
(b) Loans & Advances				
> LOANS, ADVANCES ETC	5	2,05,30,166.00	46,57,81,098.33	48,11,389.00
TOTAL			97,40,43,465.40	96,66,16,658.89

FOR M/S PARMITA & COMPANY,
CHARTERED ACCOUNTANTS

PARMITA AND COMPANY Dehradun

(CA PARMITA BHATT)
PROP., M. NO. 078018, FRN 0008751C

DATED:25.10.2023
PLACE: DEHRADUN

Under Secretary Pension Cell, ICFRE

Under Secretary
Pension Cell
ICFRE Dehradun

General Provident Fund Cum Pension Scheme (GPF)

ICFRE, P.O NEW FOREST

DEHRADUN

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31st MARCH, 2023

INCOME	SCHEDULE	CURRENT YEAR 31.03.2023	PREVIOUS YEAR 31.03.2022
		Rs.	R.s
INTEREST EARNED	6	5,11,26,871.51	6,71,25,505.00
TOTAL (A)		5,11,26,871.51	6,71,25,505.00

EXPENDITURE	SCHEDULE	CURRENT YEAR 31.03.2023	PREVIOUS YEAR 31.03.2022
		Rs.	R.s
OTHER EXPENSES			
TOTAL(B)		-	-
EXCESS OF INCOME OVER EXPENDITURE TFD		5,11,26,871.51	6,71,25,505.00

FOR M/S PARMITA & COMPANY,
CHARTERED ACCOUNTANTS

PARMITA AND COMPANY Dehradun Chartered Accountants

(CA PARMITA BHATT)
PROP., M. NO. 078018, FRN 0008751C

DATED:25.10.2023
PLACE: DEHRADUN

Under Secretary Pension Cell, ICFRE

General Provident Fund Cum Pension Scheme (GPF)

ICFRE, P.O NEW FOREST
DEHRADUN

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31st MARCH, 2023

Schedule 1	RESERVE AND SURPLUS	CURRENT YEAR 31.03.2023		PREVIOUS YEAR 31.03.2022	
		RS.	RS.	RS.	RS.
	Opening Balance	96,66,16,658.89		89,05,59,813.89	
	Add: Excess of Income and Expenditure Account	5,11,26,871.51		6,71,25,505.00	
	Add: Contribution from Employees	16,35,41,730.00		20,44,71,650.00	
		1,18,12,85,260.40		1,16,21,56,968.89	
	Less : Refund of GPF Advance Receovered			34,80,200.00	
	Less: Non Refundable Advance to Employees	9,95,22,000.00		9,30,42,248.00	
	Less: Permanent Withdrawal by Retired Employees	10,77,19,795.00	97,40,43,465.40	9,90,12,862.00	96,66,16,658.89
	BALANCE AS AT THE YEAR - END		97,40,43,465.40		96,66,16,658.89

Schedule 2	CURRENT LIABILITIES AND PROVISIONS	CURRENT YEAR 31.03.2023		PREVIOUS YEAR 31.03.2022	
		RS.	RS.	RS.	RS.
	A. Current Liabilities B. Provisions				
	TOTAL (A+B)		-		-

Schedule 3	INVESTMENTS	CURRENT YEAR 31.03.2023		PREVIOUS YEAR 31.03.2022	
		RS.	RS.	RS.	RS.
	Investment in Bonds & Securities	50,82,62,367.07	50,82,62,367.07	25,37,11,472.22	25,37,11,472.22
	TOTAL (A)		50,82,62,367.07		25,37,11,472.22

Schedule 4	CASH & BANK BALANCES & FDR	CURRENT YEAR 31.03.2023		PREVIOUS YEAR 31.03.2022	
		RS.	RS.	RS.	RS.
	FDRs	38,71,85,483.00			
	Flexi FDRs	-		70,69,74,110.00	
	HDFC Bank	4,95,00,000.00			
	Bank A/c No. - 3941	85,65,449.33	44,52,50,932.33	11,19,687.67	70,80,93,797.67
	TOTAL (A)		44,52,50,932.33		70,80,93,797.67

Schedule 5	CURRENT ASSETS & LOANS & ADVANCES	CURRENT YEAR 31.03.2023		PREVIOUS YEAR 31.03.2022	
		RS.	RS.	RS.	RS.
	B. LOANS AND ADVANCES Refundable Advance to Employee				
	Opening Balance	48,11,389.00			
	Add: Additions during the year	1,57,18,777.00	2,05,30,166.00	48,11,389.00	48,11,389.00
	TOTAL (A)		2,05,30,166.00		48,11,389.00

SCHEDULES FORMING PART OF INCOME EXPENDITURE ACCOUNT FOR THE YEAR ENDING 31st MARCH, 2023

Schedule 6	INTEREST EARNED ETC.	CURRENT YEAR 31.03.2023		PREVIOUS YEAR 31.03.2022	
		RS.	RS.	RS.	RS.
	On Term Deposits: With Scheduled Banks	4,12,28,759.51		5,82,82,752.00	
	On Savings Accounts: With Scheduled Banks	98,98,112.00	5,11,26,871.51	88,42,753.00	6,71,25,505.00
	TOTAL		5,11,26,871.51		6,71,25,505.00

PARMITA AND COMPANY Dehradun Chartered Accountants

GROUP SAVINGS LINKED INSURANCE SCHEME (GSLIS)

ICFRE, P.O NEW FOREST
DEHRADUN

BALANCE SHEET AS AT 31st MARCH, 2023

CORPUS/CAPITAL FUND AND LIABILITIES	SCHEDULE	CURRENT YEAR 31.03.2023		PREVIOUS YEAR 31.03.2022
		Rs.	Rs.	
RESERVE AND SURPLUS	1		13,59,130.11	12,66,847.11
CURRENT LIABILITIES AND PROVISIONS				
(A) CURRENT LIABILITY :	2	4,04,664.00		3,81,710.00
(B) PROVISIONS :		-	4,04,664.00	
TOTAL			17,63,794.11	16,48,557.11

ASSETS	SCHEDULE	CURRENT YEAR AS ON 31.03.2023		PREVIOUS YEAR 31.03.2022
		Rs.	Rs.	
CURRENT ASSETS & LOANS & ADVANCES			-	
(a) Current Assets				
> CASH & BANK BALANCES & FDR	3	17,63,794.11		16,48,557.11
(b) Loans & Advances				
> LOANS, ADVANCES ETC			17,63,794.11	
TOTAL			17,63,794.11	16,48,557.11

FOR M/S PARMITA & COMPANY,
CHARTERED ACCOUNTANTS

PARMITA AND COMPANY Dehradun Chartered Accountants

(CA PARMITA BHATT)
PROP., M. NO. 078018, FRN 0008751C

DATED:25.10.2023
PLACE: DEHRADUN

Under Secretary Pension Cell, ICFRE

Under Secretary
Pension Cell
ICFRE, Dehradun

GROUP SAVINGS LINKED INSURANCE SCHEME (GSLIS)

ICFRE, P.O NEW FOREST
DEHRADUN

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31st MARCH, 2023

INCOME	SCHEDULE	CURRENT YEAR 31.03.2023	PREVIOUS YEAR 31.03.2022
		Rs.	R.s
INTEREST EARNED	4	71,022.00	54,410.00
TOTAL (A)		71,022.00	54,410.00

EXPENDITURE	SCHEDULE	CURRENT YEAR 31.03.2023	PREVIOUS YEAR 31.03.2022
		Rs.	R.s
OTHER EXPENSES		-	-
TOTAL(B)		-	-
EXCESS OF INCOME OVER EXPENDITURE TFD		71,022.00	54,410.00

FOR M/S PARMITA & COMPANY,
CHARTERED ACCOUNTANTS

Under Secretary Pension Cell, ICFRE

(CA PARMITA BHATT)
PROP., M. NO. 078018, FRN 0008751C

DATED:25.10.2023
PLACE: DEHRADUN

GROUP SAVINGS LINKED INSURANCE SCHEME (GSLIS)

ICFRE, P.O NEW FOREST
DEHRADUN

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31st MARCH, 2023

Schedule 1	RESERVE AND SURPLUS	CURRENT YEAR 31.03.2023		PREVIOUS YEAR 31.03.2022	
		RS.	RS.	RS.	RS.
	Opening Balance	12,66,847.11		12,23,006.11	
	Add: Excess of Income and Expenditure Account	71,022.00		54,410.00	
	Add: Contribution from Employees	34,39,770.00		13,68,032.00	
		47,77,639.11		26,45,448.11	
	Less : Premium Paid to LIC	13,75,418.00		13,78,601.00	12,66,847.11
	Less : Refund of Pension & NPS	20,43,091.00	13,59,130.11		
	BALANCE AS AT THE YEAR - END		13,59,130.11		12,66,847.11

Schedule 2	CURRENT LIABILITIES AND PROVISIONS	CURRENT YEAR 31.03.2023		PREVIOUS YEAR 31.03.2022	
		RS.	RS.	RS.	RS.
1	**A. Current Liabilities**				
	GSLIS Claim Payable Account				
	Opening Balance	3,81,710.00		4,14,021.00	
	Add: Claim received during the year from LIC	46,21,800.00		42,87,671.00	
		50,03,510.00		47,01,692.00	
	Less: Claim Paid to Retired Employee	41,86,223.00		29,29,710.00	
	Less: Claim Paid for deceased Employee	4,12,623.00	4,04,664.00	13,90,272.00	3,81,710.00
	TOTAL		4,04,664.00		3,81,710.00

Schedule 3	CASH & BANK BALANCES & FDR	CURRENT YEAR 31.03.2023		PREVIOUS YEAR 31.03.2022	
		RS.	RS.	RS.	RS.
	Cash in Hand	-		-	
	Bank A/c No. - 3498	17,63,794.11	17,63,794.11	16,48,557.11	16,48,557.11
	TOTAL		17,63,794.11		16,48,557.11

SCHEDULES FORMING PART OF INCOME EXPENDITURE ACCOUNT FOR THE YEAR ENDING 31st MARCH, 2023

Schedule 4	INTEREST EARNED ETC.	CURRENT YEAR 31.03.2023		PREVIOUS YEAR 31.03.2022	
		RS.	RS.	RS.	RS.
	On Term Deposits:				
	With Scheduled Banks			-	
	On Savings Accounts:				
	With Scheduled Banks	71,022.00	71,022.00	54,410.00	54,410.00
	TOTAL		71,022.00		54,410.00

