भारतीय वानिकी अनुसंधान एवं शिक्षा परिषद्
INDIAN COUNCIL OF FORESTRY RESEARCH AND EDUCATION

ANNUAL REPORT

2017-18

ANNUAL Report 2017-18

INDIAN COUNCIL OF FORESTRY RESEARCH AND EDUCATION

(An Autonomous Council of Ministry of Environment, Forest and Climate Change, Government of India)

DEHRADUN (UTTARAKHAND)

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Dr. Harsh Vardhan

सत्यमेव जयते

भारत सरकार
पर्यावरण, वन एवं जलवायु परिवर्तन मंत्री
GOVERNMENT OF INDIA
MINISTER OF ENVIRONMENT, FOREST & CLIMATE CHANGE

Message

It is with great pride and accomplishment that I present the Annual Report 2017-18 of Indian Council of Forestry Research and Education. The Council has played the nodal responsibility to promote Forestry Research and Education in India in consonance with the vision and mission of the council. The research programmes have been cast suitably aligning with the national priorities in all its nine institutes and five centers throughout India.

This report highlights notable achievements like nano-science & technology, non-destructive rapid detection of tree hollowness, development of tools, techniques and methods for enhancing REDD+ forest management and climate change vulnerability of Indian forests.

ICFRE is also imparting forestry education and developing forestry curricula at various levels to accelerate the pace of capacity building and to provide expertise in different fields of forestry research.

I am aware of the Councils endeavours and continued progress in the pursuit of improved programmes, research, and knowledge for the millions.

I applaud the efforts of team ICFRE for the accomplishments featured in this report. ICFRE is expected to play an important role in national development and improve upon the best global practices in the area of forestry research.

My good wishes to everyone at all levels in ICFRE.

Date: 18.09.2018

(Dr. Harsh Vardhan)

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Dr. Mahesh Sharma

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पर्यावरण, वन एवं जलवायु परिवर्तन राज्य मंत्री
भारत सरकार
MINISTER OF STATE (I/C) OF CULTURE
MINISTER OF STATE FOR
ENVIRONMENT, FOREST AND CLIMATE CHANGE
GOVERNMENT OF INDIA

Message

Indian Council of Forestry Research and Education, an autonomous body of Ministry of Environment, Forest and Climate Change, Govt. of India provides the nation with best possible services in the field of forestry research and climate change.

It is a matter of great pleasure that Indian Council of Forestry Research and Education has brought a document "Annual Report, 2017-18" that aims at reaching out to the public/stakeholders with its outstanding achievements in the field of forestry research in India.

I am sure that the results that have been proposed will prove to be useful to the end-users including farmers, youth, foresters and the public as a whole.

It will definitely prove to be a stepping stone in addressing issue of research, education and extension in the field of forestry to its fullest.

I wish ICFRE all the success in future.

(Dr. Mahesh Sharma)

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

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सी.के.मिश्रा
C.K.Mishra

Message

The Indian Council of Forestry Research & Education (ICFRE), an apex body in the National Forestry Research System has been mandated to conduct research through need based planning, promoting, conducting and coordinating research, education and extension covering all aspects of forestry. The various activities of the Council focus on various synergistically linked domains that reflect the cross-sectoral nature of forest management.

During the year 2017- 18, ICFRE has made concerted efforts on laying emphasis on networking of resources and capabilities of all its institutes. ICFRE has taken up new programmes covering all regions of the country in furthering the cause of forestry research resulting in significant achievements and development of a strong scientific forestry research base in the country.

It is indeed a laudable initiative by Indian Council of Forestry Research and Education to plan and formulate strategies to reach out to their end users with the outstanding achievements of research by their Scientists.

I am confident that this report would impact the 'spirit of scientific research' to the public masses which would in return benefit the nation through advanced scientific research .

[C.K. Mishra]

Dated 15th October, 2018
Place: New Delhi

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SIDDHANTA DAS

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

Message

The Indian Council of Forestry Research and Education is mandated to generate, preserve, disseminate, and advance knowledge, technologies and solutions for addressing issues related to forests and promote linkages arising out of interactions between people, forests and environment on a sustained basis through research, education and extension.

The Council at present has 14 research establishments including nine institutes and five centres, which are repositories of knowledge and techniques in various branches of field forestry. The outstanding work carried out in the council is commendable and these are presented every year as an Annual Report.

The Annual Report 2017-18 presents ICFRE's contributions and lists the significant achievements in the field of Ecosystem Conservation and Management, Forest Productivity, Genetic Improvement, Wood Products and Forest Protection. The achievements are laudable as these are people-centric and sustainable.

ICFRE has developed a strong base for forestry research in the country and has achieved significant networking with a number of national and international organizations for greater outreach and cooperation. This report also highlights notable achievements of ICFRE which includes health status and age assessment of the trees of Rashtrapati Bhavan, maintenance of the holy Bodhi tree at Bodhgaya, holy trees at Smriti Park, Patna and holy pipal tree at Koteshwarnath Dham, Belaganj, Gaya.

I congratulate ICFRE for bringing out this publication.

(Siddhanta Das)

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(आई.एस.ओ. 9001:2008 प्रमाणित संस्था)

Director General
Indian Council of Forestry Research and Education
P. O. New Forest, Dehradun – 248006
(An ISO 9001:2008 Certified Organisation)

Foreword

I am very pleased to present the Annual Report for 2017-18 of Indian Council of Forestry Research and Education (ICFRE), an autonomous apex body of Ministry of Environment, Forest and Climate change, Government of India. The intent of this report is to enable the community and Government organisations to understand, that the focus of the Council has always remained on people oriented research and related activities for achieving the larger goal of sustainable management and development of forestry resources in the country.

It is appropriate to mention here that the year 2017-18 was particularly eventful with the participation and organisation of a side event by ICFRE in the COP 23 of UNFCCC, Bonn (Germany) and organising of 19th Commonwealth Forestry Conference in FRI with support from MoEF&CC and Commonwealth Forestry Association, besides new developments like two regional research conferences, to ensure the participation of the stakeholders in our research planning.

ICFRE has done commendable work in developing and releasing 30 clones of Casuarina and Eucalyptus with superior characters, capable of producing 25 to 40% more pulpwood and helping the farmers and paper industries in more production.

ICFRE has developed a DNA Isolation Kit, ArborEasy™. This kit provides an indigenous, non-biohazardous, low cost spin column based system for isolation of plant genomic DNA from wide range of tissue types.

Forest Genetic Resources (FGRs) constitute a very important sub-set of biodiversity. Under the National Programme for Conservation and Development of Forest Genetic Resources, a Memorandum of Agreement (MoA) has been signed with National Bureau of Plant Genetic Resources, New Delhi regarding long-term conservation, as they are irreplaceable resources for the future.

ICFRE has extended networking with a number of organisations to achieve greater outreach and cooperations through MoU's viz. The Energy and Resources Institutes (TERI), New Delhi, Technology Information, Forecasting & Assessment Council (TIFAC), New Delhi and Zoological Survey of India (ZSI), Kolkata.

The Council also endeavours to transfer and disseminate the technologies developed to the intended target groups including farmers, SFDs, industries, rural poor and unemployed youth by publications of targeted literature, organizing workshops, interactive meetings, symposia, seminars, trainings, awareness programmes, creating awareness through radio and TV talks, running extension programmes, networking of VVKs with KVKs of ICAR and Tree Growers Mela.

ICFRE is also rendering consultancies in 11 projects, which are awarded by Tehri Hydro Development Corporation India Ltd; Himachal Pradesh Power Corporation Limited; Karnataka State Official Authority; Uttarakhand Jal Vidyut Nigam Limited (UJVNL); MoEF&CC, GoI, New Delhi; Coal India Limited, Kolkata; NTPC Ltd., Noida; CMPDI Ranchi and NMDC Ltd., Hyderabad.

Attending to all environmental problems is an ongoing challenge for ICFRE and we will continue to regularly prioritise our activities and focus our available resources on the most critical issues of forests and climate change.

(Dr. Suresh Gairola)

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Contents

OVERVIEW

Overview

The annual report for the year 2017-18 is divided into 5 chapters namely Introduction, Research Highlights, Education Vistas, Extension Panorama and Administration & Information Technology. The Annual Report discusses about the projects undertaken by various institutes that have been grouped in the relevant sections of 5 chapters. All India Coordinated Research Projects (AICRPs)/ Multi Institutional Projects (MIPs) are presented separately.

The overall allotted budget for current financial year 2017-18 for Research, Extension and Education was Rs. 903.93 Lakh and the expenditure incurred was Rs. 865.02 Lakh.

Summary of projects*

Projects	Completed Projects	Ongoing Projects	New Projects Initiated During the Year
Plan	29	109	87
Externally Aided	08	126	34
Total	**37**	**235**	**121**

*Data provided under various research themes in similar tables may vary from this tally due to the multidisciplinary nature of the projects.

New initiatives:

ICFRE has issued guidelines during August, 2017 for organizing periodical seminars to discuss research status on identified topics which are important for improving the quality of research and its extension. It also gives an opportunity to share knowledge, ideas and provide an in-depth analysis of themes as well as future research directions for ICFRE. The details are given below:

- Institute level seminar- To be organised once in a month on one or more broad subjects/priority areas for half /full day. Officers/ Scientists of ICFRE and other organizations/stakeholders as required are invited for the meeting. The expected outcomes are i) identification of research needs ii) formulation of future strategies/roadmap iii) networking research options & opportunities.
- Regional research conference - It is organised once in a year in each of the 3 or 4 regions on major themes for one day. Officers/scientists and other stakeholders participate and the expected outcomes are i) status of knowledge ii) research needs iii) future directions/recommendations iv) networking research options & opportunities v) new concepts leading to new research projects.
- National research conference - It is organized by any of the ICFRE institutes, once in a year for one day on issues of national/contemporary significance. The expected outcomes are i) strategy paper on the subject ii) future directions/recommendations iii) networking research options/ opportunities and national level presence.
- Two Regional Research Conferences (RRCs) were organized:
  a) Regional Research Conference on 17 July, 2017 at IWST, Bengaluru.
  b) Regional Research Conference on 23 November, 2017 at AFRI, Jodhpur.

- 47 Monthly Research Seminars organized in ICFRE institutes.
- Establishment of Centre for Forest Policy Research at ICFRE
- Establishment of ICFRE Awards of Excellence in Forestry
- Establishment of ICFRE Outstanding Employees Award.
- Extension Strategy and Extension Action Plan for ICFRE
- HRD Plan for capacity building of the officials of ICFRE

Information technology initiatives

- ICFRE, Dehradun developed and hosted the application "Information System for Secretary Office" on live server. The URL of application is http://esttmgmtsec.icfre.org.
- ICFRE Dehradun developed and hosted the application "Online Office Records (Order/MoM/ Agenda etc) System on live server. The URL of application is http://records.icfre.org.

Some important research initiatives

- IFGTB, Coimbatore has released 30 clones of *Casuarina* and *Eucalyptus* so far and is actively promoting large scale cultivation of these high-yielding varieties by farmers.
- FRI, Dehradun has prepared a booklet on Butterflies of New Forest Campus, with colour photographs, text, maps, graphs and tables for 153 species of butterflies found in the campus over the last few decades.
- **Role of Nano-fillers in composite wood (FRI)**

  Study on role of nanofillers in composite wood has been initiated. Resin and Boards, with different nano-particle loadings have been prepared and evaluated for their physical and mechanical properties.
- **Nanocellulose networked natural fiber composites (IWST)**

  Nanocellulose networked composite materials have been developed with long and randomly oriented fibers from areca nut shell, jute and banana. The prepared composites can be used as biodegradable packaging material.
- **National programmes for conservation and development of forest genetic resources (FRI)**

  The activities of the projects are FGR documentation, FGR seed and germplasm storage, FGR characterization and FGR conservation.
- **Ethno-botanical study on indigenous medicinal and aromatic plants used by local people of Himachal Pradesh (HFRI)**

  A total of 213 species belonging to 172 genera and 79 plant families were inventorized under the project. Thirty high valued important medicinal plants were also geo-referenced. Some of these MAP's include *Aconitum heterophyllum*, *Berberis aristata*, *Crepidium acuminatum*, *Polygonatum multiflorum*, *Picrorhiza kurroa*, *Saussurea costus*, etc.
- An android based mobile application **"Poplar Keet"** has been launched for easy identification and management of insect pests of poplar.
- **Health status and age assessment of the trees of Rashtrapati Bhavan (FRI)**

  The older trees of the presidential estate were identified and their age was assessed. *Dalbergia sissoo* located at Bal Vatika was the oldest tree having the estimated age of 225 years. It was observed that two trees species *Manilkara hexandra* (Khirni) and *Pongamia pinnata* (Papri) recommended to be replaced. The trees in bad shape were recommended for removal and replacement with tall saplings.

- **Maintenance of important trees**

  The holy Bodhi tree at Bodhgaya, holy trees at Smriti Park, Patna and holy Pipal tree at Koteshwarnath Dham, Belaganj were regularly monitored for pathological, physiological and entomological problems and treatments were administered.

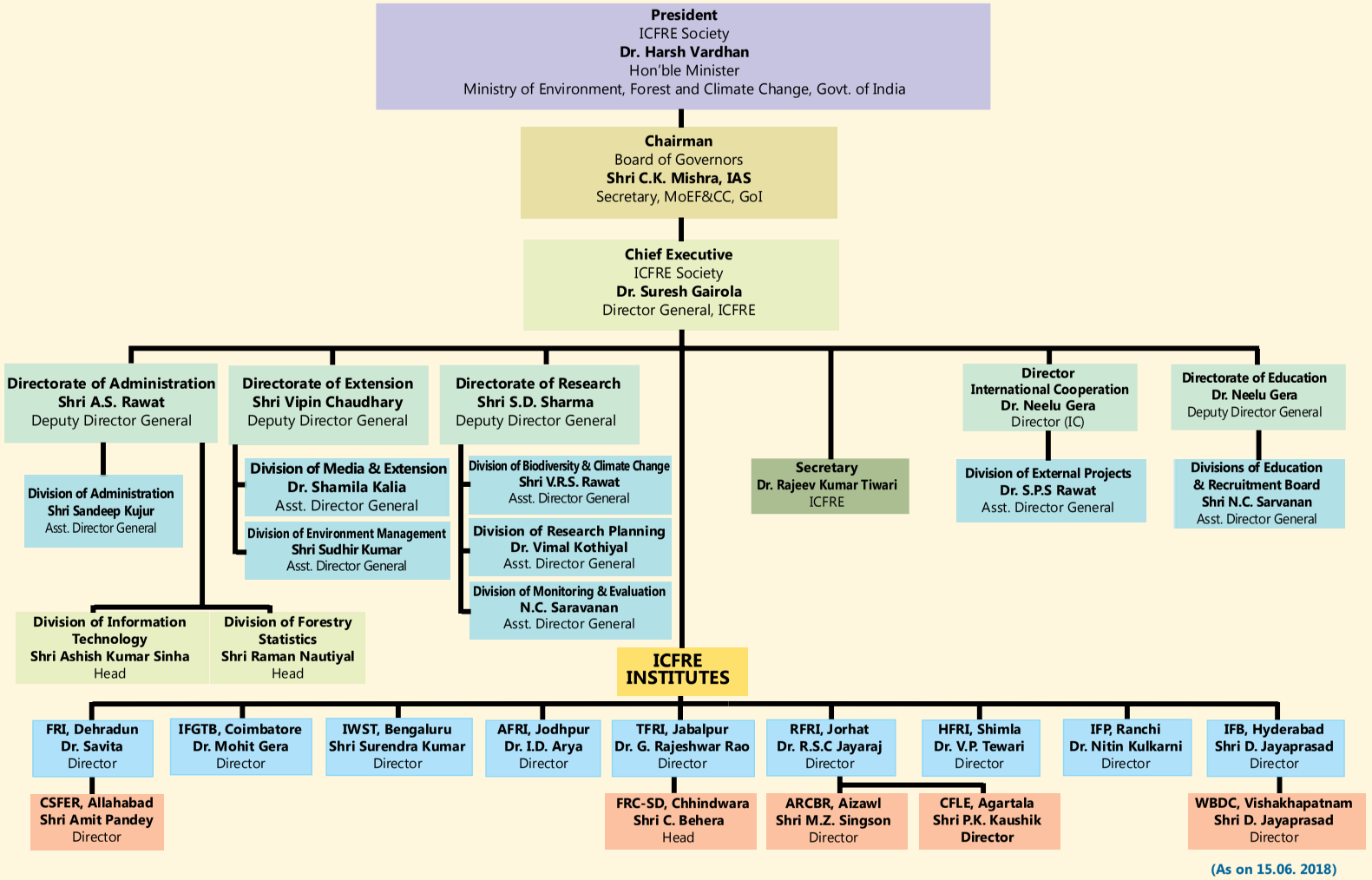
- **Climate change**

  The seedlings of forestry species such as *Grevillea robusta*, *Acacia auriculiformis*, *Shorea robusta* and *Gmelina arborea* were exposed to elevated levels of CO_2 concentration. *Grevillea robusta and Acacia auriculiformis* showed enhanced growth upto 800ppm CO_2, while *Shorea robusta* and *Gmelina arborea* showed enhanced growth upto 1000ppm and 1200ppm respectively.

- **Climate change vulnerability of Indian Forests**

  Vulnerability of Indian Western Himalayan Region (IWH) were analyzed.Studies showed that forests of Champawat, Pauri Garhwal, Bageshwar, Almora, Tehri Garhwal, and Dehradun districts of Uttarakhand, Rajouri, Poonch, and Kupwara of Jammu & Kashmir and Shimla of Himachal Pradesh are most vulnerable to climate change.

Organizational Structure of ICFRE Society



(As on 15.06. 2018)

01

INTRODUCTION

Introduction

01
CHAPTER

The Council

The 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. The Hon'ble Minister of Environment, Forest and Climate Change is the President of ICFRE society and the Director General is its Chief Executive. The General Body is the supreme authority of the ICFRE, headed by the Union Minister, Environment, Forest and Climate Change, Government of India. Its members consist of serving and retired officers from various state governments, educational institutes, and scientific organizations.

24th Annual General Meeting of ICFRE Society

Vision

Increasing forest cover and enhancing forest productivity through operationalisation of National Forestry Action Programme and National Forestry Research Plan.

Mission

To generate, preserve, disseminate and advance knowledge, technologies and solutions for addressing the issues related to forests and to promote linkages arising out of interactions between people, forests and environment on a sustained basis through research, education and extension.

ICFRE National Presence

Professional Support

ICFRE has extended networking with a number of national and international organizations to achieve greater outreach and cooperation through MoUs including following:

- ICFRE and The Energy and Resources Institute (TERI), New Delhi
- ICFRE and Zoological Survey of India (ZSI), Kolkata
- ICFRE and Technology Information, Forecasting & Assessment Council (TIFAC), New Delhi
- RFRI, Jorhat and Madhya Pradesh State Bamboo Mission (MPSBM), Madhya Pradesh
- IWST, Bengaluru and Indian Plywood Industries Research and Training Institute (IPIRTI), Bengaluru
- IWST, Bengaluru and Maharashtra Bamboo Development Board (MBDB), Nagpur
- RFRI, Jorhat and Tata Institute of Social Science, Guwahati
- RFRI, Jorhat and Central Muga Eri Research & Training Institute (CMERT&TI), Jorhat

ICFRE Signs MoU with TIFAC

ICFRE Signs MoU with TERI

New collaborations in pipeline

1. Botanical Survey of India (BSI), Kolkata.
2. Wildlife Institute of India (WII), Dehradun.
3. Indian Council of Agricultural Research (ICAR), New Delhi.
4. Navodaya Vidyalaya Samiti (NVS), Noida, Uttar Pradesh.
5. Kendriya Vidyalaya Sangathan (KVS), New Delhi.
6. University of British Columbia (UBC), Vancouver, Canada.
7. Indian Institute of Science (IISc.), Bengaluru.
8. Jaipur National University (JNU), Jaipur.
9. Anand Agriculture University, Gujarat.
10. Shree Raj Rajendra Basanti Devi Kishoremal Khimavat Charitable Trust, Rajasthan.
11. Kasetsart University (KU), Bangkok.

Visitors

- Shri Suresh Prabhu, Hon'ble Railway Minister, Govt. of India visited FRI, Dehradun on 13 May 2017.
- H.E. Mr. Philippe Le Gall, High Commissioner of Republic of Seychelles visited FRI, Dehradun on 23 June 2017.
- Dr. Harsh Vardhan, Hon'ble Minister, MoEF&CC, Govt. of India, New Delhi visited FRI, Dehradun along with senior officers of MoEF&CC including Shri Siddantha Das, DG(Forest), MoEF&CC, on 23 December 2017.

Shri Suresh Prabhu, Hon'ble Railway Minister, Govt. of India at FRI, Dehradun

Dr. Harsh Vardhan, Hon'ble Minister, MoEF&CC, Govt. of India, New Delhi at FRI, Dehradun

Visit of Shri C.K. Mishra, Secretary, MoEF&CC, Govt. of India, New Delhi at FRI, Dehradun

ALL INDIA COORDINATED RESEARCH PROJECTS (AICRPs)

MULTI INSTITUTIONAL PROJECTS (MIPs)

All India Coordinated Research Projects (AICRPs)

/Multi Institutional Projects (MIPs)

For addressing research issues of national importance in a holistic manner, ICFRE has embarked upon developing mega projects by utilizing its own strength and that of other organizations so that targeted outputs in a comprehensive manner could be achieved. For this, at the first instance, guidelines for the All India Coordinated Research Projects (AICRPs) were framed and released in August 2017 covering rigorous steps of conceptualization, formulization, screening and monitoring of projects.

Thirty three subject area/species of national importance were short listed. National Project Coordinators (NPCs) in the domain area were identified along with the lead Institutes. NPC prepared the AICRPs in consultation with scientists from ICFRE and other organizations. After rigorous scrutiny by Project Advisory Group (PAG), Project Expert Group (PEG) and Research Policy Committee (RPC), 22 AICRPs were recommended.

These AICRPs mainly cover species like Red sanders (*Pterocarpus santalinus*), Sandalwood (*Santalum album*), Bamboo (ten species of commercial importance), Casuarina (*Casuarina equisetifolia* and *C. junghuhniana*), Eucalyptus, Shisham (*Dalberia sissoo*), Tamarind (*Tamarindus indica*) and Teak (*Tectona grandis*). In addition to this, important subject like invasive species, forest fire, tree fodder, seed, assessment of demand and supply of timber, valuation of forest GDP, bio-prospecting of lesser known forest plants, silvicultural intervention for productivity enhancement, water budgeting, biopesticides, bio-fertilisers, forest soil health cards, dielectric heating of timber and nano-based wood composites are also covered under AICRPs.

Some more projects on Mahua (*Madhuca longifolia*), *Gmelina arborea*, poplar (*P. deltoides*), rosewood (*Dalbergia latifolia*), Neem (*Azadirachta indica*), combating desertification, seed production area, wild fruiting species, NTFPs, observational studies, rehabilitation of mined areas are under formulation and evaluation.

AICRPs that have been approved by RPC of ICFRE for the year 2018-19 are as follows:

Institutes	Status of AICRPs	
	Formulated and Presented in RPC 2018	Under formulations
AFRI, Jodhpur	00	03
FRI, Dehradun	07	01
HFRI, Shimla	00	00
IFB, Hyderabad	01	00
IFGTB, Coimbatore	08	02
IFP, Ranchi	00	01
IWST, Bengaluru	03	00
RFRI, Jorhat	00	00
TFRI, Jabalpur	00	04
ICFRE	03	00
Total (Rs. Lakhs)	**22**	**11**

National Program for Conservation and Development of Forest Genetic Resources: Pilot project on 'Creation of Centre of Excellence on Forest Genetic Resources (CoFGR)'at FRI Dehradun (FRI)

The activities of the projects are being executed through four Working Groups created within the strength of FRI viz. FGR Documentation, FGR Seed and Germplasm Storage, FGR Characterization and FGR Conservation. The progress made under these working groups in last one year is summarized hereunder:

A. FGR Documentation

1. Up-gradation of DD Herbarium

Herbarium of the Forest Research Institute, Dehradun which is internationally known as Dehra Dun Herbarium (DD) houses approximately 3,30,000 specimens from across the world, the oldest collection dates back to 1807.

A view of New Herbarium hall with state of art Compactors after furnish

Shifting of Herbarium specimens

2. Digitization of DD herbarium

DD herbarium offers a unique insight of flora of Asia and it is being digitized to make the herbarium data available to taxonomists worldwide.

3. Documentation of FGR species

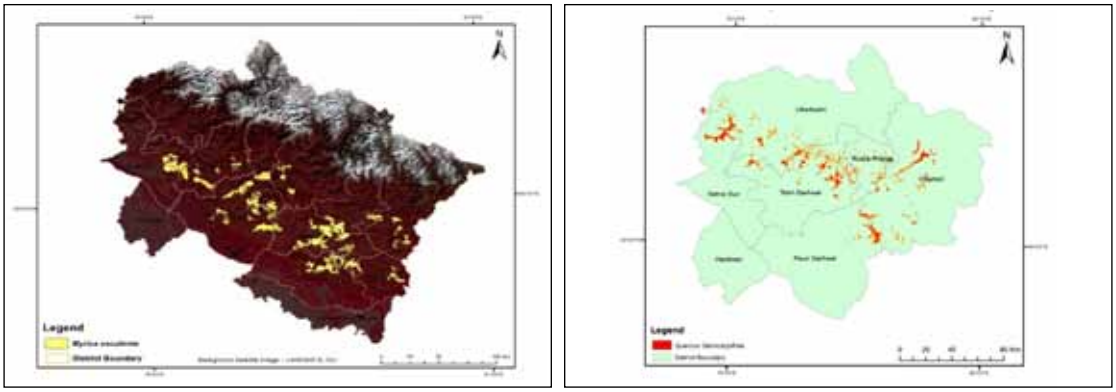
A list of 250 priority species (141- tree species, 29 shrubs, 15 lianas/woody climbers and 65 RET species) has been prepared for Uttrakhand. Out of which 50 species have been selected for the preparation of eco-distribution maps.

Collection of field data from Champawat Forest Division

4. Development of Eco-distribution maps of important FGRs

Eco-geographical mapping of forest tree species is an important aspect of germplasm conservation program as the conservation efforts are best aided by vegetation and land use maps. This is particularly important for those species which are co-dominant in occurrence, have sparse distribution and are under some kind of threat.

At present, 50 FGR species of Uttrakhand are being mapped through RS and GIS based tools. Some of the important species being mapped are *Betula utilis*, *Quercus semicarpifolia*, *Rhododendron arboreum*, *Taxus wallichiana*, *Myrica esculenta*, *Diploknema butyraceae* etc.



Myrica esculenta *Quercus semecarpifolia*

Eco-Distribution maps of *Myrica esculenta* and *Quercus semecarpifolia*.

B. FGR Seed and Germplasm Storage

It is intended to collect seeds of 90 important FGR species and their populations under this project for their long term storage and conservation.

Collaboration with NBPGR, New Delhi in germplasm conservation

Memorandum of Agreement (MoA) signed between Forest Research Institute, Dehradun and National Bureau of Plant Genetic Resources, New Delhi regarding long-term conservation of seed germplasm of FGRs at -18 °C in their Seed Bank.

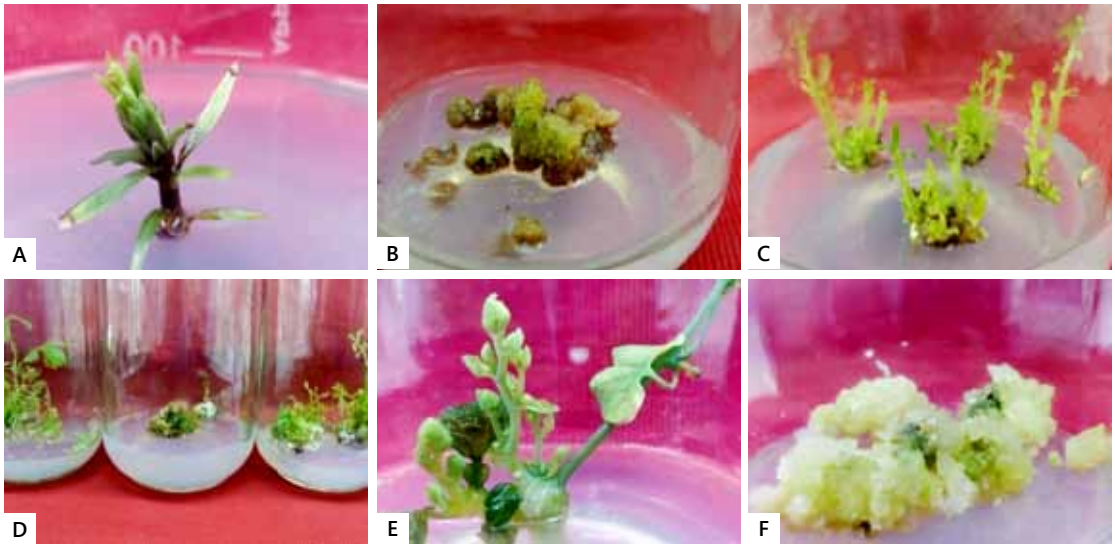
Signing MoA between FRI and NBPGR New Delhi

- Currently seeds of ten forestry species being processed for long-term conservation in consultation with team of scientists from NBPGR.

Seed Germination Test of FGR species

***In-vitro* storage of FGR species**

With an aim to conserve forest genetic resources (FGRs) of very high conservation concern or those having recalcitrant seeds or both, *in vitro* regeneration experiments have been initiated in order to achieve whole plant regeneration as well as medium term storage.



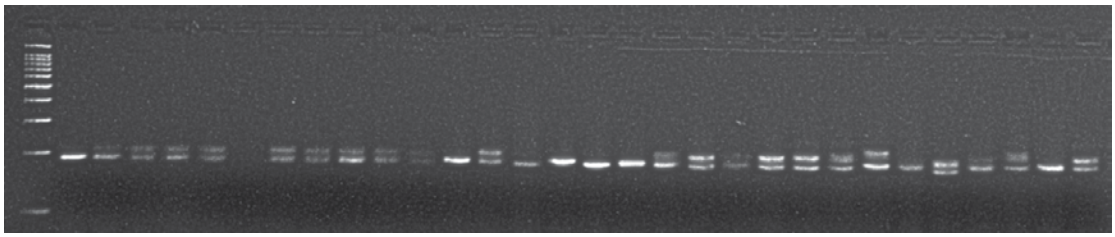
A- *In vitro* shoot elongation in *T. contorta*, B- Callus regrowth in *D. oojeinensis*, C-proliferation of in vitro cultures in *H salicifolia*, D- proliferation of in vitro cultures in *A. julibrisin*, E- proliferation of *in vitro* cultures in *A. punjabensis*, F-Callus culture in *P. eriocarpum*.

C. FGR Characterization

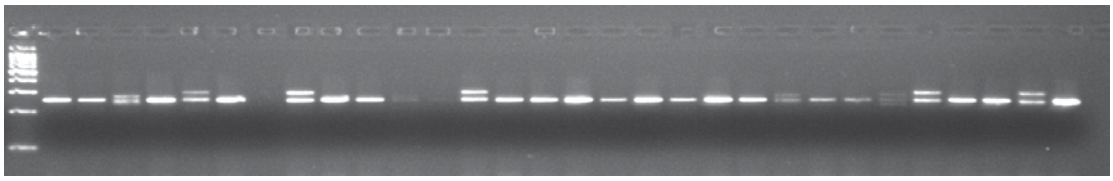
Six species have been prioritized for molecular characterization and genetic diversity estimation :

1. *Rhododendron arboreum* (Burans)
2. *Taxus wallichiana* (Thuner)
3. *Quercus semecarpifolia* & *Q. lanuginosa* (Kharsu oak and Banj Oak)
4. *Betula utilis* (Bhojpatra)
5. *Myrica esculenta* (Kafal)
6. *Diploknema butyreacea* (butter tree)

Samples of the selected species have been collected from their natural zone of occurrence and stored at -80˚C. The samples of these populations were segregated for chemical examination and DNA fingerprinting. DNA extraction protocol has been standardized for *Diploknemma butyracea*, *Rhododendron arboreum, Taxus wallichiana as* well as *Betula utilis*.Genotyping of the extracted DNA of the various populations is being carried out using robust polymorphic SSR markers. Chemical characterization/chemical marker(s) assisted screening of *Rhododendron arboreum* and *Myrica esculanta* is under process.



PCR profile of *R. arboreum* genotypes using SSR primer R460



PCR profile of *Q. semecarpifolia* genotypes using SSR primer CN627959

SSR genotyping of samples

D. FGR conservation

Five priority species have been short listed for FGR Conservation as per the target of the project. The species are *Cinnamomum tamala, Diploknema butyracea, Rhododendron arboreum, Myrica esculanta* and*Taxus wallichiana.*

Two nursery sites have been identified in District Tehri Garhwal and FRI Dehradun for multiplication of germplasm. Propagation techniques of *Cinnamomum tamala*, *Rhododendron arboreum, Myrica esculanta* and *Taxus wallichiana* have been standardized. Air layering has also proved effective in *Cinnamomum tamala and Diploknema butyracea* for their propagation. The source populations are being propagated through the standardized methods for the establishment of field gene banks.

Propagation of *Diploknema butyracea* through seeds as well as cuttings has been standardised

Cinnamomum tamala

Taxus wallichiana

All India Coordinated Project on *Melia dubia* Willd

• Genetic improvement of *Melia dubia* Willd

Melia dubia popularly known as Drake or Malabar Neem or Gora Neem has become an extremely important industrial wood, and is being grown largely by the farmers under various agro-forestry systems. Efforts on genetic improvement of *Melia dubia* by ICFRE were endorsed successfully by the Ministry of Environment, Forest and Climate Change, Government of India (MoEF&CC), when Variety Releasing Committee (VRC), released ten varieties of *Melia dubia* developed for commercial cultivation in Northern India.

The released cultivars, are extremely productive with excellent bole form, an essential aspect for plywood industries. The average productivity of released cultivars was reported to be 34.57$m^3ha^{-1}yr^{-1}$, maximum being 55.83 $m^3ha^{-1}yr^{-1}$ for the cultivar named as SHARAD and 40.41 $m^3ha^{-1}yr^{-1}$ for SHASHI.

The varieties have been recommended under irrigated conditions for different growing regions of Haryana, Punjab, Uttar Pradesh and Uttarakhand.

• Collection, conservation and evaluation of *Melia dubia* (Malai Vembu, Jangal Neem) Germplasm from North-Bengal, Orissa hills and other parts of India for identification and release of superior clones. (IFP)

DNA extraction protocol has been standardized using modifications in CTAB method and DNA extracted from 280 individual plants. Fifty SSR primers have been tested for amplification of the Melia DNA and all of the primers successfully amplified the DNA. Thirty Five SSR primers have been tested on 105 individuals belonging to 21 different genotypes

• Assessment of natural variability in selected wood traits using nondestructive tools and identification of superior genotypes of *Melia dubia* (IWST)

The effectiveness of non-destructive methods for assessing wood quality traits namely wood density and modulus of elasticity in standing trees have been established and superior genotypes based on morphological and wood quality traits has been identified in selected plantations of *Melia dubia*

- **Effect of management practices on wood quality of *Melia dubia* Cav (IWST)**

Assessment of physical properties and anatomical characterization in terms of fibre and vessel morphology of *Melia dubia* wood grown in unmanaged plantation was carried out. Assessment of mechanical properties is under progress.

- **Identification, pattern of distribution, proportion of tension wood and study of certain physical and anatomical characters in *Melia composita* Syn. *Melia dubia* Cav. wood of two different ages**

Anatomical properties such as vessel and fiber morphology of tension wood and normal wood, pattern of distribution, proportion of tension wood, moisture content, density shrinkage and air drying behaviour were studied.

- **Evaluation of genetic resources of *Melia dubia* in Tamil Nadu and Kerala for productivity enhancement in tree farming (IFGTB)**

Established about 12 ha of provenance resource stands, progeny trials, seed orchards and evaluation trials of *Melia dubia* (Malai veppu) to develop new high-yielding clones /seeds. Six clonal trials have been established in Tamil Nadu, Andhra Pradesh and Karnataka. A field gene bank of *Melia dubia* is being maintained in the Vegetative Propagation Complex.

All India Coordinated Research Project on TEAK

• Improvement of teak for higher productivity in central/peninsular India (TFRI)

Selection of plus trees, raising their progeny trials and establishing germplasm bank

Seeds were collected from M.P., Chhattisgarh and Odisha and progenies of 24 CPTs were raised. In addition to this, 12 new CPTs were selected in Chhindwara, Betul, Dewas, Hoshangabad, Jhabua and Khandwa and seeds were collected which are under treatment for germination and raising their progeny.

Selection of CPTs in Chhindwara (a & b) and (c) Dewas

• Development of management practices of teak seed production areas, seedling seed orchards and clonal seed orchards (TFRI)

14 Seed Production Areas (SPA), 11 Clonal Seed Orchards (CSO) and 8 Seedling Seed Orchards (SSO) located in M.P., Chhattisgarh and Maharashtra were selected. Asynchrony in flowering was noticed among clones, thus low to moderate seed production recorded in CSOs and SSOs. Flowering and fruiting status of 40 clones of CSO established show asynchrony in flowering among clones and low production of seeds in 35 clones. Analysis of soil samples reveals low level of Nitrogen, Phosphorus and Potash i.e. 70%, 25% and 54% samples respectively.

Seedling seed orchard at Katni (M.P.)

Clonal seed orchard at Erikpal (CG)

Seed production area at Pali (CG)

Teak seed orchard at Chandrapur (MS)

• Studies on population structure, linkage disequilibrium and marker-trait association mapping of Indian teak (TFRI)

Measured wood density, fibre length and breadth of 20 fibres/tree and 20 trees/zone. Genomic DNA from the selected thirteen zones (260 trees) was isolated, quantified and preserved. Genotyping of 13 zones was completed using 20 microsatellite (SSR) primers. Statistical analysis revealed that there is significant variation among the sampled teak populations for girth, tree height, clear bole height, wood fibre length, fibre breadth and basic wood density. Coefficient of variation for morphological traits was higher compared to the wood quality traits. This infers towards more stringent selection for wood traits compared to morphological traits for improvement.

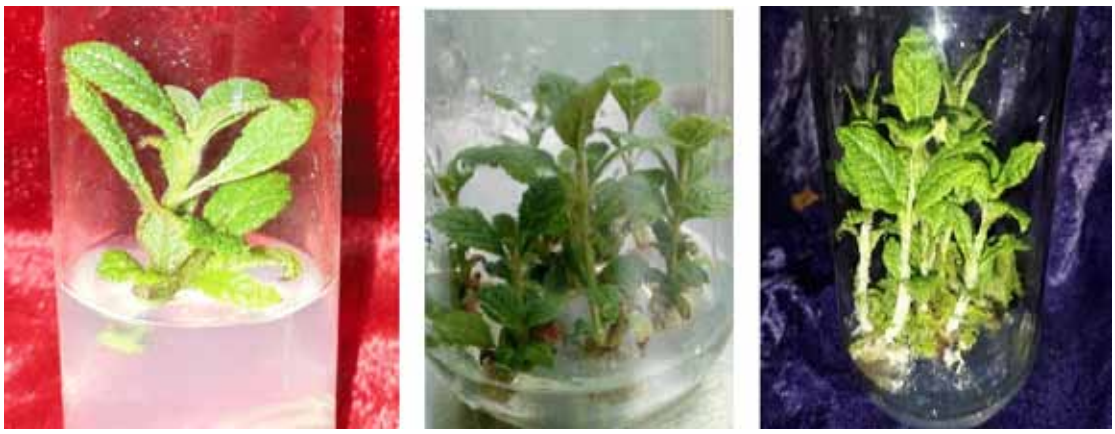
• Selection, evaluation, conservation and documentation of genetic resources of Teak and other important tree species for enhancement of productivity (IFGTB)

A total of 10 seed production areas (SPA) of Teak have been evaluated in Nilambur north and south divisions of Kerala. The morphological, phenological and geographical data have been recorded. Studies on genetic diversity of SPA are in progress

• Evaluation of progeny trials of *Tectona grandis* and production of improved planting stock tolerant to defoliator and leaf skeletonizer (TFRI)

Progeny trials established in Madhya Pradesh and Maharashtra with the objective to select clones of teak which are tolerant to defoliator and leaf skeletonizer and produce planting stock from them.

Progeny trials of *Tectona grandis* at (a) Moiyanala, (b) Seoni, (c) Chandrapur



***In vitro* shoots of *Tectona grandis* on MS medium supplemented with 2.22 µM BA and 1.16µM Kinetin**

• Documentation of population demography and genetic structure of teak for developing sustainable conservation strategies and resource management (IFGTB)

Natural teak populations harbour a variety of characteristics that determine their economic, ecological and environment importance. A draft genome of 317 Mb was assembled at 151x coverage and 36172 protein-coding genes were annotated. Genomic SSR markers developed

in this study have high potential in advancing conservation and management of teak genetic resources. Phylogeny studies confirmed the taxonomic position of the genus *Tectona* within the family Lamiaceae.

- **Comparative study on growth, wood quality and financial returns of teak managed under different agroforestry practices in Karnataka (IWST)**

Five teak trees from partially managed line and 10 trees from unmanaged block plantation were harvested and converted into planks and scantlings. Total biomass (upper ground and below ground) of teak trees from two agroforestry practices and grown in the same locality was estimated. Shrinkage, density and moisture content of both type of plantations were evaluated.

All India Coordinated Project on Capacity Building on Taxonomy (AICOPTAX) on Tettigoniidae of India (IFGTB)

Exploration of Tettigoniids in Karnataka, Kerala and Tamil Nadu is being undertaken under All India Coordinated Project on Tettigoniids. The occurrence and diversity of long horned grasshopper, Tettigoniids in different habitats under different agro climatic zones were studied. Thirty three tettigoniid species belonging to five sub-families were identified.

Himertula kinneari

Euconocepha lusincertus

• Taxonomic study of Tettigoniidae (Orthoptera) of India (TFRI)

306 insect specimens belonging to the family Tettigoniidae from more than 138 sites representing four habitat types such as grasslands, agriculture land, forest and plantations in different agro climatic zones of Madhya Pradesh, Chhattisgarh, Rajasthan, Gujarat and Maharashtra were collected and processed as per the standard entomological procedure and preserved for identification.

Tettigoniidae in grassland at Hoshangabad, M. P.

Tettigoniidae in grassland at Mandla, M.P.

• Taxonomic study of Tettigoniidae (Orthoptera) of India (RFRI)

A total of 78 tettigoniids were collected from various habitat types viz., forestlands, grasslands, agriculture land and wastelands of Assam, Meghalaya, Nagaland and Arunachal Pradesh of which 10 are identified so far.

All India Coordinated Research Project/ MIP on Bamboo

• Bamboo genetic evaluation, improvement and propagation (IFP)

Culm and culm branch cuttings have been collected from 9 superior clumps of *D. strictus* (Lathi bans) and 3 of *B. tulda* (Taral bans) from IFP Germplasm Bank established under Phase I of the project activity. The treatment of 2mM Indole 3 butyric acid was found superior in both the species with 55 and 60% plantlet production. More than 3000 numbers of plantlets from identified CPCs were produced

Prepared plantlets of bamboos

Technologies developed : Rooting of culm cuttings 2 mM IBA treatment with 55% and 60% plantlet production in *D. strictus* and *B. tulda* (Taral/ Phoka Bans) respectively.

• Bamboo genetic evaluation, improvement and propagation: Phase II (IWST)

Germplasm banks of *B. bambos* (Indian thorny bamboo), *D. stocksii* (Marihal bamboo), *D. brandisii* (Burma bamboo) and *D. strictus* (bans) have been maintained in Gottipura field station of IWST, Bangalore. Micro-propagated plants through axillary shoot proliferation of some promising genotypes of *D.stocksii, D. brandisii, D. asper D. strictus* have been produced.

• Technical support for the establishment and maintenance of Hi-tech bamboo nursery and germplasm bank at Habhavi, Belgaum Research Range (IWST)

Around 100 CPCs of *D. stocksii* transported from Bangalore and germplasm bank established at Habhavi, Belgaum Research Range. Also provided training in establishment and maintenance of vegetative propagation center (VPC) for bamboo propagation in Belghavi.

• Evaluation of germplasm of *Dendrocalamus stocksii* for growth, biomass production and quality parameters for selection of superior genotypes (IWST)

Germplasm bank of *Dendrocalmus stocksii* established at two locations, were *in-situ* evaluated non-destructively using ultrasonic technique for bamboo quality, mainly modulus of elasticity and hollowness. A significant variability was observed in assessed parameters at both locations which will help in identifying superior clumps/genotype.

• Establishment of small bamboo nursery at IWST under BTSG

200 seedlings *of B. bambos* at Nagrur nursery, 100 rooted cuttings of *G. aungustifolia* at IWST nursery, 4000 rooted cuttings of *D. stocksii* (Marihal bamboo) 1000 seedlings of *D. brandisii* (Burma bamboo), 300 seedlings of *D. asper* (sweet bamboo), 15,000 seedlings of *D. strictus* (Bidru erect variety), 12,000 seedlings of *Oxytenanthera parviflora* (Hill jati). 500 Tissue cultured (TC) plants of *D. asper* have been raised so far in IWST campus nursery and in Nagrur nursery of IWST.

• Thermal modification of bamboos for improving various properties and value-added applications (IWST)

Bamboo culms of *D. stocksii, D. strictus* and *T. oliveri* graded in terms of outer diameter were air-seasoned. Physical and mechanical properties of untreated *D. strictus* control were determined. Bamboo culms were heat treated at 160-220°C for 1-2 hours duration. Testing of physical properties such as density, shrinkage, water absorption of heat treated bamboo completed.

• Bamboo genetic evaluation, improvement and propagation (TFRI)

Germplasm bank established and maintained in the Silviculture nursery of the institute. 6000 number of plants of four species viz, *Bambusa tulda, B. vulgaris, B. bamboos and Dendrocalamus strictus* were produced of which 2000 plants were sold.

Production of *Bambusa tulda* using cuttings of different girth class

• Bamboo genetic evaluation, improvement and propagation (RFRI)

Macro propagation through primary, secondary branch and culm cutting treated with different concentrations of hormones was carried out. In *Dendrocalamus hamiltonii* and *Bambusa nutans* the results were satisfactory. However the results for *Bambusa tulda* were not satisfactory.

• Commercial production of quality planting material of bamboo species (RFRI)

To promote use of superior planting material for plantations, *in vitro* mother cultures of a superior genotype of *Bambusa tulda* were supplied under a non-exclusive licence agreement signed between RFRI, Jorhat and Devleela Biotechs, Raipur which is a commercial plant tissue culture laboratory recognised by Department of Biotechnology, Govt of India under National Certification System for tissue culture raised plants (NCS-TCP).

• Commercial production of quality planting material of bamboo species (FRI)

Capacity building and two trainings of stakeholders for mass multiplication of the cultures of *Bambusa balcooa, B. nutans, Dendrocalamus strictus, D. asper* conducted. More than five thousands plants prepared for germplasm distribution under National Bamboo Mission.

• Development of tissue culture protocol for economically important bamboo- *Schizostachyum dullooa* (AFRI)

Plant material and nodal segment collected. Shoots proliferated from offsets established. Proliferated shoots were sub cultured on fresh MS medium supplemented with cytokinin after 4 weeks of inoculation. The proliferated shoots were excised and transferred in fresh MS medium supplemented with BAP for *in vitro* shoot multiplication. Large scale *in vitro* shoot multiplication is in process.

• Standardization and popularization of treated bamboo products in Ericulture

Production of Eri silk is an important commercial activity in the northeast. For cultivation of silkworms and keeping the cocoons, structures of bamboo were being used. However, due to short life of bamboo, plastic structures are being introduced. To reduce the use of plastics and to increase the life of bamboo structures use of treated bamboo is being popularized under this project. Twenty five silk producers have been trained in bamboo treatment and production of products used in ericulture. One thousand products are also being made for supply to silk producers.

Treated bamboo products in Ericulture

Coordinated Research Programme on Agar (*Aquilaria malaccensis* Lamk.) (RFRI)

Sixteen provenances were delimited based on geographic barriers to gene flow. Fruits were collected from 14 locations of Assam and Arunachal Pradesh, and progeny from 67 families were raised in the nursery for progeny trials. Inoculation of fungal isolates in *Aquilaria* trees was carried out following different treatment combinations, and induction of Agarwood was noticed after one month of inoculation. Macropropagation trials indicated that maximum rooting was observed in medium of vermiculite : sand (1:1) treated with different concentrations of IBA.

Agarwood formation

Comparison of agarwood formation in T_2, T_3 and T_4

Seedlings at nursery

Sprouting of *A. malaccensis* of branch cuttings

- **Development of commercially viable induction system for *Aquilaria malaccensis* and management of Agarwood production in humid tropics of Karnataka (IWST)**

Aquilaria malaccensis (Agarwood) grown plantation areas in the humid tropics of Karnataka were used as experiment plots. Isolation and identification of desired fungal strain known to induce agarwood was carried out in 40 pure cultures. Out of 40 pure cultures from soil samples of Karnataka, 12 cultures were selected based on their morphology and potential to induce agarwood. These cultures were inoculated in a 9 year old plantation area in Shringeri. The inoculation was coupled with the stress induction treatments like girdling, branch pruning and root pruning. It was observed that 4 cultures out of 12 showed promising results in terms of infection in agarwood trees. The same were subjected to sporulation developed in the form of commercial kit for agarwood induction.

