



INDIAN COUNCIL OF FORESTRY RESEARCH AND EDUCATION

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



**ANNUAL
REPORT
2023-24**



ICFRE



ANNUAL REPORT 2023-24



INDIAN COUNCIL OF FORESTRY RESEARCH AND EDUCATION

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

Patron:

Smt. Kanchan Devi, IFS
Director General
Indian Council of Forestry Research and Education
Dehradun

Editors:

Dr. Sudhir Kumar, DDG (Extension), ICFRE
Dr. Geeta Joshi, ADG (M&Extn.), ICFRE
Dr. Vishwajeet Sharma, STO, (M&Extn.), ICFRE

Published by:

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

Printed at:

Shiva Offset Press, Dehradun



मंत्री
पर्यावरण, वन एवं जलवायु परिवर्तन,
भारत सरकार



सत्यमेव जयते



MINISTER
ENVIRONMENT, FOREST AND CLIMATE CHANGE
GOVERNMENT OF INDIA

भूपेन्द्र यादव
BHUPENDER YADAV



Message

Forests are the lifeline of human existence and needs to be nurtured and conserved. Indian Council of Forestry Research and Education (ICFRE) has consistently been working towards the cause of environment, climate change, conservation and sustainability.

ICFRE has been involved in addressing the climate change concerns in the forest sector by submitting a detailed report on Mitigation Actions, Constraints, Gaps and related Financial, Technical and Capacity Needs to Address Climate Change Concerns in Forest Sector in India to MoEF&CC for the Third National Communication to the UNFCCC. The Council has supported updating the National Biodiversity Strategy and Action Plan in alignment with the Kunming-Montreal Global Biodiversity Framework. To promote land degradation neutrality and knowledge sharing, training programs, webinars, and workshops have been conducted for participants from 74 countries. Council also has participated in the Environment Sustainability Working Group during India's G20 Presidency.

ICFRE's research has led to the grant of two patents, filing of one patent and transfer of technology to stakeholders. Council's efforts in implementing national campaigns such as Mission LiFE, Mission Karmayogi, Swachhata campaign for promoting sustainability, good governance, and cleanliness are appreciable.

I am confident that the outcomes and initiatives outlined in this Annual report will inspire greater collaboration and further propel the collective efforts towards achieving a greener, sustainable, and resilient future for India's forests and its dependent communities.

I wish the council success in their pursuits.

(Bhupender Yadav)

पर्यावरण भवन, जोर बाग रोड़, नई दिल्ली-110003,
फोन : 011-20819190, 011-20819187, फैक्स : 011-20819299
Paryavaran Bhawan, Jor Bagh Road, New Delhi-110003,
Tel.: 011-20819190, 011-20819187, Fax: 011-20819299
ई-मेल/E-mail : mefcc@gov.in



सत्यमेव जयते

राज्य मंत्री
पर्यावरण, वन एवं जलवायु परिवर्तन
विदेश मंत्रालय
भारत सरकार

MINISTER OF STATE
ENVIRONMENT, FOREST AND CLIMATE CHANGE
EXTERNAL AFFAIRS
GOVERNMENT OF INDIA

कीर्तवर्धन सिंह
KIRTI VARDHAN SINGH



Message

The Indian Council of Forestry Research and Education (ICFRE) has been at the forefront of advancing sustainable forestry research in India. The Annual report of ICFRE highlights the innovative research carried out in the field of forestry, environment, conservation and community development. Council has played a vital role in forest management through development of 153 Forest Soil Health Cards, volume tables, and technical support for tree translocation. Additionally, the Council has strengthened the National Transit Pass System (NTPS) by conducting 19 training programs for State Forest Departments and is also upgrading 32 nurseries to model nurseries for Himachal Pradesh Forest Department. For further reinforcing efficient forestry operations, common facilities centre for Bamboo Processing have also been established in Tripura, Meghalaya and Mizoram.

ICFRE's contributions extend to wood science innovations, where it has pioneered the development of glued laminated timber, coconut trunk plywood, and fire-retardant door shutters—advancements that support the wood industry while promoting sustainability. In agroforestry, ICFRE has established site-specific agroforestry models and conducted workshops to assist farmers in adopting optimal land-use strategies. The publication of a booklet on agroforestry models for Assam highlights the Council's unwavering commitment to empowering local farming communities with sustainable solutions.

Furthermore, ICFRE has championed environmentally responsible practices by developing bio-fertilizers and biopesticides, contributing to eco-friendly cultivation methods. The Council continues to raise awareness on forestry and environmental issues through various outreach programs, including the establishment of two new Van Vigyan Kendras, one new Demo Village, the organization of seven Tree Growers Melas, and the production of 14 documentaries focused on forestry education.

Through innovation, education, and community empowerment, the Council is building a lasting legacy of sustainability for future generations.


(Kirti Vardhan Singh)

कार्यालय: 5वां तल, आकाश विंग, इंदिरा पर्यावरण भवन, जोर बाग रोड़, नई दिल्ली-110003,
दूरभाष: 011-20819418, 011-20819421, फैक्स: 011-20819207, ई-मेल: mos.kvs@gov.in
Office: 5th Floor, Aakash Wing, Indira Paryavaran Bhawan, Jor Bagh Road, New Delhi-110003,
Tel.: 011-20819418, 011-20819421, Fax: 011-20819207, E-mail: mos.kvs@gov.in
कार्यालय: कमरा नं. 141, साउथ ब्लॉक, नई दिल्ली-110001, दूरभाष: 011-23011141, 23014070, 23794337,
फैक्स: 011-23011425, ई-मेल: mos.kvs@gov.in
Office: Room No. 141, South Block, New Delhi-110001, Tel.: 011-23011141, 23014070, 23794337,
Fax: 011-23011425, E-mail: mos.kvs@gov.in
निवास: 23, बी.आर. मेहता लेन, नई दिल्ली-110001, दूरभाष: 011-23782979
Residence: 23, B.R. Mehta Lane, New Delhi-110001, Tel.: 011-23782979



तन्मय कुमार
TANMAY KUMAR



सत्यमेव जयते



सचिव
भारत सरकार
पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय
SECRETARY
GOVERNMENT OF INDIA
MINISTRY OF ENVIRONMENT, FOREST
& CLIMATE CHANGE



Message

The Indian Council of Forestry Research and Education (ICFRE) continues to make significant progress in advancing sustainable forestry practices, research, and education. Over the past year, the Council has achieved many milestones in mass multiplication and commercialization of clones, varieties, and germplasm through license agreements and MoUs. Its efforts in farm forestry have garnered international recognition, with the Food and Agriculture Organization (FAO) highlighting research on Teak tissue culture as a success story that encourages farm forestry in India.

Apart from research innovation, ICFRE has provided scientific services that include environmental audits, reclamation strategies for mining projects, and plantation monitoring across the country. Demonstrating its commitment to technological integration, ICFRE has developed innovative mobile applications and launched the ICFRE Pension Portal, ensuring enhanced stakeholder services and seamless forestry management. ICFRE's dedication to education and capacity-building is evident in the registration of 93 research scholars for Ph.D. programs and the successful placement of MSc students from FRI Deemed to be University in prestigious organizations. By nurturing academic excellence and fostering research-driven advancements, ICFRE continues to empower future generations of forestry professionals.

This Annual Report encapsulates ICFRE's relentless pursuit of excellence in forestry research, education, and sustainable practices, reinforcing its leadership in shaping a greener and more resilient future.

Place: New Delhi
Date: June 4, 2025


(Tanmay Kumar)

इंदिरा पर्यावरण भवन, जोर बाग रोड़, नई दिल्ली-110 003
फोन: (011) 2081-9408, 2081-9308, फैक्स: (011) 2081-9238

INDIRA PARYAVARAN BHAWAN, JOR BAGH ROAD, NEW DELHI-110 003,

Ph.: 011-2081-9408, 2081-9308, Fax: 011-2081-9238;
E-mail : secy-moef@nic.in, Website : moef.gov.in



सुशील कुमार अवस्थी
Sushil Kumar Awasthi



सत्यमेव जयते

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



Message

Forests are an integral part of India's ecological and economic framework, serving as a vital resource for biodiversity conservation, climate regulation and livelihood sustenance. This Annual Report of ICFRE encapsulates a year of transformative progress towards a greener and more equitable future.

ICFRE's accomplishments under the National Programme for Conservation and Development of Forest Genetic Resources (FGR) are noteworthy. The meticulous documentation of 749 FGR species across India, coupled with the assessment of regeneration and population dynamics for 546 species, reflects the council's scientific rigor. The deposition of seeds from 156 species at the National Bureau of Plant Genetic Resources (NBPGR), New Delhi, alongside the development of advanced seed storage and nursery techniques, underscores ICFRE's leadership in ex-situ conservation. Equally commendable is the council's contribution to global biodiversity preservation, evidenced by the registration of novel fungal species in Mycobank and the rediscovery of critically endangered plants, reaffirming its dedication to safeguarding our natural heritage.

ICFRE's innovative bioengineering solutions have revitalized degraded landscapes, including coal and iron ore mining areas, exemplifying its leadership in ecological restoration. Its commitment to social empowerment is reflected through initiatives that train tribal communities in sustainable practices like vermicomposting, bamboo propagation, and value-added product creation, fostering self-reliance and environmental stewardship. ICFRE's strategic transfer of cutting-edge forestry protocols to private laboratories and industries has catalyzed the adoption of sustainable practices, bridging the gap between research and real-world application.

This Annual Report is a testament to ICFRE's relentless pursuit of excellence in forestry research, conservation, and community development. I am confident that ICFRE will continue to lead with innovation and purpose, shaping a sustainable future for generations to come.

Place: New Delhi
Date: 11th June, 2025


(Sushil Kumar Awasthi)

इंदिरा पर्यावरण भवन, जोर बाग रोड़, नई दिल्ली-110 003
फोन: 011-20819239, 20819209

INDIRA PARYAVARAN BHAWAN, JOR BAGH ROAD, NEW DELHI-110 003
Ph.: 011-20819239, 20819209, E-mail : dgfindia@nic.in



सत्यमेव जयते



कंचन देवी, भा.व.से.
महानिदेशक

Kanchan Devi, IFS
Director General

महानिदेशक
भारतीय वानिकी अनुसंधान एवं शिक्षा परिषद्
डाकघर न्यू फॉरेस्ट, देहरादून-248006
(आई एस ओ 9001 : 2008 प्रमाणित संस्था)

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



Foreword

The Annual Report 2023-24 of Indian Council of Forestry Research and Education (ICFRE) is a testament of significant advancements, unwavering dedication, and notable accomplishments in our journey towards advancing forestry research, fostering sustainable land management, and enhancing ecosystem well-being.

A significant highlight of the year was the inauguration of the Centre of Excellence on Sustainable Land Management (CoE-SLM) by the Hon'ble Union Minister of Environment, Forest and Climate Change. The major contribution of Centre was conducting national and international trainings, webinars, workshops, participation in the Environment Sustainability Working Group of G20 Summit, preparation of National Report-2022, Compendium of Best Practices of Restoration of Mining Affected Areas and Restoration of Forest Fire Affected Areas and Newsletter.

Another major advancement of the year was the release of five high-yielding varieties of medicinal plants Bankakdi, Kutki, and Mushkbala, tailored for hill temperate regions. Commitment for popularization of clones/varieties/germplasm was strengthened by signing five license agreements for poplar, teak, and bamboo and six Memorandum of Understanding for technology transfer for production of tissue culture teak. Council's research on *Teak tissue culture to encourage farm forestry in India*, recognized by the FAO, stands as a testament to our impactful contributions to farm forestry and wood security.

ICFRE has taken note worthy strides in administering the Green Credit Programme (GCP) by developing methodology, IT portal infrastructure and overseeing all aspects of registration, issuance, and audits. In GCP Portal 13 PSUs and 10 SFDs have registered as Implementing Agencies and 8,332 hectare land have been registered demonstrating the programme's successful implementation and expanding influence.

In field of climate change ICFRE has submitted a detailed report on Mitigation Actions, Constraints, Gaps and related Financial, Technical and Capacity Needs to Address Climate Change Concerns in Forest Sector in India to the MoEF&CC for the Third National Communication to the UNFCCC. Council has also supported the updating of the National Biodiversity Strategy and Action Plan in alignment with the Kunming-Montreal Global Biodiversity Framework.

Council's dedication to agroforestry has been exemplified through establishment of Agarwood and Poplar based agroforestry models and the organization of six workshops across Odisha, Tamil Nadu, Rajasthan, Haryana, Andhra Pradesh, and Uttar Pradesh to develop site-specific agroforestry models. The profitable agroforestry models have been popularized, reflecting our efforts to support farmers and wood-based industries.

Management of forest is very crucial for sustainable growth, development of Forest Soil Health Cards for 153 forest divisions of eight states and UTs mark a significant advancement in soil management practices. In addition developed form factors and volume tables, provided technical support for tree translocation, training to SFD's for effective implementation of NTPS and upgradation of 32 nurseries of Himachal Pradesh SFD.

ICFRE has made an impressive headway in advancing research on wood science. Has developed innovative products like, glued laminated timber from softwood, biochar particle boards from poplar, plywood from coconut trunks, particle boards from recycled wood composite waste, plastic-bonded bamboo and plywood products from recycled plastics and fire retardant door shutters with up to 125 minutes of fire resistance. The installation of four Vacuum Pressure Treatment Units in Manipur has provided easy availability of facilities for bamboo treatment for general public.

Innovation remains at the core of our activities, one patent was filed and two patents were granted for the process for obtaining phytoecdysteroids from *Achyranthes aspera* for the synchronized maturation of silkworm and for a natural wood preservative formulation from coconut shell pyrolytic oil.

In the realm of technology transfer, significant contributions were made by transferring the *in-vitro* propagation protocol for *Swietenia macrophylla* to a private company, and technology to replace wood particles with currency briquettes in particle board production was transferred to two industries.

Council's product development efforts have also been noteworthy, for plant health bio-products HIM Growth Booster and HIM-TrichoKawach, and biopesticides HIM-ALBIWASH and HIM-BIOKIL-1 has been developed. Development of mobile applications, such as Eco Rehab, Agroforest, LKP-Info and Bamboo Grow, highlights our dedication in leveraging technology for better forestry management and community engagement.

ICFRE has provided consultancies for monitoring and evaluation of plantations under CAMPA and other schemes for Punjab, Andhra Pradesh and Karnataka forest departments and to plywood and wood industries, on resin applications, offcut utilization, medium density fiber boards, and quality inspection. Also submitted 22 comprehensive Environmental Audit Reports for various coal mining PSUs company.

Outreach programme of the Council have expanded significantly, with the establishment of two new Van Vigyan Kendras in Madhya Pradesh and Maharashtra; organization of six tree growers' melas/ institute industry meets, and production of six informative documentaries. Our engagement with the public through 20 radio talks and TV programs, and 245 training sessions have reached thousands of stakeholders and through Prakriti program, has sensitized 16,838 school students, furthering our mission to disseminate knowledge and foster greater awareness about forestry and environmental issues.

The education sector has seen robust growth, with registration of 93 research scholars for Ph.D. programme and 66 students securing placements with prestigious organizations. Our commitment to research and education is evident in the development of new knowledge and the nurturing of future forestry leaders.

Tribal welfare initiatives like, opening of "Tribes India" outlet at Forest Campus in Coimbatore, organizing training programs on low-cost vermicomposting, bamboo propagation and nursery management, reflect our dedication for capacity building and empowerment of tribals. For promoting quality agricultural products, council has also opened NAFED Bazaar at in New Forest Campus Dehradun.

Reinforcing our commitment to sustainability, cleanliness, and good governance, ICFRE has actively participated in national campaigns like Mission LiFE and Mission Karmayogi, and Swachhata campaign. Promoted sustainable lifestyle by conducting 252 activities sensitizing around 77,300 individuals, and organized 5,500 activities as part of a mass mobilization Mission under LiFE. Mission Karmayogi has also seen commendable success, with 560 employees completing 502 forestry-related modules. ICFRE's active participation in Swachhata Campaign 3.0 involved a rigorous cleanliness drive, including the disposal of 1,138 files and the sale of 51 pieces of e-waste, reflecting environmental stewardship and organizational efficiency.

ICFRE facilitated pensioners by developing Pension Portal and mobile application and this has been useful for 1413 retired employees of ICFRE.

This annual report not only highlights our achievements but also sets the stage for continued innovation and excellence in forestry research and education. I extend my heartfelt gratitude to all those who have contributed to this journey. I express my appreciation to Dr. Sudhir Kumar, DDG (Extension), Dr. Geeta Joshi, ADG (Media and Extension), Dr. Vishwajeet Sharma, STO and the entire team of Media and Extension, Division for meticulously drafting and prompt completion of the Annual report 2023-24.



(Kanchan Devi)

पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय, भारत सरकार की एक स्वायत्त परिषद्

An Autonomous Body of Ministry of Environment, Forest & Climate Change, Government of India

दूरभाष/ Phone : 135-2759382 (O)

ई-मेल/ e-mail : dg@icfre.org

EPABX : 0135-2224855, 2224333 (O)

Members of ICFRE Society 2023-24

1. Hon'ble Minister

Ministry of Environment, Forests & Climate Change,
New Delhi- 110 003

2. Secretary to the Govt. of India and

Chairman, BoG of ICFRE,
Ministry of Environment, Forests & Climate Change
New Delhi – 110003

3. Secretary Expenditure

Ministry of Finance
Department of Expenditure
New Delhi – 110003

4. Secretary to the Government of India

Ministry of Science and Technology,
Department of Science and Technology,
Delhi-110016

5. Secretary to the Government of India

Ministry of Rural Development,
New Delhi-110001

6. Secretary to the Government of India

Ministry of Agriculture,
New Delhi-110001

7. Secretary to the Government of India

Ministry of Science and Technology,
Department of Bio Technology,
New Delhi-110003

8. Secretary to the Government of India

Department of Non-conventional Energy Sources,
New Delhi-110003

9. Chief Executive Officer

NITI Aayog,
New Delhi-110001

10. Director General of Forest and Special Secretary to the Government of India,

Ministry of Environment, Forest & Climate Change,
New Delhi – 110003

11. Director General

Indian Council of Agricultural Research,
New Delhi – 110 001

12. Director General

Council of Scientific and Industrial Research,
New Delhi – 110001

13. Chairman

University Grants Commission,
New Delhi – 110002

14. Dr. Z.P. Patel

Vice Chancellor,
Navsari Agricultural University,
Navsari- 396450

15. Dr. Anupam Mishra

Vice Chancellor,
Central Agricultural University
Imphal - 795004

16. Director

Wildlife Institute of India
Dehradun-248001

17. Director

Indian Institute of Forest Management, Bhopal

18. PCCF, HoF Himachal Pradesh

Forest Department Govt. of Himachal Pradesh
Talland Shimla – 171001

19. PCCF & HoFF Chhattisgarh Forest Dept.

Jai Road Aranya Bhavan Raipur (C.G.)
Chhattisgarh-492007

20. PCCF & HoFF, Gujarat

SF-II, Gujarat State Block No. 14/1,
Dr. Jivraj Mehta Bhavan
Gandhi Nagar, Gujarat – 382010

21. PCCF & HoFF

Uttarakhand
Department of E&F Govt. of UK,
Rajpur Road, Dehradun - 248001

22. PCCF & MD

Forest Development Corporation
Panchanan 5th Floor, Malvia Nagar,
Bhopal – 462003, Madhya Pradesh

23. PCCF & MD

Forest Development Corporation
A-84, Kharavela Nagar,
Bhubaneswar- 751 001, Odisha

24. Shri Vinay Kumar, IFS

Director (IC),
ICFRE, Dehradun - 248006

25. Dr. Sudhir Kumar

Deputy Director General (Extension)
ICFRE, Dehradun – 248006

26. Dr. Modhumita Das Gupta

Scientist G,
ICFRE-Institute of Forest Genetics and
Tree Breeding, Coimbatore

27. Dr. Tarun Kant

Scientist G,
ICFRE-Arid Forest Research Institute,
Jodhpur

28. Smt. R. Lalrodingi

Incharge, MD, North-East Cane and Bamboo
Development Council Burnihat, Assam

29. Shri Roshanlal Sharma

Managing Director,
Tajna Shellac Industries Pvt. Ltd.
Khunti – 835210 Jharkhand

30. Director

ICFRE- Institute of Forest Genetics
and Tree Breeding
Coimbatore-641002 (Tamil Nadu)

31. Director

ICFRE-Institute of Wood Science and Technology
Bangalore-560003 (Karnataka)

32. Director

ICFRE-Tropical Forest Research Institute
Jabalpur – 482001 (Madhya Pradesh)

33. Director

ICFRE-Arid Forest Research Institute
Jodhpur-342008(Rajasthan)

34. Director

ICFRE-Forest Research Institute
Dehradun – 248006 (Uttarakhand)

35. Director

ICFRE-Rain Forest Research Institute
Jorhat – 785001 (Assam)

36. Director

ICFRE-Institute of Forest Productivity
Ranchi-835303 (Jharkhand)

37. Director

ICFRE-Himalayan Forest Research Institute
Shimla-171009 (Himachal Pradesh)

38. Director, IFB

ICFRE-Institute of Forest Biodiversity
Hyderabad – 500100 (Telengana)

39. Director

Indira Gandhi National Forest Academy
Dehradun – 248006

40. Dr. Prashant Kumar Verma, IFS (Retd.)

A-1/9, Virat Khand,
Gomtinagar, Lucknow - 226010

41. Dr. D.N. Pandey

Ex. PCCF , Rajasthan

42. Secretary General and CEO

Aaranyad Advisor (Asian Rhinos),
International Rhino Foundation
Add: 50, Samanwoy Path,
Guwahati - 781028

43. Kamalayagya Foundation

C/O Shri Rangam Kumar Mishra
Ramnagar, Kochatoli, Namkum
Ranchi - 834010

44. Dr. Awadh Kishore Roy

Coordinator Sub- DIC and Director
University Centre of Bioinformatics T.M.
Bhagalpur University, Bhagalpur

45. Prof. Ramesh C Sharma

Professor and Founder Head
Department of Environment Science,
HNB Garhwal University, Dehradun- 248001

46. Shri C. Bhaskar, IFS (Retd.)

362 A lane no. 13, Mohit Nagar
Dehradun -248001

47. Shri Krishna Murthy P

Hyderabad, Telangana

48. Shri Shailendra Kumar Choudhary

Begusarai, Bihar

49. Director General

Indian Council of Forestry Research and Education
Dehradun – 248006 (Uttarakhand)

50. Additional Director General Forests (FC)

New Delhi – 110 003

51. Additional Secretary and Financial Advisor

New Delhi – 110 003

52. Deputy Inspector General of Forests (RT)

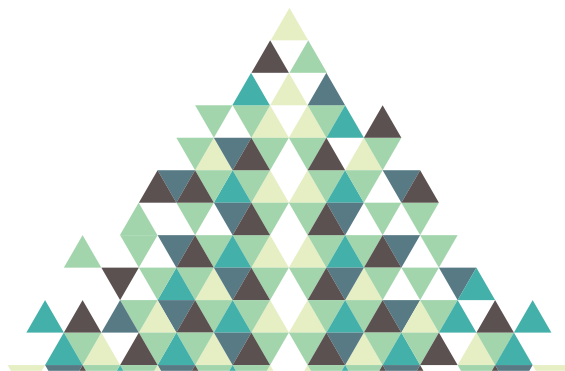
Ministry of Environment, Forest and
Climate Change,
New Delhi – 110 003

Members of Board of Governors 2023-24

- 1. Secretary to the Government of India**
Chairman, BoG of the ICFRE
Ministry of Environment, Forests
& Climate Change,
New Delhi-110003
- 2. Director General of Forests and**
Special Secretary to the Government of India,
Vice Chairman, BOG of the ICFRE
Ministry of Environment, Forests & Climate Change,
New Delhi-110003
- 3. Secretary to the Government of India**
Department of Science and Technology,
Technology Bhawan,
New Mehrouli Road,
New Delhi
- 4. Director General**
Indian Council of Agricultural Research,
Krishi Bhawan,
New Delhi
- 5. Director General**
Council of Scientific and Industrial Research
2, Rafi Marg, Anusandhan Bhawan,
New Delhi
- 6. Chairman**
University Grants Commission
Bahadur Shah Zafar Marg,
New Delhi
- 7. Vice Chancellor**
Kerala Agricultural University HQ
K.A.U. (P.O.), Vellanikkara,
Thrissur Kerala 680656
- 8. Vice Chancellor**
CSK HP Agricultural University,
Palampur, Himachal Pradesh - 176062
- 9. Dr. R. Seenivasan**
Chief General Manager
(Plantations and R&C)
Tamilnadu News Print and Papers Ltd,
Kagithapuram, Karur-639136, Tamil Nadu.
- 10. PCCF & HoFF, Telangana**
O/o PCCF HoFF,
Aranya Bhavan, Shaifabad,
Hyderabad - 500004
- 11. PCCF & HoFF, Uttar Pradesh**
17, Rana Pratap Marg
Lucknow (Uttar Pradesh) -226001
- 12. Director**
ICFRE-Institute of Wood Science and Technology
18th Cross, Malleswaram,
Bengaluru-560 003
- 13. Director**
ICFRE-Institute of Forest Genetics and Tree
Breeding, Coimbatore
- 14. Joint Secretary and Financial Advisor**
MoEF&CC
New Delhi – 110 003
- 15. Dr. Geeta Joshi**
Assistant Director General (Media & Extn.)
ICFRE (HQ), Dehradun
- 16. Director**
ICFRE-Institute of Forest Productivity
Ranchi
- 17. Director**
Indian Institute of Forest Management,
Nehru Nagar,
Bhopal – 462 003 (M.P.)
- 18. Director General**
Forest Survey of India,
Kaulagarh Road,
Dehra Dun.
- 19. Director**
Wildlife Institute of India,
Chandrabani, Clement Town,
Dehra Dun.
- 20. Director**
Indira Gandhi National Forest Academy,
P.O. New Forest,
Dehra Dun – 248006.
- 21. Director General**
Indian Council of Forestry Research and
Education, Dehra Dun-248006
- 22. Additional Director General Forests (FC)**
MoEF&CC
New Delhi – 110 003.
- 23. Deputy Inspector General Forest (RT)**
MoEF&CC
New Delhi – 110 003.

Contents

iii-x	Messages
xi-xii	Foreword
xiii-xiv	List of Members of ICFRE Society
xv-xvi	List of Members of Board of Governors
xix-xxviii	Overview
xxix-xxix	ICFRE: Organizational Chart
01-09	Introduction
11-115	Research Highlights
13-28	• Ecosystem Conservation and Management
29-39	• Forest Productivity
40-53	• Genetic Improvement
54-58	• Forest Management
59-64	• Wood Products
65-72	• Non-wood Forest Products (NWFPs)
73-82	• Forest Protection
83-115	• Schemes funded by National Authority CAMPA
117-125	Education Vistas/Activities
127-162	Extension Panorama
163-171	Administration and Information Technology
173-228	Balance sheet
229-243	Annexures
238-243	List of Abbreviation
244-244	Acknowledgement





OVERVIEW



ICFRE



OVERVIEW

Indian Council of Forestry Research and Education (ICFRE), Dehradun, an autonomous body under the Ministry of Environment, Forest, and Climate Change (MoEF&CC), Government of India, is dedicated to comprehensive research and education in forestry and environmental science. The council aims to address emerging challenges and provide solutions to various stakeholders.

Annual Report 2023-24 offers a glimpse into ICFRE's diverse activities across its institutes. The report is organized into five chapters: Introduction, Research Highlights, Education Vistas, Extension Panorama, and Administration and Information Technology.

ICFRE's research spans a wide range of areas, including forest productivity, genetic improvement, biodiversity conservation, silviculture, agroforestry, climate change, forest products, protection, combating desertification, sustainable development, ecology, and environment. The Council's significant achievements include the development of innovative technologies that have been successfully implemented in real-world applications, benefiting various stakeholders. The following provides an overview of key activities undertaken during the fiscal year:

Popularization of clones/ Varieties/ and improved Germplasm

- Released five high yielding varieties of medicinal plants viz. Bankakdi (01), Kutki (02) and Mushkbala (02) suitable for hill temperate region.
- For mass multiplication of clones/varieties/germplasm five license agreements were signed: 02 for poplar clones by ICFRE-IFP, Ranchi; 01 for Teak and CBC of Bamboo by ICFRE-TFRI, Jabalpur; and 02 for TC Teak by ICFRE-IFGTB, Coimbatore. Six MoU's were also signed for transfer of technology for production of TC Teak by ICFRE-IFGTB.

Projects	Completed	Ongoing	Initiated
Plan	29	78	20
Externally aided	37	84	32
Budget (in Crore)			
Plan			
Allotment	Rs. 467.08 Crore		
Expenditure	Rs. 468.22 Crore		
External aided			
Allotment	Rs. 124.32 Crore		
Expenditure	Rs. 113.54 Crore		

- Produced 2,26,637 Quality Planting Material of Casuarina, Teak, Shisham, Poplar, *Melia dubia*, *Dalbergia latifolia*, *Terminalia bellirica*, *P. goalparensis*, *A. mangium*, *Swietenia mahagoni*, *Pterocarpus marsupium*, *Madhuca latifolia*, *Saraca asoca*, *Flemengia semialata*, *Anthocephalus cadamba*, *Dalbergia sissoo*, *Eucalyptus sp.*, *Gmelina arborea*, *Salix alba*, Bamboo, *Rauvolfia serpentina* etc. and supplied to different stakeholders.
- Developed a successful *in-vitro* protocol for propagating *Swietenia macrophylla* through tissue culture and transferred to Shivashakti Agritec Limited, Hyderabad, for efficient mass production.

National Programme for Conservation and Development of Forest Genetic Resources

- 749 FGR species have been documented and regeneration and population structure status has been recorded for 546 FGR.
- Distribution maps for 180 species have been prepared and updated. Based on maxent model, eco-distribution maps for 109 FGR species have been developed.
- For *ex-situ* conservation, seed samples of 156 species have been deposited at NBPGR, New Delhi. Seed pretreatment and storage protocols for 57 species have been standardized and nursery technique protocol was developed for 19 species.
- A display unit (carpellarium) for seed referral centre created and 78 species displayed at IFGTB.
- For conservation, *in-vitro* aseptic cultures have been established for 27 species and slow-growth cultures have been established for 16 species. Synthetic seeds developed for two species (*Catamixis baccharoides* and *R. triquetra*).
- The four *Pterocarpus* species viz. *Pterocarpus santalinus*, *Pterocarpus marsupium*, *Pterocarpus indicus* and *Pterocarpus dalbergioides* can be distinguished by red-edge region of the visible leaf spectral signatures.
- Field gene bank of six species *Haldina cordifolia*, *Careya arborea*, *Syzygium cumini*, *Litsea glutinosa*, *Ailanthus excelsa* and *Mitragyna parvifolia* established by ICFRE-TFRI.
- Germplasm bank of *Plumbago zeylanica* and *Celastrus paniculatus* with accessions from different locations of Chhattisgarh has been established at TFRI, Jabalpur.

Tree Improvement

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

- Identified best performing clones for Tamarind (IFGTB-TI-14, IFGTB-TI-15 for high yield, and IFGTB-ST-16, 17 for superior pulp quality), Casuarina (CH5, CH1 and CH2) and *Populus deltoides* (FS-FRI-31 and FS-FRI-32)
- Established eight clonal trials of: Casuarina (04) in Orissa, Poplar (02) in Bihar, Shisham (02) in Uttar Pradesh and Uttarakhand.
- Established eighteen progeny trials of: *Semecarpus anacardium* (03) in Madhya Pradesh and Chhattisgarh; *Flacourtia indica* (03) Madhya Pradesh and Chhattisgarh, Red Sander (02) in Karnataka and Andhra Pradesh; *Haldina cordifolia* (02) in Madhya Pradesh and Chhattisgarh and Kali Musli (03) in Madhya Pradesh and *Melia dubia* (05) in Madhya Pradesh, Chhattisgarh and Maharashtra.
- Established germplasm bank for four Species: *Pithecellobium dulce* (03) at Panampally (0.25 ha), Neyveli (0.5ha) and Gudalur (0.4 ha); *Limonia acidissima* (03) at Panampally (0.1 ha), Kurumbapatti (0.3 ha) and Gudalur (0.3 ha); *Ficus palmata* (02) at Tehri Forest Division and Mussoorie Forest Division; and *Pyrus pashia* (02) at Tehri Forest Division and Chakrata Forest Division.
- Established seed orchards of disease resistant germplasm of Shisham at Bhithmera, Haryana and Near Mohand, Shivalik division, UP.
- Identified 588 CPTs for different species across the country, *Diospyros ebenum* (50), *Xylia xylocarpa* (10), *Haldina cordifolia* (30), *Dalbergia sissoo* (275), *Butea monosperma* (29), *Anogeissus pendula* (97), *Anogeissus latifolia* (34) and *Madhuca indica* (63).
- FAO selected the research on "Teak tissue culture to encourage farm forestry in India" as a success story showcasing the impactful use of tissue culture technology to meet the needs of smallholders in India, marking a significant step forward in the global efforts to achieve a wood secure nation (<https://doi.org/10.4060/cc8940en>).

Forest Soil Health Card

- Forest soil health card has been released for 153 Forest Divisions of four States (Madhya Pradesh, Haryana, Jharkhand and Tamil Nadu) and four UT's (Delhi, Laddakh, Chandigarh and Puduchery).

Agroforestry

- Prepared booklet on Suitable Agroforestry Models for Assam State.
- Established Agroforestry model for three species *Aquilaria malaccensis* with *Citrus sinensis* and *C. limon* in Meghalaya and ICFRE-RFRI campus, Jorhat; Poplar with Litchi, Sugarcane and Maize in Bihar and Poplar clones based at Jammu.; *Flemingia* with Papaya in Jharkhand
- With the aim to develop site-specific agroforestry models on community and wasteland tailored to the needs of wood-based industries. Six workshops were held across Odisha, Tamil Nadu, Rajasthan, Haryana, Andhra Pradesh, and Uttar Pradesh, involving stakeholders like SFDs, SAUs, NGOs, and farmers.
- The profitable benefit-cost ratio of 1.32 for *Leucaena leucocephala* based agroforestry system with intercrops such as *Andrographis paniculata*, *Cyamopsis tetragonoloba*, and *Brassica juncea* was popularized among farmers, state forest departments, and wood industries.
- In sandalwood based agroforestry plantations in eight agro-climatic zones of Karnataka, , the preferred host in Eastern dry zone was mulberry, in Northern dry zone mango, Melia and pomegranate, in Central dry zone mahogany, arecanut and pomegranate and in Southern dry zone mulberry, teak and banana.

Bamboo

- The Common facility Centres for Bamboo processing were established in Tripura, Meghalaya and Mizoram. Trainings were also organized for the stakeholders.
- Established eight Bambusetum/ Germplasm bank, two at ICFRE-IFP Ranchi and its Mander Research station; two by ICFRE-FRI Dehradun each at PAU Research Farm, Ladowal (Punjab) and Mansa in Research Farm of ICAR-IISWC (Indian Institute of Soil and Water Conservation) Chandigarh, one by ICFRE-TFRI Jabalpur at TFRI campus; one by ICFRE-RFRI Jorhat at RFRI campus, one by ICFRE-IFGTB at Iduvai Village, Tirupur District, Tamil Nadu and one at Goa by ICFRE-IWST.
- Database information on flowering of 61 bamboo species has been updated from different parts of the country.

Green Credits Programme

- ICFRE has been designated as Administrator of the Green Credit Programme, and is responsible for implementation of the GCP including development of activity specific methodologies and IT infrastructure (Portal/ Registry) for GCP, registration of activities, issuance of green credits, monitoring and audit. 13 PSU's completed their registrations in GCP Portal and 10 State Forest Departments registered as Implementing Agencies under GCP.
- A total of 279 land parcels have been registered, encompassing a combined area of 8,332 hectares. Of these, 148 parcels (3,887 hectares) have been approved by ICFRE.

Climate Change and Biodiversity

- Submitted a detailed report on 'Mitigation Actions, Constraints, Gaps and related Financial, Technical and Capacity Needs to Address Climate Change Concerns in Forest Sector in India' to the NATCOM Project Management Cell of MoEFCC for preparation of Third National Communication to the UNFCCC.
- Prepared inputs for updating the National Biodiversity Strategy and Action Plan in alignment with the Kunming-Montreal Global Biodiversity Framework and submitted to MoEFCC.
- Prepared 376 People's Biodiversity Registers for newly constituted gram panchayats/urban local bodies/blocks of different districts of Himachal Pradesh.
- For improving Urban Greenery and enhancing the biodiversity, 3000 seedlings of different native tree species (about 80) were planted around Singanallur Lake, Coimbatore
- Biodiversity Conservation and Wildlife Management Plan revised for Kuther HEP, JSW Energy (Kuther) Ltd.
- Prepared Biodiversity Assessment, Impact and Mitigation Measures report for Chakla Opencast Coal Block Mine in North Karanpura Coalfield of M/s. Hindalco Industries Limited, Chakla, Latehar, Jharkhand.

HRD Trainings

- Ten training programs were conducted: 03 programs for Scientists (21 participants), 01 for technical personnel (20 participants), 04 for administrative staff (135 participants), and 2 induction trainings (68 participants) one each for Scientist-B and Technical Assistant.

Centre of Excellence on Sustainable Land Management

- The Centre of Excellence on Sustainable Land Management (CoE-SLM) was officially inaugurated on 20th May 2023 by the Hon'ble Union Minister of Environment, Forest and Climate Change.
- Centre has successfully organized: international (02), national (02) training programs and international (02), national (02) webinars/ workshops as a part of its mission to "Raise Awareness, Profile, and Recognition of Sustainable Land Management".
- Prepared "National Report-2022" and submitted to MoEF&CC for onward submission to the UNCCD secretariat.
- As part of Team India during the G20 Presidency, contributed to the Environment Sustainability Working Group (ESWG), through technical note, Approach papers for G-20 summit, and Articles. Also prepared and published- Compendium of Best Practices on Restoration of Mining Affected Areas; Brochure on Best Practices on Restoration of Mining-Affected Areas and Forest Fire-Affected Areas; and edited and published Compendium of Best Practices Restoration of Forest Fire Affected Areas.
- Published several key documents including Compendium of SLM Practices, Technical Paper on Pathways to Achieve Land Degradation Neutrality in India, 1st Volume of the CoE-SLM Newsletter on Sustainable Land Management etc.

Restoration of Degraded/Mined out areas

- For restoration of Rajrappa OCP mines in Jharkhand, 31482 seedlings of trees and shrubs have been planted under Miyawaki and overburden dumps plantation.
- For rehabilitation of salt affected soils, plantation was established in 5 ha at Jhansi, U. P. and in 1.5 ha at Bhatinda, Punjab.
- In 91.58 hectares of plantation established in previous year, vegetation cover was enhanced and 30 species were observed at degraded sandy plain site, 14 at reactivated sand dune, 44 at degraded hill, 2 at ravine site and 31 at mine overburden site.
- Eco-restoration studies carried out for Gouthamkhani OC Coal mine, SCCL, Hyderabad, Meghahatuburu iron ore mines, SAIL, West Singhbhum, Districts of Jharkhand, Central Coalfields Limited, Jharkhand.

New Records

- The novel species of fungus *Calonectria populi* has been registered with MycoBank (MycoBank number 849371)
- Rediscovered the Genus *Boesenbergia* after a span of 128 years and its germplasm is conserved in RFRI Botanical Garden.
- Rediscovered *Magnolia gustavii* King (vern. Assamese: Kharikasopa or Khorokiasopa), a critically endangered tree species after a lapse of 133 years from Dangori Reserve Forest, Tinsukia district, Assam.

Managing Forest

- Developed form factors, volume tables and form quotients for *Tectona grandis* (Teak), *Shorea robusta* (Sal), *Terminalia tomentosa* (Saja), *Pterocarpus marsupium* (Beeja Sal), *Dalbergia sissoo* (Shisham), *Adina cordifolia* (Haldu), *Terminalia arjuna* (Arjun), *Bridelia retusa* (Kasai), *Ougeinia dalbergioides* (Tinsa), *Gmelina arborea* (Khamhar) and *Mitragyna parviflora* (Mundi) for different agroclimatic zones of Chhattisgarh.
- Technical advice provided for successful tree translocation of 644 trees by ICFRE-FRI, Dehradun to Public Works Department Rishikesh-Dehradun.
- In State Forest Department of Himachal Pradesh, 32 selected nurseries are being upgraded into model nursery units for quality forestry plant production in consultation with ICFRE-HFRI, Shimla.
- For facilitating the rollout of the National Transit Pass System (NTPS) by MOEFCC, ICFRE-IWST, in collaboration with NIC imparted 19 trainings to 4,878 forest officials across various states and UTs to ensure effective implementation.
- Identified 10 industrially viable populations of nine lesser known forest plants namely *Cupressus torulosa*, *Neolitsea pallens*, *Cyperus rotundus*, *Litsea cubeba*, *Prinsepia utilis*, *Mallotus nudiflorus*, *Punica granatum*, *Soymida febrifuga*, *Careya arborea* and *Woodfordia fruticosa* for their utilization into production of essential oils, fatty oils, and natural dyes which can be utilized in aroma, food, cosmetics, pharma- and agriculture industries.

Invasive species

- For restoration of *Lantana camara* and *Prosopis juliflora* affected areas of Bundelkhand and Vindhya region of UP, four site-specific models were prescribed for addressing the problem of *L. camara* and six models for *P. juliflora*.
- Spatial mapping studies revealed that *Prosopis juliflora* occupied 8.10 Lakhs ha area while *Acacia mearnsii* has occupied 25478.36 ha area in Tamil Nadu. About 31% of the study area in the states of Chhattisgarh, Jharkhand, and West Bengal is presently susceptible to invasion by *Lantana camara*.

Wood Science

- Prepared different wood and composites products: glued laminated timber from plantation grown hardwoods viz. Malabar Neem, Rubberwood and Silver Oak; biochar particle board of poplar wood; plywood from coconut trunk; particle board from recycling of wood composite waste; plastic bonded bamboo mat board and plastic bonded plywood from waste recycled plastic material; Cellulose Nano Fibers (CNF's) bonded Melia and Banana boards with calcium carbonate and thermoplasticized starch as a filler; and De-structured bamboo boards of *Dendrocalamus somdevai*, *D. membranaceus*, *B. tulda* and *B. balcoa*.
- Developed and tested fire retardant door shutters using different hardwoods, achieving up to 125 minutes of fire resistance with red meranti, complying the 120-minute rating as per BS-476/IS 3614.
- For treatment of Bamboo, installed four Vacuum Pressure Treatment Units at various locations in Manipur.
- Thermo-hygro-mechanical (THM) modification, significantly improved the specific gravity, increase in modulus of rupture, hardness, water tolerance, swelling, Color and aesthetic properties of plantation timbers such as *Melia dubia*, *Populus deltoides*, and *Ailanthus excelsa*.
- Using a microwave vacuum dryer (MWVD), large wood specimens of *Melia dubia* can be dried in about 13.5 hours across 2-4 drying runs in comparison to 1.5 to 2 months by conventional kiln drying with steam heaters.
- Treatment of wood by linseed oil nano-emulsions containing nano-ZnO and nano-CuO was highly effective against termites.

Ecosystem services

- The overall economic value of forest ecosystem services in India was assessed using remote sensing and other data sources. Habitat services were highest in littoral and swamp forests, biodiversity services were greatest in tropical semi-evergreen forests, and supporting services were most substantial in tropical wet evergreen forests. Tropical dry deciduous, moist deciduous and semi-deciduous forests were noted for their high economic value in supporting services.

Forest Protection

- Standard of procedure for reporting Shisham mortality was developed and provided to UPFD.
- An advisory report on Sal leaf Defoliator *Paectes subapicalis* outbreak in Jharkhand was given to SFD, Ranchi, Jharkhand.
- For biological control of subterranean termites, *Metarhizium anisopliae* showed faster and more lethal effects with higher efficacy.
- The efficiency of biopesticide Tree PAL^H at 1 % concentration at 24 hrs of treatment ranged from 30 % to 85 % for larval mortality of insect pests of *Dalbergia sissoo*, *Poplar sp.*, *Ailanthus sp.*, *Tectona grandis*, *Tecomella undulata*, *P. santalinus*, *Swietenia macrophylla* species.
- Inoculation with arbuscular mycorrhizal fungi (AMF) significantly enhanced the growth and essential oil yield of *Angelica glauca* and *Valeriana jatamansi*, with essential oil yield ranging from 7.32% to 25.32% compared to controls.
- Research on effectiveness of biofertilizers developed by ICFRE revealed that trees inoculated with ICFRE's biofertilizers (which included AM fungi, PSB, Azospirillum, Azotobacter, and KSB) exhibited significantly better growth and biomass after one year, with tree height being twice as compared to those inoculated with commercial biofertilizers.
- Biofertilizers treatments with Azotobacter and Azospirillum showed over 20% improved growth performance compared to controls in teak plantation.

Apps developed

- Developed four apps viz. Eco Rehab, Agroforest, LKP-Info and Bamboo Grow.

Hydrology

- Rejuvenated four springs in Lathao village, Arunachal Pradesh, by creating conical ponds, nalah bunds, and reservoir tanks to enhance water security. Also trained 106 para-hydrogeologists through workshops conducted in Arunachal University of Studies, Namsai and Krishi Vigyan Kendra, Namsai, Arunachal Pradesh.
- Report on Improvement of Water Quality in Immediate Catchment of Proposed Navnera Reservoir on Kalisindh River, Kota District, Rajasthan submitted to Chief Engineer Water Resources Zone Kota, Rajasthan.

Fodder Research

- Efforts to enhance fodder availability and quality have shown significant results across various regions. Coppicing operations in fodder plantations have led to vigorous plant growth, with *Albizia procera* (596.67 quintal/ha) and hybrid Napier grass (660.06 quintal/ha) achieving the highest biomass yields.
- In regions like Rajasthan and Madhya Pradesh, grasses such as *Panicum turgidum* (262.80 quintal/ha) and *Sesbania grandiflora* (93.93 quintal/ha) outperformed trees in biomass production.
- Silage prepared from 100% sorghum or sorghum blends was well-received by livestock, chemical-free silage making was demonstrated in Uttarakhand and Rajasthan.

Patents

Granted

- A process for obtaining phytoecdysteroids from *Achyranthes aspera* for the synchronized maturation of silkworm (No. 440485) to ICFRE-FRI, Dehradun.
- Natural wood preservative formulation from coconut shell pyrolytic oil to ICFRE-IWST, Bengaluru.

Applied

- A liquid herbal hair dye formulation coloring composition containing a decoction of a natural dye for applying to hair (Patent Application No.202421008482; Dated 08/02/2024) was applied by ICFRE-TFRI, Jabalpur.

Product developed

- HIM Growth Booster a mycorrhizal Bio-fertilizer for conifers using *Ramaria formosa*; and Bio fungicide HIMTrichoKawach for soil borne and foliar phytopathogens using *Trichoderma asperellum* was developed by ICFRE-HFRI, Shimla
- HIM-ALBIWASH a green plant-based Bio pesticide effective against Aphids, Scale insects, Salix defoliator; and HIM-BIOKIL-1 a bio pesticide using *Boenninghausenia albiflora*, effective against stored seed pests of chilgoza pine, Juniper, Oak and Shisham was developed by ICFRE-HFRI, Shimla.
- Prepared value added products from *Feronia limonia* (Murraba and pickle), *Tamarindus indica* (Squash) and *Madhuca longifolia* (Jaggary), *Carissa carandas* (Karonda chips, Energy drink, Karonda Churan (Powder), Khatmith goli, Karonda Candy, Karonda Pickle, Cherry Karonda, Honey Spread and Iron Capsule, Karonda Jam, Karonda Murabba), *Pyrus pashia* (Molu candy, Molu Jam, Molu pickle, Molu Murabba), *Ficus palmate* (Himalyan Fig Jam, Himalyan Fig Candy, Dried Himalayan Fig, Fig Squash) and *Semecarpus anacardium* (Sweet candy, Orange pickle, Green Pickle). Mosquito-repellant incense sticks prepared from *Diploknema butyracea* cake/ residue and additives.

FSSAI certificates:

- FSSAI certificate for Tara Red Jam made using the natural colourant of red tamarind has been obtained by ICFRE-IFGTB, Coimbatore.
- The herbal products derived from *Madhuca longifolia* and Moringa (nutraceutical bars, anti-bacterial handwash, wound-healing cream, (Tooth paste and powder).

Transfer of Technology

- Technology for *in-vitro* protocol for propagating *Swietenia macrophylla* through tissue culture transformed to Shivshakti Agritech Limited, Hyderabad.
- Technology for production of TC Teak plants transferred to eight private tissue culture labs and nurseries HU Gugle Biotech, Mukund Biotech, Meristem Biotech, Jagadamba Biotech, Santhi Clonal Nursery, DevLeela Biotech, Adithya Biotech and HiFi Biotech.
- Technology to replace wood particles with currency briquettes in particle board production transferred to two industries.

Outreach Programmes

- Two new Van Vigyan Kendras were established at ICFRE-Skill Development Centre, Chhindwara (MP), and Chandrapur Forest Academy, Chandrapur, Maharashtra.
- Six Tree growers melas/Institute industry meets were organized: 01 by ICFRE-IFGTB at Puducherry; 02 by ICFRE-IWST at Kerala and Gujarat; 01 by ICFRE-AFRI at Jaisalmer; 01 by ICFRE-RFRI at Assam and 01 by ICFRE-HFRI at Himachal Pradesh.
- During 2023-24, 14 documentaries were produced: 06 by ICFRE-IFGTB on "Eucalyptus Cultivation in Dry Lands", "Holding the Sky – The Casuarina Story", "Elegance in Every Grain – Tissue Culture Teak", Tara Red, TreePal, Tree Rich Bio-booster and Windbreak technology; 01 by ICFRE-AFRI on Khejri Tree: Mortality, Research & Management; 06 by ICFRE-TFRI on Management of Fly ash in Thermal Power Plants, Lac Cultivation, Lakh ki Kheti, Krishi Vaniki, Micro propagation of Bamboo, Kitaalaya.
- During the year, 20 radio talks and TV talk were delivered: 14 by ICFRE-FRI and 06 by ICFRE-TFRI.
- Total of 245 training sessions were conducted for 9,391 stakeholders on various forestry and livelihood related issues.
- ICFRE institutes collectively organized 118 Seminars/Symposia/Workshops/meetings engaging a total of 7,537 participants.
- For extension of research outcomes, published 14 books, 80 booklets, 16 articles in seminars, conferences, and workshops, and 285 popular articles, with 221 research papers in journals and 191 chapters in books or proceedings.

Education

- In the current academic year, 93 Research Scholars are registered for Ph.D. at the FRI (Deemed to be) University and a total of 19 Ph.D. degrees have been awarded.
- Students of FRI (Deemed to be) University secured 66 placement offers from over 25 agencies viz. Hindalco Industries Ltd.; Sterlite Power; S&P Global; WSP Global; Global Traceability; HCL Tech; Indus Enviro Pvt. Ltd. New Delhi; M/s Rushil Decors; JM Environet IEVO, Udaipur; CEDAR; M/s CP Veneers; M/s D R Decors, Bengaluru; Green Ply; Earthood, Noida; Sankalp Taru (NGO); Heritage, Jodhpur; Marque Impex; GICIA; SUVIDHA (NGO); Hans Foundation, Semi Govt. Organization, Eco Stewardship pvt. Ltd.; Kuantum Papers Ltd.; RSPL Ltd.; ITC Ltd.; JK Paper Ltd.

Scientific Services/Consultancies

- Twenty two Environmental Audit Report reports of various mines and projects of Coal India Limited, South Eastern Coalfields Limited, Western Coalfields Limited, Mahanadi Coalfields Limited and Northern Coalfields Limited etc. were submitted. Prepared and submitted Environmental Management, Reclamation & Rehabilitation Plans of BIOM, Bachel Complex, Dantewada district, Chhattisgarh and John Iron Ore Mine, Chitradurga district, Karnataka.
- Monitoring and evaluation of plantations raised by Punjab, Andhra Pradesh and Karnataka forest departments under CAMPA and other schemes was carried out by ICFRE and its institutes.
- Consultancies provided to various plywood and wood industries on aspects related to resins and utilization of offcuts for plywood industries, medium density fibre board, quality inspection, preservation and treatment etc.
- 3rd party Green Audit monitoring was conducted two colleges namely Moran College, Charaideo, Assam and Majuli college, Kamalabari, Majuli, Assam.

Tribal Welfare

- In collaboration with the Tribal Co-operative Marketing Development Federation of India (TRIFED), ICFRE-IFGTB opened an outlet at the Product Sales Counter called "Tribes India" in the Forest Campus, Coimbatore.
- Training on Low Cost Vermicomposting Techniques for Livelihood Generation for 25 unemployed Tribal Women was organized by ICFRE-RFRI, Jorhat.
- Training on Bamboo Propagation and Nursery Management for 45 Tribal Women representing SHG in Jampuijala, Agartala was organized by ICFRE-LEC, Agartala organized.
- To develop value-added Tamarind products, a workshop cum interactive meeting was conducted with six tribal women Self-Help Groups (SHG) from tribal hamlets of Senguttai, Arakkadavu, Sorandi, Gundoor, Gopanari, and Colanipur villages around Aanaikatty in the Coimbatore district of Tamil Nadu.

Prakriti

- Prakriti, a scientist-student connect programme, has benefited over 16838 students across ICFRE institutes and centres through various programs, including lectures, webinars, awareness campaigns, plantation programmes, nature walks, study tours.

Mission LiFE

- Mission LiFE, initiated by India's Prime Minister, aims to promote sustainable lifestyles worldwide. Launched at COP 26 in 2021, it focuses on individual actions, industries responding to consumer demands, and government policies supporting sustainable consumption and production. This year, 252 activities were carried out, sensitizing around 77300 people. Further, a mass mobilization campaign was organized in the month of May under which ICFRE and its institutes conducted nearly 5500 activities.

Mission Karmayogi

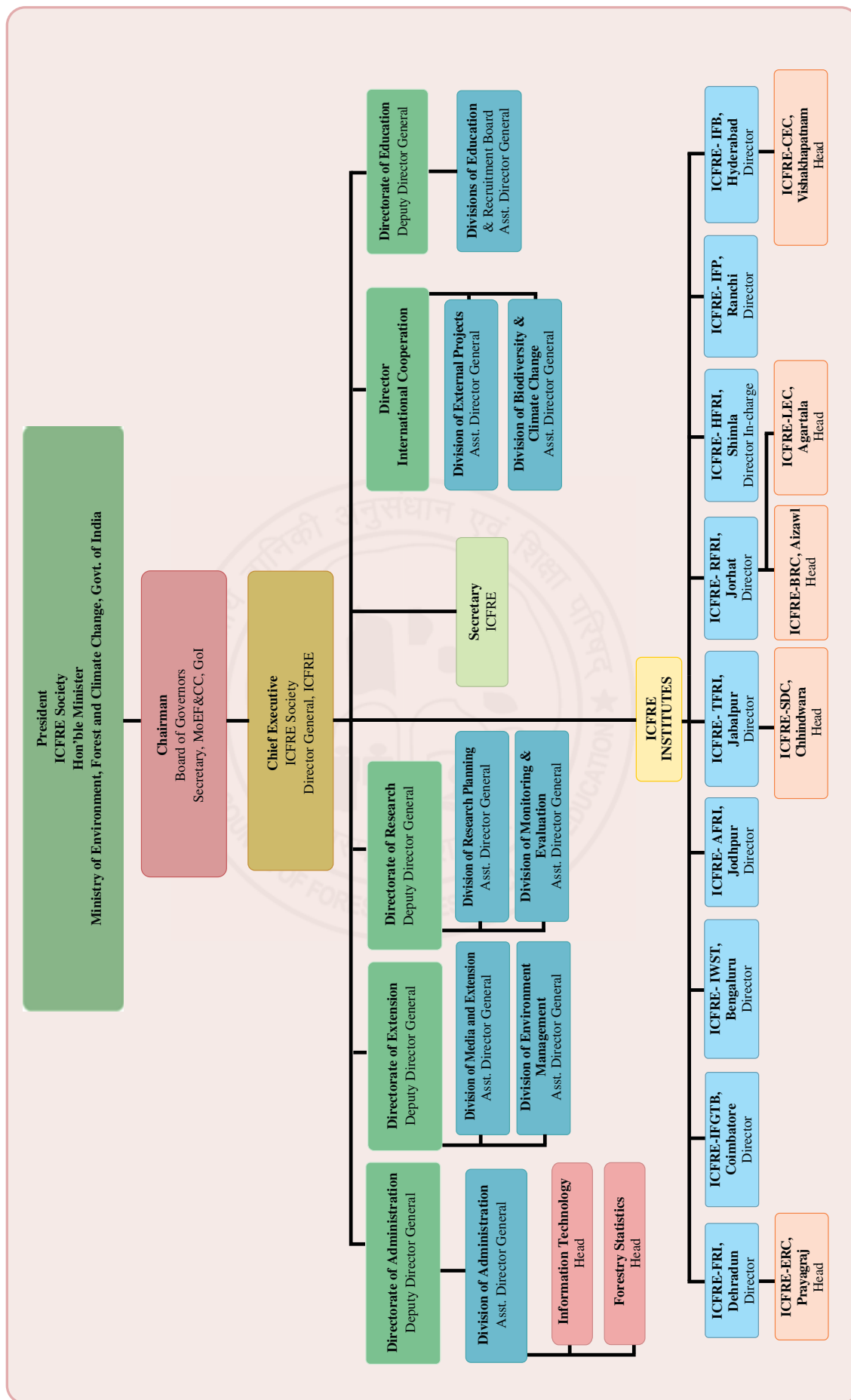
- Under Mission Karmayogi, 560 employees have successfully registered and completed 502 forestry related modules.

Swachhata campaign 3.0

- ICFRE and its institutes/centres actively participated in special campaign for Swachhata 3.0. The campaign included taking a cleanliness pledge and performing various activities like campus cleaning, e-waste disposal, and awareness programs. The campaign was executed in two phases at ICFRE, Dehradun. In preparatory phase, Cleanliness campaign sites were selected, and 3620 files were reviewed, with 1138 files earmarked for disposal. In Implementation Phase, staff conducted a cleanliness drive, disposing of the 1138 files according to government guidelines. Additionally, 56 sq. ft. of area was cleared, and 51 pieces of e-waste were sold through e-auction.



Organizational Structure of ICFRE Society





01
CHAPTER

INTRODUCTION

ICFRE





INTRODUCTION

Indian Council of Forestry Research and Education (ICFRE) is an autonomous organization under the Ministry of Environment, Forest and Climate Change (MoEF&CC), Government of India (GoI) and is registered under the Societies Registration Act, 1860. The General Body is the supreme authority of the ICFRE, headed by the Union Minister, MoEF&CC, GoI. The members consist of serving and retired senior officers from various state governments, central government, educational institutes, NGOs and national level scientific organizations. The Director General, ICFRE appointed in Apex Scale by the Government of India is the Member Secretary of the BoG. Board of Governors of ICFRE constituted under Rule 17 of ICFRE Society Rules. The Board of Governors, with the approval of Government of India, has the power for the administration and management of affairs and funds of the Council. Secretary, to the Government of India, MoEF&CC is the Chairman of the BoG of ICFRE.

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

Vision

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

Mission

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

ICFRE National Presence





29th ANNUAL GENERAL MEETING

29th Annual General Meeting of ICFRE was held on 20 May 2023 under the Chairmanship of Hon'ble Union Minister, Shri Bhupender Yadav. Shri C. P. Goyal, IFS, DGF&SS, MoEF&CC, Shri A S Rawat, Director General, ICFRE and other members of ICFRE Society attended the meeting at ICFRE, Dehradun.

29th AGM of ICFRE Society

The AGM members confirmed the Minutes of 28th Annual General Meeting of the ICFRE held on 28 May 2022 and noted the action taken on the decisions of previous meeting. Annual Report and Annual Audited Accounts of ICFRE for the year 2021-22 were approved. Technology for Manufacturing Plywood using single use plastics as a binding agent and Forest soil health card for Madhya Pradesh, Haryana, Delhi, Ladakh, Chandigarh and Puducherry were released by Hon'ble Union Minister.



Shri Bhupender Yadav, Hon'ble Union Minister, MoEF&CC releasing Forest soil health card and Technology for Manufacturing Plywood using single use plastics as a binding agent



Centre of Excellence on Sustainable Land Management

Shri Bhupendra Yadav, Hon'ble Minister of Environment, Forest & Climate Change, inaugurated Centre of Excellence on Sustainable Land Management. Two publications, i.e. "Technical Paper on Pathway to achieve LDN in India" and "Compendium of Sustainable Land Management Practices" were also released by the Hon'ble Minister during the inauguration.



Hon'ble Minister of Environment, Forest & Climate Change, inaugurating CoE-SLM

61st Meeting of Board of Governors

61st meeting of the Board of Governors (BoG) of Indian Council of Forestry Research and Education, Dehradun was held on 19 February 2024 under the Chairmanship of Ms. Leena Nandan, IAS, Secretary to GoI, MoEF&CC, and Vice Chairman Mr. Jitendra Kumar, IFS, DGF&SS, MoEF&CC. The meeting was attended by BoG members, Mrs. Kanchan Devi, DG, ICFRE, Seniors officials of ministry and ICFRE officials.

The Board confirmed the minutes of 60th meeting of BoG of ICFRE and the action taken on the decisions in the previous meeting of BoG. The Board recommended the Annual Report and Annual Audited Accounts of ICFRE for the year 2022-23 for approval of ICFRE Society.

Three publications on Soil Health Card; Integrated Identification Method for Distinguishing between *Dalbergia latifolia* and *Dalbergia sissoo* and Miyawaki Plantation were also released during the board meeting.



Mrs. Leena Nandan, Secretary, MoEF&CC releasing publication on "Miyawaki Plantation" during 61st BoG meeting

Regional Research Conferences

The formulation of research projects is a rigorous process where the inputs of stakeholders and burning research needs are given priority. To improve the quality of research projects Regional Research Conferences are organized to discuss

needs to identify the research priorities. It also facilitates and provides opportunity to share knowledge and ideas with the stakeholders as well as provide an in-depth analysis of themes and directions for priority setting for ICFRE.

During 2023-24 five RRCs were organized:

S.No.	Date	Conference	Organizing Institute
1.	04.08.2023	Improvement in productivity of forests and generation of livelihood through degraded land management	ICFRE-IFP, Ranchi
2.	11.08.2023	Climate change impacts, adaptation and vulnerability: Northeast Indian perspective	ICFRE-RFRI, Jorhat
3.	18.08.2023	Forest wealth vis a vis human health	ICFRE-TFRI, Jablapur
4.	25.08.2023	Forest Bioresource – Scope and challenges for valorization	ICFRE-IFGTB, Coimbatore
5.	28.08.2023	Research needs in forestry	ICFRE-FRI, Dehradun

Research Advisory Group (RAG) and Research Planning Committee (RPC) Meetings

The research requirements in the field of forestry need to be updated in accordance with the emerging research needs. In an effort to streamline the research process into stakeholder's requirements, National Forestry Research Plan (NFRP) was launched in 2000 keeping in view the national requirement and linkages with Five year Plan. Research Advisory Group (RAG) at Institute level prioritize the project as per guidelines and

themes given in NFRP and are finally approved by Research Policy Committee (RPC) at the National level.

- RAG meetings of all nine ICFRE institute were conducted between 18 September 2023 to 17 October 2023 and 52 research projects were presented out of which 45 projects were recommended for consideration of RPC for final approval.
- XXIV Research Policy Committee Meeting 2024 was held on 08 and 09 February 2024 and has approved 20 new and 79 ongoing projects.

United Nations Forum of Forests

ICFRE-FRI hosted United Nations Forum on Forests (UNFF) meeting from 26 to 28 October 2023. The Hon'ble Vice-President of India, Shri Jagdeep Dhankhar addressed the United Nations Forum on Forests (UNFF) Country-Led Initiative by India at ICFRE-FRI in Dehradun



Hon'ble Vice President of India addressing the United Nations Forum of Forests

World Day to Combat Desertification and Drought

ICFRE organized workshop on "Her Land Her Rights" inaugurated on 17 June 2024 by Shri C. P. Goyal DGF&SS, MoEF&CC, GoI in the presence of Padam Shri Smt. Basanti Devi, Shri Arun Singh Rawat, DG, ICFRE and other dignitaries. National Working Plan Code-2023 of MoEF&CC was also released by DGF&SS.



Shri C. P. Goyal DGF&SS, MoEF&CC releasing "National Working Plan Code-2023" of MoEF&CC.



Visit of Secretary, MoEF&CC

Smt. Leena Nandan, IAS Secretary, Govt. of India, MoEF&CC, visited ICFRE and ICFRE-FRI, Dehradun and reviewed the activities of ICFRE and its institutes.

Smt. Leena Nandan, Secretary, MoEF&CC, reviewing the activities of ICFRE and its institutes

Memorandum of Understanding with National and International Organizations

MoUs Signed

- Telangana Forest Academy, Telangana
- Deptt. of Forest, Environment and Climate Change (DoFECC), Govt. of Jharkhand
- CSIR- National Environment Engineering Research Institute (CSIR-NEERI)
- National Centre for Biological Sciences- Tata Institute of Fundamental Research (NCBS-TIFR)
- Indian Council of Agriculture Research (ICAR), New Delhi
- Rubber Research Institute of India (RRII), Kerala
- Faculty of Forestry, Kasetsart University, Bangkok, Thailand
- Alliance of Biodiversity International and CIAT, Italy

- United States Department of Agriculture (USDA) Forest Service Wash DC
- Tamil Nadu Agriculture University with ICFRE - IFGTB
- Tribal Co-operative Marketing Development Federation of India with ICFRE - IFGTB
- National Centre for Biological Sciences (NCBS) with ICFRE-IWST



MoU signing between ICFRE and Telangana Forest Academy



MoU signing between ICFRE and CSIR - NEERI



MoU signing between ICFRE and the Alliance of Biodiversity International and CIAT, Italy

Compliance with Govt. of India Initiative

- Mission Karmayogi:**
 Under Mission Karmayogi, 560 ICFRE employees were registered on iGOT Portal and completed 502 modules.
- Azadi ka Amrit Mahotsav:**
 During this year from 16th April to 15th August, 2023 around 70 activities were conducted by ICFRE and its institute to commemorate Azadi ka Amrit Mahotsav.
- Mission LiFE:**
 To promote sustainable and healthy lifestyles amongst individuals a total of 5752 activities were conducted throughout the country to sensitize students, employees, stakeholder and locals about mission LiFE.
- Swachhta Campaign:**
 Under Swachhata 3.0 ICFRE, Dehradun disposed 1138 files, cleared 56 sq. ft of area and 51 e-wastes were condemned and sold through e-auction.

MoUs in progress

- Kenya Forest Research Institute (KEFRI)
- Forestry and Environment Research, Development and Innovation agency (FOERDIA), Indonesia
- Millennium University, Blantyre, Republic of Malawi
- International Tropical Timber Organization (ITTO)
- Beijing Forestry University (BFU), Beijing
- Chinese Academy of Forestry (CAF), China
- Swedish Forestry Agency, Sweden
- Brazilian Forest Services, Brazil
- Wildlife Institute of India, Dehradun



02
CHAPTER

**RESEARCH
HIGHLIGHTS**

ICFRE



2.1 ECOSYSTEM CONSERVATION AND MANAGEMENT

Projects under the Theme

A. PLAN

Completed	11
Ongoing	28
New	07

B. EXTERNALLY AIDED

Completed	09
Ongoing	13
New	08

Climate Change

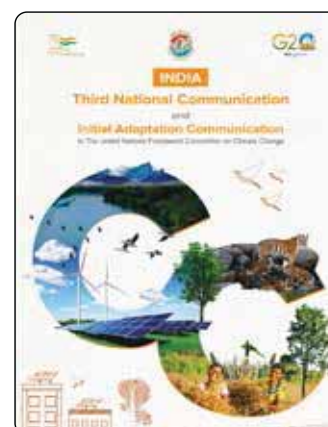
2.1.1.

Restore, Conserve and Protect Forest and Tree Cover for NDC Implementation in India (ICFRE)

German Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection has commissioned the project RECAP4NDC under International Climate Initiative. The project aims to enable actors to effectively plan, finance, implement and monitor forest landscape restoration and trees outside forests measures, thereby, to contribute to the achievement of India's NDC forestry target, enhance biodiversity conservation and sustainably improve rural livelihoods through increased forest and tree cover. ICFRE has main responsibilities in capacity development, knowledge management and communication related to different aspects of forest landscape restoration. ICFRE would also contribute in implementation of the project outputs on forest landscape restoration models, and policy and planning aspects of the forest landscape restoration. A Planning Workshop of the project was organized from 19 to 21 March 2023 at Dehradun.

Mitigation actions, constraints, gaps and related financial, technical and capacity needs to address climate change concerns in forest sector in India (ICFRE)

Report on 'Mitigation Actions, Constraints, Gaps and related Financial, Technical and Capacity Needs to Address Climate Change Concerns in Forest Sector in India' was submitted to the NATCOM Project Management Cell, MoEFCC for preparation of Third National Communication to the United Nations Framework Convention on Climate Change (UNFCCC).



Quantification of oxygen production capacity and mitigation potential of urban plantation species for improving urban health and combating climate change (ICFRE-FRI)

Project is being executed in cities namely Dehradun and Udham Singh Nagar (Uttarakhand), Bareilly and Lucknow (Uttar Pradesh), Rohtak and Gurugram (Haryana), and Delhi. The existing tree species particularly, *Lagerstroemia speciosa*, *Syzygium*

cumini, *Alstonia scholaris*, *Ficus infectoria* (*Ficus tsjahela*), *Ficus religiosa*, and *Mangifera indica* were selected in urban areas of aforementioned cities. Biophysical parameters such as DBH, height, canopy area and volume, leaf chlorophyll content, leaf area, and GPS coordinates of individuals of the selected tree species were recorded. Furthermore, environmental parameters such as CO₂, CO, PM 2.5, PM 10, SOx, and NOx were monitored for their ambient air concentration in Bareilly, Lucknow, and Dehradun city using portable environment meter.

Air pollutants in urban environment of Bareilly, Lucknow and Dehradun

Air Pollutants	Units	Concentration in Bareilly			Concentration in Lucknow			Concentration in Dehradun		
		Average	Min	Max	Average	Min	Max	Average	Min	Max
Carbon monoxide (CO)	PPM	183.80	175.57	185.75	185.47	182.50	190.00	192.31	191.13	193.48
Carbon dioxide (CO ₂)	PPM	648.17	595.67	718.33	740.00	542.50	872.00	556.26	522.69	589.78
PM 2.5	µg m ⁻³	61.31	59.00	67.50	69.00	66.00	71.00	84.45	81.65	87.25
PM 10	µg m ⁻³	76.33	66.67	93.00	43.33	32.00	62.50	101.1	98.54	103.54
SOx	PPM	87.22	75.00	109.00	52.92	36.00	72.00	56.0	48.00	64.00
NOx	PPM	11.39	9.31	12.43	10.35	9.10	11.44	9.24	9.22	9.25

High Altitude Transition Zones in Himachal Pradesh: Long-term Studies to Assess the Effects of Global Warming (ICFRE-HFRI)

Regeneration study of tree species, *Pinus wallichiana* (Kail), *Abies spectabilis* (Tosh), *Betula utilis* (Bhoj Patra), *Quercus semecarpifolia* (Kharsu) were conducted. Three years data (2019, 2020 & 2021) were processed to visualize trend in temperature and relative humidity at Satrundi study site. The lowest average temperature recorded during January was -5.33 °C, -5.61 °C and -2.33 °C for the years 2019, 2020 and 2021 respectively. The highest average temperature recorded during August was 11.55 °C, 12.19 °C and 12.01 °C and average relative humidity was recorded to be 67.29%, 64.49% and 62.67% for the year 2019, 2020 and 2021 respectively.