PARMITA AND COMPANY Dehradun Chartered Accountants

ICFRE PENSIONER HEALTH SCHEME (PHS)

ICFRE, P.O NEW FOREST
DEHRADUN

BALANCE SHEET AS AT 31ST MARCH, 2023

CORPUS/CAPITAL FUND AND LIABILITIES	SCHEDULE	CURRENT YEAR 31.03.2023		PREVIOUS YEAR 31.03.2022
		Rs.	Rs.	Rs.
PENSIONER HEALTH SCHEME FUND ACCOUNT	1	3,54,32,969.59	3,54,32,969.59	3,78,40,209.59
TOTAL			3,54,32,969.59	3,78,40,209.59

ASSETS	SCHEDULE	CURRENT YEAR 31.03.2023		PREVIOUS YEAR 31.03.2022
		Rs.	Rs.	Rs.
CURRENT ASSETS & LOANS & ADVANCES > CASH & BANK BALANCES & FDR > LOANS, ADVANCES ETC.	2	3,54,32,969.59 -	3,54,32,969.59	3,78,40,209.59
TOTAL			3,54,32,969.59	3,78,40,209.59

FOR M/S PARMITA & COMPANY,
CHARTERED ACCOUNTANTS

Under Secretary Pension Health Scheme, ICFRE

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भा.वा.अ.एवं शि. परिषद
देहरादून

(CA PARMITA BHATT)
PROP., M. NO. 078018, FRN 0008751C

DATED:25.10.2023

ICFRE PENSIONER HEALTH SCHEME (PHS)

ICFRE, P.O NEW FOREST
DEHRADUN

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31st MARCH, 2023

INCOME	SCHEDULE	CURRENT YEAR 31.03.2023	PREVIOUS YEAR 31.03.2022
		Rs.	Rs.
INTEREST EARNED	3	28,72,360.00	23,07,816.00
TOTAL (A)		28,72,360.00	23,07,816.00

EXPENDITURE	SCHEDULE	CURRENT YEAR 31.03.2023	PREVIOUS YEAR 31.03.2022
		Rs.	Rs.
OTHER EXPENSES		-	-
TOTAL(B)		-	-
EXCESS OF INCOME OVER EXPENDITURE TFD TO FUND ACCOUNT	(A+B)	28,72,360.00	23,07,816.00

FOR M/S PARMITA & COMPANY,
CHARTERED ACCOUNTANTS

PARMITA AND COMPANY Dehradun Chartered Accountants

(CA PARMITA BHATT)
PROP., M. NO. 078018, FRN 0008751C

DATED:25.10.2023
PLACE: DEHRADUN

Under Secretary Pension Health Scheme, ICFRE

ICFRE PENSIONER HEALTH SCHEME (PHS)

ICFRE, P.O NEW FOREST
DEHRADUN

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31st MARCH, 2023

Schedule 1	CENTRAL GOVERNMENT PENSION ACCOUNT	CURRENT YEAR 31.03.2023		PREVIOUS YEAR 31.03.2022	
		Rs.	Rs.	Rs.	Rs.
	Opening Balance	3,78,40,209.59		3,95,55,593.59	
	Add: Excess of Income and Expenditure Account	28,72,360.00		23,07,816.00	
	Add: Contribution from Pensioner	33,90,400.00		36,76,800.00	
	Add: Transfer from DG ICFRE Revenue Account	1,00,00,000.00		1,00,00,000.00	
		5,41,02,969.59		5,55,40,209.59	
	Less : Expenses under Health Scheme	1,86,70,000.00	3,54,32,969.59	1,77,00,000.00	3,78,40,209.59
	BALANCE AS AT THE YEAR - END		3,54,32,969.59		3,78,40,209.59

Schedule 2	CASH & BANK BALANCES & FDR	CURRENT YEAR 31.03.2023		PREVIOUS YEAR 31.03.2022	
		Rs.	Rs.	Rs.	Rs.
	Cash In Hand	-		-	
	FDR	3,48,46,846.00		3,69,99,000.00	
	Bank A/c no-87440	5,86,123.59	3,54,32,969.59	8,41,209.59	3,78,40,209.59
	TOTAL		3,54,32,969.59		3,78,40,209.59

SCHEDULES FORMING PART OF INCOME EXPENDITURE ACCOUNT FOR THE YEAR ENDING 31st MARCH, 2023

Schedule 3	INTEREST EARNED ETC.	CURRENT YEAR 31.03.2023		PREVIOUS YEAR 31.03.2022	
		Rs.	Rs.	Rs.	Rs.
1	On Term Deposits: With Scheduled Banks	27,71,752.00	27,71,752.00	21,63,481.00	21,63,481.00
2	On Savings Accounts: With Scheduled Banks	1,00,608.00	1,00,608.00	1,44,335.00	1,44,335.00
	TOTAL		28,72,360.00		23,07,816.00

PARMITA AND COMPANY Dehradun Chartered Accountants

ACCOUNT SECTION ICFRE

(A Unit of Indian Council of Forestry Research and Education)
Dehradun

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2023

INCOME	SCHEDULE	CURRENT YEAR 31.03.2023	PREVIOUS YEAR 31.03.2022
		Rs.	R.s
SUPPLY OF GOODS/SERVICES	8	3,21,32,536.00	2,95,47,647.62
GRANT RECEIVED	9	1,18,47,77,180.67	35,95,08,002.11
INTEREST EARNED	10	1,22,88,145.64	84,858.00
OTHER INCOME	11	-	-
TOTAL (A)		1,22,91,97,862.31	38,91,40,507.73

EXPENDITURE	SCHEDULE	CURRENT YEAR 31.03.2023	PREVIOUS YEAR 31.03.2022
		Rs.	R.s
EXPENDITURE ON GRANTS (PLAN)			
Establishment Expenses	12A	15,47,69,383.00	15,18,92,183.10
Other Administrative Expenses, etc	12B	4,92,74,030.49	4,96,41,008.06
Capital Expenses	12C	2,42,231.00	16,14,726.00
EXPENDITURE ON GRANTS (EAP)	13	98,04,91,536.18	15,63,60,084.95
OTHER EXPENSES	14	1,42,99,257.00	1,18,32,611.60
DEPRECIATION ON FIXED ASSETS	5	-	-
TOTAL(B)		1,19,90,76,437.67	37,13,40,613.71
EXCESS OF INCOME OVER EXPENDITURE (A-B)		3,01,21,424.64	1,77,99,894.02

(Head of the Institute)

(Drawing & Disbursement Officer)
ACCOUNT SECTION ICFRE
DEHRADUN

FOR M/S PARMITA & COMPANY,
CHARTERED ACCOUNTANTS

(CA PARMITA BHATT)
PROP.; M. NO. 078018, FRN 0008751C

DATED:25.10.2023
PLACE: DEHRADUN

VAN VIGYAN BHAWAN

(A Unit of Indian Council of Forestry Research and Education)
New Delhi

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2023

INCOME	SCHEDULE	CURRENT YEAR 31.03.2023	PREVIOUS YEAR 31.03.2022
		Rs.	R.s
SUPPLY OF GOODS/SERVICES	8	38,87,594.00	21,62,200.10
GRANT RECEIVED	9	19,97,225.89	19,96,477.07
INTEREST EARNED	10	1,61,180.00	3,20,473.00
OTHER INCOME	11	-	-
TOTAL (A)		60,45,999.89	44,79,150.17

EXPENDITURE	SCHEDULE	CURRENT YEAR 31.03.2023	PREVIOUS YEAR 31.03.2022
		Rs.	R.s
EXPENDITURE ON GRANTS (PLAN)			
Establishment Expenses	12A	-	-
Other Administrative Expenses, etc	12B	16,89,225.89	16,56,161.07
Capital Expenses	12C	1,08,000.00	3,40,316.00
EXPENDITURE ON GRANTS (EAP)	13	2,00,000.00	-
OTHER EXPENSES	14	10,04,437.61	5,39,533.63
DEPRECIATION ON FIXED ASSETS	5	-	-
TOTAL(B)		30,01,663.50	25,36,010.70
EXCESS OF INCOME OVER EXPENDITURE (A-B)		30,44,336.39	19,43,139.47

(Head of the Institute)
Resident Director
Van Vigyan Bhawan (ICFRE)
Sector-V, R. K. Puram
New Delhi-110022

(Drawing & Disbursement Officer)
VAN VIGYAN BHAWAN
NEW DELHI
D.D.O.
Van Vigyan Bhawan
Sector-5, R. K. Puram
New Delhi-110022

FOR M/S PARMITA & COMPANY,
CHARTERED ACCOUNTANTS

PARMITA MID CO... Dehradun

(CA PARMITA BHATT)
PROP.; M. NO. 078018, FRN 0008751C

DATED:25.10.2023
PLACE: DEHRADUN

FOREST RESEARCH INSTITUTE (PLAN)

(A Unit of Indian Council of Forestry Research and Education)
Dehradun

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2023

INCOME	SCHEDULE	CURRENT YEAR 31.03.2023	PREVIOUS YEAR 31.03.2022
		Rs.	R.s
SUPPLY OF GOODS/SERVICES	8	3,07,57,703.14	2,18,46,086.08
GRANT RECEIVED	9	80,35,34,903.00	69,30,76,799.00
INTEREST EARNED	10	4,77,278.00	3,16,978.00
OTHER INCOME	11	-	-
TOTAL (A)		83,47,69,884.14	71,52,39,863.08

EXPENDITURE	SCHEDULE	CURRENT YEAR 31.03.2023	PREVIOUS YEAR 31.03.2022
		Rs.	R.s
EXPENDITURE ON GRANTS (PLAN)			
Establishment Expenses	12A	56,13,90,495.00	53,18,11,118.00
Other Administrative Expenses, etc	12B	17,88,68,081.00	15,92,45,681.00
Capital Expenses	12C	4,62,71,505.00	20,20,000.00
EXPENDITURE ON GRANTS (EAP)	13	-	-
OTHER EXPENSES	14	1,72,80,783.00	
DEPRECIATION ON FIXED ASSETS	5	-	-
TOTAL(B)		80,38,10,864.00	69,30,76,799.00
EXCESS OF INCOME OVER EXPENDITURE (A-B)		3,09,59,020.14	2,21,63,064.08

16/4/23

(Head of the Institute)
वन अनुसंधान संस्थान
देहरादून

(Drawing & Disbursement Officer)
FOREST RESEARCH INSTITUTE (PLAN)
DEHRADUN

FOR M/S PARMITA & COMPANY,
CHARTERED ACCOUNTANTS

PARMITA AND COMPANY Dehradun Chartered Accountants

(CA PARMITA BHATT)
PROP., M. NO. 078018, FRN 0008751C

DATED:25.10.2023
PLACE: DEHRADUN

FOREST RESEARCH INSTITUTE(PROJECT SECTION)