02

RESEARCH HIGHLIGHTS

Research Highlights

02
CHAPTER

2.1 Ecosystem Conservation and Management

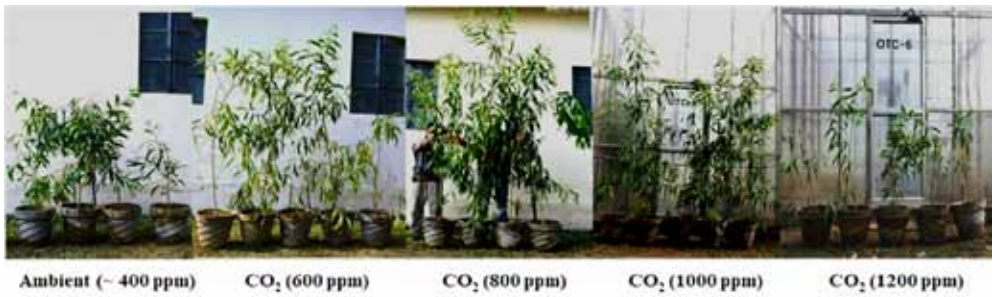
Projects under the Theme

Projects	Completed Projects	Ongoing Projects	New Projects Initiated During the Year
Plan	3	18	5
Externally Aided	12	17	10
Total	**15**	**35**	**15**

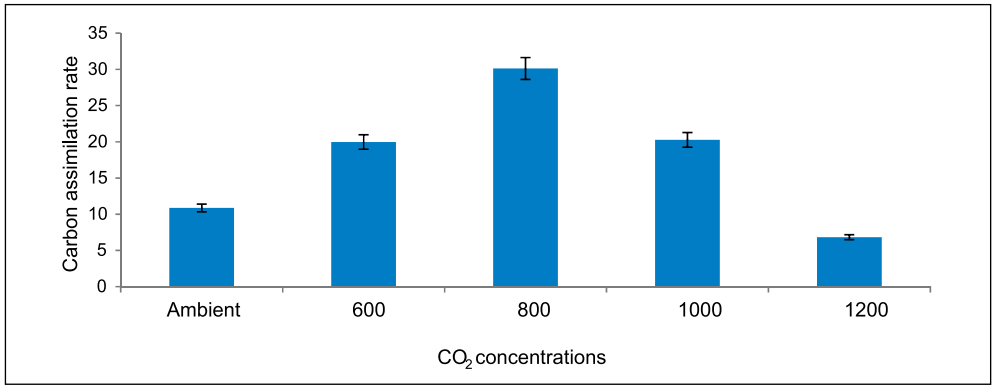
2.1.1 Climate Change

Study on adaptive response of plants to elevated CO_2 conditions (FRI)

The seedlings of forestry species such as *Grevillea robusta, Acacia auriculiformis, Shorea robusta* and *Gmelina arborea* were exposed to elevated levels of CO_2 concentration i.e., ambient, 600, 800, 1000 and 1200 ppm in open top chamber conditions to study the adaptive response of plants to elevated CO_2 conditions, to analyze their CO_2 sequestration rate. Species showed increased growth under elevated CO_2 level. Growth varied from species to species. *Grevillea robusta* and *Acacia auriculiformis* showed enhanced growth upto 800 ppm CO_2, while *Shorea robusta* and *Gmelina arborea* showed enhanced growth upto 1000 ppm and 1200 ppm respectively.



Effect of elevated CO_2 concentrations on growth of *Acacia auriculiformis*

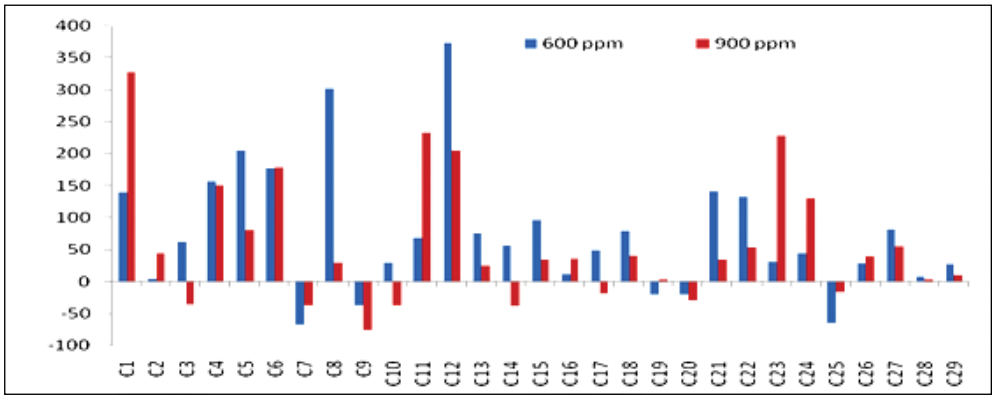


Climate change vulnerability of Indian Forest (FRI)

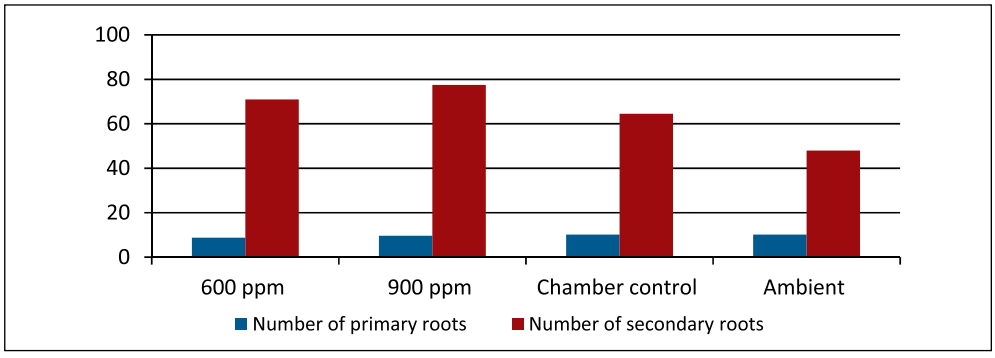
Vulnerability of Indian Western Himalayan Region (IWH) were analyzed by using simulations of Joint UK Land Environment Simulator (JULES) vegetation model under projected climate change scenarios of CORDEX South Asia regional simulations of REMO2009 forced with Coupled Model Intercomparison Project Phase 5 (CMIP5), Atmosphere-Air General Circulation Model (AOGCM) for the Representative Concentration Pathway (RCP) 4.5 (mid-range emissions). Undisturbed species rich forests were found to be resilient to climate change. As per the models, alterations in phenology, impact on regeneration and upward movement of species were identified as major impacts of changing climate on forests. Under the present scenario forests of Champawat, Pauri Garhwal, Bageshwar, Almora, Tehri Garhwal, and Dehradun districts of Uttarakhand, Rajouri, Poonch, and Kupwara of Jammu & Kashmir and Shimla of Himachal Pradesh are most vulnerable to climate change.

Screening tree species for intra-specific variation in carbon sequestration potential under elevated CO_2 (IFGTB)

Studies have shown that different tropical tree species exhibit varied growth in response to elevated CO_2. Clones of eucalypts (Safeda), Casuarina (Jungli saru) and teak (Sagaun) selected for higher productivity are being further screened for C sequestration potential under ambient and elevated CO_2 levels. Selection of clones adapted to elevated CO_2 levels can be used for future breeding programmes aimed at developing 'climate change ready genotypes'. Preliminary results show intra-specific variation in growth of the species to elevated CO_2.



Increase or decrease in total dry weight (%) under different levels of CO_2 as percentage over that of ambient grown respective clones of *Casuarina equisetifolia*



Number of primary and secondary root production under elevated CO_2 in *Casuarina equisetifolia*

Carbon sequestration through afforestation at Rourkela Steel Plant, Odisha (TFRI)

Plantation comprising of 12 tree species, having higher carbon sequestration potential was raised at Rourkela Steel Plant in four hectares. After two years, the plantation stocked 28.6 t carbon in the form of above and below ground biomass. Highest carbon sequestration was recorded in *Peltophorum pterocarpum* (19.51 kg per sapling), followed by *Melia azedarach* (18.54 kg per sapling) and *Neolamarckia cadamba* (18.32 kg per sapling).Training programme on 'Carbon sequestration through afforestation' was organized at Rourkela Steel Plant on 8-9 November 2017 for capacity building of the stake holders,30 officers of SAIL from Durgapur, Bhilai, Bokaro, Burahnpur, Ranchi, Rourkela and officials from Odisha state forest department attended the training.

Plantation raised by TFRI at RSP

Studies on the effects of MPOWER programme on mitigation and adaptation towards climate change in western Rajasthan-Phase II (AFRI)

Assessment was undertaken to study the impact of project implementation, of "Mitigating Poverty in Western Rajasthan (MPOWER)" towards community-based adaptation to climate change in Sirohi, Pali, Jalore, Jaisalmer, Jodhpur and Barmer district of Rajasthan. People of the project area are chiefly dependent on agriculture and animal husbandry for livelihood. Promotion of vegetable and fruit cultivation, fertilizer and seed distribution, use of sprinkler etc., helped in increasing income of farmers. Adaptive agriculture using crops resilient to drought and heat stresses, increased water availability through canal, revival of traditional rain water harvesting structures '*Saran*' and water-efficient irrigation added to climate change adaptation. Distribution of energy efficient stoves, LPG and solar cooker has decreased use of biomass as fuel.

People interaction (left) and plantation of *Punica granatum* (pomegranate) as climate change adaptation (right)

High Altitude Transition Zone in Himachal Pradesh (HATZ); long term studies to assess the effects of global warming and trails to rehabilitate degraded sites in this zone (HFRI)

Floristic diversity of High Altitudinal Transistional Zone (HATZ) range (3400-3900m above msl) was recorded at five sites in Kinnaur and Chamba district of Himachal Pradesh region. 418 plant species belonging to 225 genera and 59 families were documented. The collected germplasm of threatened medicinal plants is being maintained at Western Himalayan Temperate Arboretum (WHTA), Potters Hill, Shimla for *ex-situ* conservation. 350 herbarium sheets were prepared, and submitted to the Interpretation Centre (APCCF Office, Sundernagar). The findings of the present study will contribute as a baseline for future studies on global warming and climate change.

Dhel Thatch (Kullu) 3600m-3800m

Chakah (Kalpa-Kanda) 3700m-3900m

REDD+ Himalayas: Developing and using experience in implementing REDD in the Himalayas (RFRI)

The project is being undertaken as the pilot study for implementation of REDD+ in the Himalayan region under the auspices of Integrated Mountain Development (ICIMOD). Awareness programme on climate change and REDD+ was organized for stakeholders in collaboration with State Forest Department. Training and workshops on Monitoring, Reporting and Verification of REDD+ was conducted in project villages. Drivers of deforestation and forest degradation were identified through stakeholders meetings. Shade grown coffee plantations was initiated, to retain the forest cover. A solar dryer of 150 kg. capacity was installed for turmeric growers, in Reiek village, to wean them away from shifting cultivation.

Inauguration of solar dryer at project site

2.1.2 Ecology & Environment

Identification and reclamation of 10 hectares of degraded land & biodiversity development at NCL, Singrauli, Madhya Pradesh (FRI)

Model plantations for Eco-restoration of mine spoils were undertaken at Nigahi and Krishnashila project site of Northern Coalfields Limited, Singrauli. 14,000 plants of different species including horticulture species have been planted in an area of 10ha (5 ha at each site). *Dalbergia sissoo, Azadirachta indica, Emblica officinalis, Bauhinia variegata, Albizia lebbeck,* and *Albizia procera* were among the most successful species in the plantations. Grasses like *Pennisetum purpureum, Pennisetum pedicellatum, Cymbopogon martini, Cenchrus ciliaris, Cenchrus setigerus, Arundo donax* have been widely and successfully propagated in the site which has led to the enrichment of the soil nutrient. Horticulture species such *Mangifera indica* (aam), *Syzygium cumini* (jamun), *Emblica officinalis* (aonla) and *Psidium guajava* (amrud) have successfully adapted to the prevailing site condition. The faunal species such as birds, butterflies, insects and mammals have also been found to visit the ecological restoration sites.

Transfer of technology for eco-restoration of mine spoils to the stakeholders

The technology for eco-restoration of mine spoil developed by ICFRE and institutes is being extended to the stakeholders. FRI is providing technical support and assistance to BCCL for ecorestoration of OB dumps/mined out areas (44.0 ha) as a technical advisor/ expert. FRI is also preparing Road-map for ecological restoration work in Coal Mines of NCL, Singrauli.


Preparation of seed mixed soil balls


View of restored overburden site

Research to assess performance of pelletized sandal seeds in nursery and field for comparative performance assessment of pelletized, non-pelletized and planted seedlings in the field (IFGTB)

IFGTB is working on nursery and plantation technique of *Santalum album*. Mature fruits of *Santalum album* were collected from Marayoor (Kerala), Bangalore (Karnataka) and Coimbatore (Tamil Nadu), seedling vigour tests revealed that Kerala seed source are superior to Tamil Nadu and Karnataka. Seed pelleting composition of GA3 (500ppm for 24hours) +PVP (1g in 10 ml water) + Charcoal (2g/100seeds) was found to be most suitable, *Trichoderma viridae* was identified as most suitable bioinoculant. Host specificity experiments were conducted using different nurse plant with Sandal. The three shortlisted suitable hosts identified were *Pithecellobium dulce*, *Duranta repens* and *Casuarina junghuhniana*. Pilot trail for field establishment of sandal has been initiated at IFGTB.

Phytoremediation of soil for productivity enhancement during land disposal of effluent (AFRI)

Survey was conducted on effluent disposal along the river basin Jojari in Jodhpur and Bandi in Pali districts. Effluents, soil and plant samples were collected from effluent disposal area and analyzed for different physico-chemical parameters. Plantation in field (split plot design) and lysimeter experiment (CRD) have been maintained by applying different treatments. Growth data in field (yearly basis) and lysimeter experiment (monthly basis) was recorded.

Application of effluents leads to increase in soil pH, EC, NH_4-N, NO_3-N and PO_4-P. Plantation of *Prosopis juliflora*, *Salvadora persica* and *Azadirachta indica* improved the soil quality and showed enhanced growth when irrigated with effluent water and bore well water in ratio of 3:1. These plants also accumulated the heavy metals like, Cr, Ni, Cu, Se, Cd, Pb, Mn and micronutrients Mg, Fe, Co and Zn found in the effluent water.

Experimental plantation in lysimeter (left) and field condition (right) utilizing treated wastewater

Assessment of carbon stock and carbon sequestration potential of major land use sectors in Nagaland and Upper Assam. (RFRI)

As part of a nation-wide programme to map carbon under agriculture, forestry and other land uses (AFOLU) studies were undertaken by RFRI in Nagaland and Upper-Assam. Preliminary observations carried out in major land uses revealed that soil organic carbon (SOC) in Nagaland ranged from 42.5 to 141.8Mg ha^{-1}. Land use like terrace cultivation and plantation were recorded high SOC stock per unit area. In Upper Assam SOC stock ranged from 38.5 Mg ha^{-1} in Eastern Alluvial Secondary Semi Evergreen forest to 48.4 Mg ha^{-1} in Assam Valley Tropical Wet Evergreen forest. Land use with high SOC were tea garden with 53.4 Mg ha^{-1} and horticulture with 43.4 Mg ha^{-1}. Highest SOC was recorded in East Himalayan Moist Mixed Deciduous Forest (141.8 Mg ha^{-1}).

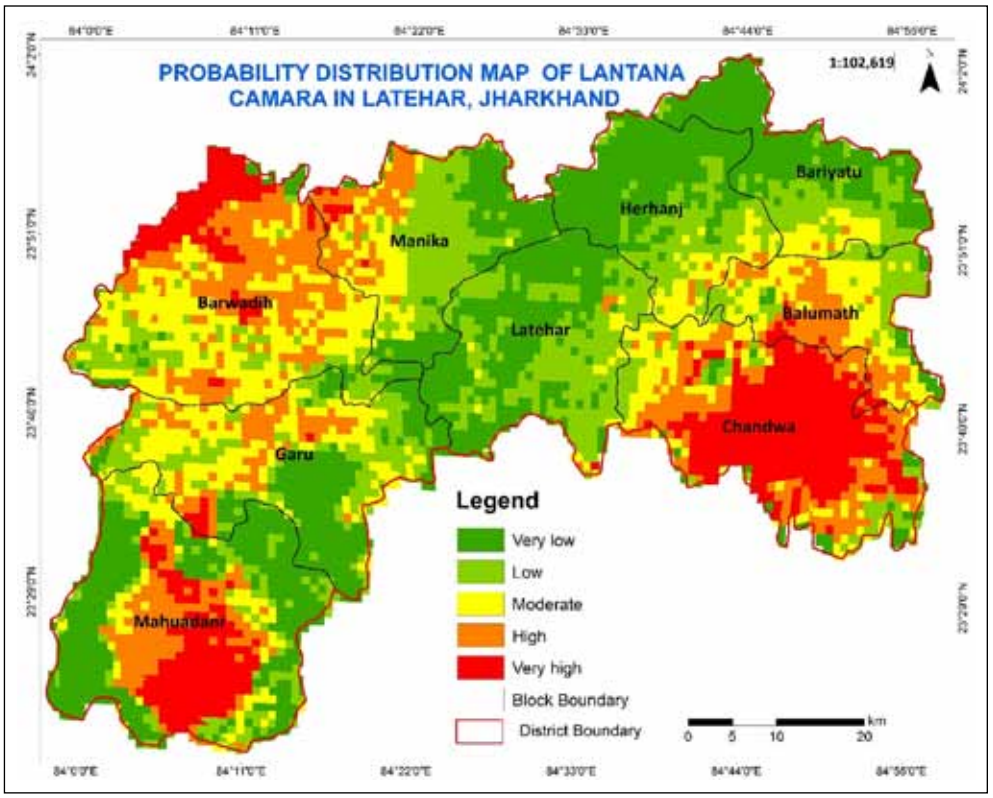
Terrace cultivation in Nagaland

Collection phyto-sociological data of a dense forest in Upper Assam

Risk assessment of *Lantana camara* (Putush) using spatial distribution modelling approach in Latehar district (IFP)

On the basis of field data collected from *Lantana* invaded sites of Latehar districts,base layer was prepared using Environmental Niche Model for 19 environmental variable and 6 geographical variables using Bioclim and SRTM-DEM.

Model simulation using MAXENT showed probable distribution map of *L. camara* for Latehar district. The study has been extended to other sites in Hazaribagh, Bokaro, Godda, Dumka, Sahebganj and Pakur districts of Jharkhand.



Probability distribution map of *Lantana camara* in Latehar, Jharkhand

2.1.3 Biodiversity

Study-cum-survey to assess the demand and supply of medicinal plants in India-in the national perspective, as well as in respect of the international market (ICFRE)

Important research findings of the project are given below:

- The total demand of herbal raw drugs, estimated 5,12,000 MT for the year 2014-15, is expected to grow to 6,50,000 MT by the year 2020.
- The estimated consumption of herbal raw drugs by the domestic herbal industry grew from 1,77,000 MT in 2004-05 to 1,95,000 MT in 2014-15.
- Total number of 907 medicinal plant species were recorded in consumption of domestic herbal industries out of which 198 species were recorded in active consumption which constitute 95% of the total consumption. Remaining 709 medicinal plant species constitute only 5% of the total consumption.

Butterflies associated with different forest types/ sub-types in Uttarakhand (FRI)

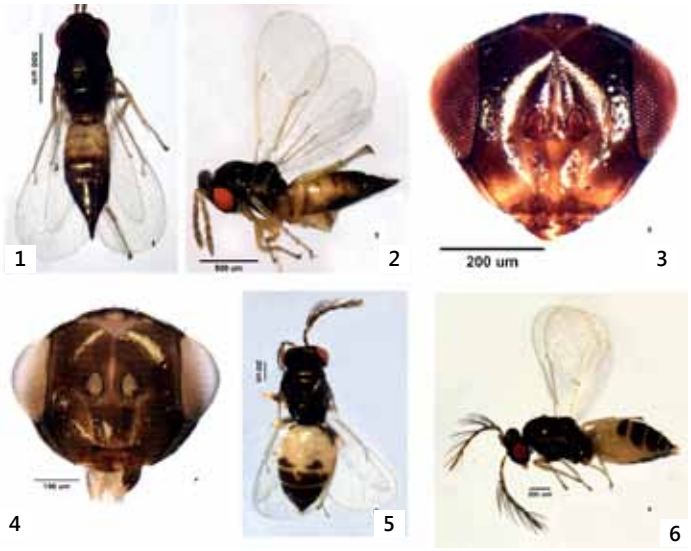
Data was collected on 127 species of butterflies associated with 9 forest sub-types in Garhwal, (Uttarakhand). Barred Wood brown, *Lethe maitrya* de Nicéville. (Lepidoptera: Nymphalidae: Satyrinae) was determined as typical of species found in the forest sub-type "12/C1e Moist Temperate Deciduous Forest" in Kedarnath Musk Deer Reserve while Tiger Wood brown, *Orinoma damaris* (Gray) (Lepidoptera: Nymphalidae: Satyrinae) was determined as associate of ringal bamboo *Arundinaria falcata* in 12/C1a Ban oak forest in Garhwal.

Barred Woodbrown, *Lethe maitrya*

Tiger Woodbrown, *Orinoma damaris*

Digitization and enrichment of National Forest Insect Collection (NFIC) of Forest Research Institute-Phase-II (FRI)

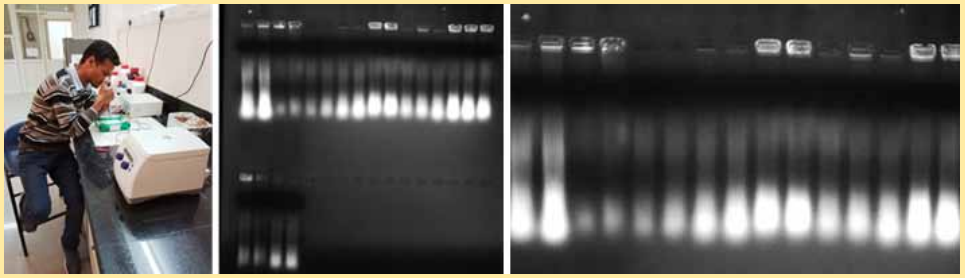
National Forest Insect Collection (NFIC) database is being updated and digitized for creation of virtual NFIC. A new species *Aprostocetus doonensis* Singh, new to science was described.Taxonomic clarification and neo-type designation for three Indian xyleborine species was done.



Aprostocetus doonensis **Singh sp. nov.(1) Female in dorsal view; (2) Female in lateral view; (3) Female head in frontal view; (4) Male head in frontal view; (5) Male in dorsal view; (6) Male in lateral**

Bio-piracy Cell, FRI: Molecular characterization of selected medicinal plants of Uttarakhand

Samples of *Aconitum heterophyllum*, *Aconitum balfourii* (meethavish) and *Dactylorhiza hatagirea* (hatajari, salempanja) were received by Bio-piracy Cell, FRI pertaining to illicit trade. Fresh samples of the plants were collected from their natural habitat. DNA has been extracted from the samples received from the Bio-piracy Cell and fresh samples. Barcoding of the samples is being carried out



Assessment of plant biodiversity of Silent Valley Buffer zone (IFGTB)

Survey was conducted in the buffer zone of Silent Valley National Park, Plant species growing in the buffer zone were enumerated, and 310 specimens belonging to 144 species were collected from the buffer area for Herbarium preparation and identification.

Antistrophe serratifolia **- an endemic species from Buffer zone of Silent Valley National Park**

Syzygium laetum **- an endemic species from Buffer zone of Silent Valley National Park**

Taxonomic study of Orthoptera of Tamilnadu (IFGTB)

Orthoptera diversity study has been conducted in different habitats (forestlands, grasslands, arable lands and wastelands) under seven agro climatic zones of Tamil Nadu. 68 species of Orthoptera representing 51 genera from 4 families were indentified during the survey.

A mobile application for identification of Orthoptera of Tamilnadu has been developed using 13 main key characters.

Aularches scabiosus

Teratodes monticollis

Acanthoprion suspectum

Preparation of user-friendly data-base of phyto-diversity in Satpura plateau agro-climatic zone of Madhya Pradesh (TFRI)

Database of 1468 plant species recorded from Satpura agro-climatic zone has been prepared on the basis of field survey and available published information. Digitization of the data is being undertaken for Keyword based search and retrieval. Digital herbarium of the Satpura eco-region with interactive user-friendly interface will be made available at web portal of TFRI and MP forest Department.

Digitization of forest floral wealth of Haryana (FRI)

Botany and Forest Informatics Division of Forest Research Institute, Dehradun has developed an online digital plant database of 444 ligneous plants (214 trees; 178 shrubs and 52 lianas) along with high quality digital photographs of live as well as herbarium specimens under the project *'Digitization of Forest Floral Wealth of Haryana'*. The data base is interactive and allows user to identify the plant on the basis of morphological features like habit, colour and arrangement of flowers on the floral axis, leaf type, leaf shape, fruit type, bark type etc. The digitised flora is available at the website http://haryanaforestflora.in/

Documentation of flora and insect fauna of mangrove ecosystems in Odisha (TFRI)

Flora and insect Fauna of Bhitarkanika National Park were surveyed.10 species of true mangroves, 7 species of mangrove associates and one species of back mangrove were documented. 25 species of butterflies, 7 species of moths, 2 species of dragonflies, 1 species of beetle, damsel fly, honey bee, ant, grasshopper and stick insect were recorded from the National park.

Documentation of biodiversity of forest fungi of central India (TFRI)

Total 210 fungi were collected out of them 113 fungi were collected and identified from forest areas of Madhya Pradesh, Chhattisgarh, Maharashtra and Odisha. Two new species of fungi (*Cercospora spigeliae* R.K. Verma sp. nov. and *Cheilymenia jabalpurens* R.K. Verma sp. nov) were identified. Five species were reported for the first time from India (*Amanita bisporigera*, *Boletellus chrysenteroides*, *Lepiota ignivolvata*, *Macro cybecrassa* and *Tricho loma equestre*). In addition to these 3 new host records of fungi were also identified.

Assessment of biological diversity and people perception for developmental plan and awareness generation in different community reserve areas in Jodhpur (AFRI)

The study aims towards conducting awareness for conservation and protection of wildlife outside the protected areas, in community lands like Oran, Gauchar and even the agricultural lands in Western Rajasthan. An interactive workshop with native communities was organized in October 2017. Species composition of these community lands were studied. Gauchars with trees like *Salvadora oleoides*, *Capparis* sp., *Acacia tortilis* and *Prosopis juliflora*; Orans dominated by *Ziziphus nummularia* and *Posopis cineraria;* agriculture lands with *Prosopis cineraria*, and forest lands dominated by *A. tortilis* attracts a host of wildlife.

Diversity of insect pollinators and their role in fruit/ pod production of *Acacia senegal, Capparis decidua* and *Prosopis cineraria* (tricuta) in Rajasthan (AFRI)

Foraging behaviour of insect pollinators on the inflorescence of *Acacia senegal*, *Prosopis cineraria* and *Capparis decidua* was studied. 16 insects were identified to pollinate *Acacia senegal*, while *Prosopis cineraria* and *Capparis decidua*, were pollinated by 11 pollinators each. Among these, the most abundant pollinator in *Capparis decidua*, *Acacia senegal* and *Prosopis cineraria* were *Apis florea* among Hymenopteran insect.

Assessment of Floristic Diversity in protected areas of Himachal Pradesh (HFRI)

Assessment of floristic diversity was undertaken in Tundah and Kibber Wildlife Sanctuaries of Himachal Pradesh. Altitudinal variation in species composition was observed. About 62 plant species of medicinal value and 12 threatened plants were recorded from the study sites at Tandhi Dhar, Mumber Dhar and Badgram in Tundah Wild Life Sanctuary, and 52 plant species (06 shrubs and 46 herbs) were recorded from Badang, Langza, Komic, Demul, Dhinam, Gate and Chichham in Kibber Wildlife Sanctuaries.

Biodiversity, Habitat Association and GIS Mapping of Noctuid moths (Noctuidae: Lepidoptera) of chirpine forest of Jammu Province (Jammu & Kashmir) India. (HFRI)

Survey was conducted in chirpine forest of Jammu province for the collection of moth samples. 203 specimens of 57 Noctuid moths were collected. Data on distributional status has been subjected to statistical analysis to determine the spread and abundance of different moth species. Associated floral elements were also studied for habitat mapping of the moths. Geographical information of collection sites had been taken for GIS mapping.

Assessment, Documentation and Characterization of Lichen diversity in Mizoram, North-East India (RFRI)

A total of 171 species of lichens have been documented from Mizoram. Old-growth forests are more diverse in lichen diversity, short-rotation Jhum practice are the only perceived threat to lichen diversity in Mizoram.

Assessment, Documentation and Characterization of Lichen diversity in Tripura (RFRI)

Field surveys were conducted in South Tripura, 67 species of lichens were identified to be growing in forest areas. Maximum diversity of lichens was found at Jampui hills at an altitude of 961 m above msl. The most abundant genus was *Cryptothecia striata* found on barks of trees followed by *Dirinaria aegialita* found on rocks and bark. The dense forests had folicolous lichens such as, *Strigula elegans* and *Calopadia puiggarii*.

Parmotrema tinctorum

Cryptothecia striata

2.1.4 Forest Botany

Biodiversity, Regeneration life-history feedback of forest communities in response to canopy openings under selection cum improvement (SCI) felling system and life (TFRI)

Study of Phyto-sociology and population structure from the identified coupes was carried out before felling operation. Effect of canopy species composition on the regeneration and species assemblage under teak forest reveals that the species diversity in the canopy facilitates the diversity of the flora under the canopy.This kind of habitat heterogeneity leads to lower density of the individuals and becomes a limitation for teak regeneration.

Carrying out regeneration studies in a teak forest before felling under SCI system

2.1.5 Tribals and Traditional Knowledge System

Exploration and utilization of wild mushroom diversity in Mizoram (RFRI)

Field surveys were undertaken at Reiek, Sialsuk, Zongaw, Kawrthah, Ngengpui and Murlen forests of Mizoram. 157 mushroom species have been collected, of which 71 species have been identified and documented. Surveys were conducted at different village markets to document the traditional knowledge on wild mushrooms. Three species of mushroom *Neotia lubrica*, *Calabaria miniata* and *Helvella atra* were reported for the first time from the study area.

Off season mushrooms available at Mizoram market

Leotia lubrica ***Clabaria miniata*** ***Helvella atra***

New-records of macro-fungi from Mizoram

Biodiversity of Satpura agro-climatic region with special reference to dependencies of tribals (TFRI)

Survey was conducted seasonally in selected sites of Satpura plateau. Data on available NTFPs (harra, baheda, chironji, aonla, mahua, bhilwa) in the selected sites was collected. Traditional healers identified 6 insect species *(Polistes carolina* Linn**.**, *Trombidium grandissimum* Koch, *Oelophyllas maragdina* Fab**.**, *Apis dorsata* Fab., *Hieroglyphus banian* Fab. and *Microtermes obesi* Holmgren) of medicinal importance. 14 species of fungi were also collected from the study area, four species viz. *Termatomyces* sp., *Sparassis crispa* and *Agaricus campestris* were edible.

Market survey of aonla, bhilwa, baheda and mahua at Betul

Market survey of aonla and chironji at Chhindwara

2.2 Forest Productivity

Projects under the Theme

Projects	Completed Projects	Ongoing Projects	New Projects Initiated During the Year
Plan	4	17	3
Externally Aided	7	8	3
Total	**11**	**25**	**6**

2.2.1 Silviculture

Data on export of carved out wood products in North India (FRI)

A study of ten wood carving centres covering U.P, Uttarakhand, Punjab, Rajasthan and Jammu & Kashmir has been taken up. Rs. 30 crore worth wooden products are exported from Nagina (U.P.) to various countries giving employment to 10,000 people in 1400 manufacturing units of carving industry. About 20 trucks/ day (1 truck=200 quintals) raw material is used in Nagina and Saharanpur centres. The amount of wooden article exports from Jodhpur and Saharanpur are approximately Rs 1500 crore and Rs 400 crore respectively. The ratio of export outside India and sale in domestic market is 9:1. USA, Canada, Spain, Japan, Taiwan, Philippines and Gulf countries are the major importers.

Development of tools, techniques and methods for enhancing REDD+ forest management (FRI)

Based on studies in Madhya Pradesh, Himachal Pradesh and Sikkim, the following have been standardized:

i. methodology with respect to biophysical characteristics of forested areas
ii. methodology for socio-economic characterization of the local forest dependent communities
iii. quantification and assessment of various drivers of forest degradation and deforestation, including geo-spatial analysis method of direct and indirect, planned and unplanned drivers of degradation and deforestation
iv. method for forest carbon assessment.
v. a set of silviculture and forest management strategies

The standardized tools, techniques and methods can be scaled up for use in different forest types in the country

Demand and supply status of wood in Punjab (FRI)

A study of 96 timber markets spread over all forest divisions in Punjab yielded the following data about demand and supply of wood in the state of Punjab:

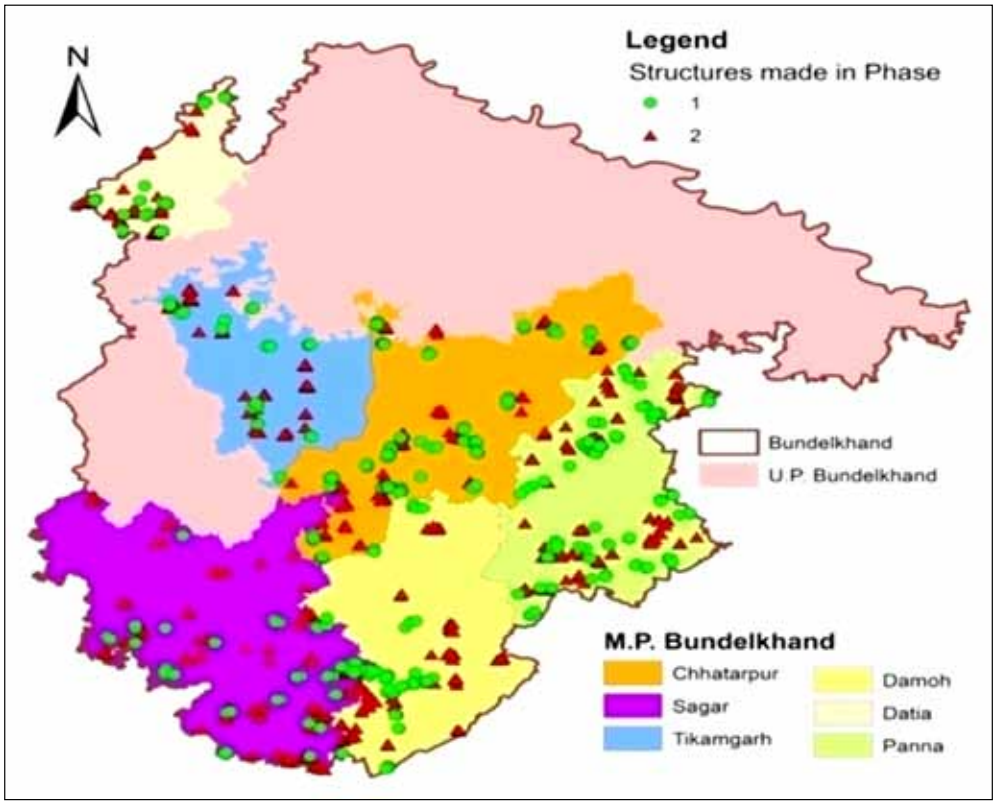
The total availability of timber and fuel wood in the state was 37,24,162 m^3 and 8,53,272 m^3 respectively. The timber included 29,84,425; 1,93,650 and 5,46,087 m^3 of state produce timber, ISIT and IIT respectively. The timber quantity from state grown produce included 61,134 m^3 of government forest production and 29,23,291 m^3 from ToF. A total of 3,93,750 m^3 timber was supplied to Yamunanagar (Haryana). The demand figures for timber and fuel wood were estimated at 30,16,155 m^3 and 8,53,272 m^3, respectively.

Seed pelleting techniques for commercially important tree species (IFGTB)

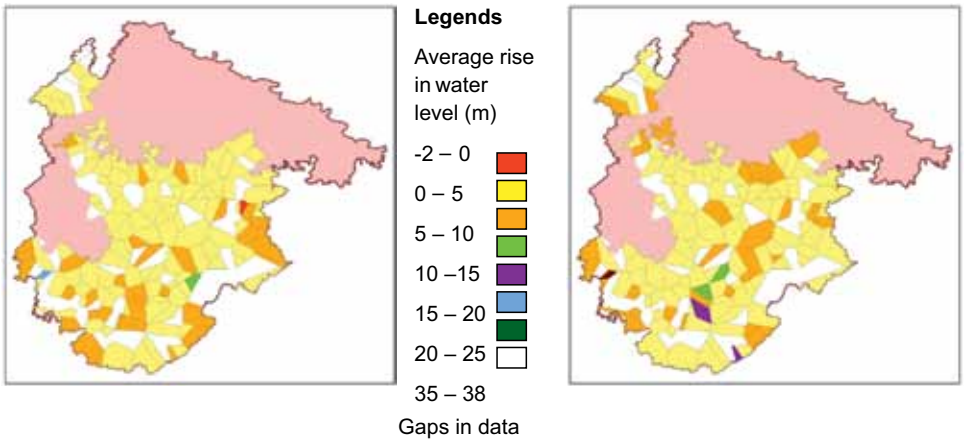
Seed pelleting is being studied for mass rapid aerial sowing or direct dibbling of seeds of important plantation species viz. *Aegle marmelos*, *Albizia lebbeck*, *Sapindus emarginatus Gmelina arborea*, *Acacia nilotica*, etc. Appropriate concentrations of bioinoculants viz. *Trichoderma viridae* and phosphorus solubilizing bacteria were worked out. Binder, filler material, priming and pretreatment were standardized for seed pelleting.

Impact of water harvesting structures on soil moisture in Bundelkhand (TFRI)

The study was undertaken to quantify changes in vegetation, surface water body and ground water level due to construction of water harvesting structures under Bundelkhand Special Package (2011-16) in six districts of Madhya Pradesh *viz*. Chhatarpur, Datia, Damoh, Sagar, Tikamgarh and Panna. Change detection in groundwater level was done between pre-development (years 2005-10) and post-development (years 2011-16) phase of the scheme for pre-monsoon and post-monsoon periods using groundwater observation well data and GIS technique.



Location of constructed water harvesting structures in Bundelkhand region of Madhya Pradesh during Bundelkhand special package



Average rise in water level during the months May to November in the years 2005-10

Average rise in water level during the months May to November in years 2011-16

Studies on seed germination and nursery technology of *Anogeissus pendula* (AFRI)

Seeds from 28 seed trees of *Anogeissus pendula* (Dhok) were sown in mother bed at AFRI nursery. Germination initiated within 6-7 days and completed in 30 days period. Various germination enhancers (growth enhancers, i.e. IBA, GA_3, IAA) were also used. In laboratory condition, seeds were sown in sterilized coarse sand medium after treatment with growth enhancers along with a control. In laboratory condition, highest germination (10.79%) was recorded in seeds collected from Desuri of Pali district without any treatment of growth enhancers (control). Growth enhancers did not enhance germination percentage. Highest germination (2.11% percent) was in seeds collected from Sirohi after treatment with IBA. In field condition, best germination (5.73%) was observed in seed lot collected from Parasram Mahadev with GA_3 treatment and 4.49% for seeds collected from Desuri without any treatment.

Root trainers (150 and 300cc) and poly bags (12x25cm, 15x25cm and 16x20cm) were used for filling potting mixture of 1:1:1 and 1:1:2 (Sand: Soil: FYM). The best seed sources were sown in mother bed and seedlings were transferred to polybags and root trainers having different potting mixtures at 3-leaf stage. Seeds collected from all sources were tested for their germination percentage, rate of emergence and germination index. Data are being processed for further analysis.

***Anogeissus pendula* seed germination in nursery beds**

Spatio-temporal landuse patterns at rural-urban interface and the relationship between green areas and biophysical features (IWST)

Field survey and marking of the 23 sample plots in the northern transect of Bengaluru along urban rural gradient was completed. Growth observations were recorded. There were 64 tree species of 32 families in urban area, 37 species of 19 families in sub-urban area and 56 species of 22 families in rural area. This indicates that tree species richness decreases from urban to rural. The procedure for analysis of leaf samples for Air Pollution Tolerance Index (APTI) has been standardized.

Evaluation of windbreaks for climate change resilience in farmlands (IFGTB)

Five productive clones of *Casuarina junghuhniana* (Jungli saru) released by IFGTB and suited for wind break agroforestry were deployed as windbreak in semiarid regions of Tamil Nadu. Red gram was planted with and without the windbreak. The crop lodging was prevented inside the windbreaks and the yield of red gram realized was 1.5 times of that observed outside the windbreaks.

Crop lodging prevented by windbreaks established with IFGTB-windbreak clones

Crop lodging in open field without windbreaks

Development of *Gmelina arborea* based agroforestry system (TFRI)

Five years old *Gmelina arborea* was intercropped with *Curcuma longa* (turmeric), *Zingiber officinale* (ginger), *Asparagus racemosus* (satawar) and *Piper betel* (paan).

Plantation of *Curcuma longa* under *Gmelina arborea* at TFRI, Jabalpur (M.P.)

Crop yield and gum production in *Acacia senegal* based traditional agroforestry system (AFRI)

Sample plots of *Acacia senegal* (kumath) with densities viz. 10-20, 20-30 and 30-40 trees/ ha were laid out at nine sites in Rajasthan. Reduction in crop yield was greatest (44.9 %) at 30-40 trees/ha and least (30.5%) at 10-20 trees/ha. Economic return from intercrop in *A. Senegal* based agroforestry was highest from guar (crop Rs. 4360/ha) followed by bajra (Rs. 1357-3290/ha) while economic return from moth was least (Rs. 634 /ha). Ethophon was injected in *A. senegal* trees to enhance gum arabic production; gum arabic yield ranged between 25 and 1270 g per tree depending upon treatment.

Effect of trees on soil fertility and crop production (AFRI)

116 tree-crop combinations covering 12 crops in kharif season, 7 crops in rabi season, 7 horticultural species and 12 silvicultural species were studied in different agroclimatic zones of Rajasthan.

Crop yield reduction was the lowest in *Prosopis cineraria* (khezri) based agroforestry where it was 17.3% (averaged over the crops) as compared to the sole crops. About 50% observation showed highest crop yield at canopy edge of *P. cineraria*. Reduction of crop yield was greater (75.6%) at 1 m distance from the tree trunk of *Salvadora oleoides* (Meetha Jaal) as compared to sole crop followed by *Prosopis juliflora* (Vilayati Babul, 74.9%), *Acacia tortilis* (Israili Babul, 71.8%), *Mangifera indica* (Mango, 59.0%) *Azadirachta indica* (Neem, 58.5%) and *A. nilotica* (Deshi Babul, 56.7%). Crop yield reduction was less in *P. cineraria* (28.5%) at 1 m distance from tree trunk as compared to sole crop followed by *A. nilotica* var. *cupressiformis* (41.5%). Reduction of crop

yield at canopy edge was 46.6% with *S. oleoides*, 37.6% with *P. juliflora*, 31.5% with *A. tortilis*, 23.6% with *D. sissoo*, 23.4% with *A. Senegal*, 22.7% with *T. undulata*, 21.8% with *A. indica* and 21.5% with *Z. mauritiana* than under sole crop.

Economic return was highest (Rs. 132500/ha) in paddy/wheat with *Acacia nilotica*, followed by cotton/wheat with *Dalbergia sissoo* based agri-silvi system (Rs. 121070/ha) in Shriganganagar under irrigated condition. It was lowest (Rs. 565-12922) in hyper-arid regions of Churu and Barmer districts. Crop failure in some sites due to very low rainfall in hyper-arid region resulted in low or negative economic returns. Economic return of *Psidium guajava* (Guava) based agri-horti system was highest (Rs. 126653/ha/annum) in Sawaimadhopur district followed by grafted *Zizyphus mauritiana* (Ber) (Rs. 106750/ha/annum) and *Punica granatum* (Pomegranate) (Rs. 89503/ha/annum) in Barmer district under irrigated condition.

Native plant growth promoting rhizobacteria for crop productivity enhancement in jhum fields (RFRI)

Performance of native plant growth promoting rhizobacteria (PGPR) isolated from the jhum fields of Nagaland was studied in a field trial using six PGPR strains of *Bacillus* sp, *Pseudomonas fluorescens* and *Azospirillum* sp. The consortium consisting of all the three strains showed the best results in terms of grain and biomass yield.

Application of biofertilizers in paddy fields of Lonhkhum village, Mokokchung

Biofertilizer field trial in wet terrace paddy fields in Khonoma village

2.2.2 Forest Soils & Land Reclamation

Post-fires impact on soil properties and microorganisms in Chirpine and Oak forests (FRI)

The soil nutrients and vegetation were assessed in unburnt (pre-fire), burnt (post-fire) areas after fire and also control fire in the *Pinus roxburghii* (chirpine) and *Quercus leucotrichophora* (ban oak) forests in Garhwal and Kumaun Himalaya. 205 soil samples and 132 bulk density samples were collected from different soil depths of fires affected areas. The effects of fire on soils were found to vary with fire intensity and duration of combustion. Preliminary findings revealed that soil pH and soil organic carbon increased in fire affected areas as compared to unburnt (pre-fire) areas. No major changes occurred in post-fire areas for available N, P, and K in first seasonal soil sampling.

Variation in soil respiration (FRI)

Soil samples were collected from *Dalbergia sissoo, Tectona grandis, Shorea robusta*, mixed forest, *Pinus roxburghii, Cedrus deodara* and *Quercus leucotrichophora* in winter season and CO_2 concentration and CO_2 emission were recorded. Soil organic carbon content ranged from 0.82 to 5.04 per cent with highest in *Quercus leucotrichophora* forest and lowest in *Dalbergia sissoo* forest. Bulk density ranged from 0.88 g/cm^3 to 1.48 g/cm^3 with highest in *Dalbergia sissoo* forest and lowest in *Quercus leucotrichophora* forest. CO_2 concentration ranged from 421 to 467 ppm with highest in *Shorea robusta* forest and lowest in *Tectona grandis* forest. CO_2 emission varied from 0.05 to 0.19 g CO_2/ m^2/hr with highest CO_2 emission in *Shorea robusta* forest and lowest in mixed forest.

Soil nutrient pool and microbial studies under different forest types in Uttarakhand Himalayas for sustainable management (FRI)

Deterioration in soil and vegetation cover has adversely affected the forest areas of Uttarakhand as the result of extreme climatic conditions in the region. Soil and vegetation survey were conducted in different forest Beats, Ranges and Divisions for soil nutrient pool studies under different forest types in Uttarakhand. 254 soils and 168 bulk density samples were collected from Chirpine *(Pinus roxburghii)*, Kharsu oak *(Quercus semecarpifolia)*, Alpine, Sub-alpine, Silver fir (*Picea smithiana*), *Rhododendron* sp., Ban oak (*Quercus leucotrichophora)* forests, Deodar (*Cedrus deodara*), *Taxus bacata*, Moru oak *(Quercus floribunda*), Himalayan pastures and miscellaneous forests of Haridwar Forest Division. Soil samples were processed for laboratory analysis and 97 soil samples were analysed for pH, EC, Soil Organic Carbon, Nitrogen, Potassium and Phosphorus. 28 soil samples were analysed for texture (% of Sand, Silt and Clay) and 56 samples were analysed for Bulk density and Coarse fragments in *Pinus roxburghii* and *Quercus semecarpifolia* forests of Tons and Upper Yamuna Forest Divisions. Preliminary findings revealed that the pH of soil ranges from 5.20 to 6.40 to *Pinus roxburghii*, *Quercus semecarpifolia* forests in Tons and Upper Yamuna Forests and *Shorea robusta* forests in Dehradun Division. Soil organic carbon (SOC) ranges from 0.26% in *Pinus roxburghii* in Tons and Upper Yamuna Forests, *Shorea robusta* forests in Dehradun to 7.90% in *Quercus leucotrichophora* forests of Chailusen beat of Lansdowne Forests Division. The available contents of N, P, and K ranges from 0.0056% to 0.041%, 0.0010% to 0.0025%, and 0.003% to 0.038% for *Pinus roxburghii*, *Shorea robusta* and *Quercus semecarpifolia* forests of Uttarakhand respectively.

Soil carbon sequestration potential in permanent preservation plots (IWST)

Survey of five permanent preservation plots (PPPs) was carried out in wet evergreen and moist deciduous forests in central Western Ghats of Karnataka. Soil samples collected across the three soil depth i.e. 0-5cm, 5-15cm, 15-30 cm in Katlekan PPP revealed soil carbon in the range of 2.10 to 3.04% and nitrogen content in the range of 0.13 to 0.27%.

Impact of tree harvesting on soil in canal side plantations of Indira Gandhi Nahar Pariyojana (AFRI)

Soil samples were collected from plots comprising four species viz. *Acacia tortilis* (Israeli babool), *Acacia nilotica* (Babool), *Eucalyptus camaldulensis* (Safeda) and *Dalbergia sissoo* (Shisham) in canalside plantations of Indira Gandhi Nahar Pariyojana collected. All the soil samples were slightly basic in nature with pH ranging from 7.65 to 8.55. Organic carbon varied between 0.23% and 0.41% being highest in *A. tortilis* plantation. SOC, NH_4-N, NO_3-N and P were higher in plantations than outside plantation. Significant increase in electrical conductivity was observed in *E. camaldulensis* and *D. sissoo* plantations.