Germplasm of several threatened plant species viz. *Rheum webbianum* (Chukhri), *R. australe* (Chukhri),

Angelica glauca (Chora), *Hedychium spicatum* (Van Haldi), *Rhodiola tibetica*, *Dactylorhiza hatagirea* (Hath-panja), *Heracleum candicans* (Patrala), *Selinum vaginatum* (Bhutkheshi), *Podophyllum hexandrum* (Ban Kakri), *Picrorhiza kurroa* (Karru), *Polygonatum verticillatum* (Salam-misri), *P. cirrhifolium* (Salam misri) and *Gymnadenia orchidis* were collected and added to the ex-situ conservation nursery at Potters Hill, Shimla, Himachal Pradesh.

Floristic data collected from study site Dhel Thach in Great Himalayan National Park, Kullu district of Himachal Pradesh were analyzed. 119 plant species from 41 families recorded with herbs (94), shrubs (12), grasses/forbs (8), ferns (3), orchids (2), and tree (1). Three-day Capacity Building Training programme organized for the frontline staff of HPSFD to upgrade basic taxonomic skills and nursery management techniques.



Field work and data collection



Capacity building programme

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

Controlled pollination experiments were completed in crossing *Rhizophora mucronata* with *Rhizophora apiculata*. Propagules from controlled pollination experiments were collected and transferred to automated nursery chambers. About 2-5% fruit setting was observed in *R. mucronata* x *R. apiculata* combination. Pollination studies indicate that *R. mucronata* is an outbreeding type, while *R. apiculata* is a mixed mating system. The hybrid R x *annamalayana* is a male-female sterile phenotype. *In lieu* to the practice of dibbling mangrove propagules, incubated seedlings with 5-6 internodes at the height of 85cm-110cm are being planted with approximate survival of 95% and prop



Rhizophora trial at Pichavaram, Cuddalore District Tamil Nadu

root emergence within 120 days after planting. Automated nursery raised seedlings escape early casualty in coastal tide zones, which most times is about 50-75%. This assists in averting causality replacement planting schedules.

Establishment of Programme Management Unit for Operationalization of Green Credits Programme (ICFRE)

The Central Government notified the Green Credit Rules, 2023 on 12 October 2023 under the Environment Protection Act, 1986. These rules put in place a mechanism to encourage voluntary environmental positive actions resulting in issuance of Green Credits. ICFRE has been designated as Administrator of the Green Credit Programme (GCP), and is responsible for implementation of the GCP including development of activity specific methodologies and IT infrastructure (Portal/Registry), registration of activities, issuance of green credits, monitoring and audit. Green Credit will arise from taking measures by various stakeholders for environmental activities such as tree plantation,

water management, sustainable agriculture, waste management, air pollution reduction, mangrove conservation, ecomark label development and sustainable building.

The program has witnessed a steady increase in participation from both entities and State Forest Departments during February and March, 2024. Mahanadi Coalfields Limited, Western Coalfields Limited, Steel Authority of India Limited, Central Coalfields Limited, NTPC Limited, South Eastern Coalfields Limited, Northern Coalfields Limited, Coal India Limited, Eastern Coalfields Limited, Bharat Coking Coal Limited, Power Grid Corporation of India Ltd, NHPC Limited, Oil India Limited and Indian Oil Corporation Ltd. completed their registrations during March 2024. A total of 10 state forest departments registered themselves as Implementing Agency.

Status of registration of plantation blocks under GCP till 31 March 2024

S. No.	State	Registered Land parcels		Approved land parcels by ICFRE		Pending for verification		Land parcels (under query)	
		No.	Ha.	No.	Ha.	No.	Ha.	No.	Ha.
1	Assam	10	454	10	454	0	0	0	0
2	Bihar	28	2042	5	400	5	337	18	1305
3	Chhattisgarh	54	1142	34	713	2	28	18	401
4	Gujarat	21	622	11	310	4	153	6	160
5	Madhya Pradesh	42	1384	26	879	1	35	15	470
6	Maharashtra	22	426	17	176	0	0	5	250
7	Odisha	48	500	10	150	33	255	5	95
8	Rajasthan	16	883	9	340	3	250	4	293
9	Tamil Nadu	5	250	0	0	5	250	0	0
10	Telangana	33	629	26	465	0	0	7	164
Total		279	8332	148	3887	53	1308	78	3138

Establishment of the Western Himalayan Temperate Arboretum (ICFRE-HFRI)

Conducted field surveys across Himachal Pradesh and added plant species such as *Ficus palmata* (Fedu), *Ficus religiosa* (Peepal), *Berberis asiatica* (Kashmal), *Berberis kunawurensis* (Kashmal), *Carpinus faginea* (Mandru), *Euonymus tingens*, *Abies spectabilis* (Tosh), *Nyctanthes arbor-tristis* (Har-shringar), *Phyllanthus emblica* (Ambla), *Skimmia anquetilia* (Ner-patta), *Populus nigra*



Carpinus faginea

(Paplar), *Sorbaria tomentosa*, *Osyris arborea* (*Osyris lanceolata*), *Symplocos paniculata* (Lodra), *Salix babylonica* (Majnu), *Engelhardia spicata*, *Aconitum laeve* and *Rubus paniculatus* to the arboretum. Collected germplasm of orchids *i.e.* *Dactylorhiza hatagirea*, *Cypripedium cordigerum* and *Gymnadenia orchidis*, *Goodyera repens*, *Calanthe tricarinata*, *Crepidium acuminatum*, *Habenaria intermedia*, *Galeola falconeri* (*Cyrtosia falconeri*) and *Habenaria marginata* in the arboretum.



Osyris arborea

Quantifying Resilience Patterns in *Rhizophora* with Reference to Hypersalinity: Solutions to Mitigation (ICFRE-IFGTB)

Soil salinity across various zones was assessed. Hybrid seedlings grown in the Automated Mangrove Incubation Nursery Technology chambers had highest survival (90%) and growth

across various salinity levels (3 to 33%). Efficient automated and manual nursery systems have been used for preparation of mangrove propagules which have higher growth rate and ability to tolerate higher saline conditions. Trials established in Killai Forest Reserve have been handed over to the Tamil Nadu Forest Department for replication in other mangrove forest areas.

Ecology and Environment

2.1.2.

Salt stress mitigation in trees by plant growth promotion and soil reclamation using bio-fertilizers in the field conditions in Haryana (ICFRE-FRI)

For field experimental plots of one hectare each were selected in three research centres namely Bithmada Research Centre (Hisar), Shekpara Research Centre (Karnal) and Jhumpa research centre by Haryana Forest Department. From soil samples collected, the isolation of microorganisms by serial dilution method and its identification by biochemical analysis were completed. Gramstaining of colonies revealed 19 gram-negative and eight gram-positive isolates. The isolates exhibited diverse colony morphologies, including variations in color (beige, off-white, yellow, and white), shape (circular or irregular), elevation

(flat or raised), and margin (entire or undulated). Biochemical tests showed that all 27 tested isolates were phosphate solubilizers. Additionally, eight isolates were positive for catalase and oxidase activities, 11 showed positive results for Indole Acetic Acid (IAA) production, and nine tested positive for ammonia production. The fermentation results indicated that 47% of isolates fermented dextrose, 25% fermented lactose, and 35% fermented sucrose. The bacterial isolates varied in shape, including cocci, rod-like, thread-like, and dumbbell forms. Based on morphological and biochemical characteristics, possible genera of the isolates include *Streptococcus* spp., *Bacillus* spp., *Enterobacter* spp., *Clostridium* spp., *Halobacterium* spp., *Serratia* spp., *Pseudomonas* spp., *Azospirillum* spp., *Rhizobium* spp., *Acinetobacter* spp., *Staphylococcus* spp., *Azotobacter* spp., *Escherichia coli*, *Micrococcus* spp., *Proteus* spp., *Flavobacterium* spp., and *Klebsiella* spp.

Centre of Excellence on Sustainable Land Management

The Centre of Excellence on Sustainable Land Management (CoE-SLM) was officially inaugurated on 20th May 2023 by the Hon'ble Union Minister of Environment, Forest and Climate Change. As part of its mission to "Raise Awareness, Profile, and Recognition of Sustainable Land Management," organized two international training programs, two international webinars, as well as two national training sessions and two national workshops.

Played a pivotal role in national reporting efforts, and submitted the "National Report-2022" to MoEF&CC for onward submission to the UNCCD Secretariat. This report, prepared using the PRAIS-4 portal and the UNCCD plugin Trends Earth tools, has been accepted and uploaded on the UNCCD website.

As part of Team India during the G20 Presidency, contributed to the Environment Sustainability Working Group (ESWG), through technical note, Articles and Approach papers for G-20 summit and prepared and published:

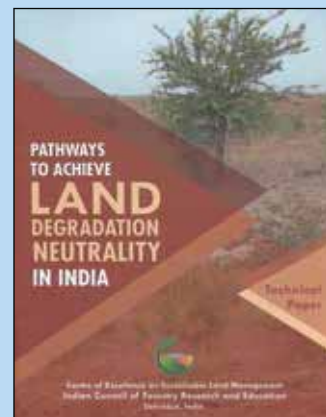
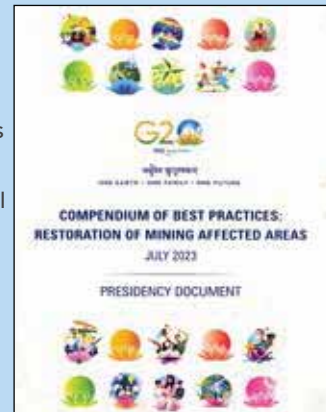
1. Compendium of Best Practices on Restoration of Mining Affected Areas (As the lead agency)
2. Compendium of Best Practices on Restoration of Forest Fire Affected Areas (Edited and Published)
3. Brochure on Best Practices on Restoration of Mining-Affected Areas and Forest Fire-Affected Areas

Other key documents also published are:

1. Compendium of SLM Practices
2. Technical Paper on Pathways to Achieve Land Degradation Neutrality in India
3. 1st Volume of the CoE-SLM Newsletter on Sustainable Land Management

Activities carried out under CoE-SLM

17 th June 2023	11-12 Sept. 2023	18-22 Sept. 2023	18-20 Dec. 2023	15-19 Jan. 2024	7 th Feb. 2024	6-10 th March 2024
Her Land Her Rights 17 th June 2023	Sensitisation workshop on "Combating Land Degradation and Collaborative Development of Training Modules"	Training on "RS-GIS Application in Land Resources Assessment"	Sustainable Land Management through adaptive and Climate Resilient Interventions	Assessing land degradation dynamics and restoration with remote sensing data and GIS tools (International Training)	Corporate Summit on SLM: Collaborative Strategies to Achieve LDN by 2030	SLM: Principles Practices and Applications (International Training)
208 Participants	23 Participants	21 Participants	22 Participants	19 participants, 18 countries	35 participants, 21 companies	19 participants, 11 countries



Greenbelt Development for HRRL, Pachpadra, Barmer, Rajasthan. HPCL Rajasthan Refineries Limited (HRRL) (ICFRE-AFRI)

A Detailed Project Report (DPR) was prepared for "Greenbelt Development for HRRL, Pachpadra, Barmer, Rajasthan. The DPR suggests various

models of forestry interventions in 540 ha under block plantations and eco-park; 50 running km under avenue plantations (without fencing) inside HRRL refinery and townships and 90 km of avenue plantations (with fencing) along different roads surrounding the refinery and township. About 325,000 plants are proposed to be planted, under five different models in the project site.



A view of greenbelt development area inside HRRL, refinery complex

Ecosystem Services Improvement Project (ICFRE)

The World Bank funded Ecosystem Services Improvement Project (ESIP) aimed to manage natural resources, improving forest quality and linked livelihood improvement, and community involved in it through a combination of technical assistance and demonstrative investments in the selected landscapes of Chhattisgarh and Madhya Pradesh was successfully completed on 30 July 2023 and Project Completion Report was submitted to the World Bank and MoEF&CC. ICFRE was responsible for the implementation of components on Forest Carbon Stocks Measuring, Monitoring, and Capacity Building, and Scaling up of Sustainable Land and Ecosystem Management in Selected Landscapes. Key achievements made under the project are as under:

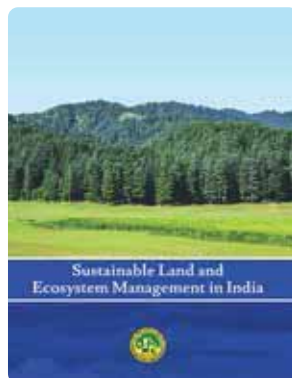
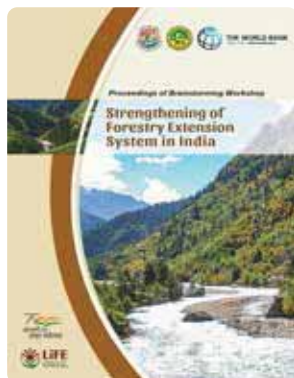
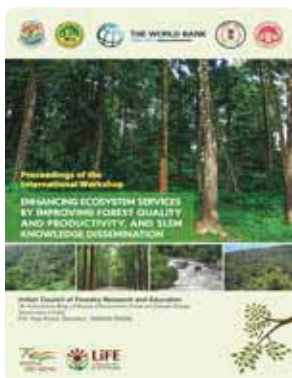
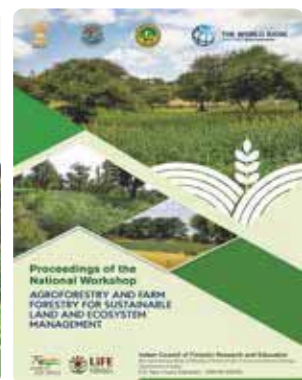
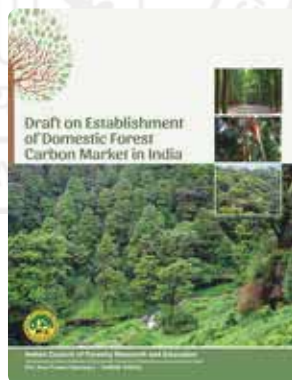
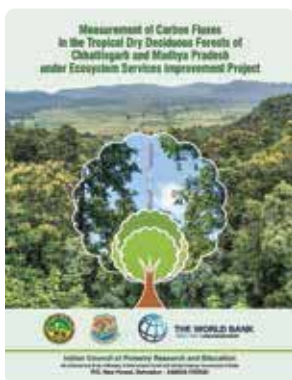
- ESIP was envisaged to support in sequestration of additional carbon of about 10% in forest areas over the baseline through implementation of project activities. Total forest carbon stock in project areas of Madhya Pradesh for 2022-23 was estimated to be 1302477.11 tonnes over the baseline total forest carbon stock of 1172639.19 tonnes for 2018-19. Total forest carbon stock in project areas of Chhattisgarh for 2022-23 was estimated to be 1312014.46 tonnes over the baseline total forest carbon stock of 1223310.56 tonnes for 2018-19. During the assessment period (2018-19 to 2022-23), total forest carbon stock was estimated to have increased by 11.25% and 7.51% for Madhya Pradesh and Chhattisgarh respectively.
- Two eddy covariance-based carbon flux towers were established at Khatpura Forest Beat in Budhni Forest Range and Sonhat Forest Beat in Raghunath nagar Forest Range to monitor CO₂ flux and Net Ecosystem Exchange at real time. Northern mixed deciduous forest of Madhya Pradesh and Southern mixed deciduous forest of Chhattisgarh act as net carbon sink with a net carbon uptake of 4.96 - 5.47 t C ha⁻¹ y⁻¹ in Madhya Pradesh and 4.15 - 4.66 t C ha⁻¹ y⁻¹ in Chhattisgarh. The highest sequestration of CO₂ was recorded in the month of August at Northern Mixed Deciduous Forest, Khatpura (Madhya Pradesh) and during September at Southern Mixed Deciduous Forest, Sonhat (Chhattisgarh). In the month of April to May, carbon was released into the atmosphere and forest acted source of carbon.
- Twenty trainings on Measurement of Forest Carbon Stock were organized for capacity building of State Forest Departments of Madhya Pradesh and Chhattisgarh in which 825 officers/officials participated.
- Trainings on Measurement of Forest Carbon Exchange through Eddy Covariance System were also organized in which participants from SFDs of Madhya Pradesh and Chhattisgarh, ICFRE, FSI, Indira Gandhi Krishi Vishwavidyalaya, Raipur and Sant Gahira Guru Vishwavidyalaya, Sarguja, and NRSC, IIRS, GBPNiHE, IIT Madras, NIH Roorkee, Uttarakhand Watershed Management Directorate participated.
- Forty-five hands-on trainings on Measurement of Forest Carbon Stock were organized in which 2915 members of JFMCs of Madhya Pradesh and Chhattisgarh participated.
- Built capacity of Chhattisgarh State Forest and Climate Change Department for preparation of State REDD+ Action Plan.
- Developed a draft on Establishment of Domestic Forest Carbon Market in India for submission to MoEFCC, Government of India for consideration.
- Total 223 trainings on Scaling up of SLEM best practices viz. lac cultivation for livelihood generation and biodiversity conservation, Wadi system – A tree-based farming system, rain water harvesting and augmentation of water resources, integrated farm development for sustainable land productivity, system of rice intensification, biopesticides and biofertilizers, and vermicomposting for local communities of project areas of Madhya Pradesh and Chhattisgarh were organized in which 18505 beneficiaries participated. Additionally SLEM best practices on Azolla cultivation for sustainable land productivity, micro irrigation system for enhancing water use efficiency and productivity, crop diversification for sustainable land productivity, climate proofing fish farming and improved cook stoves for addressing forest degradation were scaled up in project areas through community driven participatory approach. These practices improved ecosystem services and livelihoods of the local communities. Land area of 25264.42 ha was covered under SLEM practices through intervention of ESIP and other Government schemes. More than 44268 direct beneficiaries were benefitted from scaling up of SLEM practices under ESIP out of which 50% were women.
- A roadmap for institutional and policy mainstreaming of SLEM in India was developed. It provided specific guidelines to different Ministries/ Departments/ Research Organizations / Civil Society Organizations involved in restoration of degraded lands and combating land degradation and desertification.
- A portal on SLEM Knowledge Sharing and Reporting System (<https://nrdp.icfre.gov.in>) was developed for sharing knowledge, learnings, practices and success stories related to scaling up of SLEM best practices for achieving land degradation neutrality by 2030 and also to strengthen the national capacity for reporting to UNCCD Secretariat regarding the progress made in implementation of convention.
- A study was conducted to evaluate working/ effectiveness of existing Van Vigyan Kendras (VVKs) of ICFRE for fulfilling the objectives

of forestry extension services, to enable technologies from lab to land and make practicable suggestions to improve the working and effectiveness of VVKs in future. A brainstorming workshop on 'Strengthening of Forestry Extension System in India' was organized with a motive to share forestry extension experiences of ICFRE, ICAR, SFDs and to get views and ideas of experts for identification of suitable strategies and actions for strengthening of forestry extension system in India.

- National Workshop on 'Agroforestry and Farm Forestry for Sustainable Land and Ecosystem Management' and International Workshop on 'Enhancing Ecosystem Services by Improving Forest Quality and Productivity, and SLEM Knowledge Dissemination' were organized and workshop proceedings were published and shared with relevant stakeholders.
- Developed national database on SLEM practitioners for the development of institutional and individual networks (National database on 361 SLEM practitioners).
- Knowledge products on Forest Carbon Stocks of ESIP areas of Madhya Pradesh and Chhattisgarh, Socio-economic Status of ESIP areas of Madhya Pradesh and Chhattisgarh, Resource Manual on Measurement of Forest Carbon Stocks for capacity building of State Forest Departments (in English and Hindi), Sustainable Land and Ecosystem Management: Communication Strategy, National Database: SLEM Practitioners for the Development of

Institutional and Individual Networks, Evaluation of the Working/ Effectiveness of Forestry Extension System through the Van Vigyan Kendras and Recommendations for its Strengthening, Roadmap for Institutional and Policy Mainstreaming of Sustainable Land and Ecosystem Management in India, Measurement of Carbon Fluxes in the Tropical Dry Deciduous Forests of Chhattisgarh and Madhya Pradesh, Assessment of Forest Carbon Stocks of Project Areas of Madhya Pradesh and Chhattisgarh, Draft on Establishment of Domestic Forest Carbon Market in India, Sustainable Land and Ecosystem Management in India, Brochure on Forest Carbon Stocks Measurement for Joint Forest Management Committees and Flyers (in Hindi and English) on SLEM best practices were published.

- Documentaries on Ecosystem Services Improvement Project, Measurement and Monitoring of Forest Carbon Stocks and Capacity Building, Scaling up of SLEM Best Practice on Lac Cultivation for Livelihood Generation and Biodiversity Conservation, Scaling up of Biopesticides and Biofertilizers Preparation for Sustainable Land Productivity, Scaling up of Improved Cook Stoves for Sustainable Land and Ecosystem Management, Scaling up of SLEM Practice on Rain Water Harvesting and Augmentation of Water Resources for Sustainable Land and Ecosystem Management and Scaling up of SLEM Practice on Vermicomposting for Sustainable Land Productivity were prepared and disseminated through YouTube channel of ICFRE.



Publications under ESIP

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

Floral composition included 60 tree species, 29 shrub species, and 38 herb species in the study area. *Anogeissus latifolia* (*Terminalia anogeissiana*) and *Mallotus philippensis* were dominant species amongst recorded tree species. To understand the extent and implications of the soil health, soil samples were collected and analysed for

various parameters. Soil organic carbon (SOC), which fosters a diverse and abundant microbial community in the soil, was 0.53%. Greater SOC content supports higher soil biodiversity, leading to improved ecosystem resilience and productivity. Faunal species were monitored systematically through grids of 1.5 km x 1.5km size, using camera traps and trail surveys method. The estimated relative abundance was maximum for *Cervus unicolor* and minimum for *Canis aureus* amongst observed species. Avian sampling was also done by using point count method. Identified 77 bird species in the study area and were classified under 52 genera, 37 families, and 13 orders.



Motacilla cinerea (L) and *Canis aureus* (R) spotted in ASAN field firing range in Shivalik Forest Division

Eco-restoration of mined out areas and waste dumps at Meghahatuburu iron ore mines, SAIL, in Saranda Forest Division, West Singhbhum, Districts of Jharkhand (ICFRE-IFP)

In 8.50 hectares of mined-out areas and waste dumps at Meghata buruarea, a total of 19,217 number of plants have been planted (12,162 number of tree species, 2,301 number of shrubs species and 4,754 number of grass spp.). In landscape management and related forestry interventions for site amelioration, slopes plantation, bamboo mat, contour bunding, gully plugging are being carried out in slopes for control of soil erosion. Proper irrigation and maintenance of plantation along with mortality replacement are being carried out.

Assessment of performance of different species and their effect on physio-chemical properties of the mined out soil is being monitored.



Aerial view of Meghahataburu plantation site



Plantation and contour bunds to control soil erosion



Plantation site

Carbon Footprint analysis of Khan Sawmill (ICFRE-RFRI)

A gazette published by the Assam Government on 12 January 2023, pertaining to the Assam Wood-Based Industries (Promotion and Development) Rules, 2022, regulates the operation of wood-based industries in the state of Assam. According to the rules, a detailed project report (DPR) is required for opening a new or renewing an old license for wood-based industries. Within the DPR, a carbon footprint assessment is mandated for applicants seeking to establish wood-based industries. In order to meet this requirement, Khan Sawmill, based in Dibrugarh, requested the ICFRE-RFRI to prepare a carbon footprint report for their Sawmill. The carbon footprint of Sawmill was assessed using corporate greenhouse accounting and standard methods. It was found that the total annual carbon



Data collection from Khan Sawmill

emissions by Khan Sawmill for the years 2018, 2019, 2020, 2021, and 2022 were 4.32 tCO₂, 0.79 tCO₂, 0.87 tCO₂, 1.21 tCO₂, and 1.31 tCO₂ respectively, with an average of 1.7 t CO₂.

Assessment of soil carbon pools under different land uses and carbon stock simulation under climate change scenario. (ICFRE-RFRI)

Passive C pool was found higher in coffee and tea plantations than in forest and rubber plantations suggesting better Soil Organic Carbon (SOC) sequestration capacity of these land use. Data was recorded for three climatic scenarios, S0- Baseline, S1- Temp+ 2.0 °C and RH + 5%, S2- Temp + 2.0 °C and RH + 10%. Under baseline climatic scenarios (S0), simulation modeling showed that SOC stock under forest, tea and coffee plantation would increase from 57.73, 54.81, and 43.86 Mg ha⁻¹ in 2023 to 61.3,

56.1 and 46.7 Mg ha⁻¹ in 2033, respectively but would decrease in rubber plantations from 35.8 to 34.9 Mg ha⁻¹. Forest, tea and coffee plantation showed better SOC storage under climatic condition than S0. But SOC stock in rubber showed a decline possibly due to mineralization of active C in this land use and presence of low amount of passive C fractions. Irrespective of land use under climatic setup, simulated data showed decline in SOC stock with rubber being most affected. Findings implied the tea and rubber land use had potential to sequester huge amount of SOC alleviate the negative feedback of climate change and simultaneously help in income generation in NER.

Top Soil Conservation and Eco-Rehabilitation of Selected Degraded Coal Mines of Central Coalfields Limited Jharkhand through Forestry Intervention (ICFRE-IFP)

In Rajrappa OCP mines Miyawaki plantation has been carried out to an extent of 1.5 hectares while

another two hectares have been brought under overburden dump plantation. Under Miyawaki plantation and overburden dumps plantation a total number of 31482 seedlings of trees species and shrubs species have been planted. The growth data of plantation are being recorded.



Pit digging for Miyawaki plantation



Miyawaki plantation in Rajrappa OCP mines

Biodiversity

2.1.3.

Updation of National Biodiversity Strategy and Action Plan (ICFRE)

Inputs from ICFRE for updation of National Biodiversity Strategy and Action Plan in view of the Kunming-Montreal Global Biodiversity Framework were submitted to the MoEF&CC w.r.t. State-Union Territory wise number of managed forest/wildlife/social forestry/other divisions, year-wise trends in afforestation and agroforestry plantations, success rate based on monitoring of afforestation/plantation activities, production of timber and non-timber forest products, progression in afforested area, progression in operationalization of Forest Development Agencies and Joint Forest Management Committees under National Afforestation Programme, current status of forest

degradation and distribution of wasteland in India. Linkages between action points and targets under Global Strategy for Plant Conservation Targets and National Biodiversity strategy and Action Plan 2008 diversity and distribution of major forest types in India, Threats to mangroves of various maritime states of India, forests ecosystem services, change in mangrove cover, cross sectoral institutional structure in forestry sector India - forest cover change over the years - maintaining a stable trend, progression in afforested area - an achievement considering the population pressure and India's unique progress as an economic power, use of technologies for understanding the process of invasion, and National Level Institutions/Organisations in Forestry Sector and their mandates were included.

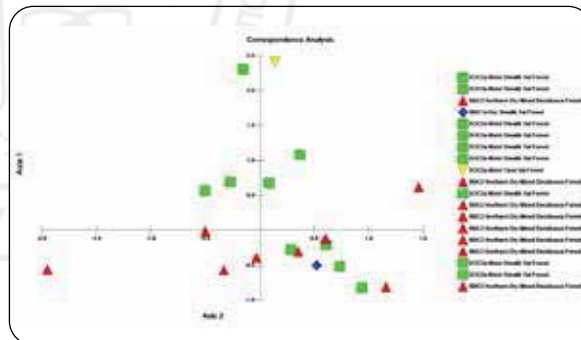
Assessment of Species Diversity of Heterocera (moths) across the Shiwalik Landscape of Northern India and Development of a Database (ICFRE-FRI)

Field surveys were carried out in 27 locations across six states (Uttarakhand, Uttar Pradesh, Haryana, Chandigarh, Punjab and Himachal Pradesh) in Shiwalik of Northern India covering three seasons (Pre-monsoon; Monsoon and Post monsoon).

Moth database of Shiwalik landscape of Northern India was updated. It now contains information on 380 species moths identified so far, belonging to 21 families, along with baseline information of sampling sites (GPS coordinates, altitude, forest sub-type, date, temperate and relative humidity) and images of each moth species. Besides, 321 voucher specimens of moths have also been collected and identified for preservation at the National Forest Insect Collection, ICFRE-FRI.



A new range extension: *Lymantria todara*, Moore, 1879(♀) collected



Correspondence analysis ordination graph of plots realized from species abundance data showing relative position of four forest type groups amongst 19 sites sampled

Improvement of Urban Greenery, Sustainable Tree Plantation and enhancing the Biodiversity at Singanallur Lake, Coimbatore (ICFRE-IFGTB)

About 3000 seedlings of different native tree species (about 80) were planted around Singanallur Lake, Coimbatore. Seedlings of Palmyra palm and mixed tree species were also raised for planting.



Plantation around Singanallur Lake

Medicinal Plant Herbarium Database of Tirupati Medicare Ltd., Himachal Pradesh (ICFRE-FRI)

From different locations in Himachal Pradesh, collected 50 medicinal plants species in flowering

stage. Specimens in duplicate were scientifically dried, sorted, processed and accession numbers have been projected and one specimen of each species have been kept in Dehradun Herbarium. Herbarium specimens with all details were handed over to Tirupati Medicare Ltd.

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

Revision of flora of nine Forest Divisions, Nainital, Ramnagar, Pithoragarh, Haldwani, Bageshwar, Terai

Central, Terai West, Almora and Civil Soyam Almora have been completed. Revision of flora of two Forest Divisions of Champawat, and Tarai East were partially completed. Nomenclature of 210 recorded species have been updated.



Dillenia pentagyna



Tamildadia uliginosa

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

Revision of the flora of seven Forest Divisions, Chakrata, Kalsi Soil Conservation, Dehradun, Tons,

Rajaji Tiger Reserve, Haridwar and Mussoorie have been completed and revision of Flora of Shiwalik Forest Division is partially completed. Taxonomical and pictorial description of 595 species under 373 Genera have been completed. Updated the nomenclature of 195 recorded species.



Inula cappa



Spermadictyon suaveolens

Updation of 176 People's Biodiversity Registers (PBRs) in different districts of Himachal Pradesh (ICFRE-HFRI)

Project was initiated in December, 2023 and documented information on domesticated floral

diversity, faunal diversity, wild floral diversity, wild faunal diversity, traditional knowledge, population, caste, occupation, landscape, crop area, insects and pests, livestock, fair and festivals, deities, temples, traditional food, dresses, jewelry etc., of Wakna and Basha Gram Panchayats of Kandaghat Block of Solan District Himachal Pradesh.

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

Regeneration potential of native flora in *Acacia auriculiformis* plantations at Nenmara, Mannarkad, Wayanad, Thiruvananthapuram, Thrissur, Ranni, Kannur, Kasargod, Walayar, Thenmala, Chalakudy and Malayattoor Forest Divisions of Kerala and adjacent natural forests were assessed. The result showed that the *A. auriculiformis* plantations in Kerala support a variety of native flora. The commonly found native flora in the plantations included *Grewia tiliifolia*, *Terminalia paniculata*, *Cleistanthus collinus*, *Diospyros melanoxylon*, *Zanthoxylum rhetsa*, *Macaranga peltata*, *Mallotus philippensis*, *Holarrhena antidysenterica*

(*Holarrhena pubescens*), *Ficus* sp, *Caryotaurens* and *Tabernaemontana alternifolia*. A total of 410 native species were recorded from various *A. auriculiformis* plantations in Kerala. Twenty four endemic plant species including *Strobilanthes ciliata*, *Meiogyne pannosa*, *Hugonia belli*, *Polyalthia fragarans*, *Psychotria flavida*, *Ecbolium ligustrinum* var. *aryankavensis* were also found growing in the plantations. Invasive alien plants such as *Chromolaena odorata*, *Mikania micrantha* and *Lantana camara* showed high frequency of occurrence in the plantations. Further, the soil analysis revealed that the soil in the plantations are acidic (pH – 4.2 to 5.9) with higher nitrogen content (280 to 832 Kg/ha). The natural regeneration of *A. auriculiformis* was found higher (upto 25 /m²) which could be due to higher seed production and higher germination potential.

Sustainable Management of Grasslands inside Tiger Reserves of Madhya Pradesh with special emphasis on Ingression of Trees (ICFRE-TFRI)

Ingression of trees or woody shrubs in grasslands significantly reduces feeding stock of ungulates, shrinking grasslands ecosystem, converting it into woody habitats. This poses immense threat to the survival of native and endemic ground flora and wildlife. In this study, forty-five quadrats of 0.1 ha each were laid for observation of tree species and 180 quadrats of 1 m x 1 m size were laid out for observation of herbaceous species including grasses and weeds at Bandhavgarh and Kanha tiger reserves. A total of six grasslands of three categories i.e. (i) Swamp, (ii) Dry meadow (natural) and (iii) Dry meadow (village relocated) in Bandhavgarh Tiger



Herbaceous sampling in the Dry-meadow in Bandhavgarh Tiger Reserve

Reserve have been identified and a checklist of 26 grass species from these grasslands has been prepared.

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

Survey was conducted in three districts namely, Latehar, Hazaribagh and Saraikela Kharsawan of

Jharkhand and 69 sacred groves were geotagged. Inception geotagged information regarding 214 sacred groves from 17 districts was documented which consisted of Munda (44), Santhal (111), Oraon (49) and other tribal groves (10). A total of 241 plant species belonging to 69 families have been documented from sacred groves.



Sacred grove of Santhal tribe at Muturkham, East Singhbhum



Sacred grove of Oraon tribe at Negain, Latehar



Sacred grove of Munda tribe at Kochasindri, Khunti

Creation of North-East Indian Zingiberales Biodiversity Garden (Gene Bank) in RFRI, Assam (ICFRE-RFRI)

The Genus *Boesenbergia* has been rediscovered after a span of 128 years and its germplasm is conserved in ICFRE-RFRI Botanical Garden. The last sample of *Boesenbergia longiflorae* for herbarium

was collected on 8 May 1895 from Nambor Reserve Forest (Rao and Verma, 1974; Mood *et al.*, 2013). A species of Genus *Zingiber* under sub-section *Cryptanthoidae* collected from Assam. A total of 36 species of plants categorized under seven genus have been collected and conserved. Out of which, 22 species belong to the 'Ginger families' while 14 are included in the 'Banana families'

Species conserved under 'Ginger families' and 'Banana families'

Banana families			
SN	Name of species	SN	Name of species
1	<i>Canna indica</i> L.	2	<i>Musa acuminata</i> Colla
3	<i>Musa balbisiana</i> Colla	4	<i>Musa × paradisiaca</i> L.
5	<i>Ensete glaucum</i> (Roxb.) Cheesman	6	<i>Musa aurantiaca</i> G.Mann. Ex Baker
7	<i>Musa velutina</i> H.Wendl. & Drude	8	<i>Musa cheesmanii</i> N.W.Simmonds
9	<i>Musa nagensium</i> Prain	10	<i>Musa laterita</i> Cheesman
11	<i>Strelitzia reginae</i> Banks	12	<i>Heliconia psittacorum</i> L.f.
13	<i>Heliconia rostrata</i> Ruiz & Pavon	14	<i>Ravenala madagascariensis</i> Sonn.
Ginger families			
1	<i>Alpinia galanga</i> L.Willd.	2	<i>Amomum subulatum</i> Roxb.
3	<i>Curcuma amada</i> Roxb	4	<i>Curcuma aromatica</i> Salisb.
5	<i>Curcuma caesia</i> Roxb.	6	<i>Curcuma longa</i> L.
7	<i>Curcuma zedoaria</i> (Christon) Roscoe.	8	<i>Hedychium coronarium</i> J.Koenig
9	<i>Hedychium spicatum</i> Buch. Ham.	10	<i>Etlingera linguiformis</i> R.M. Sm.
11	<i>Kaempferia galanga</i> L.	12	<i>Kaempferia rotunda</i> Linn.
13	<i>Zingiber officinale</i> Roscoe	14	<i>Zingiber rubens</i> Roxb.
15	<i>Zingiber zerumbet</i> (L.) Sm.	16	<i>Costus erythrophyllus</i> Loes.
17	<i>Boesenbergia</i> sp. Mood & Prince	18	<i>Cheilocostus speciosus</i> (J. Konig) Sm. [<i>Hellina speciosa</i> (J. Koenig S.R. Dutta)]
19	<i>Costus pictus</i> D. Don	20	<i>Maranta arundinaceae</i> L.
21	<i>Phrynium placentarium</i> (Lour.) (<i>Stachyphrynium placentarium</i> (Lour.) Clausager & Borchs)	22	<i>Phrynium pubinerve</i> Blume



Boesenbergia spp. with flower



Inflorescence of *Zingiber* spp. with a single flower

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

Prepared draft PBR of 198 newly formed, 158 old gram panchayats of Kinnaur district; Shimla district, Solan; Bilaspur; Hamirpur; Sirmaur, Kullu and Lahaul

& Spiti district, and 20 urban local bodies of Shimla, Kullu, Solan, Mandi, Kangra districts of Himachal Pradesh and submitted to Himachal Pradesh State Biodiversity Board. 376 People's Biodiversity Registers have been prepared for newly constituted gram panchayats/urban local bodies/blocks of different districts of Himachal Pradesh.

People Biodiversity Registers for different districts of Himachal Pradesh

S. No	Panchayats/ Urban Local Bodies/ Blocks	Districts	Blocks	No of Panchayats/ ULBs/Blocks
1.	Newly formed Panchayats	Shimla	Rohru, Chauhara, Chopal, Kupvi, Totu, Theog, Rampur, Jubbal-Kotkhai and Mashobra	51
		Bilaspur	Ghumarwin, Jhandutta, Sadar, Shri Naina Devi Ji	25
		Hamirpur	SujanpurTira, Nadaun, Bhoranj, Bijhdi and Bamsan	19
		Solan	Kunihar, Kandaghat, Dharampur, Solan and Nalagarh	29
		Sirmaur	Nahan, Ponta Sahib, Rajgarh, Sanghrah, Shillai and Pachhad	31
		Kullu	Nirmand, Anni, Banjar, Naggar and Kullu	31
		Lahaul&Spiti	Lahaul	4
		Kinnaur	Pooh, Kalpa and Nichar	8
2.	Old gram panchayats	Kullu	Kullu, Nagar, Anni, Nirmand and Banjar	140
		Lahaul & Spiti	Lahaul	18
3.	Newly constituted Urban Local Bodies	Solan	Solan, Kandaghat	2
		Mandi	Mandi, Sarkaghat, Karsog, Balh	4
		Kangra	Palampur, NagrotaSurian	2
		Shimla	Chopal, Rohru	2
		Kullu	Nirmand, Anni	2
4.	Newly Constituted blocks	Mandi	Churag, Dhanutu, Nihri	3
		Shimla	Jubbal, Kotkhai, Tutu	3
		Kangra	Badoh	1
		Sirmour	Tilordhar	1
			Total PBRs	376



Data recording at Nagar Panchayat, Karsog of Mandi district, H.P.



Data recording at Kharga Panchayat of Kullu district, H.P.



Data recording at Kardang Panchayat of Lahaul & Spiti, H.P.

Population assessment of prioritized endangered plant species of Tamil Nadu for formulating conservation measures Phase-I (ICFRE-IFGTB)

Population assessment for eight plant species (*Actinodaphne lawsonii*, *Antistrophe serratifolia*, *Dipterocarpus bourdillonii*, *Melicope indica*, *Monosis shevaroyensis*, *Phyllanthus anamalyanus*, *Elaeocarpus blascoi* and *Psychotria anamallayana*) during Conservation Assessment, Management and Prioritization workshop has been initiated. Around 29 herbarium records of selected species have been

referred from Botanical Survey of India, Southern Regional Centre, Coimbatore and other local herbaria. Population assessment of *D. bourdillonii*, *P. anamalyanus*, *P. anamallayana* and *A. serratifolia* have been carried out in different parts of the Anamalai Tiger Reserve, Tamil Nadu. Among the species surveyed at Anamalai Tiger Reserve, *P. anamallayana* had highest number of individuals (n=168) in three sub-populations while *V. shevaroyensis* has only one individual. Thirty six individuals of *D. bourdillonii* were recorded in four sub-populations. *A. serratifolia* had restricted distribution in two sub-populations with seventy three individuals.

Formulation of Strategies for Conservation of Mangrove in Visakhapatnam District, Andhra Pradesh (ICFRE-IFB)

A total of nine true mangrove (*Acanthus ilicifolius*, *Avicennia marina*, *Avicennia officinalis*, *Bruguiera cylindrica*, *Bruguiera gymnorhiza*, *Ceriops decandra*, *Ceriops tagal*, *Excoecaria agallocha* and *Rhizophora apiculata*) and six associated mangrove species (*Pentatropis capensis*, *Sauropus bacciformis* (*Synostemon bacciformis*), *Sesuvium portulacastrum*, *Suaeda fruticosa*, *Suaeda maritime* and *Ipomoea pes-caprae*) were identified. Based on water and sediment quality analysis, four sites (Near HPCL Plant, Chepalappada, China RushiKonda, Relli Beach) within city limit and four sites outside city limit (Pudimadaka, Bheemili, Appikonda beach and Mutyalammapalem) were identified for plantation. Taxonomical and phenological characteristics of various true mangrove species like season for

flowering and fruiting were assessed. A total of 200 mangrove seedlings were planted in four plantation blocks at two locations (142 at Appikonda and 58 at Bheemili). Technique called REM (Riley Encased Methodology) was implemented for the first time in India. A total of 60 seedlings from five species (*A. marina*, *B. cylindrica*, *B. gymnorhiza*, *Ceriops tagal* and *R. apiculata*) were selected for plantation. Block plantation method was employed, with a 2-meter gap between each species. To plant the seedlings, PVC pipe was longitudinally cut along its entire length. This cut allowed for unrestricted growth in cross-sectional area of tree. Results indicate that seedlings planted within PVC encasements had highest survival percentage because of their protection from waves and currents. Out of the total 60 saplings planted across all species, 55 survived, resulting in an overall survival percentage of 91.66%. This suggests a reasonably successful implementation of plantation efforts, with most of the saplings successfully surviving and growing.



Planting of mangroves species by encased methodology at Bheemili, Andhra Pradesh

Assessment of Floristic Diversity of Giri Khad Watershed, Himachal Pradesh for Developing Conservation Strategies (ICFRE-HFRI)

In Girikhad watershed total 119 species were recorded. *Aconitum heterophyllum* (Patish), *Taxus wallichiana* (Rakhal) was found endangered and *Zanthoxylum armatum* (Tirmira) was found as least concern. The 15 representative villages located in the Upper Giri watersheds were selected for utilization pattern of economically important

species. Socio-economic survey was carried out in Kot-Shilaru, Manan, Shaloha, Ghoond, Matiyana, Kandyali, Shari, Batlot, Sihal, Kyara, Mohri, Deha and Baghi, and Annu villages. Information on agricultural and horticultural crops, fuel and fodder species was collected from these villages. Total 64 medicinal plant species were recorded. 41 fuelwood tree species and 27 fodder tree species were used by villagers. Floristic survey was conducted in Sainj, Hattu, Shilaru, Sandhu Deha and Baghi forests. Information on fuelwood, fodder, agricultural and horticultural crops collected from Kalbog and Baghi villages is tabulated below:

Quantity of fodder and fuelwood collected and agricultural and horticultural crops grown in Kalbog and Baghi villages, H.P.

Name of village	Fodder collection (Kg/HH/Yr)	Fuelwood collection (Kg/HH/Yr)	Agriculture and horticulture crop
Kalbog	6531	3888	Cabbage, cauliflower, pea, maize,
Baghi	4620	4680	bean, apple, plum, pear, apricot, cherry and walnut

Tribals and Traditional Knowledge System

2.1.4.

Conservation Status, Germplasm Collection and Resource Augmentation of Priority Medicinal Plants in the Cold Deserts of Ladakh (ICFRE-HFRI)

Local medicinal practitioners (*Amchis*) were visited to document information on local plants used in traditional medicine. Secondary information in relation to *Sowa Rigpa* was collected from local Tibetan Herbal Medicine Clinics (*Men-Tsee-Khang*). Data were collected using structured questionnaire from local communities (405 nos) in Ladakh.

Planting stocks of *Rhodiola tibetica*, *Podophyllum hexandrum*, *Hyoscyamus niger*, *Cremanthodium ellisii*, *Rheum* spp., *Dactylorhiza hatagirea*, etc.

were maintained in Field Research Station, Leh. Collected raw drugs [*Aconitum heterophyllum*, *Aconitum violaceum*, *Arnebia euchroma*, *Arnebia benthamii*, *Picrorhiza kurroa*, *Dactylorhiza hatagirea*, *Rhodiola tibetica*, *Rhodiola imbricata*, *Rhodiola wallichiana*, *Rheum* spp., *Bergenia ciliata*, *Bergenia stracheyi*, *Hippophae tibetana* and *Juniperus polycarpus* (*Juniperus excelsa* subs. *polycarpus*)] with traditional knowledge of their use from Ladakh. Prepared 681 herbarium sheets as per standard methods and submitted 170 sheets to enrich the Herbarium of National Institute of Sowa Rigpa, Leh. Two community awareness programme on Medicinal plants were conducted at Padum and Sumur, Chushut, Phey and Sapi in Kargil district of Ladakh UT.



Data collection from villager in Kargil



Conducting Field Studies in Shankoo



Medicinal plants awareness program-Leh Valley of Kargil



Community awareness at Padum

2.2 FOREST PRODUCTIVITY

Projects under the Theme

A. PLAN

Completed	-
Ongoing	02
New	01

B. EXTERNALLY AIDED

Completed	03
Ongoing	02
New	04

Silviculture

2.2.1.

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

Analysed tree species change pattern along urban-rural gradient from 2017 to 2023 for northern transects and from 2018 to 2023 for southern transects. All the diversity index analysis of 2023 indicated a gradual decline in diversity along urban-rural gradient as it was in 2017 in northern transect and 2018 in southern transect. Overall in total, 14 species and 302 trees were lost within a span of six years in the northern plots. In southern transect, since 2018 the number of species lost in the urban, transition and rural plots are 16, 12 and 19 respectively and total 463 trees have been lost in total within a span of five years in the southern plots. The density of the species in the northern and southern transect indicates that *Cocos nucifera* is

of the highest density in the urban, transition and rural gradients in Bangalore.

Further assessed the growth of trees along the urban rural gradient and estimated volume and biomass for assessing carbon stock in urban trees and green spaces for 2023. Temporal change in both transects indicate the change in structure, composition and diversity of tree species all along the urban-rural gradient. The trees in southern plots and northern plots have gradually moved to diameter classes of more than 140 cm and 210 cm respectively. The health condition of trees present in all plots of northern and southern transects was evaluated using Electric Resistance Tomograph (ERT), revealing that 18 %, 17 % and 21 % of trees are unhealthy in urban, transition and rural plots in northern transect. However, in southern transect 9 %, 21 % and 15 % of trees are unhealthy in urban, transition and rural plots.

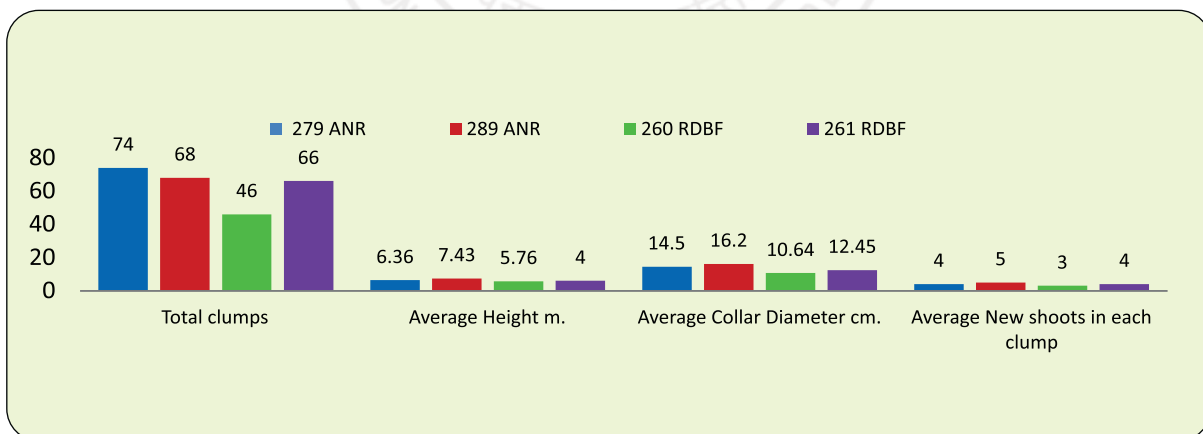
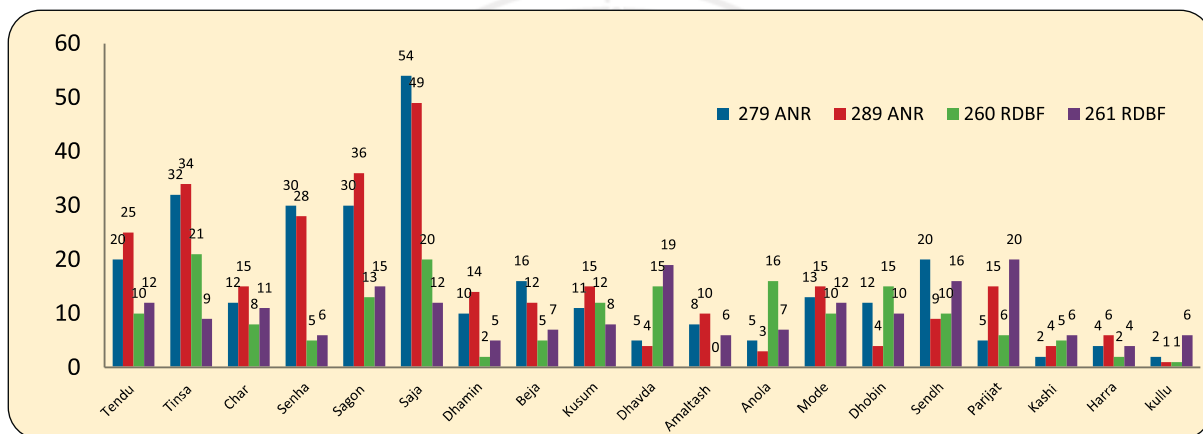
Impact of Silviculture systems on the natural forests of Chhattisgarh with special reference to Sal and Bamboo (ICFRE-TFRI)

Surveyed and collected data from the Bamboo forest of Khairagarh division of Chhattisgarh under silviculture systems -RDBF (Rehabilitation of the degraded bamboo forest) in compartments 260 and 319 and ANR (Assisted natural regeneration) in compartments 279 and 289. Prepared a road map

for execution of work in the bamboo forest which includes trench making, bamboo clumps cleaning, removing diseased culms, soil working, saucer making, adoption of bamboo (*Dendrocalamus strictus*) regeneration etc. It was observed that ANR was better than RDBF, which had associated species Bhondara / Seena, Tendu, Saja, Dhawda, Bija and RDBF was dominated by Teak, Bija, Tinsa, Saja species. Data was collected on growth and management of bamboo and its associate species.



Evaluation of ANR and RDF silviculture system in Bamboo Forests in Khairagarh forest division, Chhattisgarh



Growth performance of Bamboo clumps under different ANR and RDBF system

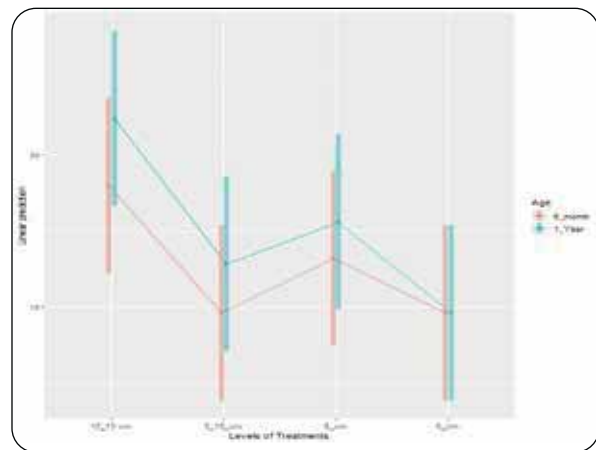
Evaluating the present status of various research trials established in Northern and Eastern zone (Karnataka Forest Department) (ICFRE-IWST)

A list of the trials that needed to be assessed in Dharwad Circle was obtained after discussion

with Conservator of Forests (Research) Dharwad. Accordingly, 140 research trials established in the Agumbe, Belgaum, Dandeli, Badami, Dharwad, Sirsi, and Thirthally Research Ranges were evaluated. Submitted a preliminary report on the 66 trials that were assessed, indicating whether or not the trials should be continued. It was suggested to conclude the trials as the status of the trials does not provide any opportunities to arrive at suitable conclusions.

Studies on quality of nursery seedlings and its relation to outplanting performance of *Dalbergia latifolia* and *Pterocarpus marsupium* (ICFRE-TFRI)

Evaluated seedlings of *Pterocarpus marsupium* of two different ages (six-months-old and one-year-old) and under four different ranges of seedling height in both the age groups. It was observed that root development was higher in one-year old seedlings compared to six month-old seedlings in all four ranges of seedling height. The study revealed that a one-year-old seedling is more appropriate for field plantation than a six-month-old seedling.



Effect of age and height on root length (cm) in *Pterocarpus marsupium*

Survey, inventurisation, documentation, propagation and conservation of rare, endangered, threatened medicinal plants of arid and semi arid regions (ICFRE-AFRI)

Extensive surveys were carried out in Barmer and Jodhpur districts of Rajasthan for the identification of natural populations of *Moringa concanensis*,

Ephedra foliata and *Farsetia macrantha*. Identified three natural populations of *M. concanensis* from Barmer and Jodhpur districts, *E. foliata* from one site in Jodhpur and *F. macrantha* in Barmer district. Seeds of *M. concanensis* were collected from selected locations, pod and seed size, number of seeds per pod were recorded. Seeds were raised under nursery conditions with an overall germination of 62%.



M. concanensis tree



Pod collection



Seedlings in ICFRE-AFRI nursery

Bamboo Resource Mapping in the State of Assam (ICFRE-RFRI)

The objectives of the project include enumeration of the forest-based and homestead bamboo in all the districts of Assam, and development of data collection tools and finalization in consultation

with the funding agency. Around 800 points in various forest and non forest areas of Assam are to be covered under the consultancy project. Till date enumeration of homestead bamboo in four districts of Assam viz., Jorhat, Golaghat, Morigaon and Nagaon has been completed. Socio-economic survey to understand the bamboo based livelihood and dependencies has also been carried out.



Data collection for mapping of bamboo resources

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

The Kair seedlings raised in various sized containers during the year 2022-2023 were planted using RBD in the Forest Ecology Field of ICFRE-AFRI, Jodhpur at 3m×3m spacing. Quantitative parameters such as survival percentage, plant height, root collar diameter and number of branches were recorded one and three months after plantation. The survival percentage after three months of plantation was recorded upto 76.78 %. Out of 392 planted seedlings 277 survived and 91 died. Mortality replacement was done for 91 seedlings. Maximum height, collar diameter and number of branches were recorded in seedlings grown in 300cc root trainer extender, followed by 500cc root trainer extenders in the nursery. Initial results reveal that root trainer extenders are the best containers for

field plantation of *Capparis decidua* due to better root shoot ratio, seedling height and other growth parameters.

Seed pre treated with as hot water, normal water and various concentrations of IBA were sown in nursery to study the germination and survival percentage of seedlings. Germination data was recorded on weekly basis after first sprouting was observed. Average germination was 57.8 % and seedling survival after 3 months in nursery was 44.6 %.



Seedling of *C. decidua* in root trainers



Plantation of *C. decidua* in ICFRE-AFRI Ecology field station



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

Nursery protocols were standardized and germination was enhanced to 70% in *Pistacia integerrima* and to 85% in *Pittosporum eriocarpum*, when seed were soaked in 500 ppm gibberellin solution. Among vegetative propagation methods, rooting was observed through air layering with 5000 ppm indole butyric acid (IBA) in monsoon season with rooting of 63% in *P. integerrima* and 47% in *P. eriocarpum*.

Invasion Mapping of *Prosopis juliflora* and *Lantana camara*, Strategy for Invasion Eradication and Restoration of Degraded Forests in Uttar Pradesh (ICFRE-FRI)

In Uttar Pradesh the areas affected by *Prosopis juliflora* and *Lantana camara* were estimated at 44,467.09 km² and 31,310 km² respectively. Four site-specific treatment models were prescribed for addressing the problem of *L. camara* and six models for *Prosopis juliflora* in UP. Specific

recommendations were provided for restoration of degraded forests of Bundelkhand and Vindhya region in the state.

Study on Silvicultural Interventions for Enhancement of Regeneration of Sal (*Shorea robusta*) (ICFRE-FRI)

Sal regeneration was studied along six different altitudinal gradients (200-300m, 300-400m, 400-500m, 500-600m, 600-700m, 700-800m) in Dehradun Forest Division (Uttarakhand) and Shivalik Forest Division (UP). Factors influencing natural regeneration of Sal have been identified from the studies conducted in 18 sites in these two forest Divisions. Dense canopy, inadequate sunlight, drought, forest fire, frost, rocky surface, sloping topography, soil compaction, presence of weeds especially *Lantana camara*, presence of thick layer of leaves on forest floor, disturbance by domestic animals and wild boar, anthropogenic factors like grazing, firewood collection, lopping and harvesting of non-timber forest produce are the major factors that adversely affect regeneration of sal. Adequate protection through fencing, weeding, loosening of soil, presence of sal associates, promoted regeneration of sal.

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

For tree translocation two sites viz., Maharana Pratap Road and Harrawala in Dehradun, Uttarakhand

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

Magnolia gustavii King (vern. Assamese: Kharikasopa or Khorokiasopa), a critically endangered tree species has been re-discovered after a lapse of 133 years from Dangori Reserve Forest, Tisukia district, Assam since the last herbaria of *M. gustavii* were reported between 1890-1891 (Ann. Roy. Bot. Gard. 3(2): 209, pl. 61. 1891). Out of 133 trees of *Magnolia sp.*, only 31 trees were identified



Plantation plot of *M. gustavii* at ICFRE-RFRI, Jorhat, Assam for *ex-situ* conservation

were selected. Prior to translocation "Root ball preparation", was carried out and pitting was done for solarisation of soil one week prior to transplanting. Fungicides (Bavistin), insecticides (Hindola) and root hormones were used to enhance survival and growth of tree. A total of 644 trees have been translocated till September 2023. Survival of transplanted trees is being monitored.

as *M. gustavii* in Dangori Reserve Forest. Owing to no regeneration observed in its natural habitat, *M. gustavii* was reintroduced at Kakopathar under Doomdooma Forest Division for *in-situ* conservation and also planted in the Botanical Garden of ICFRE-RFRI for *ex-situ* conservation. The plantation plot of *M. gustavii* at Kakopathar was handed over to Doomdooma Forest Division, Assam for further conservation. Major threats to the species were identified as illegal felling, Land Use Land Cover (LULC) change, grazing, foraging and extreme weather condition like torrential rainfall, hailstorm etc.



Officials from State Forest Department, Assam visited plantation with re-introduced *M. gustavii*

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

By survey and data collection from all forest divisions of Jharkhand, the abiotic causes of the Sal tree's mortality can be attributed to six factors. These include Staghead (dieback), anthropogenic disturbance, lightning, water logging, injury, and root exposure (soil erosion). MaxEnt model results predicted Sal mortality due to the six factors as highly vulnerable (8.77%), moderately vulnerable habitat (25.55%), poorly vulnerable (26.05%), and unsuitable habitat (39.62%). Porahat forest division recorded the highest (61) numbers of Staghead trees, followed by Ranchi and Hazaribagh West. Sal mortality due to anthropogenic disturbances at altitudinal gradients varies with height. The highest death (35.05%) due to anthropogenic disturbance was observed at >200-400 m elevation. The study helps to develop effective management and conservation strategies to restore *Shorea robusta*, which is on the verge of extinction due to the ever-increasing anthropogenic pressure.



Sal mortality in Jharkhand

Quality Planting Materials of Bamboos production and supply at ICFRE-FRI

Quality Planting Materials of 13 different bamboo species viz. *Bambusa bambos*, *B. polymorpha*, *B. balcooa*, *B. nutans*, *B. tulda*, *B. vulgaris green*, *B. wamin*, *B. vulgaris yellow*, *Dendrocalamus asper*, *D. strictus*, *D. somdevaii*, *Arundinaria falcata* and *Pseudosasa japonica* have been produced and supplied through ICFRE-NBM funded schemes of Small Bamboo Nursery and Hi Tech Bamboo Nursery. In Hi Tech nursery 24,654 and in Small Bamboo Nursery 13,842 plants were sold.

Upgradation and setting up Model Nursery Units for production of quality planting material of forestry species in Himachal Pradesh (ICFRE-HFRI)

After consultation meeting with the officers of Himachal Pradesh Forest Department, Shimla, a list of 32 nurseries was finalized for the up-gradation/ setting up these nurseries as a model nursery. The selected nurseries were visited, the inception reports were prepared and submitted to the CAMPA-CEO HPFD. The inception reports were discussed with the concerned Conservator of Forest and Divisional Forest Officer to prepare nursery specific developmental plan.

Social Forestry, Agro-forestry/ Farm Forestry

2.2.2.

Development of *Buchanania lanzan* (Chironji) based agroforestry system in Central India (ICFRE-TFRI)

Buchanania lanzan + Maize based agroforestry system was established in Chhindwara Madhya Pradesh. Also, sole crop of *Buchanania lanzan* was established in Wardha, Maharashtra. Spacing adopted is 10 m × 10 m. Initial observation showed that collar diameter and height of *B. lanzan* trees were 5.4 mm and 17.2 cm under agroforestry system in Chhindwara and it was 3.5 mm and 14.5 cm, respectively under sole cropping in Wardha. While the yield of maize in *B. lanzan* inter-cropped site was 22.4 q per acre in comparison to 21.7 q per acre in open field.

Development of multi-tier agroforestry systems in selected agro-climatic zones of Madhya Pradesh (ICFRE-TFRI)

Documented the existing agroforestry models in different agro-climatic zones of Madhya Pradesh based on secondary literature. *Gmelina arborea* was selected for site specific multitier agroforestry models. Raised planting stocks of *G. arborea*, *Moringa oleifera*, *Annona squamosa*, and horticulture crops viz. *Psidium guajava*, *Punica granatum* for establishing multi-tier agroforestry systems.

Popularization of *Leucaena leucocephala* (Subabul) based agroforestry system (ICFRE-TFRI)

Evaluated *Leucaena leucocephala* (Subabul) based agroforestry system with intercrops

like *Andrographis paniculata*, *Cyamopsis tetragonoloba* and *Brassica juncea*. The benefit cost ratio (B: ratio) was 1.32, which indicates that the model would be profitable. Popularized this agroforestry model through interaction with farmers, SFDs and wood based industries.



Leucaena leucocephala + Cowpea + Kalmegh agroforestry model in Jabalpur district

Promotion of bamboo based agroforestry system for economic upliftment and livelihood security of farmers in Madhya Pradesh (ICFRE-TFRI)

Bamboo based agroforestry model was successfully established in the farmer's field. Imparted two on site trainings to the farmers at Ranga Farms, Devri-Basaniya village, Jabalpur on management of bamboo culms. A team of NABARD officials also



Maintenance and recording of growth data of four-year old culms of bamboo

visited bamboo based agroforestry plot at: 1. Ranga Farms, 2. Konikala village, 3. Vasan Village, 4. Patan block Jabalpur district and interacted with farmers. The girth and height of culms ranged between 30.2-35.5 cm and 12-15 meters, respectively under four-year old bamboo based agroforestry system. Bamboo growers get additional revenue by selling bamboo branches for stacking of tender vegetables like tomato and support climber beans. Prepared extension material on *Bans Adharit KrishiVaniki Padhti* for the farmers and other stakeholders.



Development of suitable agroforestry models in IGNP command area of Western Rajasthan. (ICFRE-AFRI)

Established different agroforestry models viz., Agri-silviculture (2 ha), Agri-horticulture (1.5 ha) and Boundary plantation (300 RM) on farmer's field in IGNP command areas. The species planted were *Prosopis cineraria*, *Tecomella undulata*, *Cordia myxa*, *Ziziphus mauritiana* and *Dalbergia sissoo*.

Survival of these species ranged from 93 to 99% at the age of three years. Height (2.21m) and collar diameter (5.41 cm) was highest in *T. undulata* in Agri-silviculture trial. Height and collar diameter in grafted *Ziziphus mauritiana* and *Cordia myxa* were around 1.4m and 3.0 cm, respectively. Fruit yield was 1.50 - 8.50 kg per plant in grafted *Ziziphus mauritiana* and it was 0.4-1.5 kg per plant in grafted *C. myxa*. Isabgol was found to be a suitable intercrop in this Agri-horticulture model with economic return of Rs. 5833 per ha in Rabi season.



(A) Growth of *P. cineraria* and *T. undulata* in Agri-silvi system; (B) Growth of grafted *Z. mauritiana* and *C. myxa* in Agri-horti system; (C) Integrated Isabgol crop in Agri-horti system; (D) Growth of *D. sissoo* seedlings on boundary plantation.

Performance of AFRI clones of *Dalbergia sissoo* Roxb. ex DC. under Agroforestry model in IGNP command area in Western Rajasthan (ICFRE-AFRI)



AFRI clones of *Dalbergia sissoo* viz. AFRI-DS1, AFRI-DS2, and AFRI-DS4, along with Sissoo seedlings, have been planted in a Randomized Block Design (RBD) with three replications, using a spacing of 16m x 6m under block plantation and 36 seedlings planted for each treatment. The survival percentage for all treatments stood at 100%.



Intercropping Isabgol with Shisham clone in Agroforestry model at Jaisalmer, Rajasthan

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

Surveys conducted in Assam and Nagaland encompassing 216 households with 28 homegardens in Assam and 87 households with nine home gardens in Nagaland. The study revealed that Agrosil vopastoral is the major agroforestry systems in this region. The average landholdings of agroforestry managers were highest at 1500-2000m altitude (2.50 ± 1.69 ha) and lowest at

>2000m altitude (0.89 ± 0.56 ha). Lower altitude zones were characterized by home gardens, piper betel, and pineapple-based agroforestry systems. Farmers faced challenges of climate vagaries, particularly habitats at 1500-2000m altitude being most exposed. Extreme drought and forest fires were reported at higher altitudes, while intensified rainfall led to landslides and floods at lower altitudes. Farmers observed an increase in disease and pest attacks over a decade. Respondents highlighted the benefits of agroforestry practices, including higher food productivity, reduced workload, economic security, and climate change mitigation.

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

The study was conducted in 63 natural populations of *Pinus gerardiana* in Himachal Pradesh and in Jammu and Kashmir UT. The results revealed that the maximum Chilgoza tree density was recorded from Akpa (530 ha^{-1}) followed by Dubling-1 (520 ha^{-1}) and Luj (510 ha^{-1}) with IVI values 300, 266.22 and 300, respectively. Maximum sapling density recorded from Telangi (340 ha^{-1}) in North West aspect of Kinnaur Forest Division and Maximum seedling density was recorded from Lipa-I (170 ha^{-1}) in the North East aspect of the Kinnaur Forest Division. The results of ecological niche modelling of Chilgoza forests in Himachal Pradesh indicated that of the total 55,673 km² of geographical area of the state, approximately 1.92% area is favourable and another 0.35% area are under medium suitability class for the existence of *P. gerardiana* in H.P. Data

on Chilgoza extraction trend was also documented from 25 villages in Kinnaur, Bharmour and Pangi Forest Divisions. The Jackknife evaluation result indicated precipitation seasonality, precipitation of the warmest quarter, and precipitation of the driest month are the most important variables in determining the potential habitat distribution area of *P. gerardiana* in Himachal Pradesh.



Jackknife evaluation results illustrating the relative contribution of predictor variables to the habitat model of *P. gerardiana*

Assessment, Ecological Niche Modelling and Strengthening of Agroforestry Systems for Securing the Livelihoods of Inhabitants in Cold Desert Region of Himachal Pradesh and Ladakh (ICFRE-HFRI)

Assessed traditional agroforestry systems in 17 villages in the five valleys of the Cold Desert Region of Himachal Pradesh and Ladakh UT during 2023-24. The traditional agroforestry systems and prominent agroforestry species for this region were documented. Soil samples collected from 17

villages were analyzed for the estimation of various soil parameters. The soil pH varied from 7.02 to 9.45, E.C. varied from 9.78 to 26.98µS/m, moisture content varied from 2.11% to 13.94%, organic carbon varied from 1.11% to 2.97%, nitrogen varied from 105.74 to 196.18 Kg/ha, phosphorus varied from 11.17 to 25.04 Kg/ha and potassium varied from 113.47 to 189.21Kg/ha. The seedlings of preferred agroforestry species viz., *Juniperus polycarpus*, *Elaeagnus angustifolia*, *Populus nigra*, *Prunus armeniaca* and *Salix alba* were maintained in the nurseries for distribution to local communities for strengthening of traditional agroforestry systems.

Traditional Agroforestry Systems and Prominent Agroforestry species grown by local communities in Bhaga, Ropa, Pooh, Indus and Nubra Valley of Cold deserts

Locality	Agroforestry Systems	Prominent Agroforestry Species
Bhaga Valley	Agri-silviculture, Agri-horticulture, Agri-horti-silviculture, and Silvipastoral	<i>Hordeum vulgare</i> , <i>Solanum tuberosum</i> , <i>Pisum sativum</i> , <i>Phaseolus vulgaris</i> , <i>Brassica oleracea</i> , <i>B. capitata</i> , <i>B. rapa</i> , <i>Allium cepa</i> , <i>Raphanus sativus</i> , <i>Saussurea costus</i> , <i>Angelica glauca</i> , <i>Inula racemosa</i> , <i>Malus pumila</i> , <i>Salix alba</i> , <i>Populus ciliata</i> , <i>Populus nigra</i> , <i>Juniperus polycarpus</i> , <i>Ribes orientale</i> , <i>Rosa webbiana</i> , <i>Hippophae salicifolia</i>
Ropa Valley	Agri-horticulture and Agri-horti-silviculture	<i>Hordeum vulgare</i> , <i>Solanum tuberosum</i> , <i>Pisum sativum</i> , <i>Brassica capitata</i> , <i>Brassica oleracea</i> , <i>Phaseolus vulgaris</i> , <i>Malus pumila</i> , <i>Prunus armeniaca</i> , <i>Juglans regia</i> , <i>Salix alba</i> , <i>Populus nigra</i> , <i>Populus alba</i> , <i>Robinia pseudoacacia</i> , <i>Pinus gerardiana</i> , <i>Fraxinus xanthoxyloides</i> , <i>Ephedra gerardiana</i> , <i>Rosa webbiana</i> , <i>Colutea nepalensis</i> etc.
Pooh Valley	Agri-horticulture, Agri-horti-silviculture,	<i>Hordeum vulgare</i> , <i>Triticum aestivum</i> , <i>Solanum tuberosum</i> , <i>Pisum sativum</i> , <i>Brassica capitata</i> , <i>Brassica oleracea</i> , <i>Raphanus sativus</i> , <i>Phaseolus vulgaris</i> , <i>Malus pumila</i> , <i>Prunus armeniaca</i> , <i>Salix alba</i> , <i>Populus nigra</i> , <i>Populus alba</i> , <i>Robinia pseudoacacia</i> , <i>Hippophae salicifolia</i> , <i>Ephedra gerardiana</i> , <i>Rosa webbiana</i> , <i>Colutea nepalensis</i> etc.
Indus Valley	Agri-silviculture, Agri-Horticulture, Agri-horti-silviculture, Silvipastoral	<i>Hordeum vulgare</i> , <i>Triticum aestivum</i> , <i>Solanum tuberosum</i> , <i>Solanum melongena</i> , <i>Pisum sativum</i> , <i>Brassica oleracea</i> , <i>Brassica capitata</i> , <i>Brassica campestris</i> , <i>Raphanus sativus</i> , <i>Brassica rapa</i> , <i>Spinacia oleracea</i> , <i>Allium cepa</i> , <i>Solanum lycopersicum</i> , <i>Cucumis sativus</i> , <i>Daucus carota</i> , <i>Raphanus sativus</i> , <i>Medicago sativa</i> , <i>Malus pumila</i> , <i>Prunus armeniaca</i> , <i>Salix alba</i> , <i>Salix fragilis</i> , <i>Populus nigra</i> , <i>Populus ciliata</i>
Nubra valley	Agri-silviculture, Agri-horticulture, Agri-Horti-silviculture, and Silvipastoral.	<i>Hordeum vulgare</i> , <i>Triticum aestivum</i> , <i>Pisum sativum</i> , <i>Solanum tuberosum</i> , <i>Solanum lycopersicum</i> , <i>Brassica oleracea</i> , <i>Brassica capitata</i> , <i>B. campestris</i> , <i>Daucus carota</i> , <i>Phaseolus vulgaris</i> , <i>Lens culinaris</i> , <i>Allium cepa</i> , <i>Spinacia oleracea</i> , <i>Raphanus sativus</i> , <i>Vigna mungo</i> , <i>Cucumis sativus</i> , <i>Cucurbita pepo</i> , <i>Allium caesium</i> , <i>Lagenaria siceraria</i> , <i>Malus pumila</i> , <i>Prunus armeniaca</i> , <i>Salix alba</i> , <i>Salix fragilis</i> , <i>Rosa webbiana</i> , <i>Hippophae rhamnoides</i> , <i>Hippophae salicifolia</i> , <i>Rosa webbiana</i> , <i>Myricaria germanica</i> , <i>Setaria sp.</i> , <i>Medicago sativa</i>



Agri-silviculture System in Indus Valley



Silvi-Pastoral System in Indus Valley

Watershed Management

2.2.3.