(A Unit of Indian Council of Forestry Research and Education)
Dehradun

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2023

INCOME	SCHEDULE	CURRENT YEAR 31.03.2023	PREVIOUS YEAR 31.03.2022
		Rs.	R.s
SUPPLY OF GOODS/SERVICES	8	82,17,464.74	1,43,42,136.80
GRANT RECEIVED	9	10,18,88,627.46	14,08,73,934.00
INTEREST EARNED	10	35,84,354.00	75,29,847.78
OTHER INCOME	11	-	-
TOTAL (A)		11,36,90,446.20	16,27,45,918.58

EXPENDITURE	SCHEDULE	CURRENT YEAR 31.03.2023	PREVIOUS YEAR 31.03.2022
		Rs.	R.s
EXPENDITURE ON GRANTS (PLAN)			
Establishment Expenses	12A	-	-
Other Administrative Expenses, etc	12B	-	-
Capital Expenses	12C	-	-
EXPENDITURE ON GRANTS (EAP)	13	10,18,88,627.46	14,08,73,934.00
OTHER EXPENSES	14	21,45,927.00	50,60,379.87
DEPRECIATION ON FIXED ASSETS	5	-	-
TOTAL(B)		10,40,34,554.46	14,59,34,313.87
EXCESS OF INCOME OVER EXPENDITURE (A-B)		96,55,891.74	1,68,11,604.71

11/11/23

(Head of the Institute)
Director
Forest Research Institute
Dehra Dun-248 006

(Drawing & Disbursement Officer)
FOREST RESEARCH INSTITUTE(PROJECT SECTION)
DEHRADUN

लेखा अधिकारी
Accounts Officer
वन अनुसंधान संस्थान, देहरादून
Forest Research Institute, Dehradun

FOR M/S PARMITA & COMPANY,
CHARTERED ACCOUNTANTS

PARMITA AND COMPANY Dehradun Chartered Accountants

(CA PARMITA BHATT)
PROP., M. NO. 078018, FRN 0008751C

DATED:25.10.2023
PLACE: DEHRADUN

FOREST RESEARCH CENTRE FOR ECO-REHABILITATION

(A Unit of Indian Council of Forestry Research and Education)

Prayagraj

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2023

INCOME	SCHEDULE	CURRENT YEAR 31.03.2023	PREVIOUS YEAR 31.03.2022
		Rs.	R.s
SUPPLY OF GOODS/SERVICES	8	30,975.00	1,15,557.51
GRANT RECEIVED	9	2,70,84,041.13	2,75,82,499.71
INTEREST EARNED	10	45,308.00	42,312.00
OTHER INCOME	11	-	-
TOTAL (A)		2,71,60,324.13	2,77,40,369.22

EXPENDITURE	SCHEDULE	CURRENT YEAR 31.03.2023	PREVIOUS YEAR 31.03.2022
		Rs.	R.s
EXPENDITURE ON GRANTS (PLAN)			
Establishment Expenses	12A	1,96,57,579.00	1,76,38,077.00
Other Administrative Expenses, etc	12B	37,45,680.61	63,07,512.75
Capital Expenses	12C	7,18,959.00	-
EXPENDITURE ON GRANTS (EAP)	13	29,61,822.52	36,36,909.96
OTHER EXPENSES	14	42,272.10	32,430.00
DEPRECIATION ON FIXED ASSETS	5	-	-
TOTAL(B)		2,71,26,313.23	2,76,14,929.71
EXCESS OF INCOME OVER EXPENDITURE (A-B)		34,010.90	1,25,439.51

Head 3/11/23
ICFRE-Eco Rehabilitation Centre
Prayagraj

3/11/2023
(Drawing & Disbursement Officer)
FOREST RESEARCH CENTRE FOR ECO-REHABILITATION
PRAYAGRAJ

D.D.O.
ICFRE-Eco Rehabilitation Centre
Prayagraj

FOR M/S PARMITA & COMPANY,
CHARTERED ACCOUNTANTS

PARMITA AND COMPANY Dehradun Chartered Accountants

(CA PARMITA BHATT)
PROP., M.NO. 078018, FRN 0008751C

DATED:25.10.2023
PLACE: DEHRADUN

INSTITUTE OF FOREST GENETICS & TREE BREEDING

(A Unit of Indian Council of Forestry Research and Education)
Coimbatore

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2023

INCOME	SCHEDULE	CURRENT YEAR 31.03.2023	PREVIOUS YEAR 31.03.2022
		Rs.	R.s
SUPPLY OF GOODS/SERVICES	8	1,19,45,674.52	51,03,793.37
GRANT RECEIVED	9	34,32,22,730.75	30,52,45,755.98
INTEREST EARNED	10	11,74,500.00	22,67,257.75
OTHER INCOME	11	-	-
TOTAL (A)		35,63,42,905.27	31,26,16,807.10

EXPENDITURE	SCHEDULE	CURRENT YEAR 31.03.2023	PREVIOUS YEAR 31.03.2022
		Rs.	R.s
EXPENDITURE ON GRANTS (PLAN)			
Establishment Expenses	12A	19,77,28,758.00	18,99,57,530.00
Other Administrative Expenses, etc	12B	2,49,40,993.00	3,28,01,389.00
Capital Expenses	12C	11,50,102.00	12,73,932.00
EXPENDITURE ON GRANTS (EAP)	13	11,94,02,877.75	8,12,12,904.98
OTHER EXPENDITURE ON GRANTS	14	39,66,449.59	6,33,379.00
DEPRECIATION ON FIXED ASSETS	5	-	-
TOTAL(B)		34,71,89,180.34	30,58,79,134.98
EXCESS OF INCOME OVER EXPENDITURE (A-B)		91,53,724.93	67,37,672.12

DIRECTOR
Institute of Forest Genetics and Tree Breeding, Coimbatore-2

(Head of the Institute)

(Drawing & Disbursement Officer)
INSTITUTE OF FOREST GENETICS & TREE BREEDING
COIMBATORE

ACCOUNTS OFFICER
Institute of Forest Genetics and Tree Breeding, Coimbatore-2

FOR M/S PARMITA & COMPANY,
CHARTERED ACCOUNTANTS

PARMITA AND COMPANY Dehradun Chartered Accountants

(CA PARMITA BHATT)
PROP., M. NO. 078018, FRN 0008751C

DATED:25.10.2023
PLACE: DEHRADUN

INSTITUTE OF WOOD SCIENCE & TECHNOLOGY

(A Unit of Indian Council of Forestry Research and Education)
Bengaluru

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2023

INCOME	SCHEDULE	CURRENT YEAR 31.03.2023	PREVIOUS YEAR 31.03.2022
		Rs.	R.s
SUPPLY OF GOODS/SERVICES	8	1,40,53,756.00	70,06,835.00
GRANT RECEIVED	9	29,20,80,097.00	22,24,48,910.00
INTEREST EARNED	10	12,28,287.00	24,78,141.00
OTHER INCOME	11	-	5,78,015.00
TOTAL (A)		30,73,62,140.00	23,25,11,901.00

EXPENDITURE	SCHEDULE	CURRENT YEAR 31.03.2023	PREVIOUS YEAR 31.03.2022
		Rs.	R.s
EXPENDITURE ON GRANTS (PLAN)			
Establishment Expenses	12A	18,65,32,447.00	14,59,17,336.00
Other Administrative Expenses, etc	12B	3,52,89,726.00	2,67,68,651.00
Capital Expenses	12C	1,20,34,181.00	9,12,146.00
EXPENDITURE ON GRANTS (EAP)	13	5,77,75,131.00	4,88,50,777.00
OTHER EXPENSES	14	20,28,908.00	24,07,423.00
DEPRECIATION ON FIXED ASSETS	5	-	-
TOTAL(B)		29,36,60,393.00	22,48,56,333.00
EXCESS OF INCOME OVER EXPENDITURE (A-B)		1,37,01,747.00	76,55,568.00

(Head of the Institute)

(Drawing & Disbursement Officer)
INSTITUTE OF WOOD SCIENCE & TECHNOLOGY
BENGALURU

Drawing & Disbursing Officer
Institute of Wood Science & Technology Bangalore-07

FOR M/S PARMITA & COMPANY,
CHARTERED ACCOUNTANTS

(CA PARMITA BHATT)
PROP., M. NO. 078018, FRN 0008751C

DATED:25.10.2023
PLACE: DEHRADUN

Director
Institute of Wood Science and Technology
18th Cross, Malleshwaram
Bangalore - 560 003

TROPICAL FOREST RESEARCH INSTITUTE

(A Unit of Indian Council of Forestry Research and Education)
Jabalpur

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2023

INCOME	SCHEDULE	CURRENT YEAR 31.03.2023	PREVIOUS YEAR 31.03.2022
		Rs.	R.s
SUPPLY OF GOODS/SERVICES	8	34,92,459.81	1,06,15,709.15
GRANT RECEIVED	9	30,51,14,050.72	26,90,50,465.35
INTEREST EARNED	10	18,74,815.00	26,62,633.00
OTHER INCOME	11	-	-
TOTAL (A)		31,04,81,325.53	28,23,28,807.50

EXPENDITURE	SCHEDULE	CURRENT YEAR 31.03.2023	PREVIOUS YEAR 31.03.2022
		Rs.	R.s
EXPENDITURE ON GRANTS (PLAN)			
Establishment Expenses	12A	17,56,27,986.00	16,04,81,959.00
Other Administrative Expenses, etc	12B	2,14,97,463.00	2,26,44,249.00
Capital Expenses	12C	98,960.00	8,58,819.00
EXPENDITURE ON GRANTS (EAP)	13	10,67,21,992.72	8,50,65,438.35
OTHER EXPENSES	14	18,60,727.00	11,42,137.00
DEPRECIATION ON FIXED ASSETS	5	-	-
TOTAL(B)		30,58,07,128.72	27,01,92,602.35
EXCESS OF INCOME OVER EXPENDITURE (A-B)		46,74,196.81	1,21,36,205.15

Director
(Head of the institute)
Jabalpur

9/11/2023

(Drawing & Disbursement Officer)
TROPICAL FOREST RESEARCH INSTITUTE
JABALPUR
D.D.O.
T.F.R.I.
Jabalpur