Canal side stand of *Dalbergia sissoo* (left) and data recording in the study plot (right)

Enhancing fodder productivity through silvipastoral system on degraded land of India (AFRI)

***Colophospermum mopane : Cenchrus ciliaris* Silvipastoral trial**

Earlier studies at AFRI during 2003-08 revealed that exotic glycophytic tree species *Colophospermum mopane* (Mopane) is an ideal species maintaining high survival (89 %) and growth in arid environment after five years of establishment and its roots penetrated the $CaCO_3$ kanker pan**.** However, it did not suppress the growth of indigenous salt tolerant low palatable grasses like *Sporobolous diander, Chloris virgata* and *Dactyloctenium sindicum* and *D. aegyptium*. Hence, this investigation was undertaken to introduce non-salt-tolerant and highly palatable grass *Cenchrus ciliaris* in the inter-row spaces of *C. mopane* growing at a spacing of 4 m x 3m. There were 18 blocks of 9 trees between which soil was raised mound of 90 cm x 120 cm x 25 cm size. Seed sowing of *C. ciliaris* was done on the bund slope in inter-row spaces of *C. mopane* in 2013.

C. ciliaris established in 3 years and now converted into a silvipastoral system. There were 12 grass species in the area. Height and green yield recorded for 7 species were: *Sporobolus diander* (106.6 -60.4 cm, 578 g), *Dactyloctenium aegytium* (46.0-22.5 cm, 300.0 g), *Chloris virgata* (52.0-31.0 cm, 282 .3 g), *Digitaria didactyla* (50.5-29 cm, 256.5 g), *Brachiaria ramose* (53.0-28.0 cm, 256.6 g), *Dactyloctenium sindicum* (51-27 cm, 152.2 g), and *Cyperus* spp. (33.4-19.5 cm, 147.6 g). Analysis of soil pH, EC and organic carbon was also conducted.


***C. ciliaris* 75 with *C. mopane* (left) and Other grasses with *C. mopane* (right)**

***Suaeda nudiflora* - *Pennesetum typhoides* silvipasture trial**

Suaeda nudiflora is an evergreen, highly salt tolerant shrub endemic to coastal regions throughout the world and also occurs on mud flats along sea coast/saline soils in Gujarat state. *S. nudiflora* seedlings planted in August 2013 at a spacing of 4m x5m on double ridge mounds were established well with 64.5% .

Bajra variety HHB-67 (IMP) was successfully sown in the inter row spaces of *S. nudiflora*. Vegetation status on plant bunds evaluated in September 2017 showed the presence of 18 plant species, including 10 grasses. Findings suggest that these saline silvipastoral systems could provide an alternative capacity of fodder buffer and allowing sustainable production of grass even in low rainfall years.

Adaptation and mitigation measures in relation to shortening of jhum cycle (RFRI)

Soil microbes were isolated from traditional jhumlands of Nagaland. Real Time PCR (qPCR) analysis of soil samples led to identification of 15 bacterial isolates using 16S rRNA partial gene sequencing.

Changes in Soil Quality and Carbon Buildup under different land use systems (RFRI)

The major land uses were studied viz. forest, plantations, jhum, fallow jhum and tea garden. The maximum amount of soil organic carbon was found in tea gardens followed by forests. The conversion of natural forest to jhum reduces the SOC stock significantly. The conversion of fallow jhum to tea garden or plantations improved SOC. In jhuming, the soil quality in terms of nutrients is the highest immediately after conversion of the forests to jhum land. However, with one or two years of cultivation the soil quality is reduced. The soil quality improves during the fallow phase.

2.3 Genetic Improvement

Projects under the Theme

Projects	Completed Projects	Ongoing Projects	New Projects Initiated During the Year
Plan	7	37	11
Externally Aided	22	27	8
Total	**29**	**64**	**19**

2.3.1 Conservation of Forest Genetic Resources

Conservation, improvement and bioresource development of sandalwood (*Santalum album* L.) (IWST)

Young, mature and semi mature leaves and core sample from the *Santalum album* (Sandalwood) trees were collected from 31 locations in 14 states across India, Genetic diversity was assessed using 15 ISSR primers for 390 genotypes and by 5 SSR primers for 196 genotypes. Core samples from 168 trees aged between 8 to 35 years and girth class ranging between 30 to ≥ 80 cm were extracted at breast height (1.37m) using Haglof increment borer to assess variation in heartwood and oil yield. Data revealed that the oil content ranged between 1.0 to 4.0%. Results of study on growth and oil content in 10 year old multi locational agroforestry trials in Mudenahally, Bevanahally and Koppa in Karnataka revealed maximum oil content of 2.8% in Koppa and a maximum collar girth of 46.8cms in Bevanahally. Two training program and demonstration for production of quality planting material (QPM) were conducted.

Sandalwood nursery

Technologies developed: Sandalwood nursery technology has been standardized and documented by ICFRE. Sandalwood based agroforestry model plots have been established in 3 locations in Karnataka with secondary long term horticultural species like mango, amla and coffee. This has been serving as demonstration plots for farmers during annual 5 day training programme on sandalwood cultivation being conducted twice a year at IWST.

Germplasm assemblage of Dalbergias, its characterization and evaluation (IFGTB)

Superior trees have been identified from four populations of *Dalbergia* spp. located in Coimbatore (Tamil Nadu), Mannarkkad, Palakkad and Nemmara (Kerala) Forest Divisions. Morphometric data of the trees collected. Root / root sucker materials were collected from the superior trees and put on vegetative propagation under polytunnels. The rooted plants have been maintained. Protocols have been standardized for carrying out studies on molecular and biochemical characterization.

Population dynamics, structure and genetic diversity of *P. marsupium* in the tropical forests of Madhya Pradesh (TFRI)

The project aims to develop the conservation strategy for vulnerable *Pterocarpus marsupium* (Bija saal) by investigating the genetic diversity, status of natural regeneration and factors affecting regeneration and establishment. Base line data for the distribution of Bija saal was collected from the working plans of different forest divisions of Madhya Pradesh. Morphometric data along with

leaf samples were collected from each of the seven selected representative sites for assessment of variation and diversity.

Successful completion of the project will be helpful in planning and implementation of conservation strategies for *P. marsupium*.

Germplasm collection and ex situ conservation of *Pterocarpus marsupium* Roxb., (Bijasal) (TFRI)

The progeny and seed source trials established in Naya Raipur, Chhattisgarh and Chhindwara are being maintained. Another progeny trail established at TFRI, Jabalpur comprising 10 families is also being maintained.

In seed source trial at Raipur, maximum height (98.87 cm) and girth (18.79 mm) was recorded in Ansa followed by Ambikapur locality with height (84.55 cm) and girth (14.14 mm). Progeny of tree number 1 from Bilaspur has been recorded with maximum height (104.4 cm) and girth (16.62mm) followed by Balod tree number 6 (90.2 cm height, 15.85 mm girth).

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

As part of long term bamboo conservation and genetic improvement programme, 149 candidate plus clumps of nine different species, viz., *Bambusa tulda, B. balcooa, B. pallida, B. nutans, Dendrocalamus hamiltonii, D. giganteus, Schizostachyum dullooa, S. pergracile* and *Thyrsostachys oliveri* were selected from Lower Assam, Mizoram, Tripura and Manipur and added to the RFRI germplasm bank.

Genetic evaluation and improvement of *Flemingia semialata* and *Flemingia macrophylla* used for lac cultivation in Jharkhand (IFP)

A land race of *Flemingia semialata* (Vanchola) and *F. macrophylla* (Bada Sopan) for each was identified through field surveys and propagating material (Seeds) collected from Khunti district of Jharkhand. Field trial from 3 genotypes of *semialata* (Vanchola) and 5 genotypes of *macrophylla* (Bada Sopan)have been established in Randomised Block Design (RBD) at 2 places in Jharkhand (one in IFP campus and other at NB Farm, Chandwa). Growth data like plant height, collar diameter, number of primary branches/plant, number of secondary branches/plant, incidence of diseases and insect pests and days of 50% flowering were recorded at primitive stage of establishment. DNA Isolation protocol standardized using modifications in CTAB method and DNA isolated from 150 individual plants of *F. semialata* (Vanchola).

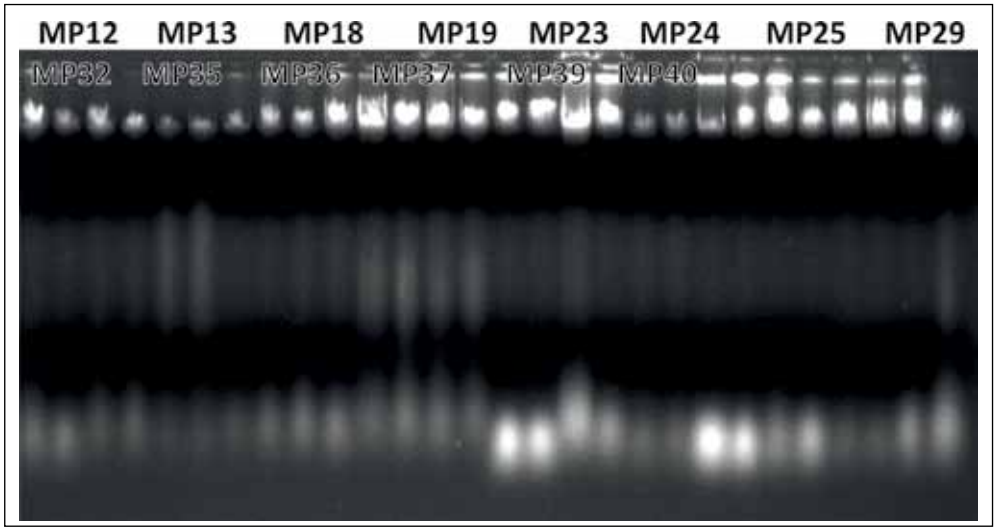
2.3.2 Tree Improvement

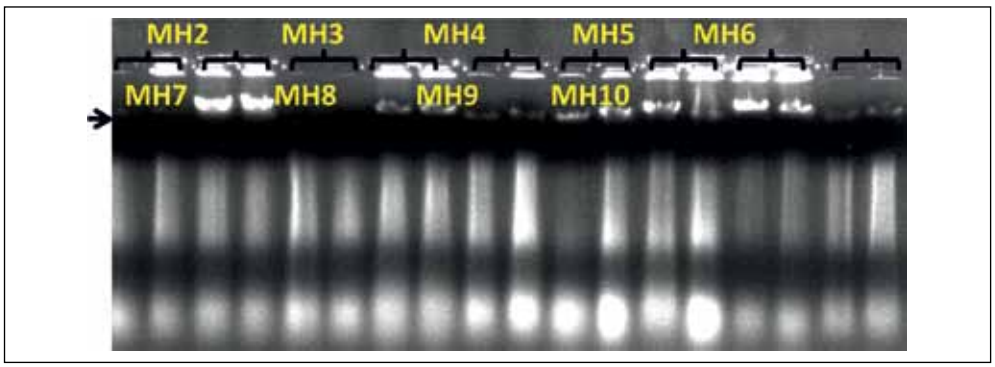
Selection and genetic evaluation of *Ailanthus excelsa* germplasm in Northern India (FRI)

Selection of candidate plus trees of *Ailanthus excelsa* from the state of Uttar Pradesh, Haryana, Punjab, Madhya Pradesh, Rajasthan and Maharashtra to capture more variability and superior tree forms from natural populations. Progenies of about 50 CPTs are being maintained in the nursery and are ready for multi-location field experiment for testing of the genetic worth of selected CPTs.

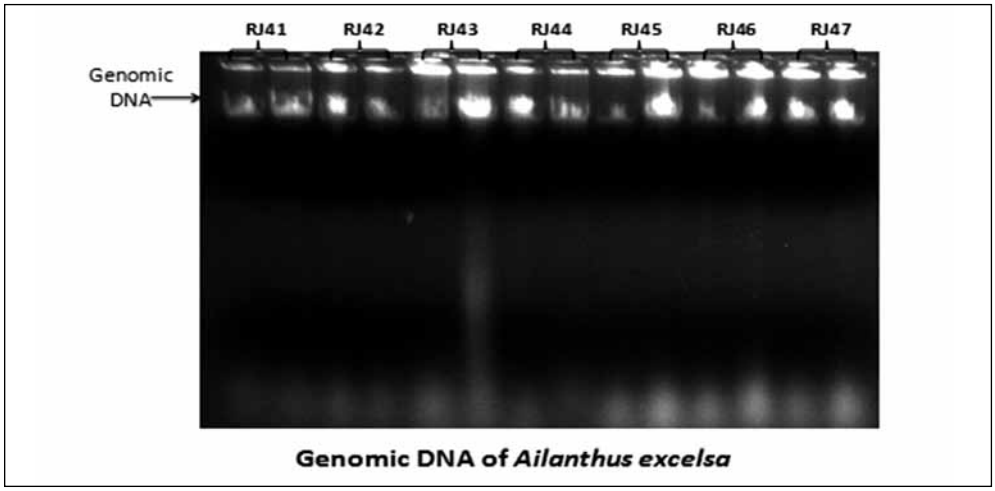
Progenies of Candidate plus trees of *A. excelsa*

Detailed view of *A. excelsa* and experimental trials at the nursery of G&TP Division, FRI





Genomic DNA of *Ailanthus excelsa*



Genomic DNA of *Ailanthus excelsa*

Induction, evaluation and development of polyploids in *Azadirhacta indica* (FRI)

Genetic Improvement of Neem has been taken up for identification of high yielding genotypes in respect to high azadirachtin and oil content, stable and adaptable over environments, coupled with reduced flowering and fruiting periods. The work has integration of various approaches of genetic improvement like selection of superior germplasm and their progeny testing, cyto-techniques for chromosome counting, validation, searching of new cytotyes and inducing polyploidy, *In-vitro* propagation of superior germplasm and supply of quality seeds to IFFCO. Under this project, seeds from various plus trees of different states was collected and processed. A set of seeds had been kept for polyploidy studies and rest was supplied to the funding agency for raising the seedling as per the commitment and Progeny trials have been established in the states of Uttar Pradesh, Gujarat, Madhya Pradesh and Rajasthan. Thorough survey of natural populations resulted in selection of 36 CPTs. Biochemical analyses of seeds of CPTs reveals that maximum azadirachtin content (µg /g of the kernel) was recorded upto 15811 with an average of 2000 and about eight progenies with ≥ 3500, which was substantially higher than average reported so far. Similarly, oil content (in kernel) were found to be maximum i.e. upto 67% with an average of 35.55% and about eight genotypes ≥46% oil. A series of evaluation trials were established at four geographically different regions i.e. Bareilly (Uttar Pradesh), Tikamgarh (Madhya Pradesh), Rajsamand (Rajasthan), and Kalol (Gujarat). The floral buds from majority of Neem growing states have also been collected for cytological studies. Chromosomes of neem were counted and validated as n=14 (2n=28) and some cytomixis and variants were also found as n=17 (2n=34). Induction of polyploids have been successfully achieved. Tissue culture protocols have been developed for more than 10 selected genotypes and technology transfer along with training to IFFCO for mass propagation provided.

Assess variability in growth, heartwood and colour, oil yield and chemical profiling for Indian Sandalwood (*Santalum album*) populations in Kerala (IWST)

From Marayoor Sandalwood reserve core samples were collected from natural population (n=80) of different sized girth trees. The girth size varied from 29.5cm to 140cm with an average of 62cm. Considerable variability was recorded for bark, sapwood and heartwood thickness.

Reassessing the population status of Indian Sandalwood (*Santalum album*) in Karnataka (IWST)

Growth parameters like height, clear bole and girth were recorded for Sandalwood plantations at Hagalwadi, Hiriyur and Madhugiri. Average growth of trees in border rows was 4 cms higher compared to core trees in the block. In one of the plantations, host *Dalbergia latifolia* (Rose wood, Beete) performed better than Sandalwood trees. In a 16 year old plantation, out of 80 trees harvested, heartwood had not yet developed in 10 trees. In a seven year old plantation (n=100), average girth and height was 22.54 cm and 5.73 m, respectively. In a nine year old plantation, grown in Kushtagi, the average girth and height was 26.0 cm and 5.62 m, respectively. In both the plantations, heartwood was not observed in the trees.

Assess variability for growth, heartwood colour and wood quality traits for different populations of Red Sanders (*Pterocarpus santalinus*) in Karnataka (IWST)

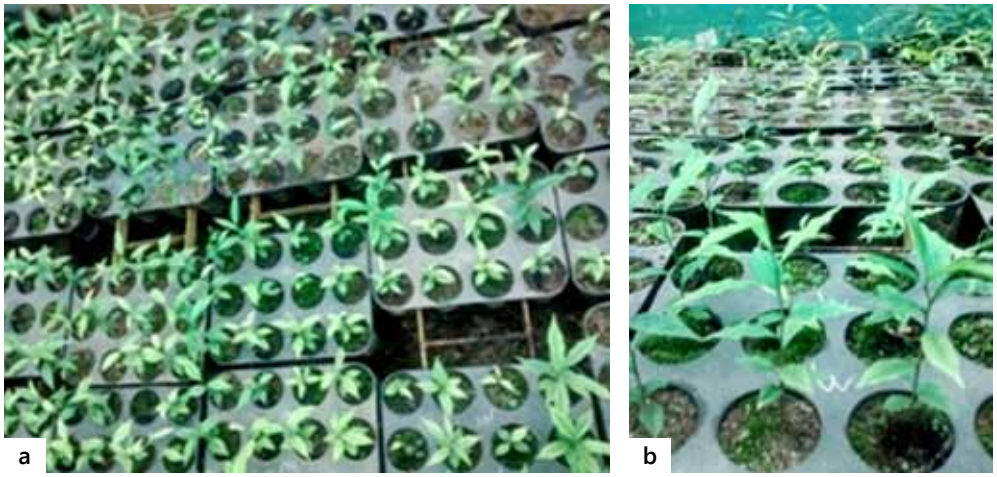
A series of discussions with APCCF (R&U) were held regarding *Pterocarpus santalinus* (Red Sanders) plantations in Karnataka. After a reconnaissance survey of two plantations, one at Jarakhabande and the other at Yeshwanthpur, growth observations (height and collar diameter) has been recorded for 200 trees and observations for 100 trees have been recorded using nondestructive tools (Pilodyn and stress wave timer) to assess the wood penetration and stiffness in Jarakhbande Plantation.

Development of commercially viable induction system for *Aquilaria malaccensis* and management of Agarwood production in humid tropics of Karnataka (IWST)

Aquilaria malaccensis (Agarwood) grown plantation areas were visited in the humid tropics of Karnataka. Soil sample from different plantation areas and from plants varying in age was collected. Soil and core samples from naturally occurring area viz., Assam in North East was also collected. These samples were subjected for isolation and identification of desired fungal strain known to induce agarwood. Soil collected from trees of different age groups from Karnataka were processed and around 40 pure cultures were obtained. Genus identification was done by permanent slide preparation method. Out of 40 pure cultures from soil samples of Karnataka, 12 cultures were selected based on their morphology and also on their potential to induce agarwood. These cultures were inoculated in a 9 year old plantation area in Shringeri. The inoculation was coupled with the stress induction treatments like girdling, branch pruning and root pruning. It was observed that 4 cultures out of 12 showed promising results in terms of infection in agarwood trees. The same were subjected to sporulation developed in the form of the commercial kit for agarwood induction. The project has been completed.

Establishment and evaluation of Provenance cum progeny trial of *Aquilaria malaccensis* (Agar) in Karnataka and Goa (Phase-I) (IWST)

Survey was conducted at certain regions of Assam, Tripura, Manipur and Arunachal Pradesh in North East India to select *Aquilaria malaccensis* (agarwood) trees to establish provenance cum progeny trial in Karnataka and Goa. 42 trees were selected from these states and fruits were collected for establishing the experimental trials. Morphological variations in fruits and seeds of agarwood were recorded. Seeds were sown for germination. Maximum of 80% germination was observed among the seedlots. The growth of the seedlings in terms of mean height varied from 7.57 cm. to 16.82 cm and collar diameter varied from 0.13 to 0.26 mm at the age of 6 months. The seedlings are maintained in the nursery for establishing the experimental trial in Karnataka.



(a) Agar seedlings of different seed lot and (b) 6 months old seedlings

Assessing the performance of *Pongamia pinnata* L. Pierre in Karnataka and Establishment of multi-location trial: A step towards varietal release (IWST)

Performance of *P. pinnata* planted by Karnataka Forest Department at different research circles/ranges were assessed based on yield potential by collecting 157 clones out of 264 clones. Selection of superior germplasm based on oil and pod/seed parameters was achieved by application of Mahalanobis statistics and Tocher's technique. The best 25 clones having total oil content of more than 34.9 % with 100 seed weight of above 125 g were selected. Established Vegetative Multiplication Garden (VMG) and Multi-Locational Trial (MLT) as per Randomized Complete Block Design (RCBD) under three different agroclimatic zones. Among 3 MLTs based on scores for volume index, performance of clones in CS Kaval (1331.50 cm^3) and Bathanahalli (1185.20 cm^3) was better than Makali.

Selection and improvement of natural dye yielding plants (IWST)

For *Morinda tinctoria*, survey was undertaken in Shivamogga district and parts of Tumkur district where dry deciduous forest formations are dominant. Superior provenances such as Anthara Gange R.F, Kodligere S.F. in Bhadravathi division and Mallapura S.F. in Ayanoor range are identified. Morphologically superior 49 genotypes are selected based on index method and age. Root samples are collected from those genotypes for the estimation of dye content. Dye content varies from 7-13 percent W/W in root bark. Extraction of dye by aqueous extract is an efficient method. The species has discontinuous distribution and large quantity of variation exists in dye producing traits.

A micro method has been developed to estimate dye content from root samples. A non-destructive method is developed to extract root samples from the standing tree.

Evaluation of inter specific hybrid clones of Eucalypts for productivity and wood traits (IFGTB)

The project aims to evaluate inter- specific hybrid clones of Eucalypts for productivity and wood traits. Forty five *Eucalyptus* hybrid clones were identified and shortlisted from the mapping population. Wood samples were collected for wood trait analysis, and clones were multiplied for clonal trials in RBD Design with spacing of 2.15 x1.5 m which have been established at Neyveli, Thuvarankuruchi in Tamilnadu and Nellore Andhra Pradesh.

Technologies developed: Evaluation of interspecific hybrid clones of Eucalypts for productivity has been carried out. Initial evaluation and short listing of the hybrid clones for clonal release have been done. Pedigree details of four clones 14, 28, 13 and 6 of the eucalyptus hybrids clones (*E. camaldulensis* x *E. tereticornis* and *E. camaldulensis* x *E.grandis*) possessing superior productivity were found to be good. As per the clonal release procedure the implementation team has already visited the plantation trials and recorded the observations.

Establishment of second generation seed orchards and selection of clones for high productivity in *Eucalyptus camaldulensis* (Safeda) (IFGTB)

The progeny trials established at Chennai, Karunya, Udumalpet, Nellore, Karikudi, Arimalam, Marakkanam, Coimbatore, Puthukottai, Thiyagadurgam, Nellore and Kandiyur were assessed and selected about 350 II generation clones. CPTs (290) coppiced and assembled in *in-situ* VMG at IFGTB campus for further multiplication.

The First generation (FG) base populations were also evaluated for their growth performance and best performing trees were identified for collection of seed. About 150 trees were identified from this trial. Seedlots from 50 families of Thai origin were also collected as infusion population. The seedlots of Thai populations were planted to assess the growth superiority of these seedlots in India.

The seeds collected from the first generation orchards were germinated and about 19000 plants were produced and established Clone Selection Blocks in 8 ha area in Panayapatti and maintained. The survival of the families under test was assessed.

Evaluation of promising clones of *Tamarindus indica* for higher fruit productivity (IFGTB)

Intensive survey was carried out in tamarind hot spots of Tamil Nadu and 15 CPTs have been selected based on higher fruit productivity. Morphometric and passport data have been collected from selected CPTs. Phenological variations were recorded among selected population. Evaluated 92 clones for vegetative and reproductive traits and ranked the clones based on higher yield and quality. Shortlisted 10 clones based on higher yield and quality for clonal multiplication. Promising clones were multiplied through approach grafting at Clonal orchard, Vringipuram, Vellore and

Selected CPT of Tamarind

Germplasm Bank of red and sweet tamarind at Salem, Tamil Nadu.

Genetic improvement of Casuarina for growth and pulp yield through intra and intespecific hybridization (IFGTB)

Control pollination experiments were carried out with three species of Casuarina (savukku, jungli sarugu, jaun, katradi) viz., *Casuarina equisetifolia, C. junghuhniana* and *C. cunninghamiana* to produce interspecific hybrids. Ten fullsib families were produced and sown in nursery to screen for hybrid individuals. Around thirty putative hybrid trees were selected based on outstanding growth and stem form from a three-year old progeny test established in farmer's field. Two clonal tests established with parent clones and hybrid clones already released have been evaluated for growth, tree form and flowering characters.

Selection and vegetative propagation of superior clones of Red Sanders (*Pterocarpus santalinus* L.) for mass multiplication and large scale planting. (IFGTB)

The radial bark length, radial sapwood length and radial heartwood length were recorded on core wood sample taken with increment borers in 15 selected trees at Maramalai Nagar (Tamil Nadu) and Tirupathi (Andhra Pradesh). Based on this percentage cross sectional area of bark, sap wood and heartwood content were assessed. The heartwood percentage varied from 21.80% to 45.19% in Maramalai Nagar and it varied from 28.90 % to 54.38 % in Tirupathi. The wood basic density and wood density (Air dry weight basis) were estimated on the core wood samples taken at stem breast height using increment borers. The mean wood density was 0.76 at Maramalainagar and it was 0.77 at Tirupathi.

Methanol extraction from powdered heartwood of Red Sanders

Clonal evaluation of *Ailanthus excelsa* in different agroclimatic zones of Tamil Nadu. (IFGTB)

40 CPTs have been identified in Western and Cauvery delta zone and clonal trials has been established in Thuvarangkurichi, Trichy District, Pilavakkal, Virudunagar District and Manakkarai, Thoothukudi District Field Research Stations.

***Ailanthus excelsa* clones assembled in the mist chamber at IFGTB**

Clonal trial of *Ailanthus excelsa*, Salem (Tamil Nadu)

Development of descriptors and DUS testing guidelines for indigenous forest tree species (*Tectona grandis* and *Melia dubia*) and establishment of Field Gene Bank (IFGTB)

The Seed Production Area (SPA) and Permanent Preservation Plot (PPP) in Kerala and Tamil Nadu were characterised. A large number of characters were observed in farmer's plantation in Tamil Nadu. The tree stem form, leaf, branching habits and reproductive characters were found to be discriminating characters. A draft report for DUS testing has been prepared and presented before the Task Force on Teak. As per the suggestions of the committee, the scope of the study has been increased to selected plus tree populations. In case of *Melia dubia* (Malai Vembu), studies were conducted in Panampally, Karur, Nellore, Tirupathi, Thithimathi, Hoskote, Annur and Chennai for developing DUS descriptors and DUS test guidelines. Variation in morphological characters in leaf, stem, bark and reproductive structures were studied. DUS characters were developed and test guidelines were presented before the Task Force on Melia and the same was approved for publication by PPV&FRA.

DUS centre for Eucalyptus (Safeda) and Casuarina (Jungli saru) (IFGTB)

In Eucalyptus, the Clonal testing area established at Salem was assessed for DUS characters and character matrix has been developed. The DUS characters were also recorded in the clonal collections established at Salem, Tamil Nadu.The reference varieties of Eucalyptus have been planted in *in-situ* Vegetative Multiplication Garden of the Institute for immediate multiplication as and when DUS testing has to be carried out. IFGTB has submitted an application for registration of IFGTB-EC6.

In Casuarina, the DUS Centre for Casuarina maintains a reference collection of over 100 clones to facilitate the registration process of new varieties of this important tree crop. Since perennials have to be continuously assessed for various descriptors notified for conducting DUS testing, the clones assembled in the DUS Centre are subjected continuous study and recording of characters. In order to simultaneously assess different characters expressed at different ages, new planting of the clones is taken every year to have trees of different ages in the DUS Centre. A clone-DUS character matrix has been developed for around 60 clones assembled in the Centre and assessment is ongoing for the remaining clones. So far six applications have been submitted to the Authority for registration and the required number of trees has already been raised to facilitate DUS testing once the Authority issues the approval for the process. The Centre is also involved in increasing awareness on varietal protection and farmer's rights among the stakeholders like farmers and industry.

Rapid improvement of Casuarina and Leucaena to enhance pulpwood production from Farm Forestry plantations (IFGTB)

Under this collaborative project between Indian Paper Manufacturers Association (IPMA) and IFGTB, provenance and clonal trials of *Casuarina equisetifolia* and seed source trials of *Leucaena leucocephala* were established in Yerravarum, Ashpi, Rayagada, Dandeli and Karur with 5 paper industries (IP-APPM, Andhra Pradesh; BILT, Maharashtra; JK Paper, Odisha; WCPM, Karnataka and TNPL, Tamil Nadu). Promising provenances have been identified. Data received from the industries at three years of age has been analyzed and submitted the interim report.

Development of DUS descriptors for Red Sanders (*Pterocarpus santalinus* L. f) and Indian Sandal Wood (*Santalum album* L.) and documentation of indigenous (traditional) knowledge regarding these species (IFGTB)

Planted population of red sanders were visited in several places in Kerala and Tamil Nadu viz., Kattilakuzhi, Trivandrum, Kerala (7 year old plantation), Aranamkuzhi, Tanjavur, Tamil Nadu (10 year old plantation) and Neyveli Tamil Nadu (3 year old progeny trial) and morphological variability in bark colour texture and leaf size, petiole characters, leaf shape, leaf color, leaf tip, leaf margin, leaf texture were studied and data were recorded.

Two types of barks viz., moderately smooth and crocodile type bark were found in sandal population at Marayoor

Evaluation of second generation *Eucalyptus camaldulensis* clones for higher productivity (IFGTB)

- Assembled VMG of *Eucalyptus camaldulensis* with 325 clones in IFGTB campus.
- One VMG cum clonal trial of *E. camaldulensis* was established at Panampally research station.
- The rooting percentage of each clone was studied and about 200 clones with good rooting capacity have been identified.

Selection and screening of germplasm of *Acacia nilotica* (Babul) to improve productivity in Tamil Nadu" (IFGTB)

Collected details of *Acacia nilotica* plantations available in different age groups, within 15 different districts of Tamil Nadu viz.Tirupur, Erode, Namakkal, Dindigul, Chennai, Thiruvallur, Thiruvannamalai, Vellore, Kanchipuram, Villupuram, Sivagangai, Ramanathapuram, Tuticorin, Thirunelveli and Virudhunagar. Based on the information , ideal plantations were selected. 10 field surveys were undertaken in those plantations and selected 14 CPTs in 15 districts falling under three agro-climatic zones, based on standard phenotypic characters. All the selected CPTs were marked in field, information on geo-coordinates recorded and morphometric data collected. Seeds were also collected from 12 CPTs selected during 2016-17. Identification of CPTs in other districts and collection of seeds are in progress.

Tank bed plantation of *Acacia nilotica*

Tank bed plantation of *Acacia nilotica*

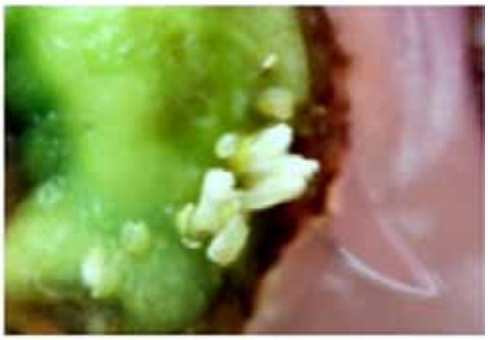
Genetic improvement of *Azadirachta indica* (Neem) through transgene pyramiding for enhancement of cold endurance (AFRI)

Surface sterlized explants (leave segments, stem nodes, immature fruits/embryos) were cultured on MS medium containing 2, 4-D, IAA and NAA auxins at 2.5 mg/L concentration. Callus induction was successful. Experiments on regeneration from callus cultures were initiated. The callus obtained from immature fruits resulted in formation of somatic embryo after moving the callus to hormone free medium. Callus cultures from leaf segments were further transferred to medium containing IAA and NAA. Callus turned green and compact with signs of shoot primordial formation. Two *Agrobacterium*-strains (GV-3101 and LBA-4404) were procured cultured at AFRI and the stocks are being maintained. These bacteria will be used for transferring the desired genes to neem cell lines in future. The plasmid vector pCAMBIA containing one reporter gene and scorable marker (GFP and GUS) has been procured and experiments on transferring the plasmid pCAMBIA to the competent cells of *Agrobacterium* strains is underway. Approval of Institute Biosafety Committee (IBSC) has been obtained from the Review Committee on Genetic Manipulation (RCGM), Government of India, New Delhi.

This research programme addresses the problem of frost-susceptibility of Neem trees. It will lead to the introduction of two types of genes, one that stabilizes the protein structures through synthesis of a cellular

Establishment of Neem cultures

Somatic embryogenesis



Somatic embryos (close-up)

Establishment of Neem cultures from immature fruits (top); Initiation of somatic embryos of Neem (bottom left); Close-up of somatic embryos (bottom right)

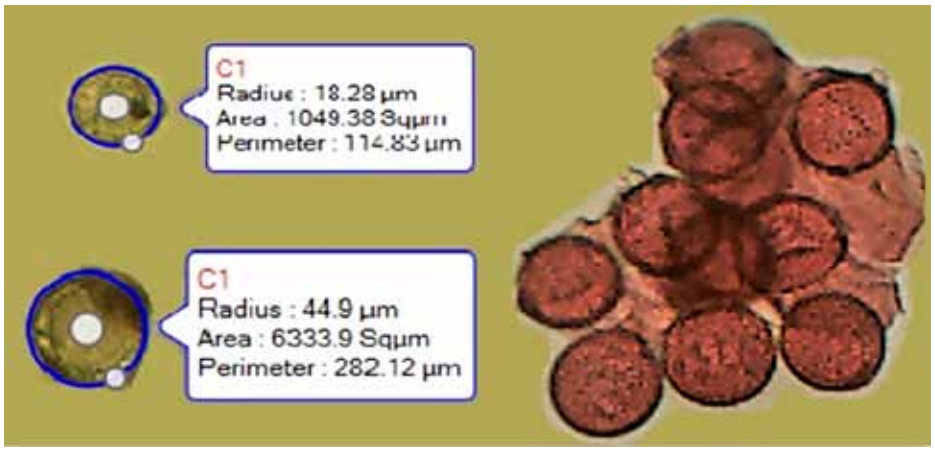
protectant compound glycenebetaine and the other that enables removal of metabolic toxic compound, methylglyoxal (MG) from the cells produced during cold-shock.

Development of Seed Production Area and Haploid plants in *Commiphora wightii* (Arnott)- A rare and threatened medicinal plant (AFRI)

Twenty-two genotypes (A0104, A0201, A0303, A0404, A0601 & A0701, B0115, B0202 & B0211, C0118, C0305, C0309, C0312, C0317, C0406, C0412, C0419, C0511, C0516, C0609, C0617, D0409) were selected having equal or above 80% black seeds as well as high total seed yield out of 660 genotypes screened. Two hundred stem cuttings of ten male plants were raised in mist chamber in July 2017. A total 96 male plants have been developed through cuttings and are growing well in IFGTB nursery .

Sprouting in stem cuttings of male plants

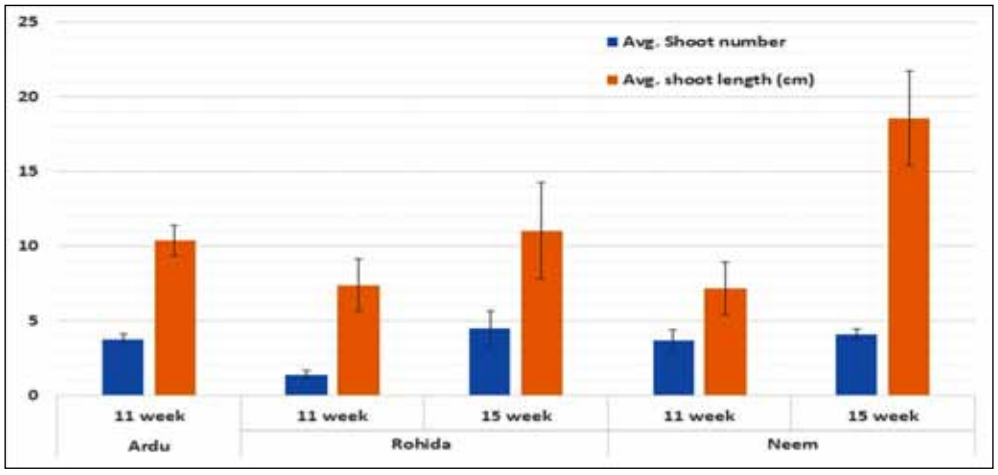
Pollen studies revealed significant variation in size though the number of pollen grains per anther were very poor (25-50). Pollen radius ranged from 18 to 54 µm. Seven male genotypes were separated into two homogeneous groups after DMRT



Microscopic view of pollen grains and their measurements

Identification of juvenility markers to improve rooting potential of some important tree species (AFRI)

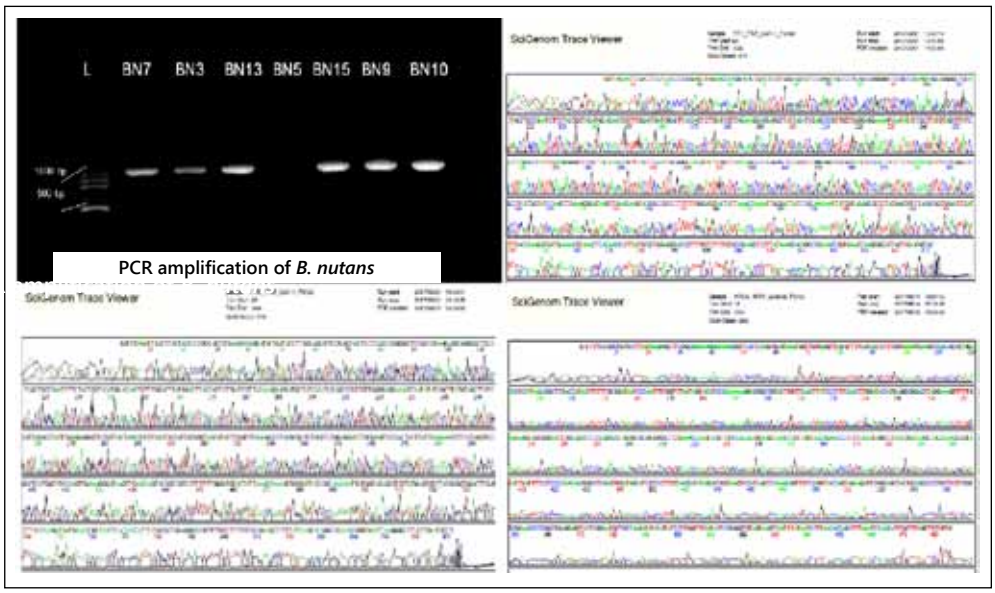
The rooting potential of juvenile shoots in neem was investigated by dividing the coppiced shoots on leaflet number and results revealed significant difference ($P<0.01$) in rooting potential between these cuttings. Maximum rooting (41.25%) was observed in cuttings of stage 13 leaflet number followed by 11 leaflet number (24.7%). Mature cuttings showed 1% rooting only. In rohida, the rooting in coppiced shoots was very poor and cuttings were dried after callusing.



Coppicing potential in Ardu, Rohida and Neem

Single Nucleotide Polymorphism (SNP) marker discovery to resolve *Bambusa tulda-longispiculata-nutans-teres* complex in bamboo taxonomy (IFP)

DNA samples from *B. nutans* (Nal/ Makla Bans) and *B. tulda* (Taral/ Phoka Bans), was isolated with adequate quality to be sequenced. The cytoplasmic genes i. e. rbcL, matK and rpoc, based markers were amplified in the genome of 37 genotypes *B. nutans* (Nal/ Makla Bans) and *B. tulda* (Taral/ Phoka Bans), and the specific single band amplicons were sent for sequencing for detection of SNPs. Sequences obtained from 11 genotypes of *B. nutans* (Nal/ Makla Bans) and *B. tulda* (Taral/ Phoka Bans) have been analysed by Mega7 software for construction of pylogenetic tree and determination of genetic distances amomg them. The alignment of sequences was done using multiple sequence alignment software Clustal Omega. DNA isolation of 24 reference bamboo species has been done.



B. nutans **(top) and** ***B. tulda*** **(bottom) sequences for SNP detection**

Assessment of genetic structure, linkage disequilibrium and marker-wood trait association in CPTs of teak (*Tectona grandis* L.f.) maintained at National Teak Germplasm Bank, Chandrapur (M.S.), using molecular markers (IFP)

28 SSR markers, with polymorphic loci ranging from 92.86% to 100%, allocated major proportion of genetic diversity within population and a small proportion of genetic diversity among populations. Employing Bayesian model based STRUCTURE analysis, these markers identified two population clusters among sampled teak plus trees. However, the differentiation of detected both populations was not very strong.

Primers of MYB1 and MYB2 transcription factors successfully amplified their respective sequences in genomic (RFRI, Jorhat) DNA of teak plus trees. On the other hand, an alternative route for amplification of CCR primer followed in complimentary DNA (cDNA) prepared from total RNA extracted from teak leaves.

The primer produced an amplicon size of 1800 bp for MYB1 transcription factor and 1000 bp for MYB2 transcription factor across all sampled teak plus trees. The amplified genes were sequenced and aligned through Clutstal X2 for SNPs discovery using novoSNP software. A total of 85 SNPs found within MYB1, 212 in MYB2 and 65 in CAD gene sequences.

Image showing amplification of MYB1 transcription factor of size 1800 bp in different teak genotype.

Image showing amplification of MYB2 transcription factor of size 1000 bp in different teak genotype

Table below enlists number of SNPs lies within candidate gene and transcription factors

Gene/nucleotide name	No. of SNPs
MYB1 transcription factor	85
MYB2 transcription factor	212
CAD (Cinnamyl alcohol dehydrogenase)	65

Further, analysis for linkage disequilibrium and marker trait association is in progress.

2.3.3 Vegetative Propagation

Studies on improving adventitious rooting in *Dalbergia latifolia* Roxb. and field performance of its rooted plantlets (TFRI)

Dalbergia latifolia is a 'difficult to root' species. Plant growth regulators viz. IAA, IBA, NAA, α- Naphthol, β-Naphthol, Boric Acid, Ascorbic Acid and Thiamine were tested for their efficacy in adventitious rooting during different seasons. Cuttings collected from progenies of 10 trees and planted during the month of April performed better than planted during other months. Adventitious rooting of 15% to 22% was achieved with treatment of 800ppm IAA and 50ppm Boric Acid. No rooting was recorded during the months of October, November and December. Endogenous Indole-3-acetic acid (IAA) was estimated during different months in progenies of selected trees. IAA varies from 7.02µg g^{-1} fresh weight to 18.28µg g^{-1} fresh weight during different months.

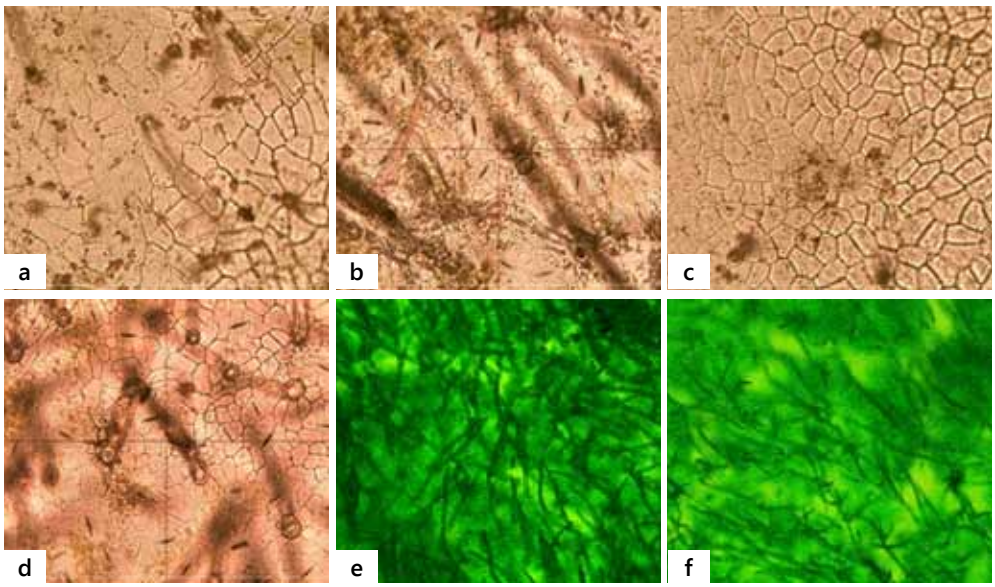
Sprouted cuttings of *Dalbergia latifolia*

Rooted cuttings of *Dalbergia latifolia*

Screening of DNA markers to distinguish male and female *Ailanthus excelsa* trees for higher biomass production / Forest genetic resource management & tree improvement (AFRI)

Studies carried out on the morphological and biochemical characters viz. bark colour, chlorophyll content, leaf length, leaflet surface area, leaf hair density and stomatal index of male and female adult trees of *Ailanthus excelsa*. Analysis of these studies revealed that female have higher stomatal index (11.01±0.23), chl-a (50.70±3.64 µg/ml) and chl-b (1.73±0.13 µg/ml) contents as compared to male, where the stomatal index was 9.86±0.89, chl-a was 46.95± 5.05 µg/ml and chl-b was 1.58 ± 0.16 µg/ml. Leaf thickness and leaf hair density was higher in male as compared to the female trees Male trees also have higher leaflet surface area (65.15±1.92 cm^2) and leaflet length (17.52±0.27 cm) as compared to female trees (39.43±1.97 cm^2 and 14.69 ±0.31 cm, respectively). Leaf samples were collected from 33 Male and 39 female Ardu trees from the plantation at Deesa, Gujarat and DNA was extracted and purified. Total 31 RAPD primers were screened for identification of DNA markers for male and female trees. Out of 31 primers, only 8 polymorphic primers were selected for further amplification. The

DNA bands produced by these polymorphic primers were analysed to distinguish the gender. Unfortunately, all these 8 primers could not separate sample population of trees into two clear gender groups.

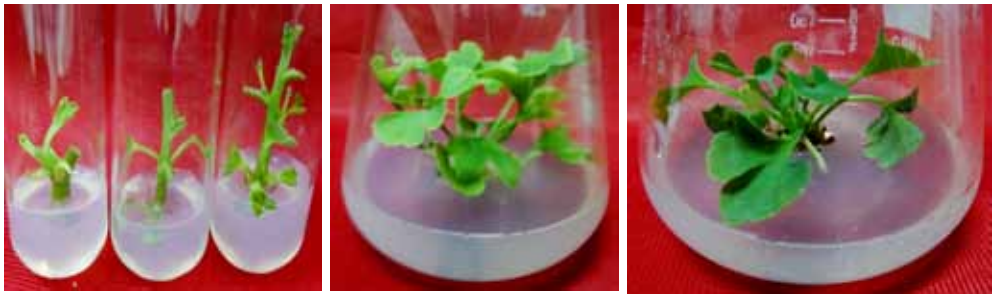


Stomatal density on adaxial (a) and abaxial (b) leaf surfaces of female and adaxial (c) and abaxial (d) leaf surfaces of male ardu trees and leaf hair density of male (e) and female (f) ardu trees

2.3.4 Biotechnology

Development of tissue culture protocol for propagation and conservation of *Ginkgo biloba* L. (FRI)

Tissue culture protocol for conservation and propagation of *Ginkgo biloba* have been carried out. Three female trees are located near Botany Department of DSB College, Kumaon University, Glenthorn Compound (High Court Campus) and Old Rajbhawan (Snow View) and one Male tree in the campus of Rajbhawan. One male tree is located near Ramgarh. *In-vitro* rooting of shoots *cum in-vi*tro hardening was completed and plantlets were transferred outside.



Shoot formation from shoot tip and nodal segment

Shoot Multiplication

Shoot Multiplication


***In-vitro* rooting cum hardening**


Rooted shoots

HPTLC analysis of leaves of *Ginkgo biloba* trees was carried out for ginkgolides and bilobalide contents. Four samples of leaves three from female trees and one from male tree were collected from Nainital city.

Stem cuttings were collected from male and female trees of *Ginkgo biloba* growing in Nainital city as well as from Forest Research Institute campus. Stem cuttings were properly washed with running tap water to remove dust particles adhered to surface. Mixture of IBA (1000 ppm) with plain talcum powder was applied on the base of the cuttings and implanted in hycotrays containing soilrite. The best results were obtained when male and female stem cuttings presoaked in the solution of IBA (1000 ppm) for 24 hours and implanted in hycotrays containing soilrite.