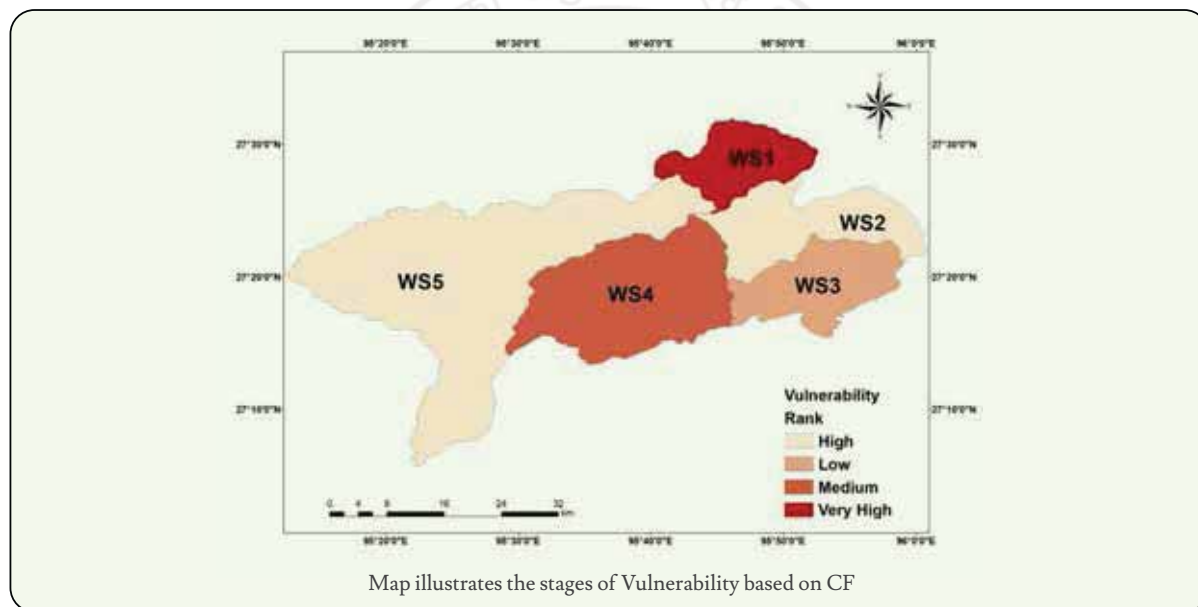
Hydrological Modelling for Predicting Runoff in Ungauged Dihing Watershed in Assam Using Multi-Source Satellite Data (ICFRE-RFRI)

The geo-morphometric parameters of the study area have been generated using multi decision

analysis and identified the soil erosion vulnerable region of the study site by generating the spatial map. The ground weather data has been collected at Jeypore Automatic Weather Station (AWS) site and Dillighat station. The validation of some gridded precipitation data has also been done.

Principal morphometric parameters for the erosivity ranking component

Sub-watershed	Linear parameter	Areal parameters					Slope	HI	Cp	Rank
	R_b	D_d	F_s	R_f	R_c	R_e				
SW1	4	3	1	2		2	5	1	2.25	Very high
SW2	2	2	3	3	2	3	4	3	2.75	High
SW3	5	4	2	5	3	5	1	5	3.75	Low
SW4	1	1	5	4	5	4	2	4	3.25	Medium
SW5	3	5	4	1	1	1	3	2	2.5	High



The final ranking suggests that WS1 is the most susceptible region to erosion. As a result, they require attention to implement both structural and non-structural procedures as corrective measures

against soil erosion. The results of the study have given a general idea of the Dihing watershed erosion status using the HI and CF-MCDM approaches.



A stream at Dihing watershed



Data collection from Automatic weather station

Spring Rejuvenation for Water Security in Himalayas (ICFRE-RFRI)

A cluster of four springs were selected for rejuvenation in Lathao village, Namsai, Arunachal Pradesh. Delineated the spring shed, Land Use Land Cover (LULC), aspect, forest cover, forest type, location, soil type, slope maps was prepared for interventions. About 40% households were identified as dependent on spring water. Dugged out 12 conical ponds to provision seepage capacity of eight lakhs liter water in the spring shed area. Constructed 10 nalah bunds to augment the seepage of rain water. Two reservoir tanks were constructed to provide spring water round the year. A water committee has been formed with the representatives from stakeholders and villagers to

look after the springs and distribution of water. Rain water harvesting systems to be established along with 10 more nalah bunds. So far under the project trained 106 para-hydrogeologists through workshops and conducted in Arunachal University of Studies, Namsai and Krishi Vigyan Kendra, Namsai, Arunachal Pradesh. A manual has been published.



Training of Para-hydrogeologists in Arunachal University of Studies Namsai, A.P.



News report on para-hydrogeologist training



2.3 GENETIC IMPROVEMENT

Projects under the Theme

A. PLAN

Completed	04
Ongoing	15
New	01

B. EXTERNALLY AIDED

Completed	06
Ongoing	25
New	11

Conservation of Forest Genetic Resources

2.3.1.

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

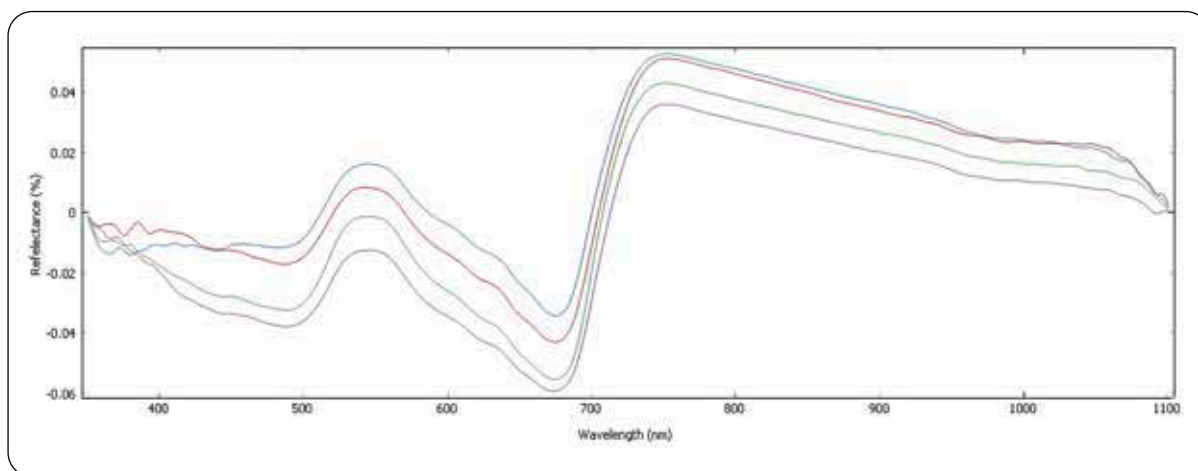
Lophopetalum wightianum Arn. is an important tree species having a good timber value and other multipurpose uses like nesting tree and fodder for animals. Natural regeneration of *L. wightianum* is very poor due to recalcitrant nature, leading to the depletion of species from its natural habitat. A total of 19 seed sources were identified in Alipurduar, Coochbehar and Jalpaiguri Divisions of North Bengal and regeneration studies were carried out in the identified populations. Two seed sources of Jalpaiguri division, two seed sources of Coochbehar division and six seed sources of Alipurduar division have been found to be 'fair' in regeneration. The growth parameters of the identified populations were recorded. The height of the populations ranged from 10 to 36 m and

GBH ranged from 0.93-3.16 m. The dominated associated tree species found were *Schima wallichii*, *Shorea robusta*, *Michelia champaca*, *Mesua ferrea*, *Terminalia tomentosa*, *Dillenia indica*, *Neolamarckia cadamba*, *Syzygium cumini*, *Lagerstroemia speciosa*, *Cinnamomum glaucescens*. The associated shrub species are *Eupatorium adenophorum*, *Clerodendrum infortunatum*, *Diplazium esculentum*, *Magnolia pterocarpa*, *Eupatorium odoratum*, *Salvinia cucullata*, *Ptilostigma malabaricum*. A field trial has been established at UdaysinghJote with the 10 seed sources. The height and collar diameter of the saplings in the trial plot were recorded. The height of the saplings ranged from 0.76-1.30m and collar diameter ranged from 0.7-1.1 cm. The seed viability study was conducted at 3 days interval. The seed viability on the first day after seed collection was 82.8% which gradually decreased to 75%, 64%, 51.2%, 35.9%, 25% and 17.2% on 4th, 7th, 10th, 13th, 16th and 19th day. Seeds viability was lost after 19 days.

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

The natural populations of *Pterocarpus santalinus* in Chittoor, Tirupati, Annamayya and Kadappa forest divisions were surveyed and 1513 trees were marked for seed collection and establishment of field gene bank. Genealogical study was conducted to delineate seed zones. A total of 300 individuals were shortlisted for multilocus genotyping using genomic SSR markers. Two novel barcodes discriminated *P. santalinus* from

P. dalbergioides, *P. indicus* and *P. marsupium*. Low depth whole genome sequencing was completed in 80 individuals spanning the natural distribution range of the species and 22.9 million variants were predicted. The potential of leaf spectral signatures to distinguish the four *Pterocarpus* species (i.e., *P. santalinus*, *P. marsupium*, *P. indicus* and *P. dalbergioides*) was assessed and the results revealed that the red-edge region of the visible spectra showed the highest potential to discriminate the above species. The study substantiates the use of leaf spectral data in species discrimination.

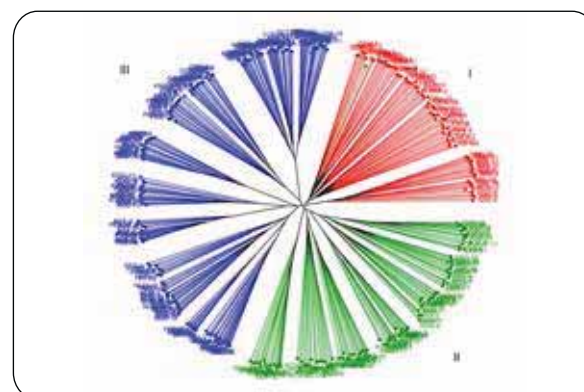
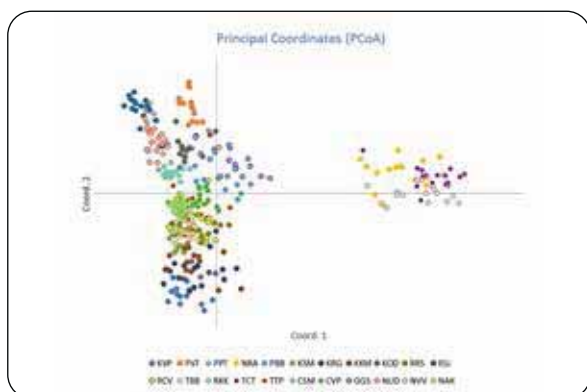


Mean reflectance factor spectra of *P. dalbergioides*, *P. santalinus*, *P. indicus* and *P. marsupium*

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

The study is focused on genome sequencing, identification, and validation of microsatellite markers of *Pterocarpus santalinus*. Analysis of 361 samples from 22 populations revealed a mean of 7.79 alleles, with lower heterozygosity (0.65) compared to other woody tree species. High

polymorphic information content (0.94) and high genetic differentiation (0.3) was observed among populations. Notably, populations from Tirupati ($He=0.93$) and Chittoor ($He=0.91$) showed high diversity while ChitaletiPati Base Camp had the lowest ($He=0.436$). Populations at lower latitudes displayed greater diversity. AMOVA indicated high within-population (72%) and moderate among-population (28%) variation. STRUCTURE analysis grouped individuals into three clusters. Genetic and geographic distances showed a positive but insignificant correlation. These findings lay a genetic groundwork for the species' conservation, management, and restoration efforts.

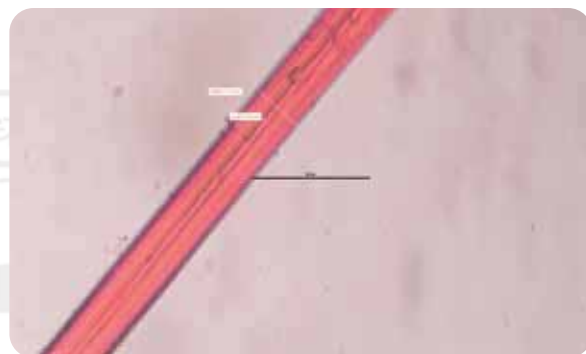
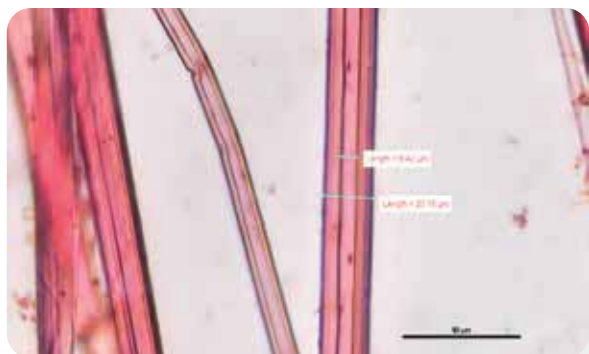


PCoA and Neighbor-joining tree of 361 *Pterocarpus santalinus* samples based on genetic distance

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

Surveyed and collected 495 accessions of germplasm of selected bamboo species viz., *Bambusa balcooa*, *B. nutans*, *B. pallida*, *B. vulgaris*, *B. polymorpha*, *B. cacharensis*, *Melocanna baccifera*, *Dendrocalamus hamiltonii*, *D. giganteus*, *D. longispathus*, *Schizostachyum dullooa* and *Thyrsostachys oliveri*. Recorded gregarious flowering in *Dendrocalamus longispathus* from Mizoram and Tripura; in *B. balcooa* and *S. dullooa* from Dibrugarh district and in *B. nutans* from Majuli district. Seeds of *D. longispathus* and *B. tulda* were collected. Wood density, shrinkage, moisture content and fibre quality were evaluated for *Bambusa tulda*, *B. balcooa*, *B. nutans*, *B. pallida* and *D. hamiltonii*.

Wood density recorded with respect to, *B. tulda*: 0.63-0.90 at base, 0.63-0.88 in middle portion and 0.70-0.90 at apex; *B. balcooa*: 0.55-0.89 at base, 0.59-0.95 in middle portion and 0.60-0.89 at apex; *B. nutans*: 0.65-0.86 at base, 0.75-0.93 in middle portion and 0.73-0.89 at apex. Shrinkage (%) along wall thickness, in *B. balcooa*: 6.23±2.01 at base, 8.74±3.96 at middle portion, 9.93±5.40 at apex; in *B. tulda*: 7.55±2.60 at base, 9.16 ±5.67 at middle portion, 6.51±3.88 at apex. Alcohol- toluene solubility, lignin and hollocellulose were estimated for *B. tulda* (3.78±1.16, 28.17±4.47, 64.84±3.47) and *B. balcooa* (3.54±0.83, 33.46±10.27, 64.21±1.50). Fibre length, fibre diameter and lumen diameter were estimated for *B. tulda* (21.74±5.59, 3.30±0.98, 3.64±0.99), *B. balcooa* (25.07±5.23, 3.05±0.75, 3.92±1.26), *B. nutans* (19.85±4.17, 3.71±1.68, 2.65±0.79) and *D. hamiltonii* (18.04±2.43, 4.19±1.48, 2.92±0.60).

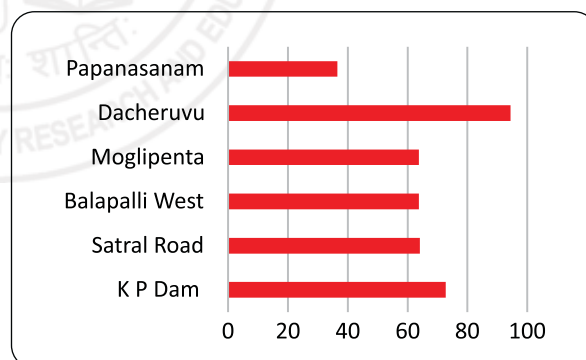


Microscopic observations of bamboo fiber

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

Field surveys were conducted during July-August, 2023 in the natural range of *Syzygium alternifolium*. Fresh seeds were collected from six populations and processed for raising nursery. Nurseries were raised at ICFRE-IFB Hyderabad and BIOTRIM, Tirupati. Population-wise variation was observed in the germination percent, minimum was recorded for Papanasanam, T.N. and maximum was for seeds from Dacheruvu, Andhra Pradesh. Fresh leaf samples were collected for genetic diversity analysis. Eleven ISSR primers were used to screen for polymorphism among the populations. Nine primers amplified only a single DNA fragment,

whereas two primers viz., (CT)8 AG and (TG)08A, amplified polymorphic bands.



Population-wise variation observed in seed germination of *S. alternifolium*



Field survey and seed collection of *S. alternifolium* from the natural range



Nursery raising at ICFRE-IFB Hyderabad

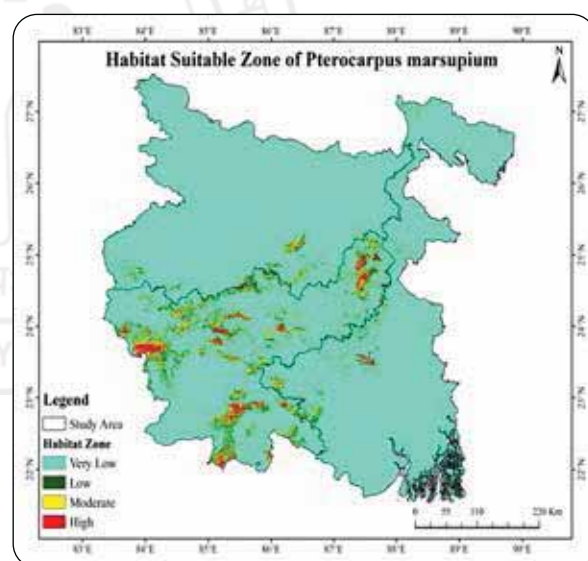
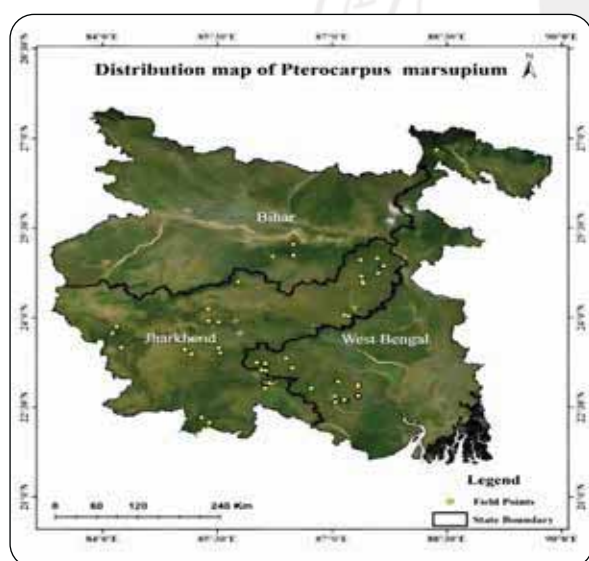
Genetic improvement of *Pterocarpus marsupium* Roxb. through germplasm collection and conservation in eastern India (ICFRE-IFP)

Germplasm collection was done in diverse areas falling in three agro climatic zones of Jharkhand, Bihar and West Bengal. A total of 227 CPTs have been selected from diverse areas in three states. Field data compilation was completed with respect to morphological traits. Seedlings were raised from seeds of 40 trees and two progeny trials were established at Chandwa Research Station, Latehar

district and Arid village, Ranchi district. The progeny trial in Chandwa exhibited 92% survival irrespective of families and the maximum height and girth was noted in family no. 2 and 4 which exhibited 11.8 feet and 11.45 feet height and 9.5 cm and 12 cm girth, respectively. First time progeny trial of the species has been established in eastern India. These progeny trials will be converted to Seedling Seed Orchards for future breeding programmes. Mapping for distribution and occurrence of Bijasal in eastern India was done. The habitat distribution of *P. marsupium* was generated through maxent software using 11 bioclimatic variables and occurrence data.



Data recording, pruning and maintenance of progeny trial of *Pterocarpus marsupium* in Chandwa, Latehar, Jharkhand



Occurrence point and habitat suitable zones of *Pterocarpus marsupium* in Eastern India

Phytochemical, morphological and molecular evaluation of RET medicinal plant *Trillium govanianum* (Nag chhatra) distributed in Northwestern Himalayan Region for its conservation and utilization (ICFRE-FRI)

Rhizomes of *Trillium govanianum* were collected from diverse sources of Himachal Pradesh and Uttarakhand, and planted as germplasm bank at ICFRE-FRI field research station at Chakrata and Khirsu. Leaf samples from three populations were collected for DNA based genetic evaluation of base populations. DNA has been extracted and screened

for SSR and ISSR markers. Previously validated SSR markers were identified through the literature survey and 12 SSRs were synthesized for screening. However, none of these found polymorphic in the analyzed samples. Therefore, a set of ISSR markers were utilized for PCR amplification and genetic evaluation. A total of three populations were screened with four ISSR primers, and 82 bands were generated. After assessment of DNA banding profiles, it was perceived that population two had maximum percentage of polymorphic bands (70.76%). Data has been scored and subjected to preliminary analysis giving an indication of low overall genetic diversity in the species.

Inducing the Variation in *Santalum album* Linn. by Polyploidy Techniques for Genetic Improvement (ICFRE-IWST)

Induction of polyploidy in sandalwood was initiated by treating seeds and tissues under laboratory culture with chemicals like oryzalin and colchicine.

Shoot tips, callus and somatic embryos were used as explants for tissue culturing and to induce polyploidy. Seeds exposed to 50 Gy irradiation treatment showed variation in number of leaves. Treatment with 0.4 % colchicine for six hours resulted in narrow leaf shape than normal seedling but the seedlings did not survive beyond 60 days.

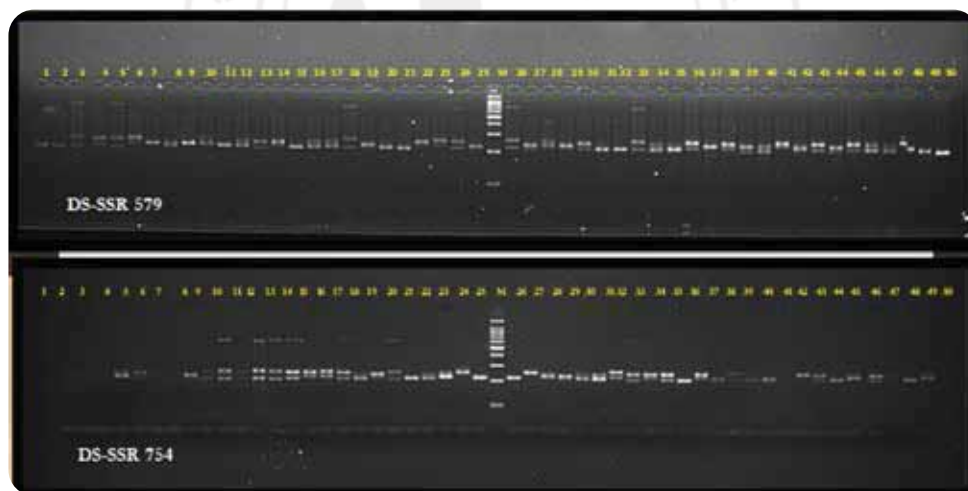
Tree Improvement

2.3.2.

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

About 150 new genotypes were added into existing germplasm of *Dalbergia sissoo*, which were collected from diverse forest and non-forest areas of UP, MP, Haryana, Punjab, Rajasthan, Himachal Pradesh and Uttarakhand. Twenty of these selected CPTs were also planted in multilocation trials at Jhansi, Uttar Pradesh and Bhatinda, Punjab, for evaluation of productivity traits. Novel 25,596 SSRs were developed through low depth whole

genome sequencing. Further, 84 primers pairs were validated and 12 of these found polymorphic. For characterization, polymorphic SSR loci were amplified in 250 individuals. Through repeated pathogenicity test, A3 isolate of *Fusarium* sp. was found most virulent and therefore used for mass screening of genotypes. Further, based on the symptomology these were categorized into resistant (R), moderately resistant (MR), and Susceptible (S). In total, 19 genotypes were screened in which six (1008, 9093-1, 046, 031, 5012 and 528) were resistant, seven (5008, 5018, 024, 9063-1, 41, 5019 and 016) were moderately susceptible, and six (9058-2, 9065-1, 169, 033, 5009 and 057) were susceptible.



SSR profiles of *Dalbergia sissoo* genotypes using selected polymorphic primer pairs

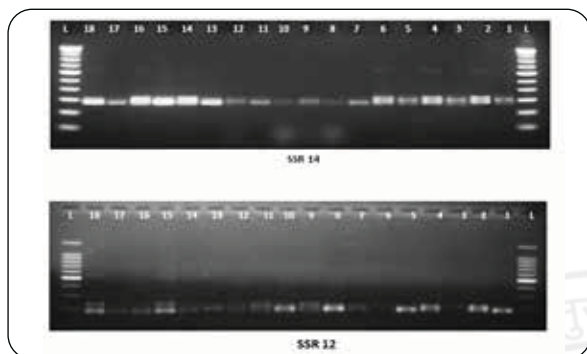
Clonal evaluation and establishing seed orchards for increasing productivity in *Ailanthus excelsa* (ICFRE-IFGTB)

Periodical biometric data were collected from existing field trials and the highest plant girth was recorded in the clone IFGTBAE- 2 and MS-11 at the age of two years at 3m x 3m spacing at Manankarai, Pilavakkal and Thuvrankurichi regions. Whereas, the highest plant girth was recorded for the clone

IFGTBAE- 12 in 5m x5m spacing at Manankarai and Pilavakkal regions. One acre of gap plantation was done in two progeny trials cum SSOs at Gudalur and Thuvrankurichi Field research stations. Alternative approach of controlling the pest using naturally occurring entomopathogenic bacteria *Alcaligenes* was adopted against target pest *Eligma narcissus* and the 16S ribosomal RNA gene sequence of *Alcaligenes* sp. has been submitted to NCBI with Accession no. OM475727A.

Identification, Ecological Assessments for Selection and Screening of Superior and Insect-Pest Resistant Clones of *Salix* for their Cultivation, Production Trends and Conservation in the Cold Deserts of Himachal Pradesh and Jammu and Kashmir (ICFRE-HFRI)

Field surveys for identification of *Salix* populations were conducted and geo-reference details along



SSR profile of *Salix*

with phenological observation were recorded. The socioeconomic survey was carried out in 10 villages and data collected from the field was analyzed for the estimation of carbon sequestration potential of Gue-1, Gue-2 and Lidang Sites. The CO₂ sequestration potential (CO₂ e t ha⁻¹) was recorded maximum at Ladang site (i.e. 467.965 CO₂ e t ha⁻¹) and lowest at Gue-2 Site (393.736 CO₂ e t ha⁻¹). Diversity assessment using SSR markers revealed highest average number of effective alleles in the Gulling population followed by the Takcha and Mud populations respectively.



Recording of data to assess DBH and collection of samples for assessment of carbon stock potential and biomass

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

Carried out extensive field surveys in Thiruvananthapuram district, Kerala and selected 14 Candidate Plus Trees of *Haldina cordifolia*. A total of 155 CPTs have been selected till date. Wood property studies were completed in 30 trees. Fibre length varied from 629.81(HC 08) to 1212.81 (HC 28) μm with a mean of 933.01 μm . HC 28 ranked first with reference to fibre diameter (32.99 μm) and HC 11 recorded the minimum value (18.39 μm) with a mean value of 25.19 μm . Lumen diameter ranged between 11.24 μm (HC 03) and 25.04 μm (HC 28) with average value of 16.95 μm . Fibre wall thickness varied from 4.89 μm (HC23) to 2.41 μm (HC 12) with average value of 3.39 μm . Double wall thickness exhibited variation from 9.77 μm (HC23) to 4.83 μm (HC 12) with midpoint value of 6.77 μm whereas Specific gravity varied between 0.62 (HC 17) to 0.71 (HC 21) with mean of 0.75. The plus tree, HC 11 recorded highest Felting Coefficient value of 53.58 and HC 08 recorded a lowest value of 25.52 with midpoint value of 39.33 whereas HC 03 showed highest Runkels ratio of 0.71 and HC 13 exhibited 0.25 with average value of 0.44. Isenberg Coefficient value ranged between 0.42 (HC03) to 0.25 (HC13) with mean value of 0.28 whereas HC 30 (0.85) recorded highest coefficient of fibre flexibility and HC 20 showed 0.60 value with midpoint value of 0.67. Due to difference in the genetic constitution of different plus trees, selected 30 plus trees exhibited a very high genetic variation for the studied wood property parameters.

Screening and assessment of the untapped potential of *Mitragyna parvifolia* (Roxb) Korth an indigenous genetic resources for Timber (ICFRE-IFGTB)

Conducted extensive field survey in different agro-climatic zones of Tamil Nadu, identified and selected 80 candidate plus trees (CPTs) based on superiority over morphometric traits and without any insects pest attack and disease infections. In Tamil Nadu, the longitudes and latitudes of selected natural populations varied from E76°40'49.8" to E77°55'56.65" and N08°41'31.32" to N 12°38'49.80 respectively. The altitude varied from 447 m to 1066 m. Among the selected populations in Tamil Nadu, tree height varied from 11 m to 30 m, clear bole height varied from 1m to 16 m and girth at breast height varied from 86 cm to 420 cm. Fruits were collected from selected CPTs and measured 100 fruits weight, its varied from 32g (Siruvani) to 141 g (Sathiyamangalam), seeds are very small (about 8000-12000 numbers per gram of seeds). Seed germination percentage varied from 40-75%. Seed germination started one week after sowing and continued up to one month. Among the selected *M. Parvifolia* CPTs wood density varied from 0.536 (Sathiyamangalam) to 0.741 kg/m³ (Top slip) and also wood moisture content varied from 31% (Mudumalai) to 47% (Sathiyamangalam).

For progeny trail of *M. parvifolia* established in ICFRE-IFGTB-FRS Thuvankurichi. Six and Twelve monthly biometric data was collected, on 12 month maximum height was 166 cm and 29 mm collar diameter (CDM) for CPT-8 and minimum height 48 cm and CDM 8mm was observed for CPT 11.

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

Biometric and qualitative data were collected from three clonal trials at Panampally, Gudalur and Thalavaipettai. Total height varied from 134.90 cm (clone 12) to 181.30 cm (clone 40) while collar diameter ranged from 2.75 cm (clone 28) to 4.37 cm (clone 11). Biomass index ranged from 1240.54 cm³ (clone 28) to 3335.27 cm³ (clone 11). The second-year data recorded from Gudalur indicated that total height, collar diameter and biomass index were significant at 5% level.

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

Surveys were carried out in natural forest and plantations in farmlands of Tamil Nadu and Kerala and selected five CPTs based on growth superiority, clear bole and freedom from pests and diseases. In total 60 CPTs were selected since the project was commenced. Biometric, phenology and reproductive characters were recorded and variation in fruit, seed, seedling germination characters and wood traits were documented. Maximum seed moisture content (17.63%) was observed in seeds from Kothamangalam. Kulathupuzha and Vazhachal recorded the highest values for seed area (1.81 cm²), seed length (1.97 cm), seed breadth (1.23 cm), and seed perimeter (7.01 cm). Maximum values for seed germination percentage (98.50%), germination index (9.64) was recorded in Anavayal and Kothamangalam. High values of mean daily germination (2.45), seedling vigor index (47.02), and peak value (4.69) were recorded in Vadakadu. Two progeny trials with a broad genetic base were established at Udumbannor, Konni and Kozhipara, Palakkad with 28 open pollinated families which will eventually be converted into seed orchards. Additionally, a vegetative multiplication garden with the short-listed clones was established and the variation in shooting and rooting potential of different clones was studied. Among the different clones IFGTBGA-32 and IFGTBGA-43 recorded higher rooting (91.00%), shooting (91.00%) and survival percentage (80.00%).

Studies on genetic variability, reproductive biology, and optimization of nursery and propagation techniques of *Diospyros ebenum* and *Xylia xylocarpa* (Phase-I) (ICFRE-IFGTB)

The natural distribution range of both species was enumerated from literature. Field surveys were conducted and 50 CPTs of *Diospyros ebenum* were marked in Anamalai Tiger Reserve, Tamil Nadu and 10 CPTs of *Xylia xylocarpa* were identified

in Anamalai Tiger Reserve and Madikeri forest division of Karnataka. Nursery techniques are being optimized for both species and variations in leaf and seed characters are being documented using image analyser.

Evaluation of *Casuarina* hybrid clones for higher productivity and wood quality in Odisha State (ICFRE-IFGTB)

This project aims at deploying the most high-yielding varieties of *Casuarina* in farm forestry and agroforestry plantations in Odisha State through multilocation testing. Established four clonal trials at Bhubaneswar, Balasore, Sambalpur and Balangir in collaboration with Odisha Forest Department. These trials included four hybrid clones and seed sources from seed orchards and local plantations. Large plot size of 49 trees were used in these trials to test the accessions under plantation-like conditions. All the four trials have established successfully recording high survival of 87 to 95% at the age of six months.

DUS Centre for *Eucalyptus* and *Casuarina* (ICFRE-IFGTB)

ICFRE-IFGTB is designated as a Centre for conducting DUS (Distinctiveness, Uniformity and Stability) testing as per provisions of the Protection of Plant Varieties and Farmers Rights Act, 2001. Six varieties of *Casuarina* and one variety of *Eucalyptus* have been registered under the Act so far. The reference and example varieties of the two species are assembled and maintained in Forest campus and Karunya Nagar (Coimbatore), Kallakurichi, Salem and Marakkanam. They were assessed for all DUS characters notified for the two species. The Centre is also working on expanding the DUS testing procedure to *Eucalyptus urophylla* in collaboration with Navsari Agricultural University, Gujarat. It has also supported paper industries in the process of submitting applications to register the varieties of *Casuarina* and *Eucalyptus* developed by them.

DUS Centre of *Melia dubia* (ICFRE-IFGTB)

DUS Character assessment of *Melia dubia* clone GK 10 was carried out at Panampally, Kerala and Thalalalai, Tamil Nadu. The unique identity of the clone based on the descriptors developed - the stem scar length (Long), width (Broad), stem lenticels appearance (flat), Pistil Length (Short), Fruit Width (Narrow), Fruit Shape (Ellipsoid), Endocarp Length (Medium), Endocarp Width (Narrow), Endocarp: Shape (Ovoid) were highly uniform across different ramets and clearly distinguished it from the reference clone MD11. This clones has been submitted to the PPVFRA for registration as an extant variety.

Strengthening collaborative tree seed supply systems for restoration in Asia (ICFRE-IFGTB)

This project is funded by UK-DARWIN and is aimed at improving tree seed supply for forest and landscape restoration. About 100 forest nursery operators, seed suppliers and seedling distributors from Tamil Nadu were interviewed for assessing

the current capacities and to develop modules for training programs based on their requirements. Three trainings were imparted to the grass root level staffs of the forest department and to support the Tamil Nadu Greening Mission program. The findings were presented in the International Workshop held at Bandung, Indonesia in February 2024.

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

A total 160 wood core samples were extracted from 16 populations of *Hardwickia binata* in Madhya Pradesh State. The selected trees were also assessed for girth, bark thickness, sap wood and heartwood proportion. The analysis revealed

that bark thickness ranged from 0.5-1.0 cm with an average of 0.95 cm; sapwood thickness from 4.5 - 5.5 cm with an average of 5.01 cm and heart wood diameter from 7.5-9.5 with an average of 8.0 cm.

Quadrates of 10 × 10 m laid out in compartment No.157 and 161 of Narsinghpur range under Narsinghpur forest division for natural regeneration studies. It was observed that regeneration of *H. binata* is poor in this area. Disturbances such as animal grazing and fire have contributed immensely to the poor regeneration.



Selected population of *H binata*



Collection of wood core sample of *H binata*



Collected wood core samples of *H binata*

Selection and Evaluation of *Haldina cordifolia* (Haldu) for Higher Wood Productivity (ICFRE-TFRI)

Thirty Candidate Plus Trees (CPTs) of *Haldina cordifolia* were marked after extensive surveys in three States of Central India i.e. Madhya Pradesh, Maharashtra and Chhattisgarh. Progenies of these CPTs were raised and two trials were established at Jagmandal Range, Mandla, Madhya Pradesh and at Guru Ghasidas Vishwavidyalaya, Bilaspur, Chhattisgarh in July 2023. The height of *H. cordifolia* seedlings raised in polybags ranged from 80 cm to 120 cm with a diameter range from 8 to 13 cm after one year of growth.



Plantations of *H cordifolia* at Mandla (A), and Bilaspur (B)

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

Evaluation trials of *Melia dubia* have been established in five sites Morena, Chhindwara, Nagpur, Amravati and Durg by planting 50 improved

varieties/genotypes with three replications in a randomized block design. Genotypes 700, 2035, 2094, 2059, 2028, 2084, 2093 and 2025 performed better in terms of height and collar diameter among all in the tested sites, however these genotypes need further evaluation for site specific recommendation.

Evaluation of accessions of *Withania somnifera* (Ashwagandha) collected across India for varietal development (ICFRE-TFRI)

Seeds of *Withania somnifera* was collected from different States i.e. Chhattisgarh (Bilaspur), Himachal Pradesh (Shimla and Solan), Maharashtra (Nagpur and Latur), Uttar Pradesh (Varanasi), Rajasthan (Jodhpur) and Bihar (Patna and Bhagalpur) for screening and field evaluation. Multiplication through seeds of these germplasm was carried out at the institute for phytochemical screening. The height of *W. somnifera* seedlings raised from seeds of 11 different locations (Mandsaur, Neemuch, Amarkantak, Latur, Varanasi, Bilaspur, Shimla, Dehradun, Jodhpur, Hisar, Jhansi)

ranged from 30 cm (Amarkantak) to 60 cm (Jhansi) after five months of growth in polybags.



Multiplication of *W. somnifera* germplasm

Development of Seed Production Areas of Economically Important Tree Species of Rajasthan (ICFRE-AFRI)

Extensive surveys were carried out in Rajasthan for the identification of natural populations of targeted species and identified six potential stands of *Prosopis cineraria* in six districts, two of *Tecomella undulata* in two districts, seven of *Ziziphus mauritiana* in four districts, 14 of *Ziziphus nummularia* in 10 districts, two of *Salvadora persica* in two districts and five of *Salvadora oleoides* in four districts. Quadrants of 30×30 m were laid down at each of the identified sites and the location and morphological data like GPS location, height, girth, crown, number of branches, flowering, fruiting percentage and health were recorded for each of the trees.



Map representing the identified populations of *T. undulata*, *P. cineraria*, *Z. mauritiana*, *Z. nummularia*, *S. persica* and *S. oleoides* in Rajasthan.

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

Demonstration plot cum clonal trials were established at two places viz. Tajpur village, Bhagwanpur, Begusarai and Barnihar, Narkatiyaganj, West Champaran. In Begusarai, 31 accessions were planted while demonstration plantation of released clones were established in West Champaran and Begusarai districts. In Barnihar, Narkatiyaganj, West Champaran the demonstration plot of two released clones viz. Arambh and Khushi were established while in Tajpur village, Bhagwanpur, Begusarai demonstration plantation of Kshitij were established. Poplar based agroforestry models viz. Poplar-Litchi, Poplar-Sugarcane and Poplar-Maize were established in Muzaffarpur, Narkatiyaganj and Araria for estimating the economics of the model. A nursery has been raised through stem cutting of released poplar clones and other accessions of poplar for establishing field trial in next planting season and to provide plants to the stakeholders. Non-exclusive license for micro propagation of clones has been signed with two farmers in Bihar.



Poplar clonal field trial cum Poplar-Sugarcane agroforestry model at Narkatiyaganj, West Champaran (Bihar)



Poplar-Maize agroforestry model developed at Nathpur, Araria West Champaran (Bihar)



Poplar-Turmeric agroforestry model at Karaila, Muzaffarpur, Bihar

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

Extensive surveys were conducted in different districts of Jharkhand and West Bengal to identify CPTs. In addition to the 49 CPTs selected in previous year, 31 new CPTs have also been identified in this year, totalling 80 Kusum CPTs. Ripened fruits were collected from the CPTs and phenotypical data of these fruits and seeds data were recorded. Oil extraction from seed samples collected from all CPTs was performed and an average of 32-35% oil content was recorded.



CPTs of *Schleichera oleosa* (Kusum)

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

Based on plant architecture and growth data, 25 individual of *F. semialata* and 30 individual of *F. macrophylla* were selected and seeds were collected for raising progeny trial in the present year. Both the species were inoculated with brood lac in the month of July 2023 and lac was harvested in January 2024. The per plant lac yield was recorded and based on lac settlement, encrustation of lac and per plant lac yield, 30 individuals of *F. semialata* and 18 individuals of *F. macrophylla* were selected for raising advance generation progeny trial. The progeny of FSC 1 reported to produce Lac yield (KG) ranging from 0.520kg to 1.190kg whereas FMC 5 reported to produce Lac

yield (KG) ranging from 0.35 kg to 2.305 kg. The *Flemingia*-Papaya based agroforestry model was established at Roro, Khunti, New Bhusur, Ranchi and Lalgotwa, Ranchi.



Field trial of FMC-5 (*F. macrophylla*) established at Roro, Khunti



Lac encrustation of *F. semialata* (FSC-1)



Field trial of *F. semialata* (FSC-1) at Roro Khunti



Establishment of Flemingia-Papaya agroforestry

Assessment of *Melia dubia* for growth performance in multilocal trials in Kerala (ICFRE-IFGTB)

The project aims to identify site-specific clones of *Melia dubia*, for use as an alternative pulpwood species in Kerala. Clonal trials were

raised in Panampally, Anaikatty, Mathilagam and Pathinamthitta, Kerala in an area of 0.2 hectare with 20 selected clones and seedlings as control. Annual growth performance was recorded in all the trials except Pathinamthitta since it was raised in August 2023. The second year results revealed that clone numbers 12, 10, 5, 6, and 8 performed better across two sites.

Vegetative Propagation

2.3.3.

Establishment of small bamboo nursery at Khirsu (ICFRE-FRI)

In the year 2019 project was initiated with funding from National Bamboo Mission (BTSG-ICFRE) for Establishment of Small Bamboo Nursery at Field Research Station of Forest Research Institute at Khirsu, Uttarakhand and also for establishment of demonstration trials in the hills of Uttarakhand. Planting stock of species like *Drepanostachyum falcatum*, *Thamnocalamus spathiflorus*, *Yushania anceps*, *Himalyacalamus falconeri*, *Phyllostachys mannii* and a few other species were multiplied using offsets. The plants were maintained using fertilizer application and data collected on their physical and physiological conditions. Plants were raised for *Drepanostachyum falcatum* (891), *Himalya calamus falconeri* (30), *Thamnocalamus spathiflorus* (392), *Phyllostachys mannii* (101), *Sinarundinaria anceps* (530).

Development of *in-vitro* cloning protocol for micropropagation of thornless variety of *Prosopis cineraria* (Khejri) (ICFRE-AFRI)

To obtain *in vitro* propagation response of the thornless variety of *P. cineraria*, optimization of surface sterilization protocol was performed with different sterilizing agents such as ethanol, sodium hypochlorite, and mercuric chloride at different concentrations and periods. The lowest contamination of 31% with the highest bud break of 93% was found at 0.1% mercuric chloride for 1 minute.

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

Swietenia macrophylla (mahogany) is one the most commonly used high demand wood in the timber industry. Since the seeds are recalcitrant, their viability is very short. Hence vegetative propagation, especially tissue culture enables mass production of selected germplasm. The Institute developed a *in vitro* working protocol for the Shivashakti Agritec Limited, Hyderabad (funding agency). The barriers related to contamination and shoot growth were eliminated and rooting was initiated in a short period of one year. The complete protocol with media composition for contamination free initials, shoot multiplication and rooting have been provided to the Company along with culture bottles as per the terms of reference.



Bud Break of thornless *Prosopis cineraria* (Thar Shobha).

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

Seeds and cuttings of *Plumbago zeylanica* and *Celastrus paniculatus* were collected from 16 locations of different agro-climatic zones of Chhattisgarh. Rooting of stem cuttings treated with

200 ppm IBA was 70% in *Plumbago zeylanica* and 40% in *Celastrus paniculatus*. Germination of seed was 80-90% in *Plumbago zeylanica* and 60-70% in *Celastrus paniculatus*. Plants were multiplied through various micro-propagation methods like *In vitro* shoot cultures and organogenesis in both species. Germplasm bank of *P. zeylanica* and *C. paniculatus* with accessions from different locations of Chhattisgarh has been established at TFRI, Jabalpur.



Stem cuttings of *Celastrus paniculatus* and *Plumbago zeylanica*



Shoot cultures of *Celastrus paniculatus* and *Plumbago zeylanica*

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

Experiments on *in-vitro* culture establishment showed that maximum number of shoots (4.27) was recorded in MS media supplemented with 1 mgL⁻¹ TDZ, and maximum number of leaves (3.18) was recorded with 0.5 mgL⁻¹ TDZ. Maximum rooting percentage (33 %) was recorded in semi-solid MS media fortified with 10 mgL⁻¹ coumarin and phloroglucinol. In *P. stocksii* treated, highest rooting percentage (54.87%) was observed in culm cuttings treated with 2000 ppm NAA, while maximum rooting percentage (47.25%) was obtained in culm branch cuttings with 2000 ppm NAA treatment. Morphometric data for species trial of six bamboo species viz., *B. tulda*, *B. nutans*, *B. vulgaris*, *B. balcooa*, *B. bambos* and *D. strictus* established at Kundam and ICFRE-TFRI, Jabalpur were recorded. In Kundam trial, maximum culm height (3.09 m) and maximum number of culms (5.98) was observed in *B. bambos* (MAN-CL-2), whereas, highest culm diameter (2.61 cm) was recorded in *B. vulgaris* (RAI-CL-1). In trial established at TFRI campus, maximum culm height (5.82 m) in *B. balcooa* (BOT-CL-1), maximum number of culms (6.93) in *D. strictus* (BAL-CL-4) and maximum culm diameter (4.94 cm) in *B. nutans* (GEN-CL-1), were recorded.



Micropropagation of *Pseudoxytenanthera stocksii*



Bamboo plantation at Bharhut, Umaria

Biotechnology

2.3.4.

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

Codon-optimized synthetic gene constructs comprising the fused alpha and beta subunits of the animal type Na⁺, K⁺ ATPase gene, and chloride channel *CIC* gene from the crustacean *Artemia* were cloned for *Agrobacterium rhizogenes* and *A. tumefaciens* mediated transformation. The integration and overexpression of *NaKA* and *CIC* genes in the roots of *Eucalyptus* composite transgenic plants, under the control of the root-preferential and salt-inducible promoter, *MsPRP2* were confirmed using PCR and RT-qPCR analysis. The composite transgenics were treated with incremental salt concentrations of up to 150 mMNaCl for salt survival studies. A marginal increase in salt tolerance was observed in composite plants expressing the *CIC* gene. Furthermore, the shoot/root ratio of Cl⁻ was observed to be lower (0.88) in *CIC* expressing composite plants compared to control pHKN29 plants (1.16), suggesting reduced Cl⁻ ion transport to the shoots.

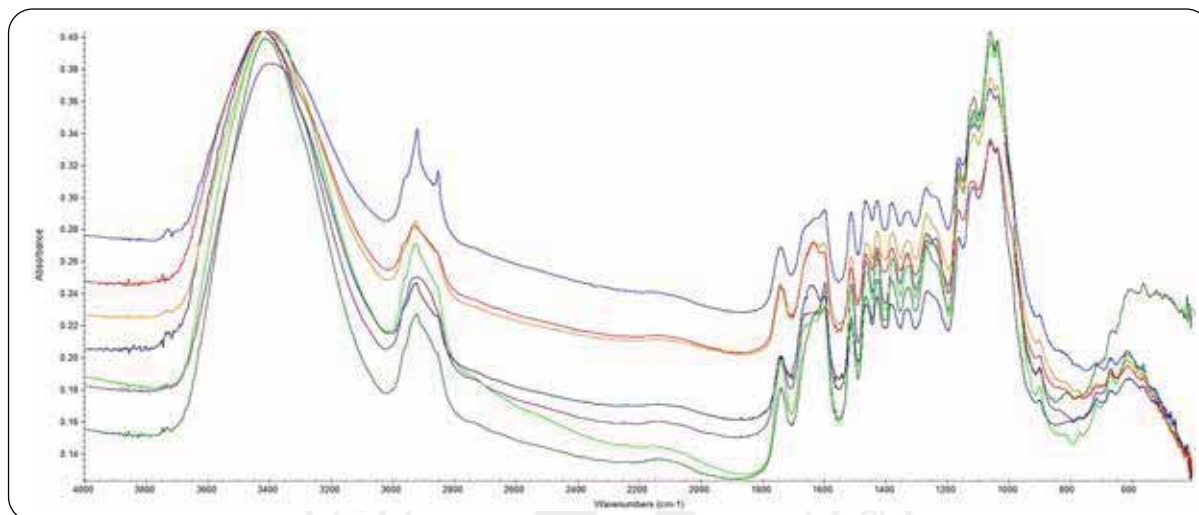
Evaluation of transgene-free genome engineering methods in *Eucalyptus* (ICFRE-IFGTB)

The electroporation conditions with DC current at 75 V for 50 ms was observed to favor maximum uptake of GFP encoding plasmid, pHKN29, into callus cultures (cf. 50, 100 and 125 V for 5 ms, 10, 20 and 50 ms). Earliest stage of embryo (embryonic axis) from one to two days of imbibed seeds of *Eucalyptus* was identified as optimal for particle bombardment. Higher regeneration and transformation efficiency were observed in embryonic axes subjected to bombardment at 5 kg/ cm² He pressure (cf. 10 kg/ cm²). *Agrobacterium tumefaciens* mediated transformation experiment was conducted using AGL1 pGFPGUSplus strain, to evaluate optimum hygromycin concentrations for generation of gene edited events without T-DNA integration.

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

This India-Denmark bilateral project targets teak improvement through genomic selection approach. Whole genome re-sequencing (WGRS) of teak clones was performed and ~1200 GB of raw data and 2,68,868 single nucleotide polymorphism

(SNP) loci across 18 chromosomes were identified. Genomic clustering of the clones into three groups was identified using this SNP dataset representing the genetic diversity of teak in India. In addition to the genomic analysis, phenotyping parameters such as wood sample processing, tree-ring width measurement, wood density measurements, wood color quantification, and metabolomic data collection were standardized and automated/semi-automated. Also, as a part of the project, Denmark and Indian researcher exchange visits were conducted for discussion, field visit and training.



FT-IR spectra of teak heartwood

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

Developed rapid protocol for evaluating *EchKT1;1* gene edits in Eucalyptus using composite plant strategy. For the first time, *MsPRP2* promoter was shown to successfully express gene editing guide RNA constructs for generating gene edits in Eucalyptus. These composite transgenic plantlets were evaluated and preliminary studies showed enhanced salt tolerance. *EchKT1;1* gene-edited plantlets were generated using *A. tumefaciens*-mediated transformation and PCR analysis of these plants yielded the expected 964 bp amplicon. For gene-editing in *C. junghuhniana*, *CCX5* was identified as a candidate gene, and two gRNAs were selected. Cloning of CaMV:CCX:HSP cassette

into the transformation vector (pHKN29::Cas9_1) was carried out. *A. rhizogenes* mediated transformation in *C. junghuhniana* was also optimized using the A4RS pHKN29::Cas9_1 strain.



GFP tagged gene edited Eucalyptus roots generated using gRNA constructs targeting *EchKT1;1* gene

Genetic modification of *Populus deltoides* clone(s) against Lepidopteran pest(s) (ICFRE-FRI)

Gene constructs for insecticidal genes in two *Agrobacterium tumefaciens* strains (GV3101 & EHA105) were received from ICAR-NIPB, New

Delhi. Routine glycerol stock maintenance and culture revival in prescribed media are being done. Also, gene constructs confirmation through PCR and restriction digestion was carried out. Co-cultivation experiments for transformation is under optimization. Shoot organogenesis was achieved in one of the *P. deltoides* clones.

Engineering base edits in *EcHKT1;1* gene to enhance potassium uptake and salt stress tolerance in *Eucalyptus* (ICFRE-IFGTB)

A strategy for cloning (i) the adenine base editor, ecTadA*7.10-nSpCas9 (D10A), and polycistronic SNG-sgRNA (targeting S95 & N381 of *EcHKT1;1*) into pCambia1305.1 and (ii) LD-sgRNA (targeting Loop deletion of *EcHKT1;1*) into the pAtCas9_1 construct for *Agrobacterium tumefaciens*-mediated transformation was developed. The synthesized pUC57::SNG-sgRNA and pUC57::LD-sgRNA plasmid were confirmed by restriction digestion analysis using *XhoI* and *HindIII*. The SNG-sgRNA and LD-sgRNA were cloned into pUC57::CaMV:HSP to generate pUC57::CaMV:SNG-sgRNA:HSP and pUC57::CaMV:LD-sgRNA:HSP. The generated vectors were confirmed by PCR, restriction digestion analysis, and amplicon sequencing.

Cloning and Characterization of a Na⁺ And Ca²⁺ Homeostasis Gene – *Spcb1-10* (Calcineurin B-like Protein-10) from Facultative Halophytic Tree – *Salvadora persica* L. (Miswak). (ICFRE-IFGTB)

High-quality RNA extraction from *S. persica* was achieved using PVP-based protocol. Two *Spcb1-10* transcripts with amplicon size of 812 bp and 731 bp were amplified and sequence confirmation is in progress.

Support to preparation of the Fourth National Biosafety Reports to the Cartagena Protocol on Biosafety (ICFRE-IFGTB)

Project Steering Committee meeting was conducted by the MoEF&CC and based on the recommendations, MoEF&CC would be conducting a workshop for the capacity building of state biosafety committees, with ICFRE-IFGTB having an advisory role.



2.4 FOREST MANAGEMENT

Projects under the Theme

A. PLAN

Completed	05
Ongoing	02
New	-

B. EXTERNALLY AIDED

Completed	15
Ongoing	18
New	04

Sustainable Forest Management (SFM)

2.4.1.

Assessment of Seed source variation of *Corylus jacquemontii* Decne. and use of Near Infrared Reflectance Spectroscopy for viability and oil content studies (ICFRE-FRI)

After carrying out extensive surveys in different forest areas of Himachal Pradesh, collected seeds of *Corylus jacquemontii* (hazelnuts) from 12 different populations. Seeds were extracted and morphological parameters were recorded. Maximum length (16.80 ± 0.17 mm) was observed in Shor (Pangi, Chamba) and minimum (14.03 ± 0.62 mm) was in Mindhal Forest (Pangi, Chamba); maximum width (16.96 ± 0.42 mm) and minimum (14.42 ± 0.28 mm) was observed in Shor (Pangi, Chamba) and Tindi (Lahaul and Spiti) respectively. Paregram Forest (Pangi Chamba) observed maximum thickness of 11.53 ± 0.42 mm whereas minimum thickness was found in 9.32 ± 0.08 mm. The minimum whole seed weight (98.36 ± 8.18 gm) was observed in Tindi (Lahaul and Spiti) and the maximum (148.59 ± 13.35 gm) was observed in case of Sahli (Pangi, Chamba). Similarly the seed viability was minimum in seeds from Shor

(Pangi, Chamba) and 100% in seeds from Tindi (Lahaul and Spiti), Dhanala Forest (Pangi, Chamba), Sahli (Pangi, Chamba), Paregram Forest, Chaloli (Pangi, Chamba).

Initial Seed Viability status of *Corylus jacquemontii*

S.No.	Location	Initial Viability %
1	Gajta Forest (Kothkhai, Shimla)	85.0
2	Tindi (Lahaul And Spiti)	100.0
3	Rohli (Lahaul And Spiti)	60.0
4	Shor (Pangi, Chamba)	57.5
5	Bambal Forest (Pangi, Chamba)	82.5
6	Mindhal Forest (Pangi, Chamba)	80.0
7	Cherry Forest (Pangi, Chamba)	87.5
8	Dhanala Forest (Pangi, Chamba)	100.0
9	Sahli (Pangi, Chamba)	100.0
10	Sidhmandir (Pangi, Chamba)	90.0
11	Paregram Forest (Pangi, Chamba)	100.0
12	Chaloli (Pangi, Chamba)	100.0

Monitoring and Evaluation of plantations carried out by the Punjab Forest Department under the scheme of CAMPA and CA (ICFRE-FRI)

Department of Forest and Wildlife, Government of Punjab had entrusted the task of third-party monitoring and evaluation of plantations raised under the CAMPA and CA scheme for the year

2019-20, 2020-21, and 2021-22 (three years) to Forest Research Institute, Dehradun. Data were collected from 16 Forest Divisions of Punjab. A total of more than 16,000 ha area of CAMPA and CA plantation was monitored. The average survival percentage for plantations raised in three years in sixteen forest division was 66.04% to 76.4% (2019-20); 65.64% to 76.4% (2020-21) and 67.55% to 79.08% (2021-22).



Sirhind feeder Rd 413-434.5 R/S UP Fangtoli

Preparation of Working Plan of NCT Delhi (ICFRE-FRI)

Vegetation sampling has been done under three broad categories of forest viz. Reserved Forest (RF), Protected Forest (PF), and Tree outside Forest (ToF). In reserved forest (RF), all five ridges viz. Northern ridge, Central ridge, South-central ridge, Nanakpura ridge, and Southern ridge have been extensively sampled. A total of 222 points have been laid out in Reserved Forest to completely cover its area of 8,489.39 ha. To cover the total area of 1,615.42 ha of the Protected Forest, a total of 95 sample plots were laid out. Additionally, 207 plots have been laid out in the Tree outside Forest (ToF) to cover its total area of 2,218.8 ha. Vegetation and ecological parameters

viz., regeneration status, growing stock, carbon stock, basal area, Importance Value Index, Shannon Diversity Index, Simpson Diversity Index were analyzed from the data of sample plots. The values for Shannon and Simpson Indices were found to be between 1.7 and 2.5, indicating moderate to high species diversity in most of the ranges with the dominant species viz. *Prosopis juliflora*, *Dalbergia sissoo*, *Eucalyptus sp.*, *Anthocephalus cadamba*, *Callistemon viminalis*, *Morus australis* and *Kigelia Africana*. The maximum growing stock (2,41,652.71 m³) and carbon stock (0.34 Million Tonnes) was observed in "South" range and the minimum growing stock (953.11 m³) and carbon stock (0.00) was observed in North West range. Soil samples have also been collected from 74 locations distributed among RF, PF, and ToF for Soil Organic Carbon (SOC) estimation.

Phytodiversity growing stock and carbon stock of forest ranges of NCT Delhi

Forest Range	Growing Stock (cubic metre)	Carbon Stock (Million Tonnes of C)	Importance Value Index (IVI)		Shannon Diversity Index (H')	Simpson Diversity Index (1/D)
			Dominant Tree species (DTS)	IVI of DTS		
Asola Bhati	85,753.77	0.13	<i>Prosopis juliflora</i>	122.34	2.14	0.76
Central	33,342.85	0.04	<i>Prosopis juliflora</i>	129.95	2.09	0.72
East	11,025.82	0.02	<i>Dalbergia sissoo</i>	133.33	2.26	0.82
Kapashera	14,451.43	0.02	<i>Eucalyptus sp.</i>	160.9	2.55	0.89
Najafgarh	6,254.47	0.01	<i>Prosopis juliflora</i>	124.4	2.02	0.75
North East	16,855.55	0.02	<i>Anthocephalus cadamba</i>	102.42	2.41	0.84
North	12,976.57	0.02	<i>Prosopis juliflora</i>	174.9	1.70	0.21
North West	953.11	0.00	<i>Callistemon viminalis</i>	153.07	2.049	0.832
Shahdra	2,477.38	0.00	<i>Eucalyptus sp.</i>	81.44	1.811	0.795
South	2,41,652.71	0.34	<i>Morus australis</i>	133.49	2.63	0.861
Vasant Vihar	82,340.52	0.12	<i>Prosopis juliflora</i>	113.9	2.226	0.742

Forest Economics

2.4.2.

Study on Marketing Mechanism of Agroforestry produce in Punjab funded by Punjab Forest Department (ICFRE-FRI)

Field surveys in various wood-based industries, agroforestry farmers, wood mandi/ markets, etc, have been carried out. Out of 5857 registered total wood based industries (WBIs) in Punjab, surveyed around 970 WBI, which is 16.56% of total WBIs. About 121 agroforestry farmers have also been surveyed division wise. Wood mandi markets have also been surveyed in each division. The interim report has been submitted to Punjab Forest Department (PFD). Most wood-based industries in

the state solely meet their demand internally, but to some extent, the plywood, veneer, and pulp & paper manufacturers met their demands through trade with neighbouring states. It was noticed that demand for a large amount of non-agroforestry woods like Chir Pine, Sal, Deodar and Teak, etc. were met from other states such as Uttarakhand, Himachal Pradesh, Madhya Pradesh etc. along with imports from Russia, Malaysia etc. On the other hand, the demand for majority of agroforestry species, such as eucalyptus and poplar etc., were met from Uttar Pradesh and Haryana and supplied to large sized WBIs for production of pulp, paper, plywood, and veneer. A small portion of large sized WBIs' supply comes from their own plantations.



Survey of wood based industries in Punjab

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

The study was undertaken by ICFRE-RFRI, Jorhat, on the request of the Department of Environment and Forest, Assam, following the directions of the Honourable Supreme Court of India. Out of 33 forest divisions, data was collected from 19 divisions of Assam. Surveys were conducted across 1,387 households to analyze timber harvesting patterns, usage, and potential timber production in rural areas. In addition, 228 quadrates were laid across various canopy covers to document current timber stock outside forest areas. Data from 102 timber depots, 40 sawmills, and 12 plywood industries were also collected to understand the timber demand and supply. The findings highlighted that the total annual demand for primary WBI industries in Eastern Assam Circle ranges from minimum 112,317 to maximum 292,396 cubic meters, while the total timber supply from all sources is approximately 48,438 cubic meters. In the Eastern Assam Circle,

the growing stock is predominantly in the open cover category, contributing 14.81 million cubic meters, with 13.85 million cubic meters available. The majority of this stock falls under the B category, with 88% suitable for composite wood products and only 3% for high-quality furniture. About 48% of the stock is in the 30-50 cm diameter class. Sustainably, only 0.19 million cubic meters from patta land and 0.79 million cubic meters from tea gardens can be harvested annually. However, current harvesting practices in patta land exceed sustainable limits by 1.8 times, while tea garden harvesting is well below sustainable levels. Rural households primarily use timber for construction (80%) and fuel (14%), with significant sales to traders and sawmills. The total annual timber sale in Assam is approximately 87,110 cubic meters, predominantly from patta land. The study estimates that sustainable harvesting could support 57 sawmills and nine plywood industries from patta land, and 235 sawmills and 31 plywood industries from tea gardens. There is also potential for significant enhancement of timber stock through household planting, which could yield approximately 40.44 million cubic meters over 40 years.



Household survey



Ecological data collection

Forest Biometrics

2.4.3.

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

Surveys were conducted in 40 villages, covering 758 households with 3687 people for assessment of the socio-economic status of local communities. 52.70% of households lived in semi-pucca, 33.56% in pucca and 88.26% of households were

predominantly nuclear. The majority belonged to Scheduled Tribes (38.51%) or the general category (28.83%), with 77.03% having Below Poverty Line (BPL) or similar cards. 33.78% of households are dependent on agriculture and 30.18% of households are dependent on wage labor as their primary livelihood. The study revealed that the successful translocation of Rhinos in Manas National Park (MNP), enhanced the tourism sector thus benefiting both local communities and wildlife preservation efforts.

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

Developed form factors, volume tables and form quotients for *Tectona grandis* (Teak), *Shorea robusta* (Sal), *Terminalia tomentosa* (Saja), *Pterocarpus marsupium* (Beeja Sal), *Dalbergia*

sissoo (Shisham), *Adina cordifolia* (Haldu), *Terminalia arjuna* (Arjun), *Bridelia retusa* (Kasai), *Ougeinia dalbergioides* (Tinsa), *Gmelina arborea* (Khamhar) and *Mitragyna parviflora* (Mundi) in different agroclimatic zones of Chhattisgarh. Provided training to forest officials for validating these developed form factors with existing ones.



Measurement of diameter of felled trees at different height segments at Dhamtari forest division



Measurement of tree diameter at different height segment Bastar forest division using Basal Area Finder (BAF)

Preparation of local volume table and calculation of rotation age of Khasi Pine in Meghalaya (ICFRE-RFRI)

This study investigated the growth rates and ideal harvest time (rotation age) of *Pinus kesiya* trees in Meghalaya, India. The study also found that

the biological rotation age varies depending on the location and growth rate of the trees. In the case of Meghalaya, it was found that the average biological rotation age of Khasi pine is 48 years growing in poor site quality and 27 years growing in good site quality. This highlights the importance of considering local conditions when making forest management decisions.



Growth rings of *Pinus kesiya*



Counting of growth rings of *Pinus kesiya* in Meghalaya

Eco-tourism feasibility study in Intanki national park to promote tourism, livelihood improvement and biodiversity conservation (ICFRE-RFRI)

The study was conducted in Intanki National Park, located in the Peren district of Nagaland. The feasibility assessment consists mainly of four different thematic areas, viz., assessment of floristic and faunal diversity, socio-economic survey of fringe villages, understanding the stakeholders' views on ecotourism development, and SWOT analysis of Intanki National Park. The study revealed that Intanki National Park has rich floristic, faunal, and ecosystem diversity, making it a very appealing ecotourism

destination. Socioeconomically, the fringe villages are home to diverse ethnic communities with rich traditional and cultural heritage and have a positive perception towards the development of ecotourism in Intanki National Park. The study reveals that the Intanki National Park has great ecological and socio-cultural feasibility; however, some impactful and immediate attention has to be paid to infrastructure and few other administrative issues to improve the logistics and economic feasibility of the park. Overall, the study highlights the enormous potential for ecotourism in Intanki National Park, which would promote environmental friendly tourism, strengthen community well-being, and foster the preservation of biodiversity.



Glimpses of Workshop at Intanki National Park, Nagaland



Socioeconomic data collection in the fringe village of Intanki National Park

Policy and Legal Issues

2.4.4.

National Transit Pass System (NTPS) (ICFRE-IWST)

For effective implementation and roll out of National Transit Pass System (NTPs) launched by MoEF&CC, in states/ UTs, ICFRE-IWST is providing hand hold and training to states /UTs in collaboration with NIC. ICFRE-IWST has conducted

19 training for the 4878 Forest Department Officials/users of NTPS to the State/UTs viz. Goa, Dadra & Nagar Haveli and Daman & Diu, Andaman and Nicobar Islands, Himachal Pradesh, Uttarakhand, Mizoram, Maharashtra, Uttar Pradesh, Tamil Nadu, Telangana, Gujarat, Karnataka, Sikkim, Arunachal Pradesh, Meghalaya and Manipur.

2.5
WOOD
PRODUCTSProjects under the
Theme

A. PLAN

Completed	01
Ongoing	18
New	06

B. EXTERNALLY AIDED

Completed	-
Ongoing	03
New	-

Wood and other
Lignocellulosic Composites

2.5.1.

Study on Suitability of Coconut trunk for Rotary Peeling and Plywood Manufacture (ICFRE-IWST)

Coconut trunks were procured and study on boiling of Coconut trunks were carried out. Heat treatment schedule for coconut trunks having higher specific gravity of above 0.75 were worked out. Peeling parameters viz., Knife Bevel Angle, Knife and Pressure Bar Gap for Peeling of Coco veneers of 2.4 mm thickness have been worked out. Optimized the processing parameters for the manufacture of MR grade Plywood by utilizing Coco veneers of thickness 2.4 mm with three ply construction in lab scale. Pilot scale trials on manufacture of 1.22 m x 0.6 m size 5 ply has also been optimized. Boards of size 0.3 m x 0.3 m and 1.2 m x 0.6 m meet the

requirements for bond quality as per IS 848-2006 for MR Grade plywood and IS-303 for General purpose Plywood.



Coconut Trunk Veneering on Spindle less lathe

Suitability of glulam from plantation timbers for door and window frames (ICFRE-IWST)

Glued laminated timber (Glulam/GLT) was prepared using plantation grown hardwoods such as Malabar Neem (*Melia dubia*), Rubberwood (*Hevea brasiliensis*) and Silver oak (*Grevillea robusta*) using polyurethane adhesive as binder and characterized for physical and mechanical properties. Melia wood GLT exhibited an average flexural Modulus of Elasticity (MoE) of 9.9 GPa and Modulus of Rupture (MoR) of 56.7 MPa. Similarly, Rubberwood GLT had an average MoE of 10.5 GPa and MoR of 65 MPa, while initial trials of Silver Oak GLT exhibited an average MoE of 8.0 GPa and MoR of 46 MPa.

Preparation and characterization of mixed-species GLT, as well as exploring the suitability of phenol resorcinol formaldehyde (PRF) as a binder for GLT production are under progress.