FOR M/S PARMITA & COMPANY,
CHARTERED ACCOUNTANTS

PARMITA AND COMPANY Dehradun Chartered Accountants

(CA PARMITA BHATT)
PROP., M. NO. 078018, FRN 0008751C

DATED:25.10.2023
PLACE: DEHRADUN

FOREST RESEARCH CENTRE FOR SKILL DEVELOPMENT

(A Unit of Indian Council of Forestry Research and Education)
Chhindwara

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2023

INCOME	SCHEDULE	CURRENT YEAR 31.03.2023	PREVIOUS YEAR 31.03.2022
		Rs.	R.s
SUPPLY OF GOODS/SERVICES	8	2,14,604.00	1,52,025.00
GRANT RECEIVED	9	1,59,04,140.96	1,37,35,882.10
INTEREST EARNED	10	42,471.00	1,236.00
OTHER INCOME	11	-	-
TOTAL (A)		1,61,61,215.96	1,38,89,143.10

EXPENDITURE	SCHEDULE	CURRENT YEAR 31.03.2023	PREVIOUS YEAR 31.03.2022
		Rs.	R.s
EXPENDITURE ON GRANTS (PLAN)			
Establishment Expenses	12A	1,18,59,477.00	1,17,17,395.00
Other Administrative Expenses, etc	12B	13,99,976.00	11,08,722.70
Capital Expenses	12C	22,343.00	2,44,325.00
EXPENDITURE ON GRANTS (EAP)	13	26,22,344.96	6,65,439.40
OTHER EXPENSES	14	41,714.00	
DEPRECIATION ON FIXED ASSETS	5	-	-
TOTAL(B)		1,59,45,854.96	1,37,35,882.10
EXCESS OF INCOME OVER EXPENDITURE (A-B)		2,15,361.00	1,53,261.00

(Head of the Institute)

(Drawing & Disbursement Officer)
FOREST RESEARCH CENTRE FOR SKILL DEVELOPMENT
CHHINDWARA

D.D.O.
I.C.F.R.E.- S.D.C.
CHHINDWARA (M.P.)

वैज्ञानिक प्रभारी/ Scientist Incharge
भा.वा.अ.शि.प.-वा.वि.केन्द्र छिन्दवाड़ा(म.प्र.)
I.C.F.R.E; S.D.C. CHHINDWARA (M.P.)

FOR M/S PARMITA & COMPANY,
CHARTERED ACCOUNTANTS

(CA PARMITA BHATT)
PROP., M. NO. 078028, FRN 0008751C

DATED:25.10.2023
PLACE: DEHRADUN

ARID FOREST RESEARCH INSTITUTE

(A Unit of Indian Council of Forestry Research and Education)
Jodhpur

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2023

INCOME	SCHEDULE	CURRENT YEAR 31.03.2023	PREVIOUS YEAR 31.03.2022
		Rs.	R.s
SUPPLY OF GOODS/SERVICES	8	1,20,89,152.00	1,17,56,525.00
GRANT RECEIVED	9	20,63,90,800.13	20,25,65,563.22
INTEREST EARNED	10	8,70,882.00	4,36,108.00
OTHER INCOME	11	-	-
TOTAL (A)		21,93,50,834.13	21,47,58,196.22

EXPENDITURE	SCHEDULE	CURRENT YEAR 31.03.2023	PREVIOUS YEAR 31.03.2022
		Rs.	R.s
EXPENDITURE ON GRANTS (PLAN)			
Establishment Expenses	12A	13,88,25,235.00	14,24,74,339.00
Other Administrative Expenses, etc	12B	2,59,98,656.00	2,26,49,990.00
Capital Expenses	12C	6,11,943.00	3,98,274.00
EXPENDITURE ON GRANTS (EAP)	13	4,09,54,966.13	3,70,42,960.22
OTHER EXPENSES	14	6,68,097.00	-
DEPRECIATION ON FIXED ASSETS	5	-	-
TOTAL(B)		20,70,58,897.13	20,25,65,563.22
EXCESS OF INCOME OVER EXPENDITURE (A-B)		1,22,91,937.00	1,21,92,633.00

निदेशक
(Head of the Institute) Director
शुष्कवनिकी-शुष्क वन अनुसंधान संस्थान
ICFRE-Arid Forest Research Institute
जोधपुर (राजस्थान)
(Drawing & Disbursement Officer) Jodhpur (Rajasthan)
ARID FOREST RESEARCH INSTITUTE
JODHPUR

FOR M/S PARMITA & COMPANY,
CHARTERED ACCOUNTANTS

(CA PARMITA BHATT)
PROP., M. NO. 078018, FRN 0008751C

DATED: 25.10.2023
PLACE: DEHRADUN

आहरण एवं संवितरण अधिकारी
Drawing & Disbursing Officer
शुष्क वन अनुसंधान संस्थान
Arid Forest Research Institute
जोधपुर/Jodhpur

HIMALAYAN FOREST RESEARCH INSTITUTE

(A Unit of Indian Council of Forestry Research and Education)

Shimla

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2023

INCOME	SCHEDULE	CURRENT YEAR 31.03.2023	PREVIOUS YEAR 31.03.2022
		Rs.	R.s
SUPPLY OF GOODS/SERVICES	8	31,65,064.80	45,05,996.22
GRANT RECEIVED	9	15,22,83,105.50	15,72,66,089.58
INTEREST EARNED	10	7,59,858.54	15,24,262.00
OTHER INCOME	11	-	-
TOTAL (A)		15,62,08,028.84	16,32,96,347.80

EXPENDITURE	SCHEDULE	CURRENT YEAR 31.03.2023	PREVIOUS YEAR 31.03.2022
		Rs.	R.s
EXPENDITURE ON GRANTS (PLAN)			
Establishment Expenses	12A	9,90,70,055.00	7,71,73,935.00
Other Administrative Expenses, etc	12B	1,31,45,000.00	1,57,06,774.00
Capital Expenses	12C	23,65,006.00	6,01,009.00
EXPENDITURE ON GRANTS (EAP)	13	3,76,08,178.50	6,37,84,371.58
OTHER EXPENSES	14	13,41,097.36	11,20,266.00
DEPRECIATION ON FIXED ASSETS	5	-	-
TOTAL(B)		15,35,29,336.86	15,83,86,355.58
EXCESS OF INCOME OVER EXPENDITURE (A-B)		26,78,691.98	49,09,992.22

Director
निदेशक
10/11/2023
Himalayan Forest Research Institute
हिमालयन वन अनुसंधान संस्थान
Shimla - 171
शिमला - 171
(Drawing & Disbursement Officer)
HIMALAYAN FOREST RESEARCH INSTITUTE
SHIMLA

FOR M/S PARMITA & COMPANY,
CHARTERED ACCOUNTANTS
PARMITA AND COMPANY Dehradun Chartered Accountants
(CA PARMITA BHATT)
PROP., M. NO. 078018, FRN 0008751C

DATED:25.10.2023
PLACE: DEHRADUN

INSTITUTE OF FOREST PRODUCTIVITY

(A Unit of Indian Council of Forestry Research and Education)
Ranchi

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2023

INCOME	SCHEDULE	CURRENT YEAR 31.03.2023	PREVIOUS YEAR 31.03.2022
		Rs.	R.s
SUPPLY OF GOODS/SERVICES	8	26,53,993.22	39,72,266.00
GRANT RECEIVED	9	16,08,50,564.88	13,98,21,798.59
INTEREST EARNED	10	13,99,882.39	18,40,893.00
OTHER INCOME	11	-	-
TOTAL (A)		16,49,04,440.49	14,56,34,957.59

EXPENDITURE	SCHEDULE	CURRENT YEAR 31.03.2023	PREVIOUS YEAR 31.03.2022
		Rs.	R.s
EXPENDITURE ON GRANTS (PLAN)			
Establishment Expenses	12A	10,27,83,594.57	8,29,32,783.00
Other Administrative Expenses, etc	12B	1,01,51,165.94	1,50,90,566.00
Capital Expenses	12C	6,87,488.28	8,19,698.00
EXPENDITURE ON GRANTS (EAP)	13	4,27,71,908.03	4,09,78,751.59
OTHER EXPENSES	14	61,20,433.94	12,20,545.95
DEPRECIATION ON FIXED ASSETS	5	-	-
TOTAL(B)		16,25,14,590.76	14,10,42,344.54
EXCESS OF INCOME OVER EXPENDITURE (A-B)		23,89,849.73	45,92,613.05

(Head of the Institute)

(Drawing & Disbursement Officer)
INSTITUTE OF FOREST PRODUCTIVITY
RANCHI
/DRAWING AND DISBURSING OFFICER
भा.वा.अ.शि.प.-व.उ.सं./ICFRE-IFP
रांची-झारखण्ड/RANCHI-JHARKHAND-835303

निदेशक / Director
वन उत्पादकता संस्थान
Institute of Forest Productivity
राँची / Ranchi-835303

FOR M/S PARMITA & COMPANY,
CHARTERED ACCOUNTANTS

(CA PARMITA BHATT)
PROP. M. NO. 078018, FRN 0008751C

DATED:25.10.2023
PLACE: DEHRADUN

INSTITUTE OF FOREST BIODIVERSITY

(A Unit of Indian Council of Forestry Research and Education)
Hyderabad

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2023

INCOME	SCHEDULE	CURRENT YEAR 31.03.2023	PREVIOUS YEAR 31.03.2022
		Rs.	R.s
SUPPLY OF GOODS/SERVICES	8	3,09,549.41	8,94,514.11
GRANT RECEIVED	9	8,40,99,693.60	8,40,73,588.28
INTEREST EARNED	10	6,52,931.00	9,03,858.00
OTHER INCOME	11	-	-
TOTAL (A)		8,50,62,174.01	8,58,71,960.39

EXPENDITURE	SCHEDULE	CURRENT YEAR 31.03.2023	PREVIOUS YEAR 31.03.2022
		Rs.	R.s
EXPENDITURE ON GRANTS (PLAN)			
Establishment Expenses	12A	5,70,50,861.01	5,79,75,853.80
Other Administrative Expenses, etc	12B	78,50,709.00	73,62,593.30
Capital Expenses	12C	1,15,000.00	2,49,846.40
EXPENDITURE ON GRANTS (EAP)	13	1,89,56,239.59	1,84,85,294.78
OTHER EXPENSES	14	8,71,432.40	7,66,653.58
DEPRECIATION ON FIXED ASSETS	5	-	-
TOTAL(B)		8,48,44,242.00	8,48,40,241.86
EXCESS OF INCOME OVER EXPENDITURE (A-B)		2,17,932.01	10,31,718.53