Propagation of *Ginkgo biloba* through stem cuttings taken from female tree

Female *Ginkgo biloba* plants produced through stem cuttings

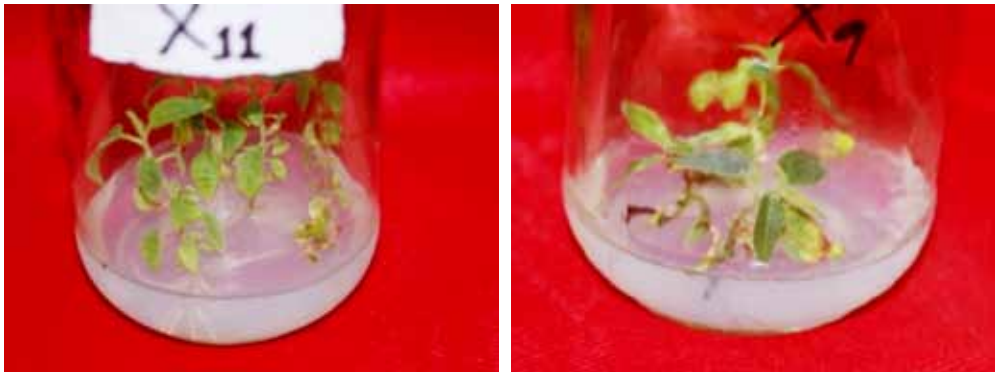
Field evaluation of recombinants emanating from F_1 and F_2 generations of *Corymbia* (syn. *Eucalyptus*) hybrid *C. citriodora* Hook. × *C. torelliana* F.v. Muell for high productivity (FRI)

Tissue culture protocols were developed for *Corymbia* hybrids and recombinants namely ; E1a, E1b, E1c,E2, E14, X1, X2, X4, X6, X7, X8, X9 and X11. Rooting and hardening of five accessions E2, E14, X 8, X9 and X11 have completed.

6.5 yrs old *Corymbia* hybrid at Hoshiarpur

11.5 yrs old *Corymbia* hybrid at Bithmara

***In vitro* shoot multiplication of *Corymbia* hybrid**



Rooting of *Corymbia* hybrid

Product developed from *Corymbia* hybrids

Characterization of barcoding genes in *Pterocarpus* species (IFGTB)

Three barcode genes viz rbcL, ITS, psb-trnH were characterized in *Pterocarpus santalinus* (Semmaram) and *P. marsupium* (Vengai). Putative single nucleotide polymorphism/ indels were identified in both species.

Isolation and characterization of Cinnamoyl coA reductase gene in *Casuarina equisetifolia* (IFGTB)

Eight lignin biosynthesis pathway genes were mined from the wood transcriptome data of *C. equisetifolia*. Full length sequence of Cinnamoyl coA reductase gene (980 bp) was determined for the first time. Expression profiling of Cinnamoyl coA reductase gene in different tissues viz., leaf, wood, stem and root revealed that gene expression was highest in the wood tissues.

High density genetic linkage maps for QTL localization and validation for rooting ability and wood property traits in Eucalyptus (IFGTB)

Attempts were made to generate high density genetic linkage map for *E. tereticornis* × *E. camaldulensis* and *E. grandis* × *E. tereticornis*. These interspecific crosses had been selected for mapping of adventitious rooting traits and wood properties using SNP markers. F1 progenies were genotyped using Genotyping by sequencing-Single Nucleotide Polymorphism (GBS-SNP) markers. The GBS –SNPs were generated on an Illumina HiSeq 2000 using 100 for 75 bp paired-end chemistry. Totally, 13700 SNPs were shortlisted for the assessment of segregation ratio and linkage mapping.

Incorporating resistance in *Eucalyptus* to *Leptocybe invasa Fisher & La Salle* (Hymenoptera: Eulophidae) through expression of insect specific dsRNA (IFGTB)

Leptocybe invasa is a major pest of Eucalyptus plantations. To develop transgenic strategies in Eucalyptus for incorporating tolerance to the insect pest *Leptocybe invasa*, a chimeric multigene targeting hpRNAi construct developed at IFGTB, was electroporated into *Agrobacterium tumefaciens* and is being used for generating transgenic of Eucalyptus.

***In vitro* production of secondary metabolites from tree species of Dasamoola through hairy root cultures (IFGTB)**

Development of protocols for hairy root culture has been initiated in tree species in which roots are the major source of the medicinal constituent. Tissue culture of *Aegle marmelos*, (Bael), *Oroxylum indicum* (Syonkha), *Gmelina arborea* (Ghamari) and *Premna integrifolia* (Agnimantha) have been standardised. This facilitates production of large number of sterile explants for hairy root culture. Hairy root transformation was tested in tobacco using different *Agrobacterium rhizogenes* strains.

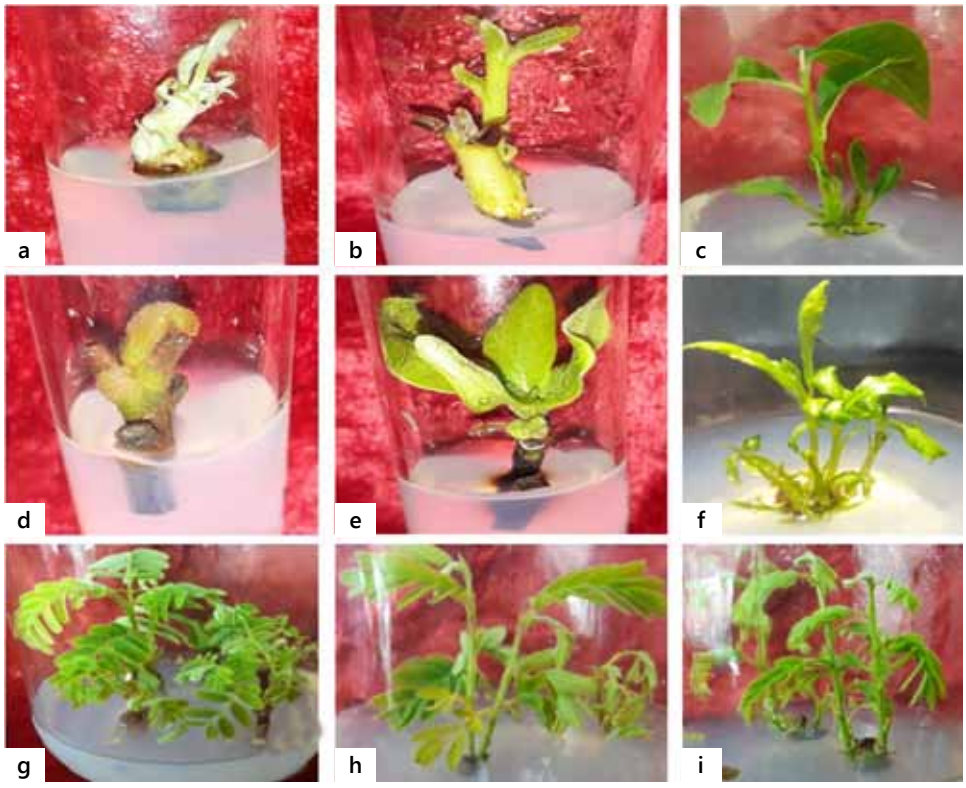
Pilot production and sale of DNA isolation kit (Under Direct to Consumer Scheme of ICFRE) (IFGTB)

A low cost spin column based DNA isolation kit was developed based on IFGTB-DBT joint patent. The kit provides an indigenous, non-biohazardous, low cost spin column based system for isolation of plant genomic DNA from wide range of tissue types, specifically challenging tissues from tree species. The DNA isolated kit is stable and can be used for routine and high-end molecular biology experiments. A trade mark "ArborEasy" was registered for the kit and the same was launched on 24 January 2018 by Dr. Meenakshi Munshi, Adviser, Department of Biotechnology, GoI in a program organized in the Institute. The kit is now manufactured in pilot scale by the Institute. A total of 300 reactions were manufactured and 250 reactions were supplied for researchers in the Institute. A total Rs. 23,750/- (250 reactions) revenue has been generated through sale of kit. Efforts are being taken to sell the kit world-wide through e-commerce portal.

Launching of DNA isolation kit by Dr. Meenakshi Munshi, Advisor, DBT,GoI

Development of tissue culture protocols for important forestry species, viz., *Buchanania lanzan, Madhuca indica* and *Tamarindus indica* (TFRI)

In vitro culture establishment and shoot multiplication in *Buchanania lanzan* (chironji), *Madhuca indica* (mahua) and *Tamarindus indica* (tamarind) was achieved. Buds from these three species were monthly inoculated on MS medium supplemented with 3 mg l^{-1} BA. Sprouting was obtained in *B. lanzan* and *T. indica* in the months of December-January and in *Madhuca indica* in the months of May-June. In *Tamarindus indica*, the effect of culture medium was found to have significant effect on number of nodes and maximum number of nodes (5.06) and maximum shoot length (2.79cm) was obtained on B_5 medium. *In vitro* shoot cultures were maintained on MS medium supplemented with 3mg l^{-1} BA for *Madhuca indica*, MS medium supplemented with 1mg l^{-1} Kinetin for *Tamarindus indica* and MS medium supplemented with 3mg l^{-1} BA and 0.5mg l^{-1} NAA for *Buchanania lanzan*. Maximum *in vitro* rooting (85.41%) was obtained on full strength of MS medium supplemented with 2 mg l^{-1} IBA in *Tamarindus indica*. Around 2-3 roots were formed per shoot and these plantlets were hardened in soilrite. The project aims to develop tissue culture protocols for the three important NTFP species.



In vitro* shoot cultures- (a-c) *Madhuca indica*, (d-f) *Buchanania lanzan*, (g-i) *Tamarindus indica

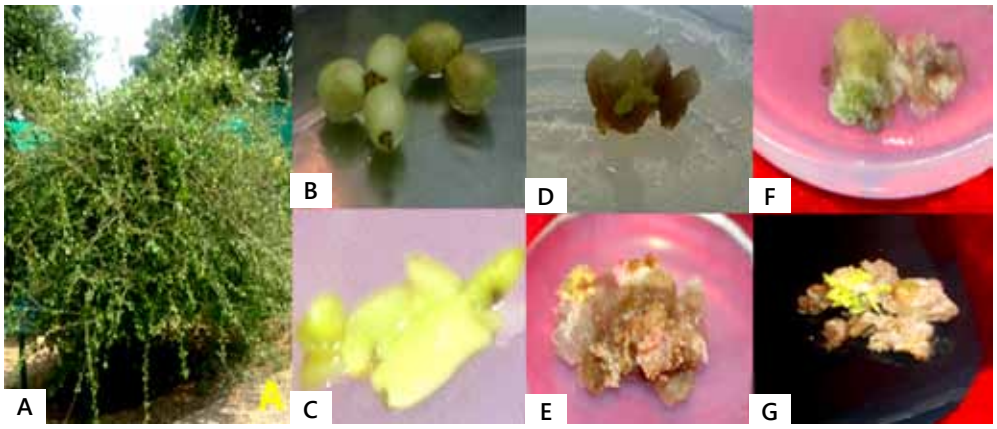
***In-silico* identification of abiotic stress-tolerance candidate genes using co-expression network analysis and comparative genomics (AFRI)**

Bioinformatics (*in-silico*) tools are being used under the current programme to carry out new gene exploration and identification for abiotic-stress tolerance . Co-expression network analysis has been conducted gene by gene for shortlisted 100 genes, using bioinformatics platform-ATTED-II. Based on this analysis, gene co-expression networks have been constructed. Work on identification of orthologous genes in Poplar was completed. The Secondary Clusters were finalized. Linked genes were tabulated and were further used for functional analysis. BlastP searches against the *Populus* genomic datasets for identification of orthologous genes associated with abiotic stresses in the tree species (i.e., *Populus*) was completed. Reciprocal Best Hit (RBH) one-to-one analysis through two-way BlastP was initiated and completed successfully. Final data analysis is underway and findings would be brought out in due course.The identification of orthologous genes in trees

that are equivalent to this abiotic stress tolerance counterpart in *Arabidopsis* will lead to new gene discovery that will help the improvement work of trees.

Non-destructive *in vitro* production of pharmacologically-active natural extract containing guggulsterones – a potent cardio-protective and anti-cancer drug from *Commiphora wightii* (Guggul) using bioreactor (AFRI)

Immature fruits were collected from plants of *Commiphora wightii* growing at AFRI nursery and also from tissue culture raised plants growing at AFRI campus, Jodhpur. Embryos were scooped out from immature fruits and inoculated on Gamborg's B5 medium supplemented with 0.5 mg/l 2, 4-D. Callus obtained was further inoculated on hormone free B5 medium for induction of somatic embryogenesis. Embryogenic callus were transferred to modified MS medium supplemented with 0.1 mg/l IBA, 0.25 mg/l BAP and 0.5% activated charcoal. Tissue culture raised plants showed 66.66% callusing while callusing from seed raised plant source was only 57.24% on Gamborg's B5 medium. Percentage of conversion of primary callus to embryogenic state was 78.94% in explants derived from tissue culture raised mature plants compared to only 60% in case of explants from seed derived plants. Explants from tissue culture raised plants were more responsive with fast somatic embryogenesis in just 15 days of inoculation. Our protocol for somatic embryogenesis in *C. wightii* is reproducible and showing good results.



A- Guggal plant growing at AFRI nursery, B- Immature fruit, C- Scooped out embryo, D- Callus initiation on Gamborg's B5 medium, E- Callus multiplication, F- Conversion of non embryogenic callus to embryogenic callus, and G- Development of somatic embryos on modified MS medium

Clonal propagation, characterization and biochemical analysis of *Leptadenia reticulata* – A threatened medicinal plant (AFRI)

During survey *Leptadenia reticulata* plants were selected from 4 sites in Jodhpur, Barmer and Pali. Best *in vitro* shoot multiplication was obtained on MS medium supplemented with 1.5 mg/l BAP and 0.5 mg/l Kn. For *ex vitro* rooting, *in vitro* raised shoots were pulse treated with different range of auxins (IBA and NOA). Best result was obtained by pulse treatment of *in vitro* raised shoot for 3 minutes with 200 mg/l IBA. Micro shoots were *in vitro* rooted. Experiments were conducted for organogenesis and embryogenesis from the proliferated callus. 0.8 mg/l BAP and 0.1 mg/l NAA was found suitable for the induction of embryogenesis in callus from immature seeds and organogenesis in callus from leaf.

Tissue culture studies on *Leptadenia reticulata*

2.4 Forest Management

Projects under the Theme

Projects	Completed Projects	Ongoing Projects	New Projects Initiated During the Year
Plan	2	-	-
Externally Aided	2	4	1
Total	**4**	**4**	**1**

2.4.1 Sustainable Forest Management (SFM)

Study on impact of ban on green felling on biophysical status of forests in context to production prescribed in working plan vis-à-vis actual production from chir forests of Uttarakhand (FRI)

Data was also collected on prescribed yield vs actual yield of chir, growing stock from sample plots in chir forests of Uttarakhand (62 Sample plots laid by FRI & 85 Sample Plots laid by Uttarakhand Forest Depatment). The output of the above study are:

- Ban on green felling has not resulted into steady increase of growing stock.
- The revival of silvicultural operations in the Chir Pine forests is the key to regenerate the forests and to increase the density of the stocking. (not an output)
- The Chir pine forests need to be worked on regular basis to prevent forest fire. (not an output)

Effect of management practices on wood quality of *Melia dubia* (Malabar Neem) Cav (IWST)

Assessment of physical properties and anatomical characterization in terms of fibre and vessel morphology of *Melia dubia* wood grown in unmanaged plantation was carried out. Assessment of mechanical properties is under progress. The study will ascertain the effect of management practices on wood properties and the findings may suggest the intensity of management practices for production of quality timber for solid wood utilization

Capacity Building on Bamboo Treatment Techniques for Promotion of Earth Quake Resilient Housings and Structures in Hill regions of Tripura (RFRI)

The aim of the project is to popularize the use of preservative treated bamboo in building constructions. Participatory planning through interaction with the communities under *Anand Marg Sanstha* and *Twisa Watalok* was done with the help of *Jan Unnayan Samiti Tripura* (JUST) and Tripura Bamboo and Cane Development Centre (TRIBAC). The use of Boucherie machines and treatment tanks (Boiling and Soaking) were demonstrated in the field on trainings.

Bamboo treatment techniques: Training cum Demonstration

2.4.2 Forest Economics

Assessment of selected ecosystem services and their inter-linkage with human wellbeing in Dibru-Saikhowa Biosphere Reserve, Assam (RFRI)

All tangible goods as provisioning services, carbon sequestration/storage assessment as regulating services and ecotourism/ recreation as cultural services were assessed for the economic valuation. The survey indicated that about 80% income of the families of forest villages is coming from the use of provisioning services from the national park. The main source of income are fishing, livestock rearing and agriculture. Around 20% families of surrounding villages having income by means of fishing, fuelwood collection and tourism linked with the Dibru-Saikhowa National Park. Data regarding travel cost was collected using structured Travel Cost Questionnaires from tourists. Maximum tourists (60%) are day visitors, who are coming from nearby cities.

Household survey

2.4.3 Policy and Legal Issues

A study on implication of legislation/ deregulation policy (2001) on Sandalwood cultivation in Karnataka (IWST)

In order to understand the impact of Sandalwood deregulation policy, information from Sandalwood growing farmers in Raichur, Bagalkote, Shimoga, Hassan and Kolar districts was studied. Various stakeholders of Sandalwood like farmers, artisans, craftsman and oil factory were studied. Government of Karnataka has started a new scheme called *Krishi Aranya Prosthana Yojana* (KAPY), wherein seedlings at subsidized rates are supplied. This has encouraged large scale cultivation of Sandalwood in Karnataka. There is a big gap between the harvest and the final payment for the produce to the farmers. This gap needs to be reduced. There is no entry in the RTC's for the farmers involved in Sandalwood cultivation. It is observed that majority of the farmers were not aware of the rules and regulations of Sandalwood harvesting and grading in Karnataka.

Assessing the impact of pruning of *Diospyros melanoxylon* bushes on its yield, quality and natural regeneration of tree species in Maharashtra (TFRI)

In Gondia and Gadchiroli forest divisions of Maharashtra, sites were selected and quadrats of 0.1 ha size were laid in State Forest Department (SFD) and Community Forest Rights (CFR) controlled forests. SFD controlled had pruned bushes and CFR controlled had non-pruned poles of tendu. Healthy leaves in pruned bushes contributed 5 times more of total harvested leaves than non-pruned poles. Gall infested diseased and defoliated leaves were observed more in non-pruned tendu poles. Tendu leaves were chemically analysed with phenols, ascorbic acid and proline and correlated with the resistance against gall attack. Trace elements in tendu leaves were estimated using inductively Coupled Plasma Emission Spectrometer. The results will help the state forest departments in enhancing quality and productivity of tendu leaves.

Control fire experiment conducted at Gondia

Gall infested tendu leaves

Protocol standardization for microchip based e-protection system for valuable trees (IWST)

Protocol for microchip based e-protection system for Sandalwood trees is being developed. Based on preliminary study, model microchip has been assembled, communication between the microchips tested. Fifty microchips have been installed at IWST Campus in Sandalwood trees. The communication between the Gateway and Microchip has been tested. Stakeholder meeting was conducted for further improvement of microchip. Further modification of microchip is in progress. Microchip based e-protection system for sandalwood trees will help to conserve and enhance the status of these precious bio-resources of the country.

2.5 Wood Products

Projects under the Theme

Projects	Completed Projects	Ongoing Projects	New Projects Initiated During the Year
Plan	2	15	7
Externally Aided	2	6	3
Total	**4**	**21**	**10**

2.5.1 Wood and other Lignocellulosic Composites

Role of Nano-fillers in composite wood (FRI)

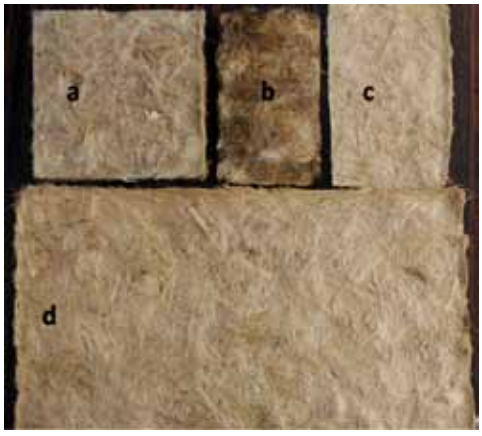
Additives with dimensions in the nano-scale seem to be promising because nano-filers have large surface area and can bring on new properties or even modify properties of resin. A new project on Role of nanofiller in composite wood has been initiated. Resin and Boards, with different nano-particle loadings have been prepared and evaluated for their physical and mechanical properties. Conventional hot plate pressing requires extremely long times for heat to transfer from surface to the core, particularly when pressing thick veneer based composites. Radio frequency current causes a uniform heating of the wood, so that the centre is heated as fast and to the same degree as the outer surfaces. RF current gives a very fast uniform temperature rise and materials with any volume and cross-sectional dimensions can be heated in a very short time. Research work on RF curing of adhesives for plywood manufacturing has been initiated.

Formaldehyde emission reduction from panel products (IWST)

Particle boards were prepared using Urea Formaldehyde (UF) resin and subjected to microwave irradiation. Formaldehyde emission was quantified using perforator method from both control and irradiated boards. Microwave irradiation was found very effective in accelerating removal of unreacted formaldehyde from the board without affecting the board properties thereby reducing emission in subsequent use. Use of UF and MDI resin mixture in preparation of board and formaldehyde emission is under progress.

Nanocellulose networked natural fiber composites (IWST)

Nanocellulose networked composite materials have been developed with long and randomly oriented fibers from areca nut shell, jute and banana. The concentration of nanocellulose in water suspension is a critical factor in binding of the fibers. Polyvinyl acetate, polylactic acid and furfuryl alcohol were also used as additive to improve the adhesion. The prepared composites were extremely light weight exhibiting density range from 0.11 g/cc to 0.24 /cc. The prepared composites can be used as biodegradable packaging material.



Nanocellulose networked composite: (a) Banana fiber-nanocellulose-PLA composite, (b) banana fiber-nanocellulose-furfuryl alcohol composite, (c) banana fiber nanocellulose composite, and (d) banana fiber-nanocellulose-PVA composite

2.5.2 Wood Processing

Non-destructive rapid detection of tree hollowness (FRI)

Research work on Assessment of decay in trees by non destructive technique was initiated. In the first phase of this work completed under an earlier project, technique was developed to test live trees for their hollowness without damaging / cutting the trees. About 1110 trees were tested and the results were found very accurate in detection of hollowness in trees. In the present work the technique of rapid detection of hollowness in live trees is being refined to next level of accuracy.

Development of modified solar kiln with energy storage system for timber drying (FRI)

The doctoral works carried out in the Forest products Division, FRI, Dehradun resulted in a new design double inclination solar kiln which trapped more solar energy during day time compared to the traditional kiln. This extra solar heat was stored in a phase change material (PCM) and water based thermal storage system from which heat was utilized in the night to dry timber inside the kiln. This resulted in appreciable savings in drying times.

Modified solar kiln with phase change material as solar storage system

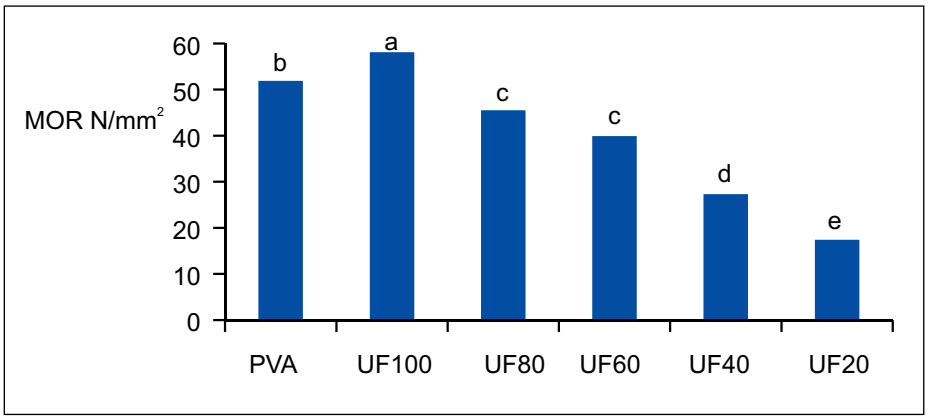
Efficacy of Nano metal oxides as wood preservative (IWST)

The termite resistance of *Hevea* braziliensis (rubberwood) specimens treated with the different concentrations of nano zinc oxide and normal zinc oxide is being evaluated by exposing specimens in the Test-yard. The mean absorption of 8% nano zinc oxide treated wood by brushing, dipping and pressure methods was 0.41, 6.09 and 8.08kg/m^3, respectively. The absorption for normal zinc oxide for same concentration by brushing, dipping and pressure methods is 0.42, 5.80 and 9.49kg/m^3, respectively. After 12 months of exposure the specimens treated by dipping and pressure methods were in good condition. The decay resistance of wood specimens treated with nano and macro size zinc oxide against two brown rot and two white rot fungi is in progress. Experiments conducted for leaching study show that 81.33% of the preservative is intact indicating fixing of nano zinc oxide into the wood. The SEM analysis of preservative treated wood shows distribution of zinc nano particles in all the wood elements, viz., vessels, pores, pits and fibres.

2.5.3 Value Addition and Utilization

Effect of different adhesives on the bending strength of finger jointed Eucalyptus sections (FRI)

In the continuing efforts to improve the efficiency of finger joints with eucalyptus hybrid sections using adhesive manipulation, experiments were initiated with combinations of Urea Formaldehyde (UF) and Poly Vinyl Acetate (PVA) adhesives under the ongoing project "Effect of different adhesives on the bending strength of finger jointed *Eucalyptus* sections". Four sets of finger profiles were profiled and were joined with four combinations of these adhesives and their flexural behaviour were recorded. The study revealed that addition of PVA to UF could not enhance the bending strength that was obtained with UF alone.



UF100, UF80 etc denote the concentration of UF in the UF-PVA mixture. Letters on the bars indicate the differences in the levels of significance in the MOR values.

Value addition in bamboo, canes and lantana through thermal modification (IWST)

Effect of temperature and treatment time on physical properties (weight loss, colour changes and density) of thermally modified *Dendrocalamus stocksii and Dendrocalamus brandisii* was studied at 190, 205 and 220° C. Thermally modified *D. stocksii* attained uniform dark colour and resulted in weight loss and some reduction in density. FTIR spectroscopic study indicated degradation of hemicellulose and increase in cellulose crystallinity of bamboo. Modification reduced volumetric swelling coefficient and improved dimensional stability of bamboo.

Studies on post harvest technologies of *Azadirachta indica* and *Acacia senegal* – as alternative timber species for handicraft industries. (AFRI)

Rajasthan is well known for its woodwork and Jodhpur wooden furniture has been always in great demand across India and outside the country. Work on *Azadirachta indica* (Neem) and *Acacia senegal* (Kumath), which are important but underutilized tree species of arid region, was initiated in 2014 with alternative treatments due to problems with CCA treatment. Sawn wood of both the species was treated with prevailing industrial method- a synthetic Biflex Tc used as chemical preservative and a complex mixture of Copper sulphate, potassium dichromate and *Prosopis juliflora* bark extract (prepared at IWST Bangalore) at 2.5% dilution with water. Value added products with carving were prepared. Coffee table with chip carving was prepared in April 2016. So far there is no sign of deterioration. Display boards of size 5' x3.5' and Book shelf and small almirah of Neem wood and photo frames and Side Table with carving from *A. senegal* wood were also prepared.

1. Coffee table

2. Display board

3. Book shelf

4. Small Almirah

5. Photo frames

6. Side table

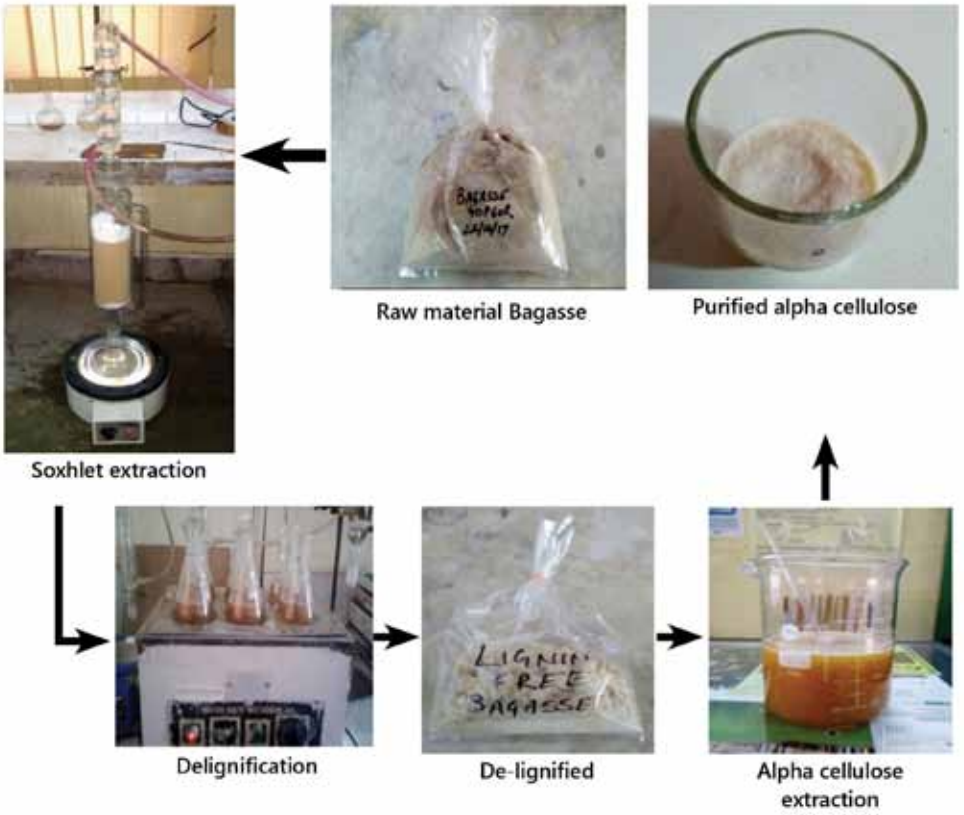
Utilization of Neem and *A. senegal* woods in preparation of different carved utensils. Items 1 to 4 are from *A. indica* wood and 5-6 from *A. senegal* wood

Thus identified alternate tree species as source of wood for making handicrafts may reduce the cost because of utilization of unutilized/plantation grown wood and improve the life of wood by simple chemical/ preservative treatments and become a potential source of handicraft industry.

2.5.4 Pulp and paper

Study on utilization of cationic cellulose as strength additive for quality paper production (FRI)

Proximate analysis results of selected raw material showed moisture content (5.97%), ash content (4.20%), hot water solubility (6.82%), cold water solubility (2.53%), N/10-NaOH solubility (35.60%), alcohol-benzene solubility (2.37%) and klason lignin content (21.48%). After confirming the suitability of the raw material through chemical analysis, the raw material was taken for delignification. The delignified samples were further processed for extraction and purification of alpha cellulose. Sufficient quantity of alpha cellulose was extracted and stored for further modifications. The results of the study carried out so far indicates the suitability of procured raw material for synthesis of cationized cellulose products.



Flow diagram of alpha cellulose extraction in laboratory

2.6 Non-wood Forest Products (NWFPs)

Projects under the Theme

Projects	Completed Projects	Ongoing Projects	New Projects Initiated During the Year
Plan	4	11	6
Externally Aided	13	21	6
Total	**17**	**32**	**12**

2.6.1 Resource Development of NWFPs

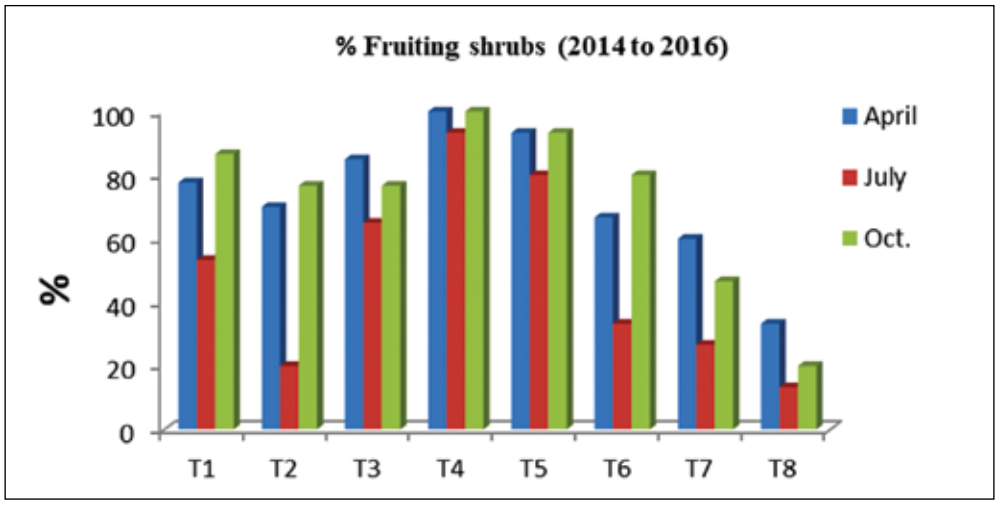
Selection of Superior Quality Germplasm of *Oroxylum indicum*- an endangered species (FRI)

This study was aimed at preparing geo-referenced state wise availability of *Oroxylum indicum* (Shyonak) in Forest Areas of Uttarakhand, Uttar Pradesh, Haryana and Punjab for serving as baseline data for future conservation and potential utilization. 50, 16, 06 and 12 populations have been recorded in Uttarakhand, UP, Haryana and Punjab respectively. Bark samples collected from different states have been analysed both for qualitative and quantitative parameters as per prescribed Ayurvedic Pharmacopeia standards.

Productivity enhancement of *Capparis decidua* (Kair) to generate livelihood in rural areas of Thar Desert (AFRI)

Capparis decidua is the most important indigenous NTFP yielding shrub species, the fruits of which yield supplementary income to the rural people.This project was taken in collaboration with SFD Rajasthan and after a survey experimental field was selected in July 2013 in Gogelao beed forest area in Nagaur. All the plants were divided into three blocks. Three trials were laid. Various treatments were: leaf compost (LCM), goat FYM (GM), and VAM in combination with SSP, SSP + K, K, Zn and SSP, K, + Zn and NPK etc., along with irrigation in October 2013. The results of LCM with inorganic fertilizers gave best results.

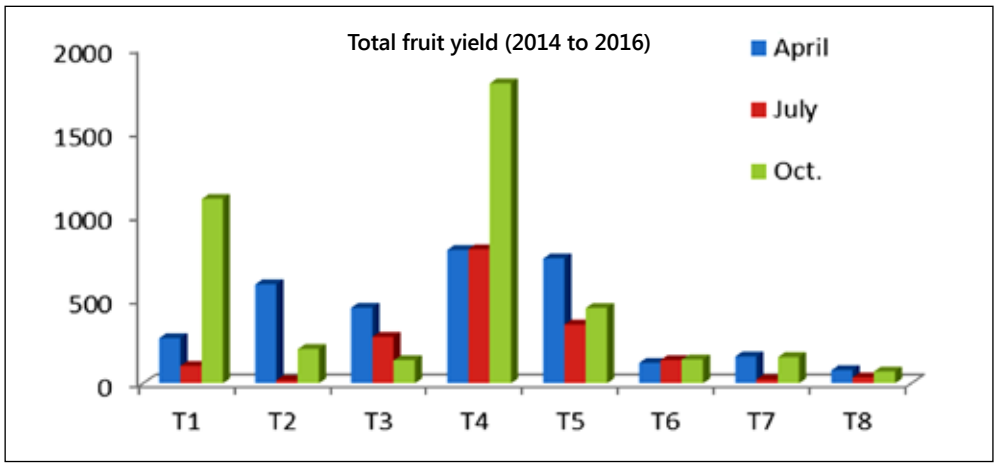
Two way ANOVA for cumulative data indicates significant ($P<0.05$) variations in mean height and crown diameter. Application of fertilizer enhanced the growth. Treatment effect was also significant in case of height ($P<0.05$) where all the treatments recorded more height than control and with 18.8% overall increment with LCM+ Zn followed by 13.06% with LCM, P, K and Zn combination and only 5.46% in the control. Increment for crown diameter was also higher in treated shrubs as compared to control.



Per cent fruiting shrubs in different season under different treatments

Three years cumulative data revealed that a combinations of LCM, P, K and Zn was best treatment recording almost 100% fruiting shrubs throughout seasons in all three years followed by LCM+NPK combination with 88.9% and LCM + K combination with 74.5%, whereas in control it was only in 22.5% shrubs. Season wise, April recorded 73.2% fruit shrubs closely followed by October 72.6%. Fruiting was only in 47.5% shrubs in July. Control shrubs recorded minimum values in all three seasons.

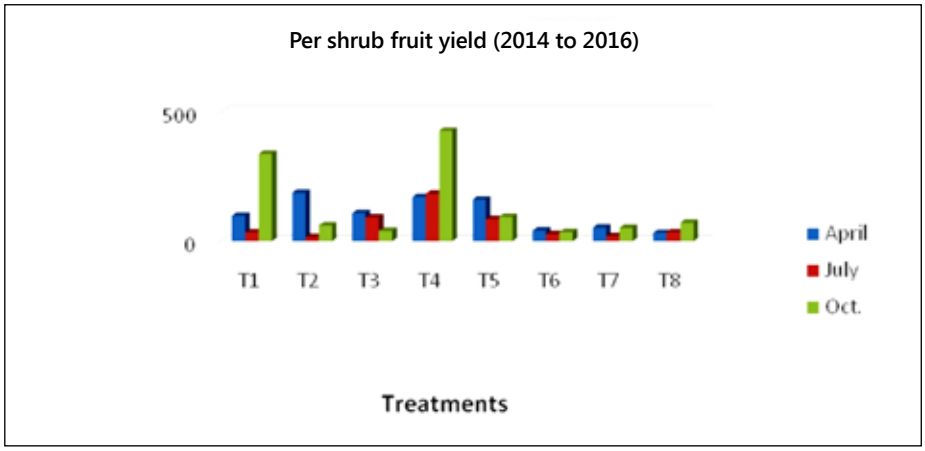
Average fruit yield was 1129.0 g for T_4 treatment (LCM +SSP+K+Zn) which was significantly high as compared to all treatments. Application of LCM only in T_7 treatment (LCM) enhanced the yield to 114.1g only indicating the additive role of inorganic fertilizers. It resulted in maximum fruit yield per season for T_4 treatment which was 10.2 times more (796.32 g to 78.01 g)) than control in April , 2.24 times more in July (800.2 g to 35.71 g) and almost 100 times more in October (1790 .7 g to 71.7 g). Total fruit yield was high in October than April indicating the positive influence of moisture conservation.



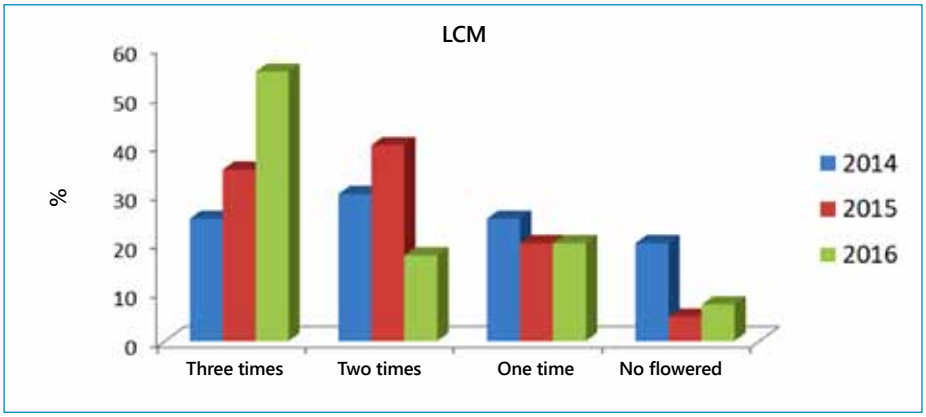
Total fruit in different years influenced by different treatments

Two ways ANOVA indicated the positive effects of treatments on per plant yield in all seasons and was mainly due to per shrub yield. The difference between T_4 and control was 5.32 times in April, 5.15 times in July and 5.98 times in October. A combination of LCM, P and K (T_1) was second best treatment followed by a combination of LCM and NPK (T_5).

Annual fruiting frequency in 2014 indicates that 20% shrubs fruited 3 times, 32.5% shrubs fruited 2 times and 27.5 % plants fruited only 1 time. There were 20% plants (8 nos) which did not fruit at all, four of which belonged to control. In 2015, 35% shrubs fruited 3 times, 40% shrubs fruited 2 times and 20% plants fruited only 1 time. There were 2 plants (5%) one each in control and LCM only treatments did not fruit. In 2016, 55% plants fruited 3 times, 17.5% plants fruited 2 times and 20% plants fruited only 1 time. There were 3 plants (7.5%) two in control and one in LCM only treatments did not fruit. These unfruited plants though belonged to T_7 and T_8 (Control) treatments but different than those in 2015.



Per shrub fruit yields in different season influenced by different treatments



Per cent fruitng shrubs in different years

Conclusively, integrated use of organic and inorganic fertilizers is helpful in enhancing the number of fruiting shrubs and per shrub yield. LCM in combination with inorganic fertilizer provided highest fruit yield. In the treated shrubs, three times fruiting was under a combination of LCM, P, K and Zn, closely followed by a combination of LCM and NPK. Moisture conservation led significant fruit yield recorded in October also. Protein, Sugar and Vitamin C contents were similar for the fruits obtained in April and October and hence can be utilized.

Documentation of Neem products and their role in socio-economic upliftment of rural livelihood in Rajasthan and Gujarat (AFRI)

For preparation of neem litter compost Sonai Manji, Lundawas and Bilawas villages were identified as Model Villages. After a detailed discussion with DST experts and concerned farmer, two sites in Sonai Manji and three site in Sojat were selected. Five compost bins of size 3m x 1.8 m x 0.9 m capacity were constructed in July 2017 and neem litter was dumped. The ingredients were neem litter, animal dung and soil in the ratio of 45:5:50 by weight. Water was sprinkled twice a week for about 120 days for complete decomposition of the material. The compost was then sun dried, grinded and filled in gunny bags and is being used by farmers. This compost was used in one acre agriculture field and good response was obtained. The operational cost was Rs. 11,490/- for 1045 kg compost.

Various steps in neem litter composting (top) and compost preparation and storage (bottom)

Production of quality planting material of *Aconitum heterophyllum* Wall. ex Royle, *Podophyllum hexendrum* Royle & *Angelica glauca* Edgew and extension of their cultivation technology to local Communities (HFRI)

In this NMPB funded project, raised and maintained around 0.85 lakhs nursery stock of Atish, Ban Kakri and Chora at different Field Research Stations of the Institute. Distributed around 0.69 lakhs medicinal plants and some seeds of these species to various stakeholders in the states of Himachal Pradesh (H.P.) and Jammu & Kashmir (J&K) thereby, enabling them to initiate cultivation practices. Under the extension component of the project, successfully organized one training and demonstration programme at Bhadarwah, Doda (J&K) in collaboration with KVK Doda, Jammu and another at Sarain, Chopal, Shimla (H.P.) for the ultimate benefit of local communities and frontline staff of these states. Also organized two meetings in J&K. at Khellani Top, Bhalla, Doda and at Bhadarwah to sensitize local communities for taking up medicinal plants cultivation.

Medicinal Plants distribution at Rampur and Nichar (H.P.)

Ethno-botanical study on indigenous medicinal and aromatic plants used by local people of Chopal Forest Division, Shimla Forest Circle, Himachal Pradesh (HFRI)

A total of 213 species belonging to 172 genera and 79 plant families were inventorized under the project. Out of the total species recorded, 206 species of 165 genera and 74 families are angiosperm, whereas, the remaining five species of five genera and three families belong to gymnosperms. Out of total MAP species, 187 are medicinal, 15 used for medicinal and aromatic purposes both and 11 species are aromatic. Thirty one of these MAP species (15.20 per cent) fall in different category of threatened list of medicinal plants. Besides, a total of 120 ethno-botanical important medicinal and aromatic plant species of 107 genera belonging to sixty one families traditionally used by local people of the division to treat different minor ailments were documented from the study area. Thirty high valued important medicinal plants were also geo-referenced. Some of these MAP's include *Aconitum heterophyllum*, *Berberis aristata*, *Crepidium acuminatum*, *Polygonatum multiflorum*, *Picrorhiza kurroa*, *Saussurea costus*, etc. During the project period two trainings were imparted to various stakeholders.

Ethno-botanically important MAP species viz. *Delphinium vestitum* and *Lactuca micorhiza*

Programme support on elucidation of biosynthetic pathways and development of gene markers of high valued endangered medicinal herbs of NW Himalayas (Phase II)- Collaborative project with JUIT, Waknaghat (HFRI)

Relevant literature collected and nursery beds already identified and established were maintained for raising the germplasm to be supplied to JUIT for biosynthetic study. Carried out additional surveys in different probable locations of Himachal Pradesh and collected the germplasm of *P. kurroa* and established them at FGB at FRS, Brundhar. Field gene bank of *P. kurroa* of total 52 provenances was maintained and multiplied and raised 10000 plants. Leaf samples of all provenances of *P. kurroa* were supplied to JUIT for biosynthetic studies.

Field Gene Bank of *Picorhiza kurroa* at FRS, Brundhar, Manali (H.P.)

Evaluation of genetic superiority and stability of identified high active ingredient content accessions of *Picrorhiza kurroa* Royle ex Benth., *Valeriana jatamansi* Jones and *Podophyllum hexandrum* Royle through multi-location trials and promotion of their cultivation amongst rural communities (HFRI)

Twenty provenances of *Picrorhiza kurroa*, *Valeriana jatamansi* and *Podophyllum hexandrum* were shortlisted for trials and their subsequent maintenance was carried out. After extensive surveys, sites for establishing multi-location trials of selected species were finalized. Field genebank were also maintained at FRS Brundhar.

During the year, prepared nursery beds for establishing trials and collected the plants from already identified locations. Multi-location trials of *Valeriana jatamansi* were established at FRS Brundhar, FRS Shilly (Solan) and FRS Shillaru (Shimla). Multi-locational trials of *Picrorhiza kurroa* and *Podophyllum hexandrum* were established at FRS Brundhar (Kullu), HPSFD Nursery Kothi (Kullu) and HPSFD Nursery Nichar (Kinnaur). The trials of the selected species and maintained. Data for various growth and morphological parameters were periodically recorded. Also one day training programme on "Cultivation of important temperate medicinal plants" was organized at Mansari, Haripur, Kullu (HP), which was attended by 40 participants from the Kullu valley.

Survey and collection of *Picrorhiza kurroa, Valeriana jatamansi* and *Podophyllum hexandrum*

Standardization of nursery and propagation methods of *Trillium govanianum* Wall. ex D. Don (Nag chhatri) (HFRI)

Maintained the trials as laid out in the past. Besides, extensive surveys in 14 different geographical locations of Himachal Pradesh were conducted and accordingly, collected the genetic material from all these locations by recording the various morphometric characteristics from each of the sites. Established Field Gene Bank of *T. govanianium* (12 sources) at FRS, Brundhar Manali (H.P.) and maintained during the period under report. Propagation trials of *T. govanianium* were established by giving hormonal treatment of IBA and IAA (50, 100, 150, 200 ppm concentration of both growth hormones and control). Data for subsequent analysis were recorded for survival and sprouting .

Survey and collection of *Trillium govanianum*


***Trillium govanianum* propagation trials at FRS Brundhar Nursery**

Development of descriptors and evaluation of artificial inoculation in *Aquilaria malaccensis* Lamk (RFRI)

Survey was carried out in different parts of Northeast India to identify different variants/ecotypes of *Aquilaria malaccensis* and to develop a descriptors list of the same. Further, experiment on response to agarwood induction by such variants through artificial inoculation was also carried out in this study. Differences were observed in leaf shape, base, apex, margin and area; bark colour and texture; flowering time and fruit shape. Artificial inoculation of agar trees showed formation of agarwood in all inoculated trees and no variation was noticed in response. Six to seven year old trees with 30-45 cm GBH were found ideal for inoculation. The infection was found established three months after inoculation. The inoculated trees can be harvested after two years.

Standardization of artificial inoculation in *Aquilaria malaccensis* in Meghalaya (RFRI)

Artificial inoculation in *Aquilaria malaccensis* plantation was carried out in South East Khasi hills and North Garo hills of Meghalaya with three different types of fungal cultures. Initiation of agarwood formation was noticed, within one month of inoculation.


Artificial inoculation *A. malaccensis*


Formation of Agarwood after inoculation

Coordinated Research Programme on Agar (*Aquilaria malaccensis* Lamk.) (RFRI)

Sixteen provenances were delimited based on geographic barriers to gene flow. Fruits were collected from 14 locations of Assam and Arunachal Pradesh, and progeny from 67 families were raised in the nursery for progeny trials. Inoculation of fungal isolates in *Aquilaria* trees was carried out following different treatment combinations, and induction of Agarwood was noticed after one month of inoculation. Macropropagation trials indicated that maximum rooting was observed in medium of vermiculite: sand (1:1) treated with different concentrations of IBA.