Rubber wood GLT



Melia dubia GLT

4- Point bending test

Exploratory work on Recycling of Wood Composites Waste (Offcuts of Plywood and Particle Board) for Manufacturing of Particle Board (Phase 1) (ICFRE-IWST)

An approach based on the recycling of waste plywood (PW) and particle board (PB) as a recover wood resource for the particle board industry was explored/investigated. It was demonstrated that urea-formaldehyde (UF) and phenol-formaldehyde (PF) Bonded plywood and particle board can be effectively shredded to form the recovered particles that can be a valuable material in particle board manufacturing. The effects of shredding conditions, binder type on the recovered particle characteristics were optimized. The physical properties of 100% plywood waste particle boards with 12% (solid content) urea formaldehyde resin content were as follows: density 0.83 g/cm³, moisture content 6.21%, water absorption 10.36% (after 2 hours) and 20.54% (after 24 hours), and surface swelling 2.13%. The mechanical properties were also evaluated, showing a tensile strength of 0.79 N/mm², modulus of rupture (MOR) 19.65 N/mm², modulus of elasticity (MOE) of 2420 N/mm², and screw withdrawal strength 2051 N. The physical and mechanical properties of the particle boards were assessed and found to conform to IS 3087 standards.

of APP. Samples were prepared as per the relevant IS standard and were evaluated for flammability, flame penetration and rate of burning tests. The results were encouraging for flammability test with APP 10% and 20% concentration treatment of Rubber wood species while Eucalyptus species yielded better results for the flame penetration and rate of burning.

Development of Bio-char Wood Composite as Low-Cost Sustainable Green Technology (ICFRE-FRI)

Biochar particle board of Poplar wood was developed using Urea formaldehyde (1:2/Urea: Formalin)) resin. Ratio of Urea and Formalin has been optimized for the development of bio-char modified particle board.

Development of Hybrid Bio board from recycled plastic materials with waste lignocellulosic fiber generated from wood/bamboo industry as a sustainable raw material for circular bio-economy (ICFRE-IWST)

Optimized the process of sizing, drying and shredding of bamboo particles and milk packets. The blending of bamboo particles and shredded milk packets have been worked out. The process parameters like hot press temperature, specific pressure and the curing time have been optimized. The time required for the panels to attain equilibrium moisture level at ambient temperature before sending to dimensioning has been carried out. The hybrid bio-board samples were tested according to IS 3087 standards for Particle Boards of Wood & Other Lignocellulosic Materials (Medium Density) for general purposes. The test results conformed to moisture content, density, water absorption, bending strength, and internal bond strength as per relevant specification. Chemical characterization of the bamboo plastic-bonded particleboard is currently underway, which will provide further insights into its composition and properties.

Exploratory studies on the addition of fire-retardant chemicals in different stages for the development of fire-retardant plywood (ICFRE-IWST)

Boards for fire retardant plywood were made out of *Melia dubia*, Poplar (*Populus deltoides*), Rubber wood (*Hevea brasiliensis*) and *Eucalyptus* by using the melamine urea formaldehyde resin. 1% Tri cresyl phosphate was added to the resin system at the time of condensation. 10% and 20% Ammonium poly phosphate (APP) were used to treat all the glue and panel core veneers of *Melia dubia*, Rubber wood, Eucalyptus and Poplar. Boards were prepared as per the combination of 10% and 20%

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

Pilot scale study was performed to assess the suitability of plastic bonded bamboo mat board & Plywood for industrial trial. Total 12 plywood and bamboo panels of thickness 9 mm were prepared using 4' x 2' wood veneers and bamboo mats. The samples prepared during pilot scale trial showed strength properties comparable with conventional plywood panels. The industrial-scale production of the prepared plywood conforms to the Moisture Resistant (MR) grade standards as specified by the Bureau of Indian Standards (IS 303/1734). The plywood meets the necessary criteria for both physical and mechanical properties outlined in these standards.

Establishment of Bamboo Treatment Plant in Manipur- Phase-II (ICFRE-IWST)

Installed four Vacuum Pressure Treatment Units (VPTI) in Manipur: one at Sowmbung measuring 22



Installation of VPTI and training at Manipur site

Development of Fire Retardant Door (FRD) Shutter for 120 mins Rating as per BS-476/IS 3614 (ICFRE-IWST)

Developed and evaluated three door shutters under this project. Teak wood, with a density of 565 kg/m³, was the raw material utilized in the first experimental attempt to create fire-resistant door shutters. The door shutter withstood 72 minutes of fire rating. The second attempt used steam beech (*Fagus sylvatica*) hard wood with a density of 650 kg/m³ to manufacture Fire Retardant Door (FRD) shutters; during the test, the door shutter stood for 85 minutes. The third trial used red meranti (*Shorea albidia*) with a density of 700 kg/m³ as raw material; during the test, there was no failure found for up to 125 minutes. The fire retardant door complies to the requirement of 120-minute rating as per BS-476/IS 3614.

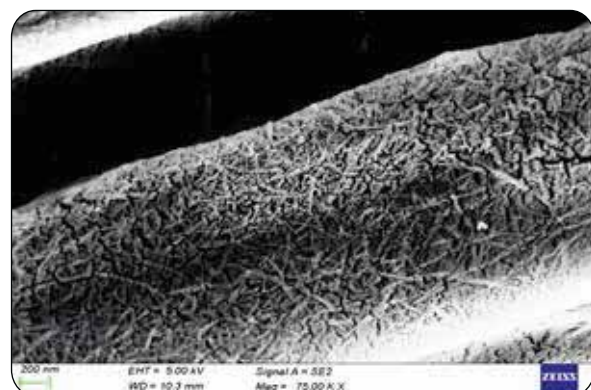
feet in length and 3.3 feet in diameter, and three others at Churachandpur, Khangsim, and Noney, each measuring 22 feet in length and 2.3 feet in diameter. Comprehensive training on operation and maintenance was provided to ensure efficient functioning of the units across all locations.



Cellulose Nano fibrils (CNF) from different lignocellulosic materials using cryo-crushing and ultra-sonication techniques (ICFRE-IWST)

Eucalyptus wood was pretreated to remove lignin and hemicelluloses. The treated wood pulp was then subjected to partial hydrolysis using sulphuric acid at concentrations of 5%, 10%, and 15% (W/W). The resulting pulp suspension was centrifuged 7-8 times until a neutral pH was achieved. Each suspension was then ball-milled with liquid nitrogen for a total of 8 hours, with small quantities separated every 2 hours. The suspension was subsequently sonicated for five hours using a 400-watt instrument. The samples were characterized using Scanning Electron Microscopy (SEM). All the

samples resulted in the formation of cellulose nanofibers.



SEM image of Nano cellulose fibre formation from 30% (W/V) sulphuric acid followed by ultrasonication

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

For particle board making, wood particles were replaced by 30%, 40% and 50% currency briquettes. Single layered and multilayered particle board with varying the combination of the currency briquettes and wood particles were made. Panels made using



30% replacement conformed to physical and mechanical properties as per IS 3087 for grade 2 particle board.

Two firms were identified for commercial implementation of the technology developed and the firms successfully made panels at industrial scale with 10% and 20% replacement of wood particles and bagasse particles by currency briquettes.



Particle board made by replacement of wood particles with currency briquettes particles

Development of Particle board from Corn Cob for sound insulation application (ICFRE-IWST)

Study was undertaken to develop particle board for sound insulation application from agro waste corn cob. Particles from corn cobs were produced using three different methods: hammer mill, pulverizer, and compression-pulverizer. Initial trial boards were manufactured using particles obtained from these three methods, targeting densities ranging from 400 to 700 kg/m³. Physical and mechanical properties were evaluated for the manufactured

boards using particles from all three methods. The results of particle boards made from particles obtained through the compression-pulverize method, compared to the other two methods showed a 39% increase in modulus of rupture. Additionally, tensile strength perpendicular to the surface (internal bond strength) was enhanced by 48%, and thickness swelling of the boards was reduced by 48%, demonstrating minimal water absorption characteristics. Furthermore, boards are planned to be manufactured using different density and different sizes of cob particles to evaluate the sound properties.

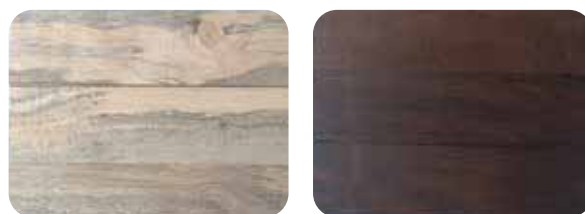
Wood Processing

2.5.2.

Thermo-hygro-mechanical (THM) modification of plantation grown timbers for value addition (ICFRE-FRI)

Wood properties of plantation timbers are not as good as conventional long rotation timber. Density, color, and other key wood characteristics can be improved with thermo-hygro-mechanical (THM) wood modification. Wood of *Melia dubia*, *Populus deltoides* and *Ailanthus excelsa* were modified using THM technique. Strength properties of these species significantly increased after THM modification compared to their unmodified wood. Thermo-hygro-mechanical (THM) modification of *M. dubia* with 30% compression resulted in specific gravity enhancement from 0.4 to 0.57 with minimum enhancement at highest steam temperature (200°C). At 167°C steam temperature followed by cold compression, an increase in modulus of rupture (MoR) was observed, whereas, a minor reduction in modulus of elasticity (MoE)

(5.3%) was recorded. Higher equilibrium moisture content (EMC) reduction occurred at higher steam treatment temperatures. It was found that hardness of THM modified poplar wood was 65.5% higher than the raw wood. Modified *A. excelsa* wood showed excellent water tolerance. Even after 168 h of water absorption, modified wood (furfuryl alcohol treated and compressed) did not go beyond 30% moisture content (MC%), whereas, raw wood achieved MC% of 140.5%. Hardness and, swelling properties improved significantly. Color and aesthetic properties of the modified wood were also enhanced significantly.



Raw *A. excelsa* wood board (upper) and THM modified wood board (lower) of *A. excelsa*

Development of Microwave Vacuum dryer for timber and bamboo (Development of dielectric heating based processing technologies for solid-wood, bamboo and their composites (ICFRE-FRI)

This study has investigated the viability of low-girth log drying using microwave vacuum drying. *Eucalyptus* hybrid logs (girths of 0.55 m and 0.6 m) and *Populus deltoides* (poplar) logs (girths of 0.46 m, 0.64 m, and 0.75 m) were taken for microwave vacuum drying. According to the findings, poplar logs may be dried without any defects between 30 and 43 hours. Various handicrafts articles (turnery products) were made from low girth plantation timbers dried in microwave vacuum dryer.

The quality of the surface of the turnery products looked smoother and better than sawn wood products. However, it also shows a propensity to develop defects such as cracks during drying. Culms of mature *Dendrocalamus asper* (about 3–3.5 years old) were felled and dried in the microwave vacuum dryer (MWVD). MWVD took 12 h (upper

half) to 20 h (bottom half) to dry the bamboo sections, whereas it takes approximately 12–15 days in conventional drying. On average, 3.78 units of electrical energy were consumed for the removal of 1 kg of water from bamboo during MWVD.



Decorative handicrafts made from Microwave vacuum dried logs of poplar and Eucalyptus

Value Addition and Utilization

2.5.3.

Phytochemical analysis of *Pterocarpus santalinus* bark for its potential utilization (ICFRE-IWST)

The bark of the Red Sanders tree exhibits a multitude of valuable properties, including biocidal activity, enhancement of aesthetic qualities, and UV protection capabilities. The petri plate bioassay established the possibility of Red Sanders bark extract as probable bio fungicide. The important aspect of the study lies in improvement in the aesthetic appeal and protection of rubberwood (HB), mango wood (MI) and *Melia dubia* wood (MD) coated and/or impregnated with Red Sanders bark extractives. The brown-rot fungus *Oligoporus placenta* had a 100% inhibition rate against the methanolic and acetone extracts of RS bark even at a low concentration of 0.5% (w/v).

However, in the white-rot fungus *Trametes hirsuta* inhibition percentage were up to 77.92% and 75.97% for methanol and acetone extracts of RS bark, respectively. The UV protective effect of the extracts further contributes to the aesthetics of coated wood. After impregnation of the extractive in the rubber wood, mango and melia wood, the retention of the extracts were in range from 2.64 to 7.57 kg/m³, 0.94 to 8.81 kg/m³ and 1.16 to 6.61 kg/m³ in case of rubber wood, Mango, *Melia* wood respectively. Thus, Red Sanders bark extracts can be used as potential bio-fungicides. Significant decrease in mass loss was observed in all three treated wood species with acetone extract which may be treated as being most effective against wood rotting fungi which was also observed in SEM images and FTIR analysis. These potential utilizations proved that the bark extracts can be used to treat the low durability plantation grown timbers for their value addition.



Rubber wood coated with Red Sanders bark extractive

Study on the effect of ZiBOC treatment on physical, mechanical, biological and fire retardant properties of plywood (ICFRE-FRI)

Treatment of Poplar veneers was carried out by diffusion method with two different fire retardant and preservative compositions. Plywood of size 2ft x 2ft was prepared using phenol formaldehyde adhesive. Fire retardant tests and strength test were carried out as per IS 5509 and IS 1734. Preliminary results show the samples treated with fire retardant composition I (Phosphoric acid + Ammonium phosphate + Sodium silicate + Ziboc + Borax) and composition II (Ammonium sulphate + Ammonium Phosphate : Borax : ZIBOC) passed MoE, MoR and fire retardant tests i.e. flammability test, rate of burning test and flame penetration test as per IS specification.

Study the tree biomechanics behavior with respect to the hollowness (decay) of urban trees in wind affected area (ICFRE-FRI)

Development of a method to understand the capabilities of the tree trunk to withstand external forces acting on it (wind) so that forest managers can prioritize the order of felling such hollow trunks. Collected field data of 77 trees fallen during cyclone at West Bengal (Dec'2019), Orissa (July 2019 and Oct'2021), Gujarat and Diu (Oct'2021 and Sept'2023), Chennai (Dec'2022). It is observed that 85% of the broken trees (excluding uprooted) in cyclone affected areas had the trunk hollowness in the range between 68%-75%. Corresponding estimated strength loss (%) lies in the range of 28% to 32%. Also evaluated mechanical strength of hollow logs (43 Nos) of different girth and different hollow sizes of five different tree species (*Eucalyptus spp.*, *Mangifera indica*, *Melia dubia*, *Cupressus spp.*, *Grevillia robusta*). Strength loss greater than 28% has been observed to be fatal for tree trunk and can be stated as threshold limit.

Pulp and paper

2.5.4.

Characterization of bamboo for pulp and paper (ICFRE-FRI)

Nine candidate plus culms (CPCs) of *Dendrocalamus strictus* have been collected from the field, air dried and converted into chips for making bamboo dust using a Wiley mill. The proximate chemical analysis of CPC no (9-10), (10-12), (12-33), (11-23), (15-25), (10-11), (11-37), (13-10) and (13-37) was performed for moisture content (6.14 - 8.22%), ash content (1.81 - 2.70%), silica content (0.26 - 1.33%), cold water solubility (4.57 - 10.74%), hot water solubility (6.68 - 12.45%), alcohol- benzene solubility (0.35- 3.16%), 1% NaOH solubility (21.77 - 30.45%), lignin content (25.25 - 28.90%), holocellulose content (74.24 - 77.76%) and α -cellulose content (46.96 - 55.64%) as per TAPPI standard methods. Kraft pulping of procured CPCs is under progress.

Study on pulp yield enhancement and cellulose degradation stabilization through addition of reducing end protector (ICFRE-FRI)

Pulping was carried out using bagasse lignocellulosic biomass with additives as pulp yield enhancer. The degradation and pulp yield was estimated. Pulping carried out using bagasse lignocellulosic biomass and an additive showed impact on pulp yield and on kappa number and showed promising increase in pulp yield with increase in pulp brightness; detailing and optimization with this additive with varying pulping parameters are in progress. The pulp yield of control was 64.28% and it increased to 66.46% with the addition of reducing end protectors.

2.6 NON-WOOD FOREST PRODUCTS (NWFPs)

Projects under the Theme

A. PLAN

Completed	02
Ongoing	04
New	-

B. EXTERNALLY AIDED

Completed	03
Ongoing	12
New	03

Resource Development of NWFPs

2.6.1.

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

The experiments were laid out under three shade levels (0, 50 & 75%) by applying 15 tonnes/ hectare FYM, 20 tonnes/ hectare FYM and 3 tonnes/ hectare poultry manure to study the germination and growth attributes of different propagation materials (apical, distal, end, segments, whole tuber) of *Kali*

musli tubers in NWFP nursery of TFRI, Jabalpur. Apical buds along with combined effect of FYM at the rate of 20 tonnes/ hectare and 50% shade level showed the maximum germination percentage (73.75%), yield (3.84 q/ hectare) and curculigoside content (0.38 ± 0.05 %). Multilocational trials of *Kali musli* using standardized propagation technique were established at three different sites i.e. Mandla, Jabalpur and Narsinghpur under three different agroclimatic regions of Madhya Pradesh state.

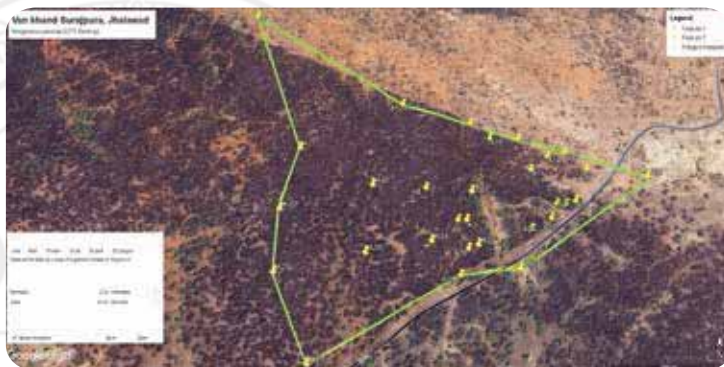


Multilocational trials of *C. orchioides* established at two different sites (a) Mandla (b) Jabalpur

Survey and selection of Candidate Plus Trees (CPT) and Identification of Seed Production Areas (SPA) of Broad Leaves Species of Rajasthan (ICFRE-AFRI)

Reconnaissance survey was conducted for selection of CPTs and marked 29 CPTs of *Butea*

monosperma in Jhalawad and Banswara, 97 CPTs of *Anogeissus pendula* in Banswara, Jhalawad, 34 CPTs of *Anogeissus latifolia* in Jaipur, Udaipur and 63 CPTs of *Madhuca indica* in Banswara (Rajasthan). Recorded passport data of 223 selected CPTs of different species.



(A) *Madhuca indica* CPT identification and marking in Koi Bao, Danpur (Banswara); (B) Google Earth location of CPTs (13 CPTs) of *Madhuca indica* in Koi Bao, Danpur Bari, Banswara (Area 1.36 ha, Perimeter 0.59 Km); (C) *Anogeissus pendula* CPT identification and marking in Van Khand Surajpura, Jhalawad; (D) Google Earth location of CPTs (36 CPTs) of *Anogeissus latifolia* in Van Khand Surajpura, Jhalawad (Area 22.27 ha, Perimeter-2.24 Km).

Production of Quality Planting Material of Medicinal Plant and Creation of Herbal Garden in Northern West Bengal (ICFRE-IFP)

A nursery has been set up to propagate and produce medicinal plants of 10 species. The planting materials of selected species are being distributed to the farmers, NGO's, Forest Department and other organization engaged in cultivation of medicinal Plants. Six awareness and training programmes for importance of medicinal plants and developing agro-techniques were also organized. Upgradation of Herbal Garden for information and demonstration has been done. 1554 saplings of *Rauwolfia serpentina*, *Terminalia arjuna*, *Tinospora cordifolia*, *Withania somnifera*, *Asparagus racemosus*, *Paederia foetida*, *Acorus calamus*, *Gymnema sylvestris*, *Messua ferrea*, *Saraca asoca* has been distributed through "Ayush aapke Dwar" under Azadi Ka Amrit Mahotsav under the aegis of NMPB, Board.

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

In bamboo Hi-Tech Nursery (BHTN) established at the Institute, produced quality planting stock (12,936 nos) of 11 commercially important bamboo species viz., *Bambusa bambos* (Mulmoongil), *Dendrocalamus strictus* (Kalmoongil), *Bambusa balcooa*, *B. tulda*, *B. nutans*, *Dendrocalamus asper*, *D. stocksii*, *B. vulgaris* (G) and ornamental species viz., *Thyrsostachys oliveri*, *B. vulgaris* (Y) and *B. vulgaris*. Planting stock was distributed to different stakeholders (582 nos) and also utilized for in-house planting operations (953 nos). The nursery facility is being utilized to maintain 48 Candidate plus clumps belonging to 30 species, and 170 germplasm accessions representing 58 species under various bamboo-related projects handled by the institute.

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

A silviculture trial plot of *Aquilaria malaccensis* was established at Silpathar, Dhemaji district of Assam and growth data with regard to spacing and fertilizer application of three year old agar plantations were collected and given in table. Best

growth was recorded in 2x2m spacing iwht full dose of 10:4:4 urea: SSP: MOP (100gm/plant)+ 100g vermicompost. Agroforestry model comprising of *A. malaccensis* with *Citrus sinensis* (vern; ass Komola) was established at Mawtunu village of Ri- Bhoi district of Meghalaya and *A. malaccensis* (vern; ass Agar) with *Citrus limon* (vern; Ass: Kazilemon) was established at ICFRE-RFRI campus.

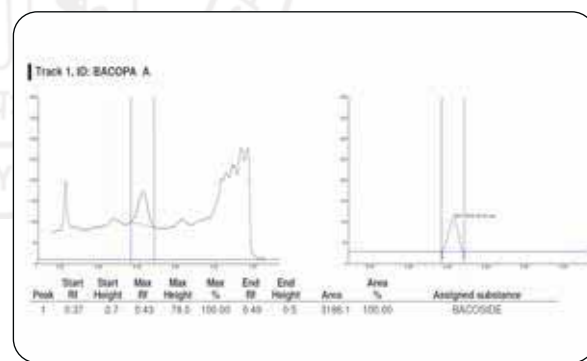
Effect of spacing & fertilizers on growth of *A. malaccensis*:

Treatment	Repl- cation	Spacing (m)	Fertilizer application	Height (cm)	Collar diameter (cm)
T1(S ₁ F ₀)	3	2x2	Without fertilizer	46.1-85.3	0.31-0.37
T2 (S ₁ F ₁)	3	2x2	Vermicompost (200g/plant)	37.1-87.4	0.48-0.52
T3 (S ₁ F ₂)	3	2x2	½ dose of 10:4:4 urea: SSP:MOP (50g/plant) + 50 g vermicompost	50.2-115.1	0.32-0.86
T4 (S ₁ F ₃)	3	2x2	Full dose of 10:4:4 urea: SSP:MOP(100g/plant) + 100 g vermicompost	52.2-197.2	0.59-0.79
T1(S ₂ F ₀)	3	3x3	Without fertilizer	42.1-82.3	0.35-0.77
T2 (S ₂ F ₁)	3	3x3	Vermicompost (200g/plant)	35.3-142.4	0.38-0.52
T3 (S ₂ F ₂)	3	3x3	½ dose of 10:4:4 urea: SSP:MOP (50g/plant) + 50 g vermicompost (50g/plant)	37.2-128.1	0.39-0.86
T4 (S ₂ F ₃)	3	3x3	Full dose of 10:4:4 urea: SSP:MOP (100g/plant) + 100 g vermicompost	51.4-146.4	0.46-0.79

Evaluation of hydroponics technique for the cultivation of medicinal plants: *Bacopa monnieri*, *Centella asiatica*, *Acorus calamus* and *Stevia rebaudiana* (ICFRE-TFRI)

Growth kinetics of hydroponically grown medicinal plants *Bacopa monnieri*, *Centella asiatica*, *Acorus calamus* and *Stevia rebaudiana* were evaluated in indoor and outdoor hydroponics systems with different nutrient solutions and compared with plants grown in soil. The total biomass of *B. monnieri* and *C. asiatica* in hydroponic systems were respectively found 4.37 and 7.96 times more compared to plants grown in soil. Total phenols, flavonoid and antioxidant activity in leaves of *B. monnieri*, *C. asiatica* and *A. calamus* in different nutrient solutions varied 0.234-1.597%, 0.239-1.575, 0.37-0.93%, 0.22-3.38%, 1.39-9.05%, 2.65-6.44% and 55.06-84.81%, 16.03-66.24%, 30.07-81.16% respectively.

Biologically active ingredients, Bacoside (0.016-0.057%) and β-asarone (0.053-0.28%) were quantified. Maximum concentration of bacoside and β-asarone were observed in inorganic nutrient formulations, with NPK ratio 1.5:0.5:2.5 and 3.5:1:7.5, respectively.



Estimation of Bacoside



Growth performance of *S. rebaudiana* in NFT system



Growth performance of *C. asiatica* in NFT system

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

Total 17 populations of *F. roylei* were identified from Himanchal Pradesh and maximum population density was recorded from Tahuk (2.30 m²) followed by Shalgran (1.8 m²). 95 % of germination was recorded in the seeds of Chhitkul, Kinnaur with seed stratification treatment for 30 days. 66 % germination of seeds was recorded in pre-winter sowing (November) and in post winter sowing (March).

A maximum of 69.3% germination was recorded in seeds sown at 1.50 cm depth followed by 56 % in a depth of 1.00cm and minimum germination (48%) in seeds sown at 0.5 cm depth. Maximum germination 62.5% recorded in Sand + Soil + FYM (1:1:1) and minimum germination 25% recorded in Soil + Sand (2:1). Irrigation schedule and growth data of *F. roylei* showed maximum sprouting 92% in treatment with irrigation at 3 days interval followed by treatment with irrigation at 5 days interval 88% and minimum sprouting 66% was recorded in the treatment with irrigation at 7 days interval.

The average sprouting percent was 81.18% in the bulbs, collected from 17 sites. The bulbs of *F. roylei* were collected from Mural Danda, Chanshal, Kalaban (Shimla) and Churdhar (Sirmaur) for cultivation trials. Intercropping trial on the effect of spacing of bulbs of *F. roylei* on sprouting percent and biomass maintained at farmer's field at Shirmoling Kanda Ribba, Kinnaur, Himachal Pradesh. The maximum sprouting of 82% was recorded in treatment T₁ (30cm x 30cm) followed by 72 % in Treatment T₂ (25cm x 25cm) and a maximum biomass of 19.43 gm was recorded in T₁ followed by 16.43 gm in T₂.

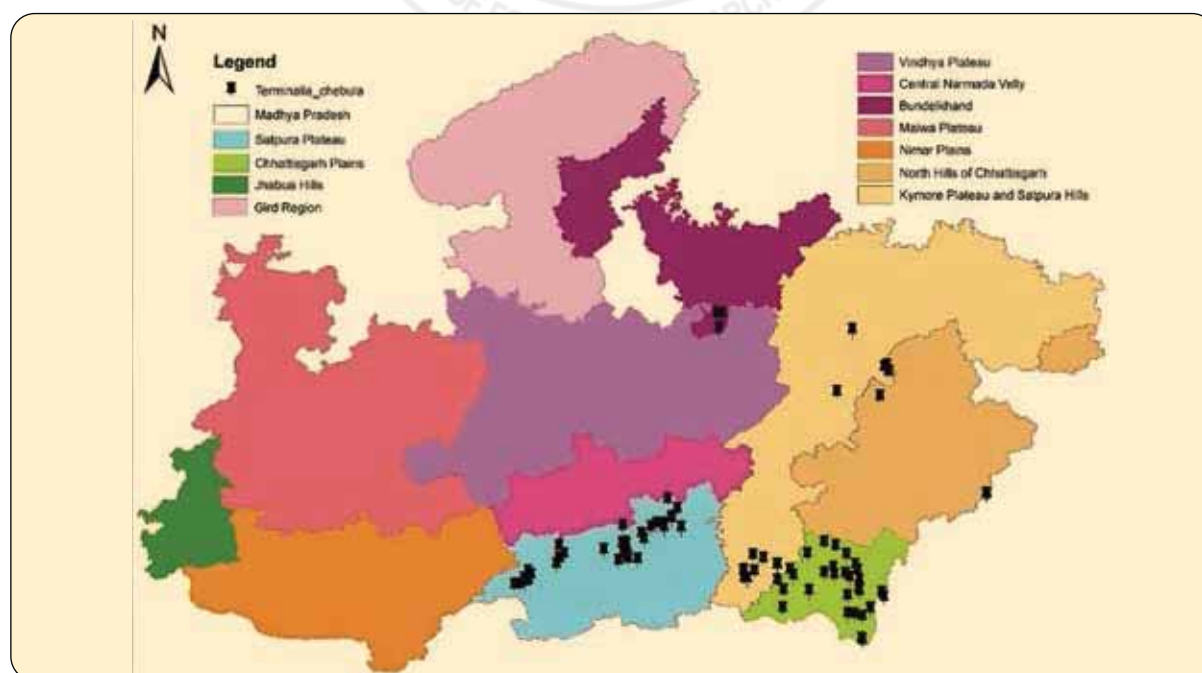


Recording of biomass data of intercropping trials

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

Prominent locations of *Terminalia chebula* (Harra) were identified and distribution map of species in

Madhya Pradesh was prepared. The fruit samples were collected from 84 beats of 14 forest divisions. The content of gallic acid in collected fruit samples varied from 0.43±0.02 to 6.22±0.25%. Average fruit size (length x width) varied from 493.31 to 1151.13 mm² for the samples collected from Dodramau beat of West Chhindwara and Bhimpur beat of North Betul forest divisions.



Distribution Map of *Terminalia chebula*

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

Seeds and rhizome samples of Mahameda were collected from 27 different geographic locations of Himachal Pradesh and established seeds and vegetative propagation trials under nursery conditions. Chemical profiling of rhizome samples of *P. cirrhifolium* revealed maximum Diosgenin content (0.501mg/g) and Protein content (3.80 mg/g) in Tower House, Nichar; Phenol content (1.432 mg/g) in Yalinge-Nichar; Reducing Sugar content (1.39 %) and carbohydrates content (33.75%) in Kasol-Parvati; Tannin content (2.85%) in the Lapah (GHNP)

Mahameda cultivation trials harvested after one year:

Treatment	Plant Height (cm)	Plant Collar Diameter (mm)	Rhizome Yield/Weight (Kg/m ²)	Rhizome Thickness (mm)	Rhizome Length (cm)	Survival Percentage
Vermi-compost						
Control	9.61	2.06	0.12	7.28	3.81	84%
250g/m ²	10.61	1.77	0.14	12.52	5.24	91%
500g/m²	16.05	6.94	0.16	13.33	5.26	100%
1 kg/m ²	8.87	1.65	0.09	11.41	3.79	100%
1.5kg/m ²	9.49	5.43	0.15	13.09	5.13	93%
Mulching						
Control	7.83	2.64	0.01	7.64	4.1	78%
500g/m ²	15.77	1.68	0.18	14.31	5.08	86%
1.0 Kg/m ²	7.38	6.06	0.07	11.70	4.57	95%
1.5kg/m ²	11.57	5.84	0.14	12.88	5.73	100%
2 kg/m²	18.65	7.64	0.22	14.27	6.41	100%
Spacing						
20*20cm	8.16	5.73	0.18	11.55	5.94	91%
25*25cm	14.85	7.41	0.29	14.57	6.31	98%
30*25cm	11.37	6.48	0.21	12.39	6.08	95%
Shading Treatment						
Control	8.71	1.85	0.02	8.75	5.66	64%
50%	14.47	6.49	0.22	11.61	7.58	92%
75%	17.94	7.28	0.25	13.75	8.64	100%
Irrigation Trials						
3rd Day	15.24	6.21	0.18	12.57	6.28	86%
4th Day	18.49	7.62	0.24	12.96	7.97	95%
7th Day	12.29	3.44	0.07	11.15	3.41	74%

The data on post-harvest management of Mahameda in semi structured questionnaire from Cheog, Danoghat, Barshaini, Tosh and Pulchan, etc., was collected. Organized one day training programme on nursery technique at Chirgaon, Rohru, Shimla H.P. 35 participants including local farmers, villagers and the President, Tridev Aushdhiya Society, Chirgaon, Shimla attended the programme.



Data collection regarding Post Harvest Management



Training Programme at Chirgaon, Rohru, H.P.

Ecological Assessment, Niche Modeling, Phytochemical Investigation and Standardization of Propagation Protocol of Some Important Himalayan Medicinal Plants for Mass Multiplication of Elite Germplasm (ICFRE-HFRI)

Total 23 populations of *Cinnamomum tamala* from Mandi district of Himachal Pradesh (09 populations); Nainital district of Uttarakhand (10 populations); and Kathua and Udhampur districts of Jammu & Kashmir UT (04 populations) were identified. One population of *Paris polyphylla* (Hurang-Narayan) in Mandi district of Himachal Pradesh identified. Population data of *C. tamala* recorded from each 23-site analyzed. Maximum species richness was recorded at Khaddi (46 species) while minimum was recorded at Kaladungi (9). Density of *C. tamala* was ranged from 20 (Mandi) to 120 Ind/ha (Keya). Germplasm of *C. tamala* collected from 20 sites during different

seasons were air-dried at room temperature for chemical profiling of bioactive contents.

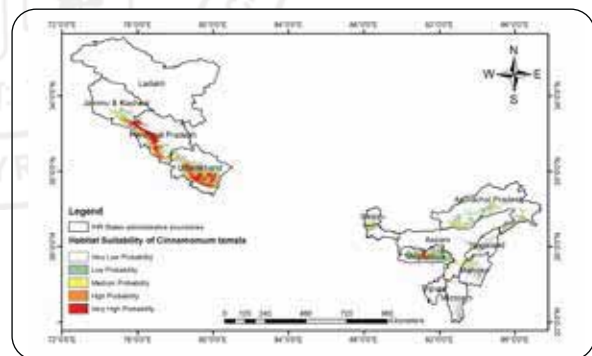
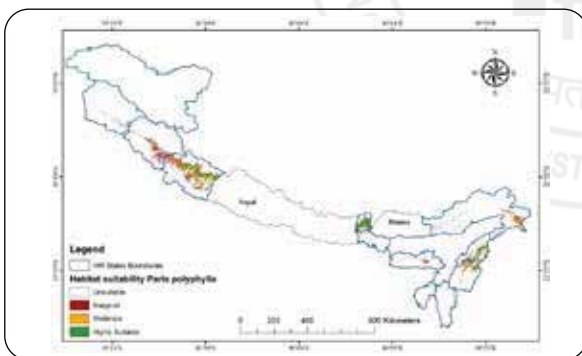
Seed viability of *C. tamala* was recorded 72% in 0.5% solution of Tetrazolium. The stored seeds were treated with gibberellic acid (GA_3 100, 200 and 300 PPM) and potassium nitrate and sown at Baragaon model nursery. A total thirty (primary 21 and secondary 9) distributional records of *C. tamala* and 123 (primary 1 and secondary 122) distributional records of *P. polyphylla* were collected through field surveys, review of literature and Global Biodiversity Information Facility (GBIF) database. The MaxEnt model's findings showed that 11.83 % (~63000 km²) geographical area of the Indian Himalayan Region (IHR) is suitable for the occurrence of *C. tamala* and only 6.00 % (~31000 km²) area is suitable for *P. polyphylla* occurrence. Two hundred stem cuttings of the *C. tamala* treated with different concentration of IBA were planted in the raised nursery bed at Baragaon nursery.



Collection of stem cuttings of *C. tamala*



Stem cutting treatment



Predicted potential distribution map of *C. tamala* and *P. polyphylla*

Chemistry of NWFPs Value Addition and Utilization

2.6.2.

Chemical and Biological Exploration of *Skimmia laureola* Essential Oil for its Industrial Utilization (ICFRE-FRI)

Skimmia laureola leaves samples were collected from Chakrata and Rudraprayag Forest areas of

Uttarakhand. Collected specimens of the plants were submitted at DD herbarium, ICFRE-FRI, Dehradun for authentication. The essential oil of leaves was extracted by hydro-distillation. The yield of essential oil and density was $0.56 \pm 0.03\%$ (w/w) and 0.878 g/cm^3 respectively.

Exploration and utilization of natural forest resources for formulation of mosquito repellents and their evaluation (ICFRE-TFRI)

Herbal Mosquito repellent liquids, creams, larvicide and sprays were developed. Herbal mosquito repellent liquid formulations were optimized and tested for mosquito repellent activity, knock down and mortality. Four formulations were found effective and formulate containing species *Lantana camara*, *Hyptis suaveolens*, *Chloroxylon swietenia*, *Murraya koenigii* and *Andrographis paniculata* resulted in 72-92% knockdown and mortality of mosquitoes. Four herbal mosquito larvicidal preparations (ELC, HHS, HLC and HECS) resulted in 100% mosquito larvae mortality, comprised plants viz. *L. camara*, *H. suaveolens* and *C. swietenia*. Four herbal mosquito repellent sprays were prepared with plants *Cassia fistula*, *Adhaotoda vasica*, *L. camara*, *H. suaveolens*, *Pongamia pinnata* and *Andrographis paniculata*. A herbal mosquito repellent cream sample was also formulated. All the developed cream samples complied with IS

6608:2004 specifications for the tested parameters viz. pH, thermal stability, total fatty substance content, total residue, heavy metals and microbial content. Herbal mosquito repellent Cream formulation (CSO) containing *C. swietenia* gave 98% repellency followed by HSME (95%) containing *H. suaveolens* species. Work was also conducted for development of market linkages for the developed herbal products.



Herbal mosquito repellent sprays creams



Herbal mosquito repellent vaporizers and larvicidals



Mosquito repellent creams

Phytochemical, morphological and molecular evaluation of RET medicinal plant *Trillium govanianum* (Nag chhatri) distributed in Northwestern Himalayan Region for its Conservation and Utilization (ICFRE-FRI)

Plant samples and geographical coordinates of *Trillium govanianum* were collected from four locations in Himachal Pradesh (Jagatsukh, Solang Nala, Kullu Valley, and Mandi). The collected plant-rhizomes were planted at ICFRE-FRI field nurseries in Chakrata, Dehradun and Khirsu, Pauri. Herbarium specimens were prepared and authenticated at DD herbarium, ICFRE-FRI, Dehradun. Morphological studies on rhizome size, scars, and weight, as well as phytochemical analysis were conducted on *T. govanianum* rhizomes. Results showed diverse rhizome sizes for length (1.2–4.7 cm), girth (0.3–1.6 cm), weights (0.18–5.0 g), and extractive yields (9.7–16.1% w/w), with varying saponin content (5.95–21.9 mg g⁻¹). Chemical profiling analysis revealed identification of 31 phytochemicals, particularly saponins, showcasing morphotype-specific accumulation patterns. Statistical analysis confirmed significant saponin variation (p=0.001) across morphotypes, with protodioscin and dioscin as prominent compounds.

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

Molecular docking studies of the identified antiviral compounds from 10 plant species *Asparagus racemosus* Willd., *Boerhavia diffusa* L., *Senna occidentalis* L., *Cissus quadrangularis* L., *Volkameria inermis* (L.) Gaertn, *Wrightia tinctoria* (Roxb.) R. Br., *Stereospermum chelonoides* (G. Don) DC., *Salacia chinensis* L., *Sphaeranthus indicus* Linn., *Strobilanthes* sp. including bufotalin, colchicine, scillarenin, phytol, α -amyrin, quinine, gamma-sitosterol, lupeol, campesterol and stigmasterol against the target protein viz., ACE2, TMPRSS2, 3CLpro, PLpro, RdRP revealed α -amyrin and stigmasterol as the most potential compounds with highest docking values. Four species viz., *B. diffusa*, *C. quadrangularis*, *W. tinctoria* and *S. indicus* revealed high bonding affinity and rmsd/ub and rmsd/pb value < 2Å° against the target proteins viz., ACE2, TMPRSS2, 3CLpro. These plant species would be promising sources for potential viral inhibitors.

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

A total of 12 blends of the dyes from the species *Stevia ovata* (Candy leaf) and *Eupatorium adenophorum* (Kalobanmara) were used in developing more color shades on silk, wool, and cotton fibres. Total 36 dyed fabrics samples were evaluated for colour coordinate, colour fastness and UV Protection Factor (UPF). The extracted dyes were also evaluated for preliminary qualitative phytochemical analysis to confirm the type of compounds present. The colour fastness of dye on silk and wool was found in the range of 4 to 4.5 in the colour scale of 1 to 5 showing very good colour

fastness of the dyed fabrics. The results show that UPF rating of the dyed wool was excellent followed by dyed cotton.

Extraction of polysaccharides was carried out from *E. adenophorum* leaves. The extracted polysaccharide was purified via repetitive precipitation, centrifugation and dialysis followed by Ion Exchange Chromatography. Subsequently, single polysaccharide was isolated by Gel Permeation Chromatography. The total carbohydrate content of *E. adenophorum* was found to be $92.91 \pm 1.16\%$. The polysaccharide was assessed for its constituent monosaccharides which were found to be Arabinose, Xylose, Mannose, Glucose and Galactose. The molecular weight was found to be 405KDa by High-Performance Size Exclusion Chromatography.



2.7 FOREST PROTECTION

Projects under the Theme

A. PLAN

Completed	06
Ongoing	09
New	05

B. EXTERNALLY AIDED

Completed	01
Ongoing	11
New	02

Insects pests, diseases and their control

2.7.1.

Insect Pest Management of Poplars using Bio-pesticides (ICFRE-FRI)

Insecticidal trials using plant extract of curry leaf (*Murraya koenigii*), moringa (*Moringa oleifera*), silver oak (*Grevillea robusta*), crofton weed (*Ageratina adenophora*), marigold (*Tegetes patula*) leaf extract, Custer apple seed (*Annona squamosa*), and sadabahar (*Catharanthus roseus*), were conducted against poplar defoliators, *Clostera cupreata* and *Clostera fulgurita* in the laboratory to screen the most effective biopesticide. Combinations of the extracts were also tested in addition to *Bacillus thuringiensis* subsp. *kurstaki* (Btk) formulation for its bio efficacy. Amongst these, seed extract of *Annona squamosa* was found to be most effective followed by leaf extract of *Tegetes patula* (Marigold) and *Moringa oleifera* leaf extracts.

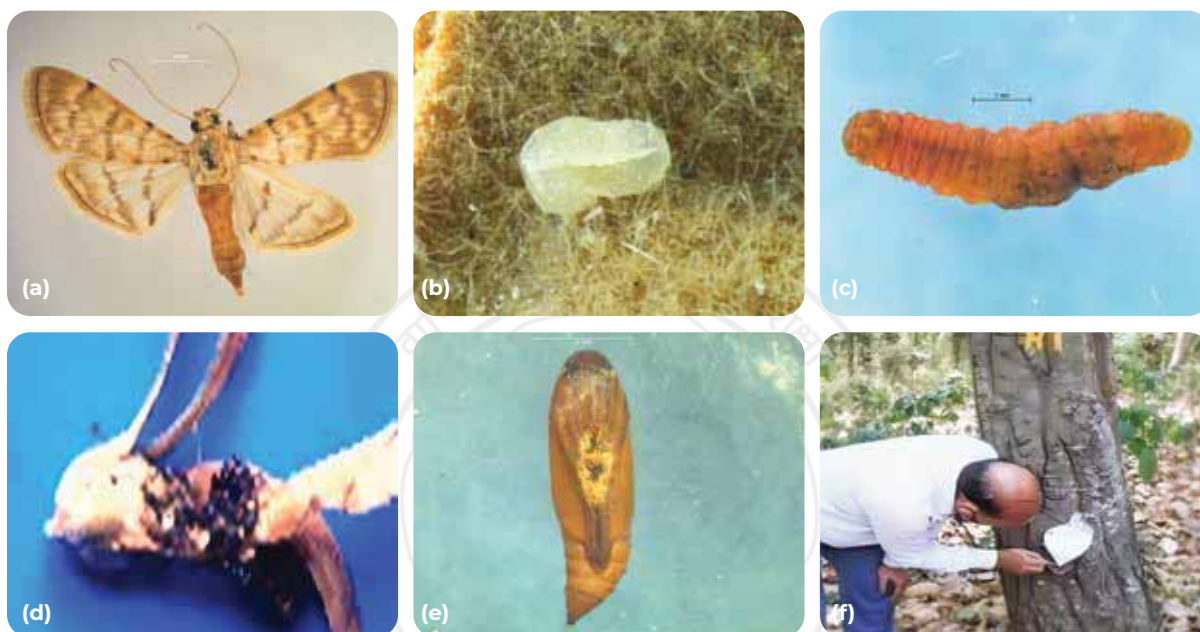
Studies on Semiochemicals for Management of Sal heartwood borer, *Hoplocerambyx spinicornis* Newman (Coleoptera: Cerambycidae) (ICFRE-FRI)

Attractancy of chemical compounds viz. ALPIN, MA, HXD, (R+LIM), HXD and MA, LIM, and CAR, in different concentrations prepared in the laboratory was tested against sal heart wood borer, *Hoplocerambyx spinicornis* beetle, for their efficacy in the field [ALPIN- 20, 56.66, 73.66,200, 400, 600ppm; HXD-20, 48,72,200, 400, 600ppm; MA-20, 50, 75 ppm; R+LIM-20, 53.66, 74.66ppm; CAR-20, 53.33,74.66ppm; Mixture-54.59 ppm]. These concentrations were used at the rate of 50, 100, and 200 micro litres per keromone trap installed in the field trials in the sal borer infested forests ranges of Asarori and Malhan, Dehradun Forest Division, Uttarakhand. Sal heartwood borer beetle did not show significant attractance towards any of these compounds, while 3 to 6 sal borer beetles were recorded daily on 'trap trees' kept in the same locations.

Bioecology and management of Sal seed borer - *Dichocrocis leptalis* Hamp. (Lepidoptera: Pyralidae) (ICFRE-FRI)

Biology of sal seed borer, *Dichocrocis leptalis* revealed four annual generations. The larva after hatching enter in the seed through micropylar end and feed vigorously on the endosperm by completely hollowing it and then form the pre-pupal stage. Incidence of attack varied from 20-45% in different sal forest ranges (Timli, Thano, Barkot and Kalsi) across Dehradun district. Experiments on Management of sal seed borer – *D. leptalis*

was conducted under both laboratory and field conditions using insecticides. The results revealed that under laboratory conditions, the most effective fumigant against the seed borer at 24 hours, 48 hours and 72 hours was Ethylene Dibromide (EDB) + CCl₄, followed by EDB, Paradichlorobenzene (PDCB) and Carbon disulfide (CS₂), respectively. In the field trails, maximum percentage of borer control was obtained by Imidacloprid 19.87%+ Beta cyfluthrin 8.49% OD at 0.16 per cent concentration with 68.10% followed by 0.08 per cent concentration resulting in 65.29 % control and 0.04 per cent concentration gave 62.07% control of the pest.



a. Moth, b. Egg; c. Larva; d. Larval damage to seed; e. Pupa; f. Control trials using tree insecticide injections

Current status of nursery diseases and insect pests of important species in forest nurseries of Madhya Pradesh and their eco-friendly management (ICFRE-TFRI)

Periodical surveys were conducted in Social Forest Nursery of Seoni (Poama nursery), Betul (Kalapatha, sapna nursery), Khandwa (Ashapur, Nimad, and Boregaon nursery), Indore (Bodgonda nursery), Jhabua (Anas and Mojipada nursery), Ujjain (Kshipra Bihar nursery), Sagar (Sironja nursery) and Jabalpur

(Sehari nursery) to record the seasonal incidence of insect pests and diseases in nursery.

An average disease incidence ranging from 35 to 45% was noted. The predominant diseases identified included pink leaf spot in *Madhuca longifolia*, Alternaria leaf spot in *Ficus* spp., leaf blight in *Dalbergia longifolia* and *D. sissoo*, leaf spot and dieback in Neem, Bipolaris leaf spot in *Bamboo* spp, rust in *Phyllanthus emblica*, anthracnose blight in *Terminalia* spp, and stem blight and rust in Teak.



Leaf skeletonization observed in teak seedlings by *Eutectona machaeralis*

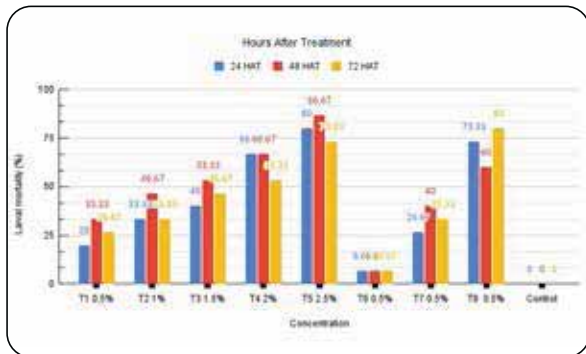


Stem gall formation by *Betousa stylophora* observed in Aonla

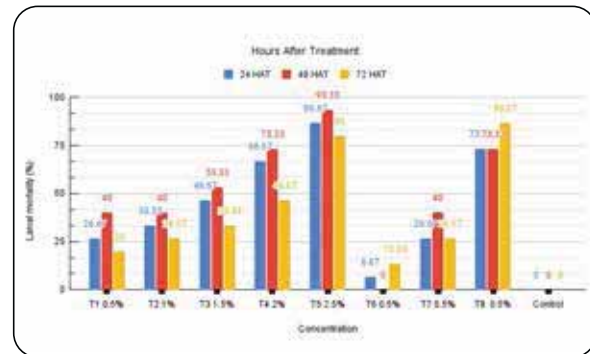


Development of nanoformulation of *Cleistanthus collinus* leaf extract for management of major defoliator pests of Teak and *Gmelina* (ICFRE-TFRI)

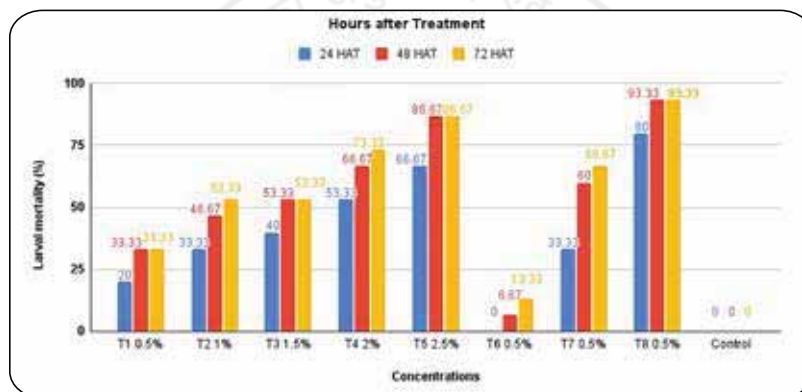
Bioassays were conducted to test the insecticidal effect of different concentrations of *Cleistanthus collinus* leaf extractives at ICFRE-TFRI, Jabalpur. The results showed that larval mortality of teak skeletonizer, *Eutectona machaeralis*, teak defoliator, *Hyblea puera* and *Gmelina* leaf webber at 2.5% concentration after 72 hours of treatment were 80%, 73.33% and 86.6% respectively.



Bioassay of different concentration of *C. collinus* leaf extract against *H. puera* larvae



Bioassay of different concentration of *C. collinus* leaf extract against *E. machaeralis* larvae



Bioassay of different concentration of *C. collinus* leaf extract against *E. machaeralis* larvae

Investigation on mortality status of *Carallia brachiata* (Lour.) Merr. in Kundapura Forest Division (ICFRE-IWST)

The stands of *Carallia brachiata* (Corkwood) trees are sparse at Shankaranarayana, Kundapura and Hebri Range, Karnataka. Comparatively the tree numbers were near about 9 to 10 along the transect of 1km on either side from the midpoint, at Udor

section, Byndoor Range. Out of the quantified 112 trees (with avg. ht. 10m and girth 1.5m) assessed in Shankaranarayana, Kundapura, Hebri and Byndoor Range, 88 trees exhibited infection (discolouration of leaves and twigs) and infestation (defoliation of leaves), apart from other symptoms like necrosis, knots, and dieback. Oozing symptom associated with decay (*Phytophthora* species) was observed in trees stand at Shankaranarayana Range.



Orchids growing over the barks



Oozing of sap (*Phytophthora* symptom) (initial stage)



Layers of bark peel (advance stage)

Determination of the vectors of Sandal Spike Disease (SSD) of Indian sandalwood (*Santalum album* L.) and development of integrated vector management strategies (ICFRE-IWST)

Sandal spike disease is prevalent in all the natural habitats of sandalwood in the forests of Southern India (Karnataka, Kerala, and Tamil Nadu) with 0 to 15 per cent incidence in symptomatic trees. Total of 115 leafhoppers have been collected from different sandalwood growing areas in Karnataka and Kerala, of which 101 species belong to Cicadellidae family and remaining 14 species to the families Coelidiini, Delphacidae, Fulgoridae, Issidae, Ricanidae and Typhlocybiniae, respectively. Symptomatic seedlings (30-40 DAS) those tested negative for phytoplasma infection were subjected to further screening of bacterial and fungal isolates. The isolated bacterial strains were *Rothia*, *Erwinia*, *Bacillus*, *Curtobacterium*, *Microbacterium*, *Rhodococcus*, and *Pseudomonas*, while fungal isolates were *Aspergillus*, *Colletotrichum*, *Fusarium*,

and *Neofusicoccum*. Non-chemical methods and nano-based products such as monitoring using sticky traps and biopesticides treatments were used in developing management strategies against the phytoplasma vectors at IWST, Bengaluru. Two species of entomopathogenic fungi infecting the leafhoppers were isolated and identified to genus level. Transition studies containing draft genome sequence of "*Candidatus phytoplasma asteris*" strain SW86 associated with sandal spike disease was also carried out.

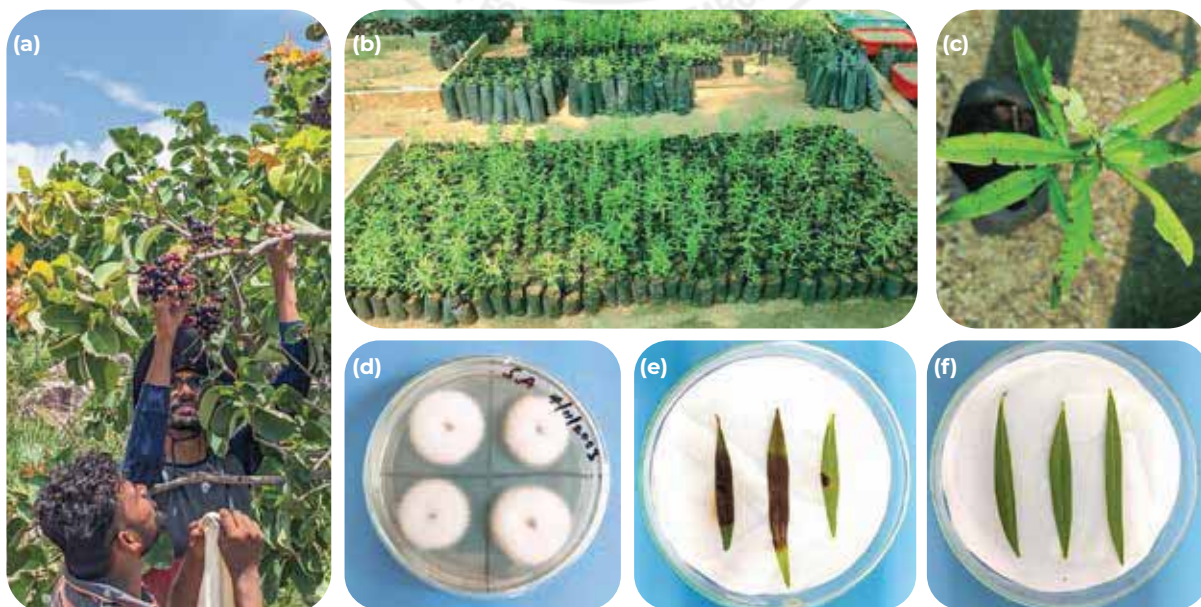


Isolation of Entomopathogenic fungi (EPFs) from putative vector

Etiology, pathogenesis and management of leaf blight disease of *Syzygium alternifolium* (Wight.) Walp. (ICFRE-IFB)

For fruit collection and disease estimation in *Syzygium alternifolium* seedlings in natural forests, surveys were conducted in Tirupathi, Chamala, Venkatagiri ranges of Tirupathi division, Balapally, Rajampet, Chitvel ranges of Rajampet division, Rapur range of Nellore division, Rayachoti and Sidhavatam ranges of Kadapa division, A.P. Blight

disease was not observed in *S. alternifolium* seedlings in natural forests in the surveyed forest ranges. Collected fruits were sown and the germination percentage of seeds across locations ranged from 43.6% to 94.4%. Blight disease incidence ranged from 0.88% to 5.66% in seedlings from different locations under nursery conditions. Pathogen associated with diseased leaf tissue was isolated and pure cultured through hyphal tip method. Pathogenicity test was conducted through the detached leaf assay. After 7-10 days post inoculation, blight symptoms were observed in leaves inoculated with the fungal isolates.

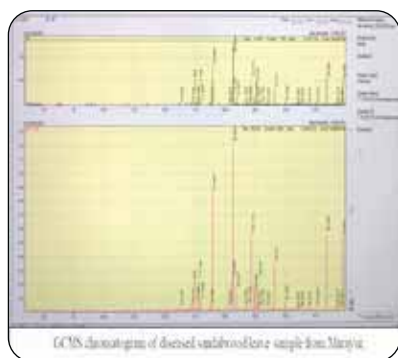


Syzygium alternifolium fruit collection in forest ranges (a), Raising of *S. alternifolium* seedlings in nursery (b) Blighted *S. alternifolium* seedling in nursery (c), Isolation of fungi from symptomatic leaf tissue (d), Pathogenicity assay of isolated fungus (e), Control (f)

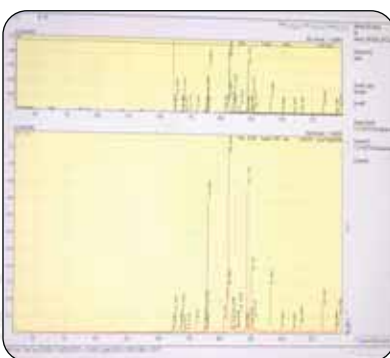
Comparative Metabolic Profiling of Healthy and Diseased Indian sandalwood (*Santalum album L.*) for early detection of spike diseases (ICFRE-IWST)

The extracts of samples of leaves and twigs of sandalwood collected from various locations of Satyamangalam, Tamil Nadu were dried, powdered and soaked in hexane, ethylacetate solvent at room temperature and were analyzed using GC-MS. The chromatograms of both healthy and diseased samples show similarity in most of the metabolites. For identification of asymptomatic

trees and their role in disease transmission, sap sucking insects, particularly the leafhoppers were collected from MM Hills Karnataka and Marayur Kerala and screened for the presence of phytoplasma. 18 species of leafhoppers were recorded in IWST Malleshwaram campus on sandalwood trees and around 20 insect species each recorded in MM Hills and Marayur Sandal wood reserve. From the above, two species *Balclutha* spp., *Maiestas* spp., had the presence of phytoplasma. All the bio physical characters like Epicuticular wax (EW), stomatal index, leaf shape, and leaf thickness in trees showed distinct variations. These findings will help in early detection of sandalwood spike disease.



GCMS chromatogram of diseased sandalwood leaf sample from Marayur



Leaf Hoppers:
Balclutha sp.



Maiestas sp.

Study on seasonal episodes of Neem (*Azadirachta indica A. Juss*) decline in parts of Karnataka (ICFRE-IWST)

Incidence of decline of Neem due to dieback symptoms ranges between 40 to 100 percent. High incidence above 80% was observed at Shahpur and Hunsigi taluks of Yadgiri district, and Lingsugur and Raichur taluks of Raichur district.

Sixty percent of incidence was prevalent in a plantation inside the forest, and 75% was prevalent in a roadside plantation at Sira taluk of Tumkur district. *Phomopsis azadirachtae* was the pathogen prevalent and isolated from the infected trees of Raichur and Tumkur district. *Fusarium semitectum*, *Pestalotiopsis* sp., and *Curvularia lunata*, were also isolated and recorded from the infected trees of Sira taluk of Tumkur district.



Infected trees



Spores of fungi *Pestalotiopsis* sp., and *Fusarium* sp.

Entomopathogenic Fungi as Endophytes for Biological Control of Subterranean Termites (ICFRE-AFRI)

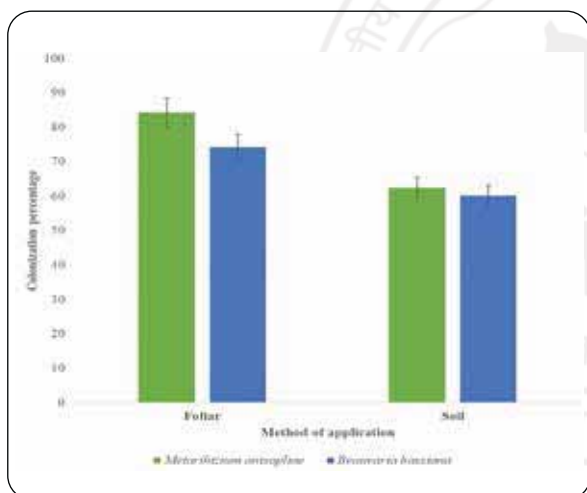
From the study it was revealed that *Metarhizium anisopliae* exhibited higher efficacy against termite with a median lethal time (LT50) of 32.849 hours and LT90 of 60.088 hours, compared to *Beauveria bassiana*'s LT50 of 42.485 hours and LT90 of 94.832 hours. The chi-square values indicated a good fit for the data, with slopes reflecting a potent effect, especially for *M. anisopliae*. The heterogeneity factors were 2.52 for *B. bassiana* and 0.27 for *M. anisopliae*, indicating some variability among insect responses. These findings highlight *M. anisopliae* as a more effective candidate for termite control, showing faster and more potent lethal effects.

Also evaluating the colonization rates and efficacy of *M. anisopliae* and *B. bassiana* against termites in *Dalbergia sissoo* seedlings. Both foliar and soil inoculation methods were meticulously implemented, with seedlings inoculated with

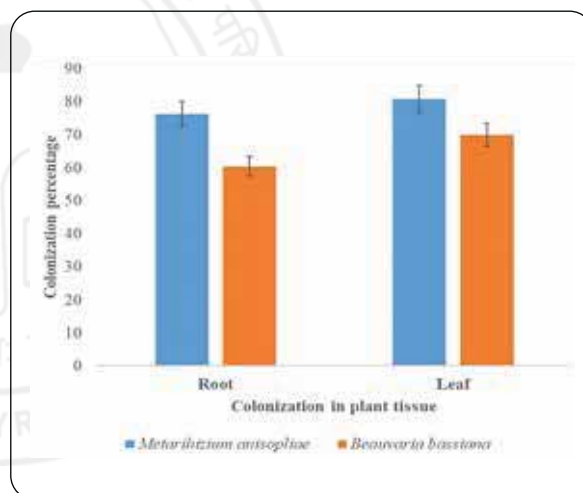
spore suspensions. Colonization rates were regularly monitored, and samples were cultured to confirm fungal presence. *M. anisopliae* exhibited robust colonization, with 84.31% in foliage, 62.45% in soil, 76.36% in roots, and 80.94% in leaves, demonstrating strong colonization across all plant parts. In contrast, *B. bassiana* showed lower rates, with 74.32% in foliage, 60.15% in soil, 60.52% in roots, and 69.98% in leaves.

Statistical analysis revealed significant differences, particularly in root and leaf colonization, where *M. anisopliae* outperformed *B. bassiana*. The P-values for root and leaf colonization were highly significant ($P < 0.01$), indicating a stronger colonization efficacy of *M. anisopliae*. Least Significant Difference (LSD) values further confirmed these differences.

Overall, *M. anisopliae* demonstrated superior colonization capabilities, particularly in roots and leaves, suggesting it as a more effective biological control agent for managing subterranean termites in forest plantations. This comprehensive assessment provides a strong foundation for future field trials and large-scale implementation in pest management programs.



The colonization percentage of Entomopathogenic Fungi (EPFs) achieved through two different application methods.



The colonization percentage of Entomopathogenic Fungi (EPFs) in the root and leaf tissues of *D. sissoo* seedlings.

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

From different Oak (*Quercus* spp.) forests from various Forest Divisions (Shimla, Karsog, Nachan, Chamba, Churah, Kullu and Kinnaur) of Himachal Pradesh. 116 species of insects were collected and identified. Major pests included Lepidoptera [*Heterocrassa expansalis*, a tent caterpillar of moru oak; *Areas galactina*, *Deroca inconclusa*, *Cerace* sp. and *Arctornis submarginata* as defoliators of ban oak]; Hemiptera [*Halyomorpha* sp. and

Physomerus sp., sap sucker of ban and moru oaks] Coleoptera [*Phyllobius argentatus*, a leaf feeder of ban, *Apoderus bistrifolatus*, leaf roller of ban; *Curculio glandium*, a seed borer of ban oak]. Selected treatments of insecticides (Chlorpyrifos, Nimbecidine); bio-pesticides (*Boenninghausenia albiflora*) were applied to check their efficacy against the moth *Heterocrassa expansalis*. The average mortality of *H. expansalis* recorded after 72 hours of treatment with Chlorpyrifos, Nimbecidine, *B. albiflora* (Pissumar) extract was found to be 86.11%, 67% and 53.33%, respectively.

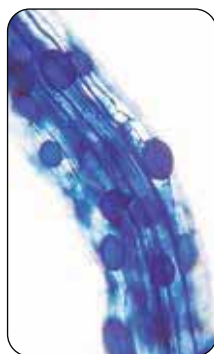
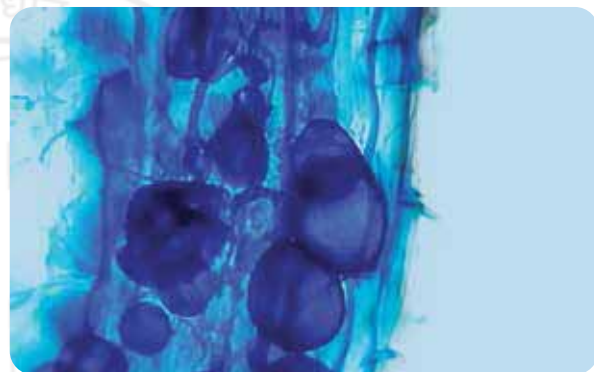
Mycorrhizae, Rhizobia and other useful microbes

2.7.2.

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

Uttarakhand and Himachal Pradesh of Indian Himalayan region were surveyed for the collection of soil/seed/plant samples of *Angelica glauca*. During survey in Uttarakhand, three new distribution sites were explored i.e. Khait Parvat (Tehri range), Harsil (Gangotri range, Uttarkashi) and Chopta region (Rudraprayag range). The plant samples/seedlings were propagated in High Altitude Herbal Garden, FRI nursery at Chakrata, Dehradun for its propagation and conservation. Isolation,

identification, inoculum production and mass multiplication of elite strains of Endomycorrhizae and Root fungal endophytes are accomplished. Some of the major isolated root fungal endophytes are *Penicillium chrysogenum*, *Fusarium oxysporum* and *Geotrichum candidum* whereas some of the significant endomycorrhizal spores are found to be *Glomus mosseae*, *Acaulospora* sp., *Glomus macrocarpum*, *Gigaspora gigantea*, *Acaulospora laevis* and *Sclerocystis coremioides*. In addition, about 35 phytochemicals from the essential oil of *A. glauca* roots (natural) have been identified through GC-MS analysis. The protocol for callus formation for rootlet biomass production through root cuttings has been completed and rootlet biomass production is under process.



Inoculum production and mass multiplication of elite strains of Endomycorrhizae

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

Tectona grandis stumps were inoculated with VAM, *Phosphobacterium*, *Azotobacter*, *Trichoderma* and *Azospirillum* in different combinations and planted in Konni Forest Division Kerala. Evaluation of the trial in the first year revealed that treatment with *Azotobacter* and *Azospirillum* showed > 20% growth performance in the field when compared to control and other treatments.



Teak stump plantation trial at Konni Forest Division, Kerala

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

Cultures of *Funneliformis mosseae*, *F. constrictum* and consortium of Arbuscular Mycorrhizal Fungi (AMF) were maintained in pots with living host. Artificial inoculation with AM fungi exhibited significant improvement compared to the control in the growth metrics of *A. glauca* and *V. jatamansi*. Rhizomes of two-year-old *A. glauca* were utilized for the extraction of essential oil. Inoculation with

AMF increased the oil yield in the range of 7.32-25.32% as compared to control. The maximum increase in oil yield in comparison to control was recorded in the plants inoculated with *F. mosseae*, followed by plants inoculated with *F. constrictus* and consortium of AMF. One day training programme on 'Application of mycorrhizal biofertilizers in organic cultivation' was organized at KVK Saru, Distt. Chamba, Himachal Pradesh. Eighty farmers attended the training programme. The participants were also given access to the product (Him MridaSanjeevini) that ICFRE-HFRI has developed. One gram formulation contains about 100 viable propagules of Arbuscular Mycorrhizal Fungi (AMF).



Left to right- Maintenance of AMF consortium in pots; Essential oil extracted from *A. glauca*

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

The ectomycorrhizal associates of *Abies pindrow* and *Picea smithiana* were identified belonging to 22 species representing 14 genera. *Russula* (4 species), *Ramaria* (3 species), *Geastrum*, *Lactarius*, *Boletus* and *Amanita* each with 2 species were recorded as dominant genera. The growth parameters of the inoculated seedlings were found to be 31.70 % higher compared to the control. Him Growth Booster a mycorrhizal biofertilizer formulation was prepared by ICFRE-HFRI, Shimla. Each Capsule contains the culture of *Ramaria formosa* cultivated in Ragi (Finger

Millet) and mixed with talc. Protocol for molecular characterization of ECM fungi was optimized. DNA of *Ramaria* and *Geastrum* sp. was isolated. DNA sequences were amplified using PCR. Additionally, a metagenomic analysis of fungal diversity in the roots of *P. smithiana* was conducted using Next-Generation Sequencing. The analysis yielded a total of 0.4 million reads, representing 161 Operational Taxonomic Units (OTUs) belonging to 95 genera, 67 families, 35 orders, and 4 divisions. Of these, 27 OTUs were identified as belonging to the ectomycorrhizal guild, which constituted the most abundant fungal community, representing 79 percent of the total. 'Him Growth Booster' was released by Director General, ICFRE Dehradun in Kisan Mela at Chamba, Himachal Pradesh.



From left- Non-inoculated and inoculated seedlings of *P. smithiana*; Him growth booster formulation and release of the product

Production of Quality Planting Stock and Capacity Building of Field Functionaries of HPFD on Quality Seedlings Production by Using Mycorrhizal Biotechnology (ICFRE-HFRI)

Himachal Pradesh Forest Department (HPFD) representatives were consulted in order to choose nurseries that would be inoculated with mycorrhizae.

Ectomycorrhizal fungus, *Ramariaformosa* was effectively mass produced. Two-year old *Cedrus deodara* seedlings were artificially inoculated with *R. formosa* at the Sainj nursery in the Theog Forest Division. The impacts of the inoculation process on the growth parameters of the seedlings are being periodically recorded.



(a) Mass culture of *R. formosa*; (b) Artificial inoculation of *C. deodara* seedlings; (c) Inoculation of *C. deodara* seedlings with Him growth booster

Studies on Ecological and Ethnomycological Aspects of Macrofungi of Lower Subansiri, Arunachal Pradesh (ICFRE-RFRI)

A total of 18 species of macrofungi were collected from Ziro and Yachuli following the transect method. Ethnomycological survey was conducted in Lumri village under Yachuli and Posa village

under Yazali circle. During ethnomycological survey, it was found that five species viz. *Auricularia judae*, *Pleurotus citrinopileatus*, *Lactarius camphoratus*, *Pleurotus pulmonarius* and *Termitomyces* sp. of wild edible mushrooms are harvested from forest and *Jhum* cultivated land by Nyishi tribe. During the field survey two wild edible mushrooms viz. *Pleurotus citrinopileatus* and *Lactarius camphoratus* were also collected from Yachuli.



Pleurotus citrinopileatus

Lactarius camphoratus

Microsporus spp

Suillus mediteraneensis

Lycoperdon pyriforme

Favolaschia spp.