(Head of the Institute)

निदेशक / Director
वन जैव विविधता संस्थान
Institute of Forest Biodiversity
हैदराबाद / Hyderabad - 500

(Drawing & Disbursement Officer)
INSTITUTE OF FOREST BIODIVERSITY
HYDERABAD

आहरण एवं संवितरण अधिकारी
Drawing & Disbursing Officer
वन जैव विविधता संस्थान
Institute of Forest Biodiversity
हैदराबाद Hyderabad-500

FOR M/S PARMITA & COMPANY,
CHARTERED ACCOUNTANTS

(CA PARMITA BHATT)
PROP. M. NO. 078018, FRN 0008751C

DATED:25.10.2023
PLACE: DEHRADUN

FOREST RESEARCH CENTRE FOR COASTAL ECOSYSTEM

(A Unit of Indian Council of Forestry Research and Education)
Vishakhapatnam

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2023

INCOME	SCHEDULE	CURRENT YEAR 31.03.2023	PREVIOUS YEAR 31.03.2022
		Rs.	R.s
SUPPLY OF GOODS/SERVICES	8	-	-
GRANT RECEIVED	9	16,48,208.46	20,43,490.00
INTEREST EARNED	10	8,595.00	4,680.00
OTHER INCOME	11	-	
TOTAL (A)		16,56,803.46	20,48,170.00

EXPENDITURE	SCHEDULE	CURRENT YEAR 31.03.2023	PREVIOUS YEAR 31.03.2022
		Rs.	R.s
EXPENDITURE ON GRANTS (PLAN)			
Establishment Expenses	12A	-	-
Other Administrative Expenses, etc	12B	11,99,815.63	19,37,770.00
Capital Expenses	12C	2,99,986.83	1,05,720.00
EXPENDITURE ON GRANTS (EAP)	13	1,48,406.00	-
OTHER EXPENSES	14		4,680.00
DEPRECIATION ON FIXED ASSETS	5		-
TOTAL(B)		16,48,208.46	20,48,170.00
EXCESS OF INCOME OVER EXPENDITURE (A-B)		8,595.00	-

(Head of the Institute)

(Drawing & Disbursement Officer)
FOREST RESEARCH CENTRE FOR COASTAL ECOSYSTEM
VISHAKHAPATNAM

FOR M/S PARMITA & COMPANY,
CHARTERED ACCOUNTANTS

[CA PARMITA BHATT]
PROP., M. NO. 078018, FRN 0008751C

DATED:25.10.2023
PLACE: DEHRADUN

RAIN FOREST RESEARCH INSTITUTE

(A Unit of Indian Council of Forestry Research and Education)

Jorhat

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2023

INCOME	SCHEDULE	CURRENT YEAR 31.03.2023	PREVIOUS YEAR 31.03.2022
		Rs.	R.s
SUPPLY OF GOODS/SERVICES	8	1,18,86,535.00	71,89,645.60
GRANT RECEIVED	9	23,94,14,532.60	20,48,12,060.70
INTEREST EARNED	10	20,17,483.00	26,90,536.00
OTHER INCOME	11	-	-
TOTAL (A)		25,33,18,550.60	21,46,92,242.30

EXPENDITURE	SCHEDULE	CURRENT YEAR 31.03.2023	PREVIOUS YEAR 31.03.2022
		Rs.	R.s
EXPENDITURE ON GRANTS (PLAN)			
Establishment Expenses	12A	17,47,96,737.00	13,16,47,304.60
Other Administrative Expenses, etc	12B	1,70,76,526.00	1,97,36,785.00
Capital Expenses	12C	5,85,000.00	5,99,587.00
EXPENDITURE ON GRANTS (EAP)	13	4,68,39,421.60	5,28,28,384.10
OTHER EXPENSES	14	18,72,072.02	52,22,010.00
DEPRECIATION ON FIXED ASSETS	5	-	-
TOTAL(B)		24,11,69,756.62	21,00,34,070.70
EXCESS OF INCOME OVER EXPENDITURE (A-B)		1,21,48,793.98	46,58,171.60

(Head of the Institute)

निदेशक/Director
भा.वा.प.शि.प. वर्षावन अनुसंधान संस्थान
ICFRE-Rain Forest Research Institute
जोरहाट, असम/Jorhat, Assam

(Drawing & Disbursement Officer)
RAIN FOREST RESEARCH INSTITUTE
JORHAT

FOR M/S PARMITA & COMPANY,
CHARTERED ACCOUNTANTS

PARMITA AND COMPANY Dehradun Chartered Accountants

(CA PARMITA BHATT)
PROP. M. NO. 078018, FRN 0008751C

DATED:25.10.2023
PLACE: DEHRADUN

FOREST RESEARCH CENTRE FOR LIVLIHOOD EXTENSION

(A Unit of Indian Council of Forestry Research and Education)
Agartala

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2023

INCOME	SCHEDULE	CURRENT YEAR 31.03.2023	PREVIOUS YEAR 31.03.2022
		Rs.	R.s
SUPPLY OF GOODS/SERVICES	8	12,612.00	9,47,266.00
GRANT RECEIVED	9	98,48,798.00	1,04,51,437.00
INTEREST EARNED	10	1,03,009.00	2,01,201.00
OTHER INCOME	11	-	-
TOTAL (A)		99,64,419.00	1,15,99,904.00

EXPENDITURE	SCHEDULE	CURRENT YEAR 31.03.2023	PREVIOUS YEAR 31.03.2022
		Rs.	R.s
EXPENDITURE ON GRANTS (PLAN)			
Establishment Expenses	12A	66,65,847.00	75,25,316.00
Other Administrative Expenses, etc	12B	10,90,000.00	10,40,869.00
Capital Expenses	12C	-	-
EXPENDITURE ON GRANTS (EAP)	13	20,92,951.00	18,85,252.00
DEPRECIATION ON FIXED ASSETS	5	-	-
TOTAL(B)		98,48,798.00	1,04,51,437.00
EXCESS OF INCOME OVER EXPENDITURE (A-B)		1,15,621.00	11,48,467.00

(Head of the Institute)

कार्यालय प्रमुख/Head of Office
भा.वा.अ.शि.प.-आ.वि.कें.
ICFRE-LEC
अगरतला/Agartala

(Drawing & Disbursement Officer)
FOREST RESEARCH CENTRE FOR LIVLIHOOD EXTENSION
AGARTALA

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DDO
भा.वा.अ.शि.प.-आ.वि.कें
ICFRE-LEC
अगरतला / Agartala

PARMITA AND COMPANY Dehradun Chartered Accountants

FOR M/S PARMITA & COMPANY,
CHARTERED ACCOUNTANTS

(CA PARMITA BHATT)
PROP., M. NO. 078018, FRN 0008751C

DATED:25.10.2023
PLACE: DEHRADUN

FOREST RESEARCH CENTRE FOR BAMBOO & RATTAN

(A Unit of Indian Council of Forestry Research and Education)
Aizwal

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2023

INCOME	SCHEDULE	CURRENT YEAR 31.03.2023	PREVIOUS YEAR 31.03.2022
		Rs.	R.s
SUPPLY OF GOODS/SERVICES	12	4,10,641.00	1,15,798.13
GRANT RECEIVED	13	1,26,84,952.00	1,28,34,900.50
INCOME FROM INVESTMENT	15		
INTEREST EARNED	17	1,06,428.00	81,824.50
OTHER INCOME	18	-	-
TOTAL (A)		1,32,02,021.00	1,30,32,523.13

EXPENDITURE	SCHEDULE	CURRENT YEAR 31.03.2023	PREVIOUS YEAR 31.03.2022
		Rs.	R.s
EXPENDITURE ON GRANTS (PLAN)			
Establishment Expenses	20A	91,36,167.00	72,48,500.50
Other Administrative Expenses, etc	20B	28,43,038.00	40,28,965.00
Capital Expenses	20C	1,98,160.00	-
EXPENDITURE ON GRANTS (EAP)	21	5,07,587.00	15,57,435.00
EXPENDITURE ON CONSULTANCY PROJECT	22	-	-
OTHER EXPENSES	23A	560.50	16,050.13
INTEREST	23B	23,157.00	-
DEPRECIATION ON FIXED ASSETS	8	-	-
TOTAL(B)		1,27,08,669.50	1,28,50,950.63
EXCESS OF INCOME OVER EXPENDITURE (A-B)		4,93,351.50	1,81,572.50

(Head of the Institute)

FOR M/S PARMITA & COMPANY,
CHARTERED ACCOUNTANTS

(CA PARMITA BHATT)
PROP., M. NO. 078018, FRN 0008751C

(Drawing & Disbursement Officer)
FOREST RESEARCH CENTRE FOR BAMBOO & RATTAN
AIZWAL

DATED:25.10.2023
PLACE: DEHRADUN

DDO
ICFRE-BRC
AIZAWL : MIZORAM

Statement of Allotment & Expenditure for the year 2022-23

(Rs.in lakh)