Agarwood formation

Comparison of agarwood formation in T_2, T_3 and T_4

Seedlings at nursery

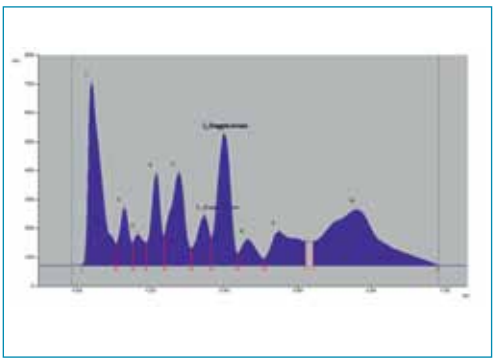
Sprouting of *A. malaccensis* of branch cuttings

2.6.2 Sustainable Harvesting and Management

Standardization of non-destructive harvesting practices of *Commiphora wightii* (Guggal) gum oleo gum resin in Madhya Pradesh (TFRI)

Experiments were laid out at Piprai (Morena) and Kankura (Bhind) to standardize non destructive harvesting technique of *Commiphora wightii* (Guggul) for collection of oleo-gum resin. The quantum of gum yield showed an increasing trend with increase in girth sizes (10-20, 21-30, 31-40cm) and maximum yield was observed in summer tapping season (April-May) in multiple slant cuts by Guggul blazer. The quantity of total Guggulsterone increased in the month of May (0.58%), containing Guggulsterone E- 0.048% and Guggulsterons Z- 0.52 %.

Oozing of Guggul oleo-gum



HPTLC Fingerprint profile of *C. wightii* resin

2.6.3 Chemistry of NWFPs, Value Addition and Utilization

Utilization of forest biomass through value added application as source of natural dyes (FRI)

Dyes were extracted from leaves of *Alternantheria philoxeroides* (alligator weed), *Erythrina suberosa* (Dhauldhak), *Ardisia solanacea* (Bisi), *Mimosa himalayana* (alral, shiahkanta), *Cassia occidentalis* (Kasunda), *Cassia fistula* (Amaltas), and *Lannea coromandelica* (Mohin) and *Terminalia alata*, (sadora, usan, amari) and applied on silk, wool and cotton fabrics which produced various shades on applied fabrics using different mordants.

Bioprospecting of *Pinus roxburghii* needles wax and other extractives (FRI)

Pine needles are a source of various important chemicals and constitute one of the important constituent viz. epicuticular wax was isolated in 1.64 % yield. The physicochemical properties of wax were comparable to bees wax and carnauba wax. Further, holocellulose has been isolated from the pine needles. Shikimic acid which is an important biomolecule and precursor of tamiflu has been isolated in 2-4% yield from pine needles.

Investigation on population biology, characterization and conservation of some high value threatened medicinal plants of North East region (FRI)

Conditions for isolation of the essential oil from *Valeriana jatamansi* rhizomes and its GC-MS analysis were established. Using this protocol, previously unknown chemical characterization of 19 accessions of wild grown population of *Valeriana jatamansi* was carried out and compared for marker constituents variability. Conditions for extraction of the *Dicentra scandens* tubers and HPTLC quantification of marker alkaloid protopine in the tubers were standardized. These conditions are being used for chemical profiling of different population lines of *Valeriana jatamansi* and *Dicentra scandens* growing in the north- east region of India.

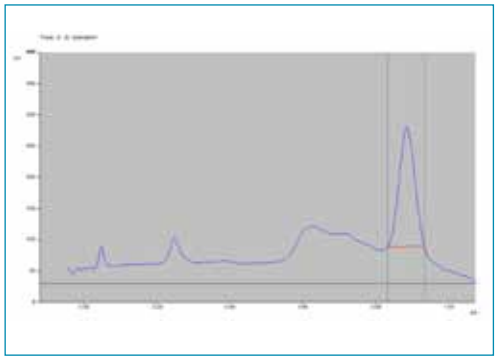
Development of plant based bio-pesticide for management of poplar defoliator, its field trial in northern region and conduction of awareness programme for farmers (FRI)

A herbal biopesticide was developed and tested under laboratory condition, semi field and at farmer's field of Uttarakhand, Haryana and Uttar Pradesh to test their efficacy for the management of *C. cupreata* larvae. Results showed that under laboratory condition 1% concentration of biopesticide was found effective which provided 61.25±0.32% larval mortality. Further, bioassay of biopesticide was also carried out and it was reported that 1.5% and 2.0% concentration showed 66.50±0.35 and 68.75±0.35% larval mortality. Therefore 1.5% biopseticide concentration is recommended under laboratory conditions. Field trials were carried out at the farmer's field inUttarakhand, Haryana and Uttar Pradesh. It was observed that 2.0% concentration provided 63.33±0.36% larval mortality at three different locations. Whereas 2.5% concentration yielded 63.33±0.36, 65.00±0.0 and 66.67±0.35% larval mortality in Uttarakhand, Haryana and Uttar Pradesh trial respectively. Therefore, 2.5% concentration for the farmer's field which yielded maximum larval mortality 66.67±0.35% in Uttar Pradesh trial after 72 hrs. of biopseticide exposure is recommended. A herbal biopesticide **Rashak** was developed.

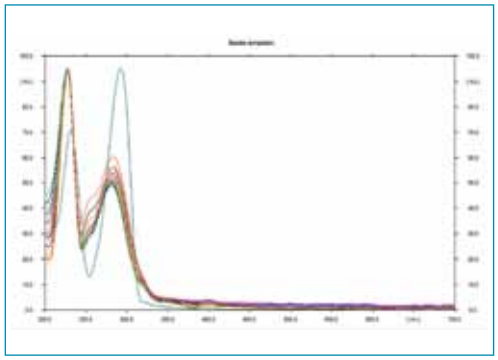
Phytochemical examination, molecular characterization and propagation of *Illicium griffithii* Hook. f. &Thoms.: a medicinally important RET plant of Northeast India for improving economic- and conservation-status (FRI)	Shikimic acid is one of the potent globally acknowledged pharmaceutical intermediate and sole building block for antiviral drug oseltamivir (Tamiflu). Shikimic acid was isolated and analysed from *Illicium griffithii* fruits, small branches, bark and leaves from different locations of North East India to	study the best genotypes for its propagation. The shikimic acid content varied from 1-18%.
Identification of superior germplasm of *Andrographis paniculata* and *Bacopa monnieri* and its cultivation at farmers/tribals field for livelihood generation (FRI)	Germplasms of *Andrographis paniculata* (Kalmegh- 28 accessions) and *Bacopa monnieri* (Brahmi -24 accessions) were collected from the states of Jharkhand, Odisha, West Bengal, Chandigarh, Madhya Pradesh, Uttar Pradesh, Karnataka, Gujarat, Haryana and Uttarakhand. Germplasm was also collected from research institutions like CIMAP, Lucknow; NBPGR, New Delhi; NBRI, Lucknow; SFRI, Jabalpur; JNKVV, Jabalpur; DMAPR, Anand; Anand Agricultural University, Anand; IIHR, Bengaluru; FRLHT, Bengaluru; Dabur, India Ltd. and Patanjali Ayurved, Haridwar.	In *Andrographis paniculata*, andrographolide content ranged from 1.38 to 3.12 % on dry weight basis. In *Bacopa monnieri*, bacoside content ranged from 0.47% to 3.18% on dry weight basis. Jute bags with polythene lining were found to be most suitable packaging material for Kalmegh and Brahmi. In case of Brahmi, there is a sharp decrease in bacoside content even after four months of storage. Preliminary findings indicate that Kalmegh and Brahmi should not be stored for longer period after harvest to obtain quality produce.
Gas Chromatography-Mass Spectrometry (GC-MS) based authentication of Sandalwood Oil (IWST)	Sandalwood oil and wood samples were collected from different locations (Uttarakhand, Delhi, UP, Haryana, Maharashtra, Telangana, Andhra Pradesh, Karnataka, Kerala and Tamil Nadu). Collected wood and oil samples were subjected to distillation followed by physicochemical analysis (color, odour, relative density,	refractive index and solubility etc.). Further, chemical profiling of distilled oils was carried out using gas chromatography mass spectrometry (GC-MS). GC-MS profile protocol was developed for pure oil samples and adulterants were confirmed and quantified.
***Ailanthus excelsa* –for alternate protein: as a potential of fodder in terms of nutritive value and qualitative assessment. (NFRP-154) (IFGTB)**	Anti-nutritive factors like Aflatoxins (B1, B2, G1 and G2) one of the most important mycotoxin, phytate (phosphorous complex) and nitrite were analysed for 66 accessions of *A.excelsa* and observed in non detectable quantity in leaf samples which concluded that all the accessions were suitable for animal consumption. Total	ash content ranged between 1.6 and 12.2 %. Crude protein content was above 20 % in 30 accessions, which is higher than the prescribed limit for cattle feed (>20%). The digestibility of the fodder was greater than 50%.

Evaluation of phytochemicals from forest species - *Terminalia bellerica*, *Sapindus laurifolius*, *Acacia concinna*, *A. auriculiformis*, and *Ziziphus mauritiana* for removal of chemical residues from edible produce (TFRI)

Potential of plant extractives in removal of chemical residues from edible produce was evaluated. Brinjal and Okra samples were treated with commercial pesticides formulations i.e. Tricel (20% a.i. chlorpyriphos) and Profex (4% a.i. cypermethrin) and different dilutions *i.e.* 5, 10 and 15% of *S. mukrissi* and *Ziziphus maurtiana* for different periods and extracted in suitable solvents following standard protocol. The residue of chlorpyriphos was found below detectable limit in *Sapindus mukrossi* treated samples. Similarly *Z. maurtiana* treated samples showed the presence of 0.45-1.1mg pesticide residue in different treatments.



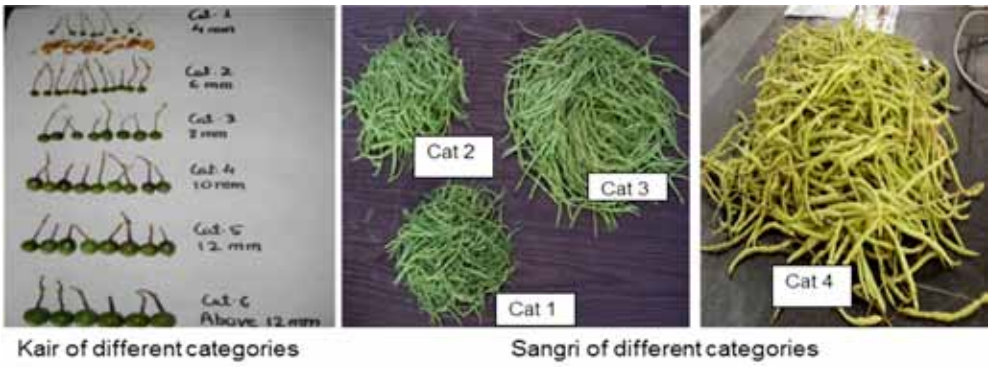
HPTLC Chromatograph of Tricel (Chlorpyriphos)



HPTLC Spectra of different treatments

Optimization of processing methods for *Prosopis cineraria* and *Capparis decidua* fruits for their improved utilization in western Rajasthan (AFRI)

Sugar, protein and seed oil content were determined for *Capparis decidua* (Kair) and *Prosopis cineraria* (Khezri) fruits. In kair fruits sugar content was high in March-April season fruits (10.83 %) and minimum in fruits of July-August season (8.67%). Protein content was maximum in July-August season (13.56%) and minimum in March-April season fruits (10.15 %). Fatty oil content in kair seeds showed maximum oil for the fruits of winter season (19.15%) and minimum (13.51%) in case of fruits of April. Variation of sugar and protein in different categories of kair was also studied. In case of April season fruits, sugar increased from category (cat) 3 (19.99%) to cat 4 (11.58%), it then decreases in cat 5 (19.14%) and increased again in cat 6 (10.6%). Other season fruits also showed similar trend in sugar content. Protein content also varied in similar way. It increased from cat 3 (7.46 %) to cat 4 (10.96%), it then decreased in cat 5 (10.0 %) and increased again in cat 6 (12.2 %).



Variation in fruit size of Kair and Sangari collected from different locations

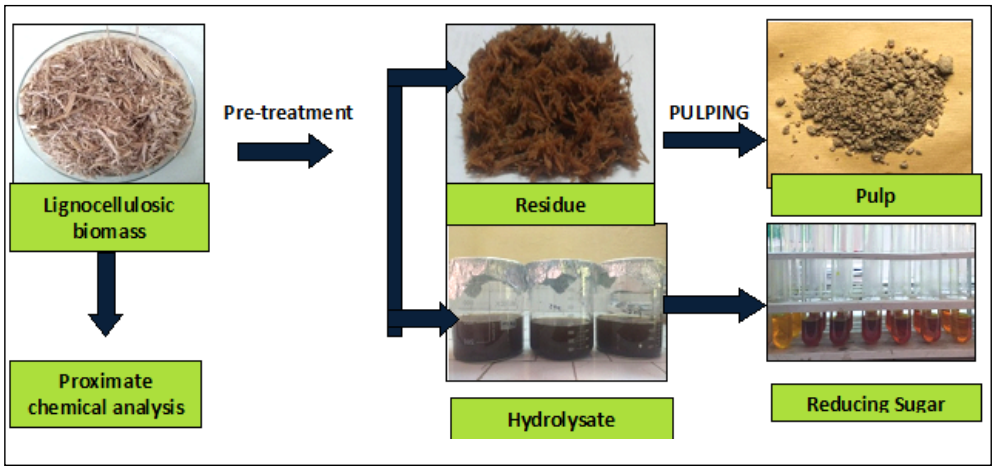
Sugar and protein content of khezri fruits were also determined in different categories viz. Cat 1(Immature) < 2 mm, Cat 2 ((Immature) 2-2.5mm, Cat 3 (Mature) 2.5-3.5 mm, Cat. 4 (Ripe) 3.5-5.5 mm. The sugar content increased from cat 1 (11.57 %) upto

cat 3 (14.8 %) and then decreased in cat 4 (10.81%). It increased again in ripe pods (13.06%). Protein content increased upto cat 2 (12.24%) and then decreased from cat 3 continuously.

2.6.4 Biofuels and Bioenergy

Studies on chemoenzymatic treatment of black liquor recovery of reducing sugars for bioethanol production (FRI)

Production of reducing sugars through pretreatment of lignocellulosic biomass for bioethanol. Lignocellulosic biomass was procured from local agricultural field. Sample was taken for proximate chemical analysis after grinding to pass a 0.4-mm (40-mesh) screen in order to permit complete reaction of the sample with the reagents used in the analysis. The sample was assessed for moisture content (7.5%), ash content (2%), hot water solubility (9.5%), cold water solubility (5.33%), N/10 NaOH solubility (32.25%), Alcohol-benzene solubility (1.70%), holocellulose content(73.60%) and acid insoluble lignin content(22.5%) as per TAPPI standard methods. The raw material was subjected to Physico-chemical pretreatment for the extraction of maximum reducing sugar content. Maximum 25-30mg/ml of reducing sugar was extracted by pretreatment of raw material under optimized reaction condition (0.1N H_2SO_4) treatment at 120ºC for 2 hours with bath ratio of 1:10). However for further enhancement in the yield of fermentable reducing sugars in pretreated liquor, it is being treated with saccharifying microbial enzymes. The pre-treated raw material was further subjected to pulping for the production of pulp. The assessment of pulp quality is under progress.

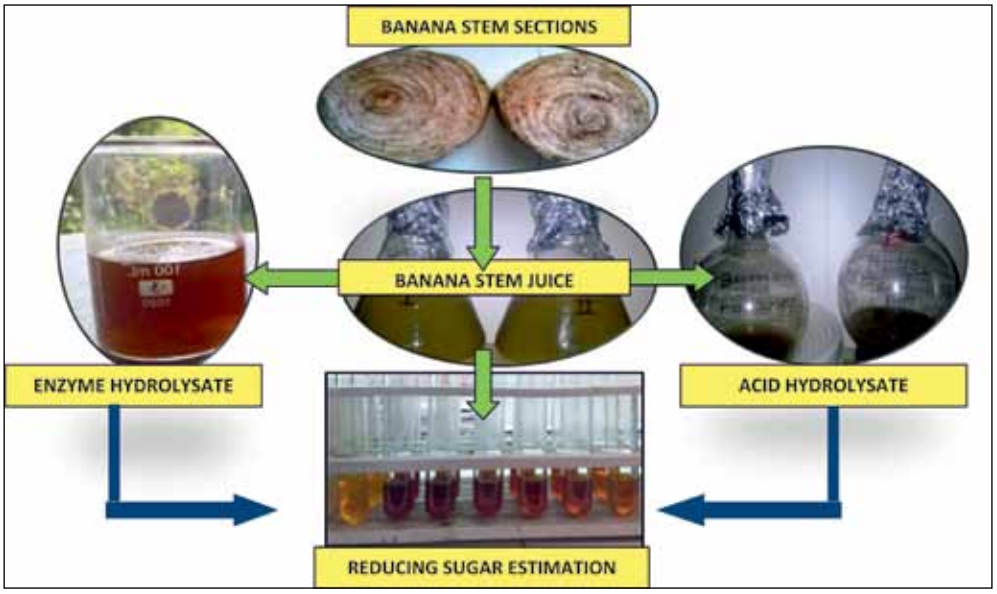


Integrated utilization of lignocellulosic raw material for paper making and bioethanol

Utilization of banana stem juice for renewable energy and value added production (FRI)

Banana stem sample was obtained soon after the fruits were harvested from local plantation field. After determining the total moisture content of stem (93.8%), mechanical processing of banana stem was performed prior to extraction of juice in order to achieve maximum Total Reducing Sugar (TRS) concentration. The extracted banana stem juice [80% (v/w) of the stem] was filtered, basic properties were determined (pH-6.8, dissolved solid content- 4%) and assessed for TRS content. A maximum 12mg/ml of TRS was attained in raw juice. The raw juice was further subjected to acid hydrolysis (at 100°C for 2.5 hours with 1.2N H_2SO_4) and Enzymatic saccharification [0.5-1% Enzyme(w/v), 24-48 hours, 45°C, pH 4.5-5] in order to enhance TRS yield in raw juice. The acid hydrolysis resulted an increase in TRS content from

12mg/ml to 25mg/ml where as enzymatic saccharification [with 1% Enzyme (w/v) for 48 hours] enhanced TRS content from 12mg/ml to 15mg/ml. A further application of concomitant enzymes for maximum extraction of reducing sugars from banana stem juice is under progress.



Extraction of reducing sugars from banana stem juice

Study on microwave assisted direct biodiesel production from *Pongamia pinnata* (L) seed oil by two phase solvent extraction (IWST)

Quality of *Pongamia pinnata* (Karanj) oil was improved when oil extraction was carried out by microwave assisted two phase solvent extraction (MATSE) process. Acid value of oil was reduced from 5.0mg KOH/g to 1.0 mg KOH/g and peroxide value from 6.0 to 2.0meqO_2/kg, under MATSE process. Fatty acid composition of treated and untreated *P. pinnata* seed oil remained unchanged. Optimum condition for MATSE was found to be 30sec of seed pretreatment; particles size of -40 + 60 mesh; 40°C temperature and 3min extraction time. It was observed that the change in oil quality was particularly appreciable in pretreated seeds. The optimum reaction condition for 100% direct biodiesel production was found to be 1% KOH; 60 °C temperature; 7 min microwave irradiation time and 1:9 oil methanol molar ratios. There are various other experimental advantages in direct biodiesel production by MATSE method over conventional method; such as easy separation of moisture or water from oil and biodiesel due to presence of hexane, significant reduction in acid value of the oil, refinement of several impurities of the oil, rapid biodiesel production etc.

2.7 Forest Protection

Projects under the Theme

Projects	Completed Projects	Ongoing Projects	New Projects Initiated During the Year
Plan	3	23	2
Externally Aided	8	16	5
Total	**11**	**39**	**07**

2.7.1 Insects pests, diseases and control

Insect pests of oaks in the western Himalaya (FRI)

Insect pest surveys for three oak species - *Quercus leucotrichophora* (Ban oak), *Q. floribunda* (Moru oak) and *Q. semecarpifolia* (Kharsu oak) - resulted in collection of 17 insect species (10 lepidopteran defoliators, 3 cerambycid borers, 3 hemipteran sap suckers and one seed boring beetle). They were reared in the laboratory and life histories of following four species feeding on Ban oak were studied: *Artena dotata* (Fabricius, 1794) (Noctuoidea: Erebidae), *Calliteara grotei* (Moore,1859) (Lymantridae: Eribidae) (Grote's Tussock Moth), *Mixochlora vittata* (Moore,1867) (Geometridae: Geometrinae) and borer, *Xylotrechus basifuliginosus* Hall. (Coleoptera: Cerambycidae), later also attacked Kharsu oak. *Artena dotata* was recorded for the first time as larval host plant of the Ban oak.

Second instar larva | Fourth instar larva | Cocoon | Male moth

Grote's Tussock Moth, *Calliteara grotei* (Moore,1859) (Lymantridae: Eribidae)

Larva | Pupa | Moth

***Mixochlora vittata* (Moore,1867) (Geometridae: Geometrinae)**

***Artena dotata* (Fabricius, 1794) (Noctuoidea: Erebidae)**

***Xylotrechus smeii* (Coleoptera: Cerambycidae)**

Epidemiology and management of *Chlorophorus annularis* Fab. (Coleoptera: Cerambycidae)–A major borer of cut and dry bamboo. (FRI)

Chlorophorus annularis infested bamboos were collected from different places in Uttarakhand (FRI, Timli, Langha and Thano), Haryana (Kalesar) and Uttar Pradesh (Saharanpur) and reared in the chimney, zinc, wooden and outdoor cages. Adult emergence was observed during April to September. Female had longevity of 21 days and laid about 21-66 eggs singly at nodes, cracks and splits of cut and dry bamboos. Elliptical, off-white coloured freshly laid egg later turned yellowish and has incubation period of 11-14 days. Larvae are milky white in colour with smooth body and blackish brown head. The incidence of attack was recorded on eight bamboo species, out of which three reported for the first time.

Mature larva | Pupa | Pupal chamber | Adult

***Chlorophorus annularis* Fab. (Coleoptera: Cerambycidae): 1, mature larva; 2, pupa; 3, pupal chamber and 4, adult.**

An android based mobile application "Poplar Keet" has been launched for easy identification and management of insect pests of poplar.

Development and extension of *Trichoderma* spp. based formulation for disease biocontrol and plant growth promotion of eucalypts seedlings (FRI)

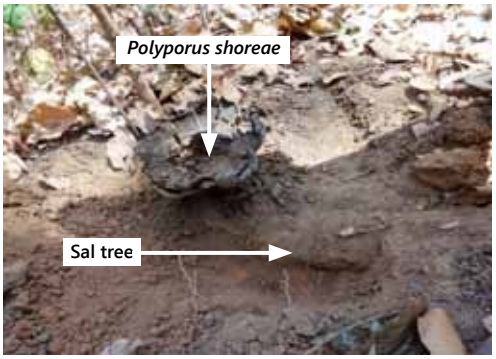
Eucalyptus seeds and nursery soil used for raising seedlings were treated with *Trichoderma* spp. isolates for evaluating their effect on seed germination and seedling growth. Different growth and biochemical parameters suggested significant improvement in seed germination, root, stem and leaf growth and form in nursery.

Sal mortality in Bokaro forests (FRI)

Jharkhand State Forest Department reported Sal trees mortality in the Bokaro Forest Division due to unknown reason. Scientific investigation was carried out and a root rot pathogen *Polyporus shoreae* was found to be the cause of Sal mortality in Paterwar. Widespread attack by *P. shoreae* occurred due to high soil moisture and heavy weed growth thus predisposing the roots to pathogen attack. Control burning was

recommended for checking weed growth, reduction of soil moisture and enhancement of biocontrol fungus *Trichoderma* sp. population in soil. Human activities in and around Sal forest must be discouraged as it led to root and butt region injury thus giving easy entry to the pathogen.

Occurrence of diseased trees in groups suggest infection spread from the diseased tree to adjoining healthy trees by root contact or root grafting



***Polyporus shoreae* sporophore growing on Sal tree roots causing root rot disease**

Health Status and Age Assessment of the Trees of Rashtrapati Bhavan (FRI)

The project was proposed with the objective to determine the age of some important older trees and record pathological and entomological problems and physiological stress in the trees including edaphic causes. The older trees of the presidential estate were identified and their age was assessed. All the trees of President's Estate were examined for the signs and symptoms of insect-pests and diseases, physiological changes including soil parameters and accordingly the recommendations were proposed. *Dalbergia sissoo* located at Bal Vatika was the oldest tree having the estimated age of 225 years. It was observed that two trees species *Manilkara hexandra* (Khirni) and *Pongamia pinnata* (Papri) are now not performing well in the President's Estate. These species were recommended to be replaced with suitable avenue tree species. Most of the *Ficus microcarpa* (Indian Laurel) trees were in bad shape, damaged and suffering from heart rot disease. The trees were recommended for removal and replacement with tall saplings.

Increment cores of older trees (1-2. *Pinus roxburghii;* 3. *Dalbergia sissoo;* 4. *Tectona grandis;* 5. *Azadirachta indica;* 6. *Ailanthus excelsa;* 7. *Putranjiva roxburghii;* 8. *Ficus virens)*

Maintenance of important trees: (FRI)

The holy Bodhi tree at Bodhgaya, holy trees at Smriti Park, Patna and holy Pipal tree at Koteshwarnath Dham, Belaganj were regularly monitored for pathological, physiological and entomological problems and required treatments were administered. Recommendation of branch support prop erection, repair and adjustments, wound treatment, pilgrim safety cautions with respect to hazardous trees, measures for minimizing soil compaction and root asphyxiation, nutrient application etc. were regularly imparted to keep the holy trees in sound health and prolong their lives.

Holy Pipal tree at Koteshwar Nath Dham, Belaganj whose large branches have turned towards the temple bending downwards as if offering prayers to Lord Shiva

Erection of prop supporting wounded branch of Mahabodhi Vriksha

Cavity treatment of holy tree suffering from heart rot

Monks offering prayers at Mahabodhi Vriksha, Bodhgaya. Decayed branches are threat to human life

Biopesticides from seed extract of *Hydnocarpus pentandra* for the management of insect pests of agriculture/forestry importance (IFGTB)

Petroleum ether and n-Hexane extracts of *Hydnocarpus pentandra* seeds were found to have 1.345% and 1.964% of LC_{50} value, respectively, and 98.74% antifeedancy at 20000 ppm against 3rd instar larvae of Ailanthus defoliator, *Atteva fabriciella*. FAME tested against *A. fabriciella* found to have 97.27% and 79.05% of antifeedancy at 10000 and 20000 ppm, respectively. n-hexane extract and saponified FFA tested against third instar larva of *Eligma narcissus* showed 100% larval mortality for n-hexane extract at 10000 ppm and saponified FFA at 5000 ppm. n-hexane extract, saponified FFA and FAME fractions 2, 3 & 4 were tested for their insecticidal activity against third instar larvae of *A. fabriciella* and arrived at LC_{50} value and found as 983, 644, 837, 755 and 968 ppm, respectively. LD_{50} value estimated after 74 hours for n-hexane extract was

4974 ppm. Among all, saponified oil has highest antifeedant index (89.16%) and n-hexane extract has lowest antifeedant index (63.19%) at 1000ppm. The antifeedant index of fractions was 71.14%, 5.87% and 73.31% for fractions 2,3 &4 respectively. The oil was formulated using suitable surfactants and adjuvants, and the preformulations were evaluated with *A. fabriciella* at concentration of 10,000, 15,000 and 20,000 ppm. 94.75% antifeedancy was observed at 10,000 ppm within 24 h of treatment. The LC_{50} value was arrived and found to be 0.856 %. Oil based ecofriendly biopesticide formulation named "Hy-Act" was developed.

Determining bio-control efficacy of spiders against insect pests of rice agro-forestry system (TFRI)

The project highlights the utilization of spiders for ecologically based pest management of insect pests of paddy . 28 species of spiders were collected and identified from rice fields. The colony of social spider (*Stegodyphus sarasinorum*) were reared in the Arachnarium of TFRI and 2 such colonies, which are to be utilized as mother colony for experimental work, were transported to experimental site. This project is being executed in collaboration with JNKVV, Jabalpur.

Giant wood-spider *Nephila pilipes* for rice-pest control and its egg-sac

Social Spider *Stegodyphus sarasinorum*

Integrated pest management against flower gall inducers of *Prosopis cineraria* (L.) Druce. (AFRI)

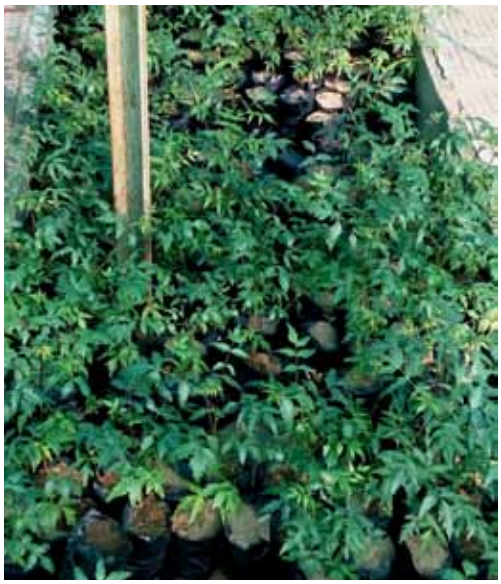
Surveys to record the status of flower gall problem of Khejri Khejdhali, Gudha Bishnoiyan, Phalodi, Lohawat Osian, Nagaur, Pali and Luni were visited. Gall intensity was more severe at Phalodi, Osian and Lohawat areas resulting in loss of 80-90% pods in these areas as compared to the other areas under study. Biochemical analyses for carbohydrate and protein in leaves and seeds have been completed and analysis of samples for phenols is in progress. Output of the project will be beneficial in managing the problem of flower galls of Khejri adopting integrated management approach and to enhance fruit yield.

Khejri infested with flower galls

Flower galls of Khejri

Development of package for integrated management of insect pests & diseases (IPDM) and improvement of planting stock material of neem (*Azadirachta indica*) through biofertilizers (AFRI)

For managing the insect pests and diseases in Neem, *Trichoderma viride* and *Prosopis juliflora* leaf extract were found to be effective. Combinations of 5 different biofertilizers were used in neem for improving the growth of planting material. These beneficial microbes improved the plant growth and enabled them to endure various biotic and abiotic stresses. A combination of *Azotobacter, Azospirillum* and *Trichoderma* increased the Neem plant biomass by 58.88%.



Mass production of neem seedlings using combination of *Azotobacter, Azospirillum* and *Trichoderma*

Taxonomic study of Tettigoniidae (Orthoptera) in India (RFRI)

Mortality of *Parkia roxburghii* in North-East India

The tree bean, *Parkia timoriana* (syn: *Parkia roxburghii* vern: Yongchak in Manipuri) is the most popular food amongst the people of Manipur and Mizoram. But, large scale mortality of this tree species has become a major concern. *Coptops aedificator* (Long horned beetle) was found responsible for the mortality, and this is the first report of this pest on *Parkia timoriana*. Besides this beetle, other insects and fungal infestation was also noticed. This malady appears to be of complex nature involving both insects and fungi, and proper Integrated Pest and Disease Management (IPDM) strategies need to be identified after further study. The causative factors need further investigation as the role of pathogen is inconclusive. However, to check the spread of the mortality, painting the base of the trees with a mixture of Malathion (50% EC) and lime powder in 1:10 ratio was found effective.

Yellowing of leaves

Die back of twigs

Necrotic lesions and Blisters on the bark of Parkia

2.7.2 Mycorrhizae, rhizobia and other useful microbes

Exploration of potential beneficial microbes in different forest and agriculture ecosystems in Kolli hills, Tamil Nadu and imparting training cum demonstration on bio-fertilizer production and application in nursery and field (TNSPC) (IWST)

After testing 50 Plant Growth Promoting Rhizobacteria (PGPR), 20 isolates showed promising results. Arbuscular Mycorrhizal (AM) association was found to be higher in forestry species as compared to agriculture crops. Nursery experiment conducted to test the efficacy of selected bio-fertilizers (VAM fungi, *Azospirillum*, *Azotobacter*, Actinomycete and Phosphobacteria) on some important medicinal plants revealed that combined application of all bio-fertilizers in general had 25-30% growth and biomass increment in inoculated plants.

Formulation of biofertilizers consortium and their distribution to forest department (TFRI)

Packets of bio-fertilizers were supplied for application in nurseries of 11 research and extension circles including 661 packets of *Rhizobium*, 668 of *Azatobacter*, 308 of *Azospirillum*, 544 of PSB and 24 bags of VAM fungi. In addition AM fungi were also distributed to MP Forest Development Corporation (11 nurseries) for application in bamboos.

Value addition to plants of agricultural and horticultural importance by application of consortium of root fungal endophyte and nitrogen fixing prokaryote – Azotobacter spp. (AFRI)

Seeds of neem (*Azadirachta indica*), Khejri (*Prosopis cineraria*), Senna (*Cassia angustifolia*), and Isabgol (*Plantago ovata*) were treated with AM fungi *Piriformospora indica*, *Azotobacter* spp. and consortium of these microbes to study their effect on the growth and development of the plant species. In Khejri, the consortium application resulted in better plant growth. In neem seedlings, *P. indica* application led to better plant growth. *P. indica* application to annual plants Senna and isabgol, gave better results as compared to other treatments.

P. indica treated Isabgol

Control

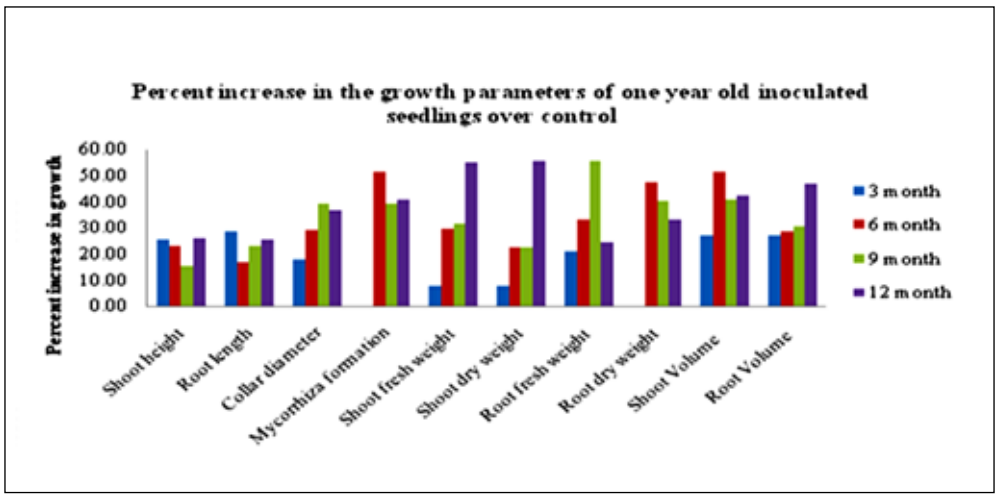
P. indica treated senna

Control

Increase in yield of Isabogal and Senna by *Piriformospora indica* application

Conservation of *Pinus gerardiana* (Chilgoza) through mycorrhizal biotechnology (HFRI)

P. gerardiana forests of Kinnaur district were surveyed for the collection of mycorrhizal fungi, mycorrhizal roots and rhizosphere soil. The dominant genus was *Scleroderma*, followed by *Lycoperdon* and *Geastrum*. Since *S. polyrhizum* was encountered in all survey sites, it was selected for nursery trials. The per cent increase in the growth of one year old inoculated seedlings over the control varied from 25-55% in different parameters. The analysis of rhizospheric soil of seedlings revealed 20-59% higher NPK content in inoculated nursery bags. Maximum increase was recorded for phosphorus, followed by nitrogen and potassium.



Isolation and study of the efficiency of Arbuscular mycorrhizal fungi, phosphate and potash solubilizing bacteria in enhancing productivity and nutrient status of degraded soil under shifting cultivation of Karbi Anglong, Assam (RFRI)

Four isolates of PSB and KSB (Phosphate and potassium solubilizing bacteria) were found efficient in broth medium as well as pot culture experiment with rice and maize. These strains were selected for inoculation in jhum field under cultivation of rice, maize and mixed crop.

2.7.3 Forest Fire and Grazing

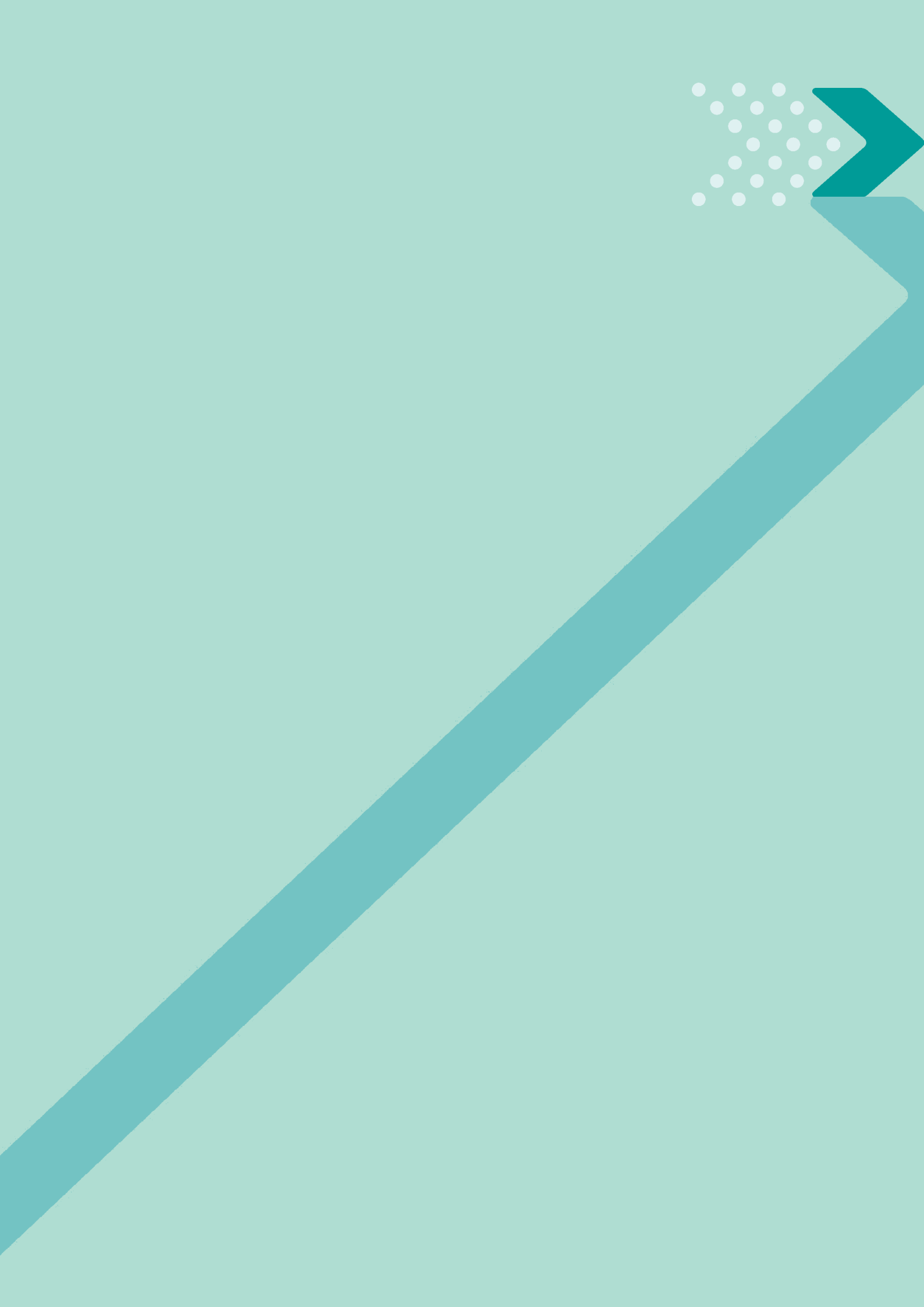
Analyzing impact of control burning on plant diversity and soil properties in chir pine forests (HFRI)

The present study has been initiated with specific objectives to assess the effect of control burning on floristic diversity, phyto-sociology, natural regeneration of chirpine forest and soil properties. Total nine sites have been selected and accordingly, controlled burning carried out in all the nine sites. Phyto-sociological data and soil samples have been collected. Soil samples have been analysed for physico-chemical properties.

Forest fire study site Mangoti Mor (Control and Burnt)

03

EDUCATION VISTAS



Education Vistas

03
CHAPTER

3.1 Improving Formal Forestry Education

The council is promoting forestry education in the country by providing grant-in-aid to the State Agricultural Universities/Colleges offering forestry education, upgradation of the skills and competencies of the various categories of the ICFRE personnel by organizing trainings on various subjects and coordination of the visit of Scientists and other personnel, working in ICFRE and its institutes to various conferences/seminars/ workshops, both within the country and abroad.

Accreditation of universities

11 State Agricultural Universities have been accredited with ICFRE during 2017-18 in the meeting of the Accreditation board held on 09.06.2017.

1. Indira Gandhi Agricultural University, Raipur, Chhattisgarh
2. Sher-E-Kashmir University of Agricultural Sciences and Tech. of Kashmir, Srinagar, (J&K)
3. University of Agricultural Sciences, Dharwad, Karnataka
4. University of Agricultural and Horticultural Sciences, Shimoga, Karnataka
5. Jawaharlal Nehru Krishi Vishawavidhyalaya, Jabalpur
6. Central Agricultural University, Pasighat, Arunachal Pradesh.
7. College of Horticulture & Forestry, Agriculture University, Kota, Jhalawar (Rajasthan)
8. Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu
9. FRI Deemed University, Dehradun, Uttarkhand
10. Uttar Banga Krishi Viswavidyalaya, Cooch Behar, West Bengal
11. Guru Ghasidas Vishwavidyalaya, Koni, Bilaspur, Chhattisgarh

Human resource development plan

1. 10 no. of trainings were organized by ICFRE for various categories of ICFRE personnel during 2017-18 under the HRD Plan at a cost of Rs. 19, 24,715/- lakhs.
2. The Human resource development plan for the next five years from 2018-19 to 2022-23 has been finalized. The plan envisages both induction training and subsequent professional upgradation trainings for all the categories of ICFRE personnel (scientists/technical officers/ administrative staff/executive staff) besides participation in the national and international seminars/conferences/ workshops, etc. Besides capacity building, the plan also proposes other initiatives like awards to ICFRE personnel, increase in remuneration of research support staff, etc.

3.2 Forest Research Institute (Deemed) University, Dehradun

The establishment of Forest Research Institute (Deemed) University, Dehradun was an important step in the promotion of the Forestry Education in India. The academic activities of the Institute has been fostering research and education in forestry, environment and other allied disciplines with a view to incorporate scientific inputs in forestry sector leading to higher productivity, safeguarding environmental concerns as well as to offer employment to the students.

UGC Team visited FRI, Dehradun on 8-1-2018

Academic courses

1. The FRI (Deemed) University has been offering the following two year M.Sc. academic courses on a regular basis:-
   i. Forestry
   ii. Environment Management
   iii. Wood Science & Technology
   iv. Cellulose & Paper Technology.
2. The university is also fostering pioneering research in specialized areas under Ph.D programme

The details of the students/scholars admitted for different courses, pass out and the placements during 2017-18 is given below

1. Number of students
   Admitted - 138 (Foreign Nationals - 13)
   Pass outs - 128 (Foreign Nationals -09)
2. Ph.D scholars registered - 35
3. Ph.D Awarded - 39
4. Total no. of Placements - 45

3.3 Visits Abroad

During the year 2017-18, officers/scientists participated in various conferences/ workshops aboard as below:

1. Dr. R.S. Rawat, Scientist – C, BCC Division, ICFRE, Dehradun attended workshop on South-South learning "Forest Reference Level (FRL) Assessment Process in Asia/Pacific" from 10-12 April 2017 in Nepal.
2. Dr. N.S.K. Harsh, Scientist – G, FRI, Dehradun attended Health assessment of Heritage trees at the Ta-Prohm site in Siem Reaping and imparting training to Cambodian staff from 17-23 April 2017 in Cambodia.
3. Dr. A.K. Sethy, Scientist – D, visited the University of Ljubljana, Slovenia from 30 May – 1 June 2017 to attend a workshop for preparing a proposal for Marie Sklodowska Curie Fellowship.
4. Dr. Rashmi, Scientist – D, attended a Conference on Forest Sector Innovations for a Greener future at Vancouver, Canada from 12–16 June 2017.
5. Dr. Meena Bakshi, Scientist – F, FRI, Dehradun attended and presented research paper in International conference of IUFRO All Division 5 on "Forest Sector Innovations for a Greener Future" from 12-16 June 2017, Vancouver, Canada.
6. Dr. Ombir Singh, Scientist-E, FRI, Dehradun attended the *8th World Congress on Allelopathy* at Marseille, France from 24- 28 June 2017.
7. Mr. M. Z. Singson, DCF & Head, ARCBR, Aizawl participated in the Consultative meeting on REDD+ project in Kathmandu, Nepal in June, 2017.
8. Dr. Girish Chandra, Scientist-C, ICFRE, Dehradun attended World Statistics Congress, 2017 from 11 to 21 July 2017,Marrakech, Morocco and received International Cochran Hansen Prize.
9. Dr. B. Nagarajan, Scientist – G, participated as a resource person in the 2nd ASEAN Mangrove Congress-2017 at Manila, Philippines from 5-12 September 2017 and delivered

a talk on "The role of pollinators in true mangroves *Bruguieras* a case study"

10. Dr. K.K. Pandey, Scientist – G, attended UNEP - Environmental Effects Assessment Panel (EEAP) meeting from 11-19 September 2017 at Stratford-upon Avon, UK and contributed towards UNEP-EEAP 2017 progress report.

11. Dr. Rashmi, Scientist-D, attended the 125 IUFRO Anniversary Congress at Freiburg, Germany from 18-22 September 2017.

12. Dr. Anita Tomar, Scientist-E, CSFER, Allahabad attended "IUFRO 125th Anniversary Congress from 18-22 September 2017, Freiburg, Germany.

13. Dr. V. P. Tewari, Director, HFRI participated in the IUFRO 125th Anniversary Congress, Freiburg, Germany from 18-22 September 2017. During the congress, he chaired the Technical Session on "Advanced Methods for Measuring, Monitoring and Accessing Forest to Meet Societal Challenges" and presented a research paper.

14. Dr. S.C. Gairola, D.G., ICFRE, Dehradun, attended "6th Dialogue on land sector" from 19-21 September 2017 Kyoto, Japan.

15. Sh. V.R.S. Rawat, ADG (BCC), ICFRE, Dehradun attended "6th Dialogue on land sector" from 19-21 September 2017 Kyoto, Japan.

16. Dr V. K. Varshney, Scientist-G, delivered plenary lecture in the 9th International Medicinal Mushrooms Conference (IMMC9) and chaired symposium on 'Biochemistry of Medicinal Mushrooms' at University of Palermo at Palermo (Italy) from 24-28 September 2017.

17. Ms. Namitha Nhandadiyil Kaliyathan, Technical Officer participated in *"2017 Asia Forest Fire Management Training"* at Seoul, South Korea from 15 - 22 October 2017.

18. Dr. Amit Verma, Technical Officer participated in *"2017 Asia Forest Fire Management Training"* at Seoul, South Korea from 15 - 22 October 2017.

19. Dr. R.S. Rawat, Scientist D, ICFRE, attended REDD+ Himalaya: "Regional Planning and Review Meeting", from 23-25 October 2017 in Kathmandu, Nepal.

20. Sh. V.R.S. Rawat, ADG, BCC, ICFRE, attended REDD+ Himalaya: "Regional Planning and Review Meeting", from 23-25 October, 2017 in Kathmandu, Nepal.

21. Dr. Savita, Director, FRI, Dehradun, attended the International Conference "Mountain Resources and Livelihoods in the Hindu Kush Himalayas: Higher Education Research and Regional Collaboration for Sustainable Mountain Development in Conjunction with the HUC Annual Meeting 2017, from 30 October - 01 November 2017 in China.

22. Sh. V.R.S. Rawat, ADG(BCC) ICFRE, Dehradun attended the ICFRE side event of India Pavilion of MoEF&CC, Govt. of India at COP 23 of UNFCCC from 6-17 November 2017 in Bonn, Germany.

23. Dr. Suresh Gairola, Director General, ICFRE, Dehradun attended the ICFRE side event of India Pavilion of MoEF&CC, Govt. of India at COP 23 of UNFCCC from 6-17 November 2017 in Bonn, Germany.

24. Dr. Savita, Director, FRI, Dehradun attended the ICFRE side event of India Pavilion of MoEF&CC, Govt. of India at COP 23 of UNFCCC from 6-17 November 2017 in Bonn, Germany.

25. Dr Vineet Kumar Scientist – G delivered lecture entitled 'Bioprospecting of essential oils' during International DAAD Alumni Seminar organized by the University of Kassel and the DITSL, Germany from 06 - 18 November 2017.

26. Dr. Savita, Director, FRI, Dehradun, attended International Conference titled "Wild Harvest, Governance and Livelihoods in Asia" from 30 November - 2 December 2017 in Kathmandu, Nepal.

27. Mr. M. Z. Singson, DCF & Head, ARCBR, Aizawl participated in the training programme on Preparation of State REDD+ Action Plan at Virat Nagar, Nepal from 18 - 21 December 2017.

28. Dr. Sanjay Singh, Scientist – C, BCC Division, ICFRE participated in "Regional Training on Synthetic Aperture Radar for Mapping of Forest Degradation and Deforestation" from 12-16 February 2018 in Kathmandu, Nepal.