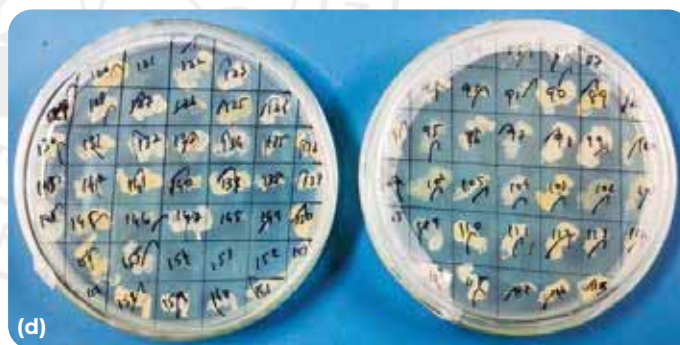
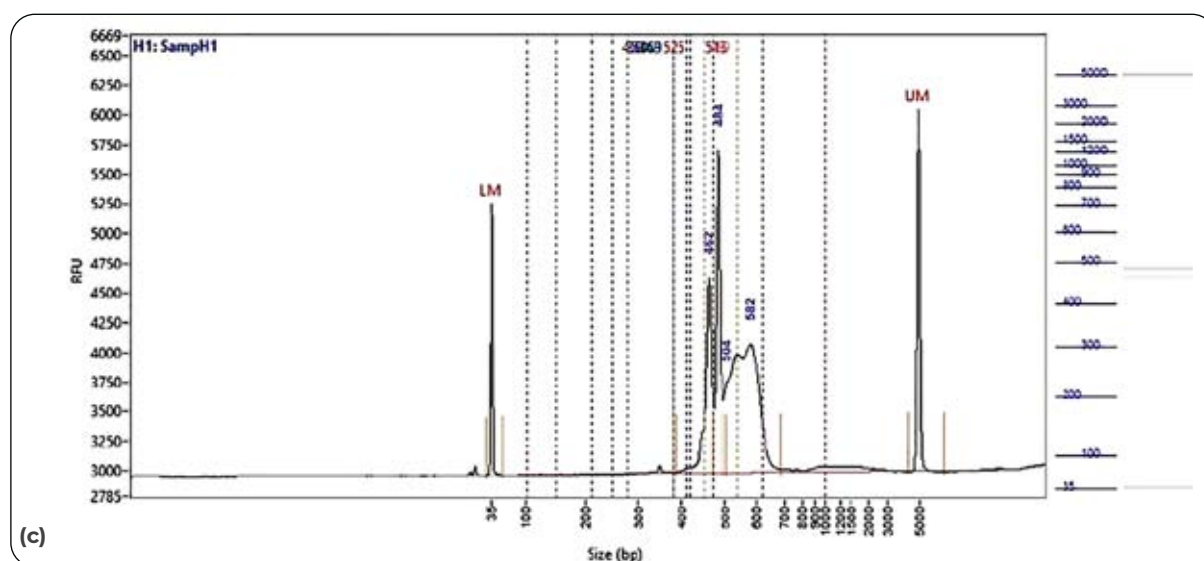
Suillus collinitus

Suillus spp.

Exploration of rhizospheric and endophytic microbiomes of *Rhizophora mucronata* Lam. in the east coast mangroves of India and their deployment for stress management in tree crops (ICFRE-IFB)

Leaf and rhizospheric soil samples were collected from three small-sized *Rhizophora* trees (>50 m apart) growing in Coringa mangroves. DNA was isolated from one batch of surface sterilized leaf samples and rhizospheric soil samples in two

replicates. V3-V4 region (bacteria) was amplified from the isolated DNA, libraries were prepared, quality checked and sequenced in an Illumina platform. Number of raw paired-end reads obtained across samples ranged from 1.02 lakh to 1.2 lakh. Other batch of surface sterilized leaf samples was crushed in phosphate buffer and the serial dilutions (10^{-2} to 10^{-5}) of the supernatant were plated in marine agar (MA) plates. Serially diluted rhizospheric soil samples (10^{-2} to 10^{-5}) were also plated in MA plates and incubated. A total of 134 bacterial colonies were picked and pure cultured.



Collection of leaf samples from *Rhizophora* trees in Coringa mangroves (a), Quality of one of the prepared amplicon libraries (V3-V4) for Next Generation Sequencing (c), Bacterial isolates obtained from rhizospheric soil and surface-sterilized leaf samples (d), Pure cultures of some of the obtained bacterial isolates (e)

2.8 SCHEMES FUNDED BY NATIONAL AUTHORITY CAMPA

All India Coordinated Research Projects (AICRPs)

1 Component

Conservation and Productivity Improvement of Red Sanders

During the period under report two progeny trials were established at Nelhal, Karnataka and Mangapuram, Andhra Pradesh, with half-sib progenies of 21 plus trees. About 2757 seedlings were raised in nurseries at ICFRE-IFB and BIOTRIM, for two planned provenance trials in the current year. Vegetative propagation was further explored through grafting and rooting trials of micro coppice shoots. Grafting was carried out in 35 plus trees. Altogether, 545 numbers of grafts were prepared. For micropropagation of Redsanders, multiple shoot induction and shoot elongation were achieved in TDZ (2 mg/l) + Kn (3.0 - 4.5 mg/l) and TDZ (2 mg/l) +BAP (3.0 - 4.5mg/l) medium after three subcultures. Root initiation was observed at ½ strength MS Medium with coconut water (2.0ml) and IBA (0.5mg/l). In the field trial plot

established at Puliangudi Village, Thenkasi, Tamil Nadu, 90% survival was recorded. Better growth was recorded in Rhizobium inoculated seedlings compared to the control. Seventy-five EST-SSR primers were synthesized and screened, out of which 26 primers detected polymorphism in the initial screening done on five germplasm accessions. Allelic data generated with 10 EST-SSR primers revealed high level of polymorphism in the 59 natural population accessions with a mean PIC value of 0.800. Fifty-seven (57) plus trees were characterized with six polymorphic EST-SSR markers. High polymorphism was observed with a mean polymorphic content of 0.749. The number of different alleles per loci ranged from 4-13 with a mean Na of 7.167. The Shannon's information index ranged from 1.110 to 2.409 with a mean of 1.623. Two chemical compounds were isolated, purified from methanolic extract of Red sanders heart wood and one compound was characterized and identified.

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

Highly productive interspecific hybrid clones along with benchmark varieties were tested in 15 diverse locations across eight States (Andhra Pradesh, Gujarat, Haryana, Jharkhand, Madhya Pradesh, Tamil Nadu, Telangana and Uttar Pradesh). These trials were assessed for growth and tree form traits. In most of the test locations, clone CH5 showed the best survival, growth and form traits followed by clones CH1 and CH2. They are recommended for cultivation in and areas similar to the test locations. The top-ranking clone CH5 is shortlisted for release as an All-India Variety through the variety releasing procedure of ICFRE. Progeny trials established in eight locations using germplasm assembled from breeding populations in India, China, Kenya and Malaysia were evaluated for growth and form characters at the age of two years (5 trials) and one year (three trials). Ranking of families and trees was made based on early growth data and 75 outstanding individuals have been clonally propagated for future field testings. Evaluation of two trials involving sandalwood trees and different clones of *Casuarina* showed that *Casuarina* clones CH2 and CH5 were fast growing

and also promoted growth of sandalwood trees. The water use efficiency of the three superior clones and one benchmark clone were studied using Sap Flow Meter. The uptake of water by individual trees were recorded throughout the day during different seasons in one location. Among the four clones evaluated, water uptake was higher in clone CH2 (10.85 liters per day) followed by CH1 (10.57 liters per day) and CH5 (9.38 liters per day). The least water uptake was recorded in Marakkanam clone (7.06 liters per day). The nutrient uptake and distribution by the trees was studied by collecting wood samples from different clones and analyzing them for the presence of different nutrients. The nutrient concentration was higher in clone CH5 for all the three elements studied viz. N, P and K by registering 2.72%, 0.13% and 1.23% respectively. Clone CH1 recorded lower concentrations of N (2.41%), P (0.09%) and K (0.88%). Intermediate nutrient concentration values were recorded for clone CH2 for N (2.62%), P (0.12%) and K (1.07%). Wood properties (basic density, moisture content, fibre dimensions, pulp yield) were studied in five trials that have attained the age of three years. The basic wood density ranged from 504 to 565 kg m⁻³ and pulp yield from 47.8% to 50.3% offering scope for selecting accessions with dense wood high pulp content.



Variable growth and poor stem form of seed source (foreground) compared to uniform and straight stems of clone CH5 (background) at three years age (Ariyalur, Tamil Nadu)



Recording of water use by selected *Casuarina* clones using Sap Flow Meter



Comparable growth and tree form of newly selected clone PV27 (left) and commercial clone CH2 (right) in a three-year old clone screening trial (Ariyalur, Tamil Nadu)

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

The project aims to map the spatial extent of selected Invasive Alien Plant Species, their impact on native plant diversity, their future invasion/spread potential using Species Distribution Models and their utilization potential with a view to come up with species-specific management strategies. Spatial mapping studies showed that *Prosopis*

juliflora occupied 8.10 Lakhs ha area while *Acacia mearnsii* has occupied 25478.36 ha area in Tamil Nadu. About 31% of the study area in the states of Chhattisgarh, Jharkhand, and West Bengal is presently susceptible to invasion by *Lantana camara*.

The study on the impact of *Lantana* on regeneration revealed that in *Lantana* invaded sites, regeneration of native species affected by 40-70% compared to non-*Lantana* area in Madhya Pradesh. The impact of *P. juliflora* on soil moisture and humidity were studied using sensors, which showed that soil moisture and humidity was lower in the invaded sites than the control sites.

Briquettes from *P. juliflora* biomass were prepared at $7\pm 2\%$ and $18\pm 2\%$ moisture contents and it was found that the briquette produced at less moisture content crumbled during abrasion whereas, good quality briquettes were obtained at $18\pm 2\%$ moisture content. The potential of *A. mearnsii* bark as a source of natural dye for textile industries has been explored. Optimum dye extraction occurred in 30% methanol with five hour extraction time with the material to liquor ratio of 1:50. The effect of various mordants on the quality of natural dye is being assessed.

Pre-emergence herbicides proved to be more efficient in controlling Lantana in experimental sites. Release of bioagent *Teleonemia scrupulosa* for biological control of Lantana under net house conditions did not cause any damage during October to March. Manual removal of *M. micrantha* after germination was found effective to check its climbing on the trees. Restoration trials established in *P. juliflora* (Pudukkottai, Tamil Nadu), *L.camara* (Solan forest division, Himachal Pradesh; Jabalpur, Madhya Pradesh) and *M. micrantha* (Dissoi RF, Assam) invaded areas are being monitored for the survival, growth and regeneration of native plant species.

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

Microwave vacuum drying characteristics of *Bambusa balcooa* were evaluated. The results indicate that drying time was significantly reduced from 12 days (using conventional kilns) to 17-20 under when microwave pre-treatment. High intensity microwave treatment resulted in higher defects and lower intensity treatment resulted in almost no defects. However, the defects arisen after MW pre-treatments did not advanced further during conventional drying. Purely conventional kiln drying resulted in longest drying time (12 days)

and highest drying defects. Colour of the bamboo improved from pale whitish tone to golden brown. Status of the drying stresses also gave interesting patterns. A C-ring prong movement test revealed that microwave vacuum dried bamboo specimens were under compressive stresses whereas, conventional kiln dried specimens were found to be under tensile stresses. The tensile stress during the bamboo drying was responsible for the development of nodal and intermodal cracks in the round bamboo. MW based bamboo bending and straightening system have been designed, developed and commissioned at ICFRE-IWST. Initial trials and training have been carried out at ICFRE-IWST.



High intensity, Low intensity MW pre-treated bamboo drying quality



MWVD and conventional kiln dried *B. balcooa*

Large size wood specimens of *Melia dubia* (5" x 5") cross section were dried in the microwave vacuum dryer (MWVD) in four batches. In conventional kiln drying using steam heated kiln, it may take 1.5 to 2 months (1000-1200 h) to dry these sizes of the timber. In MWVD, it took, approximately 13.5 h in 2-4 drying runs.

However, mean electrical energy consumption was found to be 21.6 units/ cubic feet wood volume (676.3 units/ m^3 wood volume) or 5.74 units/ kg water removed.



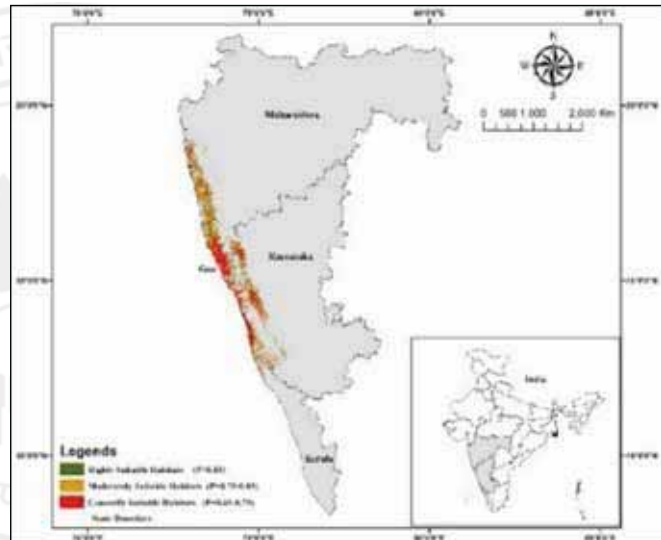
Building and construction grade (window and door frame/ railing main support/ handicrafts) sizes of *Melia dubia* dried in microwave vacuum dryer

All India Coordinated Research Project on Bamboo

For eco-distribution mapping, SENTINEL satellite data was utilized for the North Eastern hill states, namely Arunachal Pradesh, Assam, Manipur, Meghalaya, and Nagaland with 87.33% accuracy. The LULC map was completed for Ariyalur, Coimbatore, Cuddalore, Dharmapuri, Dindigul, Erode, Kanniyakumari, Kallakurichi, Karur, Krishnagiri, Madurai, Namakkal, Nagapattinam, Nilgiris, Perambalur, Pudukottai, Ramanathapuram, Salem, Sivaganga, Tenkasi, Theni, Thoothukkudi, Thiruvavur, Trichirappalli, Tirunelveli, Trippur, Virudhunagar district of Tamil Nadu with 88.22% accuracy.

For the distribution of *B. balcooa* six states; Assam, Arunachal Pradesh, Nagaland, Sikkim, Tripura and West Bengal were sampled to record 330 geo-coordinates. Estimated area of 2206.08

km² with maximum 425.81 km² in Jorhat, Assam and minimum 0.75km² in Khowai, Tripura were recorded for the distribution of *B. balcooa*. The distribution maps of *Dendrocalamus strictus* (Dstr) and *D. stocksii* (Dsto) were completed. 26 states, namely Arunachal Pradesh, Assam, Bihar, Chhattisgarh, Goa, Gujarat, Haryana, Himachal Pradesh, Jammu Kashmir, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Mizoram, Odisha, Punjab, Rajasthan, Sikkim, Tamil Nadu, Telangana, Uttar Pradesh, Uttarakhand and West Bengal were sampled to record 116 geo-coordinates of *D. strictus*. Estimated area of 40122.58 km² with maximum 11877.95 km² (Karnataka) and minimum 1.63 km² (Mizoram) were recorded. In case of *D. stocksii*, four states, namely Goa, Karnataka, Kerala and Maharashtra were sampled to record 68 geo-coordinates. An estimated area of 8281.12 km² with maximum 3736.08 km² (Karnataka) and minimum 72.76 km² (Kerala) were recorded for the distribution.



Habitat suitability map of *D. strictus* pan India and *D. stocksii* in Southern India

For mass propagation of the selected germplasm tissue culture protocols have been developed for *Bambusa balcooa*, *B. cacherensis*, *B. nutans*,

B. tulda, *B. nutan*, *B. polymorpha*, *Dendrocalamus brandisii* and *D. stocksii* and *D. strictus*.



Tissue culture of *B. balcooa*; *D. brandisii* and hardened plantlets of *B. balcooa*

Standardization of propagation through culm cutting recorded 55.5% of rooting in *B. cacharensis* at 1200 ppm of IBA and for *Schizostachyum dullooa* culm at 1000 ppm. Culm cuttings of *B. balcooa* macropropagated in 2000 ppm IBA talc formulation

gave 70% success. About 1500 propagules of *B. cacharensis* (Genotype: KR/BC/01) and *B. tulda* (Genotype: AP/BT/06) available, with propagation protocol at ICFRE-RFRI, Jorhat.



Marking of age in stand of *D. strictus*

The species *Murraya koenigii* and *Ageratina adenophora* were tested for antifungal potential against fungal isolates from diseased bamboo samples. It was found that 1.5% extract of *Murraya koenigii* was most inhibiting against *Pestalotiopsis* followed by *Alternaria* and *Fusarium*. Whereas, 1.5% extract of *Ageratina adenophora* was most effective against *Alternaria* followed by *Fusarium* and *Pestalotiopsis*.

Four new insects, bamboo leaf defoliators – *Oxya fuscovittata*, bamboo borer – *Lyctus carboneris*, flower chafer beetle – *Clinteria klugi* and bamboo termite – *Odontotermes obesus* were abundantly found on *B. tulda*, *D. strictus* and *B. vulgaris*

The outbreak of insect leaf roller *Prausta coclesalis* was observed in bamboo species during September – October at nursery and plantation. Insecticides Monocrotophos 36% EC (0.05%) was most effective against *P. coclesalis* in nursery and field.

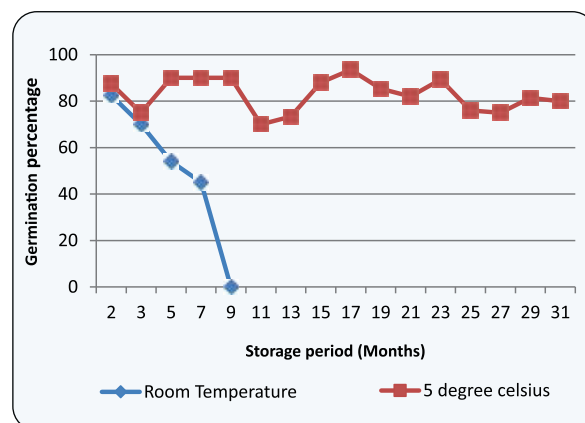
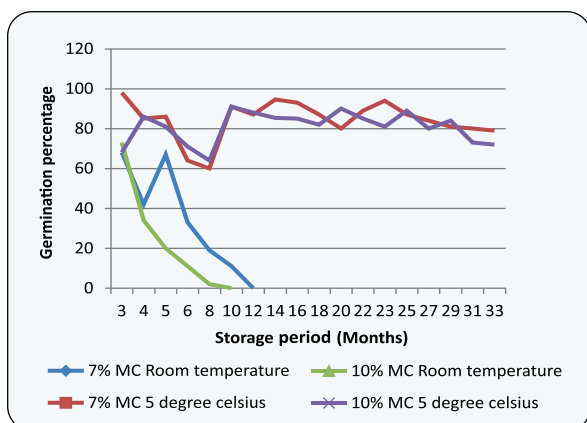
Neem and *Pongamia pinnata* seeds oil were tested against identified fungal strains for the protection of in service bamboos. Fumigation of *B. balcooa*, *D. strictus* and *B. tulda* with 5%, 10% and 15% of Neem seed oil (NSO) and Pongamia seed oil (PSO) against the fungus *Poria monticola* yielded upto 70% protection with 15% concentration of NSO. Soil block bioassay of *B. balcooa*, *B. tulda* and *D. strictus* fumigated with Pongamia seed oil with the fungus *Pycnoporus sanguineus* showed upto 75% protection with 15% concentration of PSO.



Field test of bamboo samples (*B. tulda*, *B. balcooa* and *D. strictus*) fumigated with different concentration of neem seed oil (Left) and pongamia seed oil (Right)

In farmer's plot of *Bambusa vulgaris* in Kotiya, Raebareli, UP, clump management by thinning and soil loosening was carried out for demonstration purpose. In demo plantation at farmer's field in Kundam village of MP maximum emergence was recorded in the treatment - Soil working + Manure 50 kg + Thinning 50 %, maximum with 15 and minimum eight shoots in each clump.

Seed storage of two most widely distributed species of bamboo in forest *Bambusa bambos* and *Dendrocalamus strictus* achieves a breakthrough success in storage. In case of seeds of *Bambusa bambos* 80 % germination was maintained at 7 to 10 % moisture content and 5° C temperature whereas in *Dendrocalamus strictus* 80 % germination was maintained at 5° C temperature in 33 and 31 months respectively.

Germination behaviour of stored seeds of *Bambusa bambos* and *D. strictus*

All India Bamboo Flowering Database is under development, presently validation is going on. Flowering data of 19 bamboo species have been recorded, information on total 61 bamboo species from different parts of the country have been incorporated in the flowering database.

De-structured bamboo boards of *Dendrocalamus somdevai*, *D. membranaceus*, *B. tulda* and *B. balcooa* were prepared with various pressure levels viz; 21.0, 24.5, 28.0, 31.5 kg/cm² and physical and mechanical testing were carried out as per IS 1734 and 1708.

Flowering record and herbarium specimen of *Bambusa polymorpha*.Preparation of destructured Bamboo Board from *Bambusa balcooa*

Twenty-five CPCs of *Dendrocalamus strictus* were collected and maximum Kraft pulp yield was recorded for CPC- 6-16 (54.85% at 16% alkali charge; 53.15% at 18% alkali charge; 50.58% at 20% alkali charge) followed by CPC-10-4 (54.43% at 16% alkali charge; 50.89% at 18% alkali charge; 48.06% at 20% alkali charge) and CPC-6-20 (53.78% at 16% alkali charge; 50.40% at 18% alkali charge; 50.30% at 20% alkali charge).

Established eight Bambusetums/ Germplasm banks, two at ICFRE-IFP Ranchi and its Mander Research station, two at ICFRE-FRI Dehradun each at PAU Research Farm, Ladowal (Punjab) with 18 species and Mansa in Research Farm of ICAR-IISWC (Indian Institute of Soil and Water Conservation),

Chandigarh with 21 species, one at ICFRE-TFRI Jabalpur campus with 37 species and one at Assam (ICFRE-RFRI Jorhat) with 27 bamboo species, one by ICFRE-IFGTB with 44 species at Iduvai Village, Tirupur District, Tamil Nadu, one at Goa by ICFRE-IWST.

Printed technical bulletin, posters and conducted trainings for dissemination of information on Bamboos. A Digital Brochure on bamboo Hindi and English has been prepared by ICFRE-FRI Dehradun and a technical bulletin on *Dendrocalamus stocksii* in Kannada by ICFRE-IWST Bangalore. Five posters on Bamboo Value Addition have been prepared in English and the same has been translated into Tamil and Malayalam by ICFRE-IFGTB.

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

Surveyed 61 natural/ naturalized populations of sandalwood across six states including Tamil Nadu, Karnataka, Andhra Pradesh, Rajasthan, Kerala and Gujarat and a nursery with single tree selection were raised for 316 families. Established two Field Trials in 1 ha area at Pachamalai, Tamil Nadu (single tree selections) and Kanasar village, Rajasthan (bulked seed collections).

The first single base resolution unbiased methylome maps were generated for leaf and wood. Functional analysis predicted maximum differentially methylated regions in the intergenic region with chromosome-1 registering maximum methylated region. DNA methylation is significantly correlated with gene expression and is reported to govern phenotypic plasticity. The tissue-specific methylation status predicted in sandalwood genome can facilitate research in identifying epigenetic signatures/ biomarkers for climate adaptation, response to biotic/ abiotic stress and oil yield in heartwood.

The heartwood content in standing trees was estimated using Electrical Resistivity Tomography (ERT) in 73 plantations in Karnataka. The data was shared with the farmers and the technology is being extended to the sandalwood growers of the state at the cost of Rs. 200.00 per tree for a minimum of 50 trees. Further, analysis of tree growth and soil properties across different agro-climatic zones indicated that the Northern dry zone including Bagalkote, Belgum, Bellary, Bijapura, Dharwad, Koppal districts was more suitable for sandalwood cultivation while coastal zone including Dakshina Kannada, Udupi districts were least suitable for the species.



Extension of ERT technology to farmers in Karnataka

Survey was conducted in 150 sandalwood based agroforestry plantations in eight agro-climatic zones of Karnataka to document the silvicultural practices implemented in these trials. In the Eastern dry zone, the preferred host was mulberry while mango, *Melia* and pomegranate were planted in the Northern dry zone. The predominant secondary hosts in the Central dry zone were mahogany, arecanut and pomegranate. Mulberry, teak and banana were cultivated as the main host in Southern dry zone of Karnataka.

Survey of natural forests of Karnataka, Kerala and Tamil Nadu revealed 34 to 46% of incidence of Sandal Spike Disease. Endpoint nested PCR and real-time nested PCR-detected 37.92 % phytoplasma positivity in the seeds collected from symptomatic trees. One month and four month old seedlings showed 38.66% and 23.23% diseased condition respectively.



Seedlings from infected trees showing Sandal Spike Disease (SSD) symptoms

Value addition of wood and wood based composites using nanomaterials

Termite resistance of untreated and linseed oil nano-emulsion containing nano-ZnO and nano-CuO treated rubberwood specimens was tested, after three months the untreated samples were affected due to termite attack, whereas samples treated with only nano-emulsions showed initiation of termite attack. Wood treated with ZnO and CuO loaded nano-emulsions remained unaffected and showed no attack. After six months of exposure, the untreated specimens were heavily attacked with more than 50% deterioration. Nano-emulsion treatment without nano materials also failed to protect the samples from termite attack. However, samples treated with 30% linseed oil nano-emulsion loaded with 2.0% nano-ZnO and nano-CuO were not affected by termites as shown in figure.

Large number of medium density fiber boards were prepared using *Melia dubia* fibers and nanoparticles dispersed resin system. Addition of 2% nanoclay with 20 minutes of ultra sonication in urea formaldehyde resin system was found to reduce formaldehyde emission by 50% as compared to control particle/fiber boards.

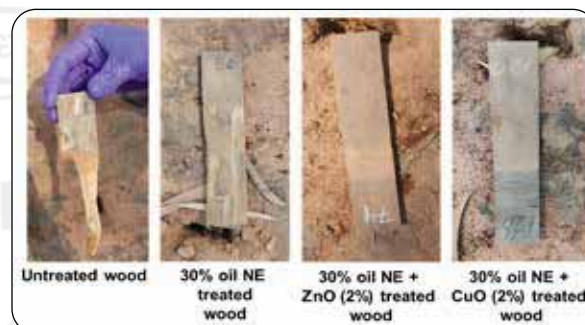
To prepare Nano-Wood Composites (NWC), the process parameters for curing nano-particle (Boron Nitride and ZnO) fortified furfuryl alcohol (FA) resin was optimized. A significant improvement in Anti Swelling Efficiency (ASE), a measure of dimensional stability, was observed with FA treatment.

Maximum ASE was 74% in Poplar wood and 54% in Melia wood. The difference in ASE values is due to higher WPG (23%) in Poplar as compared to Melia (12%). Poly Vinyl Acetate (PVA) was not very effective in improving dimensional stability of wood. For mechanical properties, the addition of nanoparticle significantly improved the surface hardness in both PVA and FA treated wood. However, for other properties such as compressive strength perpendicular to grain and static MoE, only FA and FA with nano-particle treatments could produce significant improvement. Resin impregnation also improved the resistance against biodegradation. Fortification of PVA with higher concentration of ZnO nanoparticle, significantly improved the decay resistance (from non-durable class to very durable class) as well as termite resistance (control samples of poplar perished in 6 months but treated samples are still intact after 12 month). FA treatment alone was quite effective against decay and termite attack. In Poplar wood, weight loss was reduced from 50% to 10% in case of white rot decay and 53% to 5% in case of brown rot decay with 25% FA treatment. Addition of nano ZnO further improved the resistance against biodegradation with weight loss of less than 5% with both fungi. There was no termite attack on FA treated wood even after 12 months of exposure.

Cellulose Nano Fibers (CNFs) synthesized from different lignocellulosic fibers were characterized for their dimensions, crystallinity and thermal

stability. The study revealed that the prepared CNFs were having diameter of about 10-15 nm irrespective of the base lignocellulosic material. It was also found that one-time processing (Single pass) in high pressure homogenizer was sufficient to achieve the nano dimensions. The crystallinity of CNFs was found to decrease with multiple processing of fibers in the homogenizer.

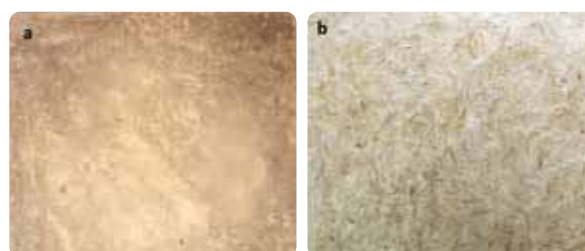
The potential of CNFs was explored as the binding agent in wood adhesion. Fiber boards were prepared with varying concentration of CNFs and fillers like calcium carbonate (CC) and thermos-plasticized starch (TPS). The effectiveness of CNFs in bonding wood fibers was established with the mechanical properties particularly modulus of rupture which was 10.2 MPa at 7.5% CNF and 12.3 MPa at 15% CNF concentration. Further, addition of fillers (10% by weight) resulted in significant improvement in the physical and mechanical properties of the boards as compared to boards prepared without fillers as shown in figure.



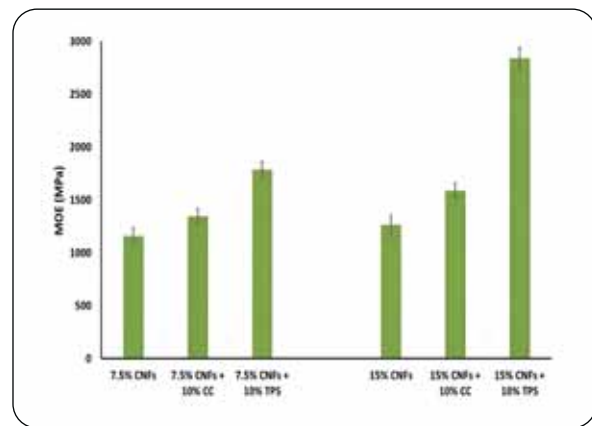
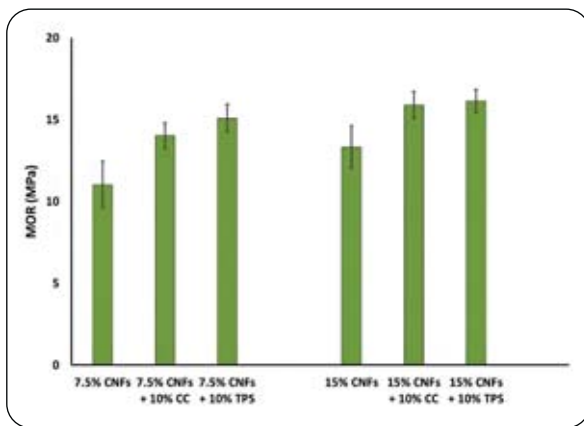
Visual observations of termite attack in untreated and linseed oil nano-emulsion (30% oil content) containing ZnO and CuO nanoparticles (2.0 wt.%) treated rubberwood specimens after 6 months of installation.



Medium Density Fiber boards



CNF bonded boards (a) Melia fiber board (b) Banana fiber board



Mechanical properties of CNFs bonded Melia fiberboards (CC and TPS as fillers)

Eucalyptus improvement

About 200 second generation clones have been multiplied by ICFRE-IFGTB and tested by ICFRE-IFB, ICFRE-IFP, ICFRE-TFRI, ICFRE-CSFER, ICFRE-FRI, ICFRE-AFRI by laying three multi-locational trials (MLTs). Accordingly, IFB established MLTs in Mulugu, Mulakalapally and Jaheerabad, FRI established MLTs in Pratapgarh, FRI campus and Kachnari, Gopamau, UP, ICFRE-TFRI established MLTs in TFRI campus, Bargi range, Jabalpur and at Samnapur, Mandla, ICFRE-AFRI established MLTs in Mahua (JAU), Mohangarh, Jaisalmer and Linch, Mesana, ICFRE-IFP established MLTs in Chandwa, Latehar, BAU, Kanke and Harhad, Hazaribagh, ERC established MLTs in Pratapgarh, Bigahiya-Prayagraj and Andawan, Prayagraj. The participating institutes were imparted two trainings on MLT data handling.

In order to produce new hybrids, clones with high breeding value were cross pollinated and hybrid progeny trials were established in Thiyagadurgam, Salem and Kunathur. Top 1% of the trees in the trial have been marked for further observation and selection. In order to produce interspecific hybrids with *E. pellita* and *E. urophylla*, seed lots have been imported from CSIRO and a base population trial for these species have been established in Thalamalai.

MsPRP2 promoter-driven *GFP* expression in callus and MsPRP2 promoter-driven *GUS* expression in salt treated and untreated roots of *Eucalyptus* composite plants showed that the synthetic promoter designed based on truncated promoter sequence of *PRP2* gene from *Medicago sativa* was able to drive gene expression preferentially in callus and root tissues of *Eucalyptus* and was salt inducible. The putative *Li* hpRNA transgenics were multiplied and hardened in transgenic greenhouse.

For the identification of secondary development specific miRNAs in *E. tereticornis*, association analysis was conducted and nine conserved and seven novel miRNAs were predicted. Sixty six miRNAs belonging to 34 families were specific to secondary development and transcription factor, SQUAMOSA promoter binding protein while Cellulose synthase (*CesA9*) had maximum miRNA targets. Marker-trait association was conducted with 12 SNPs across 20 genotypes. A total of two SNPs were associated with holocellulose content, one SNP with lignin content and 40 SNPs were associated with fibre parameters at $P < 0.01$.



MsPRP2: *GFP* expressed transgenic event Hardened *Li* hpRNA transgenics

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

Population survey for identifying the seed sources completed for all 78 species in 12 states. Phenological observations on flowering and fruit-setting were recorded in eight species viz *Garcinia gummi-gutta*, *Garcinia indica*, *Vateria indica*, *Lophopetalum wightianum*, *Hopea parviflora*, *Knema attenuata*, *Mammea suriga* and *Schleichera oleosa* at various locations like Agumbe, Sirsi, Gersoppa, Makutta and Sampaje in Karnataka. Seed maturation studies completed in the 10 species: *Buchanania lanzan*, *Putranjiva roxburghii*, *Butea monosperma*, *Kydia calycina*,

Hymenodictyon excelsum, *Santalum album*, *Boswellia serrata*, *Salvadora persica*, *Capparis decidua* and *Anogeissus latifolia*.

Seed maturation studies were continued in, *Mallotus philippensis*, *Sterculia villosa*, *Stereospermum chelonoides*, *Cochlospermum gossypium*, *Feronia limonia*, *Commiphora wightii*, *Pterospermum acerifolium*, *Toona serrata* and *Salix tetrasperma*. Mature seeds of *Acer pictum* were collected from Chakrata FD, *Stereospermum chelonoides* from Dehradun FD; *Chukrasia tabularis*, *Pinus kesiya* were collected from Meghalaya that of *Phoebe goalparensis* from Lakhimpur and *Dipterocarpus macrocarpus* from Jorhat, Assam and seed germination studies conducted. Seed germination behavior of various species was studied and pretreatments to overcome dormancy were devised.

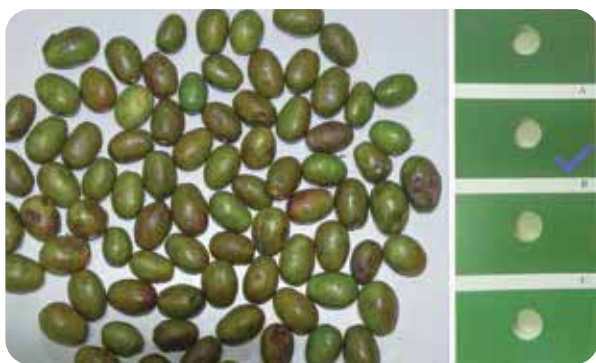
Species	Pretreatment	Germination (%)
<i>Acer pictum</i>	Cold stratification (2 months) and GA ₃ (0.05%) soaking for 24 hours	20 (5% in untreated seeds)
<i>Boswellia serrata</i>	Mechanical scarification followed by soaking in gibberellic acid (750ppm) for 24 hours	41.7% (3.4% in untreated seeds)
<i>Buchanania lanzan</i>	Mechanical scarification + soaking in thiourea (0.5%) solution for 24 hours	75 (31% in untreated seeds)
<i>Capparis decidua</i>	two days soaking with bavistin and warm water	54.6 (11.67% in untreated seeds)
<i>Nyctanthus arbor-tristis</i>	pericarp removed and scarification + GA ₃ (500ppm) soaking for 24 hrs	58 (27% in untreated seeds)
<i>Salvadora persica</i>	soaking in cooling warm water overnight	24 (6.7% in untreated seeds)

Seed desiccation trials of seeds of *Bischofia javanica*, *Cipadessa baccifera*, *Maesa indica*, *Elaeocarpus serratus*, *Buchanania lanzan*, *Stereospermum chelonoides*, *Kydia calycina*, *Hymenodictyon excelsum*, *Feronia limonia*, *Semecarpus anacardium*, *Nyctanthes arbor-tristis* revealed their orthodox nature while *Aphanamixis polystachya*, *Cullenia exarillata*, *Memecylonum bellatum* seeds were sensitive to desiccation and exhibit recalcitrant storage physiology. Seeds of *Murraya paniculata* belonged to intermediate category. To develop seed storage protocols of various species for conservation of their germplasm, the seeds were stored at various temperatures and their germinability was evaluated periodically.

Seed storage trials were completed in 12 species viz. *Albizia odoratissima*, *Butea monosperma*, *Bischofia javanica*, *Cipadessa baccifera*, *Elaeocarpus serratus*, *Erythrina suberosa*, *Heteropanax fragrans*, *Maesa indica*, *Kydia calycina*, *Hymenodictyon excelsum*, *Nyctanthes arbor tristis* and *Quercus glauca*.

Nursery trials on the effect of potting media and time of pricking out *Betula utilis* and root pruning on the growth performance of *Prunus cerasoides* seedlings and effect of growth regulators (IBA1000-10000ppm) on rooting of *Sorbus lanata* were carried out. For *Boswellia serrata* potting mixtures that showed best result for almost all parameters (germination, shoot and root length; shoot and root fresh weight) were found to be soil: sand: vermicompost (1:1:1), soil: sand: vermicompost (1:1:2) and soil: sand: compost (1:2:1).

Species	Storage temperature (°C)	Storage period (months)	Germination (%)
<i>Albizia julibrissin</i>	5	33	74
<i>Alnus nitida</i>		21	30
<i>Hymenodictyon excelum</i>		30	85
<i>Pterospermum acerifolium</i>		21	95
<i>Sterculia villosa</i>		30	56
<i>Stereospermum chelonoides</i>		36	80
<i>Betula alnoides</i>	-5	33	25
<i>Betula utilis</i>	-10	39	27
<i>Boswellia serrata</i>		9	27
<i>Capparis decidua</i>		9	44
<i>Salvadora persica</i>		9	32
<i>Sorbus lanata</i>		39	36
<i>Rhododendron campanulatum</i>		39	29
<i>Chukrasia tabularis</i>	4	12	80
<i>Pinus kesiya</i>		10	41
<i>Pinus merkusii</i>		14	41
<i>Prunus cerasoides</i>	2	33	23
<i>Kydia calycina</i>	15	33	34
<i>Tsuga dumosa</i>		9	43
<i>Schleichera oleosa</i>	20	4	31



Colorimetric observations (Colour chart of Royal Horticultural Society) of fruits of *Elaeocarpus serratus* and *Pterospermum acerifolium*



Seedlings of *Capparis decidua* and *Mammea suriga* in the nursery

Quality Teak Production: Capitalizing on Cloning

The project aimed to popularise short rotation (SR) teak clones raised through tissue culture. The clones established in ~100 ha in different states (Kerala, Tamil Nadu, Chhattisgarh, Maharashtra,

Punjab, Gujarat, Karnataka, Jharkhand, West Bengal, Madhya Pradesh and Telangana) are under evaluation. At the end of five years, data reveals that the trees have attained a height of 12-15 m with an average girth of 40- 50 cm while seedlings as control have shown an average height of 8m with about 25-30 cm girth.

The technology for production of Tissue Culture plants has been extended to the following:

S. No.	Commercial Facility	State	Status	Progress
1	HU Gugle Biotech	Karnataka, Maharashtra	Licensee	Production in full swing. Supplied in bulk based on orders.
2	Mukund Biotech	Madhya Pradesh	Licensee	Initiated in March 2024.
3	Meristem Biotech	Karnataka	MoU for ToT	Bulk production initiated.
4	Jagadamba Biotech	Karnataka	MoU for ToT	Supplied to ICFRE-IFGTB based on orders.
5	Santhi Clonal Nursery	Tamil Nadu	MoU for ToT	Technology adoption
6	HiFi Biotech	Tamil Nadu	MoU for ToT	Technology adoption
7	Adithya Biotech	Karnataka	MoU for ToT	Technology adoption
8	DevLeela Biotech	Chhattisgarh	MoU for ToT	Technology adoption



Two and a half year old TC teak in Melaiyur TN

A documentary on TC teak cultivation and management practices was released on YouTube (<https://www.youtube.com/watch?v=Fms-ApH5eLY>).

FAO Rome has selected the research as a success story showcasing the impactful use of tissue culture

technology to meet the needs of smallholders in India, marking a significant step forward in the global efforts to achieve a wood secure nation (<https://doi.org/10.4060/cc8940en>).

All India Coordinated project on *Dalbergia sissoo* mortality

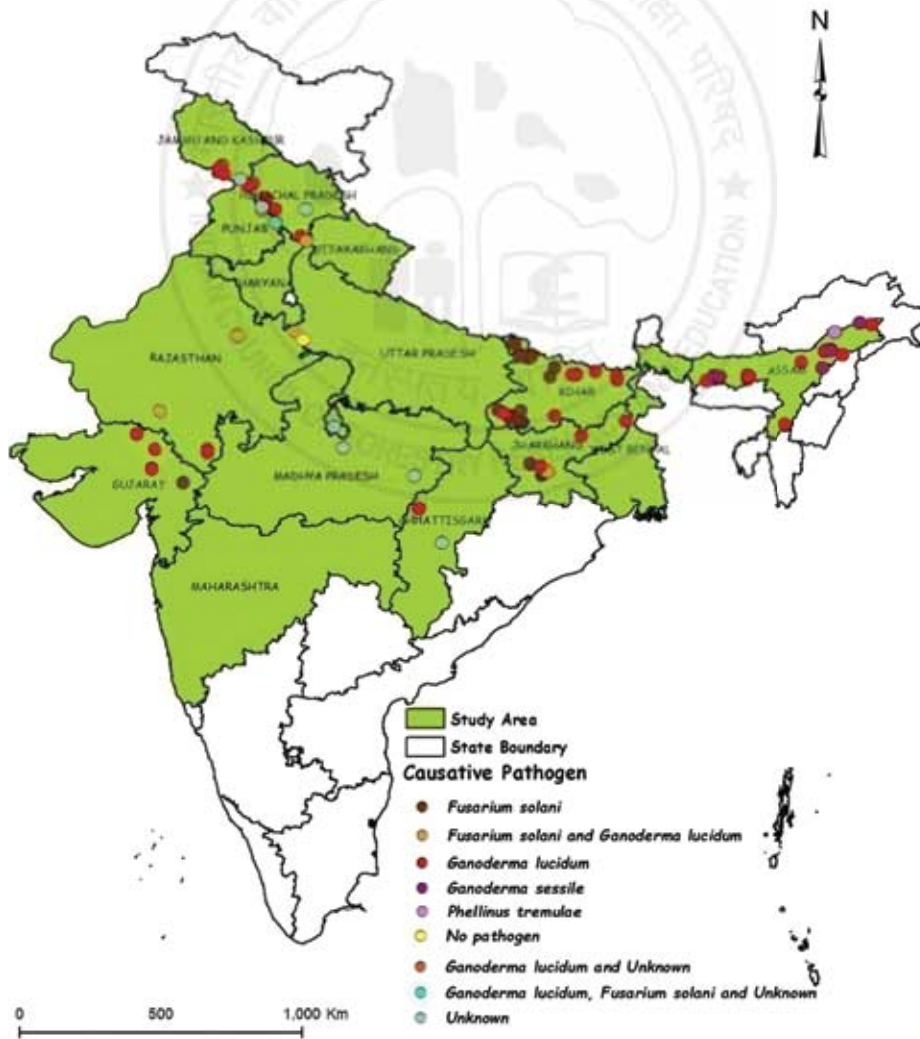
Surveys of Shisham mortality in growing area of Jammu and Kashmir, Himachal Pradesh, Punjab, Haryana, Uttar Pradesh, Uttarakhand, Bihar, MP, Chhatisgarh, Assam, Rajasthan, Gujarat, West Bengal and Jharkhand were completed. Disease identified on the basis of symptoms (wilting, oozing and stag head appearance) and signs (sporophore) associated with infected or dead Shisham trees. The severity of disease was recorded in the range of 5-20% in Kangra district, upto 60% at Birplasi in Solan district, upto 22% in Sirmaur district, between 11-21% in Una, district of HP 12-17% in 5 sites of Jammu and Kashmir. In Assam, survey revealed that out of 414 trees observed 90 trees were infected and 50 trees were dead and remaining, 274 trees were found unaffected. A new pathogen *Phellinus tremulae* was found on *D. sissoo* causing root rot in Dhemaji district of Assam.

The point distribution maps of Eastern region, Himachal Pradesh and Jammu & Kashmir depicting

affected and non-affected samples and habitat suitability map for eastern region of India have been prepared. The habitat suitability map for the current scenario indicates suitable habitats of *D. sissoo* occurring in the eastern, central and upper southern part of the study area. The prominence of distribution was found in the eastern part of the study area encompassing Bihar.



Affected *D. sissoo* roadside plantation in Sasaram, Bihar
















Map showing affected locations with their causative pathogen of *D. sissoo* for entire study area.

Surveys were conducted in different regions of Jammu and Kashmir, Himachal Pradesh, Punjab, Haryana, Uttar Pradesh, Uttarakhand, Bihar, MP, Assam, Rajasthan, Gujrat, West Bengal and Jharkhand. On the basis of productivity and disease resistance 275 CPTs have been selected across India; 72 CPTs and 24 Plus trees from Punjab, Haryana, Uttarakhand, and UP, 85 CPTs and 33 plus trees from Himachal Pradesh and Jammu and Kashmir, 34 CPTs from MP and Chattishgarh, 18 CPTs and 6 plus trees from Bihar, West Bengal and Jharkhand, 13 CPTs from Rajasthan and Gujarat, and 53 CPTs and Plus Trees from Assam.

For disease resistant trials of shisham genotypes under gnotobiotic *in vitro* condition, pathogenic strains A5 and A7 of *Fusarium solanii* were used. Genotype FRIDS 14 and FRIDS 232 (which were resistant and susceptible, respectively) were used as standard, and five genotypes (03 new genotypes and 2 old (FRIDS 113 and 239) showed resistance after nine days of incubation against strain A5 but were susceptible to strain A7.

Callus of five genotypes of *D. sissoo* co-cultured with the H-5 and H-7 strains of *Fusarium solani*.

Genotype No.	Callus on 1 st day of Infection	Callus on 11 th day of infection with Strain A5	Callus on 11 th day of infection with Strain A7
Genotype FRIDS 14 – Released variety (showing resistant against A5 and slightly resistant to A7)			
Genotype FRIDS 23 (New) (Susceptible)			
Genotype FRIDS 113 (New Potential resistant against A5)			
Genotype 232 (standard Susceptible)			
Genotype 239 (New potential resistant)			

Established seed orchards of disease resistant germplasm of Shisham at Bhithmera, Haryana in 4.2 ha and Near Mohand, Shivalik division, UP in 0.42 ha. Established vegetative multiplication garden/ clonal area at Saharanpur, UP and at ICFRE-FRI, Dehradun in 0.1 ha each.

Standard procedure developed for reporting shisham mortality and provided to UPSFD. *Trichoderma* cultures were provided to UPSFD to develop *Trichoderma* assisted nursery of shisham. Field staffs were trained in *Trichoderma* applications in nursery and also in trees. Also *Trichoderma* cultures and its application training were provided to Gonda Forest division staff for nursery application. Also *Trichoderma* treated shisham plants were supplied to Assam forest Department.



Two years old clonal seed orchard of disease resistant *Dalbergia sissoo* at Bhithmera

Assessment of Demand and Supply of Timber, Fuelwood and Fodder in India

For Fuelwood Consumption in Cremation and Burial practices, the preliminary assessment shows that India required 2.42 to 2.83 MT of fuelwood for cremation and burial, equivalent to 3.8 to 4.5 M CUM Round Wood Equivalent (RWE) volume, amounting 17.9 to 20.7 billion INR, equivalent to cutting of 5.64 to 6.59 million trees.

For Fuelwood Consumption in Small Restaurant, the preliminary assessment shows that small restaurants in India consumed 0.55 MT to 0.77 MT of fuelwood, equivalent to 0.87 to 1.22M CUM RWE volume amounting 3.94 to 4.47 billion INR, equivalent to cutting of 1.29 to 1.80 million trees.

Un-recorded removal of Timber, Fuelwood and Fodder from forests in India was recorded and is given in table.

Zone-wise proportion (%) of Households in fringe villages for extracting Un-recorded forest resources

Zone	Himalayan	Dry & Desert	Central	Eastern	Southern	North-East	Total
Timber	0.48	0.18	0.38	0.41	0.21	0.3	1.96
Fuelwood	0.64	0.53	0.61	0.46	0.56	0.51	3.31
Grazing	0.6	0.76	0.72	0.72	0.61	0.32	3.73

The analysis of household fuel energy transition and attributable Factors in a Developing Economy by NSSO survey of 2.76 lakh households in India indicated that energy transition follows “Fuel stacking theory” rather than “Energy ladder theory” i.e. households continue to prefer different energy sources for different purposes. The modeling results that income and wealth growth push households to use clean fuel; however, landholding and household size adversely affect the clean fuel usage.

Under international trades of wood products in India, in FY 2021-22, the total quantity of approximately 60 MCUM RWE of wood products

was traded internationally with 46 M CUM RWE under import and 14 M CUM RWE under export. The percentage share of Indian wood products export in total value of Indian exports has increased from 0.2% in 2001 to 1.2% in 2021, whereas the percentage share of Indian wood products import in total value of Indian imports is anchoring around 1.5% during the period. In India, the import and export value for wood products during 2021-22 was US\$7344 Mand US\$4948 M respectively.

The State wise household consumption of timber, fuelwood and fodder from forests in India during 2023 is given in table

State/UT's	Timber (Mft ³ RWE)		Fuelwood (MT)	Fodder (MT)
	Fixture	Furniture		
Uttarakhand	1.06	0.44	4.061	7.83
Haryana	2.15	0.76	2.06	3.37
Punjab	1.71	0.61	0.33	8.82
Bihar	9.74	3.55	9.71	9.99
Jharkhand	3.01	1.32	2.98	3.12
West Bengal	3.61	1.35	7.61	9.63
Assam	3.52	2.12	0.30	3.26
Meghalaya	0.28	0.19	0.00	4.60
Chhattisgarh	1.59	0.97	2.62	4.50

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

Forests provide ecotourism services, various physical and mental health benefits to the visitors. Based on the visitor's survey of 29 eco-tourism sites across the country, the preliminary results shows that estimated median willingness to pay (WTP) of the visitors was around 353 rupees per person per visit using the Double Bound Contingent Valuation Method and the average WTP of a site correlates with accessibility and infrastructure rather than forest types. In 17 out of 29 sites, positive relationship between expenditure (a proxy for

income) and WTP was observed, which indicates the need for product differentiation which in turn increases the revenue.

Forest provides pollination services, specially, pollinators of Insect a order inhabiting the forests and contributing for pollination for neighbouring agricultural fields. The pollination services for Sabhawala site, Uttarakhand containing FT 3 was estimated to be 22100 rupees ha⁻¹ using the Maximum Forage distance-based method, dependency ratio and market price based methods.

Various edaphic, climatic and biological settings of the region govern the composition, growth,

structure of forests and the ecological processes that underlie the delivery of various ecosystem services. The supporting services consisting of habitat and biodiversity services of all the sixteen forest types of India were estimated based on associated indicators of the services using data from Remote Sensing and secondary sources. The habitat service was defined through climatic and bio-physical parameters; and the biodiversity service was estimated based on the flora and fauna diversity. Various indicators were aggregated by assigning weight using Analytical Hierarchical approach and the value of the both services was estimated using benefit transfer method. The results suggest that littoral and swamp forest had maximum habitat services, tropical semi-

evergreen forest had maximum biodiversity service and tropical wet evergreen forest had maximum supporting services. The annual per hectare economic values of habitat, biodiversity and supporting services from different forest types of India were estimated to be US\$ 4,330.71/ha, US\$ 5,987.38/ha and US\$ 10,624.23/ha respectively. The annual economic value of habitat, biodiversity and supporting services from Indian forests were US\$ 303,506.09 million, US\$ 419,609.45 million and US\$ 744,570.85 million respectively. In totality, tropical dry deciduous forest, tropical moist deciduous and tropical semi-deciduous forest had higher economic value for supporting service as compared to other forest types.

Bioprospecting for industrial utilization of lesser-known forest plants

Chemical screening for essential oil and fatty oil contents for 18 populations of *Cinnamomum cecidodaphne* from West Bengal, and 15 populations of *Pithecellobium dulce* from Jharkhand, revealed that the population of *C. cecidodaphne* from Rajabhat Khawa, Jalpaiguri in West Bengal, and the population of *P. dulce* from Jammukhadi in Jharkhand were identified as chemically superior populations (CSPs) for industrial applications. Chemical screening of 17 populations of *P. dulce* located in eastern part of Uttar Pradesh for fatty oils isolated from the seeds has been carried out.

UPLC-QTOF-MS/MS assisted metabolomic study coupled with chemometric analysis of 25% aqueous methanol extracts isolated from *Prinsepia utilis* leaves collected from 14 different locations (273 accessions) of Uttarakhand and Himachal Pradesh led to the identification of 80 compounds and their interpopulation variability. This finding highlights the rich phytochemical diversity of *P. utilis* leaves. Among these, 57 were marker compounds, mostly phenolic compounds, with 56 of them being previously unreported. These marker compounds can serve as chemical fingerprints for the plant, aiding in its authentication and standardization. The population located in Munsyari, Uttarakhand, was identified as the chemically superior population due to its highest compound count (80) and extract yield (30.46%) among 14 populations.

Developed a validated HPTLC method for simultaneous quantification of ursolic acid, betulin, lupeol and β - sitosterol in leaf, stem, and flowers of CSP of *Woodfordia fruticosa*. This method enhances the accuracy and efficiency of quality assessment, contributing to the standardization of *W. fruticosa* products in pharmaceutical and herbal industries.

The essential oils isolated from CSPs of *Cupressus torulosa*, *Neolitsea pallens*, *Litsea cubeba* and *Cyperus rotundus* were evaluated for their performance in scent blends for incense sticks. The oils demonstrated their suitability, as their

aromatic profile harmonized effectively with other fragrances, making them a viable option for use in incense production.

Fabrics, including wool, silk, and cotton, were dyed with the *Punica granatum* peels derived dye and mordanted using two natural ones, baheda and amla. The CIELab* values for the dyed fabrics were also determined which demonstrated durability of dyed textiles.

To develop a practical formulation for field application, various formulations containing solutions of essential oil (ranged from 0.5 to 3.0 ppm) derived from the CSP of *Cupressus torulosa* were assessed for their insecticidal efficacy against pests namely *Sitophilus oryzae*, *Rhizopertha dominica*, and *Carpophilus dimidiatus* commonly found in stored rice, dal, and peanuts, respectively. KT_{50} of the oil was 72 min. irrespective of the pest. The *in vitro* cytotoxic potential of the essential oil isolated from the CSP of *Litsea cubeba* was tested against B16-F10 (mouse skin melanoma cell line) and MDA-MB-231 (human breast cancer cell line) cancer cells. The oil exhibited significant cytotoxicity against MDA-MB-231 (human breast cancer cell line), with an IC_{50} value of $52.64 \pm 7 \mu\text{g/ml}$.

Protocol for isolation of fatty oil from seeds of CSP of *Mallotus nudiflorus* has been standardized to ensure optimal yield and consistent quality. Procedure for making ink from *Mallotus philippensis* fruit pericarp derived dye was also standardized.

Identified 10 industrially viable populations of nine lesser known forest plants namely *Cupressus torulosa*, *Neolitsea pallens*, *Cyperus rotundus*, *Litsea cubeba*, *Prinsepia utilis*, *Mallotus nudiflorus*, *Punica granatum*, *Soymida febrifuga*, *Careya arborea* and *Woodfordia fruticosa* for their utilization into production of essential oils (CT, NP, CR and LC), fatty oils (PU and MN), and natural dyes (PG, SF, CA and WF) which can be utilized in aroma, food, cosmetics, pharma- and agriculture industries.

Patent Application Filed: A liquid herbal hair dye formulation coloring composition containing a decoction of a natural dye. (Patent Application No.202421008482; Dated 08/02/2024).

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

Genetic variability assessed in 30 tamarind selections from Tamil Nadu (15), Telangana (5), Andhra Pradesh (5), and Gujarat (5) and documented in the National Tamarind Registry (NTR). Eight heritage tamarind trees were identified in Coimbatore, Cuddalore and Thoothukudi districts of Tamil Nadu. A heritage tamarind tree venerated and worshipped over 300 years was recorded at Mullankadu, Coimbatore district. About 3,500 grafts and seedlings were produced from 25 tamarind selections at Forest Campus, Coimbatore. Thirty five high-yielding tamarind selections were collected from six organization (TNAU, Tamil nadu, UAS, Dharwad and Bangalore, Karnataka Forest Department, YSR Agricultural University, Marathwada Agricultural University) for assembling in the National Tamarind Germplasm Bank (NTGB).

Performances of red, sweet, and sour tamarind selections were assessed at Mulugu telangana; Centre for Crop Improvement Station, SDAU, Sardarkrushi nagar, Banaskantha; Agricultural Research Station, SDAU, Ladol, Mehsana; Cotton Research Station, and SDAU, Talod, Sabarkantha, Gujarat. Phyto-chemical variations was quantified in 60 tamarind selections, Total Soluble Solids (TSS), pH, Titratable Acidity (TA), reducing sugar, non-reducing sugar, total sugar, total ascorbic acid, protein, carbohydrate, lipids, phenol, flavonoids, phenol, tannins, and tartaric acid, parameters were quantified using standard biochemical procedure. Clones such as IFGTB-TI-14 and IFGTB-TI-15 yielded the highest among the shortlisted accessions. IFGTB-ST-16 and 17 exhibited the highest quality pulp (sweet tamarind).

Recording of growth performance and regular maintenance was carried out in the multi-location trials at Neyveli, Cuddalore district; Kangeyam, Tirupur district; and Melur, Madurai district

in Tamil Nadu. Clones IFGTB-TI-14 and IFGTB-TI-15 yielded the highest survival, growth and naturalization among the shortlisted accessions. A community Tamarind plantation was also established near Villupuram, along village road avenues and community lands. Two Memorandum of Understandings (MOUs) signed with Tamil Nadu Agriculture University (TNAU) for the establishment of the National Tamarind Germplasm Bank (NTGB) at Dry land Agricultural Research Station in Kanadukathan, Sivagangai District, TamilNadu and with TNAU, Coimbatore, to develop value-added Tamarind products and provision training to various stakeholders. A workshop cum interactive meeting was conducted with six tribal women's Self-Help Groups (SHG) from tribal hamlets of Senguttai, Arakkadavu, Sorandi, Gundoor, Gopanari, and Colanipurur villages around Aanaikatty in the Coimbatore district of Tamil Nadu.



300 Years old Tamarind venerated and worshiped by local of Mullankadu, Thondmuthur Taluk, Coimbatore



Interactive meeting with tribal women's Self-Help Groups from Aanaikatty at ICFRE-IFGTB

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

Coppicing operation has been carried out in established fodder plantations. Plants resprouted and produced multiple shoots with vigorous growth. This allowed fodder harvest in plantations at 1-2 years of age. More fodder production was recorded in 1m x 1m spacing than in 1.5 m x 1.5 m spacing upto 2½ years age. The following tentative estimates of fodder were obtained from the trials:

- At Idar, Himmatnagar, Gujarat *Ailanthus excelsa* produced greatest quantity of biomass i.e. 324.41 quintal/ha biomass in two harvests upto the age of 2½ years in plantation at 1 m x 1m spacing.
- At Jaisalmer, Rajasthan, the greatest biomass yield at the age of 1½ years was 57.00 quintal/ha obtained from one harvest in plantation at 1 m x 1m spacing. Grasses yielded more than trees at this site with *Panicum turgidum* yielding 262.80 quintal/ha.
- Growth in the hilly regions of Himachal Pradesh and Uttarakhand were found to be slow. At Chakhra, Junga, district Shimla, HP at 2½ years age, maximum 6.01 quintal/ha biomass was obtained in one harvest from *Morus alba* at 1mx1m spacing. Grasses yielded more than trees with tall fescue (*Festuca arundinacea*) producing 23.7 quintal/ha.
- At Prayagraj, 197.5 quintal/ha biomass was obtained from *Gmelina arborea* upto 2 years age at 1mx1m spacing.
- At Parasi, Dheemarkheda, district Katni (Madhya Pradesh) *Sesbania grandiflora* aggregated the greatest biomass (598.17 quintal/ha) in three harvests upto 2½ years age 1mx1m spacing. Yield of grasses was less than trees. *Pennisetum purpureum* recorded 186.47 quintal/ha in four harvests upto 2½ years age.
- At village Mangatta, Rajnandgaon (Chhattisgarh) grass *Pennisetum purpureum* recorded greatest biomass (388.13 quintal/ha) in three harvests upto 1½ years age. *Sesbania grandiflora* trees at about nine months age produced 93.93 quintal/ha biomass in one harvest.



Field trial at Idar, Himmatnagar, Gujarat at 2½ years age Uttar Pradesh

- At Jorhat, hybrid Napier (*Pennisetum purpureum*) recorded highest 660.06 quintal/ha fodder in four harvests upto age of two years.
- At Narsampet, Warangal, Telangana *Albizia procera* produced greatest quantity of biomass with a yield of 596.67 quintal/ha in two harvests upto 1¾ years age at 1mx1m spacing.
- At Myrada, Talamalai, Tamil Nadu *Gliricidia sepium* aggregated greatest 95.05 quintal/ha biomass from two harvests upto two years age at 1mx1m spacing. At Weavers Park, Palladam, Tamil Nadu, *Leucaena leucocephala* produced 96.08 quintal/ha upto two years with same spacing.
- At Madathukulam, Tiruppur, Tamil Nadu *Gliricidia sepium* yielded maximum 48.33 quintal/ha upto 1½ years age at 1mx1m spacing.

To increase storage life of green fodder, silage has been prepared by using 100% sorghum (pure sorghum), 90% sorghum + 10% *Bauhinia purpurea* and 90% sorghum + 10% *Celtis australis* without use of chemicals. The silage was relished by cattle and goat. ICFRE-FRI demonstrated the technique of silage making without use of chemicals to people in one village in Dehradun district, Uttarakhand. ICFRE-AFRI created awareness about potential of silage making in Tree Growers Mela in Jaisalmer, Rajasthan.



Demonstration of silage making in a village in district Dehradun, Uttarakhand



Vigorous shoot growth of *Gmelina arborea* after coppicing at Prayagraj at 2 years age

Forest Fire Research and Knowledge Management

The major objectives of this project are collection of baseline data from burnt and unburnt forest areas, mapping and categorization of fire prone areas, design and development of fire fighting tools kit and safety gears and designing and development of strategy for awareness campaign on forest fires in selected fire vulnerable landscapes. Baseline data on timber, fuelwood, fodder, NTFPs, floral biodiversity (including Invasive Alien Species), carbon storage, carbon sequestration, soil nutrients from 193 burnt and 193 unburnt sites have been collected from five forest types and 15 states. Preliminary findings in Sub-tropical pine forest shows lower floral biodiversity in burnt areas immediately after fire. Burnt sites shows higher uniformity in species composition post one monsoon. Higher vegetation growth is observed for herbs and shrubs post monsoon. Nitrogen, Phosphorus and Potassium in burnt site were found to be less than unburnt site immediately after fire and post one monsoon and two monsoons.

Data has been collected for historical fire incidence, fuel load and socioeconomic status from Pauri Grahwal, Idukki and Amrawati district. Mapping of fire prone areas is in progress.

ICFRE-FRI has collaborated with IIT, Roorkee and CFEES-DRDO for design and development of fire-fighting tool kit and fire safety gears. A total of 15 sets of fire-fighting hand tools along with tool kit bag are being developed by IIT, Roorkee. Physical prototype of sickle, Jhapa and rakes were presented by IIT, Roorkee. Comments have been given to modify Jhapa. High density carbon steel is being used for manufacturing sickle prototype. A total of six sets of fire-safety gears are being developed by CFEES, DRDO. Sample of fire safety suit, gloves, socks and helmet developed by CFEES, DRDO has been received and the same has been sent to Uttarakhand State Forest Department for field testing.



Fire Suit & helmet



Fuel Bed Depth Measurement

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

For preparation of Forest Soil Health Cards a total of 34968 soil samples have been collected at pan India level and 348234 samples were analysed for 12 comprehensive parameters (*i.e.*, Basic, Major, Secondary and Micro, nutrients). State/ UT wise soil test results were considered to draw standard values for forest soils of that particular state and to prepare Forest Soil Health Cards (FSHC).

Accordingly, based on state wise standard values, 153 FSHCs (Bilingual) were prepared and pre-release consultation meetings were organized to discuss their contents and uses with the forest officers/ officials of concerned State/UT forest Department. The Hon'ble Union Minister for Environment, Forest

& Climate Change, Shri Bhupender Yadav released the FSHCs of Madhya Pradesh (63), Haryana (22), Delhi (4), Puducherry (2), Ladakh (2), Chandigarh (1) at ICFRE-FRI, Dehradun. Similarly, Forest Soil Health Cards for 28 territorial forest divisions of Tamil Nadu were released by Smt. Leena Nandan, IAS, Secretary, MoEFCC during the 61st Board of Governors meeting of the ICFRE, at New Delhi. Sh. Sanjay Srivastava, IFS Principal Chief Conservator of Forests & Head of Forest Force Jharkhand released 31 FSHC of State Forest Divisions of Jharkhand. Capacity building training for promoting "Soil Test Based Nutrient Management Practices" for the officials of Madhya Pradesh State Forest Department" was organized. Overall, 79 per cent soil sampling and 66 per cent sample analysis have been completed countrywide. FSHC Web portal has been developed by National Informatics Centre, Dehradun for easy access to State Forest Departments.



Capacity Building for Promoting Soil Test Based Nutrient Management Practices of Officers/ Officials of MPSFD at ICFRE -TFRI Jabalpur, MP

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

One of the objectives of this project envisages on assessment on the complimentary benefits of mixed planting systems particularly mixed planting of teak with N-fixing trees like Casuarina/ *Acacia auriculiformis*. Eighteen field trials of mixed plantations of Teak with Casuarina / *A. auriculiformis* have been established so far under this project. The major outcome of these trials would be information on feasibility of minimizing planting stock requirement for teak through mixed planting with Nitrogen fixing trees to the tune of 50 to 75%.

Preliminary observations on growth of teak in 2-year-old mixed plantation trial plot at Muthur village in Tiruppur district of Tamil Nadu showed greater girth (20.2 cm) and height (7.92 m) growth was recorded under Teak + Casuarina in 50:50 proportion when compared to pure teak (Girth – 17.9 cm; Height – 7.48 m) and Teak + Casuarina in 25:75 proportion (Girth – 17.4 cm; Height – 6.65 m). Further, there was greater percentage (34.4%) of bigger girth trees (having girth above 20 cm) under trial plot with Teak + Casuarina in 50:50 proportion than in pure teak plot (17.3%) and in plot with Teak + Casuarina in 25:75 proportion (25.6%). The interim results are encouraging for promoting Teak + Casuarina based mixed plantations for harnessing three-pronged benefits viz. i) enhancing productivity ii) reducing of planting stock requirements up to 50% and iii) providing short-term and interim economic returns to the teak

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

To investigate the complex ways in which global change is impacting forest dynamics, a total of 1,86,176 woody individuals having ≥ 1 cm DBH have been measured, identified to species level, tagged with unique numbers and mapped, covering 84.4 ha in seven forest type groups.

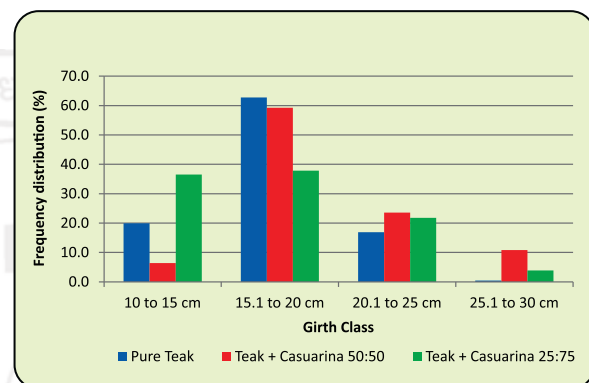
Highest density of woody individuals has been recorded from Tropical evergreen forests, Upangala, Karnataka (6132/ha) whereas the lowest density has been in Western Mixed Coniferous Forest, Shikari Devi sanctuary, Shimla, H. P. with 330 individuals per hectare. Girth class distribution in the observation plot has been worked out for total population and individual species as well. The population structure followed a reverse J shaped structure in most of the enumerated sites signifying large number of individuals in the lower diameter class

Floral diversity of the long term observation plots, established by 13 institutes across seven forest types of India, has been studied. Phenological study is

growers through harvesting of Casuarina in 3rd or 4th year of planting.



Growth measurement in 2-year-old Teak + Casuarina mixed Block plantation trial plot in Muthur village, Tiruppur district of Tamil Nadu



Frequency distribution of teak trees of different girth classes under pure and mixed teak plantations

being conducted on 2921 geo-tagged individuals in the experimental areas of different forest types. At Benog wildlife sanctuary, Mussoorie, Uttarakhand, the initiation of flower buds was observed over an extended period from December to March, with the exception of conifers, in which flower initiation predominantly occurred between July and November. A book titled "Floral diversity of Kanha Tiger Reserve (Sarhi Range)" has been published by ICFRE-TFRI, Jabalpur. Insect pests and pollinators of the respective observation plots have been studied and recorded and over seventy species of butterflies have been observed as new records from the study area.