Sl. No.	Budget Sub-Head / Name of Institutes/Centres	Plan (GC)											
		Salaries				General				Capital			
		Budget Allot.	Opening balance	Total	Exp. 2020-21	Budget Allot.	Opening balance	Total	Exp. 2020-21	Budget Allot.	Opening balance	Total	Exp. 2020-21
1	ICFRE/Pension	1825.86	0.00	1825.86	1825.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	VVB, New Delhi	0.00	0.00	0.00	0.00	38.00	0.00	38.00	37.98	1.15	0.00	1.15	1.08
3	DDO, ICFRE	1575.00	114.83	1689.83	1538.07	480.17	0.00	480.17	480.51	2.40	0.00	2.40	2.42
4	FRI, Dehradun	5621.64	353.68	5975.32	5584.72	1788.61	0.33	1788.94	1788.68	462.71	0.00	462.71	462.71
5	FRC-ER, Prayagraj	181.53	15.06	196.59	196.56	37.32	0.07	37.39	37.46	7.20	0.00	7.20	7.19
6	IFGTB, Coimbatore	1919.99	142.60	2062.59	1904.14	255.00	0.12	255.12	255.00	11.50	0.00	11.50	11.50
7	IWST, Bangalore	1488.07	111.58	1599.65	1531.48	334.50	0.00	334.50	334.48	115.16	0.00	115.16	115.16
8	TFRI, Jabalpur	1757.34	105.14	1862.48	1716.36	277.00	0.00	277.00	276.72	1.00	0.00	1.00	0.99
9	FRC-SD, Chhindwara	118.50	9.83	128.33	128.31	14.00	0.00	14.00	13.80	0.25	0.00	0.25	0.22
10	AFRI, Jodhpur	1400.16	102.13	1502.29	1375.15	261.00	0.00	261.00	261.00	6.10	0.02	6.12	6.12
11	HFRI, Shimla	917.90	82.58	1000.48	918.63	131.50	0.00	131.50	131.49	23.65	0.00	23.65	23.65
12	IFP, Ranchi	933.93	92.43	1026.36	959.60	101.50	0.00	101.50	101.50	6.88	0.00	6.88	6.87
13	IFB, Hyderabad	585.00	44.75	629.75	583.44	78.50	0.00	78.50	78.45	1.15	0.00	1.15	1.15
14	FRC-CE, Vishakhapatnam	0.00	0.00	0.00	0.00	12.00	0.00	12.00	12.00	3.00	0.00	0.00	3.00
15	RFRI, Jorhat	1620.08	127.97	1748.05	1615.94	166.00	0.00	166.00	166.00	5.85	0.00	0.00	5.85
16	FRC-LE, Agartala	61.90	4.63	66.53	66.30	10.90	0.00	10.90	10.90	0.00	0.00	0.00	0.00
17	FRC-BR, Aizawl	93.10	8.51	101.61	99.80	28.00	0.00	28.00	28.00	2.00	0.00	2.00	1.99
Total		**20100.00**	**1315.72**	**21415.72**	**20044.36**	**4014.00**	**0.52**	**4014.52**	**4013.97**	**650.00**	**0.02**	**641.17**	**649.90**

Section Office (Budget)
ICFER

Assistant Director General (Admin.)
ICFRE

Statement of Revenue received in Budget Section, ICFRE for the year 2022-23

(Rs.in lakh)

Sl. No.	Name of Institutes/Centres	Revenue Generated								
		Externally Aided Projects	Consu-ltancy	Scientific Consultancy charges other than consultancy projects	Internal Resource Generation	Sale of Forest Products	Income from Interest	Misc. Income	Any other source which have not been mentioned above	Total
1	ICFRE	0.00	0.00	0.00	0.00	0.00	1.98	45.75	0.00	47.73
2	VVB, New Delhi	0.00	0.00	0.00	0.00	0.00	1.53	22.61	0.00	24.14
3	DDO, ICFRE	571.76	0.00	0.00	0.00	0.00	0.69	92.43	0.00	664.88
4	FRI, Dehradun	16.96	0.00	0.00	23.78	60.98	2.39	230.15	0.43	334.69
5	IFGTB, Coimbatore	39.05	0.00	0.00	2.78	10.92	0.78	37.07	1.06	91.66
6	IWST, Bangalore	20.97	54.88	0.82	33.43	0.60	1.75	24.77	56.78	194.00
7	TFRI, Jabalpur	22.80	78.02	0.00	0.00	0.56	3.21	13.03	0.93	118.55
8	AFRI, Jodhpur	9.15	0.00	0.00	0.00	16.97	0.97	104.22	0.01	131.32
9	HFRI, Shimla	25.20	0.68	0.00	0.93	2.67	0.36	9.59	0.77	40.20
10	IFP, Ranchi	19.25	0.00	0.00	6.83	1.49	0.55	40.51	0.05	68.68
11	FRC-ER, Prayagraj	0.10	0.00	0.00	0.00	0.00	0.01	0.22	0.00	0.33
12	FRC-SD, Chhindwara	0.00	0.00	0.00	1.26	0.01	0.01	0.85	0.00	2.13
13	IFB, Hyderabad	1.98	0.00	0.00	0.00	0.00	0.26	1.36	0.02	3.62
14	RFRI, Jorhat	36.16	56.98	0.00	0.00	4.15	0.62	21.54	0.11	119.56
15	FRC-LE, Agartala	0.52	0.00	0.00	0.00	0.13	0.00	0.00	0.00	0.65
16	FRC-BR, Aizawl	0.00	1.08	0.00	0.00	0.02	0.05	2.35	0.00	3.50
Total		763.90	191.64	0.82	69.01	98.50	15.15	646.45	60.16	1845.63

Section Office (Budget)
ICFRE

Assistant Director General (Admin.)
ICFRE

Statement of Allotment & Expenditure upto October 2023

(Rs.in lakh)

Sl. No.	Budget Sub-Head Name of Institutes/Centres	Plan (GC)					
		Salaries		General		Capital	
		Budget Allot.	Exp. upto Oct. 2022	Budget Allot.	Exp. upto Oct. 2022	Budget Allot.	Exp. upto Oct. 202
1	ICFRE/Pension	472.55	3280.00	0.00	0.00	36.34	0.00
2	VVB, New Delhi	0.00	0.00	20.00	10.00	6.00	5.99
3	AO, ICFRE	1554.00	1136.90	390.00	277.98	1.00	1.38
4	FRI, Dehradun	6077.50	3894.55	1086.18	530.54	12.99	10.36
5	FRC-ER, Prayagraj	0.00	0.00	44.02	22.04	0.00	0.00
6	IFGTB, Coimbatore	1988.30	1371.47	200.08	98.82	10.00	0.00
7	IWST, Bangalore	1976.00	1739.71	304.87	169.56	8.00	21.16
8	TFRI, Jabalpur	1942.00	1241.84	174.53	98.98	7.00	3.20
9	FRC-SD, Chhindwara	0.00	0.00	14.75	5.96	0.00	1.03
10	AFRI, Jodhpur	1439.50	938.09	193.05	110.78	2.67	1.60
11	HFRI, Shimla	1073.85	637.57	96.76	47.37	5.00	1.02
12	IFP, Ranchi	1000.80	630.69	92.34	45.90	5.00	3.00
13	IFB, Hyderabad	620.50	312.31	93.61	44.44	5.00	0.99
14	FRC-CE, Vishakhapatnam	0.00	0.00	10.25	8.25	0.00	0.00
15	RFRI, Jorhat	1855.00	1174.03	150.16	72.44	0.00	0.00
16	FRC-LE, Agartala	0.00	0.00	7.15	3.58	0.00	0.00
17	FRC-BR, Aizawl	0.00	0.00	22.25	12.35	1.00	0.48
Total		20000.00	16357.16	2900.00	1558.99	100.00	50.21

Statement of Revenue Generated upto October, 2023.

(Rs.in lakh)

Sl. No.	Name of Institutes/Centres	Approved Revenue Target for 2023-24	Revenue Generated upto Oct. 2023
1	VVB, New Delhi	20.00	12.21
2	AO, ICFRE	500.00	239.46
3	FRI, Dehradun	500.00	233.94
4	FRC-ER, Prayagraj	15.00	0.03
5	IFGTB, Coimbatore	200.00	27.80
6	IWST, Bangalore	300.00	102.40
7	TFRI, Jabalpur	200.00	20.34
8	FRC-SD, Chhindwara	10.00	0.44
9	AFRI, Jodhpur	200.00	47.03
10	HFRI, Shimla	150.00	11.00
11	IFP, Ranchi	150.00	37.00
12	IFB, Hyderabad	75.00	1.25
13	FRC-CE,Vishakhapatnam	10.00	0.00
14	RFRI, Jorhat	150.00	72.70
15	FRC-LE, Agartala	10.00	0.28
16	FRC-BR, Aizawl	10.00	1.15
Total		2500.00	807.03

Section Office (Budget)
ICFER

30.1.23

Assistant Director General (Admin.)
ICFRE

Proposed Budget Estimate for the Financial Year 2024-25

(Rs.in lakh)

Sl. No.	Budget Component	Proposed BE 2024-25
1	Grant-in-aid "Salary"	300.00
2	Grant-in-aid "General"	40.00
3	Grant-in-aid "Capital"	10.00
	Total	**350.00**

Target Proposed for Revenue ICFRE (Hqtr.) Institutes/Centres for the year 2024-25

(Rs.in lakh)

S.No.	Name of Institutes/Centres	Target Proposed
1	VVB, New Delhi	20.00
2	DDO, ICFRE	500.00
3	ICFRE-FRI, Dehradun	500.00
4	ICFRE-ERC, Prayagraj	15.00
5	ICFRE-IFGTB, Coimbatore	200.00
6	ICFRE-IWST, Bangalore	300.00
7	ICFRE-TFRI, Jabalpur	200.00
8	ICFRE-SDC, Chhindwara	10.00
9	ICFRE-AFRI, Jodhpur	200.00
10	ICFRE-HFRI, Shimla	150.00
11	ICFRE-IFP, Ranchi	150.00
12	ICFRE-IFB, Hyderabad	75.00
13	ICFRE-CEC, Vishakhapatnam	10.00
14	ICFRE-RFRI, Jorhat	150.00
15	ICFRE-LEC, Agartala	10.00
16	ICFRE-BRC, Aizawl	10.00
	Total	**2500.00**

Section Office (Budget)
ICFER

30/11/22

Assistant Director General (Admin.)
ICFRE

Annexures

ANNEXURES

Annexure - I

RIGHT TO INFORMATION

A Public Information Officer and Appellate Authority are functioning in Public Authority, ICFRE under the RTI Act 2005. During the year 2022-23, RTI application (411) and RTI Appeals (50) are disposed off. Consolidated Quarterly RTI returns of the Public Authority are regularly uploaded by the ICFRE on CIC website (*rtir.nic.in*).