29. Dr. K.K. Pandey, Scientist – G, attended UNEP – EEAP meeting from 14 - 20 February 2018 at University of Malaga, Spain and contributed towards preparation of the draft of 2018 Quadrennial Report.

30. Dr. R. S. C. Jayaraj, Director, RFRI, Jorhat participated in the Regional workshop on REDD+ in Myanmar on "Role of REDD+ in supporting SDGs and NDC" from 21- 22 February 2018.

31. Dr. V.P. Panwar, Scientist-E delivered a presentation on "Soil degradation and challenges in land reclamation in the Indian Himalayan region" during Joint BMUB-ICIMOD Expert Consultation Workshop on Hindu Kush Himalayan Mountain Soils held from 20–21 March 2018 at Kathmandu, Nepal.

32. Dr. K. Palanisamy, Scientist-G, IFGTB Coimbatore, attended APFORGEN workshop on "Evaluation, Conservation and Documentation of Forest Genetic Resources" at Kunming, Yunnan, China from 25 -28 March 2018.

33. Dr. Rekha R. Warrier, Scientist – E, IFGTB Coimbatore, attended APFORGEN workshop on "Evaluation, Conservation and Documentation of Forest Genetic Resources" at Kunming, Yunnan, China from 25 -28 March 2018.

34. Dr. H.S. Ginwal, Scientist – G & Dean (A), FRIDU, Dehradun, participated in the "Conference on Forest Rehabilitation in the Asia-Pacific Region & the 5th Asia Pacific Forestry Education Coordination Mechanism (AP-FECM) Meeting from 26-28 March 2018 at Beijing, China.

04

EXTENSION PANORAMA

Extension Panorama

04
CHAPTER

4.1 Seminars/Symposia/Workshops Organized

Name of Institute	No	Topics	No. of Participants
ICFRE	03	• Forests and Beyond: Regional Consultation on Forest Landscape Restoration – South Asia. • Conference of Parties (COP23) of United National Framework Convention on Climate Change (UNFCCC) in Bonn, Germany. • Regional Stakeholder Consultation and Capacity Building Workshop on National REDD+ Strategy at Guwahati (Assam).	167
FRI	09	• Potential of forestry technologies in employment generation for youth. • Biological control of insect pests, current developments and future strategies. • Development of Bio-pesticides and Bio-fertilizers for use in Forestry. • Future research needs in the field of paper sciences & bio-energy from cellulosic waste. • Research Needs and Networking Opportunities in Soil Science. • Water Conservation, Management, Development and Sanitation. • CBSA Inception workshop with states under Neeranchal Watershed Programme. • Sharing the knowledge on Technologies developed by Chemistry Division. • Research Needs: Forest and Climate Change in Himalayan Region.	360
IFGTB	02	• Kedharnath Memorial Lecture 2017 • Strategies for aligning forestry skill courses to national skill qualification framework.	150
IWST	05	• Regional Research Conference. • Directors of ICFRE Meet. • National Seminar on Green Cover Retention-The Critical Need. • Institute Industry Integration, 2018 (III-2018). • Workshop on collaborative research.	255
TFRI	05	• Monitoring of NTPC Ltd. Accelerated Afforestation Programme of Plantation of 10 Million Trees – In Seven States (M.P. and Maharashtra). • Eco-friendly Management of teak defoliator and leaf skeletonizer. • Nursery and Plantation Management Development of high biological and economic yielding varieties of *Rauwolfia serpentina* Benth. • Promotion of Biofertilizers in forestry. • Environmental and Economical function of Agro forestry.	246

Name of Institute	No	Topics	No. of Participants
RFRI	04	• Inception meeting cum Workshop on "Monitoring of NTPC Accelerated Forestation Programme of 10 million Trees in seven different states held at Guwahati. • Knowledge sharing programme of effective management of *Mikania micrantha* held at Forest IB Community Hall, Sonari and Sivasagar Forest Division from 18-05-2017 under the project "Impact of *Mikania micrantha* Kunth ex HBK. on micro environment of native species in Borjan-Bherjan-Podumoni WLS, Dilli RF and Abhoypur RF of Upper Assam ". • SWOT Analysis Workshop on "Assessment of Feasibility and Effectiveness of various Bamboo Preservation Techniques/Trials". • Regional Stakeholder Consultation and Capacity Building Workshop on National REDD+ Strategy in collaboration with BCC Division, ICFRE.	93
AFRI	05	• Inception workshop on 'Biological diversity and people perception for developmental plan and awareness generation in different community reserve areas in Jodhpur district'. • Dissemination workshop on 'Studies on the effects of MPOWER programme on mitigation and adaptation towards Climate Change in western Rajasthan-Phase II'. • Institutional level seminar. • Plant Tissue Culture Associations Symposia. • Regional Research Conference and Directors meet.	-
HFRI	08	• Identification and Prioritization of Research Needs in Forestry. • "Eradication of weeds / invasive alien species" under the issue "Biodiversity conservation and ecological security". • "Increase in availability of fodder from forest and its quality improvement" under the issue "Managing Forest and Forest Products for Livelihood Support and Economic Growth". • "Forest Health and Vitality Protection" under the issue "Managing forests and forests products for livelihood support and economic growth". • "Conservation of Forest Genetic Resources" under the issue "Forest genetic resource management and Tree Improvement". • "Biodiversity Conservation" under the issue "Biodiversity Conservation and Ecological Security". • "NTFP Resource Development" under the issue "Managing forests and forests products for livelihood support and economic growth". • "Development of Bio-pesticides and Bio-fertilizer for use in Forestry" under the issue "Managing forests and forests products for livelihood support and economic growth".	260
IFP	05	• Training on Lac cultivation. • Training on livelihood generation though Lac cultivation. • Basics of Plant Molecular Biology Techniques (NTFP & Medicine plants). • Local level training in Agroforestry capacity building (Agroforestry models). • Production and usages of vermicompost.	986

4.2 National Forest Library and Information Centre (NFLIC) Dehradun

The National Forest Library and Information Centre (NFLIC) is richest in document collection on forestry and allied sciences in South and Southeast Asia.

The document collection of the NFLIC was enriched by the addition of 639 books and other documents. The NFLIC subscribed to 42 Indian periodical titles and 16 International Journals for the coming year.

NFLIC has started a new service to train the Library Science students. During the year eight Library students were trained professionally in the field of Library Science.

4.3 Technologies Transferred

- One solar seasoning kiln for timber drying was installed during 2016-17 for Gujarat Forest Department at Government Saw Mill Campus, Waghai, and it was successfully commissioned during the current year after imparting two onsite trainings on working of the installed kiln.
- Developed technology was demonstrated to stakeholders and people were motivated to cultivate edible mushrooms. Beside this people were also trained to prepare mushroom utilization products such as '*Achar*', '*Papad*' and '*Bari*' during different training programme.
- Technology was demonstrated to stakeholders and people were motivated to cultivate *Ganoderma lucidum* for income generation because of its high economic returns during different training programme.
- Forest Pathology Division imparted knowledge to stakeholders and visitors regarding culturing *Trichoderma* sp. on agriculture waste and other substrates on demand.
- The holy Bodhi Tree at Bodhgaya, holy trees at Smriti Park, Patna and holy pipal tree at Koteshwarnath Dham, Belaganj was regularly monitored for pathological, physiological and entomological problems and required treatments were administered.
- Tissue culture Technology developed for 'quality germplasm of Neem for high oil and Azadirachtin content' and transferred to Tissue Culture Unit of Kalol

(Gandhinagar) IFFCO. Master cultures will be maintained at Tissue culture Laboratory, FRI, Dehradun.

- Clonal Technologies and popular clones of Eucalyptus, Casuarina were popularized in Tree Growers Mela conducted by IFGTB on 16 February 2018. Nearly 34 farmers, who had grown Melia and Eucalyptus, registered their plantation details with TNPL and Sharon Plywoods for a possible wood procurement at maturity. The industrial partners, research institutions FC&RI, Mettupalayam, KVK and IFGTB exhibited various technologies in cultivation, clonal technology, pest & disease management & wood procurement, Seed handling and testing techniques for forestry species,
- "Tree Rich Biobooster (TRB)– The product development technology was transferred to Irular tribal Women SHGs for their livelihood support who inhabit in forest fringe villages and fully depends on forest for their livelihood. Dr. N. Senthilkumar, Scientist E and PI of the project demonstrated the whole process of Tree Rich Biobooster disc making to the WSHG. Tree Rich Biobooster disc is an alternate to potting mixture (Sand soil and FYM), light weight, cost effective, less water usage, easy to transport as compared to the conventional potting mixture.

Coir Pith Disc Making Machine was inaugurated by Shri R.S. Prashanth, IFS, Director, IFGTB

4.4 Consultancies and Technical Services

ICFRE, Dehradun

- During the period works on 11 consultancy projects, awarded by Tehri Hydro Development Corporation India Ltd; Himachal Pradesh Power Corporation Limited; Karnataka State Official Authority; Uttarakhand Jal Vidyut Nigam Limited (UJVNL); MoEF&CC, GoI, New Delhi; Coal India Limited, Kolkata; NTPC Ltd. Noida; CMPDI Ranchi and NMDC Ltd, Hyderabad are in progress.
  - Six (06) individual Reclamation and Rehabilitation (R&R) Plans of six mines of category A (02 Nos.), B (01 no.) and C (03nos.) for the mines in Bellary, Chitradurga and Tumkur Districts as per the directions of the Hon'ble Supreme Court in line with Central Empowered Committee (CEC) guidelines were prepared/compiled and submitted to Department of Mines and Geology, Government of Karnataka.
  - Thirteen (13 nos.) Environmental audit reports of coal mines of Coal India Limited (CIL) subsidiaries and Makri Barka (East and West Block) biodiversity study reports (02 nos.) were completed and submitted to CIL, Kolkata and Central Mine Planning and Design Institute (CMPDI), Ranchi respectively.
  - Report on Monitoring of NTPC Accelerated Afforestation

Programme of Plantation of 10 million tress- in seven different states for year 2017-18 and six monthly progress report on Third Party Monitoring of Catchment Area Treatment Plan of Vishnugad Piplikoti HEP (444 MW), at Chamoli district, Uttarakhand were submitted to NTPC Ltd and THDCL Rishikesh respectively.

Forest Research Institute, Dehradun

- Consultancy on "Assessment of water discharge in the plywood factory" to M/s Parvatiya Plywood, Ramnagar, Nainital
- BCCL Dhanbad has engaged FRI as technical advisor/expert for the ecological restoration works being undertaken by BCCL on OB dumps/ mined out areas (44.0 ha). The aim of project is to provide technical assistance for the restoration of coal mine area at nine project sites of Bharat Coking Coal Limited (BCCL) Dhanbad, Jharkhand.

Institute of Wood Science and Technology, Bengaluru

- Consultancy on "Investigation of health status of trees along highway, Ranchi, Jharkhand" to Varha Infra Ltd-Sunil Hitech Engineers Ltd (JV).

Consultancy awarded by M/s Mahindra Lifespace Developers Ltd., Bengaluru, on quality of raw materials used in manufacturing doors for residential projects.

Tropical Forest Research Institute, Jabalpur

- Consultancy on "Implementable forestry research for ash utilization promotion and development of research park at APML, Gondia" to Adani Maharashtra Power Ltd
- Consultancy on "Controlling fugitive dust emission through biological reclamation of flyash lagoons in Shri Singaji Thermal Power Project (SSTPP), Khandwa (M.P.)" to M.P. Power Generating Co. Ltd.
- Consultancy on "Wildlife Conservation plan for Malachua Open Cast Mine" to SECL
- Consultancy on "Wildlife Conservation plan for Dipka Expansion Project" to SECL

Rain Forest Research Institute, Jorhat

- Consultancy on 'Identification of Drivers of Deforestation' in Meghalaya" to Meghalaya Basin Management Agency, Shillong.
- Consultancy on 'Baseline study under the World Bank funded Meghalaya Community Led Landscape Management Project' " to Meghalaya Basin Management Agency, Shillong.

4.5 Awards and Honours

- The Director General, ICFRE, Dehradun has awarded the Official Language Award, Certificate and Shield to Tropical Forest Research Institute, Jabalpur (M.P.) which comes under ICFRE, and situated in 'A' region for outstanding performance in Official Language Implementation work for the year 2016-17.

Special Achievements

- Dr. A. Karthikeyan, Scientist - F received the best research paper award on Environment from Dept of Environment, Govt. of Tamilnadu on 7.11.2017.
- Dr. Manisha Thapliyal, Scientist – F, won the best paper award under the theme 'Biodiversity Conservation' during the XIX Commonwealth Forestry Conference from 3-7 April 2017 at FRI, Dehradun.
- Sh. Shailendra Kumar, Scientist – C received Award Young Scientist at the 12th Science and Technology Congress from 07-09 Mar, 2018, UCOST, Dehradun, (Uttarakhand).
- Dr. Parmanand received the Outstanding Scientist Award in Forest Hydrology in the Research Awards-VIRA 2017 during 3rd Annual Research Meet- ARM 2017 held at Chennai on 11 November, 2017.
- Dr. Meena Bakshi, Scientist-E, Botany Division received Best Poster Award for Ringal resources and peoples livelihood, a case study of Rudrprayag district of Garhwal Himalayas, Uttarakhand, India. Presented poster in XIX Commonwealth Forestry conference, held at FRI, Dehradun from 3 - 7 April 2017.
- Dr. Rashmi received two times Scientist Assistance Programme (SAP) award under SPDC programme from International Union of Forest Research and Organization (IUFRO), Vienna, Austria.
- Rain Forest Research Institute is awarded by Town Official Language Implementation Committee (TOLIC), North East Institute of Science & Technology (NEIST), Jorhat for excellent work towards implementation of Official Language during the year 2016-17 in 33rd Meeting of TOLIC held at NEIST, Jorhat on 1st March, 2018.

नगर राजभाषा कार्यान्वयन समिति (नराकास), जोरहाट:असम
TOWN OFFICIAL LANGUAGE IMPLEMENTATION COMMITTEE (TOLIC), JORHAT: ASSAM

अध्यक्ष का कार्यालय CHAIRMAN OFFICE

सीएसआईआर-उत्तर-पूर्व विज्ञान तथा प्रौद्योगिकी संस्थान, जोरहाट :असम
CSIR-NORTH EAST INSTITUTE OF SCIENCE AND TECHNOLOGY(NEIST), JORHAT-785006 : ASSAM

प्रशस्ति पत्र

जोरहाट शहर में अवस्थित केंद्र सरकार के कार्यालयों के बीच वर्ष 2016-17 के दौरान राजभाषा हिंदी कार्यान्वयन के बेहतर प्रदर्शन एवं उत्कृष्ट कार्य संपादन के लिए वर्षा वन अनुसंधान संस्थान, जोरहाट को नराकास की 33वीं बैठक में 01 मार्च 2018 को शिल्ड के साथ यह प्रशस्ति पत्र प्रदान किया जाता है।

(अजय कुमार)
सचिव, नगर राजभाषा कार्यान्वयन समिति, जोरहाट

(डॉ डी रामाचय्या)
अध्यक्ष, नगर राजभाषा कार्यान्वयन समिति, जोरहाट
निदेशक, सीएसआईआर-नेस्ट, जोरहाट

4.6 Activities of Rajbhasha

ICFRE and its Institutes regularly conducted the following:

- राजभाषा कार्यान्वयन समिति की त्रैमासिक बैठकों का आयोजन किया गया।
- सितम्बर 2017 में हिन्दी सप्ताह का आयोजन किया गया।
- हिन्दी का त्रैमासिक प्रतिवेदन एवं वार्षिक प्रतिवेदन भेजा गया।

राजभाषा विभाग के उत्तरी क्षेत्रीय कार्यान्वयन कार्यालय–1 (दिल्ली) के सहायक निदेशक (कार्यान्वयन) श्री नरेंन्द्र सिंह मेहरा ने दिनांक 27/11/2017 को शुष्क वन अनुसंधान संस्थान, जोधपुर का राजभाषा संबंधी निरीक्षण किया तथा हिन्दी के प्रगामी प्रयोग की स्थिति की समीक्षा की। राजभाषा निरीक्षण रिपोर्ट में संस्थान में राजभाषा कार्यान्वयन की स्थिति बहुत अच्छी होने का उल्लेख किया गया है वहीं कई मदों पर सराहना भी मिली है।

Hindi Week at RFRI, Jorhat

Rajbhasha Inspection at AFRI, Jodhpur

4.7 Research Publications

Name of Institute	National journal	Foreign journal	Chapters in Books/ Proceedings	Popular articles	Abstract published	Brochure etc	Books
ICFRE	-	-	-	-	03	02	04
FRI	106	53	28	-	-	01	04
IWST	26	24	07	02	11	06	02
IFGTB	33	23	48	08	22	03	04
TFRI	36	08	Nil	18	18	17	-
RFRI	07	22	1/12	04	12	-	-
AFRI	10	04	01	-	24	-	01
HFRI	34	04	14	12	02	05	01
IFP	03	02	06	01	11	0	01

Books/booklets

- Book published on Drivers of deforestation and Forest Degradation in Mizoram. (ICFRE)
- Training Manual on REDD+ Measurement, Reporting and Verification. (ICFRE)
- Book Published on Medicinal Plants in India: An Assessment of their Demand and Supply (ICFRE)
- Dagar, J.C. and Tewari, V.P. (eds.) 2018. Agroforestry: Anecdotal to Modern Science. Springer, 879 p.
- Murugesan, S and Senthilkumar N. 2018. Training manual on "Instrumentation methods and phytochemical analysis" IFGTB publications, pp 84.
- Bachpai, V.K.W., Rekha Warrier., John Prasanth Jacob and Yasodha. R. 2017. Hand Book on Clonal Propagule Production in Forest Trees.
- Kunhikannan, C. and Sasidharan, K.R. 2018. *Training on Plant Taxonomy: Resource Manual.* Institute of Forest Genetics and Tree Breeding, Coimbatore, pp 128.
- Kunhikannan, C. 2017. *Precious Trees of India*- Series I, ENVIS Centre on Forest Genetic Resources & Tree Improvement. IFGTB Coimbatore.

- Swaranlata, Negi, S.P. 2017. चिलगोजा –जिला किन्नौर का पारिस्थितिकी, सामाजिक एवं आर्थिक रूप से महत्वपूर्ण वृक्ष
- Gem of Peninsular India: Indian Sandalwood: Compendium of Abstracts of Research carried out at Institute of Wood Science and Technology

Popular Article

Natural pigment from the red tamarind fruits used in the preparation of lipstick was published in the daily viz. Dinamalar on 11th November 2017.

4.8 Report on VVKs & Demo Villages

Name of Institute	No. of VVKs			No. of DV		
	No. of Training	No. of Days	No. of participants	No. of Training	No. of Days	No. of Participants
IWST	5	-	-	-	-	-
IFGTB	1	2	75	-	-	-
RFRI	9	15	293	1	2	46
HFRI	1	1	-	-	-	-

Training on "Capacity building on the development of Tree rich biobooster to Irular tribes in forest fringe villages of Coimbatore, Tamilnadu: An alternate source of livelihood support"

4.9 Participation in Seminars/Symposia/Workshops/Trainings

Name of Institute	No.	Days	No. of Participants
ICFRE	19	28	-
FRI	65	11	2603
IWST	42	74	382
IFGTB	59	127	2914
TFRI	21	101	36

Name of Institute	No.	Days	No. of Participants
RFRI	35	101	68
AFRI	08	21	12
HFRI	32	71	54
IFP	11	15	11
IFB	07	17	07

4.10 Outstanding Achievements

Shri C. K. Mishra, IAS, Secretary, Ministry of Environment, Forest and Climate Change, Govt. of India, New Delhi has released the natural colourant named "Tara Red" during his visit to IFGTB, Coimbatore on 23rd March, 2018. The natural colourant has been extracted from red tamarind *Tamarindus indica* var. *rhodocarpa* and successfully added in jam preparation. The pigment has the potential to be used as a natural colourant for food, beverages, cosmetics and textile.

Natural colourant "Tara Red"released by Shri C. K. Mishra, IAS, Secretary, MoEF&CC, Govt. of India, New Delhi

4.11 Distinguished Visitors

- Prof. Panjab Singh, (Ex Director General, ICAR) and Chairman, UGC-NAAC Accreditation Committee visited Herbarium and Botanical Garden from January 6-7, 2018.
- Sh. Siddhanta Das, IFS, Director General (Forests) and Special Secretary, Ministry of Environment, Forests and Climate Change visited Dehradun Herbarium on 12.03.2018

Prof. Panjab Singh, Chairman, UGC-NAAC Committee visited DD Herbarium

Sh. Siddhanta Das, IFS, Director General (Forests) and Special Secretary, Ministry of Environment, Forest and Climate Change visited Dehradun Herbarium

Indonasia delegation visited FRI, Dehradun on 5-9-2017

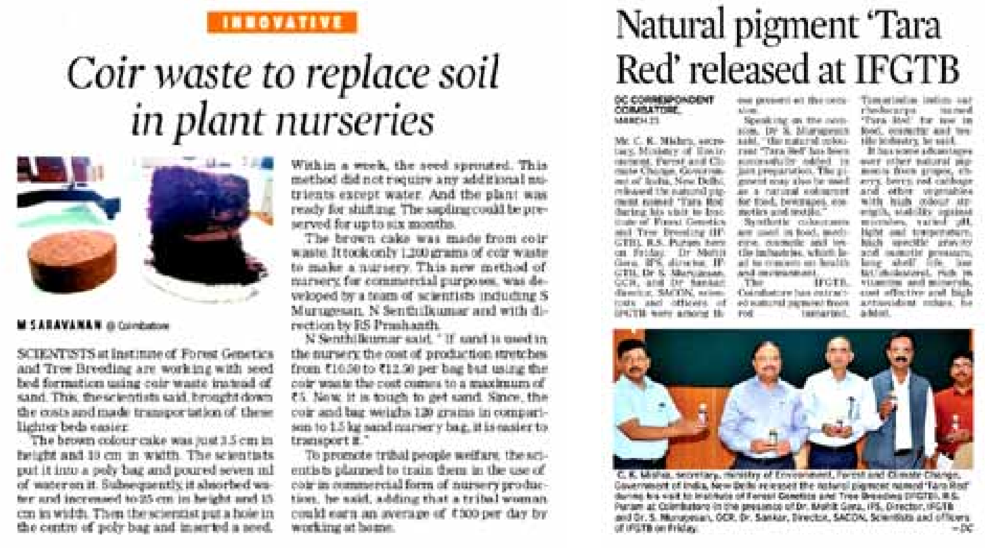
HE Dato. Hidayat Abdul Hamid, High Commissioner, Malaysia visited FRI, Dehradun on 9-10-2017

Andrew Ayre, British, Deputy High Commissioner visited FRI, Dehradun on 17-8-2017

4.12 Media coverage

The research finding of the project Biocolourant: Bioprospecting of selected accessions of Red tamarind as ecofriendly and protective natural dye in textiles/ foods ie. Natural pigment from the red tamarind fruits used in the preparation of lipstick was covered in Dinamalar and Pudhya Thalaimurai channels.

Natural pigment from red tamarind fruit covered in Tamil channels



INNOVATIVE

Coir waste to replace soil in plant nurseries

M SARAVANAN @ Coimbatore

SCIENTISTS at Institute of Forest Genetics and Tree Breeding are working with seed bed formation using coir waste instead of sand. This, the scientists said, brought down the costs and made transportation of these lighter beds easier.

The brown colour cake was just 3.5 cm in height and 10 cm in width. The scientists put it into a poly bag and poured seven ml of water on it. Subsequently, it absorbed water and increased to 25 cm in height and 15 cm in width. Then the scientist put a hole in the centre of poly bag and inserted a seed.

Within a week, the seed sprouted. This method did not require any additional nutrients except water. And the plant was ready for shifting. The sapling could be preserved for up to six months.

The brown cake was made from coir waste. It took only 1,200 grams of coir waste to make a nursery. This new method of nursery for commercial purposes, was developed by a team of scientists including S Murugesan, N Senthilkumar and with direction by RS Prashanth.

N Senthilkumar said, "If sand is used in the nursery, the cost of production stretches from ₹10.50 to ₹12.50 per bag but using the coir waste the cost comes to a maximum of ₹5. Now, it is tough to get sand. Since, the coir and bag weighs 120 grams in comparison to 1.5 kg sand nursery bag, it is easier to transport it."

To promote tribal people welfare, the scientists planned to train them in the use of coir in commercial form of nursery production, he said, adding that a tribal woman could earn an average of ₹300 per day by working at home.

Natural pigment 'Tara Red' released at IFGTB

DC CORRESPONDENT
COIMBATORE, MARCH 23

Mr. C. K. Mishra, secretary, Ministry of Environment, Forest and Climate Change, Government of India, New Delhi, released the natural pigment named 'Tara Red' during his visit to Institute of Forest Genetics and Tree Breeding (IFGTB), R.S. Puram here on Friday. Dr Mohit Gera, IFS, director, IFGTB, Dr S. Murugesan, GCR, and Dr Sankar, director, SACON, scientists and officers of IFGTB were among those present at the occasion.

Speaking on the occasion, Dr S. Murugesan said, "the natural colourant 'Tara Red' has been successfully added in jam preparation. The pigment may also be used as a natural colourant for food, beverages, cosmetics and textile."

Synthetic colourants are used in food, medicine, cosmetic and textile industries, which lead to concern on health and environment.

The IFGTB, Coimbatore has extracted natural pigment from red tamarind, Tamarindus indica var rhodocarpa named 'Tara Red' for use in food, cosmetic and textile industry, he said.

It has some advantages over other natural pigments from grapes, cherry, berry, red cabbage and other vegetables with high colour strength, stability against microbes, varied pH, light and temperature, high specific gravity and osmotic pressure, long shelf life, low fat/cholesterol, rich in vitamins and minerals, cost effective and high antioxidant values, he added.

C. K. Mishra, secretary, ministry of Environment, Forest and Climate Change, Government of India, New Delhi released the natural pigment named 'Tara Red' during his visit to Institute of Forest Genetics and Tree Breeding (IFGTB), R.S. Puram at Coimbatore in the presence of Dr. Mohit Gera, IFS, Director, IFGTB and Dr. S. Murugesan, OCR, Dr. Sankar, Director, SACON, Scientists and officers of IFGTB on Friday. —DC

Tara Red release published in Deccan Chronicle (23.3.18)

THE HINDU
INDIA'S NATIONAL NEWSPAPER SINCE 1878

Natural colourant

The Hindu 27.03.2018

COIMBATORE

'Tara Red', a natural colourant developed by Institute of Forest Genetics and Tree Breeding here was released by C.K. Mishra, Secretary, Ministry of Environment, Forest and Climate Change, in New Delhi on Friday. The product was developed from natural pigment extracted from red tamarind. This can be used in food, cosmetics, and textiles.

The product was developed by scientist N. Senthilkumar and his team.

Tara Red release published in The Hindu (27.3.18)

4.13 Special Activities

World Environment Day – 2017

The World Environment Day-2017 was celebrated in a befitting manner by the Institutes of ICFRE in the first week of June by inculcating the values of environmental conservation among the public and younger generation by way of various competitions on the theme of natural conservation: Photography competition, Quiz competition, Painting competition, Elocution competitions etc.

Observing World Environment Day at : (a) IFGTB (b) FRI (c) HFRI

Van Mahostav – 2017

The Van Mahostav – 2017 was observed in all the ICFRE institutes on 07 July 2017 under the theme "ever green".

a **b**

Van Mahostav at : (a) FRI (b) TFRI

Swachh Bharat Mission (02 October 2017)

To create awareness about Swachh Bharat Mission among young generation, particularly among student community, awareness programmes were organized.

Swachh Bharat Mission at HFRI

International Day of Forests (21 March, 2018)

International Day of Forests - 2018 was celebrated on the theme "Forests and Sustainable Cities".

a

b **c**

Observance of International Day of Forests on 21 March 2018 at (a) FRI (b) IFGTB (c) HFRI

Tree Growers Mela 2018

Tree Growers Mela was organized on 16 February, 2018 at KVK, Papparapatty, Dharmapuri under the theme "Tree farming for increasing Farm income", in collaboration with Tamil Nadu Forest Department and Tamil Nadu Agricultural University.

Tree Growers' Mela served as an integration platform for Scientists, research institutions, industrial partners and government agencies to serve forestry research and market inputs for the tree growers'. Industrial partner's viz., Tamil Nadu Newsprint & Papers Limited

(TNPL), Sharon Plywood Limited; Research Institutions like Institute of Wood Science & Technology, Bengaluru and Forest College & Research Institute, Mettupalayam contributed their technical inputs on wood market information and technology transfer on improved planting material availability of the priority species. Overwhelmingly, about 700 farmers from various districts of Tamil Nadu participated in the mela.


Tree Growers Mela at IFGTB

International Biodiversity day (22 May 2017)


Essay and quiz competition on the occasion of International Biodiversity day (22 May 2017)


A view of "Nature Walk"

International Yoga Day (21 June, 2017)


International Yoga Day at FRI

Vigilance Awareness Week (30th October to 4th November, 2017)


Vigilance Awarness Week at (a) FRI (b) HFRI

National Technology Day (11 May 2017) & National Science Day (28 February, 2018)

All museums of FRI, Dehradun were opened free for the general public on National Technology Day & National Science Day.


National Technology Day at FRI

Technological intervention and networking for basic community needs in mountains of Himachal Himalayas. (HFRI)

Seed pretreatment for germination was standardized for khirak, *Robinia* and ban oak. The plants were raised in nursery and distributed among the farmers/ village communities in Mandi, Shimla and Kinnaur.

Biodiversity conservation and ecological security (FRI)

A medicinal and aromatic plant garden is being established in FRI campus for public awareness. 25 species have been planted. Infrastructure is being improved for public awareness and to facilitate multiplication of plants.

Development of biodiversity park at Vigyan Dham, (UCOST), Jhajra, Dehradun (FRI)

A state-of-art Biodiversity Park was developed in the premise of Uttarakhand Council of Science and Technology (UCOST),VigyanDham, Jhajra (Dehradun) in the year 2016-17 by FRI. 700 plants of 200 species were planted at the park. The park is established with the objective to educate students, researchers and public about importance of biodiversity and promotion of science and technology.

Biodiversity Park at Vigyan Dham, Dehradun

Development of Herbal Vatika at MoEF&CC Headquarters, New Delhi (FRI)

As per directives received from MoEF&CC, a small herbal Vatika has been designed, civil works executed and plantation of various medicinal trees, shrubs and herbs has been undertaken at the MoEF&CC headquarters.

Awareness training for conservation of *Pinus gerardiana* (Chilgoza) through scientific intervention in Moorang forest range of district Kinnaur, Himachal Pradesh. (HFRI)

During the period, four field demonstration trainings on "Harvesting of Chilgoza cones through scientific methods" were conducted at Ribba, Rispa, Rarang and Jangi villages of district Kinnaur, Himachal Pradesh in which 160 farmers and horticulturist of the area participated. 20 Nos. of multi angular long reach pruners were procured and distributed to four Panchayats (5 each) of Moorang forest Range, Kinnaur.

Some photographs of Field demonstration at Ribba, Rispa and Jangi, Kinnaur

Quantification, value addition of NTFP and improved agricultural productivity to enhance livelihood opportunities in Tribal belt of Sirohi district of Rajasthan. (AFRI)

Training cum demonstration programme conducted for value addition of *Manilkara hexandra* (Khirni) and *M. dioica* (Kandkeda) fruits for SHG members in Jamboori village of Sirohi district.

Sorting and washing of good quality fruits

Scanting off excess water

Deseeding after 48 hours

Dried fruits

Packing of dry fruits

Value addition of *Manilkara hexandra* for improved livelihood

Cutting and weighing of fresh *M. dioica* fruits

Passing through boiled water

Drying of fruits

Preparation of pickle

Value addition of *M. dioica* for improved livelihood

Study on production of briquettes from invasive forest weed and its utilization by JFM villages (IWST)

Lantana camara and *Prosopis juliflora* briquettes were found to have high calorific value (19-21 MJ kg^{-1}), high density (1.0 – 1.2 g/cm^3), high fixed carbon content (18-20%), less ash content <2% and moisture content <5%. The village for training and utilization of biomass briquettes has been identified.

Management of *Lanatana camara* to improve livelihood in Kandi region of Punjab" (FRI)

A training programme was conducted for Self Help on "Handmade Paper from *Lantana camara*" to improve livelihood in Ramgarh Sikri from Village Maili of kandi region of Punjab.

Formulation of biofertilizers consortium and their distribution to forest department (TFRI)

Packets of bio-fertilizers were supplied for application in nurseries of 11 research and extension circles including 661 packets of *Rhizobium*, 668 of *Azatobacter*, 308 of *Azospirillum*, 544 of PSB and 24 bags of VAM fungi. In addition AM fungi were also distributed to MP Forest Development Corporation (11 nurseries) for application in bamboos.

05

ADMINISTRATION AND INFORMATION TECHNOLOGY

Administration and Information Technology

05
CHAPTER

Information Technology Division, ICFRE

Information Technology Division at ICFRE HQ plays an important role in supporting research, administrative 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 from time to time.

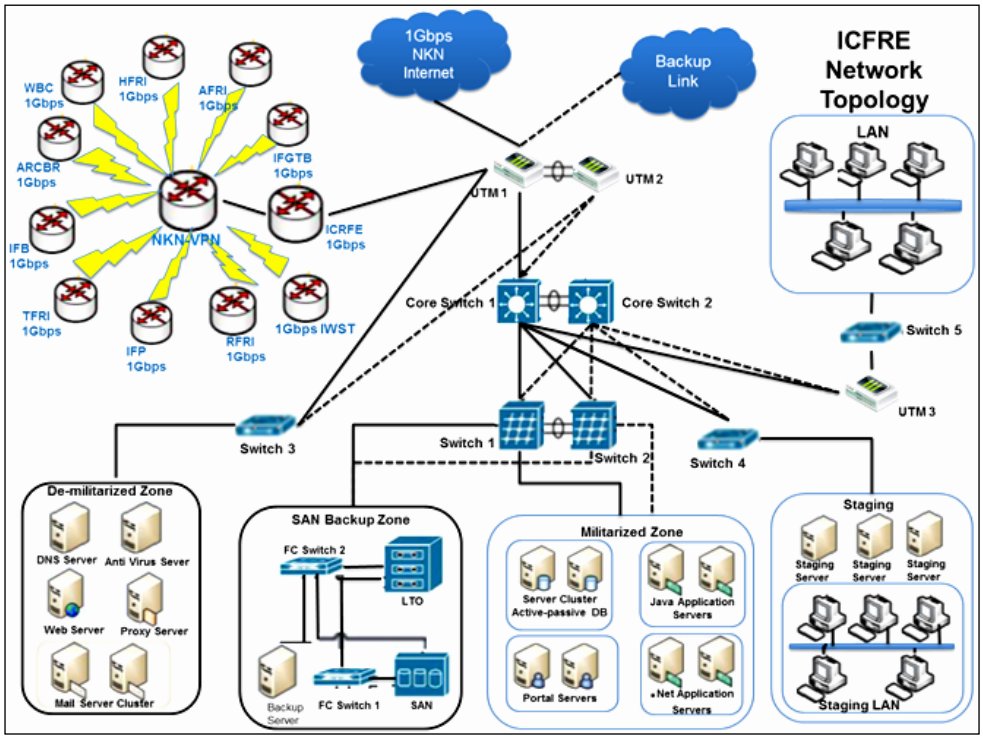
Following new initiatives were taken during 2017-18:

1. Upgradation of Data Centre :

The ICFRE Server Farm was established in the year 2009-10 and has been functional since then. It provides 24x7x365 services to all the employees of ICFRE and its Institutes. It caters services like Messaging Service, Web Service, Database Service, Proxy Service, DNS Service, DHCP Service, FTP Service, Backup Service, Internet Service, NKN-VPN service, Video conferencing, Antivirus Service, Helpdesk Service, CA EMS ISS.

Around 38 websites/applications on the different aspects of ICFRE and its Institutes have been hosted on ICFRE Web Server. The achievement of the ICFRE Server Farm in terms of availability for 2017-18 was 100 %.

The Methodology for the Upgradation of ICFRE Data Centre was prepared in consultation with external experts of NIC. The Request for Proposal (RFP) for Selection of Vendor for Continuity of Data Centre (Server Farm) was prepared and discussed

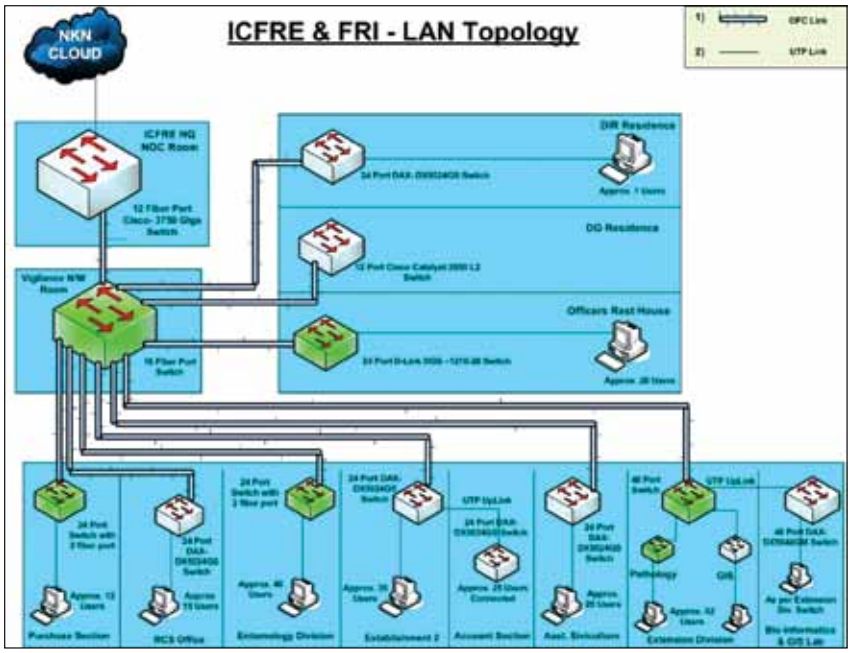


Proposed Data Centre Architecture

in Technical Committee of External Experts and In-House High Level Administrative Committee meeting and finally approved in In-House High Level Administrative Committee. Three times tenders were floated for upgradation of data centre. LoI was issued to the vendor for upgradation and upgradation is in process.

2. Upgradation of LAN :

Head IT and officials of IT Division, ICFRE had a series of Videoconferencing sessions with IT in-charge of ICFRE Institutes to discuss on the LAN topology of each institute for Upgradation of LAN Hardware. Consequently the methodology for revamping the Local Area Network (LAN) of ICFRE Head Qtr and Institutes/Centre was prepared. Survey of site, Preparation of Site after dressing, Installation of network hardware after configurations and final testing were done. Upgradation of Network across ICFRE was started in the month of July 2017 and finished by September 2017.



ICFRE and FRI LAN Topology

3. New applications/websites developed :

A: Information System for Secretary Office (Men-in-Position):

The system comprises of a central repository containing comprehensive personal information of each employee. It is facilitated with an Administrative Control delegated to the Secretary Office and the Institute level Administrators, who can update / modify the profile of the employees as per requirement. URL of the application is http://esttmgmtsec.icfre.org/.

Screenshot of Information System for Secretary Office after login

B. Online-Office Records (Orders/MoM/ Agendas etc.) System:

This application is developed to keep and view the records related to office order, notifications, agenda, MoMs etc of ICFRE and its institutes/centres. All office orders/ notifications/ circular of after 01.12.2017 are uploaded in this portal and available to the world through internet. URL of Online Office Records (Orders/MoM/ Agendas etc.) System is http://records.icfre.org/.

Screenshot of Online Office Records (Orders/MoM/Agendas etc.) System

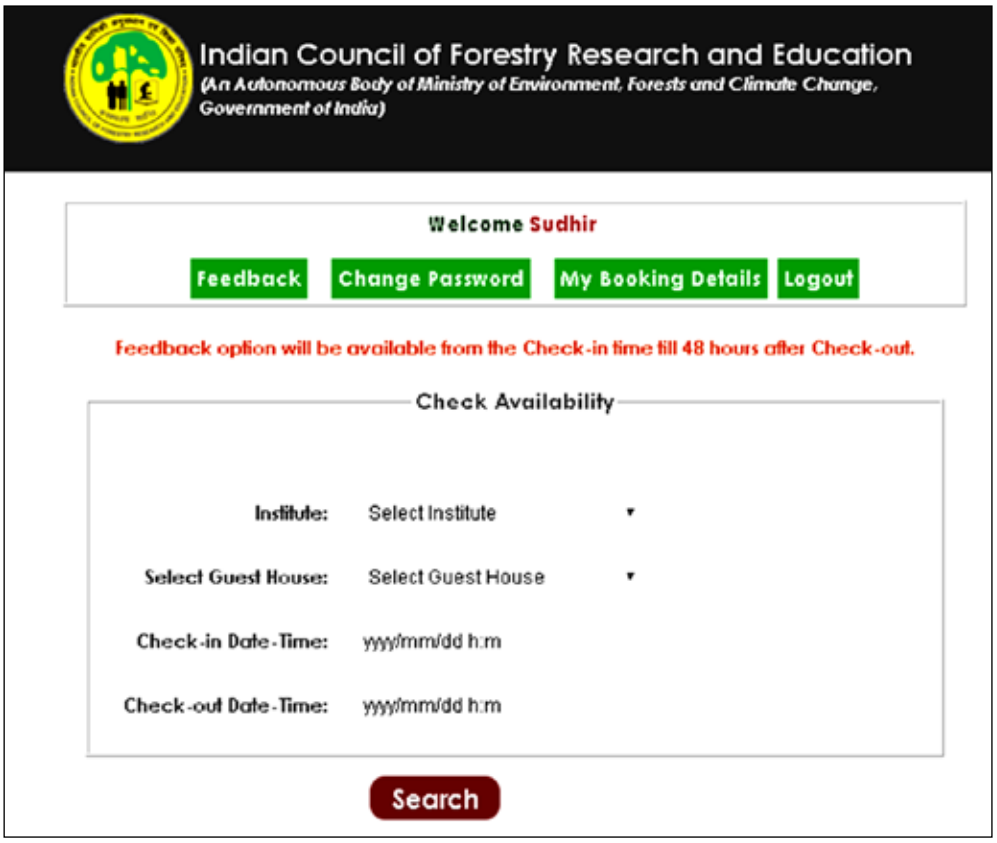
C. ICFRE new website (English):

ICFRE new website developed as per Guidelines of Indian Government Website (GIGW). URL of the website is http://icfre.gov.in/.

Screenshot of ICFRE website

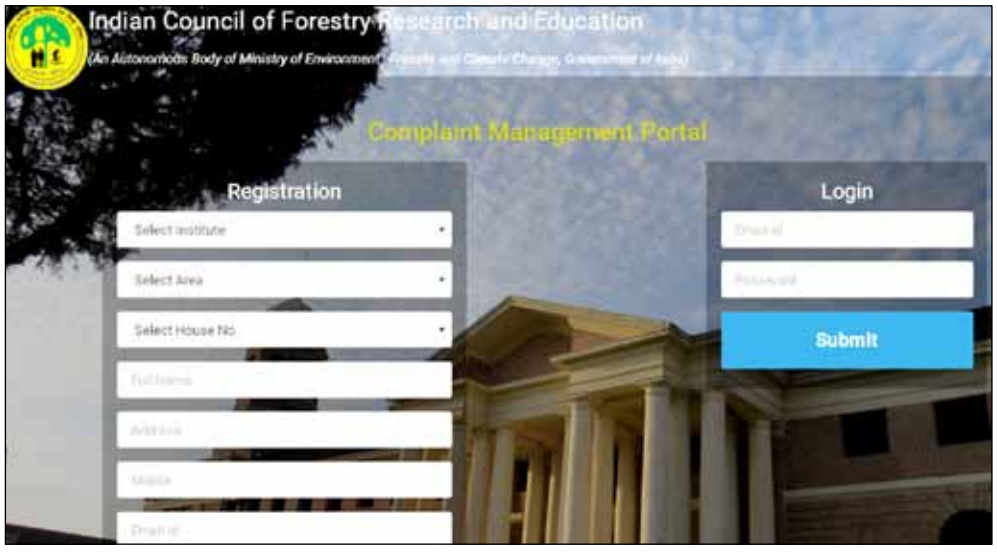
D. Guest House Booking Portal:

Guest houses of IFP, TFRI, HFRI, IWST, AFRI and ARCBR are made online in the year 2017-18. . URL of this portal is http://bookingsystem.icfre.org/.



Screenshot of Guest House Booking Portal after login

E. Complaint Management System: Application is developed to lodge, track and better management of civil complaints of FRI Campus. This application is to be made operational. URL of the portal is http://complaint.icfre.org/.



Screenshot of Complaint Management System

F. Hindi website of IFGTB: This website is developed and to be implemented on live server after updation/uploading of Hindi Material.

Screenshot of IFGTB Hindi website

G. Hindi website of RFRI:

This website is developed and to be implemented on live server after updation/uploading of Hindi Material.

4. Maintenance of Software Applications /websites :

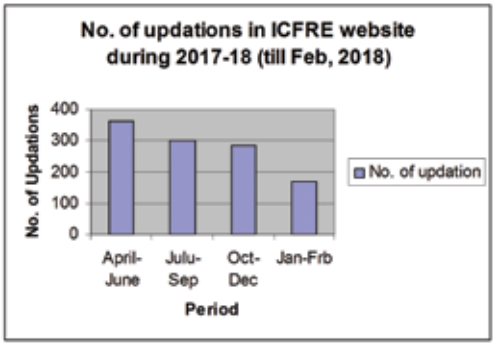
Developed applications are being maintained and updated from time to time. Apart from above mentioned, following applications/websites developed in the previous years are also being maintained and updated from time to time.

1. Pensioner database
2. ICFRE website (Hindi) with CMS
3. HFRI website (English) with CMS
4. HFRI website (Hindi) with CMS
5. AFRI website (English) with CMS
6. AFRI website (Hindi) with CMS
7. Guest House Booking Portal
8. Fixed Assets Database and Application
9. Interactive Portal: Interface with stakeholders
10. Annual Property Returns Portal

Around 38 websites/Database/CMSs/ applications including applications and websites of ICFRE institutes which are on live server are being maintained.

5. Updation of website of ICFRE (http://icfre.gov.in) :

ICFRE's website is promptly updated. Detail of ICFRE website updation during 1st April2017 to 28th February, 2018 is as below:



6. **Upgradation of Video conferencing (VC):**
Videoconferencing Services had been implemented in April 2008 across ICFRE Headquarter and 8 Institutes. VC services have been functioning since then.

The new Videoconferencing (VC) system comprises of Polycom End Point Group 700, Display device (LG TV) 65"equipments are installed at ICFRE Hq., Polycom End Point Group 500 at IFB, Hyderabad and Polycom End Point Group 500 , Display device (LG TV) 40" at ARCBR, Aizawl in the month of July 2017. Audio and Video quality is better during videoconferencing session.

7. **e-Office:**
Inputs were provided to MoEF&CC related to ICFRE and its institutes for implementation of eOffice. MoEF&CC is processing the invoice received from NIC.

8. **National Knowledge Network (NKN) connectivity:**
National Knowledge Network (NKN) connectivity provided to 12 location of ICFRE since September 2013. The National Knowledge Network (NKN) connectivity availability was more than 99% at ICFRE Head Qtr.

9. **Project:**
A project on "Integrated System for dissemination of Forestry Databases developed at ICFRE and its institutes" is prepared and submitted.

10. **Maintenance of IFRIS (Indian Forestry Research Information System):**
Maintaining the Payroll Management System (PMS), Personal Information Management System (PIMS) and other modules of IFRIS and looking after the users problems related to these modules.

11. **Maintenance Contract of IT Hardware (Computers, laptop, Printer, Scanner and Franking machine) at ICFRE Head Qtr.:**
Maintenance Contract of Computers, laptop, Printer of three years with M/s Bharat IT Solutions Pvt, Ltd, Dehradun is extended for another six months beyond 31.10.2017. New UPSs with three year warranty are installed at ICFRE HQ.

At ICFRE institutes:

The above mentioned services, Institutes' websites, databases, hardware/software is being looked after and maintained at Institute level by IT Division of respective institutes. Apart from other following activities are also carried out at Institutes:

Forest Research Institute, Dehradun

- The IT has dedicated computer training cum Bioinformatics Centre equipped with latest state of art desktop computers having LAN/WAN facilities. The Cell is actively involved in the process of imparting in-house training to the FRI Officers and staff.
- The IT cell provides faculty support for theory and practical classes in various courses to the Forest Research Institute Deemed University. Several induction courses of computer applications have been conducted for Ph. D. scholars and M.Sc. course.
- The IT Cell also provides the database development services for various biodiversity data collection as well as Bioinformatics related database.
- Design and Development of FRI website.

Institute of Wood Science and Technology, Bengaluru

- Design and development of institute and seminars websites.
- Organized stakeholder meeting on "Development of database on Non Timber Forest Produce In Karnataka" on 7th June 2017 in the Conference Hall, Forest Head Quarters, Mysore.

- Organized stakeholder meeting on "e-Protection System for high value Tree" on 27th June 2017 at Extension Hall, Institute of Wood Science and Technology, Bengaluru.

Institute of Genetics and Tree Breeding, Coimbatore

- IFGTB has taken the Green computing initiatives to communicate all letters, reports using E-mail effectively to reduce paper and power consumption.