Enumeration and tagging at Sitamata wildlife sanctuary, Chittorgarh

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

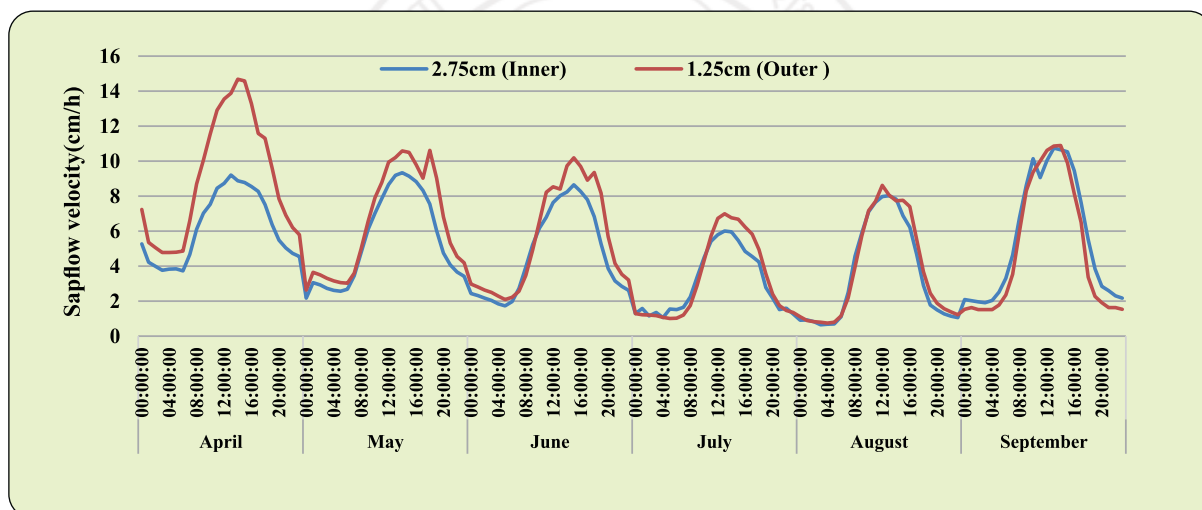
Water requirement of nine forest tree species (*Prosopis juliflora*, *Azadirachta indica*, *Anogeissus latifolia*, *Tectona grandis*, *Pinus roxburghii*, *Quercus leucotrichophora*, *Shorea robusta*, *Terminalia tomentosa*, *Melia dubia*) are being studied, at 10 experimental sites, to identify the best suitable forest species for plantation under different rainfall conditions with an objective to maximise water yield from a catchment. Total water requirement for transpiration of a particular tree species is measured with the help of sap flow monitoring systems.

Initial data on sap flow reveals that there is a distinct variation in sap flow rate recorded from the inner and outer areas of sapwood with a significantly higher flow rate in the outer sapwood area. The preliminary data on water used in transpiration suggest that under the climatic conditions of Coimbatore, *P. juliflora* (4.58 liters/day) and *M. dubia* (5.85 liters/day) may be more suitable

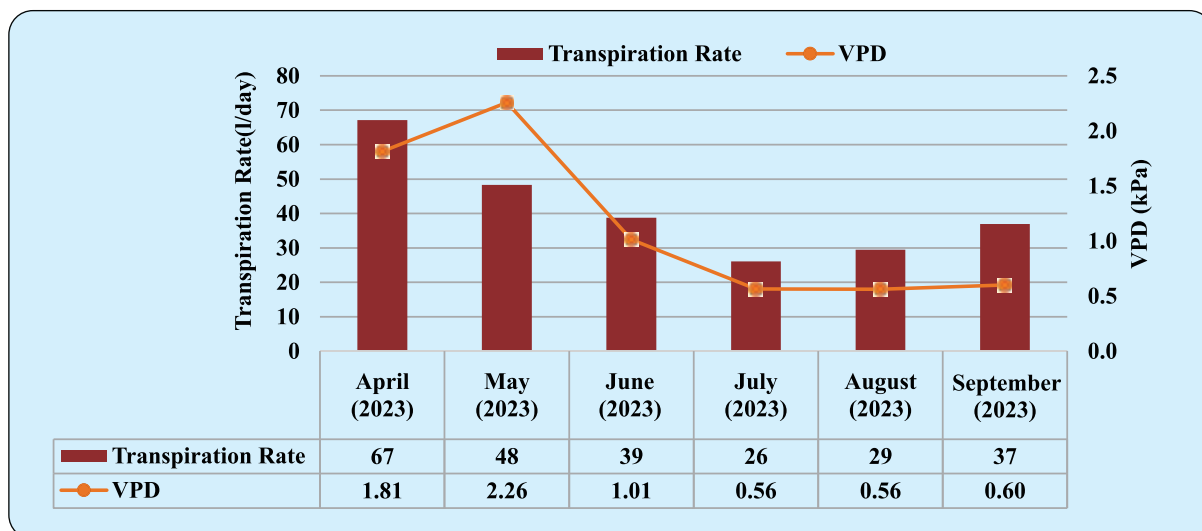
than *T. grandis* (18.60 liters/day) and *A. indica* (20.12 liters/day) which used more water for transpiration. However, more data for a longer period are required to substantiate these findings.

Water use /transpiration in *Q. leucotrichophora* (oak) varied between 25.8 to 45.8 liters/day in Kempty watershed. The average daily water use was 48.5 to 68.3 liters/day in *P. roxburghii* (Chir Pine). Transpiration rate of 8 to 18 liters/day was recorded in *P. juliflora* at Sanjay Van, New Delhi. The mean transpiration rate in *Shorea robusta* varied from 26 liter/day in July to 67 liter/day in April 2023 at ICFRE-FRI experimental site Dehradun whereas, a wider variation of 18.6 lpd in July to 88.8 liters/day in September 2023 was recorded from Mawai forest of Mandla, MP. Higher transpiration rate was observed to be associated with higher values of vapor pressure deficit and vice versa.

Initial observations on the correlation between transpiration and soil moisture suggest that a rainfall induced increase in soil moisture is coinciding with a low rate of transpiration during that period which might be attributed to low vapour pressure deficit.



Sap velocity in inner and outer sapwood area of *Shorea robusta*, Dehradun



Transpiration rate (L/day) and vapour pressure deficit (VPD) in *Shorea robusta*, Dehradun

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

Chromatographic characterization of various parts of eleven targeted tree borne oil/plant species (*Simarouba glauca* and *Pongamia pinnata* in Tamil Nadu; *Jatropha curcas* and *Madhuca indica* in Madhya Pradesh; *Boeninghausenia albiflora* (Pissumaar), *Cedrus deodara* and *Abies pindrow* (Silver Fir) in Himachal Pradesh; *Balanites aegyptiaca* and *Capparis decidua* in Jodhpur; *Chloroxylon swietenia* and *Sphearanthus indicus* in Telangana) to isolate and identify active compounds revealed the presence of various bioactive compounds having antifeedant, effecting larval mortality, and ovipositional deterrents. The GC-MS examination indicated that terpenoids are the main component in *B. albiflora* leaf; fatty acids viz., Oleic acid, Palmitic acid, Eicosanoic acid, Octadecanoic acid, Heptadecanoic acid and Linoleic acid in *S. glauca* seed oil; *C. decidua*, *B. aegyptiaca* and *S. indicus*; and terpenoids, phenolic, aldehydes, ketonic, benzenoids in the seeds of *Abies pindrow*. This confirms with FTIR analysis of *B. aegyptiaca* and *C. decidua* having main characteristic bands of functional groups viz., carboxylic acids, alcohols, olefin, aromatics, aliphatics, esters, ketones, alkene, alkane and ester in *B. aegyptiaca* and *C. decidua* contains alcoholic, aliphatic primary amines, alkyne, isothiocyanate and 1, 3-disubstituted molecules.

The seed oil having active constituents especially fatty acids such oil, oleic acid, palmitic acid, stearic acid and linoleic acid with insecticidal properties were preformulated and found to be very effective when tested against insect pests of forestry

importance. Bioassay of botanicals extracts of tree borne oil/plant species tested on target insect pests showed significant mortality. The preformulated seed oil of chosen plants tested against Ailanthus defoliators (*Eligma narcissus* and *Atteva fabriciella*) and Teak defoliator (*Hyblaea puera*) showed 70 % and 60 % larval mortality respectively at 72 hours. From the field experimental data, it was observed that 1% concentration / dose was optimum to manage the defoliators and further consecutive infestations on Teak and Ailanthus were reduced. Pre flowable formulations of *B. albiflora* (Himalbiwash) and powered formulation (Himbiokill-1) have been prepared and their evaluations against targeted insect pests of forestry viz., *Plecoptera reflexa* (Shisham defoliator), *Agrotis ipsilon* (cutworm) are in progress.

The efficiency of biopesticide Tree PAL^H was tested against the insect pests of the following species at two different concentrations 0.5 and 1.0 % under field condition and the efficacy was high at 1 % concentration at 24 hrs of treatment ranged from 30 % to 85 % larval mortality.



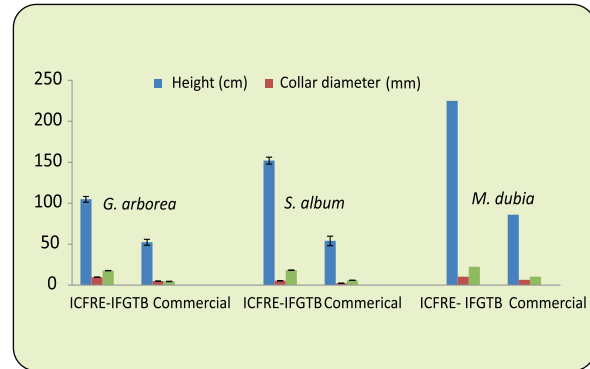
Tree PAL^H evaluation against teak defoliator at Sivagangai Nursery, Tamil Nadu

Institute name	Field evaluation		
	Insect name	Tree crop	Mortality (%)
FRI, Dehradun	Shisham defoliator	Shisham - field in UK of FRI (NWFP) plantation	51.26
Tree PAL	<i>Plecoptera reflexa</i>	Poplar - field in UK of FRI (NWFP) plantation	47.62
	Poplar defoliator <i>C. cupreata</i>	Shisham plantation in Haryana	56.15
	Shisham defoliator <i>P. reflexa</i>	Poplar plantation in Haryana	52.35
	Poplar defoliator <i>C. cupreata</i>	Shisham plantation in Punjab	54.58
	Shisham defoliator <i>P. reflexa</i>	Poplar plantation in Punjab	53.65
	Poplar defoliator <i>C. cupreata</i>		
IFGTB, Coimbatore	Defoliator	Ailanthus - Tirupuvanam and Singampunari at Kallikudi	72.0
	Defoliator	Ailanthus - Idikarai, Coimbatore	67.0
	Defoliator	Ailanthus - Salem	98.0
	Defoliator	Ailanthus - Dharapuram	91.5
	Defoliator	Ailanthus - Aliyar Dam	95.0
	<i>H. Puera</i>	Teak - Salem	92.0
TFRI, Jabalpur	<i>Eutectona machaeralis</i>	Two years old plantations at Barbati, Jabalpur	93.93
	<i>Hyblaea puera</i>	Two years old plantations at Barbati, Jabalpur	87.87
HFRI, Shimla	<i>P. reflexa</i> (Shisham defoliator)	<i>D. sissoo</i> in 1 ha at Manali	49.1
	<i>P. reflexa</i> (Shisham defoliator)	<i>D. sissoo</i> in 1 ha at Jhungi	37.7
AFRI, Jodhpur	<i>Patialus tecomella</i>	<i>Tecomella undulata</i>	58.54
IFB, Hyderabad	<i>Achaea janta</i>	<i>P. santalinus</i>	82.21
IWST, Bangalore	<i>Hypsipyra robusta</i> - shoot borer	<i>Swietenia macrophylla</i>	66

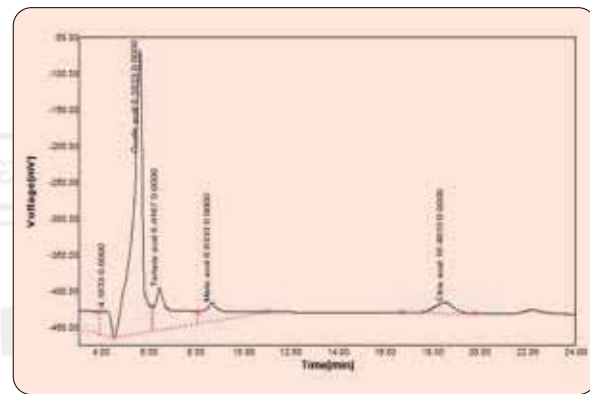
Development of superior biofertilizers for enhanced plant productivity

The tree species *Santalum album*, *Gmelina arborea*, *Dalbergia sissoo*, *Melia dubia* were inoculated with ICFRE developed biofertilizers (AM fungi, PSB, *Azospirillum*, *Azotobacter* and KSB) and growth was compared with commercial biofertilizers inoculated plants. The study was carried out at eight different locations in Tamil Nadu, M.P. Assam, Rajasthan and Uttarakhand as per species availability. The results showed that ICFRE developed biofertilizers significantly improved the growth and biomass after a period of one year as compared to commercial biofertilizers, and tree height was twin the initial measurement.

The biofertilizer *Azospirillum brasilense* control root pathogens of *Fusarium oxysporum* in *Gmelina arborea* and *Melia dubia*. Phosphate solubilization activity of PSB was studied through HPLC. The PSB produced higher amount of citric acid (535.42 mg/L) than the tartaric acid (24.14 mg/L), oxalic acid (12.27 mg/L) and malic acid (9.55 mg/L) isolated from *M. dubia* tree. Hence it is understood that the phosphate solubilization by PSB is due to secretion of citric acid. Two trainings were conducted on biofertilizers for the state forest departments of Karnataka and Punjab. Six VAM biofertilizers units were constructed at ICFRE-IFGTB, Coimbatore, ICFRE-IWST, Bangalore, ICFRE-RFRI, Jorhat, ICFRE-TFRI, Jabalpur, ICFRE-FRI, Dehra Dun and ICFRE-AFRI, Jodhpur under this project for producing VAM biofertilizers.



Growth responses of *Gmelina arborea*, *Santalum album* and *Melia dubia* ICFRE- IFGTB and Commercial biofertilizers at field conditions



HPLC chromatogram showing standards of 4 organic acids (Oxalic acid, Tartaric acid, Malic acid and Citric acid)



S. album plantation inoculated with ICFRE biofertilizers in Hoskate, Karnataka



Awareness cum training programme at SFRI, Dhandowal, Punjab



Constructed VAM biofertilizer production unit at ICFRE-IWST

Genetic improvement and value addition of *Madhuca longifolia*

Fruits from 81 selected phenotypically superior trees were collected from six locations of Balaghat and Gunain Madhya Pradesh, Raigad, Gondia, Nashik and Thane in Maharashtra by ICFRE-TFRI. Oil content was estimated in seeds and maximum 56.39% oil was obtained in seeds of Tree No. 2 from Guna. Average oil percentage ranged from 13.47% to 56.38%. From flowers of 45 selected phenotypically superior trees collected by ICFRE-IFP, sugar content ranged from 12.03% - 98.53%, phenol 0.52% - 4.72% and protein 4.50% - 49.30%. Sugar content of flowers collected from seven trees collected by ICFRE-IFGTB ranged from 26.15 to 44.20% and oil content of seeds from 10 trees ranged from 36.03 to 55.06%. Biochemical estimation of sugar, phenol and protein was carried out from flowers of 125 selected trees and oil content was estimated from fruits of 40 trees by ICFRE-ERC. Percentage of oil ranged from 44% - 64%. In flowers collected from 33 trees of Andhra Pradesh, Odisha and Telangana by ICFRE-IFB, sugar ranged from 31.20 to 43.83% and Oil from seeds collected from 14 trees ranged from 36.6 to 58.6%.

Second Vegetative Multiplication Garden (Clonal Orchard) and Seedling Seed Orchard (30 families) were also successfully established at Guru Ghasi Das University campus, Bilaspur, Chhattisgarh (Lat.22.12287°, Long.82.140572°) by ICFRE-TFRI. After one year of establishment of VMG, growth data on plant height, collar diameter and number of branches was recorded. Maximum 118.67cm plant height in MH-GND-5, maximum 22.36 mm collar diameter in CG-BSP-2 and maximum seven branches in MP-JBP-15 were recorded. VMG was established at ICFRE-IFB, Hyderabad campus with grafted plants of 15 phenotypically superior trees from Kamareddy, Banswada, Yellandhu, Manuguru and Chinthuru. One Seedling seed orchard was established with mahua seedlings of 15 phenotypically superior trees selected from Bundelkhand region, Gangetic region and Vindhyan

region at village Basahara, Prayagraj, Uttar Pradesh.

Extraction of genomic DNA from leaf samples of 90 selected phenotypically superior trees using CTAB method. The purity of extracted DNA ranged from 0.89 to 1.96 (A260/280) and quantity of DNA ranged from 148 to 597 ng/μl. In nurseries 9000 seedlings were raised though seeds collected from 112 selected phenotypically superior trees.

Natural Regeneration studies were carried out in Dharmapuri, Tamil Nadu at two locations and regeneration was 60% and 100%. Natural regeneration of Mahua was observed in Jaunpur, Uttar Pradesh by ICFRE-ERC.

FSSAI registration number (21423210001180) was obtained for developed herbal products of *M. longifolia*. Nutraceutical bars developed from Mahua flowers had shelf life of 180 days. Herbal Anti bacterial Handwash gel formulation and Herbal cream developed from *M. longifolia* plant parts were found to be safe and effective. MB25 handwash showed best zones of inhibition of 15.66, 9.33, 14.0 and 15.33 mm in diameters against *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Bacillus subtilis*, and *Escherichia coli*. Alkaloids, phenol and saponin gave positive test for handwash sample. Wound healing activity was assessed in the cream MLB2 and found satisfactory with complete healing period of 14 days. Experiments were performed for better ethanol production from Mahua flowers through fermentation of sugars in anaerobic conditions using activated yeast. 8.52% alcohol content was recorded in distilled liquor.

Formulation of herbal tooth powder and tooth powder using different combinations of *M. longifolia* leaves, bark and leaves + bark in combination with other medicinal plants was done and optimized. Consumer acceptability studies were done and found acceptable. Assessment of tooth powder sample as per BIS specifications and market linkage development under progress.



A booklet entitled 'Indigenous Traditional Knowledge (ITKs) of *Madhuca longifolia* (Mahua) prevalent in India'



Mahua Tooth powder



Mahua Chocolate samples prepared for one year shelf life testing



Experimentation for wine preparation from Mahua flowers

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

This project aims to develop region specific live fencing and boundary plantation on farmer's lands for improved farm protection, soil and water conservation to enhance farm production and people livelihoods. Live fencing around farmer's fields established in previous years are being maintained in 12 villages in Rajasthan (2), M.P (2), H.P (5) and T.N. (3) through weeding, watering and soil working. Performance of survival of live hedge fencing varied from 43 to 92 %. Soil moisture conservation structures like Bunds, trenches and snow harvesting structures are being maintained at selected sites. In plantation sites established in previous years covering 91.58 ha area, assessment of vegetation recovery was done. After protection and plantation of experiment site 30 species were observed at degraded sandy plain site, 14 at reactivated sand dune, 44 at degraded hill, 2 at ravine site and 31 at mine overburden site. Growth and survival data also recorded from all fields/ plantations. Average survival percentage of 77.4% recorded in degraded hill slopes of Himachal Pradesh, 63.1% at degraded sandy plain site, 46% at reactivated sand dune, 82% at degraded hill, 83.3% at ravine site, 76.6% at saline site and 84.94% at mine overburden site. Soil moisture conservation structures like trenches (Kiriburu site Jharkhand, Lunawas site Jodhpur, Rajasthan) and Check dams (Ravine site, Morena, M.P.) established at plantation sites and bamboo mat and boulders were used for control of soil erosion at kiriburu mine site, Jharkhand. Seed sowing also done on trenches

for soil moisture conservation and enhance green cover of degraded site.

Plantations for rehabilitation of salt affected soils were established at two sites at Jhansi, U. P. and Punjab. Thirteen species, including *Acacia catechu*, *Dalbergia latifolia*, *Aegle marmelos*, *Dalbergia sissoo*, *Bambusa bambos*, *Dendrocalamus strictus*, *Draphanostachym falcatum*, *Phyllostachys aurea*, *Salvadora persica*, *Terminalia bellirica*, *Butea monosperma*, *Chukrasia tabularis*, and *Toona ciliata* were planted in a five-hectare area in Babina (Jhansi, U.P.). At the plantation sites, additional soil moisture conservation measures like excavating pits perpendicular to the slope to catch runoff water and also staggered trenches to further obstruct water flow were laid. The second plantation done in Bhatinda, Punjab with ten different species in 1.5 hectares area namely *Dalbergia sissoo*, *D. latifolia*, *Toona ciliata*, *Acacia catechu*, *Aegle marmelos*, *Bambusa bamboos*, *Dendrocalamus strictus*, *Draphanostachym falcatum*, *Terminalia bellirica*, and *Butea monosperma*.



Live fencing of *Carissa carandas* and the bunds raised for water harvesting structure at – Esah Shikaripura, M.P.



Overall view of Kiriburu mine area plantation, Jharkhand



Growth measurement at Rathinampillai Pudur village, Karur, Tamilnadu



Rain water harvesting structures at Lunawas site, Jodhpur, Rajasthan



NGO and progressive farmers visit at Lunawas site, Jodhpur, Rajasthan

Domestication, Genetic Characterization, Improvement and Diversified Utilization of Poplars

Field trials of 16 clones of *Populus deltoides* are progressing at six sites in Himachal Pradesh, Punjab, Haryana, Uttar Pradesh and Bihar. Clones FS-FRI-31 and FS-FRI-32 are among the best performers at four sites in Hoshiarpur (Punjab), Yamunanagar (Haryana), Saharanpur and Kushinagar (both in Uttar Pradesh), at the age of two years with 15 cm dbh and height 11 to 14 m.

Introduction trial of *Populus gamblei*, a native poplar species of north-eastern India, was established at Dehradun (Uttarakhand).

Oriented strand board was made from wood waste of *P. deltoides* during 2023-24 at FRI and their quality testing, is underway.

Seasonal incidence of insect pest spectrum in *P. deltoides* has been studied in Himachal Pradesh, Punjab, Haryana, and Uttar Pradesh and a calendar of seasonal incidence has been prepared. Natural enemies viz. the parasitoid *Netalia testacea* (Hymenoptera: Ichneumonidae) and the predator crab spider, *Camaricus formosus* (Araneae: Thomisidae) of minor pests of *P. gamblei* were recorded from nursery in Assam.

Ceratocystis sp. was identified as a causal agent of a serious wilt disease of *P. deltoides*. The disease was successfully managed by root application of *Trichoderma* sp. in a farm field at Kalesar, Haryana. The novel species *Calonectria populi* sp. found by the team of ICFRE-FRI has been registered with MycoBank (MycoBank number 849371). *Trichoderma* isolate is being tested for antagonistic potential against three *Alternaria* isolates and *Calonectria populi* using dual culture technique.

Table-1: Seasonal incidence of insects found in *Populus deltoides* in the field

S. No.	Species Name	Damage	Seasonal incidence
1	<i>Acraea terpsicora</i>	Defoliator	June, July, August, September
2	<i>Artaxa guttata</i>	Defoliator	July, August, September
3	<i>Ascotis selenaria</i>	Defoliator	June, July, August, September, October
4	<i>Botyodes asialis</i>	Defoliator	May, June, September
5	<i>Botyodes diniasalis</i>	Defoliator	August, September
6	<i>Botyodes principalis</i>	Defoliator	April, September, October, November
7	<i>Cheromettia apicata</i>	Defoliator	July, August, September, October, November
8	<i>Chrysodeixis eriosoma</i>	Defoliator	April, October
9	<i>Clostera cupreata</i>	Defoliator	May, June, July, August, September
10	<i>Clostera fulgurita</i>	Defoliator	April, May, June, July, August, September, October, November
11	<i>Cupha erymanthis</i>	Defoliator	April, May, June, July
12	<i>Eupterote undata</i>	Defoliator	July, August, September
13	<i>Hyposidra talaca</i>	Defoliator	May, June, July, August, September, October, November, December
14	<i>Olene inclusa</i>	Defoliator	April, May, November
15	<i>Olene mendosa</i>	Defoliator	October
16	<i>Orgyia postica</i>	Defoliator	May, September, October, November
17	<i>Oxyrachis tarandus</i>	Sap sucker	March, April, May, June, July, August, September, October, November
18	<i>Patania ruralis</i>	Defoliator	July, August
19	<i>Phalanta phalantha</i>	Defoliator	March, April, May, June, July, August, September, October
20	<i>Ricania speculum</i>	Sap sucker	April, May, June, July, August, September, October
21	<i>Syntomoides imaan</i>	Defoliator	April, May, June, July



Vegetative propagation trial of *P. alba* at VVK, Jagatsukh, Manali, H.P.



Populus gamblei seedlings at Jadua, Hajipur (Bihar)

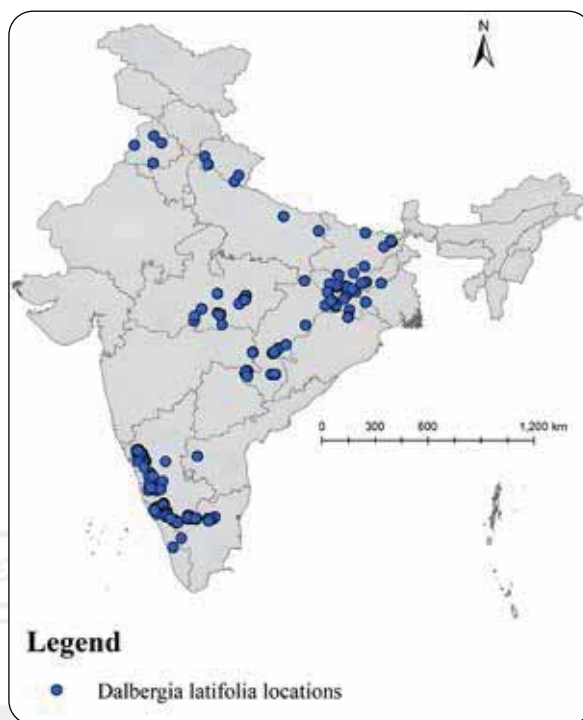


Preparation of oriented strand board from *P. deltoides*

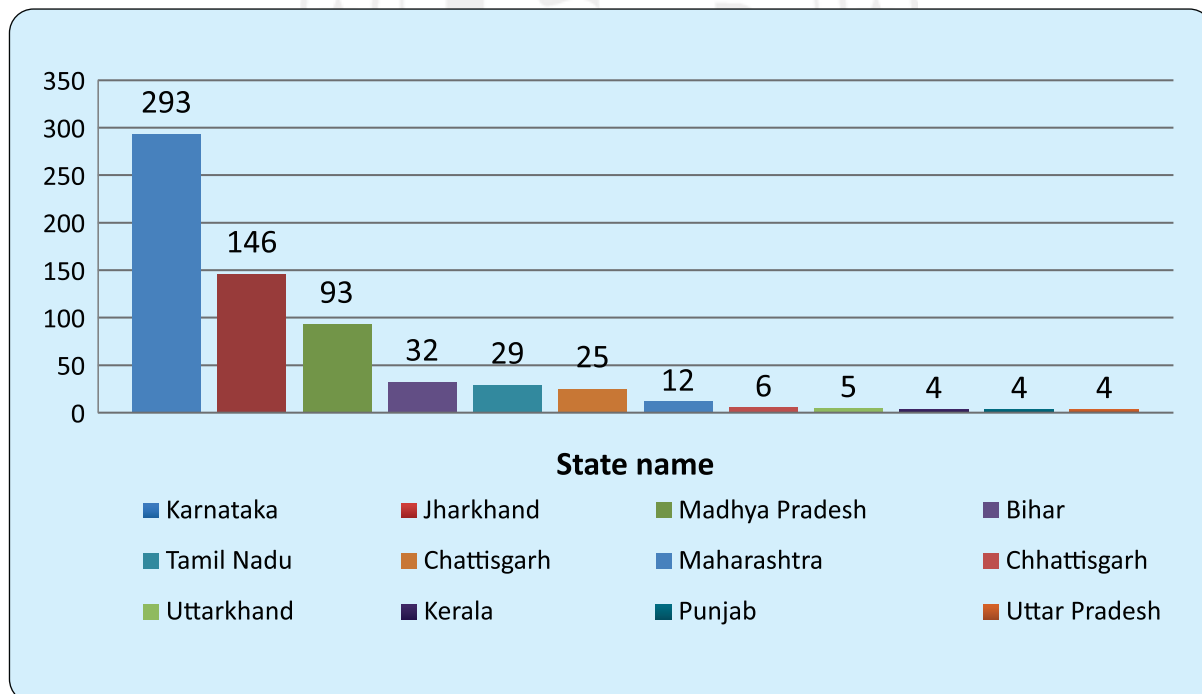
Dalbergia latifolia Roxb.

The study on the population structure and regeneration status of *Dalbergia latifolia* (Indian Rosewood) was carried out in eight Forest Divisions, four Tiger Reserves, and one Wildlife Sanctuary comprising 82 Ranges in the forests of Karnataka. 190 transects and 1705 individuals were enumerated belonging to seedlings, poles, and trees of *Dalbergia*. The study revealed considerable variation in Rosewood populations across different forest divisions. The mean density of trees in Karnataka was 6.66 ± 6.51 per 0.1 ha (range 0 – 34, N = 190). The highest basal area was seen in Madikeri Forest Division with $1.7483 \text{ m}^2/0.1\text{ha}$ and the least in Cauvery Wildlife Sanctuary with $0.0152 \text{ m}^2/0.1\text{ha}$. Natural regeneration of *Dalbergia* mainly occurred from seeds, with suckers or root coppice being insignificant. Invasion of weeds (*Chromolaena odorata*, *Lantana camara*) with high allelopathic potential and forest fires (both anthropogenic and controlled burning) were identified as factors contributing to the decline in Rosewood populations.

A PAN India distribution map was prepared for the species and the species is distributed in Bihar, Chhattisgarh, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Punjab, Tamil Nadu, Uttar Pradesh, Uttarakhand, and West Bengal.



Map for distribution of *D. latifolia*



Distribution of *D. latifolia* in 12 states and number of locations in each state

So far under project a total of 12 progeny trials of *Dalbergia latifolia* were raised following Randomized Block Design, 3m x 3m spacing, at

different locations and are being maintained. The details of the progeny trials are as follows:

ICFRE Institutes	States	Multi-location trials details [Randomized Block Design (RBD)]	Number of Families/Seedlings
IFP, Ranchi	Jharkhand	NB farm Chandwa, Latehar	Progeny trial cum germplasm bank with 7 accessions, 5 replications and 6 plants/progeny/replication - (210 plants). Progeny trial cum germplasm bank with accessions 3 replications and 4 plants/ progeny/replication - (168 plants).
	Bihar	Mohabata Chapra, East Champaran	Progeny trial cum germplasm with 21 accessions, 4 replication and 3 plants per progeny per replication (252 plants).
	Jharkhand	Chandwe near Hundur (Ranchi)	Progeny trial with 15 accessions, 4 replications and 4 plants per replication - (240 plants).
		Harhad village Kundilbaghi, Hazaribagh	Progeny trial with 21 accessions, in 3 replications and 6 plants per accession (378 plants).
TFRI, Jabalpur	Madhya Pradesh	Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur.	Progeny Trial with 32 accession 6 replication 2 plants per replication (384 plants).
	Chhattisgarh	Guru Ghasidas Central University, Bilaspur, Chhattisgarh	Progeny trial 32 accession 6 replication 2 plants per replication (384 plants).
FRI, Dehradun	Uttarakhand	G&TI, FRI, Dehradun	Progeny trial cum germplasm bank comprising 12 accessions, 3 replications 1 plant per replication (36 plants)
	Uttar Pradesh	Simariya Pachimi Block, Jhansi	39 families 3 replication, 1 plant per replication (117 plants)
	Punjab	Central University of Punjab, Bhatinda	10 families, 3 replication, 4 plants per replication 120 plants
IWST, Bengaluru	Karnataka	Madahalli, Karnataka Forest Department Research plot	395 plants of 26 families
		Yenekallu	400 plants of 26 families
IFGTB, Coimbatore	Tamil Nadu	Ahalia foundation, Palakkad and KFDC	700 plants

Genomic DNA from 502 trees was isolated, and 223 SSR markers were synthesized to understand genetic variation and breeding systems *D. latifolia*. *De novo* genome sequencing yielded 22,319 contigs totaling 613.95 Mb, with high completeness (95%) and identification of 92% single-copy BUSCO genes. Repeat masking unveiled that approximately 60% of the genome comprises interspersed repeats, indicating structural complexity. Structural annotation predicted 45,682 genes, enriched in

pathways like chromosome segregation ATPases and inorganic ion transport. Evolutionary analysis showed genetic relatedness to other Fabaceae members. The genomic resource of *D. latifolia* is deposited in NCBI, SRA public database and can be utilized further by the research community.

In nurseries across India, observed 22 insect species, with 14 defoliators and eight sap-suckers forest areas

Sap-suckers	<i>Psyllidae</i> , <i>Drosicha stebbingi</i> , <i>Myzus persicae</i> , brown marmorated stink bug – <i>Halyomorpha halys</i> , <i>Leptocentrus taurus</i> , <i>Leptocoris</i> sp., <i>Ricania speculum</i> , and Leaf footed bug.
Defoliators	<i>Orgyia postica</i> , <i>Somena scintillanus</i> , <i>Trypanophora semihyalina</i> , <i>Hyposidra talaca</i> , <i>Plecoptera reflexa</i> , <i>Ectropis bhurmitra</i> , <i>Apoderus crenatus</i> , <i>Acrocoelopus cretaceous</i> , <i>Chrysochus cobaltinus</i> , <i>Gastrophysa viridula</i> , <i>Olene inclusa</i> , <i>Orgyia postica</i> , and <i>Somena scintillanus</i> .

Infestation of the pinhole borer, *Euplatypus parallelus*, on living *D. latifolia*, trees was observed. Localized application of Chlorpyrifos (4 ml L⁻¹) along

with, Carbendazim (2g L⁻¹) using syringes and soil quenching (5 L per tree) once a week found to be effective in controlling infestation.

Conservation and Sustainable Management of Wild Edible Fruiting Species

Phyto-sociological and ethnobotanical studies on *Semecarpus anacardium* and *Flacourtia indica* show that these species now exist only in scattered populations (1-3 trees per site) due to overharvesting and lack of natural regeneration. *S. anacardium* decline is mainly due to its use for edible and medicinal purposes, while *F. indica* is affected by cattle grazing and its use for fruits and medicine. Both species are highly valued, with *S. anacardium* having 18 uses and *F. indica* having 29, highlighting the urgent need for conservation efforts.

Completed vegetative propagation studies in *F. indica* and *Pithecellobium dulce*. Air layering of *Myrica esculenta* with soil and *Aloe vera* at Shilly forest Solan resulted in 70 percent success. Seed propagation was found to be suitable method for propagation of *F. indica* and *Semecarpus anacardium* over vegetative propagation where the seed propagation resulted in 45 and 70 percent germination than 40 and 50 percent success in vegetative propagation respectively. Cuttings of *Spondias pinnata* and *Prunus jenkinsii* treated with 200ppm IBA showed better survival than IAA and NAA treatments.

Best seed germination of 85% in *Pyrus pashia* was observed in 100ppm GA₃ treatment while 95% germination was recorded in *Ficus palmata*. Mature seeds of *Spondias pinnata* soaked in water for 72 hrs showed 80% germination compared to those soaked for 24 and 48 hours. 600 seedlings of *Spondias pinnata* and 300 seedlings of *Prunus jenkinsii* have been developed from seeds, in the RFRI nursery.



Germination in fresh seeds of *Pyrus pashia*



Air layering of the target species



Pithecellobium dulce germplasm establishment at Neyveli



Value added products prepared from *Semecarpus anacardium*

Surveyed 26 more village markets in Jharkhand dealing with sale and purchase of wild edible fruits adding the total to 82 village markets falling in 60 blocks of Jharkhand. Wild edible fruits found in village markets are *Tamarindus indica*, *Solanum torvum*, *Coccinia grandis*, *Semecarpus anacardium*, *Diospyros melanoxylon*, *Spondias pinnata*, *Madhuca indica*, *Buchnanian lanzan*, *Mangifera indica*, *Aegle marmelos*, *Artocarpus heterophyllus*, *Syzygium cumini*, *Ziziphus mauritiana*, *Momordica charantia*, *Phoenix sylvestris*, *Terminalia bellerica*, *Terminalia chebula*, *Phyllanthus emblica*, *Momordica dioica* and *Borassus flabellifer*.

Progeny and plantation trail of *Semecarpus anacardium* (30 CPTs) and *Flacourtia indica* (25CPTs) was carried out at three locations i.e. ICFRE-TFRI, Jabalpur; Guru Ghasidas University, Bilaspur (CG) and FRC-SD, Chhindwara. Established germplasm bank of *Pithecellobium dulce* in at Panampally (0.25 ha), Neyveli (0.5ha), Gudalur (0.4 ha) and germplasm bank of *Limonia acidissima* at Panampally (0.1 ha), Kurumbapatti (0.3 ha) and at Gudalur (0.3 ha). Germplasm bank of superior trees of *Ficus palmata* was established at Tehri Forest Division and Mussoorie Forest Division while, germplasm bank of superior trees of *Pyrus pashia* was established at Tehri Forest Division and Chakrata Forest Division.

Prepared value added product (21Nos) Karonda chips, Energy drink, Karonda Churan (Powder), Khatmithgoli, Karonda Candy, Karonda Pickle, Cherry Karonda, Honey Spread and Iron Capsule, Karonda Jam, Karonda Murabba from *Carissa carandas* and Molu candy, Molu Jam, Molu pickle, Molu Murabba, from *Pyrus pashia* and Himalyan Fig Jam, Himalyan Fig Candy, Dried Himalayan Fig, Fig Squash from *Ficus palmata* and Sweet candy, Orange pickle, Green Pickle from *Semecarpus anacardium*.

Sustainable management of NTFPs through conservation and value addition

Germplasm of 30 NTFPs/ medicinal plants species were collected for the identification of superior germplasm. Taxol content was estimated in germplasm of *Taxus wallichiana* from 19 locations, maximum taxol contents (bark - 2.252 μ g/100 mg and leaf - 2.297 μ g/100 mg) was observed in the samples, collected from Ranikot (Chamba). Diosgenin content (0.01 to 0.8%) was estimated in germplasm of *Costus speciosus* (15 locations) rhizomes, highest concentration of diosgenin was determined in Alliguda, Mulugu district (Telangana). Saponin glycoside contents (26.5-49.5%) was estimated in germplasm of *Sapindus laurifolius*, collected from Madhya Pradesh and Maharashtra (10 locations).

A trialon pretreatment of *Rheum austral* seeds was conducted and in cold stratification 66.66% germination was observed after 75 days. Standardized sustainable harvesting protocols of *Casia fistula*, *Oroxylum indicum*, *Wrightia tinctoria* barks, roots of *Desmodium gangeticum* and *Curculigo orchiooides* and fruits of *Helicteris isora*.

Ethno-medicinal knowledge on four major disease- Cardiovascular, Arthritis, Bronchitis



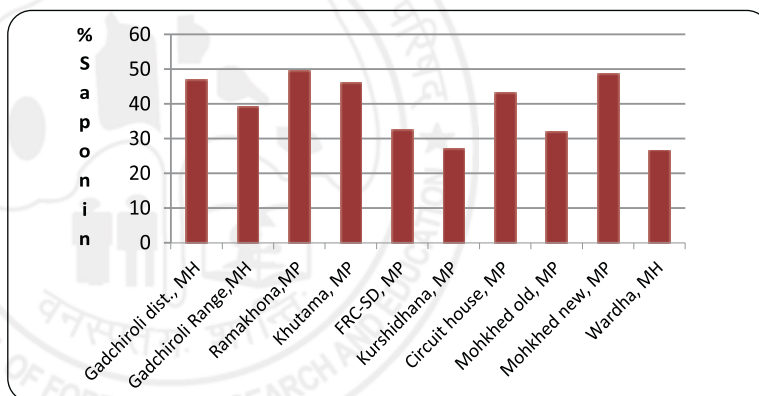
Assemblage *Desmodium gangeticum* germplasm from 33 locations of MP, C.G. and M.H. Forest Division

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

Seeds were collected from 929 seed sources from the nine different agroclimatic zones during the fruiting period (June-July), for the second consecutive year. The seeds were processed as per the standard SOP that includes de-pulping, drying followed by the estimation of Azadirachtin using HPLC and oil estimation. Total oil content ranged between 16.67% (ACZ-10A) to 66.92% (ACZ-4). Highest Azadirachtin content was reported from zone 10B that was 6914.42 ppm and lowest 39.37ppm were reported from zone 4. Results indicate that the maximum Azadirachtin content was found in the seed sources of agroclimatic zone 10 B and 10 A both from the southern part of India.

and Diabetes were documented by different institutes from 294 villages in the states of Madhya Pradesh, Chhattisgarh, Maharashtra, Telangana, Andhra Pradesh, Uttar Pradesh, Jharkhand, Bihar, Arunachal Pradesh, Assam, Rajasthan, Gujarat, Uttarakhand and Uttar Pradesh. A low cost solar dryer was developed for processing of NTFPs/ medicinal plants in interior areas. A natural dye was extracted from bark of *Aporosa octendra*.

Marketed samples of different NTFPs (52 species) were collected from different state mandis. Prepared value added products from *Feronia limonia* (Murraba and pickle), *Tamarindus indica* (Squash) and *Madhuca longifolia* (Jaggary). Mosquito-repellant incense sticks were prepared from *Diploknema butyreacea* cake/residue and additives. Herbal anti-inflammatory wound healing cream was developed and complied as per BIS 6608: 2004 specifications and tested parameters viz. pH, thermal stability, total fatty substance content, total residue and heavy metals content. Developed cream was found to be effective for healing skin disease- Eczema. FSSAI license for Herbal chocolates, herbal noodles with registration number 21423210001180 was obtained by ICFRE-SDC, Chhindwara to develop market linkages.



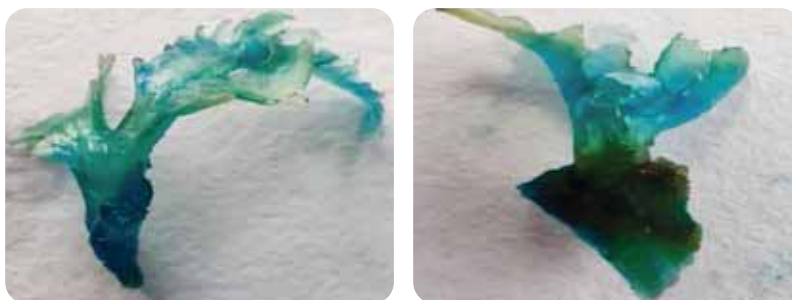
Variation in saponin content in germplasm (MP and MH) of *Sapindus laurifolius*

The occurrence of natural pollination both by wind and insects indicates ambophily in Neem. Insect pollinators were predominantly represented by Hymenoptera and Lepidoptera. *Apis spp.* are the most effective pollinators.

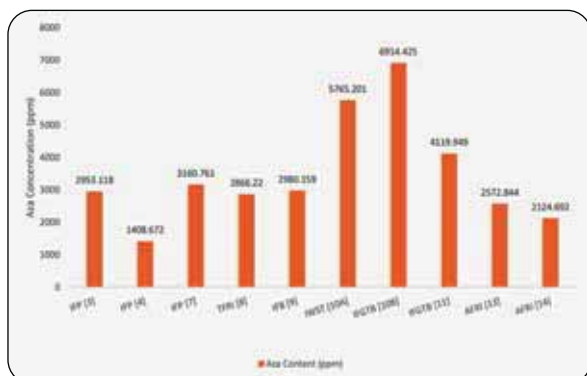
Putative transformed *in vitro* shoots with *glyIII* gene inserted developed roots on the half MS supplemented with auxin treatment. *Gus*-histochemical assays were repeated on microshoots giving positive results with appearance of blue coloration.

Callus initiated from various explants like flowers, leaf and embryos in fifteen different media combinations were maintained. In callus Azadirachtin estimation was done by colorimetric method and through HPLC. Azadirachtin content was highest in flower callus cell line followed by

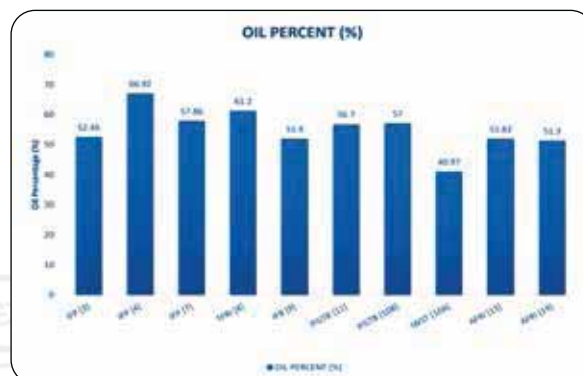
leaf. To increase the Azadirachtin in cell lines elicitor treatments were given and the accumulation has been estimated. RNA was isolated from one month old flower callus, leaf callus and seed samples Transcriptome analysis is being done for identification of genes involved in azadirachtin pathway.



Genetically Modified Neem Microshoots (showing positive results of *gus*-histochemical assay)



Institute with their respective agroclimatic zones



Institute with respective agroclimatic zones

Development of Package of practices on *Gmelina arborea* Roxb. (Khamer or Gamhar) in selected agroclimatic regions of India

A total of 46 CPTs were identified (35 in Jharkhand, Bihar and West Bengal; five in Chhattisgarh; six in Maharashtra) under the project. Established one clonal trial at ICFRE-TFRI, Jabalpur. Growth data recorded for four CSO established by the ICFRE-RFRI (ICR-AAU, Jorhat, Silviculture Forest Department, Siliguri W.B, RARS DiphuKarbi-Anglong and HRI, Kahikuchi Guwahati). 68 clones were evaluated for genetic diversity assessment. Genomic DNA isolation protocol has been standardized and genomic DNA of 135 CPT at ICFRE-IFP; 48 at ICFRE-IFGTB and 90 at ICFRE-TFRI has been isolated by using the developed protocol. Biology of the key defoliator of the *G. arborea* were studied in the laboratory condition. A pest calendar was also prepared based on the nature of damage and intensity of attack in nurseries and plantations.

Increment core samples from 96 trees belonging to 49 progenies and 30 trees belonging to 18 clones were collected to measure the moisture content and actual wood density. The basic density of the progenies ranged from 0.49-0.63 g/cm³ while that of the clones ranged between 0.27-0.67 g/cm³. Determined the dynamic modulus of elasticity (DMoE) from the acoustic data which ranges from 6.6 GPa to 15.1 GPa among the progenies and 5.40-9.5 GPa among the clones.

Conducted survey to record utilization of *Gmelina* wood for Value Chain study in different parts of India. Karnataka, Tamil Nadu and Kerala have potential market for *Gmelina* wood as people are engaged in manufacturing different valuable

products like face mask for kuchipudi dancer, artificial limb, carved articles and other value added products. Also surveyed 40 timber depots and saw mills existing in eight different districts of Southern Tamil Nadu, Madhya Pradesh (five sawmills and 20 timber merchants at Seoni), Maharashtra (131 sawmills and timber merchants at Jalgaon and adjacent areas) and Chhattisgarh (50 sawmills and timber merchants at Raipur, Durg, Kabirdham and Rajnandgaon) for demand supply of *Gmelina* wood.

One book has been published on Seed Orchard Establishment in Northeast India and two booklets published on Clonal Propagation of *Gmelina arborea* Roxb. through Bud Grafting and through Branch Cutting.



Recorded the penetration depth of Pylo-dyn pin in 15 selected trees at Nallal plantation, Karnataka



Collecting information about uses of *Gmelina arborea* wood for value chain analysis at Jalgaon District, MS



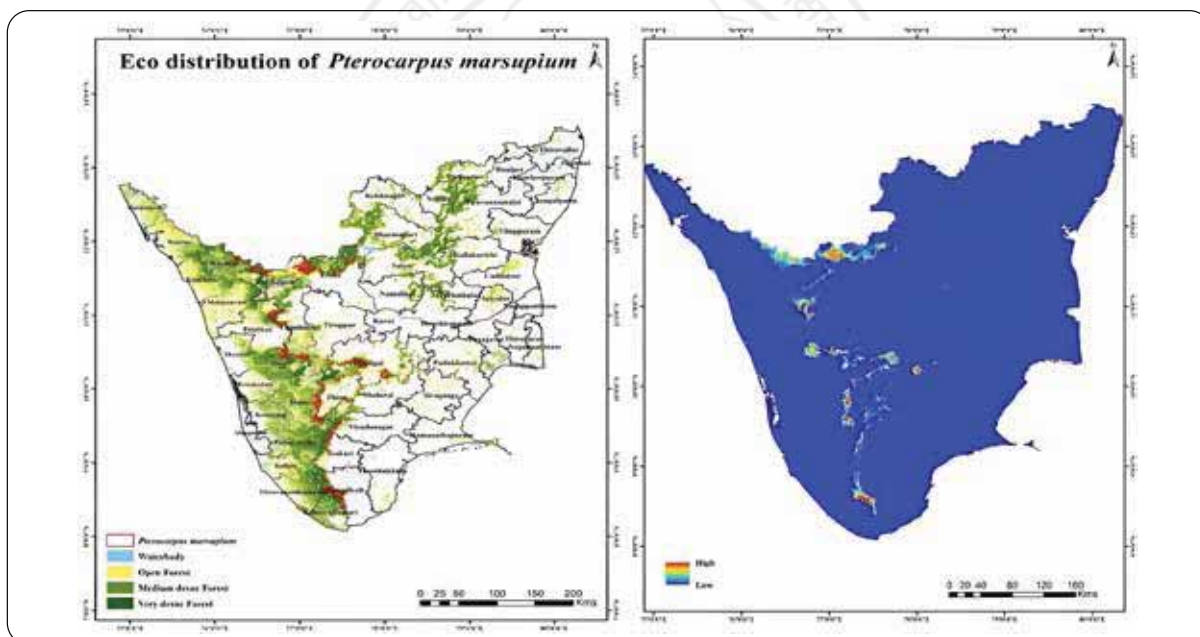
Top dying of *Gmelina* tree due to lace wing bug attack

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

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

Distribution maps were prepared and updated for 180 species. Eco distribution maps based on Maxent Model were developed for four species. Selected mother trees for 170 species from different forest types. Carried out regeneration studies for 22 species. Seed handling and storage behaviour studies were carried out for 80 species. Seed accessions from 750 mother trees were collected for storage. Standardized seed pretreatment and storage protocols for 47 species. Conducted molecular diversity studies for 10 species, biochemical characterization for three species and image analysis for 75 species. Seedlings of 20 species were produced from various selected seed sources of Tamil Nadu, Kerala, Madhya Pradesh, Chhattisgarh and Maharashtra. Infrastructure

facilities such as borewell and fencing were completed for field gene bank at Tiruvannamalai (45 ha), by ICFRE-IFGTB, Coimbatore. Established field gene bank in 10 ha at KVK, Katni, Madhya Pradesh, by ICFRE-TFRI, Jabalpur. Field gene bank of six species *Haldina cordifolia*, *Careya arborea*, *Syzygium cumini*, *Litsea glutinosa*, *Ailanthus excelsa* and *Mitragyna parvifolia* were established by ICFRE-TFRI. Fencing work was completed at Mulugu research station for the field gene bank establishment, by ICFRE-IFB, Hyderabad. A customised Database Management system is being developed. A display unit (carpellarium) for seed referral centre was created and displayed 78 species at ICFRE-IFGTB. An International Symposium on Forest Genetic Resource Conservation and Utilization was conducted by ICFRE-IFGTB in the 59th Annual Meeting of the Association for Tropical Biology and Conservation (ATBC 2023), at Kumaraguru College of Technology, Coimbatore.



Ecodistribution mapping of *Pterocarpus marsupium*, Tamil Nadu



Trewia nudiflora accessions collected for variability studies



Seed germination studies in *Sapindus laurofolius*

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

Since inception of project, documentation of 749 species has been completed. So far, 124 forest subtypes have been covered in 14 states. Regeneration and population structure status has been recorded for 296 FGR species in Haryana, Uttar Pradesh, Punjab, Rajasthan, Bihar and Jharkhand. Till date, regeneration of 546 species has been recorded across all the 18 states. In the pictorial guide prepared last year for 200 species, this year 17 species were added by ICFRE-FRI for field working staff for authentic identification of the species. This year, Eco-distribution map have been prepared for 77 species and a total of 105 maps have been completed for FGR species.

Seed samples of 118 species were collected in 2022 from Punjab, Haryana, Uttar Pradesh, Rajasthan, Himachal Pradesh, Bihar, Jharkhand, West Bengal, Assam, Meghalaya, and Arunachal Pradesh. This year seeds of 82 species were collected. The sampled seeds have been extracted, cleaned, processed and kept for medium and long term storage. Till date, seed samples of 156 species have been deposited at NBPGR, New Delhi and minimum moisture content and seed viability have been tested for 161 species.

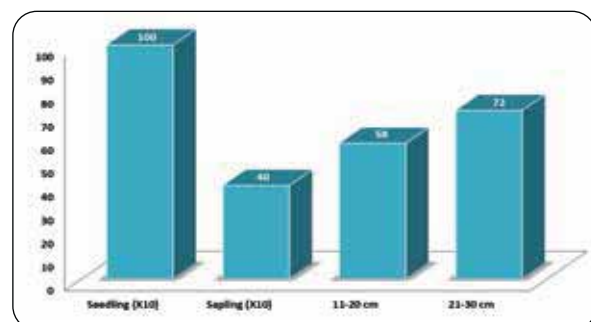
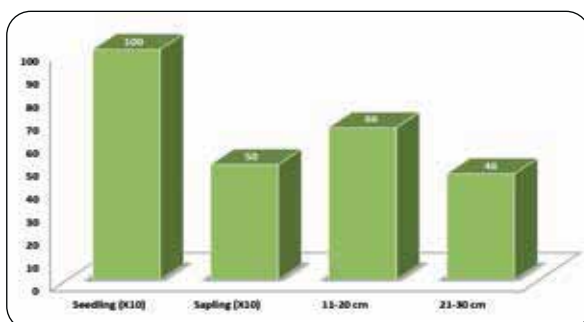
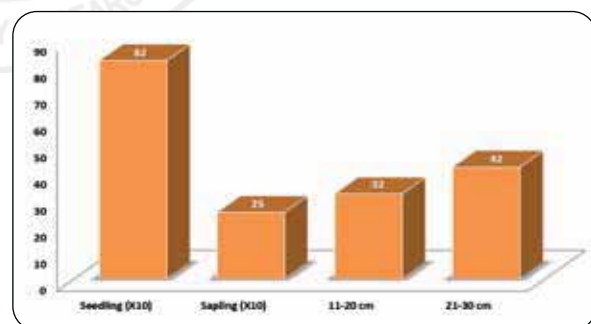
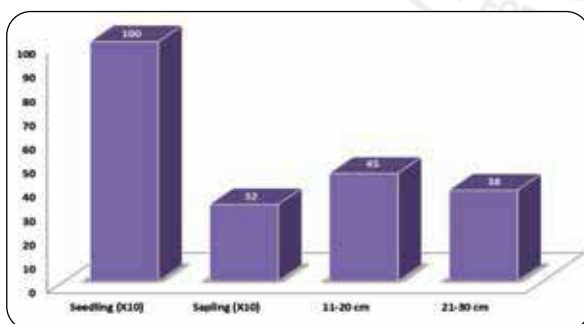
For conservation, in vitro aseptic cultures have been established for 27 species and slow-growth cultures have been established for 16 species so far. Synthetic seeds development for two species, *Catamixis baccharoides* and *Rhamnus triquetra* have been completed.

A total of 660 accessions of eight species (*Salvadora persica*, *Commiphora wightii*, *Boswellia serrata*, *Capparis decidua*, *Terminalia chebula*, *Terminalia arjuna*, *Madhuca longifolia* and *Pterocarpus marsupium*) have been collected for biochemical

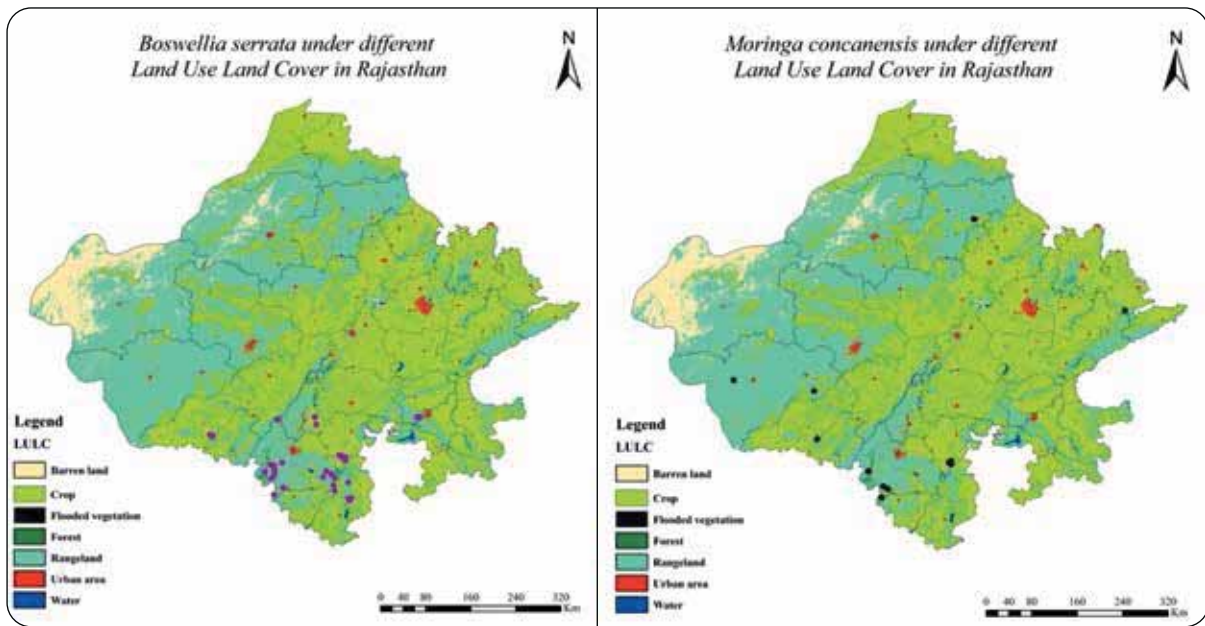
characterization from 62 different FDs of Gujarat, Rajasthan, Haryana and Uttar Pradesh surveyed by ICFRE-FRI and ICFRE-AFRI. Extensive field survey for collection of diseased populations was conducted for six FGR species (*Acacia catechu*, *Terminalia arjuna*, *T. bellirica*, *Shorea robusta*, *M. longifolia* and *P. marsupium*) from 33 forest divisions of Uttar Pradesh, Haryana, Punjab and Delhi and a total of 77 diseases were assessed with 49 fungal and 10 insect infestation records.

For genetic diversity studies, DNA isolation protocols have been standardized for 15 species (*Prosopis cineraria*, *Tecomella undulata*, *S. robusta* (ICFRE-FRI and ICFRE-IFP), *A. catechu*, *M. longifolia*, *P. marsupium*, *T. arjuna*, *T. bellirica*, *Buchanania cochinchinensis*, *Quercus semecarpifolia*, *Rhododendron arboreum*, *Myrica esculenta*, *Pinus wallichiana* and *Magnolia champaca*). SSR markers development has been completed for 12 species. Genotyping has been completed in seven species (*S. robusta*, *T. bellirica*, *A. catechu*, *M. esculenta*, *R. arboreum* and *M. champaca*).

For development of nursery techniques, a total of 30 species have been selected and the protocols have been developed for 19 species (*Salvadora persica*, *T. undulata*, *C. decidua*, *C. wightii*, *Butea monosperma*, *Aegle marmelos*, *Careya arborea*, *Phoebe goalparensis*, *Litsea cubeba*, *Shorea assamica*, *Morus laevigata*, *Q. semecarpifolia*, *Carpinus viminea*, *B. cochinchinensis*, *Haldina cordifolia*, *P. marsupium*, *Litsea glutinosa*, *Sterculia urens* and *Boswellia serrata*). Eight field gene banks have been established at Chandwa, Latehar; ICFRE-IFP Campus; Jagatsukh Nursery, Manali; FRS Shillaru; Hisar, Haryana; Babina, Jhansi; Malajaal, Jasol and ICFRE-AFRI Campus. Also 63 species have been planted and maintained in ICFRE-AFRI arboretum and ICFRE-FRI arboretum was enriched with 20 FGR species. National Forest Seed and Referral Centre is being established at ICFRE-FRI.



Regeneration status of *Shorea robusta*, *Buchanania cochinchinensis*, *Madhuca longifolia* and *Lagestromia parviflora*



Distribution mapping under different LULC



Seedlings raised in nursery (a) *Litsea glutinosa*, (b) *Boswellia serrata*, (c) *Haldina cordifolia*; (d) *Pterocarpus marsupium*; (e) *Sterculia urens*; (f) *Oroxyllum indicum*



In vitro conservation of *Phlogacanthus thyrsiflorus* by slow growth storage

03
CHAPTER

**EDUCATION
VISTAS/ACTIVITIES**

ICFRE





EDUCATION VISTAS/ACTIVITIES

FRI Deemed to be University (FRIDU)

3.1.

The Forest Research Institute (Deemed to be University) aims to advance forestry education throughout the country. The Ministry of Human Resource Development accorded it Deemed University status in 1991 vide Notification No. F.9-25/89-U.3 dated 06-12-1991. Since then, the institute has greatly expanded its academic endeavors, supporting forestry, environmental, and other discipline-related research and education. Entrance tests for M.Sc. courses and Ph.D. programs are conducted expeditiously and well in time. Two years M.Sc. courses offered by FRI (Deemed to be) University with their academic requirement are as follows:



Institute visit of students of M.Sc. Wood Science & Technology

S.No.	M.Sc. Course	Academic requirement
1.	M.Sc. Forestry	B.Sc. with at least one of the subjects from Botany, Chemistry, Geology, Mathematics, Physics and Zoology or B.Sc. in Agriculture or Forestry
2.	M.Sc. Wood Science & Technology	B.Sc. with Physics, Chemistry and Mathematics or B.Sc. in Forestry.
3.	M.Sc. Environment Management	B.Sc. in any branch of basic or applied Sciences or Bachelor's degree in Forestry or Agriculture or BE in Environment Sciences.
4.	M.Sc. Cellulose & Paper Technology	Passed graduation with minimum 50% marks in aggregate in Sciences with Chemistry as one of the subjects, BE/B.Tech (Chemical or Mechanical Engineering).

The university also initiated pioneering research in specialized areas under the Ph.D. Programme. University offers PhD (Forestry) as main degree and also PhD (Forestry) with more than 20 allied disciplines of Forestry. In the current academic year, 93 Research Scholars have registered for Ph.D. at the FRI Deemed to be University and a total of 19 Ph.D. degrees have been awarded.

During financial year 2023-24, students of FRI (Deemed to be University) registered a total of 66 placement offers. Over 25 different agencies

participated in the placement drive including Hindalco Industries Ltd.; Sterlite Power; S&P Global; WSP Global; Global Traceability; HCL Tech; Indus Enviro Pvt. Ltd. New Delhi; M/s Rushil Decors; JM Environet IEVO, Udaipur; CEDAR; M/s CP Veneers; M/s D R Decors, Bengaluru; Green Ply; Earthood, Noida; Sankalp Taru (NGO); Heritage, Jodhpur; Marque Impex; GICIA; SUVIDHA (NGO); Hans Foundation, Semi Govt. Organization, Eco Stewardship pvt. Ltd.; Kuantum Papers Ltd.; RSPL Ltd.; ITC Ltd.; JK Paper Ltd.

Training Programmes Organised (HRD)

3.2.

3.2.1. Trainings under Environment Knowledge and Capacity Building (EKCB)

Trainings programmes have been organized by the ICFRE and its institutes under Environmental

Knowledge and Capacity Building Scheme of the Ministry:

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



Role of Agroforestry in Land Management training conducted by ICFRE-FRI, Dehradun



Identification of Flora & Methodology of Plant Inventory for Baseline Data Collection conducted by ICFRE-HFRI, Shimla



Agroforestry & its Management for livelihood security training conducted by ICFRE-TFRI, Jabalpur



Vegetative Propagation Techniques of Forest Tree Species conducted by ICFRE-IFGTB, Coimbatore



Methods for documentation of biodiversity conducted by ICFRE-IFB, Hyderabad



Red Sanders – Lords own tree training conducted by ICFRE-IWST, Bengaluru



Environmental Impact Assessment training conducted by Environmental Management Division, ICFRE, Dehradun

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

Under HRD plan a total of Ten training programmes were organized, out of which Three trainings for Scientists, one training for technical personnel, Four

trainings for administrative staff and two induction trainings one each for Scientist-B and Technical Assistant were organized.

Name of HQ/Institute	No. of Trainings	Duration (in days)	No. of participants
ICFRE (HQ), Dehradun	03	11	36
ICFRE-FRI, Dehradun	05	105	128
ICFRE-IFGTB, Coimbatore	01	05	20
ICFRE-IWST, Bengaluru	01	03	60
Total	10	124	244



Training on Recruitment, Roster writing & Reservation in service, promotion & engagement of Personnel at ICFRE-IWST, Bengaluru



Training on Basic Techniques in plant Molecular biology at ICFRE-IFGTB, Coimbatore



HRD training of Administrative Staff at ICFRE - FRI, Dehradun



Induction training of Technical Assistants of ICFRE - FRI, Dehradun

Awards and Honours

3.3.

3.3.1. ICFRE Awards

To promote and motivate the professional competence of the employees, council has

instituted the Headquarter/Institute level employees Awards.

3.3.1.1. ICFRE Lifetime Meritorious Service Award (ICFRE Level)

- Dr. Prosanta Hazarika, Chief Technical Officer, ICFRE-RFRI, Jorhat
- Sh. Ratna Ram Lohara, Senior Technical Officer, ICFRE-AFRI, Jodhpur

3.3.1.2. ICFRE Outstanding Employee Award (Institute Level)

- Smt. C.V. Vijayam, Technical Officer, ICFRE-IFGTB, Coimbatore
- Sh. Ashok Kumar, Senior Technical Officer, ICFRE-IWST, Bengaluru
- Smt. Bhanumathy, Upper Division Clerk, ICFRE-IWST, Bengaluru
- Sh. Mukesh Kumar Sonkar, Technical officer, ICFRE-TFRI, Jabalpur
- Sh. Saikat Banerjee, Senior Technical Officer, ICFRE-TFRI, Jabalpur
- Sh. Rajendra Kumar Sarwate, Asst. Chief Technical Officer, ICFRE-AFRI, Jodhpur
- Sh. Laxman Meghwal, Upper Division Clerk, ICFRE-AFRI, Jodhpur
- Ms. Ellora Dutta Borah, Chief Technical Officer, ICFRE-RFRI, Jorhat
- Dr. Girish Gogoi, Asst. Chief Technical Officer, ICFRE-RFRI, Jorhat



Awardee of ICFRE Lifetime Meritorious Service Award



Awardee of ICFRE Best Employee Awards

Visits Abroad

3.4.

- Dr. M.P. Singh, IFS, Director, ICFRE-IWST, Bengaluru visited Gottingen, Germany on 19th-28th June 2023 for Research purpose.
- Sh. P.C. Lakra, IFS, DCF, ICFRE-IFP, Ranchi attended workshop on Eco-tourism from 16th-29th August, 2023 at Taiwan, Republic of China.
- Sh. P.C. Lakra, IFS, DCF, ICFRE-IFP, Ranchi attended 88th UNEP/UNESCO/BMUV course on "Nature Based Solutions on Water Challenges from 18th October to 10th November, 2023 at Dresden, Germany.
- Dr. B.N. Divakara, Scientist, ICFRE-IWST, Bengaluru visited Gottingen, Germany on 19th-28th June 2023 for Research purpose.
- Dr. B.N. Divakara, Scientist, ICFRE-IWST, Bengaluru visited Putrajaya, Malaysia to attend 3rd International Scientific symposium on Agarwood (ISSA 2023).
- Dr. A. Vijayaraghavan, Scientist, ICFRE-IFGTB, Coimbatore attended the ITCFGR International Training Course on "Institutional Building and Capacity Development for the Conservation and Utilization of Forest Genetic Resources" during 17th-31st December, 2023 at Guangxi Provincial Academy of Forestry (GAF), Nanning, China.
- Dr. Rekha R. Warriar, Scientist, ICFRE-IFGTB, Coimbatore attended Regional Workshop on "Strengthening tree seed supply systems for forest and landscape restoration: Good practices, lessons learned and collaboration Opportunities from 27th February to 1st March, 2024 at Bandung, Indonesia.
- Dr. Rekha R. Warriar, Scientist, ICFRE-IFGTB, Coimbatore attended the 30th session of the Asia Pacific Forestry Commission (APFC) from 2nd-6th October, 2023 at Sydney, Australia and presented the new APFORGEN strategy 2023-2030.
- Dr. R. S. Rawat, Scientist, Biodiversity & Climate Change, ICFRE, Dehradun visited International Centre for Integrated Mountain Development, Kathmandu, Nepal participated in the workshop on "Actioning Incentives for Biodiversity and Landscapes" on 29th-30th November, 2023.
- Dr. Maneesh Singh Bhandari, Scientist, ICFRE-FRI, Dehradun attended and participated in oral presentation at IUFRO 2023 Conference from 4th-8th June, 2023 at Cairns in Australia.
- Sh. K. Suresh Kumar, Technical Officer, ICFRE-IFGTB, Coimbatore attended the ITCFGR International Training Course on "Institutional Building and Capacity Development for the Conservation and Utilization of Forest Genetic Resources" during 17th-31st December, 2023 at Guangxi Provincial Academy of Forestry (GAF), Nanning, China.
- Ms. P. Maheswari, Senior Project Associate, ICFRE-IFGTB, Coimbatore visited University of Copenhagen, Denmark from 3rd September, 2023 to 2nd October, 2023.
- Dr. Ani E. Elias, Ramalingaswamy fellow, ICFRE-IFGTB, Coimbatore visited University of Copenhagen, Denmark from 3rd September, 2023 to 2nd October, 2023.

Participation in Seminars/Symposia/Workshops/Trainings

3.5.

Name of HQ/Institute	No of Seminars/Symposia/ Workshops/Trainings	Duration (in days)	No. of participants
ICFRE (HQ), Dehradun	65	142	245
ICFRE-FRI, Dehradun	83	238	1075
ICFRE- IFGTB, Coimbatore	56	108	179
ICFRE-IWST, Bengaluru	128	169	2749
ICFRE-TFRI, Jabalpur	242	455	980
ICFRE-AFRI, Jodhpur	23	133	169
ICFRE-RFRI, Jorhat	18	125	37
ICFRE-HFRI, Shimla	135	193	279
ICFRE-IFP, Ranchi	69	203	157
ICFRE-IFB, Hyderabad	24	166	49
Total	843	1932	5919

Mission Karmayogi

3.6.

Mission Karmayogi' aims to build a competent civil service rooted in Indian ethos with a shared understanding of India's priorities, working together for effective and efficient public service delivery.

ICFRE and its employees are actively participating in this Government of India initiative. During this financial year, 560 employees registered in the iGOT portal and completed 502 iGOT modules.

CAMPA Component-3 Policy Studies under Centre for Forest Policy Research

3.7.

Following three Policy Research Studies have been completed under Centre for Forest Policy Research (CFPR) of ICFRE during 2023-24:

1. Study of Grazing Policies in different States and Formulation of Grazing Guidelines for states

Grazing in forest lands poses a significant threat to forest health across India. To address this issue, a comprehensive review of existing grazing policies in different states is essential to formulate effective guidelines. Based on this analysis, the following recommendations are proposed:

Prohibition of grazing in Protected Areas, strict restrictions on unregulated grazing in Ecologically Sensitive Zones and a permit-based system for grazing in outside protected forest areas are necessary to safeguard forest ecosystems. To reduce reliance on forest grazing, infrastructure

development for silage, hay, and fodder production from crop residue and surplus biomass, along with the expansion of fodder cultivation, is crucial. Promoting stall feeding for ruminants through government programs and public-private partnerships can further alleviate pressure on forest resources. Additionally, state policies must be tailored to accommodate pastoral communities and specific local ecological and social conditions. Finally, funding for these initiatives can be secured through multiple government departments under a mission like "Green Revolution 2.0" or "Green-Yellow Revolution."