RTI Applications/ Requests	No. of applications received as transfer from other P/As u/s 6(3)	Received during the month (including cases transferred to other Public Authority)	Number of cases transferred to other Public Authorities u/s6(3)	Decisions where requests/ Appeals rejected	Decisions where requests/ Appeals accepted
1st Quarter	12	92	7	--	90
2nd Quarter	09	112	11	--	115
3rd Quarter	11	85	06	--	87
4th Quarter	20	102	08	--	119
Total	**52**	**391**	**32**	--	**411**
			--	--	
RTI First Appeals			--	--	
1st Quarter	N/A	13	N/A	--	13
2nd Quarter	N/A	13	N/A	--	13
3rd Quarter	N/A	16	N/A	--	16
4th Quarter	N/A	08	N/A	--	08
Total	**--**	**50**	**--**	--	**50**

NAME AND ADDRESS OF PUBLIC INFORMATION OFFICERS AND APPELLATE AUTHORITIES UNDER THE RIGHT TO INFORMATION ACT 2005 IN ICFRE AND ITS INSTITUTES

Headquarters / Institutes	Appellate Authorities	Public Information Officers	Subject matter(s) allocated
Indian Council of Forestry Research and Education (ICFRE Hq.), P.O. New Forest Dehradun-248 006	Smt. Kanchan Devi, IFS Dy. Director General (Education) Phone (O) : 0135-2224832, 0135-2758571 E-mail : dir_edu@icfre.org	Dr. Rajiv Pandey, Phone (O) :0135-2224811, E-mail : pio_icfre@icfre.org	All matters related to ICFRE Hqrs., Dehradun
Forest Research Institute, P.O. New Forest, Dehradun-248 006	Dr. Renu Singh, IFS Director Forest Research Institute P.O. New Forest Dehradun- 248006 Phone: 0135-2224444, 2755277 Fax: 0135- 2757021 E-mail: dir_fri@icfre.org	Dr. N.K. Upreti Group Coordinator Research, ICFRE-FRI, P.O. New Forest Dehradun- 248 006 Phone : 0135- 2224316, 0135-2752670, 0135-2757021 Email: groupco_fri@icfre.org	All Research & Account matters
		Sh. S.K. Thomas Registrar, ICFRE-FRI Phone: 0135- 2757021-26 (O) Email: registrar_fri@icfre.org	Establishment, Administrative & all other matters
		Dr. A.K. Tripathi, Registrar & PIO, ICFRE-FRI (D) University Phone: 0135-2224439 (O) 0135-2751826 (O) Email: tripathiak@icfre.org	University matters
Eco-Rehabilitation Centre (ERC), 3/1, Lajpath Rai Road, New Katra, Prayagraj-211 002	Dr. Sanjay Singh Head Phone: 0532-2440795, E-mail: head_frcer@icfre.org	Dr. Anita Tomar Scientist -F Phone:0532-2440796 E-mail:anitatomar@icfre.org	All matters related to ICFRE-ERC, Prayagraj
Institute of Forest Genetics and Tree Breeding, Forest Campus, P.B.No 1061 R.S.Puram, Coimbatore - 641 002	Dr. C. Kunhikannan, Director, ICFRE-IFGTB, Coimbatore, Phone: 0422-2484100 (O) E-mail: dir_ifgtb@icfre.org	Dr. R. Yasodha Scientist 'G' & GCR ICFRE-IFGTB, Coimbatore Phone: 0422-2484102 (O)	All matters related to ICFRE-IFGTB, Coimbatore
Institute of Wood Science & Technology, PO Malleswarum, Bengaluru -560003	Dr. M.P. Singh, IFS, Director, ICFRE-IWST, Bengaluru Phone : 080-23341731, E-mail: dir_iwst@icfre.org	Dr. H.R. Prabhudha ICFRE-IWST, Bengaluru, Phone: 080-22190107(O) Email: prabuddhahr@icfre.org	All matters related to ICFRE-IWST, Bengaluru
Tropical Forest Research Institute, Jabalpur P.O. – R.F.R.C, Mandla Road, Jabalpur – 482 021	Dr. Nitin Kulkarni, Director, ICFRE-TFRI, Jabalpur Phone : 0761-2840483 Fax: 0761-4044002 E-mail: dir_tfri@icfre.org	Shri A.J.K Asaiya, Scientist-C, ICFRE-TFRI, Jabalpur. Phone: 0761-2744119 (O)	As per provision and guidelines provided under RTI Act, 2005

Headquarters / Institutes	Appellate Authorities	Public Information Officers	Subject matter(s) allocated
Skill Development Centre (SDC) P.O. Kundalikala, Poama, Chhindwara - 480001	Dr. Nitin Kulkarni, Director, ICFRE-TFRI, Jabalpur Phone : 0761-2840483 Fax: 0761-4044002 E-mail: dir_tfri@icfre.org	Shri N.D. Khobragade, Scientist -E Phone : 6261430470 E-mail:khobragadend@icfre.org	As per provision and guidelines provided under RTI Act, 2005
Rain Forest Research Institute Post Box No. 136, Deovan, Sotai, A.T. Road, Jorhat- 785 001(Assam)	Dr. Rajib Kr. Borah Director, ICFRE-RFRI, Jorhat Phone: 0376-2305101(O) Fax. 0376-2305130 E-mail: dir_rfri@icfre.org	Dr. R.K. Borah GCR ICFRE-RFRI, Jorhat Phone: 0376-2305103 (O)	All matters related to ICFRE-RFRI, Jorhat
Bamboo & Rattan Centre (BRC), P.O. Box 171, Kulikawn Aizwal-796001	Dr. Rajib Kr. Borah Director, ICFRE-RFRI, Jorhat Phone: 0376-2305101(O) Fax. 0376-2305130 E-mail: dir_rfri@icfre.org	Dr. Hans Raj Head ICFRE-BRC, Aizwal Phone: 0389-2301157 (O) E-mail:head_frcbr@icfre.org	All matters related to ICFRE-BRC, Aizwal
Livelihoods Extension Centre (LEC) Sal Bagan Forest Campus PO – Gandhigram Agartala- 799 012 Tripura	Dr. Rajib Kr. Borah Director, ICFRE-RFRI, Jorhat Phone: 0376-2305101(O) Fax. 0376-2305130 E-mail: dir_rfri@icfre.org	Dr. R.K. Borah GCR ICFRE-RFRI, Jorhat Phone: 0376-2305103 (O)	All matters related to ICFRE-LEC, Agartala
Arid Forest Research Institute, P.O. Krishi Upaz, Mandi, New Pali Road, Jodhpur, 342005.	Sh. M.R. Baloch, IFS Director, ICFRE-AFRI, Jodhpur Phone: 0291-2742549 (O) Fax. 0291-2722764 E-mail: dir_afri@icfre.org	Shri K.C. Gupta, ICFRE-AFRI, Jodhpur. Phone: 0291-2729122	All matters related to ICFRE-AFRI, Jodhpur
Himalayan Forest Research Institute, Conifer Campus, Panthaghati, Shimla – 171 009.	Dr. Sandeep Sharma, Director, ICFRE-HFRI, Shimla Phone : 0177-2626778 (O), Fax : 0177-2626779 E-mail: dir_hfri@icfre.org	Smt. Shilpa, CTO ICFRE-HFRI, Shimla Phone: 0177-2626778(O) Fax: 0177-2626779	All matters pertaining to HFRI, Shimla
Institute of Forest Productivity, NH 23, Gumla Road, Lalgutwa, Ranchi-835303.	Dr. Yogeshwar Mishra Director, ICFRE-IFP, Ranchi, Ph- 0651-2526140 8986608161 E-mail: dir_ifp@icfre.org	Mr. Sanjeev Kumar Scientist-E, ICFRE-IFP, Ranchi, Phone : 9798967363 E-mail: bhatiask@icfre.org	All matters related to ICFRE-IFP, Ranchi
Institute of Forest Biodiversity, Dulapally, Kompally, Post Hyderabad- 500100	Sh. E. Venkat Reddy, IFS Director, ICFRE-IFB, Hyderabad Phone: 040-66309501(O) Fax : 040-66309521 E-mail: director_ifb@icfre.org	Shri M.B. Honnuri Scientist-C ICFRE-IFB, Hyderabad Phone: 040-66309503 Email: mbhonnuri@icfre.org	All matters related to ICFRE-IFB, Hyderabad
Coastal Ecosystem Centre (CEC), HPCL Colony, Panduranga Puram Visakhapatnam- 530 003	Dr. E. Venkat Reddy, IFS Director, ICFRE-IFB, Hyderabad Phone: 040-66309501(O) E-mail: director_ifb@icfre.org	Shri M.B. Honnuri Scientist-C, ICFRE-IFB, Hyderabad Phone: 040-66309503 Email: mbhonnuri@icfre.org	All matters related to ICFRE-FRC-CE, Visakhaptnam

Annexure - II

INFORMATION ON VIGILANCE CASES

A Chief Vigilance Officer is functioning at ICFRE, Dehradun. During the year 2022-23, the cases handled were as follows:

Vigilance cases carried forward from previous years	Vigilance cases initiated in the year	Vigilance cases disposed	Vigilance cases pending	Nature of such cases
03	-	02	01	Violation of conduct rules

Name and address of Chief Vigilance Officer, ICFRE is as follows:

Smt. Kanchan Devi, IFS
Chief Vigilance Officer
PO New Forest, Dehradun – 248 006
Phone: 0135-2224851

Annexure - III

INFORMATION ON AUDIT OBJECTIONS

An Internal Audit Cell is functioning at ICFRE, Dehradun under the Head, Internal Audit, ICFRE. During the year 2022-23, the audit objections handled were as follows:

Information on the Audit Objections raised by Principal Director of Audit (Scientific Department), New Delhi

Audit objections carried forward from previous year	Audit objections initiated in the year	Audit objections disposed	Audit objections pending	Nature of Audit objections	Remarks, if any
88 (1994 to 2018)	14 (2018-21)	05	97	Paras on Research/ Projects/ Admin/ Accounts	Reply of audit para are pursued from different Directorates and Director of Institutes of ICFRE. Efforts for settlement of these CAG audit paras are under process

Name and address of Head, Internal Audit, ICFRE is as follows:

Head, Internal Audit
PO New Forest, Dehradun – 248 006
Phone: 0135-2224860/ 2753290
Email: head_iac@icfre.org

Annexure - IV

E-MAIL AND POSTAL ADDRESSES OF ICFRE AND ITS INSTITUTES

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Secretary, ICFRE
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Conifer Campus, Panthaghati,
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Fax : 0177-2626779 (O)

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Phone : 0651-2948505 (O)

Director
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Head
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Head
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Head
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Head
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Fax : 0389-2301159