Tropical Forest Research Institute, Jabalpur

- All the circulars, notifications, office orders, proceedings of monthly seminars and other documents have been regularly uploaded over the Online Office Records (Order /MoM / Agenda etc) System for wider circulation.
- Web pages have been updated for the institute's online open access e-magazine 'Van Sangyan' (ISSN 2395 - 468X) linked with institute's web site on regular basis and issues have been uploaded on monthly basis over it for easy access to the users.

Arid Forest Research Institute, Jodhpur

- Aadhar based biometric attendance system with CCTV was implemented at the Institute

Rain Forest Research Institute, Jorhat

- IT Cell of RFRI took initiative in establishment of 3G and Wi-fi Hot Spot infrastructure at RFRI campus and surrounding areas through BSNL.

Institute of Forest Biodiversity, Hyderabad

- Aadhar based biometric attendance system (AEBAS) was installed at IFB, Hyderabad during the month of January 2018.

BALANCE SHEET

Balance Sheet

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION
DEHRADUN

BALANCE SHEET
2017-18

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INDEPENDENT AUDITORS' REPORT

To,
The Members,
Indian Council of Forestry Research & Education,
Dehradun - 248001,
Uttarakhand.

Report on the Financial Statements

We have audited the accompanying financial statements of Indian Council of Forestry Research and Education (ICFRE) which comprise the Balance Sheet as at March 31, 2018, the Income & Expenditure Account for the year then ended on that date and a summary of significant accounting policies and other explanatory information.

Management's Responsibility for the Financial Statements

Management is responsible for the preparation and presentation of these financial statements that give a true and fair view of the financial position and financial performance of the firm in accordance with the accounting principles generally accepted in India. This responsibility also includes design, implementation and maintenance of adequate internal financial controls that were operating effectively for ensuring the accuracy and completeness of the accounting records, relevant to the preparation and presentation of the financial statements that give a true and fair view and are free from material misstatement, whether due to fraud or error.

Auditor's Responsibility

Our responsibility is to express an opinion on these financial statements based on our audit. We have taken into account the relevant provisions and rules framed thereunder, the accounting and auditing standards and matters which are required to be included in the audit report under the provisions of the Act and the Rules made thereunder.

We conducted our audit in accordance with the Standards on Auditing issued by the Institute of Chartered Accountants of India. Those Standards require that we comply with ethical requirements and plan and perform the audit to obtain reasonable assurance about whether the financial statements are free from material misstatement.

VERENDRA KALRA & CO
CHARTERED ACCOUNTANTS

75/7 Rajpur Road,
Dehradun - 248001
INDIA

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An audit involves performing procedures to obtain audit evidence about the amounts and disclosures in the financial statements. The procedures selected depend on the auditor's judgment, including the assessment of the risks of material misstatement of the financial statements, whether due to fraud or error. In making those risk assessments, the auditor considers internal control relevant to the firm's preparation of the financial statements that give true and fair view in order to design audit procedure that are appropriate in the circumstances, but not for the purpose of expressing an opinion on whether the firm has in place an adequate internal financial control system over financial reporting and the operating effectiveness of such controls. An audit also includes evaluating the appropriateness of accounting policies used and the reasonableness of the accounting estimates made by the Firm's Partners, as well as evaluating the overall presentation of financial statements.

We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our qualified audit opinion on the financial statements.

Basis for qualified opinion

a) ICFRE is not capitalizing fixed assets which are self-owned and have been purchased out of funds received for projects since inception, including purchase of the fixed assets of Rs. 1,91,53,968 out of grants received for projects during the financial year 2017-2018.

b) The balances of One Time Special Grant in Financial Statements for previous years are not in agreement with the balances as per utilization certificates submitted by the institute to Ministry of Environment, Forest and Climate Change.

c) The sponsored projects from funding agencies are treated as Earmarked Funds. Sponsored project does not fulfil the criteria of Earmarked Fund. In our opinion, the amount received for projects but not spent should be treated as current liabilities. Balance of completed projects should be treated as Current liability/income, as per the terms and conditions as agreed with the funding agency.

d) The impact of the following are not ascertainable:
   - Reconciliations are in progress for amount of contributions made by centres to Controller Pension Cell (ICFRE), PAO and other units (for pension contribution GPF, GSLIS and NPS) and balances recoverable from Controller Pension Cell (ICFRE), PAO and other units, amount of advances given to employees, statutory dues and inter unit balances.

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- Goods and Services Tax (GST) has not been charged on some of the chargeable supplies provided by individual centers of ICFRE in the financial year. In absence of relevant details which should have been provided to us, we are unable to ascertain the unrecognized GST liability.

e) As mentioned in para no. 6 of Notes to Accounts, the receipts and payments of Pension Cell and Forest Research Institute (Deemed to be) University of ICFRE are not included in Consolidated Balance sheet. Pension cell and the University forms part of ICFRE and the accounts thereof should be consolidated in the Balance sheet, in our opinion.

Qualified Opinion

In our opinion and to the best of our information and according to the explanation given to us, subject to the effects of matters described in Basis for qualified opinion paragraph above, the financial statement give information required by law in the manner so required by law and give true and fair view:

I. in the case of Balance Sheet, of the state of affairs of the Society as at March 31, 2018;
II. in the case of Income & Expenditure Account of the surplus for the year ended on that date.

For **Verendra Kalra & Co.**
Chartered Accountants

Verendra Kalra
FCA Partner
Membership No. 074084

Signed at Dehradun on

SCHEDULE	PARTICULARS
	BALANCE SHEET AS AT MARCH 31, 2018
	INCOME AND EXPENDITURE ACCOUNT FOR THE PERIOD ENDED MARCH 31, 2018
	SCHEDULES FORMING PART OF BALANCE SHEET AS AT MARCH 31, 2018
SCHEDULE - 1	CORPUS/CAPITAL FUND
SCHEDULE - 2	RESERVES AND SURPLUS
SCHEDULE - 3	EARMARKED/ENDOWMENT FUNDS
SCHEDULE - 4	SECURED LOANS AND BORROWINGS
SCHEDULE - 5	UNSECURED LOANS AND BORROWINGS
SCHEDULE - 6	DEFERRED CREDIT LIABILITIES
SCHEDULE - 7	CURRENT LIABILITIES AND PROVISIONS
SCHEDULE - 8	FIXED ASSETS
SCHEDULE - 9	INVESTMENTS FROM EARMARKED/ENDOWMENT FUNDS
SCHEDULE - 10	INVESTMENTS-OTHERS
SCHEDULE - 11	CURRENT ASSETS, LOANS, ADVANCES ETC.
SCHEDULE - 12	INCOME FROM SALES/SERVICES
SCHEDULE - 13	GRANTS/SUBSIDIES
SCHEDULE - 14	FEES/SUBSCRIPTION
SCHEDULE - 15	INCOME FROM INVESTMENTS
SCHEDULE - 16	INCOME FROM ROYALTY, PUBLICATION ETC.
SCHEDULE - 17	INTEREST EARNED
SCHEDULE - 18	OTHER INCOME
SCHEDULE - 19	INCREASE/(DECREASE) IN STOCK OF FINISHED GOODS & WORK IN PROGRESS
SCHEDULE - 20	ESTABLISHMENT EXPENSES
SCHEDULE - 21	OTHER ADMINISTRATIVE EXPENSES ETC.
SCHEDULE - 22	EXPENDITURE ON GRANTS, SUBSIDIES ETC..
SCHEDULE - 23	INTEREST PAID
SCHEDULE - 24	NOTES TO ACCOUNTS
	RECEIPTS AND PAYMENTS FOR THE YEAR ENDED MARCH 31, 2018

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN

BALANCE SHEET AS AT MARCH 31, 2018

(Amount in Rs.)

CORPUS/CAPITAL FUND AND LIABILITIES	Schedule	Current Year 31.03.2018		Previous Year 31.03.2017	
CORPUS/CAPITAL FUND	1		1,265,987,553		1,439,136,535
RESERVES AND SURPLUS	2		-		-
EARMARKED/ENDOWMENT FUNDS :	3				
> One time special grant		29,460,936		113,962,936	
> Project unspent balance		403,071,002		402,487,786	
> Chair of Excellence		136,760,669	569,292,607	48,174,739	564,625,461
SECURED LOANS AND BORROWINGS	4				
UNSECURED LOANS AND BORROWINGS	5				
DEFFERRED CREDIT LIABILITIES	6				
CURRENT LIABILITIES AND PROVISIONS					
(A) CURRENT LIABILITY:	7	125,131,387		104,439,657	
(B) PROVISIONS:		-	125,131,387	-	104,439,657
TOTAL			1,960,411,547		2,108,201,653

ASSETS	Schedule	Current Year 31.03.2018		Previous Year 31.03.2017	
FIXED ASSETS	8		1,181,968,254		1,237,973,229
INVESTMENTS-FROM EARMARKED/ENDOWMENT FUNDS	9		135,769,200		127,184,200
INVESTMENTS-OTHERS	10		-		-
> F.D.R.(With Institutes)					
CURRENT ASSETS, LOANS, ADVANCES ETC.	11		642,674,093		743,044,224
MISCELLANEOUS EXPENDITURE					
> (to the extent not written off or adjusted)			-		-
> (items under reconciliation)			-		-
TOTAL			1,960,411,547		2,108,201,653

This is the balance sheet referred to in our audit report of even date

Schedule referred above form an integral part of balance sheet

For **Verendra Kalra & Co.**
Chartered Accountants
Firm registration no. 006568C

Verendra Kalra
FCA Partner
Membership no. 074084

Signed at Dehradun on 30.10.18

For and on behalf of ICFRE

Dr. Suresh Gairola
(Director General, ICFRE)

A. S. Rawat
(Dy. Director General, Admin., ICFRE)

Sandeep Kujur
(Asset. Director General, Admin., ICFRE)

Brijesh Kumar Sharma
(Section Officer, Budget Section, ICFRE)

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN

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

(Amount – Rs.)

INCOME	Schedule	Current Year	Previous Year
Income from sales/services	12	-	47,000
Grants/Subsidies	13	1,910,000,000	1,620,000,000
Fees/Subscriptions	14	15,349,244	17,230,104
Income from Investments (Income on Invest .from earmarked/endow.)	15	-	-
Income from Royalty, Publications etc.	16	-	-
Interest earned	17	13,283,556	34,339,292
Other income	18	125,809,376	75,631,925
Increase/(decrease) in stock of finished goods and works-in-progress	19	-	-
Total(A)		**2,064,442,176**	**1,747,248,321**

EXPENDITURE	Schedule	Current Year	Previous Year
Establishment Expenses	20	1,830,901,893	1,333,825,961
Other Administrative Expenses etc.	21	354,804,364	329,021,780
Expenditure on Grants, Subsidies etc.	22	1,895,270	7,500,000
Interest paid	23	-	-
Depreciation(Net Total at the year end-corresponding to Schedule 8)	8	90,449,331	92,205,892
Prior period item (Depreciation for last year)	8	2,315,300	96,977,943
Total (B)		**2,280,366,158**	**1,859,531,576**
Balance being excess of Income over Expenditure(A-B)		(215,923,983)	(112,283,255)
Transfers to Special Reserve(Specify each)			
Transfer to/from General Reserve			
BALANCE BEING DEFICIT CARRIED TO CORPUS FUND		**(215,923,983)**	**(112,283,255)**

This is the income expenditure referred to in our audit report of even date

Schedule referred above form an integral part of balance sheet

For **Verendra Kalra & Co.**
Chartered Accountants
Firm registration no. 006568C

Verendra Kalra
FCA Partner
Membership no. 074084

Signed at Dehradun on 30.10.18

For and on behalf of ICFRE

Dr. Suresh Gairola
(Director General, ICFRE)

A. S. Rawat
(Dy. Director General, Admin., ICFRE)

Sandeep Kujur
(Asset. Director General, Admin., ICFRE)

Brijesh Kumar Sharma
(Section Officer, Budget Section, ICFRE)

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN

SCHEDULES FORMING PART OF BALANCE SHEET AS MARCH 31, 2018

Amount-(Rs)

SCHEDULE 1-CORPUS/CAPITAL FUND:	Current Year		Previous Year	
Balance as at the beginning of the year	1,439,136,536		1,483,999,818	
Add: Asset purchased from OTSG Capitalized	2,775,000	1,441,911,536	55,419,973	1,539,419,791
Add: Contributions towards Corpus/Capital Fund				
Plan Account	40,000,000		10,000,000	
North East	-	40,000,000	2,000,000	12,000,000
Less: Surplus/(deficit)of income over expenditure for the year		(215,923,983)		(112,283,255)
BALANCE AS AT THE YEAR-END		1,265,987,553		1,439,136,536

Amount-(Rs)

SCHEDULE 2-RESERVES AND SURPLUS:	Current Year		Previous Year	
1. **Capital Reserve:**				
As per last Account				
Addition during the year				
Less: Deductions during the year				
2. **Revaluation Reserve:**				
As per last Account				
Addition during the year				
Less: Deductions during the year				
3. **Special Reserves:**				
As per last Account				
Addition during the year				
Less: Deductions during the year				
4 **General Reserve:**				
As per last Account				
Addition during the year				
Less: Deductions during the year				
TOTAL				

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN

SCHEDULES FORMING PART OF BALANCE SHEET AS MARCH 31, 2018

Amount-(Rs)

SCHEDULE 3-EARMARKED / ENDOWMENT FUNDS	FUND –WISE BREAK UP			TOTAL	
	ONE TIME SPECIAL GRANT	PROJECT ACCOUNTS	CHAIRS OF EXCELLENCE	Current Year 31.03.2018	Previous Year 31.03.2017
a)Opening balance of the funds	113,962,936	402,487,786	48,174,739	564,625,461	567,142,931
b)Additions to the Funds:				-	
i) Donations/grants				-	
One time special grant (General)				-	
One time special grant (Creation of assets)				-	
ii) Income from interest made on FDR account of funds			8,585,930	8,585,930	9,080,245
iii) Other additions (Corpus for chair fund transfered from OTSG)			80,000,000	80,000,000	
iv) Project receipts		327,560,244		327,560,244	270,738,862
				-	
TOTAL(a+b)	113,962,936	730,048,030	136,760,669	980,771,635	846,962,038
C) Utilization/Expenditure towards objectives of funds				-	
i) Capital Expenditure				-	
- Fixed assets	2,775,000	19,153,968		21,928,968	70,754,744
- Others				-	-
ii) Refunded to Ministry					
Total	2,775,000	19,153,968		21,928,968	70,754,744
iii) Amount transferred / refunded					
- Amount refunded to Ministry of Environment & Forests	1,727,000			1,727,000	5,276,380
- Amount transferred to 'Chair of excellence fund'	80,000,000			80,000,000	
iv) Revenue Expenditure				-	
- Salaries, wages and allowances etc.				-	
- Rent				-	
- Other administrative expenses				-	
- Project payments		307,823,060		307,823,060	206,305,454
				-	
Total	81,727,000	307,823,060		389,550,060	206,305,454
TOTAL(c)	84,502,000	326,977,028		411,479,028	277,060,198
NET BALANCE AS AT THE YEAR END(a+b-c)	29,460,936	403,071,002	136,760,669	569,292,607	569,901,840

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN

SCHEDULES FORMING PART OF BALANCE SHEET AS MARCH 31, 2018

Amount-(Rs)

SCHEDULE 4-SECURED LOANS AND BORROWINGS:	Current Year	Previous Year
1. Central Government 2. State Government(Specify) 3. Financial Institutions a) Term Loans b) Interest accrued and due 4. Banks: a) Term Loans -Interest accrued and due b) Other Loans(specify) -Interest accrued and due 5. Other institutions and Agencies 6. Debentures and Bonds 7. Others(specify)		
TOTAL		

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN

SCHEDULES FORMING PART OF BALANCE SHEET AS MARCH 31, 2018

Amount-(Rs)

Schedule 5-UNSECURED LOANS AND BORROWINGS	Current Year	Previous Year
1. Central Government		
2. State Government		
3. Financial Institutions		
4. Banks:		
a) Term Loans		
b)Other Loans (specify)		
5. Other Institutions and Agencies		
6. Debentures and Bonds		
7. Fixed Deposits		
8. Others(specify)		
TOTAL		

Note: Amount due within one year

SCHEDULE 6-DEFERRED CREDIT LIABILITIES:	Current Year	Previous Year
a) Acceptances secured by hypothecation of capital equipment and other assets		
b) Others		
TOTAL		

Note: Amounts due within one year

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN

SCHEDULES FORMING PART OF BALANCE SHEET AS MARCH 31, 2018

Amount-(Rs)

SCHEDULE 7-CURRENT LIABILITIES AND PROVISIONS	Current Year		Previous Year	
A.CURRENT LIABILITIES				
1.Acceptances				
2.Sundry Creditors:				
a)For Goods				
b)Others				
3.Advances Received				
4.Interest accrued but not due on:				
a)Secured Loans/borrowings				
b)Unsecured Loans/borrowings				
5.Statutory Liabilities:				
a)Overdue				
b)Others				
6.Other Current Liabilities				
Security & EMD Account		11,197,086		10,905,102
Amount Payable to Controller, Pension Cell, ICFRE		6,036,157		6,035,137
Amount Payable to PAO (F), New Delhi		578,883		498,883
GPF Subscription/ Refund	358,692		358,692	
CGEGIS	91,740		11,740	
Any other recovery	128,451		128,451	
Amount Payable to other units		1,672,945		1,630,459
Saving Fund	89,361		65,361	
Death Claim	44,013		44,013	
Advance Recovery	541		511	
Other	1,540,971		1,525,755	
CGEIS	(1,941)		(5,181)	
Salary Payable Account				
Opening balance	85,370,076		98,465,003	
Add: Payable for March, 2018	105,646,946		85,370,076	
Total	191,017,022		183,835,079	
Less: Paid for March 2017	85,370,706	105,646,316	98,465,003	85,370,076
TOTAL(A)		125,131,387		104,439,657
B.PROVISIONS				
1.For Taxation				
2.Gratuity				
3.Supernnuation/Pension				
4.Accumulated Leave Encashment				
5.Trade Warranties/Claims				
6.Others(Specify)				
TOTAL(B)				
TOTAL(A+B)		125,131,387		104,439,657

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN

SCHEDULES FORMING PART OF BALANCE SHEET AS AT MARCH 31, 2018

Amount-(Rs)

SCHEDULE 8 -FIXED ASSETS

DESCRIPTION	GROSS BLOCK					ACCUMULATED DEPRICIATION						NET BLOCK	
	As on 01.04.17	Addition during the year before 30.09.2017	Addition during the year after 30.09.2017	Transfer during the year	As at 31.03.2018	Rate of depreciation	As on 01.04.17	On Additions during the year before 30.09.2017	Depreciation for current year	Prior period depreciation	As at 31.03.2018	As at 31.03.2018	As at 31.03.2017
A. Fixed Assets:													
1.LAND:													
a)Freehold	57,185,420			(46,306,000)	103,491,420							103,491,420	57,185,420
b)Leasehold													
2.BUILDINGS:													
a)On Freehold Land	1,131,296,588		5,829,000	46,306,000	1,090,819,588	5.00%	202,085,583		48,805,810	2,315,300	253,206,694	837,612,894	929,211,004
									-		-		
3.PLANT MACHINERY & EQUIPMENT									-		-		
a) Scientific Equipment	237,357,090	2,349,452	4,859,279		244,565,821	15.00%	104,878,279		20,588,685		125,466,964	119,098,857	132,478,811
b) I.T.Equipment	25,938,696	1,592,551	7,386,660		34,917,907	40.00%	23,483,769		3,096,323		26,580,092	8,337,815	2,454,927
									-				
4.VEHICLES	11,893,337	-	-		11,893,337	15.00%	5,684,941		931,259		6,616,200	5,277,137	6,208,396
									-				
5.FURNITURE,FIXTURES	22,197,203	99,452	627,609		22,924,264	10.00%	6,855,557		1,575,490		8,431,047	14,493,217	15,341,647
									-				
6.OFFICE EQUIPMENT	89,971,097	713,693	7,913,620		98,598,410	15.00%	41,050,843		8,038,614		49,089,457	49,508,953	48,920,254
									-				
8.ELECTRIC INSTALLATIONS	2,181,700	-	-		2,181,700	15.00%	1,042,839		170,829		1,213,668	968,032	1,138,861
									-				
9.LIBRARY BOOKS	76,978,182	1,779,635	3,388,189		82,146,006	15.00%	33,938,015		6,977,084		40,915,100	41,230,906	43,040,166
									-				
10.TUBEWELLS & W.SUPPLY									-		-		
									-				
11.OTHER FIXED ASSETS						0.00%			-		-		
									-				
12.TOOLS & EQUIPMENTS	3,387,384				3,387,384	15.00%	1,619,149		265,235		1,884,384	1,503,000	1,768,236
TOTAL OF CURRENT YEAR	1,658,386,696	6,534,783	30,004,357		1,694,925,836		420,638,974		90,449,331	2,315,300	511,088,305	1,181,522,231	1,237,747,722
PREVIOUS YEAR													
B.CAPITAL WORK-IN-PROGRESS	225,507	151,061	69,455		446,023			-			-	446,023	225,507
TOTAL	1,658,612,203	6,685,844	30,073,812		1,695,371,859	0.00%	420,638,974	-	90,449,331	2,315,300	511,088,305	1,181,968,254	1,237,973,229

Note: The addition to building was incorrectly shown as addition to land. It is corrected in financial year 2017-18. Depreciation effect of it is shown in column 'Prior Period Depreciation

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN

SCHEDULES FORMING PART OF BALANCE SHEET AS MARCH 31, 2018

Amount-(Rs)

SCHEDULE - 9 INVESTMENTS FROM EARMARKED/ENDOWMENT FUNDS	Current Year	Previous Year
1. In Government Securities > F.D.R.(For Chair of Excellence)	135,769,200	127,184,200
2. Other Approved Securities		
3. Shares		
4. Debentures and Bonds		
5. Subsidiaries and Joint Ventures		
6. Others(to be specified)		
TOTAL	135,769,200	127,184,200

SCHEDULE 10- INVESTMENTS-OTHERS	Current Year	Previous Year
1. In Government Securities > 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)		
TOTAL		

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN

SCHEDULES FORMING PART OF BALANCE SHEET AS MARCH 31, 2018

Amount-(Rs)

SCHEDULE 11 – (A) CURRENT ASSETS,LOANS,ADVANCES ETC.(Cont.)	Current Year		Previous Year	
B.LOANS,ADVANCES AND OTHER ASSETS				
1. Loans and advances:				
a) Staff Advance		3,476,736		5,058,123
b) Other Entities engaged in activities/objectives similar to that of the Entity				
c) Other (Statutory Dues)		882,673		427,216
2. Advances and other amounts recoverable in cash or in kind or for value to be received:				
a) On Capital Account				
CPWD TFRI	4,388,010		4,934,103	
CPWD - NE RFRI	6,017,600		6,017,600	
CCU -NE Budget Section	5,917,000		5,917,000	
CCU -(Plan Account) FRI	27,365,500		27,365,500	
CCU -(OTSG) Budget Section	596		2,785,258	
CCU -IFGTB	4,291,500		-	
CCU-IWST	697,100	48,677,306	697,100	47,716,561
Bundelkhand Project (TFRI)	-		184,876	
Scientific equipments	781,472		11,445	
Advances for building renovation	5,128,300	5,909,772		196,321
b) Others				
Amount Recoverable From Controller, Pension Cell, ICFRE		11,872,309		7,648,390
Amount Recoverable from PAO (F) NEW DELHI		2,625,967		2,725,967
Amount Recoverable From Other Units		(85,663)		(85,663)
Amounts Recoverable (other)				
-Inter Unit Account	45,030,225		45,931,057	
-Misc. Recoveries	7,067,737		7,067,737	
-Payable to Controller ICFRE	8,121,476	60,219,438	6,935,121	59,933,915
3. Income Accrued:				
a) On Investments from Earmarked/Endowments Funds	-			
b) On Investments-Others	-			
c) On Loans and Advances	2,083,590		2,083,590	
d) Others (includes income due unrealized - Rs)	-	2,083,590		2,083,590
TOTAL(B)		**135,662,128**		**125,704,420**
TOTAL(A+B)		**642,674,093**		**743,044,224**

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN

SCHEDULES FORMING PART OF INCOME EXPENDITURE ACCOUNT

FOR THE YEAR ENDING MARCH 31, 2018

(Amount – Rs.)

SCHEDULE 12 – INCOME FROM SALES/SERVICES	Current Year	Previous Year
1) Income from Sales		
a) Sale of Finished Goods		
b) Sale of Raw Material		
c) Sale of Scraps		
2) Income from Services		
a) Labor and Processing Charges		
b) Professional /Consultancy Services		
c) Agency Commission and Brokerage		
d) Maintenance Services(Equipment/Property)		
e) Others(Specify)		
f) Sharing Cost received from others		47,000
TOTAL	-	47,000

(Amount-Rs)

SCHEDULE 13 –GRANTS/SUBSIDIES	Current Year	Previous Year
(Irrevocable Grants & Subsidies Received)		
- Plan (GC-General)	1,910,000,000	1,170,000,000
- Non Plan (GC-General-KV)	-	332,000,000
- North East (GC-General)	-	118,000,000
2) State Government	-	-
3) Government Agencies	-	-
4) Institutions/Welfare Bodies	-	-
5) International Organizations	-	-
6) Others(Specify)	-	-
TOTAL	1,910,000,000	1,620,000,000

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN

SCHEDULES FORMING PART OF INCOME EXPENDITURE ACCOUNT FOR THE YEAR ENDING MARCH 31, 2018

(Amount – Rs.)

SCHEDULE 14 –FEES/SUBSCRIPTION	Current Year	Previous Year
1) Entrance Fees		
2) Annual Fees/Subscription		
3) Seminar/Program Fees		
4) Consultancy Fees	15,349,244	17,230,104
5) Others (Service Charges)	-	
TOTAL	**15,349,244**	**17,230,104**

(Amount – Rs.)

SCHEDULE 15-INCOME FROM INVESTMENTS	Current Year	Previous Year
1) Interest		
a) On Govt. Securities		
b) Other Bonds/Debentures		
2) Dividends:		
a) On Shares		
b) On Mutual Fund Securities		
3) Rents		
4) Others(Specify)		
TOTAL	-	-

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN

SCHEDULES FORMING PART OF INCOME EXPENDITURE ACCOUNT FOR THE YEAR ENDING MARCH 31, 2018

(Amount – Rs.)

SCHEDULE 16 – INCOME FROM ROYALTY, PUBLICATION ETC.	Current Year	Previous Year
1) Income from Royalty		
2) Income from Publications	-	
TOTAL	-	-

(Amount – Rs.)

SCHEDULE 17 – INTEREST EARNED ETC.	Current Year	Previous Year
1) On Term Deposit/Saving Accounts:		
a) With Scheduled Banks	12,617,395	33,213,628
b) With Non—Scheduled Banks		
c) Post Office Savings Accounts		
d) Others		
Less: Interest paid to the Ministry (OTSG)		
2) On Loans:		
i) Interest accrued during the year		
a) Employees/Staff		
ii) Interest earned during the year		
a) Employees/Staff	666,161	1,125,664
3) Interest on Debtors and Other Receivables		
TOTAL	13,283,556	34,339,292

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN
SCHEDULES FORMING PART OF INCOME EXPENDITURE ACCOUNT
FOR THE YEAR ENDING MARCH 31, 2018

SCHEDULE 18 – OTHER INCOME /PRIOR PERIOD ITEMS:	Current Year	Previous Year
1) Profit on Sale/disposal of Assets:		
a) Owned assets		
b) Assets acquired out of grants, or received free of cost		
2) Revenue from various activities		
a) Revenue received (House License Fees, Guest House,Mandap, etc.)	74,651,637	52,379,055
3) Export Incentives realized		
4) Fees for Miscellaneous Services		
5) Miscellaneous Income	51,157,738	23,252,871
6) Prior Period Income		
TOTAL	125,809,376	75,631,925

SCHEDULE 19 – INCREASE/(DECREASE) IN STOCK OF FINISHED GOODS & WORK IN PROGRESS	Current Year	Previous Year
a) Closing stock		
- Finished Goods		
- Work-in-progress		
b) Less: Opening Stock		
- Finished Goods		
- Work-in-progress		
NET INCREASE(DECREASE) [a-b]		

SCHEDULE 20 – ESTABLISHMENT EXPENSES	Current Year	Previous Year
a) Salaries and Wages		
Non- Plan (General Component-General)	-	332,108,040
Plan (General Components-General)	1,576,816,893	781,789,626
Plan (North East)	-	78,766,820
Plan (KVS)	96,399,000	-
b) Allowances and Bonus	-	-
c) Contribution to Provident Fund	-	-
d) Contribution to other Fund (specify)	-	-
Revenue Paid to Pension Cell ICFRE out of Own Revenue Account	157,686,000	141,009,975
e) Staff Welfare Expenses	-	-
f) Expenses on Employees' Retirement and Terminal Benefits	-	-
g) Others (sharing cost of medical)	-	151,500
h) Salary paid in excess than provision of previous year	-	-
TOTAL	1,830,901,893	1,333,825,961

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN
SCHEDULES FORMING PART OF INCOME EXPENDITURE ACCOUNT
FOR THE YEAR ENDING MARCH 31, 2018

(Amount – Rs.)

SCHEDULE 21 – OTHER ADMINISTRATIVE EXPENSES ETC.	Current Year		Previous Year	
a) Purchases				
b) Labor and processing expenses				
c) Cartage and Carriage Inwards				
d) Electricity and power		37,827,177		34,817,253
e) Water Charges		5,731,110		4,043,459
f) Insurance		-		
h) Rent, Rates and Taxes				
> Rent building / Equipment	821,626		1,414,700	
> Municipal Tax	594,147	1,415,773	525,000	1,939,700
i) Vehicles Running and maintenance				
> Fuel	3,672,136		3,477,865	
> Repair	274,066		2,528,797	
> Road Taxes / Insurance	1,544,447	5,490,649	1,025,632	7,032,294
j) Postage, Telephone & Communication Charges				
> Telephone charges	2,755,429		2,054,477	
> Postal / Stamp Charges	393,446	3,148,875	921,721	2,976,198
k) Printing and Stationary				
> Printings & Publication	1,691,791		3,068,428	
> Stationery	1,911,659	3,603,450	2,044,460	5,112,888
l) Traveling and Conveyance Expenses				
> T.E. (Technical Staff)	15,719,628		9,358,278	
> T.E. (Non Technical Staff)	6,224,011		5,037,828	
> O.E. (Technical)	-	21,943,639	-	14,396,106
m) Expenses on Seminar/Workshops				
> Seminar / Conference / HRD	1,759,213		3,262,187	
> Extension - Normal	2,873,299		3,320,613	
> V.V.K. & Demo Villages	1,876,202		3,399,785	
> Direct to Consumer Project	294,331		664,135	
> DOE	-		-	
> Field Research Expenses	23,686,047		28,098,212	
> R.A.G. Expenses	1,691,768	32,180,860	464,563	39,209,495
n) Subscription Expenses		-		139,725
m) Expenses on fees				
> Fellowship/Scholarship/cash Awards		21,255,394		9,294,427
p) Auditors Remuneration		182,509		55,200
q) Hospitality Expenses		-		-
r) Professional Charges/legal/consultancy charges		2,172,527		3,769,982
s) Training Expenses		2,033,946		-
t) Consumables		11,013,954		-
u) Packing Charges		-		
v) Freight and Forwarding Expenses		-		
w) Distribution Expenses		-		
x) Advertisement and Publicity		1,693,962		1,920,217
y) Maintenance of Equipment				
> Scientific	2,510,124		2,946,636	
> Office	11,477,143		9,669,738	
> I.T. Equipment / Services	986,924			
> Furniture Expenses	345,755			
> Vehicle	2,877,469		45,056,549	
> Building and Minor Work	33,415,009	51,612,424	1,736,984	59,409,907
z) Others (specify)		672,555		4,347,211
za) Contingency Expenditure		148,436,988		110,034,676
zb) Medicines / X-ray		3,491,746		4,471,803
zc) Liveries		110,918		285,939
zd) Newspaper Bill		785,909		600,938
ze) North East Expenditure		-		25,164,363
TOTAL		354,804,364		329,021,780

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN
SCHEDULES FORMING PART OF INCOME EXPENDITURE ACCOUNT
FOR THE YEAR ENDING MARCH 31, 2018

(Amount – Rs.)

SCHEDULE 22 – EXPENDITURE ON GRANTS, SUBSIDIES ETC..	Current Year	Previous Year
a) Grants given to Institutions/Organizations > Grants to Universities	1,895,270	7,500,000
b) Subsidies given to Institution/Organizations		
TOTAL	1,895,270	7,500,000

(Amount – Rs.)

SCHEDULE 23 – INTEREST PAID	Current Year	Previous Year
a) On Fixed Loans		
b) On Other Loans (including Bank Charges)		
c) Other		
TOTAL		-

INDIAN COUNCIL FORESTRY RESEARCH AND EDUCATION

NOTES TO ACCOUNTS FOR THE YEAR ENDED MARCH 31, 2018

Schedule 24: Significant accounting policies and notes to accounts

Significant accounting policies

1. **Accounting convention**
   The financial statements have been prepared following going concern concept. Accounts are not maintained as per dual accounting concept. The entity has primarily followed cash system of accounting, in respect of salary which is accounted for on accrual basis at year end in the month of March.

2. **Use of estimates**
   The preparation of financial statements requires management to make estimates and assumptions that affect the reported amounts of assets and liabilities, the disclosure of contingent assets and liabilities on the date of the financial statements and reported amounts of revenues and expenses during the period reported. Actual results could differ from those estimates.

3. **Depreciation**
   Depreciation in the books of accounts has been provided at written down value method at the rates specified in Income Tax Act 1961. Additions in fixed assets during the first half of the year are depreciated at full rate and additions in the later half are depreciated at half rates.

4. **Revenue recognition:**
   Revenue is recognized when income is transferred to 'Own Revenue account' maintained by centers.

5. **Fixed Assets, Intangible Assets and Capital Work-in-progress**
   Fixed Assets have been valued at historical costs. The cost of an asset comprises its purchase price and any directly attributable cost of bringing the asset to working condition for its intended use.
   Capital Work-in-progress includes costs of fixed assets that are not ready for their intended use at the date of balance sheet.

6. **FUNDS:**
   EARMARKED FUND
   One Time Special Grant (OTSG): One Time Special Grant of Rs. 100 crores was sanctioned to the Institute of Forestry Research and Education in recognition of its excellence in the field of forestry research, education and extension. The sanctioned grant was released in parts, which is utilized within sanctioned budgets in the supplementary demands.

   Chair for Excellence: To attract eminent personalities and outstanding researchers to teach and educate in the field of forestry and allied emerging subjects, funds amounting to Rs. 8 crores out of

INDIAN COUNCIL FORESTRY RESEARCH AND EDUCATION

NOTES TO ACCOUNTS FOR THE YEAR ENDED MARCH 31, 2018

One Time Special Grant have been provided for establishment of Chair of Excellence'. The amount of interest thereon is to be utilized for payment of salary and other expenditures in relation thereto'.

Project Accounts: The receipts for consultancy projects, Externally Aided projects, Service charges collected with guesthouse fees, welfare funds are included under this head.

7. **Grants and subsidies:**
   Amount of Grants from Ministry of Environment Forest and Climate Change (MOEF&CC) are recorded on receipt basis. Grants received for salaries and general expenses are recognized as income on receipt basis and grants received for procurement of capital assets is credited to Corpus Fund irrespective of their subsequent utilization.

8. **Employees benefits:**
   The Society has various schemes of employee benefits such as Provident Fund, Gratuity and Pension Schemes. Pension, leave encashment etc. and the accounting in respect thereof is being done on cash basis. Accordingly, no provision has been made in books of accounts for expenditures pertaining to such schemes and are recorded on payment basis.

9. **Taxation**
   The society is registered under section 12AA of the Income Tax Act, 1961. The income of society is exempt under section 12A.

10. **Contingencies liabilities and assets**
    A disclosure for a contingent liability is made when there is a possible obligation or a present obligation that probably will not require an outflow of resources or where a reliable estimate of obligation cannot be made.
    Contingent liabilities are not recognized in the financial statements and are disclosed in the notes to the financial statements after an evaluation of the fact and legal aspects of the matter involved.
    Contingent assets are neither recognized in the financial statements nor disclosed in the notes to the financial statements.

INDIAN COUNCIL FORESTRY RESEARCH AND EDUCATION

NOTES TO ACCOUNTS FOR THE YEAR ENDED MARCH 31, 2018

Notes to accounts

1. Out of total sanctioned One Time Special Grant of Rs. 100 crores, grants amounting to Rs. 56.28 crores was received by ICFRE. In the current year, amount of Rs. 17.27 lacs were refunded to Ministry of Environment, Forests & Climate Change. Except the amount of Rs. 3,61,182, the whole grant has been utilized in previous years. Closing balance of the fund is yet to be rectified/regrouped in the balance sheet.

2. The One Time Special Grant included Rs. 8 crores on account of Chair for Excellence which was deposited as FD in the bank account. However, a separate fund for the same was not created in the financial statements of previous years. The interest earned on such fixed deposit was credited to a separate fund- 'Interest Corpus Fund'. In the current financial year (for better understanding and presentation), these balances have been credited to a separate fund set aside for establishing "Chairs of Excellence". The fund balance is represented on the assets side of Balance Sheet by the balance of Fixed deposits as per Schedule 9. The balance of Fixed Deposits is lesser by Rs. 9,91,469. Efforts are being made to work out the cause of mismatch.

3. The amount of contributions made by centres to Controller Pension Cell (ICFRE), PAO and other units for pension contribution, GPF, GSLIS and NPS and amount recoverable from Controller Pension Cell (ICFRE), PAO and other units to centres, amount of advances given to employees, statutory dues and inter unit balances are subject to confirmations, the reconciliations of which are in progress.

4. **Grants and subsidies:**
   The grants received during the year have been accounted for in following manner:

(Amount INR)

Plan(GC)	191,00,00,000	Treated as revenue in nature.
Plan (Capital)	4,00,00,000	Treated as corpus fund.

5. The building completed in last year was incorrectly reflected as land in the financial statements in FY 2016-17. This was rectified by transferring the WDV of building as on 01.04.2017 from "Land" to "Building" head. The expenditure on account of last year's depreciation has been shown separately in the Income Expenditure account as 'Prior Period Item'.

6. The accounts of Pension Cell have not been consolidated in the financial Statements for which separate Receipts and Payment account has been prepared.

7. Previous year figures have been re-grouped as necessary to conform to this year's classification.

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN
RECEIPT & PAYMENT ACCOUNT FOR THE YEAR ENDING MARCH 31, 2018

(Amount – Rs.)

RECEIPTS	AMOUNT	TOTAL AMOUNT	PAYMENTS	AMOUNT	TOTAL AMOUNT
I. Opening Balances			I. Expenses		
a) Cash in hand	243,859		a) Establishment Expenses	1,652,939,653	
b) Bank Balances			b) Administrative Expenses (Corresponding to Schedule 21)	354,951,867	
i) Incurrent accounts	65,371,169		c) Expenditure On Grant Subsidy Etc. (Corresponding to Schedule 22	1,895,270	2,009,786,790
ii) In deposit accounts	227,997,571				
iii) Savings accounts	429,294,479	722,907,078	II. Payments made against funds for various projects		
			Expenditure on Projects		327,846,611
II. Grants Received					
a) From Government of India					
Plan (G C-General) Project /Revenue	1,910,000,000		III. Investments and deposits made		
Non Plan (GC-General)	-		a) Out of Earmarked/Endowment funds		
North East (General Component)	-		b) Out of Own Funds (Investments-Others)		
One Time Special Grant	-				
Plan (Research/Creation of Assets)	40,000,000				
North East (Capital Assets)	-	1,950,000,000	IV. Expenditure on Fixed Assets & Capital Work-in-Progress		
			a) Purchase of Fixed Assets		
b) From State Government			Scientific Equipments	6,855,702	
c) From other sources (Project Receipts)		327,551,189	Office Equipment	6,364,737	
			I.T. Equipments/Services	10,165,382	
III. Income on Investments from			Furniture & Fixture	727,061	
a) Earmarked/Endow.Fund	8,585,930		Books & Journals	5,167,824	
b) Own Funds (Oth. Investments)	16,706,484	25,292,414	Vehicles	-	
			Land	-	
IV. Interest Received			Road and Buildings	4,703,950	
Interest Received from Schedule Banks	12,580,117		b) Expenditure on Capital Work-in-progress	-	33,984,656
Other Receipts (Interest on Advances)	37,278	12,617,395			
			V. Refund of surplus money to Ministry		1,727,000
V. Other Income (Revenue earn)		141,824,781			
			VII. Other Payments (Specify)		
VII. Any other receipts (give details)			Payments made on to Own Revenue Accoun	17,892,839	
			Payments made on Behalf of PAO(F) New Delh	-	
Reimbursement from PAO (F) New Delhi	100,000		Payments made on Behalf of the Controller ICFRI	90,054,189	
Reimbursement from Controller, ICFRE	108,328,221		Payment made to PAO (F) on behalf of Staf	2,011,499	
Recoveries from Staff on behalf of PAO(F) New Delh	2,091,497		Payments made to other offices on behalf of Staf	8,306,557	
Receipt from Staff on behalf of other Office	8,349,063		Payments to Controller, ICFRE on Behalf of the Staf	284,358,925	
Recoveries from Staff on Behalf of Controller ICFRI	284,359,945		Advances paid to Staff on behalf of ICFRI	77,340,723	
Recoveries of Advances from Staff on behalf of ICFRI	78,922,110		Payments made to other Offices on behalf of staf	177,032,655	
Recoveries from Staff on behalf of Others	177,035,585		Inter Unit Transactions	6,353,343	663,350,728
Inter Unit Transactions	7,254,175	666,430,576			
Advance refund from CCU		555,755	Revenue Receipt Paid DDG ICFRE		152,463,121
			Revenue Receipt Paid to Controller ICFRE FOR PENSION		147,686,000
Revenue received in Revenue account DDG (ICFRE)		152,463,281	Revenue Receipt Paid to Controller ICFRE FOR PHS		10,000,000
			EMD/Security Refundec		
			Advance Paid		
			» CCU/ CPWD	4,291,500	
			» Scientific Equipments	596,596	
			» Advances for repairs and renovation	5,128,300	10,016,396
			VIII. Closing Balances		
			a) Cash in hand	206,529	
			b) Bank Balances		
			i) In Current Account	30,993,564	
			ii) In Deposit Accounts	230,410,693	
			iii) Savings Accounts	378,594,709	
			iv) Cheques in Transi	2,575,628	642,781,163
TOTAL		3,999,642,468	TOTAL		3,999,642,469

For Virendra Kalra & Co.
Chartered Accountants
Firm registration no. 006568C

Virendra Kalra/CA Partner
Membership no. 074084
30.10.18
Dehradun

Dr. Suresh Gairola
(Director General, ICFRE)

A.K. Rawat
(Dy. Director General, Admin., ICFRE)

Sandeep Kujur
(Asstt. Director General, Admin., ICFRE)

Brijesh Kumar Sharma
(Section Officer, Budget Section, ICFRE)

INDIAN COUNCIL FORESTRY RESEARCH AND EDUCATION

NOTES TO ACCOUNTS FOR THE YEAR ENDED MARCH 31, 2018

8. In the management's view, there is no contingent liability pertaining to society.

For **Verendra Kalra & Co.**
Chartered Accountants
Firm Registration No: 006568C

Verendra Kalra
Partner
M. No: 074084

Signed at Dehradun on 30-10-18

For and on behalf of
Indian Council of Forestry Research and Education

Dr. Suresh Gairola
(Director General, ICFRE)

Sh. A. S Rawat
(Dy. Director General, Admin., ICFRE)

Sh. Sandeep Kujur
(Asset. Director General, Admin., ICFRE)

Sh. Brijesh Kumar Sharma
(Section Officer, Budget Section, ICFRE)

BALANCE SHEET OF CONTROLLER PENSION CELL OF
(GPF, GSLIS, PENSION SCHEME AND NEW PENSION SCHEME)
INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN
AS ON 31ST MARCH, 2018

Annexure 1

(Amount-Rs.)

Corpus/Capital Fund And Liabilities	Current Year		Previous Year	
Pension cell fund account				
General provident fund	811,453,126		769,612,799	
GSLIS A/c	1,711,084		908,679	
Pension a/c	951,583,815		1,153,697,231	
New pension fund a/c	4,877,454		4,176,437	
ICFRE PHS	35,698,568	1,805,324,046	29,170,975	1,957,566,120
TOTAL		**1,805,324,046**		**1,957,566,120**
Fixed assets	-		-	
Current assets loans and advances	1,555,572,519		1,823,407,247	
Investment others	-		-	
Cash and bank balance	249,751,527	1,805,324,046	134,158,873	1,957,566,120
TOTAL		**1,805,324,046**		**1,957,566,120**

Dr. Suresh Gairola
(Director General, ICFRE)

A. S. Rawat
(Dy. Director General, Admin., ICFRE)

Sandeep Kujur
(Asset. Director General, Admin., ICFRE)

Brijesh Kumar Sharma
(Section Officer, Budget Section, ICFRE)

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN

Annexure 2

GPF-INCOME & EXPENDITURE ACCOUNT FOR THE YEAR ENDING 31ST MARCH 2018

(Amount-Rs.)

PARTICULARS	AMOUNT
Income	
Interest	47,605,393.00
	47,605,393.00
Expenditure	
Expenditure	416.00
Excess of income over Expenses	47,604,977.00
TOTAL	**47,605,393.00**

GSLIS-INCOME & EXPENDITURE ACCOUNT FOR THE YEAR ENDING 31ST MARCH 2018

PARTICULARS	AMOUNT
Income	
Interest	42,052.00
	42,052.00
Expenditure	
Misc. Exp.	-
Excess of income over Expenses	42,052.00
TOTAL	**42,052.00**

PENSION-INCOME & EXPENDITURE ACCOUNT FOR THE YEAR ENDING 31ST MARCH 2018

PARTICULARS	AMOUNT
Income	
Interest	40,449,711.00
	40,449,711.00
Expenditure	
Misc Exp.	1,693.00
Excess of income over Expenses	40,448,018.00
TOTAL	**40,449,711.00**

NEW PENSION ACCOUNT INCOME & EXPENDITURE A/C FOR THE YEAR ENDING 31ST MARCH, 2018

PARTICULARS	AMOUNT
Income	
Interest	348,217.00
	348,217.00
Expenditure	
Excess of income over Expenses	348,217.00
TOTAL	**348,217.00**

ICFREPHS INCOME & EXPENDITURE A/C FOR THE YEAR ENDING 31ST MARCH, 2018

PARTICULARS	AMOUNT
Income	
Interest	2,246,056.19
	2,246,056.19
Expenditure	
Excess of income over Expenses	2,246,056.19
TOTAL	**2,246,056.19**

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN
DETAILS OF PENSION FUND AS ON 31 MARCH 2018

Annexure 3 (Amount-Rs.)