2. Issues in Forest Certifications and Certifying agencies

The primary goal of forest certification is to ensure that forests are managed sustainably, considering environmental, social, and economic factors. As per the present scenario, the owners of the forests are governments or various institutions/organizations in different countries or individuals. To ensure that these entities, achieve the objectives of forest management, the forest certification of Indian forests must be carried out.

It offers numerous benefits, including financial support through guaranteed markets for certified products. However, the system requires simple and cost-effective certification schemes to be widely

adopted. Raising awareness among foresters, stakeholders, and farmers about the importance of forest certification is crucial. Currently, India lacks a domestic certification body offering FSC Forest Management certification. To address this gap, existing certification agencies should strive to obtain accreditation from international bodies like ASI, despite the associated cost increase. Encouraging forest owners to participate in certification programs and developing an India-specific Forest Management Certification Scheme can further promote sustainable forest management in the country.

3. Popularization of the use of wood and wood substitutes National Forest Policy and Modalities for Facilitating industries for its Optimum Utilization

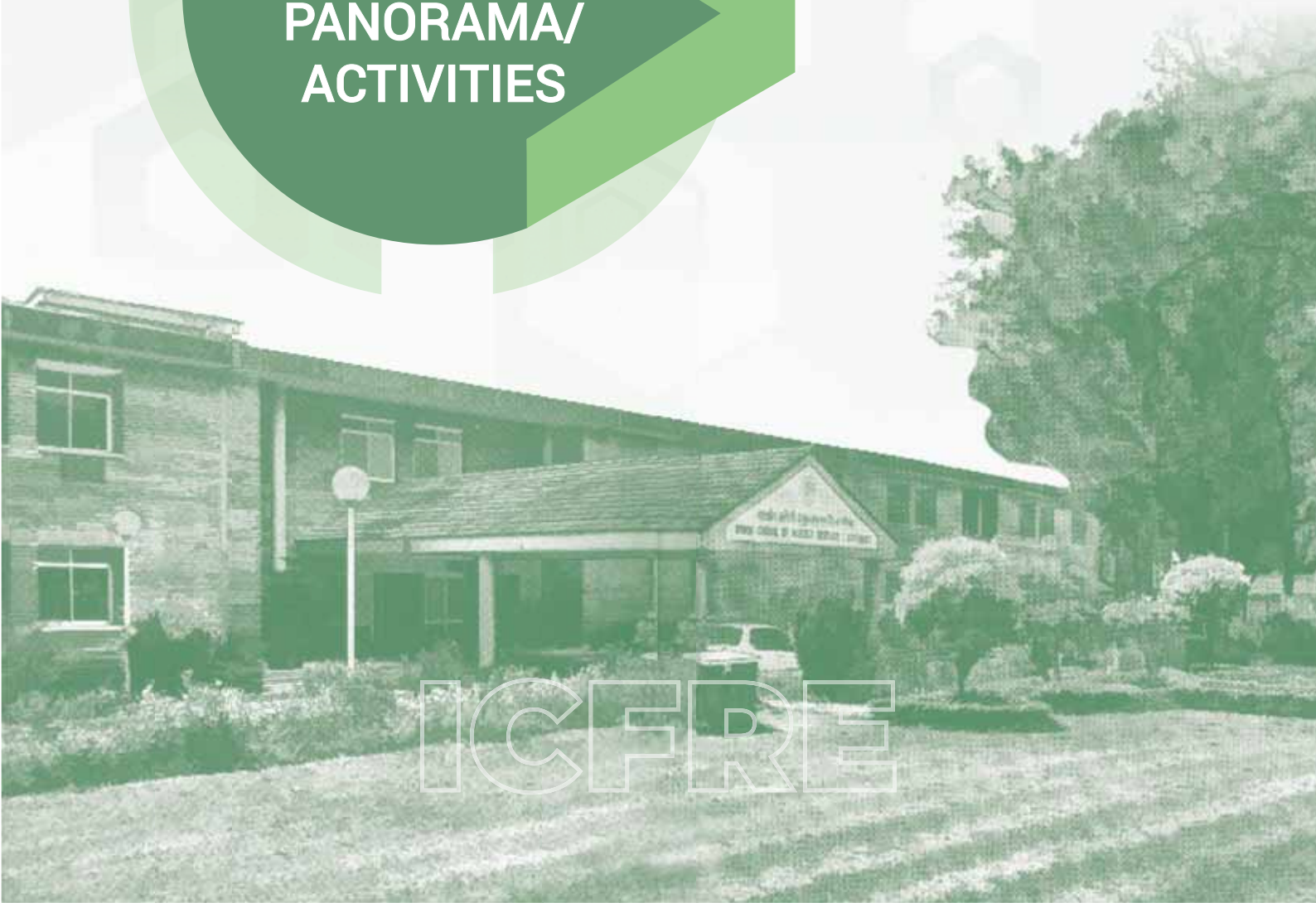
To optimize the utilization of wood and wood substitutes in India, several key recommendations are proposed. Establishing a national database of wood and wood substitute, identifying and upgrading important export-oriented sectors promoting wood substitutes, fostering skilled manpower through vocational education programs, enhancing production for mapping supply chains and ensuring quality assurance for both wood and wood substitutes are crucial. A national awareness campaign can highlight the benefits of using wood and wood products. Investing in research and

development to explore alternative timber species and simplifying felling and transit regulations through the National Transit Pass system can streamline the timber industry. Additionally, promoting the cultivation of promising tree species through appropriate agro-forestry models and establishing effective marketing mechanisms can enhance the overall utilization of wood and wood products. Finally, technological advancements and quality assurance measures can further optimize the value derived from these resources.

04
CHAPTER

**EXTENSION
PANORAMA/
ACTIVITIES**

ICFRE





EXTENSION
PANORAMA/
ACTIVITIES

Lab to Land

4.1.

Capacity Building on Promoting Practices for Conservation of Native Pollinators and their Food Plants through Community Based Approach in the Selected Forest Ranges of Kinnaur District, Himachal Pradesh

Three field demonstration cum training programmes in promoting practices for conservation of native pollinators and their food plants through community based approach were organized with support of NABARD. Sensitized 255 participants belonging to local communities on pollinators conservation and native flora in the three forest ranges i.e. Kalpa, Pooh and Bhawanagar, H.P. One capacity building programme was also organized in the selected forest range of Kinnaur District, Himachal Pradesh. Nursery of *Prunus ceresoides* (Pazza) *Pyrus pashia* (Kainth) and *Prunus mira* (Behmi) are being raised for distribution of

plants among local community. Meetings were conducted with the respective forest officials and local community to formulate the active groups for distribution of native flowering plants, bee colonies and pollinizers.



Planting stock of *Pyrus pashia* (Kainth)

Capacity building on seed and nursery technology and plantation techniques for prioritized species of Chhattisgarh state

Two training programmes were organized on "Plantation and management techniques of commercially important tree species" for 70 forest official of Bilaspur and Durg forest divisions of Chhattisgarh on 12th and 13th March 2024, respectively.



Training for Forest officials at Bilaspur, Chhattisgarh

Technical bulletins were prepared and printed for commercially important species like *Santalum album*, *Gmelina arborea*, *Melia dubia*, *Swietenia macrophylla*, *Hardwickia binata* in Hindi language and distributed among the trainees. On site demonstration on plantation and nursery techniques of the said species were also provided to the trainees.



Training for Forest official at Durg, Chhattisgarh

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

Demo plantations of Bamboo using 11 species, 23 accessions and 5,058 plants were established in over 20 ha area in five locations during 2020-21 and data on survival and growth was regularly recorded. Survival was 100% at Iduvai village, Palladam Taluk, Trippur district at Kumaraguru Institute of Agriculture (KIA), Sakthinagar, Erode. *Bambusa nutans* performed better in terms of growth in

both these locations. Survival was 67.2% at Musiri Institute of Technology - College of Agriculture and Technology (MIT-CAT), and *Bambusa balcooa* registered better growth performance. At farmer's land at Nanjundapuram Coimbatore, survival was 15% and *Bambusa balcooa* showed better growth performance. At Agricultural Research Station-Tamil Nadu Agricultural University (ARS-TNAU), Bhavanisagar survival was 67.2% and *Bambusa nutans* and *Bambusa balcooa* had better growth performance.

Establishment of Small Nursery under the AYUSH Mission (ICFRE-HFRI)

Developed small nurseries at Model Nursery Badagaon, Field Research Station (FRS) Shilly, FRS Brundhar and FRS Shillaru and raised 1.20 lakhs

seedlings of medicinal plants species viz. *Valeriana jatamansi* (Nihani), *Ocimum tenuiflorum* (Tulsi), *Picrorhiza kurroa* (Karu). About 40 thousands of these medicinal plants were distributed amongst different stakeholders.



Raising of nursery plant in nursery



Distribution of plants

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

With the objective of expanding the area under agroforestry, six workshops were organized in different states viz. Odisha, Tamil Nadu, Rajasthan, Haryana, Andhra Pradesh and Uttar Pradesh for stakeholder including SFD, SAUs, NGOs, Wood based industries, herbal industries, farmers and

SHGs to establish promising site specific agroforestry models in Community land and wasteland, based on needs of wood based industries. Prepared booklet on Suitable Agroforestry Models for Assam State of the targeted states drawn from the workshop recommendations.



Workshop on QPM roadmap and scope of TOF in Odisha



Workshop on QPM roadmap and scope of TOF in Rajasthan

Conservation of *Stereospermum suaveolens* - A rare species in Madhya Pradesh (ICFRE-TFRI)

Technical bulletins and extension leaflets on standardized nursery technique of *Stereospermum suaveolens*, a threatened dashmool species for raising seedlings were published. Validated HPTLC assay/ analytical method for estimation of active ingredient (triacontanol) in *S. suaveolens*.



Technical bulletins and leaflets on *Stereospermum suaveolens*

Securing Pulpwood Raw Material Availability: Developing High Yielding Clones and Breeding Orchards of Casuarina and Leucaena to Increase Plantation Productivity in Andhra Pradesh (ICFRE-IFGTB, Coimbatore)

This technical consultancy project was undertaken to help the Andhra Paper Limited (APL) to secure its pulpwood raw material supply in its catchment area. IFGTB issued a non-exclusive license to APL for the mass multiplication of newly released Casuarina clones. During the period between 2019 and 2023 a total of 215 lakhs saplings of CH clones

were planted in around 8500 acres. On an average CH clones produced 20 tonnes more pulp wood than existing clones and the Company ensured production of 1,75,000 tonnes of pulp wood without extending area under cultivation. The additional income obtained by the farmers is estimated between Rs 80,000 and 1, 00,000 per acre through cultivation of CH Clones. APL-IFGTB jointly established genetic gain, progeny, clonal screening and spacing trials of Casuarina and Leucaena. The project has been successfully completed and the Company has sanctioned a second phase of technical consultancy for implementation from 2024 to 2029.

Sustainable Pulpwood Production through High-Yielding Varieties of Nitrogen Fixing and Drought Tolerant Trees (ICFRE-IFGTB, Coimbatore)

This industry funded project was initiated during April 2022 in collaboration with TNPL. Specific

strains of beneficial and antagonistic microbes like Frankia, Bacillus, Trichoderma and Micromonospora have been provided to TNPL. Technical consultancy was also provided to establish production units for mass multiplication of these cultures. The field trials have been assessed for growth and stem form traits and interim ranking of accessions and treatments have been made.

Training of Rajasthan Rural Women on Use of Biofertilizer for Crop Productivity Enhancement (ICFRE-AFRI)

Three entrepreneurs training on mass production and application of two important fungi viz. *Trichoderma harzianum* and *Piriformospora indica* was conducted at AFRI, Jodhpur on 25 July and 7

December to the rural women of NGO, MLPC and Surpura village respectively in which approximately 47 women participated. The purpose of training was to sensitize rural women of NGO, MLPC and Surpura village about biofertilizer and their usefulness and to mass produce it for their utility in the field. The product was also displayed at Van Vigyan Kendras and disseminated through stalls during the *Hastashilp mela* and *Kisan melas* (TGM).



Training to women on alternative source of income generation through mass production of fortified vermicompost

Establishment of Primary Processing Machines for Bamboo Processing in the North Eastern States

The Common facility Centres for Bamboo processing were established in Tripura, Meghalaya and Mizoram. Trainings were also organized to the stakeholders.



Common Facility Centre at Nagaland



Common Facility Centre at Meghalaya



Common Facility Centre at Tripura

Science Technology and Innovation Hub in Senguttai Tribal hamlet in Tholampalayam, Panchayat Village, Karamadai Block, Mettupalayam Taluk, Coimbatore District, Tamil Nadu State (ICFRE-IFGTB)

Eighteen tribal villages under Tholampalayam Panchayat including 16 in revenue land and two in reserve forest were assessed and based on the

ability and interest of the villagers in the scheme and land availability for infrastructure, two tribal villages at Kemmarampalayam and Pattisalai were selected subsequent to obtaining concurrence from Tholampalayam Panchayat and Tamil Nadu State Rural livelihood Mission (TNSRLM), Coimbatore. Discussions were held with Irular tribes/ WSHGs on establishment of infrastructure for Jam making machineries and 20 WSHGs agreed to work in a coordinated manner.

Van Vigyan Kendras

4.2.

4.2.1. Establishment of New Van Vigyan Kendra (VVKs)

- Established and inaugurated Van Vigyan Kendra at SDC, Chhindwara (MP).
- Established New VVK at Forest Academy, Chandrapur (Maharashtra).



Visit for establishment of new Van Vigyan Kendra at Chandrapur Forest Academy, Chandrapur, Maharashtra

4.2.2. Maintenance of VVKs including networking with KVKs

a. Training Organized

ICFRE-FRI, Dehradun

- Organized three days training on 'Biofertilizer and its application under Agroforestry" SFRI, Ladhawal, Ludhiana (Punjab) for 29 participants including Frontline Staff, Punjab Forest Department and Farmers.
- Organized two week training on 'Making of Bamboo handicrafts" for 21 participants from Umedpur, Dehradun with assistance of Gangotri Kaushal Vikas Evam Utthan Samiti (NGO) at Umedpur Village.



Training on Biofertilizer and its application under Agroforestry by ICFRE-FRI



Training on making of bamboo handicrafts by ICFRE-FRI

ICFRE-IFGTB, Coimbatore

- Organized one day training on Red Sanders – Lords Own Tree for 25 Officials of Tamil Nadu Forest Department including Forest Range Officer, Forester and Forest Guard.
- Conducted two-day Skill Development training on Forest Based Livelihood Opportunities at Northern Range, Salona in association with Nagaon Territorial Forest Division for 48 participants.



Training on Biofertilizer and its application under Agroforestry by ICFRE-FRI

ICFRE-HFRI, Shimla

- Organized one-day training on “Productivity enhancement and Additional Income through Agro-Forestry” at VVK Longani, Dharampur for 40 participants including farmers, Panchayat representatives, Mahila Mandal and Youth Club members and front line personnel of Forest Department.
- Organized one day training on Nursery and plantation techniques of *Juniper polycarpus* and Cultivation of Important Cold Desert Medicinal Plants for Increasing Income of Villagers at Sowa Rigpa National Research Institute, Leh for 40 stakeholders viz., Government school teachers, Frontline staff of Forest Department and NGO.



Training on Nursery and plantation techniques of *J. polycarpus* and Cultivation of Important Cold Desert Medicinal Plants for Increasing Income of Villagers by ICFRE-HFRI

ICFRE-IFP, Ranchi

- Organized one day trainings on ‘Nursery techniques, environmental protection and plantation programme’ for 100 farmers of Jadia, Hajipur, Bihar.
- Organized four days training on ‘Role of Farmers in Conservation, Cultivation, Harvesting and Marketing of Medicinal and Aromatic Plants in North Bengal’ at Barachenga, Mirik, West Bengal’ and Chihareejoth, Khoribari, West Bengal for 43 participants.

ICFRE-IFB, Hyderabad

- Organized one day training on “Field Identification of Mangrove and their associates” at Coringa Wild Life Sanctuary, Kakinada, Andhra Pradesh for 20 participants from Andhra Pradesh Forest department and local public.



Training on Field Identification of Mangrove and their associates by ICFRE-CEC

- Organized one day training on “Red sanders cultivation techniques” for 35 forest officials from Telangana State Forest Academy (TSFA).
- Organized three days training on “Propagation of Sandalwood in Telangana” at TSFA, Dulapally, Telangana for 60 forest officials from Telangana State Forest Academy (TSFA).
- Organized one day training on “Plant identification of Mahua (*Madhuca longifolia*) with special focus on its traditional, medicinal and nutritional uses”, at Jharsuguda, Odisha for 55 forest staff.
- Organized one day training on “Sustainable Management of NTFPs through Conservation and Value addition” at Koraput, Odisha for 55 forest officials from OSFD and media.
- Organized one day training on “High-yielding interspecific hybrid clones of *Casuarina*” at ICFRE-IFB, Hyderabad, Telangana for 16 forest officials from Telangana State Forest Academy (TSFA).
- Organized one day training on “Forest insect pest identification and their management in the field” at ICFRE-IFB, Hyderabad, Telangana for 44 forest officials from Telangana State Forest Academy (TSFA).
- Organized one day training on “Sustainable Land Management Practices for Rehabilitating Degraded Land” at ICFRE-IFB, Hyderabad, Telangana for 45 forest officials from Telangana State Forest Academy (TSFA).

ICFRE-TFRI, Jabalpur

- Organized training on TFRI technology for 100 SFDs, Industry people, SHGs.
- Organized training on Vaniki ki Unnat Taknik' at Payli, Eco-center, Seoni Van Mandal for 41 SFD officials.



Training on Vaniki ki Unnat Taknik for SFD officials

ICFRE-AFRI, Jodhpur

- Organized three day training on “Quality planting materials and Nursery Management” for 40 farmers and field functionaries from various villages/ranges of Udaipur, Rajsamand, Dungarpur, Chittorgarh, Banswara and Pratapgarh Forest Division.
- Organized three days training on Production of QPM through improved nursery techniques in the Aravalli region of Rajasthan.



Training on Quality planting materials and Nursery Management by ICFRE-AFRI

b. Networking of VVKs with KVKs

ICFRE-HFRI, Shimla

- Established agroforestry models (0.25 ha) of ten Poplar clones in farmer fields at Nagbani Jammu. Distributed about 2850 poplar seedling to farmers.
- Organized one-day training on Sustainable development through forestry technologies in collaboration with KVK Samba, Jammu for 40 participants including members of farmers, Panchayat representatives, Mahila Mandal and youth club, etc.



Training on Sustainable development through forestry technologies by ICFRE-HFRI

ICFRE-IFGTB, Coimbatore

Organized one day training program on 'Casuarina Windbreak clones for protection of banana crops and popularization of Tree Genie mobile App' in collaboration with ICAR-KVK Sirugamani, Tiruchirappalli.

ICFRE-TFRI, Jabalpur

- ICFRE-TFRI, Jabalpur organized training on Value addition of NTFPs for 257 participants from Women SHGs, Poama village, Chhindwara (MP); Jai AmbeMaa Women SHGs, Munga village, Chhindwara (MP); Anmol, Pragati & Jai Sewa, Women SHGs, Guraiya, Chhindwara (MP); Pragati, Shiva & Lucky Women SHGs Bhasadand, Chhindwara (MP) and Women SHGs, Singodi (MP) and demonstrated the newly developed facilities and equipment for preparation of herbal Dhoopbatti, Agarbatti and noodle making process.
- Organized training on Organic farming based Agroforestry for 21 Farmers from Chhindwara (MP).
- Organized training on Nursery and Cultivation Techniques of Important Medicinal Plants & NTFP species for 70 Farmers and Tree growers attended the programme.

ICFRE-AFRI, Jodhpur

- Organized training on Scale up agroforestry in IGNP command area, Jaisalmer, Rajasthan.
- Organized three-day training programme on Agroforestry in IGNP command area of Western Rajasthan for 48 farmers and field functionaries at Krishi Vigyan Kendra (KVK), Jaisalmer, Rajasthan.



Training on Agroforestry in IGNP command area of Western Rajasthan at KVK, Jaisalmer

ICFRE-RFRI, Jorhat

Conducted two-day Skill Development Training on Forest Based Livelihood Opportunities at KVK, Dibrugarh, Assam for 60 participants including

ICFRE-IWST, Bengaluru

Organized five trainings on sandalwood and two trainings on Bamboo cultivation at Karnataka and Goa for farmers and state forest department officials in collaboration with KVKs and State Forest Department.



Training on Value addition of NTFPs for Women SHGs

- Organized training on Value Addition of NTFPs/ Nursery Technique of Medicinal Plants/ Organic Farming for 48 SHG womens from Umema, GanrajRajola, Kaynath, Swami Vivekananda, Shiv Mahima, Aarohi, Vidhi, Shri Shivay, Shivam, Shiv-Shakti, Tejaswani women SHGs, Singodi, Chhindwara, M.P.

- Organized three day training on "Role of Forests in Soil and Water Conservation" for 44 participants including field functionaries and progressive farmers at Gujarat Forest Rangers College, Rajpipla, Gujarat.



Training on Role of Forests in Soil and Water Conservation by ICFRE-AFRI

Farmers, Self Help Group (SHG) Members, Forest Field Functionaries.

4.2.3. Demo Villages (DV)

Establishment of New Demo Villages (DVs)

- New Demo Village was established at D. Gudalur, Dindugul District, Tamil Nadu by ICFRE-IFGTB, Coimbatore and organized exposure visit and training on “Agroforestry models” for the



Training on Agroforestry models at Demo Village Gudalur, T.N. by ICFRE-IFGTB

progressive farmers and village representative of the Demo village.

- New Demo Village was inaugurated at Samthal Banjari, Seoni, Madhya Pradesh by ICFRE-TFRI, Jabalpur.



Shade House and nursery at Demo Village Samthal Banjari, Seoni, Madhya Pradesh

c. Activities under existing Demo Villages

ICFRE-IWST, Bengaluru

An awareness program on Forests, Wildlife and Environment Conservation was conducted for

students and faculty of school at Attivatta village, Bengaluru Rural, Karnataka.

ICFRE-TFRI, Jabalpur

ICFRE-TFRI, Jabalpur organized Live demonstrations on Mushroom cultivation and Charcoal making from weed waste for 50 forest officials and women SHGs of Banjari village, Seoni district, M.P.

ICFRE-AFRI, Jodhpur

Demonstration plot of Guggul (43 clones) was established in an area of 1 ha and maintained. Survival of Guggul plants was 78% at the site in harsh climatic conditions of Indian Desert.



Demonstrations on Charcoal making from weed waste by ICFRE-TFRI



Guggul clones plantation at Demo village, IGNP area, Mohangarh, Jaisalmer

ICFRE-RFRI, Jorhat

- Conducted two days Skill Development Training on Agarwood Cultivation and Artificial Inoculation of Agar for 38 villagers.
- Conducted two days Skill Development Training on Mushroom Cultivation for 30 farmers from Khonamukh area, Jorhat, Assam.



Training on Agarwood Cultivation and Artificial Inoculation of Agar by ICFRE-RFRI

ICFRE-HFRI, Shimla

- Raised 3000 plants of important agroforestry species viz. *Celtis australis*, *Morus alba*, *Grewia optiva*, *Bauhinia variegata*, *C. australis* and Bamboo sp.
- Organized a workshop on Agro-forestry Interventions for Livelihood Enhancement of Rural Community for 45 progressive farmers of DV Baragaon, Rajhana Panchayat, Shimla, HP.
- To control soil erosion and meet fodder requirement of villagers, planted bamboo, Buel, Khirak and Leuciana along Nallah side near DV Badagaon. Distributed about 2500 seedlings of different fodder species amongst farmers of DV and people from different panchayats of Shimla region.

ICFRE-IFP, Ranchi

- Organized training on, Vermicomposting - the benefit of using of organic manure for the environment, to the farmers and women of Kutam village, Jharkhand.
- Organized training on "Honeybee Management and Honey Production" and distributed honey bee boxes with honey bee to the farmers of Kutam demo village, Jharkhand.

4.2.4. Tree Growers Mela (TGM)/Kisan Mela/Industry-Farmers Meet**ICFRE- IFGTB, Coimbatore**

Organized a Tree Growers Mela (TGM) at Puducherry 575 participants including farmers, tree growers, front line staff of Puducherry, Villupuram and Cuddalore forest department, wood based industries and forest producer organizations attended the Tree Growers Mela. The documentary film on 'Bio-products of ICFRE – IFGTB' was released during the programme.



Tree Growers Mela at Puducherry

ICFRE-IWST, Bengaluru

- Organized Wood Industry Institute Meet at Perumbavoor, Kochi, Kerala for 350 participants from wood based industries.
- Organized Wood Industry Institute Meet at Guajrat State Forest Department training center, Gandhinagar 200 participants from Gujarat State Forest Department officials and Wood based industries attended the Meet.

ICFRE-AFRI, Jodhpur

Organized Tree Grower Mela at KVK, Jaisalmer. A short film on "Khejri Tree: Mortality, Research & Management" and Hindi Quarterly Magazine "AFRI

Darpan" was released during the programme. More than 300 farmers, environmentalists and tree growers participated in the programme.



TGM at KVK, Jaisalmer, Rajasthan

ICFRE-RFRI, Jorhat

Organized Tree Growers' Mela at Jorhat, Assam. for five hundred participants viz., Farmers, Tree Growers, JFMC Members, Forest Officials, Students, Delegates, SHG members, NGO Members, Members

from ATMA, ASRLM, Villagers of RFRI Demo Village etc. A Souvenir (Tri-lingual) and Varsharanyam, ICFRE-RFRI's bi-lingual magazine was also released during the Mela.



TGM at Jorhat, inaugurated by Director General, ICFRE

ICFRE-HFRI, Shimla

Organized TGM at Kalsui Chamba for 250 people from different Panchayats of Kalsui, Mehla, Chamba and surrounding areas.



TGM at Kalsui, Chamba, H.P.

Popularization of Clones/ Varieties/Improved Germplasm

4.3.

Production of QPM**ICFRE-FRI, Dehradun**

Raised 27,209 plants of important plantation species at Central and Centenary Nursery and sold to stakeholders.

ICFRE-TFRI, Jabalpur

Supplied 2408 QPM to State Forest Departments, farmers and nursery growers of 19 different forestry species and 11 bamboo species, viz., *Bambusa polymorpha*, *B. bambos*, *B. nutans*, *B. tulda*, *B. balcooa*, *B. vulgaris* var. green, *B. vulgaris* var. yellow, *B. wamin*, *Dendrocalamus strictus*, *D. longispathus*, *D. asper*, *Tectona grandis*,

Dalbergia latifolia, *Haldina cordifolia*, *Mitragyna parvifolia*, *Madhuca longifolia*, *Azadirachta indica*, *Buchanania cochinchinensis*, *Gmelina arborea*, *Mimusops elengi*, *Ailanthus excelsa*, *Delonix regia*, *Rauvolfia serpentina*, *Plumbago zeylanica*, *Celastrus paniculatus*, *Tamarindus indica*, *Syzygium cumini*, *Carrisa carandas*, *Careya arborea*, *Samanea saman* and *Pterocarpus marsupium*.

Total 200 plants of two improved varieties of *Rauvolfia serpentina* viz., 100 plants each of TFRI-RS-1 and TFRI-RS-2 were supplied to Chhattisgarh State Minor Forest Produce Federation Limited, Raipur, Chhattisgarh.

ICFRE-IFGTB, Coimbatore

- QPM of Casuarina (13,312) and Teak (63,704) was supplied to different stakeholders including Forest departments and farmers.
- 20,020 ramets of windbreak clonal plants (*Casuarina junghuhniana*) have been produced and supplied to the farmers.

ICFRE-AFRI, Jodhpur

Raised 25000 saplings of *Azadirachta indica*, *Prosopis cineraria*, *Tecoma undulata*, *Acacia Senegal*, *Salvadora persica*, *Salvadora oleoides*, *Cordia myxa*, *Cordia gharaf*, *Pongamia pinnata*, *Holoptelea integrifolia*, *Zizyphus species*, *Moringa*



Saplings growing in ICFRE-AFRI nursery

ICFRE-IWST, Bengaluru

- Rooted TC bottles of orchids (*Dendrobium*-2 bottles, *Cattleya*-2 bottles & *Phalaenopsis*-2 bottles) were produced and sold.
- TC plants of bamboos (562 plants) were produced for supply to stakeholders.

oleifera, *Acacia catechu*, *Ailanthus excelsa*, *Commiphora wightii*, *Santalum album*, *Syzygium cumini*, *Acacia nilotica*, *Dalbergia sissoo*, *Terminalia arjuna*, and *Anogeissus pendula* and supplied to various stakeholders.

**ICFRE-RFRI, Jorhat**

Raised 16790 QPM of different forestry species viz. *Bambusa tulda*, *B. balcooa*, *B. nutans*, *Dendrocalamus retusus*, *Phoebe goalparensis* and *Acacia mangium*.

ICFRE- HFRI, Shimla

- At VVK, Longni, Dharampur, Mandi raised 6635 different agroforestry and forestry species viz. *Bauhinia variegata* (Kachnar), *Bauhinia vahlii* (Taur), *Tectona grandis* (Teak), *Santalum album* (Chandan), *Dalbergia sissoo* (Shisham) and *Phyllanthus emblica* (Amla). Also, seeds of different tree species viz. *Terminalia bellirica*, *S. album* (Chandan), etc. were collected and sown for raising these species for distribution amongst farmers.
- At VVK, Janipur, Jammu, J&K raised and supplied QPM of different clones of *Populus deltoids* and *Terminalia bellirica* (6006) for integration in agroforestry systems of Jammu region.
- At VVK, Badami Bagh, Leh, Ladakh, UT raised 235 QPM of *Juniperous polycarpus* (Dhoop) forestry species.
- At FRS, Shillaru raised 20130 QPM of different forestry species viz. *Valeriana jatamansi* (Mushakbala), *Angelica glauca* (Chaura),

Pyrus pashia (Kainth), *Thymus serphyllum* (Jangliajwain), *Berginia cilata* (Patharchatta), *Dioscorea deltoidea* (Singlimingli) etc. and supplied to various stakeholders.

- At VVK Jagatsukh, Manali raised 18000 QPM of different medicinal plants viz. *Angelica glauca* (Chaura) *Picrorhiza kurroa* (Kadu), *Prunus armeniaca* (Chulli), *Trillium govanianum* (Nagchhtri), etc. Distributed *V. jatamansi* (Nihani), *A. calamus* (Bach), *P. kurroa* (Kadu), *V. serpens* (Vanaksha), *Podophyllum hexandrum* (Vankakdi), *A. glauca* (Chora), etc., and supplied to Government Senior Schools of Manali region and Ayurvedic dispensaries of Manali and Lahaul & Spiti.



Medicinal Plant Nursery at VVK, Jagatsukh, Manali

- At DV, Badagaon raised and supplied 3000 QPM of different forestry species viz. *Bauhinia variegata* (Kachnar), *Grewia optiva* (Buel), *Celtisa australis* (Khidak), *Leuceana leucocephala* (Leuceana) and supplied to various stakeholders.
- At FRS, Nalagarh raised 22800 QPM of different forestry species viz. *Dendrocalamus strictus* and *D. sissoo*.
- At FRS, Shilly raised 320 QPM of different forestry species viz. *Quercus leucotrichophora* (Ban), *Cedrus deodara* (Deodar), *Toona ciliata* (Tooni).
- Raised 3000 important agroforestry species viz. *Celtis australis*, *Morus alba*, *Grewia optiva*, *Bauhinia variegata* and Bamboo sp.

Transfer of Technologies

- Technology for production of TC Teak plants transferred to eight private tissue culture labs and nurseries HU Gogle Biotech, Mukund Biotech, Meristem Biotech, Jagadamba Biotech, Santhi Clonal Nursery, DevLeela Biotech, Adithya Biotech and HiFi Biotech.
- Technology to replace wood particles with currency briquettes in particle board production transferred to two industries.
- Technology for *in-vitro* protocol for propagating *Swietenia macrophylla* through tissue culture to Shivshakti Agritec Limited, Hyderabad.

ICFRE-IFP, Ranchi

Raised and distributed 78834 plants of different trees species and medicinal plants viz. *D. strictus*, *Bambusa vulgaris*, *B. multiplex*, *Swietenia mahagoni*, *Pterocarpus marsupium*, *Madhuca latifolia*, *Saraca asoca*, *Melia dubia*, *Dalbergia*

latifolia, *Flemengia semialata*, *Anthocephalus cadamba*, *Dalbergia sisso*, *Eucalyptus* sp., *Carica papaya*, *Gmelina arborea*, *Bombax ceiba*, *Syzygium cumini*, *Salix alba*, *Tectona grandis* and tissue culture teak.

License/Material Transfer Agreement/MoU Signed

4.4.

a. License agreement:

ICFRE-IFGTB signed license agreement with HU Gogle Biotech, Mukund Biotech for mass multiplication of Teak through Tissue culture.

License agreement signed for mass multiplication of clones:

- ICFRE-TFRI, Jabalpur signed agreement with M/S Mukund Biotech, Jabalpur, for mass multiplication of Teak clone through tissue culture and CPC of *Bambusa balcooa*.

- ICFRE-IFP, Ranchi signed agreement for mass multiplication of Poplar clone IFP-BPA-33, (Rohini) and IFP-BPA-41, (Lakshmi) with Mr. Manish Kumar Singh (Bhagalpur) and Mr. Vijay Kumar Pandey (West Champaran) respectively.

b. MoU signed:

MoU signed by ICFRE-IFGTB with Meristem Biotech, Jagadamba Biotech, Santhi Clonal Nursery, HiFi Biotech, Adithya Biotech and DevLeela Biotech for bulk production of TC Teak.

Package of Practices/ Products/ Apps Developed

4.5.

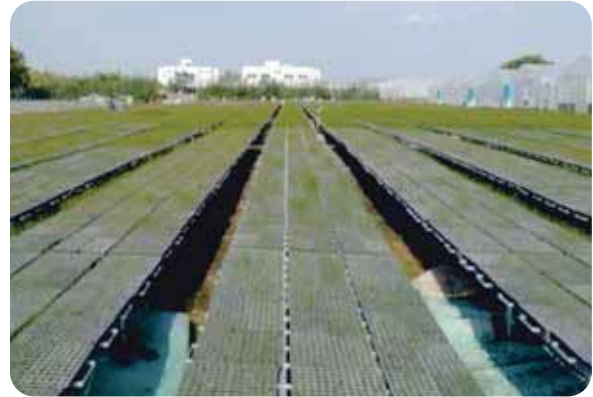
4.5.1. Packages of practices developed

ICFRE- TFRI, Jabalpur

- The package of practices for producing grafted quality planting material from *Madhuca longifolia* was standardized through cleft grafting. Cleft grafting was carried out with scions of CPTs with 40-50 % success.
- Seed handling protocol developed for 10 species viz. *Buchnanania lanzan*, *Putranjiva roxburghii*, *Butea monosperma*, *Kydia calycina*, *Hymenodictyon excelsum*, *Feronia limonia*, *Semacarpus anacardium*, *Nyctanthes arbortristis*, *Mallotus philippensis* and, *Flacourtia indica*.

4.5.2. Products developed

- ICFRE-IFGTB, Coimbatore developed IFGTB bio products (*Frankia + Micromonospora*) for inoculation in *Casuarina* clonal nursery of TNPL.
- ICFRE-IFGTB, Coimbatore obtained FSSAI certificate for Tara Red Jam made using the natural colourant of red tamarind.
- ICFRE- TFRI, Jabalpur developed Herbal Mosquito repellent liquids, creams, larvicide and sprays.
- ICFRE- HFRI developed HIM Growth Booster a mycorrhizal Bio-fertilizer for Conifers using *Ramaria Formosa*.
- ICFRE-HFRI developed bio fungicide "HIMTrichoKawach" for soil borne and foliar phytopathogens using *Trichoderma asperellum*.
- ICFRE-HFRI developed HIM-ALBIWASH a plant-based Bio pesticide effective against *Yponomeuta padella*; *Anarsia lineatella*, Aphids; Scale insects; Salix defoliator; *Heterocrassa expansalis* and *Plecoptera reflexa*.



Application of IFGTB Bio products in TNPL Nursery

- ICFRE HFRI developed HIM-BIOKIL-1 a bio pesticide using *Boenninghausenia albiflora*, effective against stored seed pests such as Seed borer of chilgoza pine, Seed/ berry pest of Juniper, Acorn weevil of Oak and seed pests of Shisham.



Herbal Mosquito repellent liquids



Biopesticide Him-Albiwash



Biopesticide Him Biokil-1



Biofungicide Him Tricho Kawach

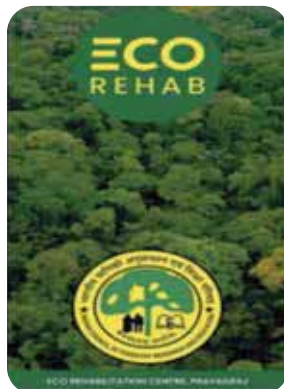
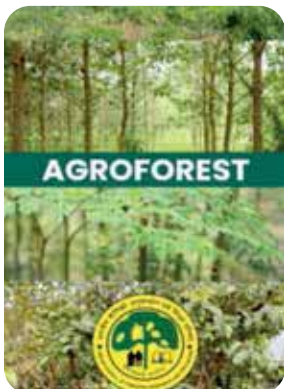


Biofertilizer Him Growth Booster

Apps developed

4.6.

ICFRE-FRI, Dehradun has developed 4 apps viz. Eco Rehab, Agroforest, LKP-Info and Bamboo Grow.



Documentaries

4.7.

During 2023-24 fourteen documentaries were prepared:

- Seven by ICFRE-IFGTB on "Eucalyptus Cultivation in Dry Lands", "Holding the Sky – The Casuarina Story", "Elegance in Every Grain – Tissue Culture Teak", Tara Red, TreePal, Tree Rich Bio-booster and Windbreak technology.
- One by ICFRE-AFRI on Khejri Tree: Mortality, Research and Management.
- Six by ICFRE-TFRI on Management of Fly ash in Thermal Power Plants, Lac Cultivation, Lakh ki Kheti, Krishi Vaniki, Micro propagation of Bamboo, Kitaalaya.



KHEJRI-Prosopis cineraria.
The State Tree of Rajasthan

Documentary on Khejri Tree: Mortality, Research & Management by ICFRE-AFRI, Jodhpur



Documentary on Kitaalaya by ICFRE-TFRI, Jabalpur



Documentary on Laakh ki Kheti by ICFRE-TFRI, Jabalpur

Other Extension Activities

4.8.

Participation in Exhibition/ Melas:

- ICFRE-HFRI, Shimla participated in Exhibition of Flying Shimla Fair at Glide Inn Junga, Shimla.
- ICFRE-HFRI, Shimla, participated in the Mega Exhibition "गतिशील जम्मू एव कश्मीर" organized by Prayas Event and Exhibition at Jammu.
- ICFRE-TFRI, Jabalpur participated and installed display stall in Weekly Market of Dhuma, Seoni, Madhya Pradesh.
- ICFRE-Tropical Forest Research Institute, Jabalpur participated in the Sub- Urban weekly market Dhuma and organized a training and demonstration program on the use of Karonda fruit.
- ICFRE-RFRI, Jorhat participated and installed display stall in Assam Diwas Celebration at Tingkhong, Dibrugarh, Assam.
- ICFRE-RFRI, Jorhat participated and installed display stall in Farmer Fair organized by Assam Agriculture University, Jorhat at AAU, Jorhat campus.
- ICFRE-AFRI, Jodhpur participated and installed display stall in District Level Exhibition during Kishan Mahotsav organized by Agriculture University, Jodhpur.
- ICFRE-IWST participated in India Wood Exhibition 2024 organized by Nurnberg Messe India Pvt. Ltd at Bangalore International Exhibition Centre, Bangalore.
- ICFRE-IWST participated in Krishi Mela at GKVK, Bangalore, University of Agricultural Sciences, Bangalore.
- ICFRE-IWST participated in MATECIA- Building material exhibition.
- ICFRE-IWST participated in 25th Science Exhibition organised by Satyendra Nath Bose Bigyan Mancha at Kolkata.
- ICFRE-IWST participated in Sunderban Mela 2024 at Canning, West Bengal.
- ICFRE-IWST participated in Science Exhibition at Kolkata.



Weekly Market, Dhuma, Seoni, M.P



ICFRE-RFRI Display stall in Assam Diwas celebration



Kishan Mahotsav organized by Agriculture University, Jodhpur



Matecia Building Material Exhibition, Pragati Maidan, New Delhi

Training Organized

4.9.

S.No.	Name of HQ/Institute	No. of Trainings	Duration (in days)	No. of participants
1.	ICFRE (HQ), Dehradun	23	47	1878
2.	ICFRE-FRI, Dehradun	05	28	135
3.	ICFRE-IFGTB, Coimbatore	33	113	1372
4.	ICFRE-IWST, Bengaluru	71	475	1831
5.	ICFRE-TFRI, Jabalpur	63	143	2992
6.	ICFRE-AFRI, Jodhpur	03	09	132
7.	ICFRE-RFRI, Jorhat	21	59	650
8.	ICFRE-HFRI, Shimla	16	25	590
9.	ICFRE-IFP, Ranchi	18	25	978
10.	ICFRE-IFB, Hyderabad	15	23	711
Total		245	900	9391



Short term training Course on Plywood Manufacture at ICFRE-FRI



Hands-on training on budding grafting at KVK Udaipur by ICFRE-AFRI



Training on forestry for productivity Enhancement and Livelihood at Keylong (L&S) by ICFRE-HFRI



Training on High yielding interspecific hybrid clones of *Casuarina* at ICFRE-IFB



Training on Biodiversity Conservation and Nature Education at ICFRE-IFGTB



Training on Bamboo Cultivation at ICFRE-IFP



Training on Mushroom Cultivation by ICFRE-RFRI



Training on Plantation and management of valuable tree species by ICFRE-TFRI



Training on Wood Polymer Composites at ICFRE-IWST

Intellectual Property-Patents Granted/Applied 4.10.

Patents granted

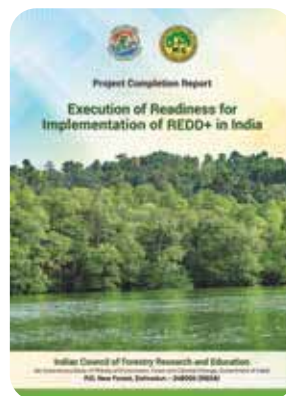
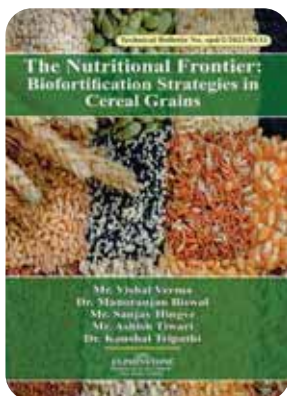
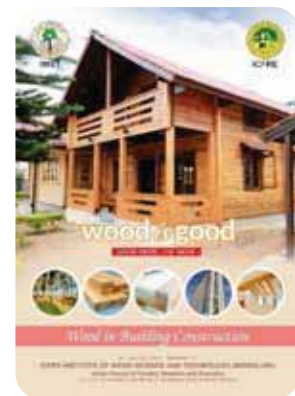
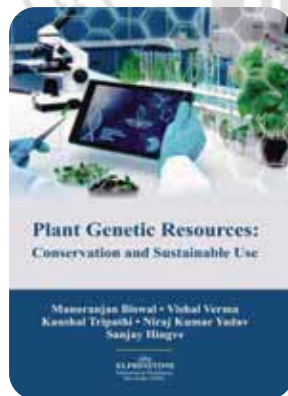
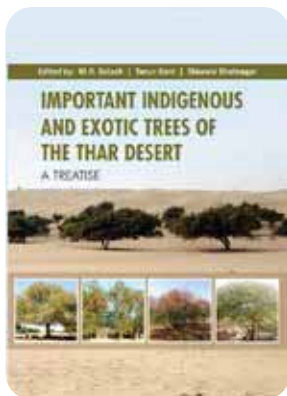
- A process for obtaining phytoecdysteroids from *Achyranthes aspera* for the synchronized maturation of silkworm” (No. 440485) to ICFRE-FRI, Dehradun.
- Natural wood preservative formulation from coconut shell pyrolytic oil, to ICFRE-IWST, Bengaluru

Patents applied

A liquid herbal hair dye formulation coloring composition containing a decoction of a natural dye for applying to hair (Patent Application No.202421008482; Dated 08/02/2024) by ICFRE-TFRI, Jabalpur.

Research Publication 4.11.

HQ/ Institute	Books	Booklets/ Brochure/ Bulletins/ Pamphlets	Article in Seminars/ Conferences/ Workshops etc.		Popular Article	Research Papers in Journals		Chapters in Books/ Proceedings
			Articles	Abstracts		Foreign	Indian	
ICFRE HQ	03	13	01	02	01	12	06	05
ICFRE-FRI	00	27	01	47	10	53	32	10
ICFRE-IFGTB	04	03	05	20	16	25	10	24
ICFRE-IWST	00	03	02	05	81	34	23	03
ICFRE-TFRI	04	25	02	89	38	11	15	15
ICFRE-AFRI	01	02	00	28	11	16	07	20
ICFRE-RFRI	01	01	05	14	35	03	14	03
ICFRE-HFRI	00	05	00	45	24	18	23	05
ICFRE-IFP	01	00	00	19	00	12	08	06
ICFRE-IFB	00	01	00	16	05	07	06	04
Total	14	80	16	285	221	191	144	95



Seminar/Symposia/Workshops Organized

4.12.

HQ/ Institute	No. of Seminars/Symposia/ Workshops/ meetings organized	No. of days	No. of participants
ICFRE HQ	14	17	1307
ICFRE-FRI	20	23	1031
ICFRE-IFGTB	06	09	489
ICFRE-IWST	10	11	581
ICFRE-TFRI	22	72	1185
ICFRE-AFRI	02	03	101
ICFRE-RFRI	03	05	155
ICFRE-HFRI	26	22	1467
ICFRE-IFP	13	14	1100
ICFRE-IFB	02	02	121
Total	118	296	7537



Workshop on National Collaborative Scheme on Forest Fire Management by ICFRE-FRI



Workshop on Applications of Artificial Intelligence and Machine Learning in Forest Insect Pests Management by ICFRE-IFGTB



Workshop on National Working Plan Code 2023 by ICFRE-IWST



Workshop on QPM roadmap and scope of TOF in Rajasthan by ICFRE-TFRI



Workshop on Conservation Assessment and Management Plan by ICFRE-AFRI



Workshop on Eco-Tourism Feasibility Study in Intanki National Park to promote tourism, Livelihood Improvement and Biodiversity Conservation by ICFRE-RFRI



Workshop on Striking Balance between Conservation and Development in LWE Areas by ICFRE-IFB



Seminar on Cultivation, Conservation and Sustainable Utilization of Medicinal Plants in North Bengal by ICFRE-IFP



Workshop on वानिकी एवं कृषि में एकीकृत कीट प्रबंधन अपनाकर सतत उत्पादन by ICFRE-HFRI

Awareness/Demonstration Programmes Organizes 4.13.

HQ/ Institute	No. of Awareness/ Demonstration programmes organized	No. of days	No. of participants
ICFRE HQ	01	01	150
ICFRE-FRI	109	131	12933
ICFRE-IFGTB	30	222	20074
ICFRE-IWST	52	89	1857
ICFRE-TFRI	60	110	3403
ICFRE-AFRI	44	38	2717
ICFRE-RFRI	57	78	11261
ICFRE-HFRI	26	50	10150
ICFRE-IFP	04	04	485
ICFRE-IFB	16	16	792
Total	399	739	63822



Demonstration programme on establishment of Medicinal Plants Garden at ICFRE-IFGTB



Awareness Programme on Bamboo based products and Eco-friendly Bamboo Housing at Dibrugarh District by ICFRE-IWST



Demonstration programme on Seed and Nursery Technology at ICFRE-FRI



Demonstration programme on Mushroom cultivation by ICFRE-TFRI



Demonstration programme on Plantation Technique by ICFRE-AFRI



Awareness programme on Bamboo Cultivation by ICFRE-RFRI



Awareness programme on Biodiversity Conservation by ICFRE-HFRI



Awareness programme on Environment Studies and Disaster Management by ICFRE-IFB



Awareness programme on Role of NTFP and Medicinal Plants on Socio-Economic Development of Forest Fringe Villagers by ICFRE-IFP

Consultancies

4.14.

ICFRE, Dehradun

Reports submitted

- Environmental Audit in respect of Gevra Open Cast Project of South Eastern Coalfields Limited (a subsidiary of Coal India Limited), Gevra Area, Korba, Chhattisgarh'.
- Ecological Studies related to Umrer and Niljay OC Coal Mine of Western Coalfield Limited (WCL) in Maharashtra'.
- Biodiversity Assessment, Impact and Mitigation Measures for Chakla Opencast Coal Block Mine in North Karanpura Coalfield of M/s. Hindalco Industries Limited, Chakla, Latehar, Jharkhand'.
- Submitted Environmental Audit Reports of Hingula, Ananta and Jagannath OCPs of MCL; Sharda Highwall Open Cast Mine, Dhanpuri Open Cast Mine and Jagannathpur, Mahan – II, Amadand OCPs of SECL; Krishnashila, Nigahi, Dudhichua OCPs and Block –B of NCL; Bhatadi, Dinesh, Mugoli, Sasti OCPs and New Majri UG to OC Coal Mine of WCL; Cluster –IV mines, Jharia Coalfields Dhanbad of BCCL; KD Hesalong, Parej and Rajarappa OCPs of CCL to Coal India Limited (CIL).
- Submitted Environmental Audit of Dipka Expansion Project, Korba, Chhattisgarh and Kusmunda, SECL, Chhattisgarh to South Eastern Coalfields Limited (SECL).
- Environmental Audit report of KTK-III OC Mine, PVK-5 UG mine, Manuguru OCP, Ramagundam Opencast-III and Expansion-II OC, SCCL submitted to Singareni Collieries Company Limited (SCCL).
- Environmental Management, Reclamation & Rehabilitation Plan for Deposit-10 of BIOM, Bachel Complex, Dantewada District, Chhattisgarh submitted to NMDC, Chhattisgarh.
- Monitoring of NTPC Accelerated Afforestation Programme of 10 Million Tree Plantations - in Seven Different States submitted to NTPC, Noida (UP)
- Study on Improvement of Water Quality in Immediate Catchment of Proposed Navnera Reservoir on Kalisindh River through Requisite Measures and Rehabilitation of Lost Habitat of Scheduled Wildlife (Reptiles) in Remaining Forest Area near Abra Village, Digod Tehsil, Kota District, Rajasthan submitted to Chief Engineer Water Resources Zone Kota, Rajasthan
- Environmental Audit Reports of Umrer, Penganga, Niljay OCPs submitted to Western Coalfield Limited, Maharashtra.
- Environmental Audit Report of Manuguru Expansion OCP, Padmavathi Khani (PVK)-5 UG Mine Project, Ramagundam Opencast-III Expansion-II OC SCCL submitted to SCCL, Telangana.
- Report on eco-restoration study of mined out and surrounding areas of Gouthamkhani OC Coal mine to SCCL, Hyderabad
- Report on Monitoring and Evaluation of Reclamation and Rehabilitation (R&R) Plan activities in John Iron Ore Mine (ML No. 2294) of Shri. R. Praveen Chandra, M/s. ERM Group of Companies, Chitradurga, Karnataka submitted to M/s. Shri. R. Praveen Chandra, ERM Group of Companies.
- Revised Biodiversity Conservation and Wildlife Management Plan of Kutehr HEP (240MW) submitted to JSW Energy (Kutehr)Ltd.
- Third Party Environmental Compliance Audit reports of Cluster –IV and Cluster –VII Coal Mines Coalfields Dhanbad of BCCL submitted to Coal India Limited (CIL), Kolkata.
- Report of Eco-restoration studies of mined out and surroundings areas of Gouthamkhani OC Project under Sustainable Development Activities in SCCL, Kothagudem submitted to M/s Singareni Collieries Company Ltd., Kothagudem District, Telangana
- Report CEIA of Sutlej River Basin in Himachal Pradesh submitted to Member Secretary, MoEF&CC, New Delhi.
- Draft 11th Third Party Monitoring report of CAT Plan of VPHEP for the period from October, 2021 to December, 2021 submitted to THDC India Ltd. Rishikesh.
- Draft EC compliance audit report of RG III OC mine project, SCCL submitted to SCCL Mines.
- Draft report wrt 3rd party Environmental Audit of Khairaha UG Mine to SECL, Bilaspur
- Draft Environmental Audit report of Cluster –VII mines of BCCL, Dhanbad
- Draft Report on R&R Plan for Devadari Iron & Manganese Ore Mine of M/s KIOCL Ltd.



External Dump Niljay OCP



ICFRE Team enumerating the vegetation from the Proposed Iron Ore pit area-I of KIOCL



ICFRE Team consultation with Chakla Mine Authorities

ICFRE-IWST, Bengaluru

- Improve the quality of Urea Formaldehyde resin to manufacture decorative plywood by using pre press technology to M/s Green Wood Craft Pvt. Ltd, Haryana to provide consultancy
- Providing consultancy to improve the quality of Urea Formaldehyde resin used for manufacturing of plywood by using pre press technology to M/s MAS Polymer, West Bengal.
- To disseminate the technology currency briquette utilization for the manufacture of particle board by partial replacement to wood/agro particles for industrial scale implementation to M/s. Eco Board industries Ltd., Maharashtra
- Provide technical inputs on processing parameters of Medium Density Fibre Board to M/s. Rushil Decors, Chikkamagalur
- Provide solutions on resin manufacturing and to utilize the offcuts of plywood for value addition to M/s.Hunsur Ply, Hunsur.
- Medium Density Fibre board processing to M/s. Century Ply, Hoshiarpur.
- Research & Development Cell Bharatiya Reserve Bank Note Mudran (P) Ltd, Mysore to understand the generation of trim wastes and the value addition of the same in similarity to the product of block board presently procured by the Bharatiya Reserve Bank Note Mudran (P) Ltd, Mysore
- To demonstrate resin manufacturing and flush door manufacturing process to M/s Elegant doors Hyderabad.
- Rashtrapati Nilayam at Secunderabad to inspect the deteriorated 120ft flag post of teak timber to assess the location and the timber construction concept utilized to replicate the same
- Prepressed - resin manufacturing for plywood manufacturing to M/s Khandewal Saw Mill, Guwaati, Assam.
- To demonstrate manufacture of E0 grade plywood bonded with Phenol formaldehyde resin to M/s Lucky Ply & Laminates, Gujarat.
- Pre- resin manufacturing for plywood manufacturing to M/s Sulogna plywood industries Pvt. Ltd, Malda, West Bengal.
- To demonstrate on resin technology and process parameters for flush door manufacturing to M/s. Gattani Industries Pvt Ltd., Jorhat.
- Quality inspection of M/S Vidhata Industries Pvt Ltd, located in Ludhiana, Punjab.
- To solve floor level problems during the manufacture of plywood of M/s. M.S.Trading Company Ltd., Ananthapur .
- A field visit to NIMHANS was carried out to assess the health status of standing trees, report submitted on "Canopy Management of Trees within the Campus, NIMHANS, Bengaluru".
- A field visit was carried out to the farm of Shri. B. M. Nagesh regarding the assessment of drying of teak trees at Sy. No. 22 and Sy. No. 23, Vatadahosahalli, HangalaHobli, Gundlupet Taluk, Chamarajanagar District, Karnataka State, and subsequently the report was submitted, by team of Scientists from Forest Protection Division.
- Plywood preservation treatment and preservative chemical preparation for the protection of plywood from deterioration to Mak Plywood Industries Mangalore.
- Visited Ambedkar Bhavan at Kollegala for quality/grade assessment of Teak wood door shutters.
- The inspection of the quality of wood being used for the roof of Sri. Uma Maheshwar temple, Mangaluru was carried out.

ICFRE-TFRI, Jabalpur

- Implementable forestry research for ash utilization promotion and development of research park at APML, Gondia for Adani Power Maharashtra Limited (APML), Maharashtra
- Raising short rotation forestry crops for intermittent periods at Dubna-Sakradhi Iron and manganese ore mines in Keonjhar district of Odisha” for Odisha Mining Corporation Limited (OMCL), Odisha.

Green and Environment Audit of Colleges

A 3rd party Green Audit monitoring was conducted by ICFRE-RFRI for two colleges namely Moran

College, Charaideo, Assam and Majuli college, Kamalabari, Majuli, Assam.



Green Auditing at Moran College, Charaideo and Majuli College, Majuli

ICFRE-HFRI, Shimla

- “Nursery Studies of Green Mantra Compostable Nursery Bags” (TSAIDC Limited, Hyderabad, Telangana).
- To identify native tree species in Nalagarh Forest Division (HPSFD).
- Preparation of ‘Detailed Project Report (DPR) for rejuvenation of Subarnarekha and Damodar rivers through forestry interventions’ (NAEB, MoEF&CC, Govt. of India).

ICFRE-IFP, Ranchi

- Eco-restoration on mined out areas and waste dumps at Meghahatuburu iron ore mines, SAIL, in Saranda Forest Division, West Singhbhum, Districts of Jharkhand (SAIL, Kolkata)
- Top Soil Conservation and Eco-Rehabilitation of Selected Degraded Coal Mines of Central Coalfield Limited, Jharkhand through Forestry Intervention, (Central Coalfields Limited, Jharkhand)

ICFRE-IFB, Hyderabad

- Completed People’s Biodiversity Registers- (17Nos).
- “Study of assessment of ecological damage including cost of river bed material, cost of ecological restoration and NPV of future ecosystem services foregone on account of illegal mining sites in Subarnarekha River. (Odisha & West Bengal)”.

Technical Services

4.15.

Identification and testing services**ICFRE-FRI, Dehradun**

1. Provided Mycorrhiza identification services to Division Director, Social Forestry Saharanpur; DFO, Shamli and DFO, Gonda.
2. Identification of *Ophiocordyceps sinensis* (keedajadi) received from Uttarakhand Court (1)
3. Soil Mycorrhiza testing for State Forest Departments(50)
4. Identification services for insects (142 no.)
5. 112 wood samples received from various Govt. Dept. including Police cases Police, Customs, CPWD, MES, Prasar Bharati, NFL, ASI, NBCC, NCC etc. and various private firms.
6. 20 plant samples received from different organization/universities were identified.

7. 10 wood samples have been tested for external agencies as per IS specifications.
8. Plywood Testing – 02 Nos and Formaldehyde Testing – 01 No.
9. Wood Testing services provided to 40 Govt./ Private Firms
10. 20,000 shingles have been treated with preservative for external agency.
11. 480 bamboo poles of 11ft. have been treated with preservative for external agencies.

ICFRE-IFGTB, Coimbatore

- Analysis of 2370 soil, litter and water samples received from various Institutes and farmers.
- Issued 37 species authentication/ identification certificates to various institutions universities and colleges.

ICFRE-IWST, Bengaluru

- A total number of 127 wood samples tested for wood identification, 50 wood samples for wood moisture content and 38 samples for wood density, 51 for chemical analysis and 09 for mechanical properties.
- Testing of treated plywood (received from pvt. Company) against Termite
- Testing of preservatives of M/S. Namiex, Punjab
- Supply of fungal cultures to College of Horticulture and Forestry, Jhansi
- Total 513 samples of plywood, timber, bamboo composites, wood-based panels, resin and chemicals and fire rated doors received from outside agencies were tested as per relevant standards.

- ICFRE-IWST attended five CED, Bureau of Indian Standards, meetings as principal member.

ICFRE-TFRI, Jabalpur

- Soil samples from IIFM, Bhopal; Gotegaon, Narsinghpur forest division, M.P. and Kanha Tiger Reserve, Mandla, M.P. were analyzed for pH, Electrical conductivity, Organic carbon, Macro (N,P,K,S) and micro nutrients (Fe, Cu, Mn, B, Zn).
- Scientific advisory to private teak planter Shri. Satyapal Daryani regarding Biological Management of Teak defoliator and Skeletonizer through ICFRE-TFRI Tricho card at Durganagar, Bargi, Jabalpur. M.P.
- Scientific advisory to forest officials, nursery frontline staffs, regarding production of insect pests free Teak seedlings at Jiawan forest nursery, Sidhi Forest Division, (MPRVNL) M.P.
- Extended HPTLC based testing services to students of NDVSU, Jabalpur.
- 2198 Soil and 962 forest floor samples received from Forest Survey of India (FSI), Nagpur was analyzed for their organic carbon content.

IFB, Hyderabad

- Provided technical services to Telangana State Forest Department on Total Growing Stock estimation for 12 forest divisions.
- Rendered technical services to TSFDC in assessing the EP/BP plantations and soil fertility status under such plantations in Paloncha, Kothagudem, Satupally, and Warangal divisions.

Advisories Given to SFDs and Other Stakeholders

4.16.

ICFRE-HFRI, Shimla

A team of Experts of ICFRE- HFRI, Shimla visited the Suket Forest Division for Treatment of Drying trees of *Cedrus deodara* in Chotta Gadon forest at

Jhungi. Inoculum of *Trichoderma* spp. was applied around the drying trees.



Application of Inoculum of *Trichoderma* spp. to the diseased trees

ICFRE-IFP, Ranchi

An advisory report on Sal leaf Defoliator *Paectes subapicalis* outbreak in Ranchi, Jharkhand was given to SFD, Jharkhand.



Larva of *Paectes subapicalis* Sal tree defoliation by Sal defoliator

ICFRE-IWST, Bengaluru

- Provided consultation to DCF (Social Forestry), KFD regarding tendering for production of TC bamboo and sandalwood plants and calculation of rates for the same.
- Provided consultation on bamboo tissue culture to DCF Social Forestry (R&U), KFD at Doresanipalya.
- Scientists of the institute visited 15 panel industries to provide technical know how on resin technology, plywood manufacturing, fire retardant plywood and door manufacturing technology, the adhesive formulation for the manufacture of Medium Density fibre board, Resin and adhesive formulation for flush doors and block board. The institute provided technical inputs on development of fabric based composites and wood plastic composites.
- A Progressive Farmer from Andhra Pradesh utilized the services of estimating the heartwood in the standing trees of sandalwood and red sanders and also to estimate the agarwood through ERT technique.
- Technical guidance related to Nursery Management of Sandalwood was provided to a Plantation Owner (Shyam K Singh, Samastipur, Bihar).
- "Standard Test Procedure and Quotation for Termite and Fungal Resistance" from National

Institute for Interdisciplinary Science and Technology (NIIST), Thiruvananthapuram, a constituent Laboratory of the Council of Scientific and Industrial Research (CSIR).

- "Information related to wood defect in imported woods", at M/s. Gayatri Timber Private Limited, Visakhapatnam.

ICFRE-FRI, Dehradun

- Provided fungal culture of *Fusarium solani*, *Calonectria* sp; Decay fungi (8); *Polyporus rubidus*; molds and Decay fungi to Kamesh Babu, UPES Dehradun; Aaditya Srinivas, Roha Biotech Chennai; Shivani Bhardwaj; BIS Mohali and Aaditya Srinivas, Roha Biotech Chennai.
- Identification of Aphid species for Forest Department of Bhutan (1 no.)
- Identification of moth species for Forest Department of Maharashtra (1 no.)

ICFRE-IFGTB, Coimbatore

For the implementation of Land reclamation and Soil and Moisture Conservation works at Tribal Villages of Hassanur Forest Division and Sathyamanalam Forest Division, a detailed soil survey of land resources was carried out to suggest possible measures for improvement of tribal lands, and soil moisture conservation.

Prakriti

4.17.

Prakriti, a scientist – student connect programme, is operational across the ICFRE institutes/centres throughout the country. During the year, over 16838 students belonging to various KVs, JNVs and other schools & colleges were benefitted through various programmes including lectures, webinars,

awareness/training programmes, exposure visits, campaigns, plantation programmes, biodiversity & nature walks, quiz/ declamation/ essay/ painting competitions, screening of documentaries, study tours, meetings etc. by ICFRE



Training cum demonstration on Seed and nursery technology by ICFRE-FRI, Dehradun



Student from JNV, Shankarpur, Dehradun visited of ICFRE-FRI, Dehradun



Demo of plantation technique to of KV, Pokharan students by ICFRE-AFRI, Jodhpur



Exposure visit of JNV, Hazaribag students at ICFRE-IFP, Ranchi



Scientists- Students interaction during Science Camp at ICFRE-RFRI, Jorhat



Interactive and Awareness programme for students of Government High School, Jammu by ICFRE-HFRI, Shimla

Activities of Rajbhasha

4.18.

ICFRE is committed for progressive implementation of Rajbhasha Rules and Acts in ICFRE Headquarter and its Institutes. All the activities are governed by the guidelines and instructions laid by Department of Official Language, Ministry of

Home Affairs. ICFRE and its Institutes located at "A" and "C" regions follow the Annual Programme of Department of Official Language. Following are the regular activities conducted pertaining to implementation of Rajbhasha Hindi:

Quarterly training/workshops on implementation of official language Hindi

Thirty four trainings/workshops were conducted at ICFRE HQ and its institutes.



Workshop on "Sansadiya Rajbhasha Samiti Nirikshan Prashnawali and Kanthasth-02 Anuvad Tool" held at Van Vigyan Bhawan, New Delhi.



Five days Unicode Hindi Typing Training workshop by ICFRE HQ



Workshop on the importance and correct method of filling out the Inspection Questionnaire



Workshop on the topic, "Inspection Questionnaire of Committee of Parliament on official language"



Rajbhasha Hindi workshop on “Information about the official language policy and use of simple Hindi in official work” at ICFRE-AFRI, Jodhpur



Workshop on “Practical problems and solutions in the use of official language” at ICFRE-IFGTB, Coimbatore



Hindi training workshop on “Kanthasth Anuvad Tool” at ICFRE-RFRI, Jorhat



Hindi workshop on “Typing, Noting and Correspondence” at ICFRE-IFP, Ranchi



Hindi workshop on “Official Language Rule 1976, Trimonthly Report” at ICFRE-FRI, Dehradun



Workshop on “Rajbhasha Abhimukhikaran Karyakram” at ICFRE-TFRI, Jabalpur

Official Language Implementation Committees meetings conducted

The meetings of ICFRE Official Language Implementation Committees under the chairmanship of DG, ICFRE and in presence of Members, Directors and Rajbhasha Officers/Employees are held quarterly. These meetings provide a platform to

review the implementation of Hindi language in various activities and operations of the council. In HQ, four meetings and thirty four meetings were held in nine institutes.

Rajbhasha inspections of subordinate offices

ICFRE regularly monitors the progress of Hindi at the HQ and Institute level. Online inspections were

conducted for ICFRE-IWST, Bengluru and ICFRE-IFB, Hyderabad during the year 2023-24.

Hindi Diwas/Saptah/Pakhwada Celebration

Apart from regular activities, ICFRE and its Institutes enthusiastically observed Hindi Day/Week/Fortnight during the month of September 2023. Various Programmes and Rajbhasha Competitions were organized during the period

to popularise Hindi among the Officials. In ICFRE HQ, Hindi Pakhwada programme was graced by Shri. A.S. Rawat, DG, ICFRE. Winners of different competitions were awarded with cash prize along with certificates.



ICFRE, HQ



ICFRE-FRI, Dehradun



ICFRE-IFGTB, Coimbatore



ICFRE-IWST, Bengaluru



ICFRE-IFP, Ranchi



ICFRE-HFRI, Shimla



ICFRE-RFRI, Jorhat



ICFRE-AFRI, Jodhpur



ICFRE-TFRI, Jabalpur



ICFRE-IFB, Hyderabad

Rajbhasha Puraskar

"ICFRE Rajbhasha Puraskar" is conferred to best performing Institutes in two categories. The award for the year 2022-23 was conferred to ICFRE-HFRI, Shimla amongst the Institutes situated in "A" region and to ICFRE-IFGTB, Coimbatore amongst the Institutes located in "C" region. Directorate

of Extension, Directorate of Education and Chief Vigilance Office were awarded for doing excellent work in Hindi at ICFRE Headquarter level. Apart from Institutes & Offices, individual awards along with cash prizes and certificates were distributed to 12 numbers of personnel working in the council.

Publication

ICFRE publishes Annual Hindi magazine Taruchintan, monthly 'Vaniki Samachar' regularly. Other important publications of Institutes i.e. 'Van

Anusandhan E- magazine', 'AFRI Darpan' and Asamese – Hindi bilingual magazine 'Varsharanyam' were also published regularly.



Smt. Urmila Harit, Director (O.L.), MoEFCC released Taruchintan 2023 during inaugural session of All India Rajbhasha Training at Van Vigyan Bhawan, New Delhi



Asamese-Hindi bilingual magazine 'Varsharanyam' by ICFRE-RFRI, Jorhat



AFRI Darpan by ICFRE-AFRI, Jodhpur

Meetings attended

During the year, ICFRE participated in the Hindi Advisory Committee meeting conducted by MoEF&CC held on 16th June 2023 and 20th December, 2023 respectively. Representative of ICFRE and

its Institutes participated in 3rd All India Official Language Conference held in Pune, Maharashtra from 14-15 September, 2023.

Radio/TV Talks

4.19.

- ICFRE-FRI delivered 14 Radio Talks on All India Radio.
- ICFRE-TFRI delivered 05 Radio talk on Kisanwani, Akashwani Kendra, Chhindwara and 01 TV talk on Kisan Darshan, Chhindwara

Visit of Dignitaries

4.20.

ICFRE-FRI, Dehradun

- Ms. Leena Nandan, IAS, Secretary, MoEFCC, Gol, New Delhi visited DD Herbarium on 13 June 2023.
- Delegates of BIMSTEC visited DD Herbarium and Botanical Garden on 1 April 2023.
- Delegates of Jindal Group visited DD Herbarium on 26 April 2023.
- Delegates of NAAC peer team visited DD Herbarium on 13 May 2023.
- Scientists of Kenya Forest Research Institute, Nairobi visited DD Herbarium on 24 August 2023.
- Hon'ble Karnataka High Court Judge visited to NTFP museum on 9 May 2023

ICFRE-IWST, Bengaluru

- Shri. Bharat Jyoti IFS, Director-IGNFA and DG, ICFRE visited ICFRE-IWST on 4 October 2023 and had fruitful interaction with scientists and officers of IWST regarding various Research projects and its progress.
- A delegation from Forest Economy Research Institute, Tokyo, Japan visited IWST on 14 Sept 2023.
- Dr. Surabhi Rai IFS, DIGF(R&T), MoEF&CC visited ICFRE-IWST and IPIRITI campus of IWST on 1 December 2023.
- Dr. Janaki A. Alavalapati, Dean, Collage of Forestry, Environment and Wildlife Sciences, Auburn Univeristy, Alabama, USA visited ICFRE-IWST on 24 January 2024.
- Shri. Leon Araujo from Brazil and Mr. Vivek Pandey of "Brazil Teak (PA Trading)" company, visited ICFRE-IWST on 26 February 2024.

ICFRE-TFRI, Jabalpur

Dr. Jochen Statz, Germany, Dr. Sanjiv Tomar and Dr. Atul Gupta, Consultant, India & Ex-PCCF Tripura state visited ICFRE-TFRI, Jabalpur on 24 August 2023.

ICFRE-AFRI, Jodhpur

- Sh. Subhash Chandra, IFS, CEO, National CAMPA, New Delhi, visited ICFRE-AFRI on 22 September 2023.
- Mr. Balthazar K. Nyamyusya, Curator in-charge, National Maji Memorial Museum, Tanzania and Sh. Kuldeep Kothari, Secretary, Rupayan Sansthan, visited ICFRE-AFRI on 16 November 2023.
- Honourable Vice Chancellor, National Law University, Jodhpur Professor (Dr.) Harpreet Kaur, along with Dr. Neeti Mathur, Assistant Professor & Assistant Registrar and Sh. Arjun Singh, Estate Officer, NLU Jodhpur visited ICFRE-AFRI, Jodhpur on 01 December 2023.
- Ms. Namita Prasad, Joint Secretary, MoEF&CC visited ICFRE-AFRI, Jodhpur on 02 January 2024.
- Mr. Manoj Mishra, National Policy Expert, FAO and Mr. Kundan Singh, Economist, FAO visited ICFRE-AFRI on 14 February 2024.
- A delegation of five French environmental experts working with the Sambali Trust visited the ICFRE-AFRI, Jodhpur on 01 March 2024.