Annexure - V

LIST OF ABBREVIATIONS

ADG	–	Assistant Director General
AGF	–	Agroforestry
AGM	–	Annual General Meeting
AICRP	–	All India Coordinated Research Project
AMF	–	*Arbuscular mycorrhizal* Fungi
ANR	–	Assisted Natural Regeneration
AYUSH	–	Ayurveda,Yoga and Naturopatty, Unani, Siddha and Homepathy
BAF	–	Basin Area Finder
BHTN	–	Bamboo Hi-Tech Nursery
BIMSTEC	–	Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation
BIS	–	Bureau of Indian Standards
BM	–	Bamboo Mat
BMRC	–	Bamboo Mat Ridge Cap
BoG	–	Board of Governors
CA	–	Compensatory Afforestation
CAMPA	–	Compensatory Afforestation Fund Management and Planning Authority
CCF	–	Chief Conservator of Forest
CFD	–	Chandigarh Forest Department
CG	–	Chattisgarh
CGM	–	Chopped Glass Fiber Mat
CLT	–	Cross Laminated Timber
CNCs	–	Cellulose Nano Crystals
CNFs	–	Cellulose Nano Fibers
CoE	–	Centre of Excellence
CPCs	–	Candidate Plus Culms
CPTs	–	Candidate Plus Trees
CSO	–	Clonal Seed Orchard
CSPOD	–	Coconut Shell Pyrolytic Oil Distillate
CTO	–	Chief Technical Officer
CV	–	Coefficient of Variation
DBH	–	Diameter at Breast Height
DG	–	Director General
DGF&SS	–	Director General of Forests and Special Secretary
DNA	–	Deoxyribonucleic acid
DPR	–	Detailed Project Report
DUS	–	Distinctness Uniformity and Stability
DV	–	Demo Village
EC	–	Electrical Conductivity
EIACP	–	Environmental Information Awareness Capacity Building and Livelihood Programme
ENVIS	–	Environmental Information System
ESIP	–	Ecosystem Services Improvement Project
FAQs	–	Frequently Ask Questions

FCRI	–	Forest College and Research Institute
FGR	–	Forest Genetic Resources
FRD	–	Fire Resistant Doors
FRS	–	Field Research Station
FSHC	–	Forest Soil Health Card
FSSAI	–	Food Safety and Security Authority of India
FTCB	–	Forest Training and Capacity Building
FTPW	–	Fluorescent Transparent Wood
GBH	–	Girth at Breast Height
GC-FID	–	Gas Chromatography with Flame Ionization Detection
GC-MS	–	Gas Chromatography-Mass Spectrometry
GDP	–	Gross Domestic Product
GEA	–	Genotype-Environment Associations
GHGs	–	Green House Gases
GIS	–	Geographic Information System
GLIS	–	Government Land Information System
GM	–	Glass Fiber Mat
GoI	–	Government of India
GPS	–	Global Positioning System
HAPPRC	–	High Altitude Plant Physiology Research Centre
HATZ	–	High Altitude Transition Zones
HoFF	–	Head of Forest Forces
HPCL	–	Hindustan Petroleum Corporation Limited
HPLC	–	High Performance Liquid Chromatography
HPSFD	–	Himachal Pradesh State Forest Department
HPTLC	–	High Performance Thin Layer Chromatography
HRD	–	Human Resource Development
HRRL	–	HPCL Rajasthan Refinery Limited
IAA	–	Indole Acetic Acid
IBA	–	Indole Butyric Acid
ICAR	–	Indian Council of Agricultural Research
ICFRE	–	Indian Council of Forestry Research and Education
ICFRE-AFRI	–	ICFRE-Arid Forest Research Institute
ICFRE-BRC	–	ICFRE-Bamboo and Rattan Centre
ICFRE-CEC	–	ICFRE-Coastal Ecosystem Centre
ICFRE-ERC	–	ICFRE-Eco-Rehabilitation Centre
ICFRE-FRI	–	ICFRE- Forest Research Institute
ICFRE-HFRI	–	ICFRE-Himalayan Forest Research Institute
ICFRE-IFB	–	ICFRE-Institute of Forest Biodiversity
ICFRE-IFGTB	–	ICFRE-Institute of Forest Genetics and Tree Breeding
ICFRE-IFP	–	ICFRE-Institute of Forest Productivity
ICFRE-IWST	–	ICFRE-Institute of Wood Science and Technology
ICFRE-LEC	–	ICFRE-Livelihood Extension Centre
ICFRE-RFRI	–	ICFRE-Rain Forest Research Institute
ICFRE-SDC	–	ICFRE-Skill Development Centre
ICFRE-TFRI	–	ICFRE-Tropical Forest Research Institute
ICP-OES	–	Inductively Coupled Plasma Optical Emission Spectroscopy
ICRAF	–	International Center for Research in Agroforestry
IFFCO	–	Indian Farmers Fertiliser Cooperative

IGNFA	–	Indira Gandhi National Forest Academy
IGNP	–	Indira Gandhi Nahar Pariyojna
IIA	–	Indian Industries Association
IIRS	–	Indian Institute of Remote Sensing
IISS	–	Indian Institute of Soil Science
IPCC	–	Intergovernmental Panel on Climate Change
IPIRTI	–	Indian Plywood Industries Research and Training Institute
ISRO	–	Indian Space Research Organization
ISSR	–	Inter Simple Sequence Repeats
ITK	–	Indigenous Technical Knowledge
IUCN	–	International Union for Conservation of Nature
IUFRO	–	International Union of Forest Research Organizations
JFMC	–	Joint Forest Management Committee
JICA	–	Japan International Cooperation Agency
JNV	–	Jawahar Navodaya Vidyalaya
KVK	–	Krishi Vigyan Kendra
KVS	–	Kendriya Vidyalaya Sangthan
LC	–	Least Concern
LiFE	–	Lifestyle of Environment
LKFP	–	Lesser Known Forest Plants
LU/LC	–	Land Use/ Land Cover
MC	–	Moisture Content
MDF	–	Medium Density Fiber Board
ML	–	Maximum Likelihood
MLTs	–	Multi-location Trials
MODIS	–	Moderate Resolution Imaging Spectroradiometer
MoE	–	Modulus of Elasticity
MoEF&CC	–	Minister of Environment Forest and Climate Change
MoR	–	Modulus of Rupture
MoU	–	Memorandum of Understanding
MP	–	Madhya Pradesh
MPCA	–	Medicinal Plant Conservation Area
MR	–	Moisture Resistance
MS	–	Maharastra
MS	–	Murashige and Skoog medium
MSP	–	Minimum Support Price
MTR/MNP	–	Manas Tiger Reserve/ Manas National Park
MW	–	Microwave
NAA	–	Napthyl Acetic Acid
NAEB	–	National Afforestation Eco Development Board
NBPGR	–	National Bureau of Plant Genetic Resources
NCBI	–	National Centre for Biotechnology Information
NCDC	–	National Cooperative Development Corporation
NDMC	–	New Delhi Municipal Committee
NDVI	–	Normalized Difference Vegetation Index
NFLIC	–	National Forest Library and Information Centre
NFRT	–	Natural Fiber Reinforced Thermoplastic
NGOs	–	Non-Government Organizations
NIRS	–	Near Infrared Spectroscopy

NPV	–	Net Present Value
NTFP	–	Non Timber Forest Products
NTPC	–	National Thermal Power Corporation
NTU	–	Nephelometric Turbidity Unit
NWC	–	Nano Wood Composites
NWFPs	–	Non-Wood Forest Products
OF	–	Open Forest
PBR	–	People's Biodiversity Register
PCCF	–	Principal Chief Conservator of Forests
PCR	–	Polymerase Chain Reaction
PF	–	Protected Forest
PLF	–	Phenol Lignin Formaldehyde
PM	–	Particulate Matter
PMES	–	Performance Monitoring and Evaluation System
PPB	–	Pre-laminated Particle Board
PPM	–	Parts Per Million
PPP	–	Public Private Partnership
PPV&FRA	–	Protection of Plant Varieties and Farmers' Rights Authority
PSB	–	Phosphate Solubilizing Bacteria
PVC	–	Polyvinyl Chloride
PWPR	–	Preliminary Working Plan Report
QGF	–	Quarter Girth Formula
QPM	–	Quality Planting Material
QTOF-MS	–	Quadrupole Time of Flight Mass Spectrometry
RAG	–	Research Advisory Group
RBD	–	Randomized Block Design
RBM	–	River Bed Material
RDF	–	Rehabilitation of Degraded Forest
REDD+	–	Reducing Emissions from Deforestation and Forest Degradation
REM	–	Riley Encased Methodology
RET	–	Rare Endangered Threatened
RF	–	Reserved Forest
RFO	–	Range Forest Officer
RLVL	–	Reinforced Laminated Veneer Lumber
RNA	–	Ribonucleic Acid
RP	–	Research and Planning
RPC	–	Research Planning Committee
RT	–	Research and Training
RWE	–	Round Wood Equivalent
SEM	–	Structural Equation Modelling
SFDs	–	State Forest Departments
SFM	–	Sustainable Forest Management
SHGs	–	Self Help Groups
SKUAST	–	Sher-e-Kashmir University of Agricultural Sciences and Technology
SLEM	–	Sustainable Land and Ecosystem Management
SMA	–	Seed Multiplication Area
SNPs	–	Single Nucleotide Polymorphisms
SOC	-	Soil Organic Carbon
SPA	–	Seed Production Area

SPS	–	Seed Production System
SSO	–	Seedling Seed Orchard
SSR	–	Simple Sequence Repeats
STO	–	Senior Technical Officer
TANU	–	Tamil Nadu Agricultural University
TC	–	Tissue Culture
TDC	–	Technology Demonstration Centre
TDS	–	Total Dissolve Soilds
TGM	–	Tree Growers Mela
TGR	–	Tamarind Genetic Resources
TLC	–	Thin Layer Chromatography
TNPL	–	Tamil Nadu Newsprint and Paper Limited
TOFI	–	Tree Outside Forests of India
TRB	–	Tree Rich Biobooster
TWC	–	Transparent Wood Composite
UF	–	Urea Formaldehyde
UNCCD	–	United Nations Convention to Combat Desertification
UNFCCC	–	United Nations Framework Convention on Climate Change
UPLC	–	Ultra High Performance Liquid Chromatography
USAID	–	United States Agency for International Development
UTs	–	Union Territories
UV	–	Ultra Violet
VAM	–	Vesicular Arbuscular Mycorrihza
VMG	–	Vegetative Multiplication Garden
VVK	–	Van Vigyan Kendra
WB	–	West Bengal
WHO	–	World Health Organization
WLS	–	Wildlife Sanctuary
WPC	–	Wood Polymer Composite
WTP	–	Willingness to Pay

ACKNOWLEDGEMENT

The arduous efforts made by the following scientists and officers in editing the allowed chapter of ICFRE Annual Report 2022-23 are thankfully acknowledged.

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Published by: *Media and Extension Division*, Directorate of Extension

Indian Council of Forestry
Research and Education

(An Autonomous Council
of Ministry of Environment,
Forest and Climate Change,
Government of India)

P.O. New Forest,
Dehradun- 248 006
Uttarakhand, India
www.icfre.gov.in

Design & Printed at Shiva Offset Press, Dehradun, Ph. 0135-2715748