	GPF (3491)	GSLIS (3498)	PENSION FUND (3660)	NEW PENSION (4994)	ICFREPHS (7440)	TOTAL	PREVIOUS YEAR 2016-17
Opening balance	769,612,799	908,679	1,153,697,232	4,176,437	29,170,973	1,957,566,120	1,844,854,399
Add : Bank Interest	47,605,393	42,052	40,449,711	348,217	2,246,056	90,691,429	144,575,851
Add : Tfd.from general fund						-	-
Amount received from PAO (F), New Delhi	168,286					168,286	
Amount received from Other offices	135,024					135,024	
Saving fund under GSLIS		2,456,897				2,456,897	1,861,267
Death claim		917,037				917,037	97,566
Advance received						-	10,000
Subscription/contribution	153,555,157	1,761,455	94,081,463	36,436,551	3,692,900	289,527,526	423,257,314
Amount Received from DDG admin			147,686,000		10,000,000	157,686,000	
New Pension Scheme/LSPC						-	
Inter transfers			16,000,000			16,000,000	
Misc receipts	340					340	
TOTAL (A)	971,076,999	6,086,120	1,451,914,406	40,961,205	45,109,930	2,515,148,659	2,414,656,397
Advances to hospital					524,558	524,558	
Death claims paid		854,576				854,576	
Saving Fund		1,987,764				1,987,764	2,110,722
Subscription to LIC		1,532,696				1,532,696	1,536,690
GPF advance reimbursement	18,919,316					18,919,316	19,196,733
GPF part payment	62,528,965					62,528,965	50,820,103
GPF final payment	62,174,836					62,174,836	53,212,314
Pensionary benefit paid			443,908,903			443,908,903	237,971,579
Paid to NSDL on A/c of NPS Contr.				36,083,751		36,083,751	24,998,774
DCRG			56,419,995			56,419,995	46,907,193
Medical reimbursement						-	3,237,682
ISO Charges/Miscellaneous payments						-	-
Tax deducted at source (Income Tax)						-	-
GPF PAID						-	10,193,488
Advances paid (FRI and HFRI)					8,886,804	8,886,804	6,905,000
Inter transfer:	16,000,000					16,000,000	
GSLIS	340					340	
Misc payments	416		1,693			2,109	
TOTAL (B)	159,623,873	4,375,036	500,330,591	36,083,751	9,411,362	709,824,613	457,090,278
BALANCE (A-B)	811,453,126.00	1,711,083.55	951,583,815.00	4,877,454.00	35,698,567.61	1,805,324,046.16	1,957,566,119

Annexure-39

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2018

Van Vigyan Bhawan

Particulars	Current Year 31.03.2018	Previous Year 31.03.2017
	RS.	RS.
Grant received		
Salary		
General	2,417,000.00	2,848,000.00
Capital	43,000.00	
Revenue	1,566,726.00	1,356,369.00
Maint. Charges	1,571,020.00	1,213,781.00
Total	5,597,746.00	4,204,369.00
Expenditure		
Salary		
General	2,588,655.59	2,679,354.00
Capital	474,722.00	45,000.00
Revenue	1,668,711.55	1,317,538.00
Maint. Charges	703,799.00	523,307.50
Total	4,732,089.14	4,041,892.00
Grand Total	10,329,835.14	8,246,261.00

Revenue expenditure i.e revenue submitteed to DG ICFRe - Revenue this includes intrest accrued; rent and sale of scrap and march revenue of previous year details are submitted in annexure 1

Signature of DDO
with Seal

D.D.O.
Van Vigyan Bhawan
Sector-6, R K. Puram
New Delhi-110022

Signature of Director
with Seal

Resident Director
Van Vigyan Bhawan, New Delhi

Annexure-39

Name of Institute/Centre : Account Office, ICFRE (Hqtr.)
INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN
INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2018

INCOME	Current Year 31.03.2018	Previous Year 31.03.2017
	RS	RS.
Income from sales/services-Institutional Charges	5,000,000.00	50,332,046.29
Grants/Subsidies-Salary and General	155,505,000	197,870,000
Grants/Subsidies-Capital	9,340,000	
Fees/Subscriptions		
Income from Investments (Income on Invest .from earmarked/endow.		
Income from Royalty, Publications etc.	2,700	
Interest Earned	4,367,443	6,963,038
Other Income	21,770,241	
Increase/(decrease) in stock of finished goods and works-in-progress	-	-
Total(A)	195,985,384	255,165,084

EXPENDITURE		Current Year 31.03.2018	Previous Year 31.03.2017
		RS.	RS.
Establishment Expenses		146,910,000	114,275,431
Other Administrative Expenses etc.		44,782,666	34,013,227
Creation of assets under Capital		7,799,960	
Expenditure on Grants, Subsidies etc.		1,000,000	11,681,394
Interest		4,367,443	
Depreciation(Net Total at the year end-corresponding to Schedule 8)			22,479,232
Other Income		22,140,768	
Institutional Charges		5,000,000	
Income from Royalty, Publications etc.		2,700	
TOTAL(B)		232,003,537	182,449,285

Accounts Officer
I.C.F.R.E. (Hq.)

Annexure-39 (A)

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION

and Expenditure Account for the year ended 31 st March 2018 in respect of Accounts (Admin), F.R.I . DEHRADUN

INCOME	CURRENT YEAR 31.03.2018	PREVIOUS YEAR 31.03.2017
	Rs.	Rs.
Opening Balance		68475505.00
Income from sales / services		
Grant / Subsidies		
Plan		
Salaries	520247000.00	
General	131961400.00	
Capital Assiets	9154000.00	
Other Receipts	69401734.00	3061946.00
Revenue received	50183188.00	213304.00
Total (A)	**780947322.00**	**71750755.00**
EXPENDITURE	**CURRENT YEAR 31.03.2018**	**PREVIOUS YEAR 31.03.2017**
	Rs.	**Rs.**
Establishment expenses	550148661.00	
Other Administrative Expenses etc	114910456.00	
Research & Operational Expenses etc	17079134.00	
Capital Assets	9355279.00	
Other Payment	68197318.00	3659591.00
Revenue Transferred to ICFRE Hq.	49839344.00	557148.00
Total (B)	**809530192.00**	**4216739.00**
Balance being excess of Income over Expenditure (A-B)	38951146.00	

सहायक अधिकारी
वन अनुसंधान संस्थान
देहरादून

Annexure-39

Forest Research Centre for Eco-Rahabilitation, Allahabad

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2018

Name of Institute/Centre: Forest Research Centre for Eco Rahabilitation, Allahaba

Particulars	Current Year 31.03.2018	Previous Year 31.03.2017
	RS.	RS.
Income		
Salary	1,45,82,000.00	1,22,33,000.00
General	28,16,600.00	37,09,000.00
Less Transfer to FRI	(3,77,000.00)	
Capital	2,23,000.00	45,000.00
Revenue	2,20,400.00	1,94,722.00
Total	1,74,65,000.00	1,61,81,722.00
Expenditure		
Salary	1,55,55,541.00	1,14,36,076.00
General	3392060.62	33,64,299.50
Capital	2,08,350.00	42,650
Revenue	2,20,400.00	1,94,820
Total	1,93,76,351.62	1,50,37,846

Signature of DDO
with Seal
D.D.O.
Forest Research Centre
for Eco-Rehabilitation

Signature of Head
with Seal
Head
Forest Research Centre
for Eco-Rehabilitation

Annexure-39

Institute of Forest Genetics & Tree Breeding, Coimbatore 641 002

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2018

INCOME	Current Year 31.03.2018	Previous Year 31.03.2017
Income from Sales/Services	2,188,200.00	
Grants/Subsidies		
Plan :		
Salaries	160,198,000.00	
General	39,344,000.00	177,433,000.00
Capital Assets	3,317,000.00	
Fees/Subscription		
Income from Investments (Income investment from)		
Income from Royalty, publications, etc.	39,236.00	7,030,405.59
Interest earned	1,475,410.00	3,317,193.00
Other Income	6,600,841.69	
Increase/Decrease in stock of finished goods and works-in-progress		
Grants received under EAPs	44,389,774.00	
Service charges	331,060.00	
Total (A)	257,883,521.69	187,780,598.59
EXPENDITURE	Current Year 31.03.2018	Previous Year 31.03.2017
Establishment Expenses	191,972,576.00	128,106,411.00
Other Administrative Expenses, etc.	24,755,400.00	38,585,623.50
Research & Operational Expenses	15,989,208.00	
Capital Assets	3,322,265.00	
Interest		
Other Payments		100,000.00
Revenue transferred to ICFRE HQ	12,154,366.69	
Expenditure under EAPs.	43,682,756.00	
Expenditure under Service Charges a/c	61,303.00	
Depreciation (Net total at the year end corresponding to Schedule - 8)		14,808,038.26
Total (B)	291,937,874.69	181,600,072.76
Balance being excess of Income over Expenditure (A-B)		6,180,525.83
Transfers to Special Reserve (Specify each)		
Transfer to/from General Reserve		
BALANCE BEING DEFICIT CARRIED TO CORPUS FND		6,180,525.83
SIGNIFICANT ACCOUNTING POLICIES		
CONTINGENT LIABILITIES AND NOTES ON ACCOUNTS		

(N. Usha)
Accounts Officer
IFGTB, Coimbatore

(Mohit Gera)
Director
IFGTB, Coimbatore

INSTITUTE OF WOOD SCIENCE AND TECHNOLOGY, BANGALORE

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2018

Particulares	current year as on 31.3.2018	Previous year as on 31.06.2017
Income		
Salary	143055000	115340000
General	23809000	25390000
Capital	6489000	1590000
Revenue	13340372	11700844
Total	**186693372**	**154020844**
Expenditure		
Salary	149876298	105100721
General	23816836	25383074
Capital	6492205	15,89,932
Revenue	13340372	12919500
Total	**193525711**	**144993227**

N. Ravi 30/
डीडीओ, आइ.डब्ल्यू.एस.टी
DDO, IWST

निदेशक / Director
काष्ठ विज्ञान एवं प्रौद्योगिकी संस्थान
Institute of Wood Science And Technology
बेंगलूरु / Bangalore - 560 003

TROPICAL FOREST RESEARCH INSTITUTE JABALPUR

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2016

INCOME	Schedule	Current Year 31.03.2018	Previous Year 31.03.2017
		RS	RS.
Income from sales/services	12	-	
Grants/Subsidies	13	231,097,343.27	136,648,350.00
Fees/Subscriptions	14	16,761,009.11	2,013,969.83
Income from Investments (Income on Invest .from earmarked/endow.	15	-	
Income from Royalty, Publications etc.	16	-	9,947,113.00
Interest Earned	17	2,285,351.20	1,489,433.00
Other Income	18	6,467,412.76	
Increase/(decrease) in stock of finished goods and works-in-progress	19		
Total(A)		256,611,116.34	150,098,865.83

EXPENDITURE	Schedule	Current Year 31.03.2018	Previous Year 31.03.2017
		RS.	RS.
Establishment Expenses	20	178,489,522.00	110,180,561.00
Other Administrative Expenses etc.	21	34,176,153.31	23,075,365.07
Expenditure on Grants, Subsidies etc.	22	18,052,923.00	
Interest	23	765,777.60	
Depreciation(Net Total at the year end-corresponding to Schedule 8)		378,272.40	4,047,340.83
TOTAL(B)		231,862,648.31	137,303,266.90
Balance being excess of Income over Expenditure(A-B)		24,748,468.03	12,795,598.93
Transfers to Special Reserve(Specify each)			
Transfer to/from General Reserve			
BALANCE BEING DEFICIT CARRIED TO CORPUS FUND		24,748,468.03	12,795,598.93
SIGNIFICANT ACCOUNTING POLICIES	24		
CONTINGENT LIABILITIES AND NOTES ON ACCOUNTS	25		

M/S C A K P K & ASSOCIATES
CHARTERED ACCOUNTANTS

CA. PIYUSH KAPOOR

Director

DDO

DATED: 05.09.2018
PLACE: JABALPUR

Name of institute/Centre: FOREST RESEARCH CENTRE FOR SKILL DEVELOPMENT, CHHINDWARA(M.P.)

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2018

INCOME	Current Year 31.03.2018 Rs.	Previous Year 31.03.2017 Rs.
Income from sales/services	6117000.00	16845000.0(
Grants/Subsidies	-	
Fees/Subscriptions	-	
Income from Investments (Income on Invest. from	-	
Income from Royalty, Publications etc.	-	231908.0(
Interest Earned	309318.00	303953.0(
Other Income	150498.00	
Increase/(decrease) in stock of finished goods and works-in-progress	-	
Total	6576816.00	17380861.0(

EXPENDITURE	Current Year 31.03.2018 Rs.	Previous Year 31.03.2017 Rs.
Establishment Expenses	13407492.00	9639038.0(
Other Administrative Expenses etc.	1620118.40	1303821.00
Expenditure on Grants, Subsidies etc.	-	-
Interest	-	-
Depreciation(Net Total at the year end-corresponding to Schedule 8)	-	-
Total	15027610.40	10942859.00

HEAD OF OFFICE
FRC-SD
CHHINDWARA

(Dr. Vishakha Kumbhare
DDO
FRC-SD
CHHINDWARA

Annexure-39

Indian Council of Forestry Research & Education, Dehradun

Income & Expenditure Account for the Year ended 31st March, 2018

Name of Institute: Arid Forest Research Institute, Jodhpur

(Amount in Rs.)

Income	Previous Year 31.03.2017	Current Year 31.03.2018
Income from Sales/ Service	0.00	0.00
Grants/ Subsidies	119614000.00	157700000.00
Fees/ Subscriptions	0.00	0.00
Income from Investments (Income on Invest from earmarked/ endow.)	0.00	0.00
Income from Royalty, Publications etc.	10974825.00	
Interest Earned	411224.00	337867.00
Other Income		12385734.00
Increase/ Decrease in Stock of Finished Goods and Works-in-Progress	0.00	0.00
Total (A)	**131000049.00**	**170423601.00**

Expenditure	Previous Year 31.03.2017	Current Year 31.03.2018
Establishment Expenses	93559068.00	128271034.00
Other Administrative Expenses etc.	28402161.00	26896163.00
Expenditure on Grants, Subsidies etc.	0.00	0.00
Interest	0.00	0.00
Depreciation (Net Total at the year end - Corresponding to Schedule B)	11635846.53	
Total (B)	**133597075.53**	**155167197.00**
Balance being Excess of Income over Expenditure (A - B)	(2597026.53)	
Transfers to Special Reserve (Specify each)		
Transfers to/ from General Reserve		
BALANCE BEING DEFICIT CARRIED TO CORPUS FUND		
SIGNIFICANT ACCOUNTING POLICIES		
CONTINGENT LIABILITIES AND NOTES ON ACCOUNTS		

Note: Chartered Accountant was not engaged for preparation of Balance Sheet as on 31.03.2018; therefore, Depreciation as a part of Expenditure for the year 2017-18 could not be assessed.

9/8/18

निदेशक/Director
शुष्क वन अनुसंधान संस्थान
Arid Forest Research Institute
जोधपुर/Jodhpur

Signature of DDO with Seal

लेखा अधिकारी
Accounts Officer
शुष्क वन अनुसंधान संस्थान
Arid Forest Research Institute
जोधपुर/Jodhpur

ANNEXURE-39

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2018

Name of Institute:- Himalayan Forest Research Institute, SHIMLA

(Amount in Rs.)

Income	Previous Year 31.03.2017	Current Year 31.03.2018
Income from Sales/Service	47240.00	111360.00
Grants/subsides	63394000.00	87256000.00
Fees/Subscriptions	1261897.00	351650.00
Income from investments (income on invest from earmarked/endow).	0	0
Income from Royalty, Publications etc.	0	0
Interest earned	2075074.00	458756.00
Other income	3777710.00	3768238.00
Increase/Decrease in Stock of Finished Goods and Works-in-Progress.	0	0
Total (A)	70555921.00	91946004.00
Expenditure	Previous Year 31.03.2017	Current Year 31.03.2018
Establishment Expenses	52334551.00	76513526.00
Other Administrative Expenses etc.	10086230.00	10521780.00
Expenditure on Grants, Subsidies etc.	7665259.00	4826150.00
Interest		
Depreciation (Net Total at the year end-Corresponding to Schedule B)		
Total (B)	70086040.00	91861456.00
Balance being Excess of income over Expenditure (A-B)	469881.00	84548.00
Transfers to Special Reserve (Specify each)		
Transfers to/from General Reserve		
BALANCE BEING DEFICIT CARRIED TO CORPUS FUND		
SIGNIFICANT ACCOUNTING POLICIES		
CONTINGNT LIABILITIS AND NOTES ON ACCOUNTS		

Note: Chartered Accountant was not engaged for preparation of Balance Sheet as on 31.03.2018, therefore, Depreciation as a part of Expenditure for the year 2017-18 could not be assessed.

निदेशक

Drawing and Disbursing Officer
HFRI, Shimla-171

Annexure-39

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2018

Name of Institute/Centre: Institute of Forest Productivity, Ranchi

Previous year 31.03.2017	EXPENDITURE	Current Year 31.03.2018	Previous Year 31.03.2017	INCOME	Current Year 31.03.2018
RS		RS	RS.		RS.
5,51,87,684.00	Establishment Expenses	7,33,92,663.00		Income from sales/services	
90,82,108.00	Other Administrative Expenses etc.	52,59,330.00		Grants/Subsidies	
			6,80,85,187.00	(1.) Salaries	7,45,25,000.00
				(2.) General	77,44,000.00
14,43,209.00	Research and operational Expenses	36,38,217.00		Fees/Subscriptions	
	Expenditure on Grants, Subsidies etc.			Income from Investments (Income on Invest .from earmarked/endow. Funds transferred to Funds)	
2,22,166.00	Interest		3,10,186.00	Income from Royalty, Publications etc.	
	Other payment		8,11,466.00	Interest Earned	2,96,963.00
				Other Income	
	Revenue Income transferred to ICFRE HQ	40,87,095.00		Revenue Income	47,85,192.00
	Depreciation(Net Total at the year end-corresponding to Schedule 8)			Increase/(decrease) in stock of finished goods and works-in-progress	
6,59,35,167.00	**Total Expenditure**	8,63,77,305.00	6,92,06,839.00	**Total Income**	8,73,51,155.00
32,71,672.00	Balance being excess of Income over Expenditure(A-B)	9,73,850.00			
	Transfers to Special Reserve(Specify each)				
	Transfer to/from General Reserve				
32,71,672.00	**Total Balance**	9,73,850.00	-		-

Signature of DDO with Seal
आहरण एवं संवितरण अधिकारी
Drawing & Disbursing Officer
वन उत्पादकता संस्थान
Institute of Forest Productivity
राँची / Ranchi-835303

31/08/18
Signature of Director with Seal
Director
Institute of Forest Productivity
RANCHI

Annexure-39

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2018

Name of Institute/Centre: INSTITUTE OF FOREST BIODIVERSITY, HYDERABAD

Previous year 31.03.2017	EXPENDITURE	Current Year 31.03.2018	Previous Year 31.03.2017	INCOME	Current Year 31.03.2018
RS		RS	RS.		RS.
20,441,163.00	Establishment Expenses	38,482,007.00	33,859,639.00	Grants/Subsides	47,690,893.00
11,444,834.00	Other Administrative Expenses	12,643,335.00	175,302.00	Income from Royalty, Publications etc.	137,834.00
1,210,242.41	Depreciation (Net Total at the year end-corresponding)	1,161,244.33	310,203.00	Interest Earned	295,434.00
1,248,904.59	Balance being excess of Income over Expenditure			Balance being excess of Income over Expenditure	4,162,425.33
34,345,144.00		52,286,586.33	34,345,144.00		52,286,586.33

Drawing and Disbursing Officer
आहरण एवं संवितरण अधिकारी
Drawing & Disbursing Officer
वन जैव विविधता संस्थान
Institute of Forest Biodiversity
हैदराबाद / Hyderabad - 14.

Director
निर्देशक Director
वन जैव विविधता संस्थान
Institute of Forest Biodiversity
हैदराबाद / Hyderabad - 14.

Name of Institute: Rain Forest Research Institute

INDIAN COUNCIL OF FORESTRY EDUCATION & RESEARCH,DEHRADUN

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH,2018

Income	Current Year 31.03.2018	Previous Year 31.03.2017
	Rs	Rs
Income from sales/Services		
Grants/Subsidies	147195038	103957000
Fees/Subscriptions		
Income from Investments		
Income from royalty,Publications etc		
Interest Earned	1879077.84	29430
Other Income	6495034	749380
Increase/Decrease in stock of finished goods and work in progress		
Total (A)	155569149.8	104735810

Expenditure	Current Year 31.03.2018	Previous Year 31.03.2017
	Rs	Rs
Establishment Expenses		
Other Administrative Expenses		
Expenditure on Grants,Subsidies etc		
Interest		
Depreciation (Net total at the year end coresponding to schedule 8		
North East Expenses	135013642.4	102255818
Total(B)	135013642.4	102255818
Balance being excess of income over expenditure (A-B)	20555507.44	2479992
transfer to special Reserve (specify Each)		
Transfer to /from general reserve		
Balance being deficit carried to corpus fund	20555507.44	2479992
significant Accounting policies		
CONTINGENCIES LIABILITIES AND NOTES ON ACCOUNTS		

FY- 2017-18	
Fund received	118703038
Opening balance	28492000
Total	147195038

18/7/18

आहरण एवं संवितरण अधिकारी
Drawing & Disbursement Officer
वर्षा वन अनुसंधान संस्थान
Rain Forest Research Institute
जोरहाट (असम) / Jorhat (Assam)

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2018

Name of Institute/Centre: FRC-LE, Agartala, Tripura (a unit of RFRI, Jorhat, Assam)

INCOME	Current Year 31.03.2018	Previous Year 31.03.2017
	RS	RS.
Income from sales/Services		
Grants, Subsidies		
Fees/Subscriptions	6,250,200.00	6,996,000.00
Income from Investments	-	-
Income from Royalty, Publications etc.	-	-
Interest Earned	97,223.00	79,725.00
Other Income	304,456.00	221,459.00
	-	
Increase/ (Decrease) in stock of finished goods and works-in-progress		
Total (A)	6,651,879.00	7,297,184.00

EXPENDITURE	Current Year 31.03.2018	Previous Year 31.03.2017
	RS	RS.
Establishment Expenses	4,527,706.00	4,058,321.00
Other Administrative expenses	1,908,355.00	2,058,271.00
Expenditure on Grants, Subsidies etc	1,980,816.00	167,665.00
Interest	-	-
Other Payments	965,717.00	1,687,691.00
Depreciation (Net Total at the year end-crresponding to Schedule 8)	-	-
Total (B)	9,382,594.00	7,971,948.00
Balance being excess of Expenditure over Income (A-B)	(2,730,715.00)	(674,764.00)
Transfers to Special Reserve (Specify each)	-	-
Transfer to / from General Reserve		
BALANCE BEING DEFICIT CARRIED TO CORPLUS FUND	(2,730,715.00)	(674,764.00)
SIGNIFICANT ACCOUNTING POLICIES		
CONTINGENT LIABILITIES AND NOTES ON ACCOUNTS		

Signature of DDO
with Seal

DDO
Forest Research
Centre For Livelihood
Extension (FRC-LE).

Signature of Head
with Seal

Head of Office
Forest Research
Centre For Livelihood
Extension (FRC-LE).

Annexure-39

Name of Institute/Centre : FRCBR, Aizawl, Mizoram
INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN
INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2018

INCOME	Current Year 31.03.2018	Previous Year 31.03.2017
	RS	RS.
Income from sales/services-Institutional Charges	1,000.00	3,000.00
Grants/Subsidies-Salary and General	1,15,34,000.00	90,77,000.00
Grants/Subsidies-Capital	3,86,000.00	4,80,000.00
Fees/Subscriptions	-	-
Income from Investments (Income on Invest .from earmarked/endow.	-	-
Income from Royalty, Publications etc.	-	-
Interest Earned	48,264.00	82,893.00
Other Income	2,71,551.00	1,89,468.00
Increase/(decrease) in stock of finished goods and works-in-progress	-	-
Total(A)	1,22,40,815.00	98,32,361.00

EXPENDITURE	Current Year 31.03.2018	Previous Year 31.03.2017
	RS.	RS.
Establishment Expenses	70,65,686.00	43,06,468.00
Other Administrative Expenses etc.	44,03,044.50	40,85,402.00
Creation of assets under Capital	4,68,217.00	7,35,890.00
Expenditure on Grants, Subsidies etc.	-	-
Interest	48,264.00	64,661.00
Depreciation(Net Total at the year end-corresponding to Schedule 8)	-	-
Other Income	2,42,968.00	1,68,138.00
Institutional Charges/sales	1,000.00	3,000.00
Income from Royalty, Publications etc.	-	-
TOTAL(B)	1,22,29,179.50	93,63,559.00

Drawing & Disbursing Officer
Forest Research Centre
for Bamboo and Rattan
Aizawl : Mizoram

Head
Forest Research Centre
for Bamboo and Rattan
Aizawl : Mizoram

Statement of Allotment & Expenditure for the year 2017-18 (Rs.in lakh)

Sl. No.	Budget Sub-Head / Name of Institutes/Centres	Plan (GC)											
		Salaries				General				Capital			
		Budget Allot.	Opening balance	Total	Exp. 2017-18	Budget Allot.	Opening balance	Total	Exp. 2017-18	Budget Allot.	Opening balance	Total	Exp. 2017-18
1	ICFRE	0.00	0.00	0.00	0.00	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	24.17	1.98	26.15	25.90	3.47	0.45	3.92	3.92
3	DDO, ICFRE	1103.22	495.73	1598.95	1469.10	451.83	6.12	457.95	457.84	93.40	-0.44	92.96	78.00
4	FRI, Dehradun	5202.47	695.11	5897.58	5501.30	1315.84	4.11	1319.95	1319.92	91.54	2.02	93.56	93.55
5	CSFER, Allahabad	145.82	23.51	169.33	155.56	28.17	6.28	34.45	34.02	2.23	0.02	2.25	2.09
6	IFGTB, Coimbatore	1601.98	208.02	1810.00	1619.72	393.44	14.39	407.83	407.43	33.17	0.08	33.25	33.21
7	IWST, Bangalore	1430.55	230.00	1660.55	1498.77	238.09	0.08	238.17	238.16	64.89	0.03	64.92	64.92
8	TFRI, Jabalpur	1822.38	84.82	1907.20	1768.96	228.85	22.69	251.54	245.03	20.83	0.14	20.97	20.89
9	CFRHRD, Chhindwara	72.92	76.92	149.84	134.08	-11.75	28.27	16.52	16.18	0.00	0.00	0.00	0.00
10	AFRI, Jodhpur	1309.51	72.08	1381.59	1282.70	267.49	2.76	270.25	268.99	13.12	0.05	13.17	13.13
11	HFRI, Shimla	768.08	58.47	826.55	765.14	104.48	0.77	105.25	105.22	38.92	0.02	38.94	38.92
12	IFP, Ranchi	745.25	52.35	797.60	733.93	77.44	12.41	89.85	88.98	7.40	0.10	7.50	7.52
13	IFB, Hyderabad	335.74	62.01	397.75	373.68	94.00	4.42	98.42	98.41	14.79	0.01	14.80	14.79
14	RFRI, Jorhat	950.00	284.00	1234.00	1112.77	224.30	0.05	224.35	223.88	10.20	3.30	13.50	13.47
15	CFLE, Agartala	39.09	14.74	53.83	45.27	21.30	0.19	21.49	19.10	2.18	0.00	2.18	1.92
16	ARCBR, Aizawl	72.99	16.85	89.84	70.66	42.35	3.10	45.45	43.33	3.86	0.85	4.71	4.71
	Total	15600.00	2374.61	17974.61	16531.64	3500.00	107.62	3607.62	3592.39	400.00	6.63	406.63	391.04

Statement of Revenue received in Budget Section, ICFRE for the year 2017-18 (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	0.00	0.00	0.00	0.00
2	VVB, New Delhi	0.00	0.00	0.00	0.00	0.00	0.08	16.60	0.00	16.68
3	DDO, ICFRE	300.03	0.00	0.00	0.00	0.00	13.54	11.30	0.08	324.95
4	FRI, Dehradun	102.25	0.15	0.00	42.56	121.91	21.58	175.21	1.13	464.79
5	IFGTB, Coimbatore	45.60	0.00	0.00	4.07	10.93	22.29	37.27	1.39	121.55
6	IWST, Bangalore	15.82	19.45	0.00	22.00	29.59	7.74	35.29	0.58	130.47
7	TFRI, Jabalpur	14.69	87.77	0.00	12.76	0.42	6.10	58.44	0.35	180.53
8	AFRI, Jodhpur	14.65	0.00	0.00	2.15	24.52	2.08	81.45	0.02	124.87
9	HFRI, Shimla	27.45	0.00	0.00	0.00	0.89	2.30	8.24	2.85	41.73
10	IFP, Ranchi	24.77	0.00	0.00	14.30	0.01	0.55	1.25	0.00	40.88
11	CSFER, Allahabad	1.01	0.00	0.00	0.49	0.14	0.48	0.09		2.21
12	CFRHRD, Chhindwara	0.00	0.00	0.00	0.36	0.06	3.21	1.06	0.03	4.72
13	IFB, Hyderabad	3.70	0.00	0.00	0.00	0.00	4.21	1.27	0.00	9.18
14	RFRI, Jorhat	21.35	19.95	0.00	0.20	2.73	9.63	10.46	0.25	64.57
15	CFLE, Agartala	2.55	0.00	0.00	0.00	0.19	0.97	0.30	0	4.01
16	ARCBR, Aizawl	0.00	0.00	0.00	0.00	0.01	0.66	2.64	0	3.31
	Total	573.87	127.32	0.00	98.89	191.40	95.42	440.87	6.68	1534.45

Statement of Allotment & Expenditure upto July 2018

(Rs.in lakh)

Sl. No.	Budget Sub-Head Name of Institutes/Centres	Plan (GC)					
		Salaries		General		Capital	
		Budget Allot.	Exp. upto July 2018	Budget Allot.	Exp. upto July 2018	Budget Allot.	Exp. upto July 2018
1	ICFRE	0.00	0.00	83.16	0.00	0.00	0.00
2	VVB, New Delhi	0.00	0.00	28.00	7.04	0.00	0.00
3	AO, ICFRE	1468.39	551.74	460.45	167.90	300.00	110.16
4	FRI, Dehradun	5300.00	2175.12	1441.54	408.71	41.98	5.01
5	FRC-ER, Allahabad	160.00	51.21	38.31	7.35	0.00	0.00
6	IFGTB, Coimbatore	1775.00	638.81	359.49	153.05	6.75	0.56
7	IWST, Bangalore	1675.00	572.47	239.31	81.50	24.00	0.08
8	TFRI, Jabalpur	1685.00	609.62	258.80	79.55	5.50	0.25
9	FRC-SD, Chhindwara	131.61	52.31	18.00	3.53	0.12	0.00
10	AFRI, Jodhpur	1300.00	461.04	269.92	85.85	3.70	0.00
11	HFRI, Shimla	780.00	293.35	118.79	36.61	1.00	0.00
12	IFP, Ranchi	800.00	300.39	90.68	32.95	0.00	0.00
13	IFB, Hyderabad	400.00	125.66	100.95	34.60	4.45	0.00
14	RFRI, Jorhat	1200.00	422.44	218.05	67.86	12.50	0.32
15	FRC-LE, Agartala	50.00	16.79	28.96	5.53	0.00	0.00
16	FRC-BR, Aizawl	75.00	25.19	45.59	11.02	0.00	0.00
Total		**16800.00**	**6296.14**	**3800.00**	**1183.05**	**400.00**	**116.38**

Statement of Revenue Generated upto July 2018

(Rs.in lakh)

Sl. No.	Name of Institutes/Centres	Approved Revenue Target for 2018-19	Revenue Generated upto July, 2018
1	ICFRE	0.00	0.00
2	VVB, New Delhi	20.00	3.63
3	AO, ICFRE	400.00	58.06
4	FRI, Dehradun	400.00	135.11
5	IFGTB, Coimbatore	190.00	9.88
6	IWST, Bangalore	190.00	26.06
7	TFRI, Jabalpur	190.00	32.80
8	AFRI, Jodhpur	190.00	27.73
9	HFRI, Shimla	100.00	10.92
10	IFP, Ranchi	100.00	8.84
11	FRC-ER, Allahabad	10.00	0.00
12	FRC-SD, Chhindwara	10.00	0.58
13	IFB, Hyderabad	30.00	4.71
14	RFRI, Jorhat	150.00	23.94
15	FRC-LE, Agartala	10.00	0.57
16	FRC-BR, Aizawl	10.00	0.79
Total		**2000.00**	**343.62**

Proposed Budget Estimate for the Financial Year 2019-20

(Rs.in lakh)

Sl.No.	Budget Component	Proposed BE 2019-20
1	Grant-in-aid "Salary"	18500.00
2	Grant-in-aid "General"	6000.00
3	Grant-in-aid "Capital"	600.00
	Total	**25100.00**

Target Proposed for Revenue ICFRE (Hqtr.) Institutes/Centres for the year 2019-20

(Rs.in lakh)

S.No.	Name of Institutes/Centres	Target Proposed
1	VVB, New Delhi	20.00
2	DDO, ICFRE	400.00
3	FRI, Dehradun	400.00
4	IFGTB, Coimbatore	160.00
5	IWST, Bangalore	180.00
6	TFRI, Jabalpur	180.00
7	AFRI, Jodhpur	180.00
8	HFRI, Shimla	120.00
9	IFP, Ranchi	120.00
10	CSFER, Allahabad	15.00
11	CFRHRD, Chhindwara	15.00
12	IFB, Hyderabad	60.00
13	RFRI, Jorhat	120.00
14	CFLE, Agartala	15.00
15	ARCBR, Aizawl	15.00
Total		2000.00

ANNEXURE

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 2017-18, RTI application (292) and RTI Appeals (10) 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	18	43	00	--	49
2nd Quarter	18	57	04	--	69
3rd Quarter	17	63	03	--	71
4th Quarter	28	77	03	--	103
Total	**81**	**240**	**10**	**--**	**292**
			--	--	
RTI First Appeals			--	--	
1st Quarter	N/A	03	N/A	--	03
2nd Quarter	N/A	02	N/A	--	01
3rd Quarter	N/A	04	N/A	--	03
4th Quarter	N/A	03	N/A	--	03
Total	**--**	**12**	**--**	--	**10**

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	Shri S.D. Sharma, Director (IC) Phone (O) : 0135-2224831, 0135-2756497 E-mail : dir_res@icfre.org	Shri Raman Nautiyal, Phone (O) :0135-2224811, E-mail : nautiyalr@icfre.org	All matters related to ICFRE Hqrs., Dehradun
Forest Research Institute, P.O. New Forest, Dehradun-248 006	Dr. Savita, 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), FRI P.O. New Forest Dehradun- 248 006 Phone : 0135-2752670, Email : groupco_fri@icfre.org	All Research & Account matters
		Smt. Neelima Shah, Registrar, FRI Phone : 0135-2757021-26 (O) Email : registrar_fri@icfre.org	Establishment, Administrative & all other matters
		Dr. A.K. Tripathi, Registrar & PIO Deemed University, FRI Phone : 0135-2224439 (O) 0135-2751826 (O) Email : tripathiak@icfre.org	University Matters
Centre for Social Forestry and Eco-Rehabilitation (CSFER), 3/1, Lajpath Rai Road, New Katra, Allahabad-211 002	Dr. Savita, Director Phone: 0135-2224444, 2755277 0135- 2757021 E-mail: dir_fri@icfre.org	Shri Amit Pandey Director CSFER Phone : 0532-2440795 Fax : 0532-2440796 E-mail : dir_csfer@icfre.org	All matters related to CSFER, Allahabad
Institute of Forest Genetics and Tree Breeding, Forest Campus, P.B.No 1061 R.S. Puram, Coimbatore - 641 002	Shri R.S. Prashanth, Director, IFGTB, Coimbatore, Phone : 0422-2431942 (O) Fax : 0422-2484101 E-mail: dir_ifgtb@icfre.org	Dr. S. Murugesan, Scientist 'G', IFGTB, Coimbatore Phone: 0422-2484102 (O)	All matters related to IFGTB, Coimbatore
Institute of Wood Science & Technology, PO Malleswarum, Bengaluru -560003	Shri Surendra Kumar, Director, IWST, Bengaluru Phone : 080-23341731, E-mail : dir_iwst@icfre.org	Dr. K. Murugesan, Coordinator (Fac.), IWST, Bengaluru, Phone : 080-22190106(O)	All matters related to IWST, Bengaluru

Headquarters / Institutes	Appellate Authorities	Public Information Officers	Subject matter(s) allocated
Tropical Forest Research Institute, Jabalpur P.O. – R.F.R.C, Mandla Road, Jabalpur – 482 021	Dr. U. Prakasham, Director TFRI, Jabalpur RFRC Mandla Road, Jabalpur. Phone : 0761-2840483 E-mail : dir_tfri@yahoo.co.in	Shri Akhilesh Kumar Sharma, DCF TFRI Jabalpur. Phone: 0761-4044003 (O)	All matters related to TFRI, Jabalpur
Centre for Forestry Research and Human Resources Development (CFRHRD), P.O. Kundalikala, Poama, Chhindwara - 480001	Dr. P. Subramanyam, IFS, Director TFRI, Jabalpur RFRC Mandla Road, Jabalpur. Phone : 0761-2840483 E-mail : head_cfrhrd@icfre.org	Dr. P. Subramanyam, IFS, Director CFRHRD, Chhindwara Phone : 07162-254473 (O) Fax : 07162-254463 Email : head_cfrhrd@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. R.S.C. Jayraj Director, RFRI Jorhat Phone : 0376-2350273(O) Fax : 0376-2350273 E-mail : dir_rfri@icfre.org	Shri B.K. Sonowal RFRI, Jorhat Phone : 0376-2350273 (O)	All matters related to RFRI, Jorhat
Advanced Research Centre for Bamboo and Rattans (ARCBR), P.O. Box 171, Kulikawn Aizwal-796001	Dr. R.S.C. Jayraj Director, RFRI Jorhat Phone : 0376-2350273 (O) Fax : 0376-2350274 E-mail : dir_rfri@icfre.org	Shri Gautam Banerjee, DCF Public Information Officer (PIO) Phone : 0376-2350273 (O) Fax : 0376-2350274	All matters related to ARCBR, Aizwal
Centre for Forest Livelihood and Extension Sal Bagan Forest Campus PO – Gandhigram Agartala- 799 012 Tripura	Dr. R.S.C. Jayraj Director, RFRI Jorhat Phone : 0376-2350273 (O) Fax : 0376-2350274 E-mail : dir_rfri@icfre.org	Shri Gautam Banerjee, DCF Public Information Officer (PIO) Phone : 0376-2350273 (O) Fax : 0376-2350274	All matters related to CFLE, Agartala
Arid Forest Research Institute, P.O. Krishi Upaz, Mandi, New Pali Road, Jodhpur, 342005.	Dr. N.K. Vasu, Director, AFRI Jodhpur Phone : 0291-2722549 (O) Fax : 0291-2722764 E-mail : dir_afri@icfre.org	Shri Ramesh Kumar Malpani, Dy. Conservator Forest AFRI Jodhpur. Phone : 0291-2729163	All matters related to AFRI, Jodhpur
Himalayan Forest Research Institute, Conifer Campus, Panthaghati, Shimla – 171 009.	Dr. V.P. Tiwari, Director, HFRI, Shimla Phone : 0177-2624392 (O), Fax : 0177-2626779 E-mail : dir_hfri@icfre.org	Dr. Rajesh Sharma, Scientist-F, HFRI Shimla -171 013 Phone: 0177-2626107(O) 0177-2626779 (O) Fax : 0177-2626779	All matters pertaining to HFRI, Shimla
Institute of Forest Productivity, Main Road, Hinoo, Ranchi-834 002.	Dr. S.A. Ansari, Director, IFP Ranchi, Ph-8986608161 E-mail : dir_ifp@icfre.org	Mr. Sanjeev Kumar Scientist- D, IFP Ranchi, E-mail : dir_ifp@icfre.org	All matters related to IFP, Ranchi
Institute of Forest Biodiversity, P.O. Hakimpet, Dulapally, Hyderabad- 500014.	Dr. GRS Reddy Director, IFB, Hyderabad Phone : 040-66309501(O) Fax : 040-66309521 E-mail : director_ifb@icfre.org	Dr. Pattnaik Scientist -F, IFB, Hyderabad	All matters related to IFB, Hyderabad

Annexure – II

Information on Vigilance Cases

A Chief Vigilance Officer is functioning at ICFRE, Dehradun. During the year 2017-18, 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
00	05	01	04	Violation of conduct rule.

Name and address of Chief Vigilance Officer, ICFRE is as follows:

Shri A.S. Rawat, IFS
Chief Vigilance Officer
P.O. New Forest, Dehradun – 248 006
Phone: 0135- 2224856

Annexure – III

Information on Audit Objections

An Internal Audit Cell is functioning at ICFRE, Dehradun under the Head, Internal Audit, ICFRE. During the year 2017-18, 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 years	Audit objections initiated in the year	Audit objections disposed	Audit objections pending	Nature of Audit objections	Remarks, if any
79	NIL	NIL	79	Routine Paras of Research /Projects/ Admin./Accounts	Reply of the all Audit Paras have been submitted

Name and address of Head, Internal Audit, ICFRE is as follows:

Dr. Rajeev Kumar Tiwari, IFS
Head, Internal Audit
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Annexure – IV

E-mail and Postal addresses of ICFRE and its Institutes

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Director
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Annexure – V

Abbreviations

AAU	-	Anand Agriculture University
ACTO	-	Assistant Chief Technical Officer
ADG	-	Assistant Director General
AFOLU	-	Agriculture, Forestry and Other Land Uses
AICOPTAX	-	All India Coordinated Project on Capacity Building on Taxonomy
AICP	-	All India Coordinated Project
AICRP	-	All India Coordinated Research Project
AM	-	Arbuscular Mycorrhizal
ANOVA	-	Analysis of variance
AOGCM	-	Atmosphere-Air General Circulation Model
APCCF	-	Additional Principal Chief Conservator of Forest
AP-FECM	-	Asia Pacific Forestry Education Coordination Mechanism
APFORGEN	-	Asia Pacific Forest Genetic Resources Programme
APTI	-	Air Pollution Tolerance Index
ARCBR	-	Advanced Research Centre for Bamboo and Rattan
ASEAN	-	Association of South East Asian Nations
BAP	-	Benzyl Amino Purine
BCC	-	Biodiversity and Climate Change
BCCL	-	Bharat Coking Coal Ltd.
BILT	-	Ballarpur Industries Limited
ICIMOD	-	International Centre for Integrated Mountain Development
BSI	-	Botanical Survey of India
CAZRI	-	Central Arid Zone Research Institute
CBSA	-	Canada Border Services Agency
CCA	-	Cooper Chrome Boron
CFLE	-	Centre for Forest, based Livelihood and Extension
CFR	-	Community Forest Rights
CFRHRD	-	Centre for Forestry Research and Human Resource Development
CG	-	Chattisgarh
CIC	-	Central Information Commission
CMD	-	Chairman and Managing Director
CMERT&TI	-	Central Muga Eri Research & Training Institute
CMIP5	-	Coupled Model Intercomparison Project Phase 5
CoFGR	-	Creation of Centre of Excellence on Forest Genetic Resources
COP	-	Conference of the Parties
CORDEX	-	Coordinated Regional Climate Downscaling Experiment
CPT	-	Candidate Plus Tree
CRD	-	Completely Randomized Design
CSFER	-	Centre for Social Forestry and Eco-Rehabilitation
CSO	-	Clonal Seed Orchards

CTAB	-	Canadian Technology Accreditation Board
CVC	-	Chief Vigilance Commissioner
DAAD	-	Deutscher Akademischer Austauschdienst (German Academic Exchange Service)
DBT-BIRAC	-	Department of Biotechnology- Biotechnology Industry Research Assistance Council
DCF	-	Deputy Conservator of Forest
DDG	-	Deputy Director General
DITSL	-	Deutsches Institut für tropische und subtropische Landwirtschaft
DMAPR	-	Directorate of Medicinal and Aromatic Plants Research
DNA	-	Deoxyribo nucleic Acid
DST	-	Department of Science and Technology
DUS	-	Distinctness, Uniformity and Stability
EEAP	-	Environmental Effects Assessment Panel
ENVIS	-	Environmental Information System
FAME	-	Faster Adoption and Manufacturing of (Hybrid &) Electric
FG	-	First Generation
FGRs	-	Forest Genetic Resource
FRI	-	Forest Research Institute
FRIDU	-	Forest Research Institute (Deemed) University
FRL	-	Forest Reference Level
FRLHT	-	Foundation for Revitalisation of Local Health Traditions
FRS	-	Free Radical Scavenging
FTIR	-	Fourier Transform Infrared Spectroscopy
FYM	-	Farm Yard Manure
GBH	-	Girth at Breast Height
GC-MS	-	Gas Chromatography-Mass Spectrometry
GIS	-	Geographic Information System
GoI	-	Government of India
HATZ	-	High Altitude Transition Zone
HFRI	-	Himalayan Forest Research Institute
HPSFD	-	Himachal Pradesh State Forest Department
HPTLC	-	High Performance Thin Layer Chromatography
IAA	-	Indole Acetic Acid
IBA	-	Indole Butyric Acid
IBSC	-	Institute Biosafety Committee
ICAR	-	Indian Council of Agricultural Research
ICFRE	-	Indian Council of Forestry Research and Education
ICIMOD	-	International Centre for Integrated Mountain Development
IFB	-	Institute of Forest Biodiversity
IFFCO	-	Indian Farmers Fertiliser Cooperative
IFGTB	-	Institute of Forest Genetic and Tree Breeding
IFP	-	Institute of Forest Productivity
IFS	-	Indian Forest Service
IIHR	-	Indian Institute of Horticultural Research
IISc	-	Indian Institute of Science
IIT	-	Indian Institute of Technology

IMMC	-	International Medicinal Mushrooms Conference
IPDM	-	Integrated Management of Insect Pests & Diseases
IPIRTI	-	Indian Plywood Industries Research and Training Institute
IPMA	-	Indian Paper Manufacturers Association
ISIT	-	International Symposium on Information Theory
ISSR	-	Institute for Social Science Research
IUFRO	-	International Union of Forest Research Organization
IWH	-	Indian Western Himalayan
IWST	-	Institute of Wood Science and Technology
JFM	-	Joint Forest Management
JNKVV	-	Jawaharlal Nehru Krishi Vishwa Vidyalaya
JNU	-	Jaipur National University
JUIT	-	Jaypee University of Information Technology
JULES	-	Joint UK Land Environment Simulator
JUST	-	Jan Unnayan Samiti Tripura
KAPY	-	Krishi Aranya Prosthana Yojana
KSB	-	Potassium Solubilizing Bacteria
KU	-	Kasetsart University
KVK	-	Krishi Vigyan Kendra
KVS	-	Kendriya Vidyalaya Sangathan
LCM	-	Leaf Compost Manure
LKFPs	-	Lesser Known Forest Plants
LPG	-	liquified Petroleum Gas
MAPs	-	Medicinal and Aromatic Plants
MATSE	-	Microwave Assisted Two Phase Solvent Extraction
MBDB	-	Maharashtra Bamboo Development Board
MG	-	Methylglyoxal
MIPs	-	Multi Institutional Projects
MLT	-	Multi-Locational Trial
MoA	-	Memorandum of Association
MoEF&CC	-	Ministry of Environment, Forest and Climate Change
MoU	-	Memorandum of Understanding
MP	-	Madhya Pradesh
MPOWER	-	Mitigating Poverty in Western Rajasthan
MPSBM	-	Madhya Pradesh State Bamboo Mission
MS	-	Maharashtra
NAA	-	Nepethane Acetic Acid
NBM	-	National Bamboo Mission
NBPGR	-	National Bureau of Plant Genetic Resource
NBRI	-	National Botanical Research Institute
NCL	-	Northern Coalfields Limited
NCS-TCP	-	National Certification System for Tissue Culture raised Plants
NEIST	-	North East Institute of Science and Technology
NFIC	-	National Forest Insect Collection
NFLIC	-	National Forest Library and Information Centre
NFRP	-	National Forestry Research Plan

NPK	-	Nitrogen Phosphorus Potassium
NTFPs	-	Non Timber Forest Produce
NTPC	-	National Thermal Power Corporation
NVS	-	Navodaya Vidyalaya Samiti
ONGC	-	Oil and Natural Gas Corporation
PCM	-	Phase Change Material
PCR	-	Polymerase Chain Reaction
PEG	-	Poly Ethyelene Glycol
PGPR	-	Plant Growth Promoting Rhizobacteria
PPP	-	Permanent Preservation Plot
PPV&FRA	-	Protection & Plant Varieties & Farmers Right Authority
PSB	-	Phosphorus Solubilizing Bacteria
PVA	-	Poly vinyl acetate
QPM	-	Quality Planting Material
QTL	-	Quantitative Trait Loci
RBD	-	Randomised Block Design
RCBD	-	Randomized Complete Block Design
RCGM	-	Review Committee on Genetic Manipulation
RCP	-	Representative Concentration Pathway
REDD+	-	Reducing Emissions from Deforestation and Forest Degradation plus
RET	-	Rare, Endangered & Threatened
RFRI	-	Rain Forest Research Institute
RNA	-	Ribonucleic acid
RPC	-	Research Policy Committee
RRCs	-	Regional Resource Congress
rRNA	-	Ribosomal ribonucleic acid
RS	-	Remote Sensing
RTC	-	Rights, Tenancy and Crops Grown
RTI	-	Right to Information
SAIL	-	Steel Authority of India Ltd.
SAP	-	Scientist Assistance Programme
SFD	-	State Forest Department
SFM	-	Sustainable Forest Management
SFRI	-	State Forest Research Institute
SHG	-	Self Help Group
SNP	-	Single Nucleotide Polymorphism
SOC	-	Soil Organic Carbon
SPA	-	Seed Production Areas
SSO	-	Seedling Seed Orchards
SSR	-	Simple Sequence Repeat
TAPPI	-	Technical Association of Pulp and Paper Industry
TC	-	Tissue cultured
TERI	-	The Energy Research Institute
TIFAC	-	Technology, Information, Forecasting and Assessment Council
TISS	-	Tata Institute of Social Science
TNPL	-	Tamil Nadu Newsprint and Papers Limited

TNSPC	-	Tamil Nadu Public Service Commission
TOF	-	Tree Outside Forest
TOLIC	-	Town Official Language Implementation Committee
TRB	-	Tree Rich Biobooster
TRIBAC	-	Tripura Bamboo and Cane Development Centre
TRS	-	Total Reducing Sugar
UBC	-	University of British Columbia
UCOST	-	Uttarakhand Council of Science and Technology
UF	-	Urea Formaldehyde
UGC-NAAC	-	University Grants Commision- National Assessment and Accrediation Council
UJVNL	-	Uttarakhand Jal Vidyut Nigam Ltd
UNEP	-	United Nations Environment Programme
UNFCCC	-	United Nations Framework Convention on Climate Change
UP	-	Uttar Pradesh
URL	-	Uniform Resource Locater
USA	-	United State of America
VAM	-	Vasicular Arbuscular Mycorrhiza
VMG	-	Vegetative Multiplication Garden
VPC	-	Vegetative Propagation Center
VRC	-	Variety Releasing Committee
VVK	-	Van Vigyan Kendra
WBDC	-	Women's Business Development Center
WCPM	-	West Coast Paper Mills
WHTA	-	Western Himalayan Temperate Arboretum
WII	-	Wildlife Institute of India
WSHG	-	Women Self Help Group
ZSI	-	Zoological Survey of India

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