ICFRE-IFP, Ranchi

- Mrs. Urmila Harit, Director, Rajbhasha, Ministry of Environment, Forest and Climate Change, GoI, New Delhi visited ICFRE- IFP, Ranchi on 14 July 2023.
- Shri Om Prakash Yadav, Special Secretary, Department of Environment, Forest and Climate Change, Govt. of Bihar, Shri Ashutosh, Principal Chief Conservator of Forests (HoFF), Department of Environment, Forest and Climate Change, Govt. of Bihar & Shri A. K. Prasad, Additional Principal Chief Conservator of Forests (Working Plan Research Training), Department of Environment, Forest and Climate Change, Govt. of Bihar visited ICFRE- IFP, Ranchi on 20 July 2023.
- Dr. N.B. Choudhary, Director, CTR&TI, visited ICFRE-IFP, Ranchi on 14 September 2023.
- Smt. Rajeshwari B., IAS, Commissioner MGNREGA, Government of Jharkhand visited ICFRE-IFP, Ranchi on 18 September 2023.
- Shri P. Sivakumar, IFS, Member Secretary & CEO, Central Silk Board, Ministry of Textiles, Govt. of India visited ICFRE-IFP, Ranchi on 17 January 2024.

Azadi Ka Amrit Mahotsav**4.21.**

During the second phase of Azadi Ka Amrit Mahotsav (from April 1 to August 15, 2024), ICFRE and its institutes organized over 70 activities to commemorate significant days like Earth Day, International Biodiversity Day, World Environment

Day, Yoga Day, and Van Mahotsav. Additionally many other activities such as Seminars, Training programmes, Cycle rallies, Cleanliness drives, and Plantation campaigns were conducted under Azadi ka Amrit Mahotsav.



Cycle rally at ICFRE-IFGTB on World Environment Day



Plantation Drive at ICFRE – RFRI



Earth Day celebration by ICFRE-TFRI



Bamboo Handicraft Training by ICFRE-IFP

Mission LiFE

4.22.

Mission LiFE is a global movement initiated by Prime Minister of India to encourage individuals and communities to adopt sustainable lifestyles. Launched at COP26 in 2021, it aims to mobilize billions worldwide to practice environmentally friendly behaviours. The program focuses on three key areas: promoting sustainable individual actions, encouraging industries to respond to changing consumer demands, and influencing government policies to support both sustainable consumption and production. By empowering individuals and communities to make a difference, Mission LiFE seeks to create a more sustainable future for the planet.

This year, under Mission LiFE 252 activities such as lectures, cleanliness drive, awareness campaigns, plantation activities, painting and quiz competitions were carried out, sensitizing around 77300 people throughout the country. Further, a mass mobilization campaign was organized in the month May under which ICFRE and its institutes conducted nearly 5500 activities.



Sensitization through to pamphlet & banners



Distribution of Cloth Bags



Awareness Lecture to School students



Bicycle Rallies for adopting Healthy Lifestyle

Cleanliness campaign by ICFRE and its Institutes/Centres

ICFRE and its institutes/centres are regularly conducting Swachh Bharat Abhiyan. Special drive for Swachh Bharat Abhiyan was conducted during the month of October 2023. The Cleanliness drive was started with taking pledge for cleanliness and activities like cleaning of the campus and nearby areas, e-waste disposal, awareness programme etc. were conducted. The Special Campaign for Swachhata 3.0 was conducted at ICFRE, Dehradun in two phases: Preparatory and Implementation.



ICFRE, Dehradun



ICFRE-FRI, Dehradun

During the Preparatory Phase, cleanliness campaign sites were identified, and 3620 files were identified for review. Out of these, 1138 files were marked for weeding out. In the Implementation Phase, a cleanliness drive was conducted by

all staff members, and the identified 1138 files were weeded out as per government guidelines. Additionally, 56 sq. ft of area was cleared, and 51 e-wastes were condemned and sold through e-auction.



ICFRE-AFRI, Jodhpur



ICFRE-HFRI, Shimla



ICFRE-IFB, Hyderabad



ICFRE-IFP, Ranchi

Special Activities

4.23.

ICFRE and its Institutes/Centres observed national days i.e. Independence Day, Republic Day, Gandhi Jayanti with great enthusiasm. In addition, other important Days were also observed by the Council such as International Day of Forests, Green Deepavali 2023, National Unity Day, World Environment Day, Himalayan day, Sardar Vallabhbhai Patel Jyanti, Constitution Day, Ambedkar Jyanti, National

Forest Martyrs Day, International Day of Biological Diversity, National Technology Day, International Day of Yoga, Van Mahotsava, International Museum Day, International Day Mangrove Ecosystem 2023, World Wetland Day, World Earth Day, Anti-Terrorism Day, Vigilance Awareness Week, International Women's Day, World Wildlife day, World Soil Day, World Health Day etc.



International Yoga Day at ICFRE, HQ



ICFRE-HFRI observed Constitution Day



Celebration of International Museum Day at ICFRE-IFGTB



Celebration of World Biodiversity Day at ICFRE-IFP



Celebration of World Soil Day at ICFRE-IFB



Celebration of World Environment Day at ICFRE-IWST



Celebration of Women's Day by ICFRE-TFRI



Celebration of Janjatiya Gaurav Divas by ICFRE-RFRI



Van Mahotsav at ICFRE-AFRI

Vigilance Awareness Week

4.24.

Vigilance Awareness Week was celebrated across the ICFRE and its Institutes/ Centres from 30 October to 5 November 2023. The celebrations

initiated with integrity pledge administered to all ICFRE Personnel followed by other activities.



ICFRE, Dehradun



ICFRE-IFGTB, Coimbatore



ICFRE-IWST, Bengaluru



ICFRE-IFP, Ranchi



ICFRE-HFRI, Shimla



ICFRE-RFRI, Jorhat

National Forest Library and Information Centre, ICFRE-FRI

4.25.

- Modernization of FRI Library under CSR activities by Hindalco, Aditya Birla Group" is also under progress under which the library is being renovated, digitized and security system is being upgraded. LED lights, computers, CCTV Camera, some garden furniture, ornamental plants, items for pantry / canteen etc. received.
- National Forest Library and Information Centre, ICFRE-FRI is the richest library in records collection in South and South-East Asia. This library is providing all types of library information services to its users like reference service, dispatch, reprography, current awareness, inter-library loan, retrieval of information etc.
- A total of 22371 books were given on loan to consumers for reading during the year. Apart from this, 20392 records were consulted in the library itself.
- The document collection was enriched by the addition of 658 books and records to the library during the year.
- This year, 264 Indian research journals were received at National Forest Library and Information Center and issues of about 237 research journals were also received free of cost.
- The revenue generated by the National Forest Library and Information Center in the financial year 2023-24 is 2,40611/-.
- A Braille section is being established in the National Forest Library and Information Centre for visually disabled. 106 (Hindi and English) books have been purchased for the same.
- On the occasion of National Technology day National Forest Library and Information Centre organized an exhibition of books for sale of publications on 11 May 2023 at Main Building, Forest Research Institute.
- National Forest Library and Information Centre organized an exhibition of books of various publishers under rate contract from 19.02.2024 to 20.02.2024 to facilitate recommendation and procurement of books for our collection. The scientists, officers, technical staff, students and other users of NFLIC attended the exhibition and made their recommendations.

Environmental Information System

4.26.

IFGTB, Coimbatore

Details of the Tree genetic resources established and maintained in the form of *in situ* conservation stands and *ex-situ* field trials maintained by SFDs were collected and incorporated into the FGR database on the website www.ifgtbenvivis.in. Published the quarterly newsletter Van Vigyan (ISSN: 2394-7543, Volume 10, 4 issues). Twelve awareness programmes were organized on the Green Days. Theme-related awareness posters and handouts were disseminated to students and various stakeholders. These awareness programmes were also registered in the respective global

networks. Periodical updates were done in the Mobile Apps. A mass tree planting drive, Walkathon - awareness walk rally and tree sapling planting challenge were also organized. 215 activities were conducted under LiFE Mission covering industries and people from different walks of life. A total of 71810 individuals were sensitized.



ICFRE-IFGTB EIACP at ICFRE-IFGTB is organizing an Online Awareness Quiz competition



ICFRE-IFGTB EIACP organized awareness campaign on Environment Puzzle game



ICFRE-IFGTB EIACP Celebrated Van Mahotsav 2023 by organizing tree sapling planting programme

05
CHAPTER

**ADMINISTRATION
AND INFORMATION
TECHNOLOGY**

ICFRE



ADMINISTRATION AND INFORMATION TECHNOLOGY

Information Technology

5.1.

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 2023-24.

ICFRE Data Centre (Server Farm)

Data Centre services are available 24*7*365 at ICFRE Head Qtr, ICFRE Institutes and Centres across the country since 01.02.2010. Some of services provided by Data Centre are Mail, Internet, Web, Videoconferencing, Antivirus, FTP, Network Security System, Databases, Building Management System (BMS), Virtual Private Network (VPN) services, Push

Mail Service, Web casting etc. Seventy four web applications/websites are hosted on Data Centre. One thousand nine hundred sixty nine (1969) active email accounts are operational on Mail server. Service Desk and IFRISDESK are Institutional framework for the resolution of issues across ICFRE.

ICFRE Pension Portal: ICFRE Pension Portal had been developed, designed and implemented. Mobile application of the portal had also been designed and developed. URL of the portal is <https://pensionportal.icfre.org>. Pension Portal and Mobile App was launched by DG, ICFRE on 29/08/2023. Data of all the old pensioners had been uploaded on the Portal and the Pensioner registration, Pension Application approval and PPO generation of new pensioners is being done on the ICFRE Pension Portal. Monthly pension scroll and monthly pension bill of all the pensioner are being prepared in the pension portal. The pensioner can view their monthly pension slip and other details from Pension portal as well as Mobile application. The information of 1413 pensioners are available in the ICFRE Pension Portal.

Integrated Portal for collating and sharing the research work and publications of the Institutes of the Ministry of Environment, Forest and

Climate Change (MoEFCC) under NIRANTAR: The development work of Integrated Portal started in the month of January 2023.

Security Audit of following applications was completed

S.No	Description	URL of Website/Application
1	Complaint Management System	https://complaint.icfre.org
2	Video Conferencing System	https://vcbooking.icfre.org

Maintenance of Software Applications/ websites

The following applications/websites developed by IT Division, ICFRE are also being maintained and updated time to time.

1. Complaint Management System
2. Guest House Booking Portal
3. Video Conferencing Booking Portal
4. Information System for Secretary Office (Men-in-Position).
5. Online Office Records (Orders/MoM/Agendas etc.) System.
6. Annual Property Returns Portal
7. Database of Research Projects
8. Pensioner database
9. GPF Application
10. Fixed Assets Database and Application
11. Interactive Portal: Interface with stakeholders
12. ICFRE websites (Bilingual)
13. ICFRE-TFRI websites (Bilingual)
14. ICFRE-HFRI Shimla website (Bilingual)
15. ICFRE-IFB Hyderabad Website (Bilingual)
16. ICFRE-AFRI Jodhpur Website (Bilingual)
17. ICFRE-TFRI, Jabalpur website (Bilingual)
18. ICFRE-RFRI, Jorhat website(Bilingual)
19. ICFRE-IFGTB website
20. ICFRE-ERC Prayagraj website
21. Ecosystem Services Improvement Project (ESIP) website.

Around 60 websites/Database/CMSs/applications including applications and websites of ICFRE institutes which are on live server at ICFRE Data Centre were maintained and updated from time to time.

Updation of websites of ICFRE (<http://icfre.gov.in> and <https://hindi.icfre.gov.in>) :

ICFRE's websites (<http://icfre.gov.in> and <https://hindi.icfre.gov.in>) are promptly updated. Details of updations made in the English and Hindi Websites

of ICFRE during 1stApril 2022 to 31st March, 2023 is as below:

S. No.	Period	No. of updations
1.	1 st April, 2023 to 30 th June, 2023	450
2.	1 st July, 2023 to 30 th September, 2023	380
3.	1 st October, 2023 to 31 st December, 2023	430
4.	1 st January, 2024 to 31 st March, 2024	416
Total		1676

Maintenance of LAN : The Operation & Maintenance (O&M) of Networking Equipments and other Hardware/ Software at ICFRE Head Qtr, nine Institutes and three centres have been done successfully during the year 2023-24.

National Knowledge Network (NKN)

connectivity : NKN connectivity has been provided to 12 locations of ICFRE. The National Knowledge Network (NKN) connectivity availability is more than 99% at ICFRE Head Qtr. The 1 Gbps internet leased line is provided by NKN through RailTel India at ICFRE Head Qtr. and media for 1 Gbps internet leased line through BSNL is also provided at ICFRE Head Qtr. The internet services are extended across ICFRE locations throughout the country.

Organizing Video Conferencing Meetings :

Three Hundred Sixteen (316) Video Conferencing sessions were organized by IT Division, ICFRE during 2023-24.

Maintenance Contract of IT Hardware (Computers, laptop, Printer, Scanner and Franking machine) at ICFRE Head Qtr. :

Computers, Printers, Scanners, Laptop and Franking Machine were maintained in time bound manner during the year 2023-24.

IT Support provided during Conferences and meetings at ICFRE :

Technical IT Support was given by the IT Division for IT and audio-visual facilities during important conferences/symposiums at ICFRE Hq.

Social Media : ICFRE's Twitter, Facebook, Instagram, YouTube, and Flickr accounts are active, and their links are available on home page of the ICFRE's website.

Administration

5.2.

Directorate of Administration comprises of Accounts Section, Budget Section, General Administration and Civil Works, Procurement Section, Store Section, Vehicle Section, Caretaker Section, IT-Division, Statistical Division, Pension Cell and PHS Cell.

The Directorate of Administration of ICFRE deals with all financial matter of Council including preparation of budget estimates, allocation of budget and preparing annual mandatory financial statements; filing of mandatory financial and

administrative returns of ICFRE; stores including inventory management and procurement. It also deals with disbursement of payment and TDS and maintains support services and official infrastructure. Besides handling general administration, the Directorate looks after civil and technical works of the Council and its Institutes. Besides, Pensioners of the Council have their centralized record at Headquarters and their payment is centrally done from Directorate of Administration.

5.2.1. Sevottam

The Government's Sevottam framework is a commitment to transforming public service delivery from an administrative mindset to a service-oriented approach. It emphasizes the importance of the relationship between service providers and recipients. Sevottam outlines a standardized model for delivering excellent services, involving identifying services, setting norms, ensuring adherence to these norms, continuously assessing service quality, and proactively addressing public grievances. ICFRE, a research organization

dedicated to forestry and environmental excellence, has adopted Sevottam to improve its service quality. Recognizing the diverse needs of its clientele, ICFRE's Citizen Charter outlines its commitment to transparency, accountability, reliability, responsiveness, and empathy in service delivery. This Charter aligns with the Government's Performance Monitoring and Evaluation System (PMES) and reflects ICFRE's dedication to serving its citizens and clients effectively.

5.2.1.1. Action taken to formulate the Charter for the Department and its subordinate Formation

ICFRE, ensure the effective formulation of charters across their 09 institutions through a meticulous approach. Council defines its charter to encompass key services such as providing accurate timber identification and analysis, offering consultancy services, and prioritizing research soil and water management, biodiversity conservation, sustainable

management and integrates stakeholder feedback into project development and execution. Each institute under ICFRE is committed to continuous improvement by employing rigorous monitoring, evaluation, and feedback mechanisms to ensure that our services and research effectively address user needs and support national forestry objectives.

5.2.1.2. Action taken to implement the Charter

ICFRE institutions have implemented the charter through various initiatives, including establishing fixed rates for consultancies and testing services, conducting need based training programs, collaborating with stakeholders, seeking external reviews, addressing stakeholder feedback,

organizing extension trainings and awareness programs, publishing research findings, conducting stakeholder training, and participating in national programs. These actions demonstrate ICFRE's commitment to effective implementation and contribution to sustainable forestry.

5.2.1.3. Details of Training Programmes, Workshops, etc. held for proper implementation of Charter

ICFRE institutions, have implemented comprehensive training programs to support the charter and offers variety of courses, including field identification, timber joinery, wood protection, and plant identification, while HFRI focuses on

making staff aware of the importance of the client charter. Additionally, IFP Ranchi conducts training programs and workshops at its research stations in compliance with the Sevottam order. These training initiatives aim to enhance institutional capacity and ensure effective implementation of the charter.

5.2.2. Welfare measures for the SC / ST/ backward / minority communities

- As a part of Mission Mode Recruitment process, Two (02) ST, One (01) SC, Eleven (11) OBC candidates have been appointed in time as per Roster during the Financial Year 2023-24 in Group-C Category by ICFRE-IFGTB, Coimbatore.
- Trainings were conducted for minor community about awareness on medicinal plants and their uses by ICFRE-TFRI, Jabalpur.
- ICFRE-AFRI, Jodhpur and ICFRE-IWST, Bengaluru celebrated Ambedkar Jayanti on 14 April 2023.



ICFRE-IWST, Bengaluru



ICFRE-AFRI, Jodhpur

Tribal Welfare

ICFRE-IFGTB in collaboration with the Tribal Co-operative Marketing Development Federation of India (TRIFED) opened an outlet at the Product Sales Counter called "Tribes India" in the Forest Campus, Coimbatore on 15 November 2023.

ICFRE-RFRI, Jorhat organized training on Low Cost Vermicomposting Techniques for Livelihood

Generation on 14 March 2024. 25 unemployed Tribal's Women's participated in the programme.

ICFRE-LEC, Agartala organized training on Bamboo Propagation and Nursery Management from 27 to 28 June 2023. 45 Tribal's Women's Representing of SHG in Jampuijala, Agartala.



Training on Bamboo Propagation and Nursery Management in Jampuijala, Agartala



Training on Low Cost Vermicomposting Techniques for Livelihood Generation

On the occasion of birth anniversary of Birsa Munda, ICFRE, HQ; ICFRE-FRI, Dehradun; ICFRE-HFRI, Shimla; ICFRE-IFGTB, Coimbatore; ICFRE-TFRI, Jabalpur, ICFRE-RFRI, Jorhat and ICFRE-IFP, Ranchi celebrated "Birsa Munda Jayanti to commemorate his contribution in the tribal freedom struggle.



ICFRE, Dehradun



ICFRE-FRI, Dehradun



ICFRE-HFRI, Shimla



ICFRE-IFGTB, Coimbatore



ICFRE-IFP, Ranchi



ICFRE-TFRI, Jabalpur

5.2.3. Welfare measures for women

- At ICFRE-IFGTB, Coimbatore an awareness talk on the issues and aftermath effects of sexual harassment of women at work places and how to handle the same was delivered by Dr. S. Gayathri Devi, from Avinashilingam Deemed University, Coimbatore and Co-chairperson-ICC.
- At ICFRE-IFGTB, Coimbatore complaint box in the Institute premises installed to facilitate filing of grievance under the purview of sexual harassment at Workplace, Board near the entrance with details of ICC and posters in the institute to spread awareness on POSH Act and the requirement for safe work environment for women displayed.
- At ICFRE-IWST, Bengaluru training provided to the newly appointed committee members regarding procedures of the POSH Act. One to one discussion was held with women employees/research scholars of the institute on 3 and 9 October 2023 to make them aware POSH Act.
- At ICFRE-AFRI, Jodhpur as a part of Azadi Ka Amrit Mahotsav, a Poster Competition under the theme Empowerment of Women and Children was organized on 7 July 2023.
- International Women's Day was celebrated by ICFRE-FRI, ICFRE-AFRI, ICFRE-HFRI, ICFRE-IFB, ICFRE-IFP, ICFRE-IWST, ICFRE-RFRI and ICFRE-TFRI on 08 March 2024



ICFRE-FRI, Dehradun



ICFRE-AFRI, Jodhpur



ICFRE-HFRI, Shimla



ICFRE-IFB, Hyderabad



ICFRE-IFP, Ranchi



ICFRE-IWST, Bengaluru



ICFRE-RFRI, Jorhat



ICFRE-TFRI, Jabalpur

- ICFRE-AFRI, Jodhpur organized a training programme for women on "Entrepreneurship on Mass Production of Trichoderma".
- ICFRE-RFRI, Jorhat organized a training programme on Low cost vermicomposting

techniques for Livelihood generation for unemployed women's from Takarjala, Tripura.

- ICFRE-IFP, Ranchi organized a training programme on "Scientific method of cultivation of Kusumi Lac" for women farmers.



Training programme on Entrepreneurship on Mass Production of Trichoderma by ICFRE-AFRI, Jodhpur



Training programme on Scientific method of cultivation of Kusumi Lac for women farmers by ICFRE-IFP, Ranchi

5.2.4. Statistical Support

The Division of Forestry Statistics conducted a scientific evaluation of ICFRE institutes, considering 103 indicators, and utilized the TOPSIS method to rank the institutes. The division also analyzed

the citation data of research papers published by ICFRE researchers. In addition, the division provides technical support to faculty and students within ICFRE.

5.2.5. Information on the status of activities under “The Rights of person with disabilities Act 2016” during the year 2023-24

The information in respect of ICFRE-Dehradun is as under:

- i. Information about the total budget provision of the Ministry/ Department for persons with disabilities –

No separate budget provision is made for persons with disabilities.

- ii. Allocation under various schemes for the benefit of persons with disabilities, the amount released and the amount utilized-

Rs. 2495945/- has been paid to persons with disabilities as double TPT.

- iii. The number of beneficiaries with disabilities and their percentage in relation to the total number to beneficiaries-

No. of beneficiaries with disabilities- 29 out of 1642 employees i.e. 1.77%.







**BALANCE
SHEET**



ICFRE



BALANCE SHEET



**INDIAN COUNCIL OF FORESTRY
RESEARCH AND EDUCATION**

DEHRADUN

**BALANCE SHEET
2023-24**


PARMITA & COMPANY
Chartered Accountants

Mob.: 9837176237

Email: caparmitaandco@gmail.com

 72, Haridwar Road, Opp. C.M.I. Hospital
 (Above H.R. Bhatt Optical Co.)
 Dehradun - 248 001 (Uttarakhand)

Dated

 To
 The Members
 Indian Council of Forestry Research and Education
 PO: New Forest, Dehra Dun – 248006
 Uttarakhand

INDEPENDENT AUDIT REPORT

1. REPORT OF FINANCIAL STATEMENTS

We have audited the attached BalanceSheet of the "Indian Council of Forestry Research and Education, (ICFRE) a society registered under the Societies Registration Act 1860, Post New Forest, DEHRADUN - 248006 as 31st March 2024 and also the annexed Income & Expenditure Account for the year ended 31-3-2024 on that date. These Financial statements are the responsibility of the management of society. Our responsibility is to express an opinion on these financial statements based on our audit.

2. RESPONSIBILITIES OF MANAGEMENT AND THOSE CHARGED WITH GOVERNANCE FOR FINANCIAL STATEMENTS

Management is responsible for the preparation and presentation of these financial statements that give a true and fair view of the financial position and financial performance of the entity in accordance with the accounting principles generally accepted in India.

3. AUDITOR'S RESPONSIBILITY

We conducted the audit in accordance with auditing standards generally accepted in India. These standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement. An audit includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statement. An audit also includes assessing the accounting principles used and significant estimates made by the management, as well as evaluating the overall financial statement presentation. We believe that our audit provides a reasonable basis for our opinion.



4. OPINION AND THE BASIS THEREOF:

We enclose the Annexure a statement on the matters specified in paragraph 5 of the report.

5. FURTHER TO OUR COMMENTS IN THE ANNEXURE REFERRED TO ABOVE, WE REPORT THAT

- (i) We have obtained all the information and explanations which to the best of our knowledge and belief were necessary for the purpose of our audit;
- (ii) The Balance Sheet, Income and Expenditure and the Cash Flow Statement dealt with by this report are in agreement with the books of account kept by Society.
- (iii) Without qualifying our opinion, we invite attention to the following notes to Annexure
- (iv) In our opinion and to the best of our information and according to the explanations given to us, the said accounts give the information required as per applicable law, in the manner so required and give true and fair view in conformity with the accounting principles generally accepted in India:
 - a. In the case of Balance Sheet, of the state of Society affairs, as at 31.03.2024 and;
 - b. In the case of the Income & Expenditure Account of the Society, Excess of Income over Expenditure of the society for the year ended 31.03.2024.

DATE: 23.10.2024
PLACE: DEHRADUN

FOR PARMITA & COMPANY
Chartered Accountant



(CA PARMITA BHATT)
Prop.
Membership No. 078018

NOTES ON ACCOUNT

These notes form an integral part of and should be read in conjunction with the accompanying financial statements.

GENERAL

The Indian Council of Forestry Research and Education (the "Society") is incorporated under The Societies Registration Act, 1860. The address of its registered office is at Post New Forest, Dehra Dun, Uttarakhand-248006. The Society has 19 Branches/Sections across India and works under different trade names but is governed by the Society. Including a consolidated Pension Cell Account.

1. ACCOUNTING CONVENTION

These financial statements are prepared on an accrual basis of accounting under historical cost convention in accordance with generally accepted accounting principles in India.

Receipts from user charges are sometimes on the cash basis, the cash is deposited into bank and cash receipts also include the petty balances left with advances to employees for expenses.

The preparation of financial statements requires estimates and assumptions that affect the reported amounts of assets, liabilities revenue and expenses during the reporting period. Although such estimates and assumptions are made on a reasonable and prudent basis taking into account all available information, actual results could differ from these estimates and assumptions and such differences are recognized in the period in which the results are crystallized.

2. BASIS OF ACCOUNTING

The financial statements have been prepared under the historical cost convention, except as disclosed in the accounting policies below. Society has adopted an accrual system of accounting during the year.

3. PROPERTY PLANT & EQUIPMENT

- a. Tangible assets are carried at historical cost less accumulated depreciation /amortization.
- b. Society is maintaining fixed assets at its branch level and fixed assets register is duly maintained at the branch level. The fixed assets register carries the



original value, there is no system to show depreciation in that register. Due to the non-maintenance of the ledger book by the branches, the written down value could not be verified from the books of account of the branch. The depreciation is continuously charged at the consolidation level and the value of depreciation is not put in the books of account.

- c. Society has purchased various capital assets in Externally Aided Projects, which the society does not recognize as capital assets of the society till ownership lies with the funding agency.
- d. Further any record of sale of old and discarded fixed assets through auction is not provided and executed for during the year.

4. DEPRECIATION

- a. Society has charged depreciation on the "Written Down Value" method and adopted the current rate of depreciation as applicable under Income Tax Act 1961.
The society follows the practice of showing depreciation in Income & Expenditure Account apart from being the capital expenditure claimed in Income & Expenditure Account as application.
- b. Since assets purchased under EAP are put separate and did not include fixed assets of Society, therefore depreciation in respect of such assets is kept outside of the purview of depreciation.

5. REVENUE RECOGNITION

Revenue for the Society comprises the fair value of the consideration received or receivable for the sale of goods and rendering of services, net of goods and services tax, rebates and discounts, Government Grants, and externally aided projects.

Revenue is recognised as follows:

- (a) Sale of goods Revenue from the sale of goods is recognized when an entity has delivered the products to the customer, and the customer has accepted.
- (b) Rendering of Consultancy Services is recognized over the period in which the services are rendered, by reference to the completion of the specific transaction assessed on the basis of the actual service provided as a proportion of the total services to be performed.



- (c) Interest Income: Interest income is recognized on a time- proportion basis using the effective interest method.
- (d) Rental income Rental/House License Fees are recognized on a cash basis.
- (e) Government Grant is recognized only after approval from Central Government. The nature of the grant received from the Central Government is of an assistance nature.

6. RESEARCH AND DEVELOPMENT

The main object of Society is research and development in Forestry. The principles and methods of determining the Research and Development Costs and their classification are not found in the financial accounting of the society.

7. RETIREMENT BENEFITS

Society has adopted various schemes for benefit of retired employees. It is governed by the Pension Rules as adopted by ICFRE.

8. PRIOR PERIOD ADJUSTMENT

Since the society has adopted an accrual system of accounting during the year, the expenses related to the prior period were set off against Capital Fund. Further an amount of Rs. 25,42,461.12/- has been lapsed in TSA as on 31.03.2023.

9. CONTINGENT LIABILITIES

Society did not recognize contingent liability during the year.

10. TAXATION

Society is registered u/s 12A(B) under Income Tax Act 1961, which allows an institution exemption from Income Tax on complying with requirements stated u/s 12A(B) of the Income Tax Act 1961. The society has duly complied provision of Section 12A(B) during the year.



ANNEXURE – KEY AUDIT MATTERS:**1. COMPLIANCE UNDER GST ACT 2017**

The society is registered under GST Act 2017 and the society has taken multiple registrations at the locations of institutes of the Society. The society is providing Consultancy Services to various organizations, but they showing them as a Supply of Service at the time of receipt of money, whereas the same should be kept under advance money, till the supply of service is progressively completed. Improvement and legal updates and time-to-time monitoring GST return filing system of all the branches is required.

2. POST- EMPLOYMENT BENEFITS TO RETIRED EMPLOYEES

The Society is running a separate wing under name of Pension Cell for the schemes applicable to benefits of retired employees.

There are six major Pension funds attached with ICFRE; previously they were merged with ICFRE consolidated financial statements. Since 2010 -2011, it had been a regular practice to show and prepare these funds separately. and, it is to be pointed out here that these funds share the same PAN as of the ICFRE, hence as advised in our previous year audit report following Balance Sheets have been consolidated with ICFRE.

- (i) General Provident Fund Cum Pension Scheme (GPF)
- (ii) Pension Employee ICFRE
- (iii) Pension Central Government Employee
- (iv) NPS – National Pension Scheme
- (v) ICFRE PHS SCHEME
- (vi) Pension Fund Account (Prior to NPS)

We have discontinued the practice and hence shown the six different Balance Sheets separately. Books are maintained separately of all these funds.

3. ACTUARIAL VALUATIONS

Society did not recognize the retirement benefits of employees towards obligation in the future. Society should estimate the amount of obligation and make provisions according to future requirements, which is not done by Society.



4. METHOD OF ACCOUNTING

Society has prepared its financial statements on an accrual basis but there is an immense need to aware their institutes about the correct method of accounting under the accrual system, which some receipts are recognised on cash basis.

5. CONTINGENT LIABILITY

The GST department may raise liability of taxes, interest, late fees and penalties due to the filing of incorrect returns/compliances.

6. GENERAL

- (a) Externally Aided Projects – These project grants are received and executed at the Institutes/Centres level only. There is no separate record of the consolidated EAPs received by different Institutes/Centres maintained by the ICFRE Headquarter. Hence, we had to rely on the Financial Statements and relevant documents provided by the Institutes/Centres at their level.
- (b) Since revenue has been taken on cash basis, TDS for the year is never reflected in books of account. It is accumulated for only when it is received.
- (c) Balance shown in Receipts and Payment Account of DDO ICFRE, is different from the actual bank balance since last more than 10 years. It could not be clarified.
- (d) Since IPIRTI, was already merged with IWST Bengaluru, there are still transactions being carried on in their books of account and bank accounts during the year. Hence it is advised that all accounts running in the name of IPIRTI should be closed and the amounts should be transferred to IWST Bengaluru.



INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION
P.O. New Forest, Dehradun

CONSOLIDATED BALANCE SHEET AS AT 31ST MARCH, 2024

CORPUS/CAPITAL FUND AND LIABILITIES	SCHEDULE	CURRENT YEAR 31.03.2024		PREVIOUS YEAR 31.03.2023
		RS.	RS.	RS.
CORPUS/CAPITAL FUND	1		1,37,86,48,274.86	1,39,02,09,368.23
PENSION FUND	1A		3,06,95,23,327.82	-
RESERVES AND SURPLUS	2		-	-
EARMARKED/ENDOWMENT FUNDS :			-	-
> Grant Plan-Primary			-	-
> Grant Plan-Secondary	3A	8,63,37,148.76	8,63,37,148.76	8,76,40,452.98
> Project (Externally Aided)	3B	86,83,60,390.96	86,83,60,390.96	81,65,45,612.90
> Chair of Excellence	3C	17,10,92,590.89	17,10,92,590.89	16,85,76,432.67
SECURED LOANS AND BORROWINGS			-	-
UNSECURED LOANS AND BORROWINGS			-	-
(A) Running Projects		2,74,91,166.70	2,74,91,166.70	2,74,91,166.70
(B) Deposit received		53,99,483.00	53,99,483.00	53,99,483.00
CURRENT LIABILITIES AND PROVISIONS			-	-
(A) CURRENT LIABILITY:	4A	25,62,27,263.53	25,62,27,263.53	22,97,19,901.79
(B) PROVISIONS:	4B	-	-	-
TOTAL			5,86,30,79,646.52	2,72,55,82,418.27

ASSETS	SCHEDULE	CURRENT YEAR 31.03.2024		PREVIOUS YEAR 31.03.2023
		RS.	RS.	RS.
FIXED ASSETS	5		88,52,54,334.46	99,42,24,683.42
INVESTMENTS-FROM	6		-	17,47,70,000.00
> F.D.R.(For One Time Special Grant)			-	-
> F.D.R.(With Institutes)			-	-
> Pension Fund Investments		69,63,62,367.07	-	-
Transferred from IPRIT			-	-
1. Corpus Fund(Fixed Deposits)		46,13,01,000.00	-	46,13,01,000.00
2. Statutory Deposits with various Govt		5,33,093.27	1,15,81,96,460.34	5,33,093.27
CURRENT ASSETS, LOANS, ADVANCES ETC.			-	-
> CURRENT ASSETS	7A	3,62,55,83,884.69	-	93,54,47,083.55
> LOANS,ADVANCES ETC	7B	13,74,36,699.45	-	10,26,98,290.45
> LOANS, ADVANCES- IPRITI, ETC		5,66,08,267.58	3,81,96,28,851.72	5,66,08,267.58
TOTAL			5,86,30,79,646.52	2,72,55,82,418.27

KANCHAN DEVI (DIRECTOR GENERAL, ICFRE)

"AS PER OUR SEPARATE REPORT OF EVEN DATE ANNEXED"
FOR M/S PARMITA & COMPANY,
CHARTERED ACCOUNTANTS

VINAY KUMAR (DEPUTY DIRECTOR GENERAL, ADMIN, ICFRE)

SUSHANT KUMAR (ASSISTANT DIRECTOR GENERAL, ADMIN, ICFRE)

BRIJESH KUMAR SHARMA, (UNDER SECRETARY, BUDGET SECTION ICFRE)



(CA PARMITA BHATT)
PROP., M. NO. 078018, FRN 0908751C
DATED: 23.10.2024
PLACE: DEHRADUN

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION

P.O. New Forest, Dehradun

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2024

INCOME	Schedule	Current Year 31.03.2024	Previous Year 31.03.2023
		Rs.	Rs.
SUPPLY OF SERVICE AND GOODS	8	19,86,34,771.52	13,29,87,679.64
FCRA RECEIPTS		2,27,82,754.00	22,72,635.00
GRANT INCOME			
(A) Grant EAP/Consultancy applied during the year	9A	1,13,10,95,324.67	1,58,53,60,079.50
(B) Grant Under Plan allotted during the year	9B	2,39,06,00,000.00	2,47,64,00,000.00
Grant Refund From Centre			
(C) Grant for IPIRTI allotted during the year	9B	-	4,61,25,000.00
INCOME FROM INVESTMENT			
Interest earned on COE Corpus Fund	10A	1,09,76,968.00	72,95,704.00
INTEREST EARNED	10B	9,60,24,690.97	2,80,93,669.57
OTHER RECEIPTS	11	2,41,180.00	3,19,155.00
DEPRECIATION FUND			
Total(A)		3,85,03,55,689.16	4,27,88,53,922.71
EXPENDITURE	Schedule	Current Year 31.03.2024	Previous Year 31.03.2023
		Rs.	Rs.
EXPENDITURE ON GRANTS			
(A) GRANT - PLAN		2,39,06,00,000.00	2,52,25,25,000.00
Establishment Expenses	12A	2,06,64,21,151.46	2,07,84,80,621.58
Administrative Expenses	12B	30,56,22,977.99	39,60,60,086.56
Capital Expenditure	12C	1,00,96,498.00	6,55,08,865.11
Unutilized Grant	12D	85,98,892.55	(1,75,24,573.25)
Grant Transferred to Other Units		(1,39,520.00)	
(B) GRANT- EXTERNALLY AIDED PROJECT		1,15,38,78,078.67	1,58,53,60,079.44
Grant Utilized During the Year	13	1,15,38,78,078.67	1,58,53,60,079.44
EXPENSES ON SUPPLY OF SERVICE & GOODS	14	21,07,53,197.78	23,08,55,716.14
DEPRECIATION	5	11,90,66,846.96	12,73,34,825.08
TOTAL(B)		3,87,42,98,123.41	4,46,60,75,620.66
Balance being excess of Expenditure over Income (A-B)		(2,39,42,434.25)	(18,72,21,697.95)

KANCHAN DEVI (DIRECTOR GENERAL, ICFRE)

VINAY KUMAR (DEPUTY DIRECTOR GENERAL, ADMIN, ICFRE)

SUSHANT KUMAR (ASSISTANT DIRECTOR GENERAL, ADMIN, ICFRE)

BRIJESH KUMAR SHARMA, (UNDER SECRETARY, BUDGET SECTION ICFRE)

"AS PER OUR SEPARATE REPORT OF EVEN DATE ANNEXED"
FOR M/S PARMITA & COMPANY,
CHARTERED ACCOUNTANTS(CA PARMITA BHATT)
PROP., M. NO. 078018, FRN 0008751C
DATED: 23.10.2024
PLACE: DEHRADUN

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION
P.O. New Forest, Dehradun

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH, 2024

Schedule 1	CORPUS/CAPITAL FUND:	CURRENT YEAR 31.03.2024		PREVIOUS YEAR 31.03.2023	
		RS	RS	RS	RS
	Opening Balance	1,39,02,09,368.23			
	Op.Balance of Capital Fund Account	-		89,49,87,668.12	
	Add: Fund Transfer from Other Unit-IPIRTI year	37,63,830.00		51,86,88,691.80	
	Add: Fixed Assets Expended From Grant	1,00,96,498.00		42,55,435.00	
	Add: Amount in Transit from the Income and Expenditure Account (Deficit)	10,63,474.00		15,24,91,336.85	
	Add: Grant Lapsed left to be considered in Preceding Previous Year	(2,39,42,434.25)		(18,72,21,697.95)	
	Add: Prior Period Items	(25,42,461.12)		68,71,000.41	
	LESS: Transfer to Revenue Account	-		1,36,934.00	
	Less: Amount Remitted/Appropriated to HQ	1,37,86,48,274.86	1,37,86,48,274.86	1,39,02,09,368.23	
		0.00		-	1,39,02,09,368.23
	BALANCE AS AT THE YEAR-END		1,37,86,48,274.86	-	1,39,02,09,368.23

Schedule 1A	PENSION FUND	CURRENT YEAR 31.03.2024		PREVIOUS YEAR 31.03.2023	
		RS	RS	RS	RS
	Opening Balance	2,85,12,98,383.93			
	Add: Exempted Interest on Pension Funds	10,75,78,076.52			
	Add: Additions During the year	1,21,09,90,238.20			
		4,16,98,66,698.65			
	Less: Expenses on Pension Funds	65,649.83			
	Add: Deductions During the year	1,10,02,77,721.00	3,06,95,23,327.82		
	BALANCE AS AT THE YEAR-END		3,06,95,23,327.82	-	-

Schedule 2	RESERVES AND SURPLUS:	CURRENT YEAR 31.03.2024		PREVIOUS YEAR 31.03.2023	
		RS	RS	RS	RS
	TOTAL				



INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION
P.O. New Forest, Dehradun

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH, 2024

Schedule 3 (A & B)	EARMARKED/ENDOWMENT FUNDS	CURRENT YEAR 31.03.2024		PREVIOUS YEAR 31.03.2023	
		PLAN	PROJECT ACCOUNTS (EAP)	PLAN	PROJECT ACCOUNTS (EAP)
	a) Opening balance of the funds	8,75,40,452.98	81,65,45,612.90	10,58,39,509.23	64,64,28,200.21
	b) Additions to the Funds (Primary)				
	Project Receipts	-	1,19,02,91,693.06	-	1836037862
	Plan (General, Salary & Capital)	4,67,08,00,000.00	5,28,75,151.61	2,47,64,00,000.00	-
	WRTI (General, Salary & Capital) from MOP	-	-	4,61,25,000.00	-
	Interest earned during the year	-	-	-	-
	TOTAL	4,67,08,00,000.00	1,24,31,66,854.67	2,52,25,25,000.00	1,83,60,37,861.58
	c) Additions to the Funds (Alloted/Secndry)				
	Plan (General, Salary & Capital)	4,67,08,00,000.00	-	2,47,64,00,000.00	-
	Grant Refund From Centre	1,39,520.00	-	-	-
	Pension Cell ICFRE	-	-	-	-
	Grant PHS	-	-	-	-
	Excess Expense Incurred	-	-	-	-
	Income from Investments made on account of funds	-	-	-	-
	TOTAL	4,67,09,39,520.00	-	2,47,64,00,000.00	-
	TOTAL (a + b + c)	9,42,93,79,972.98	2,05,97,12,467.57	5,10,47,64,509.23	2,48,24,66,061.79
	d) Utilisation/Expenditure towards objectives of funds				
	i) Capital Expenditure				
	Others	1,00,96,498.00	-	6,55,08,865.11	-
	TOTAL	1,00,96,498.00	-	6,55,08,865.11	-
	ii) Revenue Expenditure				
	Salaries, Wages and allowances etc.	2,06,64,21,151.46	-	1,89,58,94,621.58	-
	Transferred To Pension Cell ICFRE	2,28,32,00,000.00	-	18,25,85,000.00	-
	PHS Expenditure	-	-	-	-
	Other Administrative expenses	30,56,22,977.99	-	39,63,60,086.56	-
	Project Payments	-	1,13,53,79,321.89	-	1561943990
	TOTAL	4,65,22,44,129.45	1,13,53,79,321.89	2,47,45,43,708.14	1,56,19,43,990.44
	e) Grant Refund & Transfer				
	Interest Transfer	-	-	-	-
	Grant Lapsed	81,88,144.00	1,14,21,614.42	1,03,167.00	-
	Transfer to Reserve & Surplus	-	-	-	-
	Grant Refunded to Funding Agency	10,400.77	2,44,96,897.32	-	34714103.85
	Grant Refunded to Other Units	-	1,56,14,186.14	5,71,316.00	59298285.39
	Grant Trf to Pension cell	-	-	-	-
	Grant Refunded to ICFRE	17,03,652.00	44,40,056.84	-	9964069.13
	Fund Transfer	-	-	-	-
	f) Disbursement of Primary Grant to Units				
	Project Payments	-	-	-	-
	General, Salary & Capital To Plan (GC-Capital)	4,67,08,00,000.00	-	2,47,64,00,000.00	-
	Plan (GC-Salary)	-	-	-	-
	TOTAL (d + e + f)	9,34,30,42,824.22	1,19,13,52,076.61	5,01,71,24,056.25	1,66,59,20,448.89
	NET BALANCE AS AT THE YEAR END (a + b + c - d - e - f)	8,63,37,146.76	86,83,60,390.96	8,75,40,452.98	81,65,45,612.90



INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION
P.O. New Forest, Dehradun

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH, 2024

Schedule 3C	OTHER FUNDS	CURRENT YEAR 31.03.2024		PREVIOUS YEAR 31.03.2023	
		RS.	RS.	RS.	RS.
	Other Funds	-			
	Chair of Excellence	16,79,59,259.73			
	Fund Received	-			
	Add: Expenditure	9,38,509.48	16,70,20,750.25		16,79,59,259.73
	- PHS ICFRE	-			
	Opening of Unutilized Grants	2,38,279.60			
	Add: Grant Alloted during the year	1,35,80,000.00			
	Add: Medical Advance	37,77,915.00			
	Less: Expenditure	1,38,62,247.30	37,33,947.30		2,38,279.60
	DPR - Swarnrekha & Damodar	-			
	Opening of Unutilized Grants	73,913.00			
	Fund Received	36,57,000.00			
	Less: Expenditure	36,98,000.00	32,913.00		73,913.00
	Forest Fire Project Fund	-			
	Opening of Unutilized Grants	(51,519.66)			
	Fund Received	-			
	Less: Expenditure	-	(51,519.66)		(51,519.65)
	-Endowment Fund (trfd From IPRTI)	-			
	Dr. Narayan Murthy Endowment Fund	6,500.00			
	Century Plyboard Silver Medal	2,00,000.00			
	Smt. Ravi Kal Kamath Gold Medal	1,50,000.00	3,56,500.00		3,56,500.00
	TOTAL		17,10,92,590.89		16,85,76,432.67



INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION
P.O. New Forest, Dehradun

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH, 2024

Schedule 4A	CURRENT LIABILITIES AND PROVISIONS	CURRENT YEAR 31.03.2024		PREVIOUS YEAR 31.03.2023	
		RS.	RS.	RS.	RS.
	A.CURRENT LIABILITIES				
1	Sundry Creditors:				
	a) For Goods & Services (Trfd from [PIRTI])	1,67,741.00		1,67,741.00	
	b) Others	1,77,33,969.49	1,79,01,710.49	1,77,33,969.49	1,79,01,710.49
2	Advances Received		40,45,673.50	3,33,61,837.78	3,33,61,837.78
	others		3,82,98,198.02		
5	Other Current Liabilities				
	a) Security & EMD Account		3,55,48,858.52	3,62,40,678.52	3,62,40,678.52
	b) Amount Payable to Controller, Pension Cell, [CFRE Pension Medical Claim Payable New Pension Scheme	14,557.00 -	14,557.00	14,557.00 -	14,557.00 14,557.00
	c) Amount Payable to PAO (F), NEW DELHI Any Other Recovery	4,09,374.00	4,09,374.00	4,09,374.00	4,09,374.00
	e) Amount Payable to Others				
	FA/TA Payable	3,02,873.00		3,82,523.00	
	GST Payable	4,52,264.00		4,26,782.00	
	Interest Payable to MOEF	1,669.00		1,669.00	
	Salary Payable Account	15,84,62,010.00		14,01,90,694.00	
	Other Expenses Payable	-		-	
	Other Deduction (Staff) Non Technical	7,90,076.00 -	16,00,08,892.00	7,90,076.00	14,17,91,744.00
	TOTAL(A)		25,62,27,263.53		22,97,19,901.79
Schedule 4B	B.PROVISIONS				
	TOTAL(B)				
	TOTAL(A+B)				22,97,19,901.79



INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION
P.O. New Forest, Dehradun

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH, 2024

* DESCRIPTION	GROSS BLOCK			DEPRECIATION			NET BLOCK		
	Cost valuation at the beginning of the year	Additions during the year	Cost valuation at the year-end	Rate of depreciation	During the year/for the year	Addition during the year	Total up to the year-end	As at the Current year-end	As at the previous year-end
	RS.	RS.	RS.	RS.	RS.	RS.	RS.	RS.	RS.
A. Fixed Assets:									
1. LAND:									
a) Freehold	1,11,09,149.00	-	1,11,09,149.00	0%	-	-	-	1,11,09,149.00	1,11,09,149.00
b) Leasehold	-	-	-	0%	-	-	-	-	-
2. BUILDINGS									
a) on Freehold Land	1,35,37,03,478.54	8,53,922.00	1,35,45,57,400.54	10%	6,68,17,721.74	42,698.60	73,44,31,681.49	62,01,25,769.05	68,81,27,317.39
b) on Leasehold Land	-	-	-	-	-	-	-	-	-
3. PLANT MACHINERY & EQUIPMENT									
a) Scientific Equipment	24,66,937.00	10,82,773.00	42,62,71,750.28	15%	2,66,12,509.02	81,207.98	27,78,09,275.33	14,04,00,015.13	17,09,50,083.12
b) I.T. Equipment	14,25,89,119.42	20,51,960.00	14,50,21,347.42	40%	74,70,324.32	4,10,392.00	13,21,73,992.94	1,28,47,354.48	1,82,96,042.81
4. VEHICLES									
	1,64,06,021.02	-	1,64,06,021.02	15%	8,00,394.24	-	1,18,19,553.65	45,86,567.37	53,95,961.61
5. FURNITURE, FIXTURES									
	3,23,74,855.22	74,800.00	3,30,33,457.22	10%	17,10,313.49	3,740.00	1,84,69,375.80	1,54,63,081.42	1,56,19,322.91
6. OFFICE EQUIPMENT									
	12,11,85,178.95	3,65,442.00	12,28,82,255.95	15%	55,93,899.44	27,408.15	9,08,15,458.63	3,20,36,797.32	3,59,91,027.91
7. ELECTRIC INSTALLATIONS									
	35,85,389.85	-	35,85,389.85	15%	2,18,072.76	-	21,23,317.54	14,62,072.31	17,20,085.07
8. LIBRARY BOOKS									
	9,06,23,479.41	2,500.00	9,06,58,388.41	40%	19,31,139.26	6,481.80	8,77,27,722.31	79,34,666.10	48,45,398.16
9. TUBEWELLS & W SUPPLY									
	9,23,616.00	-	9,23,616.00	0%	-	-	-	9,23,616.00	9,23,616.00
10. MUSEUM									
	79,34,238.00	-	79,34,238.00	10%	5,97,350.51	-	25,48,083.42	53,76,154.58	59,73,505.09
11. TOOLS & EQUIPMENTS									
	3,93,30,288.89	-	3,93,30,288.89	15%	55,41,313.73	-	1,06,09,830.01	2,87,20,458.88	3,37,88,775.16
12. KITCHEN EQUIPMENTS									
	32,400.56	-	32,400.56	15%	4,495.58	-	6,925.62	25,474.94	29,970.52
13. NON EXPENDABLE EQUIPMENT (UNOP)									
	14,97,109.13	-	14,97,109.13	15%	2,87,723.89	-	3,20,007.08	11,77,102.05	13,84,825.95
14. NON EXPENDABLE EQUIPMENT (IC)									
	75,365.11	-	75,365.11	15%	10,456.91	-	16,109.29	59,255.82	68,712.73
TOTAL OF CURRENT YEAR	2,34,40,85,729.36	56,35,142.00	2,34,41,82,227.36		1,24,98,61,045.94	5,71,928.53	1,36,89,27,892.90	88,52,54,334.48	99,42,24,683.42
PREVIOUS YEAR	4,48,027.00	-	4,48,027.00		1,24,98,61,045.94	5,71,928.53	1,36,89,27,892.90	88,52,54,334.48	99,42,24,683.42
B. CAPITAL WORK-IN-PROGRESS									
TOTAL	2,24,45,31,252.36	56,35,142.00	2,24,45,31,252.36		1,24,98,61,045.94	5,71,928.53	1,36,89,27,892.90	88,52,54,334.48	99,42,24,683.42

(Note to be given as to cost of assets on hire purchase basis included above)



INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION

P.O. New Forest, Dehradun

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH, 2024

Schedule 6	INVESTMENTS FROM EARMARKED/ENDOWMENT FUNDS	CURRENT YEAR 31.03.2024	PREVIOUS YEAR 31.03.2023
		RS	RS
1.	In Government Securities	-	17,47,70,000.00
	> F.D.R.(For One Time Special Grant)	-	
	> F.D.R.(With Institutes)	-	
2.	Other Approved Securities	-	
3.	Shares	-	
4.	Debentures and Bonds	-	
5.	Subsidiaries and Joint Ventures	-	
6.	Others(to be specified)	-	
7.	<u>Transferred from IPIRTI</u>	-	
	1. Corpus Fund(Fixed Deposits)	46,13,01,000.00	46,13,01,000.00
	2. Statutory Deposits with various	5,33,093.27	5,33,093.27
		-	
8.	Investments Under Pension Fund	-	
	LIC	14,85,00,000.00	
	Bonds & Securities	54,78,62,367.07	
		-	
	TOTAL	1,15,81,96,460.34	63,66,04,093.27



INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION

P.O. New Forest, Dehradun

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH, 2024

Schedule 7A	CURRENT ASSETS, LOANS, ADVANCES ETC.	CURRENT YEAR 31.03.2024		PREVIOUS YEAR 31.03.2023	
		RS	RS	RS	RS
1	A. CURRENT ASSETS:	-	-	-	-
	INVENTORIES:	-	-	-	-
	> Stores and Spares	1,51,310.00	-	1,51,310.00	-
	> Postage, Stamps & Stationery in Hand	1,40,220.00	-	1,40,220.00	-
	> Raw Materials	-	2,91,530.00	-	2,91,530.00
	Security and caution deposits paid	41,000.00	-	-	-
	Medical advance-asset	3,59,000.00	-	-	-
	Loan	(90,559.00)	-	-	-
	TDS	5,74,305.00	-	-	-
	GST-ASSET	10,87,741.00	-	-	-
	Bank Guarantee	3,33,498.00	-	-	-
	LIC Premium	7,620.00	-	-	-
	Excess Payment of EPF & ESI	77,271.00	23,89,876.00	-	-
2	Sundry Debtors:	-	-	-	-
	> Debs Outstanding for a period exceeding six months	-	-	-	-
	> Others	-	-	14,12,524.00	14,12,524.00
3	Cash balances in hand (including cheques/drafts and imprest)	-	-	-	-
	> Cash (Plan General)	-	-	4,350.00	-
	> Cash (EMD)	3,000.00	-	-	-
	> Cash (EAP)1	2,200.00	-	1,00,248.00	-
	> Cash (Revenue A/c)	1,339.00	-	45,383.00	-
	> Cash (Others)	-	12,689.00	15,150.00	-
	> Trfd from IPIRTI	5,688.00	5,688.00	5,688.00	1,70,819.00
4	Bank Balances:	-	-	-	-
	a) With Scheduled Banks:	-	-	-	-
	> On Savings Bank Accounts	-	-	-	-
	Bank EAP	69,79,98,581.65	-	61,93,79,695.14	-
	Bank Gem Pool	3,19,228.00	-	-	-
	Bank AIRCP	5,92,72,590.48	-	7,57,92,315.81	-
	Bank EMD	1,35,05,363.74	-	1,88,63,673.20	-
	Bank Plan Capital	23,695.11	-	1,22,478.53	-
	Bank Plan 2	-	-	26,02,271.12	-
	Bank Plan Capital II	-	-	0.70	-
	Bank Plan General	9,91,606.75	-	14,78,257.95	-
	Bank Plan Salary	19,15,98,517.50	-	15,71,88,424.32	-
	Bank Income Tax	992.70	-	993.00	-
	UBI FRI	1,000.00	-	1,000.00	-
	Bank FRI Deemed University	1,58,380.00	-	92,218.00	-
	Bank Service charges	11,59,613.04	-	38,36,921.92	-
	Bank Student Service Charges	20,39,903.70	-	4,47,259.00	-
	Bank-Chair of Excellence	6,39,729.83	-	5,98,559.73	-
	Bank Testing Account	8,81,487.00	-	4,84,749.00	-
	Bank FCRA	1,32,120.00	-	17,383.00	-
	Bank Pension Account	1,00,992.30	-	3,89,390.60	-
	Bank Sharing Cost of Medical	38,50,778.00	-	-	-
	Bank Recruitment	3,19,650.84	-	4,50,186.84	-
	Bank TDS & GST	1,02,719.23	-	98,049.23	-
	Bank FRS	66,708.00	-	62,453.00	-
	Bank PHD	3,36,829.00	-	1,30,330.00	-
	Bank Revenue Account	1,71,69,620.61	-	65,82,094.44	-
	Bank RBI Account	84,029.00	-	65,069.00	-
	Bank IPIRTI	3,02,55,753.65	-	3,57,91,486.65	-
	Bank Guest House Service Charges	46,268.81	-	27,707.37	-
	Bank Pension Fund	16,66,71,076.75	-	-	-
	FDR	2,24,46,12,437.00	3,43,25,19,672.69	35,00,000.00	92,81,02,967.55
	> On Current Accounts	-	-	-	-
	ICFRE Recruitment Fund	54,69,243.00	54,69,243.00	54,69,243.00	54,69,243.00
	> On Deposit Accounts	-	-	-	-
	FDR-COE Corpus	18,48,95,186.00	18,48,95,186.00	-	-
	TOTAL (A)	-	3,62,55,83,884.69	-	93,54,47,083.55



INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION

P.O. New Forest, Dehradun

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH, 2024

Schedule 7B	(A) CURRENT ASSETS, LOANS, ADVANCES ETC.	CURRENT YEAR 31.03.2024		PREVIOUS YEAR 31.03.2023	
		RS	RS	RS	RS
1	B. LOANS, ADVANCES AND OTHER ASSETS	-	-	-	-
	Loans:	-	-	-	-
	a) Staff Advance	-	29,98,563.01	70,087.00	-
	Etc. (Please Specify)	-	2,97,42,965.94	3,25,10,446.84	-
	Loan & Others	-	7,16,91,928.19	3,21,57,636.30	6,47,38,170.14
	(7) Paid to Other office on behalf of staff	-	-	-	-
	Grant Receivable	17,89,838.07	-	-	-
	Chair Of Excellence	-	17,89,838.07	17,89,838.07	17,89,838.07
2	Advances and other amounts recoverable in cash or in kind or for value to be received:	-	-	-	-
	a) On Capital Account	-	-	-	-
	CCU -(Plan Account)	7,70,666.00	-	11,48,000.00	-
	SCIENTIFIC EQUIPMENTS	-	7,70,666.00	-	11,48,000.00
	b) Prepayments	-	-	-	-
	Advance for Construction of Wall	-	14,97,200.00	14,97,200.00	14,97,200.00
3	Income Accrued:	-	-	-	-
	a) On Investments from Earmarked/Endowments Funds	-	-	-	-
	b) On Investments-Others	-	-	-	-
	c) On Loans and Advances	-	-	-	-
	Loan EAP	1,361.00	-	2,26,361.00	-
	Advance for Building Maintenance	61,07,887.00	-	61,07,887.00	-
	Other Receivable	1,48,69,154.24	-	1,94,06,087.24	-
	Advance for Other Maintenance	21,08,369.00	2,30,86,771.24	21,08,369.00	2,78,48,704.24
4	Claims Receivable	-	-	-	-
	TDS EAP	-	1,29,923.00	1,29,923.00	1,29,923.00
	Transferred From (PART)	-	-	-	-
	1. Inventories	-	-	-	-
	Store & Spairs	1,10,835.00	-	1,10,835.00	-
	2. Sundry Debtors	-	-	-	-
	a) Debts o/s for a period exceeding more than 6 months	52,36,435.00	-	52,36,435.00	-
	GST Cash Ledger	3,81,574.00	57,28,844.00	1,99,185.00	55,46,455.00
	TOTAL (B)		13,74,36,699.45		10,26,98,290.45



INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION
P.O. New Forest, Dehradun

SCHEDULES FORMING PART OF INCOME EXPENDITURE ACCOUNT FOR THE YEAR ENDING 31ST MARCH 2024

Schedule #	INCOME FROM SALES/SERVICES	CURRENT YEAR 31.03.2023	PREVIOUS YEAR 31.03.2022
A	SUPPLY OF GOODS		RS
1	Sale of Product	1,95,986.00	1,34,515.00
2	Sale of Publication	3,96,490.00	3,64,022.00
3	Sale of Museum Ticket & Gate Pass	1,77,03,028.00	1,22,87,689.00
4	Sale of Scrap	-	-
5	Sale of Tender Documents	3,42,507.00	2,36,925.05
6	Sale of Timber	12,48,446.00	45,30,876.00
7	Sale of Unservicable Stores	26,40,024.00	9,76,096.00
8	Sale of Plants & Timber	7,04,38,834.28	1,43,29,522.20
9	Sale of Grass	-	-
10	Sale of Fire Wood	-	-
		9,29,65,315.28	
B	SUPPLY OF SERVICE		
1	Conference Hall	19,000.00	2,20,030.19
2	Forfeited of Security Money	4,83,285.00	98,495.00
3	Forfeited of Bank Guarantee	-	83,88,632.00
4	Income Earned from EAP	-	-
5	Licence Agreement Fees	50,888.00	-
6	Institutional Charges	1,81,95,792.00	1,29,11,165.00
7	Other Income	13,90,890.19	11,87,447.00
8	Mandap Fees	1,02,39,921.00	43,76,329.14
9	Professional /Consultancy Services	52,77,783.00	56,37,826.00
10	Rent Received (staff other than ICFRI)	1,31,443.00	38,375.00
11	Photocopy Charges	524.00	1,450.00
12	Testing Fees	1,49,69,088.60	25,29,385.00
13	Unutilized Fund & Balance of Projects	81,22,805.06	99,04,002.24
14	Application & Other Fees for Recruitment	7,75,556.14	74,74,345.00
15	Application Fees	-	4,64,500.00
16	Charges for Issuance of Identity cards	660.00	-
17	Royalty	60,08,531.00	-
18	Dossartarian Charges	33,860.00	2,32,000.00
19	Electricity & Water Charges	10,08,305.00	7,02,608.00
20	Win coin -membership	4,56,000.00	-
21	Telephone Exp	1,630.00	24,426.00
22	Guest House Rent	43,61,125.73	40,69,819.89
23	House Licence Fees	2,18,61,919.80	2,29,35,574.48
24	Licence Agreement Fees	-	-
25	Maintenance Services(Equipment/Property)	7,58,540.00	13,000.00
26	Lab Charges & Library Charges	2,29,000.00	1,99,000.00
27	Bid Fee	-	23,600.00
28	Accreditation Fee	1,00,000.00	9,50,000.00
29	House Rent Allowance	1,69,126.00	2,94,304.00
30	Internship Fee & Overdue Charges	2,94,796.00	43,851.00
31	Rent	7,65,801.40	2,87,677.00
32	Library Charges	72,436.00	9,000.00
33	Private Use of Govt. Vehicles	4,898.00	8,014.00
34	Other Fees	6,33,482.00	8,49,131.00
35	Staff Bus Fare	-	3,40,727.00
36	Penalty Charges	31,149.00	42,478.00
37	Photography Charges	-	-
38	Received from FRI Deemed University	-	2,49,200.00
39	Receipts from PHD Students	82,000.00	1,73,000.00
40	Registration Fees & Penal Interest	2,29,993.33	10,89,374.34
41	Miscellaneous Income	10,18,819.00	1,64,990.00
42	Sale of Waste Wood/Timber/Fire Wood/Bamboo	-	1,62,575.00
43	Charges for issuance of Identity Cards	-	400.00
44	Other Income	12,08,646.30	37.00
45	Interest on HBA	-	33,559.00
46	Interest on FA	-	3,340.00
47	a. Privat use of Government Vehidles	-	12,651.00
48	Sale of Publication /old news paper	-	1,605.00
49	Sale of News papers/Over due charges of Lib. Books	-	123.00
50	Vendor Pass	5,200.00	4,250.00
51	Penal Instt. On FA/TA	508.00	3,408.00
52	Any other sources which have not been mentioned	-	13,938.00
53	Interest on Loan to Employee (HBA/ MCA/PCA etc.)	4,17,097.00	3,19,949.00
54	Course fees	24,000.00	15,000.00
55	Library Fees	-	75,000.00
56	Laboratory Fees	91,200.00	41,000.00
57	mess usage charge	1,87,360.00	1,09,660.00
58	Library & Miscellaneous Charges	2,09,324.00	56,57,770.00
59	Right to Information	551.00	710.00
60	Room Rent Income	-	15,900.00
61	Security & Caution Money	-	55,70,285.30
62	Service Charges- Revenue	25,31,149.69	-
63	Student Service Charges	1,89,532.00	60,000.00
64	Service Charges	6,27,161.00	19,48,139.81
65	Training Fees	23,98,679.00	25,16,613.00
		10,56,69,456.24	
	TOTAL	19,86,34,771.52	13,52,60,314.64



INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION

P.O. New Forest, Dehradun

SCHEDULES FORMING PART OF INCOME EXPENDITURE ACCOUNT FOR THE YEAR ENDING 31ST MARCH 2024

Schedule 9	GRANTS/SUBSIDIES	CURRENT YEAR 31.03.2024	PREVIOUS YEAR 31.03.2023
		RS	RS
A	E.A.P. (INCLUDING FCRA)	1,13,53,79,321.89	1,56,19,43,990.44
	Opening of Unutilized Grant	81,65,45,612.90	64,64,28,200.21
	Add: Grant Received during the year	1,24,31,66,854.67	1,83,60,37,861.58
	Add: Interest Received during the year	-	-
	Less: Grant Lapsed	1,14,24,821.76	55,770.41
	Less Grant Transfer to Other Units	-	1,82,35,447.39
	Less: Grant Transferred to ICFRE	44,40,056.84	1,24,86,871.01
	Less: Grant Refund to funding agency	2,70,99,447.32	3,50,82,831.64
	Less: Transferred to other units	1,30,08,428.80	3,81,15,538.00
	Less: Unutilized Grant	86,83,60,390.96	81,65,45,612.90
		-	-
B	SECONDARY GRANTS		
1	Central Government	-	-
	To Plan (General, Salary & Capital)	2,38,21,40,627.45	2,54,00,49,573.25
	Opening of Unutilized Grant	8,76,40,452.98	10,58,39,509.23
	Add: Grant Alloted during the year	2,39,06,00,000.00	2,47,64,00,000.00
	Add: Grant Alloted during the year-IPRTI	1,39,520.00	4,61,25,000.00
	Add: Excess Expense Incurred	-	-
	Less: Transferred to Other Units/Centre	-	5,71,316.00
	Less: Transferred to Pension Cell	-	-
	Less: Transferred to funding agency	10,400.77	-
	Less: Grant Transferred to ICFRE	17,03,652.00	-
	Less: Grant Lapsed	81,88,144.00	1,03,167.00
	Less: Unutilized Grant	8,63,37,148.76	8,76,40,452.98
		-	-
	SECONDARY GRANTS		
	Central Government		
	PHS	1,38,62,247.30	1,91,39,423.40
	Opening of Unutilized Grants	2,38,279.60	17,12,646.00
	Add: Grant Alloted during the year	1,35,80,000.00	1,71,70,000.00
	Add: Medical Advance received	37,77,915.00	4,95,057.00
	Less: Unspent Balance	37,33,947.30	2,38,279.60
		-	-
	COE	9,38,509.48	16,80,07,377.73
	Opening of Unutilized Grants	16,79,59,259.73	16,77,83,318.73
	Add: Grant Alloted during the year	-	4,00,000.00
	Less: Unspent Balance	16,70,20,750.25	1,75,941.00
		-	-
	DPR - Swarnrekha & Damodar	36,98,000.00	39,26,087.00
	Opening of Unutilized Grants	73,913.00	-
	Add: Grant Alloted during the year	36,57,000.00	40,00,000.00
	Less: Unspent Balance	32,913.00	73,913.00
		-	-
	Forest Fire Project Fund	-	1,26,519.66
	Opening of Unutilized Grants	(51,519.66)	-
	Add: Grant Alloted during the year	-	75,000.00
	Less: Unspent Balance	(51,519.66)	(51,519.66)
		-	-
	TOTAL	3,53,60,18,706.12	4,29,31,92,971.48



INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION

P.O. New Forest, Dehradun

SCHEDULES FORMING PART OF INCOME EXPENDITURE ACCOUNT FOR THE YEAR ENDING 31ST MARCH 2024

Schedule 10A	INTEREST EARNED ETC.	CURRENT YEAR 31.03.2024	PREVIOUS YEAR 31.03.2023
		RS.	RS.
1	Income from Investment	8,55,20,929.00	72,95,704.00
	With Scheduled Banks	8,55,20,929.00	72,95,704.00
	With Non-Scheduled Banks	-	-
	With Institutions	-	-
	Others	-	-
	Total...	8,55,20,929.00	72,95,704.00
Schedule 10B	INTEREST EARNED	CURRENT YEAR 31.03.2024	PREVIOUS YEAR 31.03.2023
		RS.	RS.
2	On Saving Accounts:	-	-
	With Scheduled Banks	2,12,83,862.97	2,79,56,393.57
	With Non-Scheduled Banks	-	-
	Post Office Savings Accounts	-	-
	Others	-	-
3	On Loans:	-	-
	Interest accrued during the year	-	-
	Employees/Staff	1,96,867.00	26,400.00
	Interest earned during the year	-	-
	Employees/Staff	-	-
4	Interest on Debtors and Other Receivables	-	1,10,876.00
	TOTAL	2,14,80,729.97	2,80,93,669.57

Note - Tax deducted at source to be indicated



INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION

P.O. New Forest, Dehradun

SCHEDULES FORMING PART OF INCOME EXPENDITURE ACCOUNT FOR THE YEAR ENDING 31ST MARCH, 2024

Schedule 11	OTHER INCOME /PRIOR PERIOD ITEMS:	CURRENT YEAR 31.03.2024	PREVIOUS YEAR 31.03.2023
		RS	RS
1	Grant Chair of Excellence	-	-
2	Other Income	-	-
3	Interest on Income Tax Refund	2,41,180.00	3,19,155.00
	TOTAL	2,41,180.00	3,19,155.00
Schedule 12A	ESTABLISHMENT EXPENSES	CURRENT YEAR 31.03.2024	PREVIOUS YEAR 31.03.2023
		RS	RS
1	Expenses Salary Grant Establishment Expenses - Research	1,34,63,09,543.17	1,23,99,32,060.58
	Salary & Allowances	1,25,56,09,680.24	-1,14,74,68,574.58
	Medical	1,36,56,170.93	1,54,57,543.00
	10% Pension of ICFRE Employees	3,69,86,295.00	3,37,45,664.00
	> Honorarium	1,11,100.00	42,600.00
	> LTC	54,30,636.00	1,00,86,200.00
	> Children Education Allowance	7,11,000.00	6,48,000.00
	> LSPC	-	8,91,616.00
	> RBI	-	-
	> New Pension Scheme	3,38,04,661.00	3,15,91,863.00
2	Establishment Expenses - Non-Research	45,06,29,598.29	41,92,59,867.00
	Salary & Allowances	41,19,24,014.29	38,03,40,403.00
	Medical	1,34,98,780.00	1,21,54,211.00
	10% Pension of ICFRE Employees	1,18,34,829.00	1,18,62,324.00
	> Honorarium	2,52,866.00	6,000.00
	> LTC	16,68,137.00	27,77,425.00
	> Children Education Allowance	5,52,150.00	5,12,550.00
	> LSPC	-	-
	> RBI	-	-
	> New Pension Scheme	1,08,98,822.00	1,16,06,954.00
3	Other (specify) Shairng cost > Expenses on K.V.S.	11,10,20,000.00	9,65,12,000.00
4	Contribution to Pension Cell	2,28,02,00,000.00	18,25,86,000.00
	TOTAL	4,18,81,59,141.46	1,93,82,89,927.58
	Add: Prior Period Expenses	-	-
	Add: Salary Payable As on 31.3.24	15,84,62,010.00	14,01,90,694.00
	TOTAL	4,34,66,21,151.46	2,07,84,80,621.58



INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION

P.O. New Forest, Dehradun

SCHEDULES FORMING PART OF INCOME EXPENDITURE ACCOUNT FOR THE YEAR ENDING 31ST MARCH, 2024

Schedule 12B	ADMINISTRATIVE EXPENSES	CURRENT YEAR 31.03.2024	PREVIOUS YEAR 31.03.2023
		RS.	RS.
	Expenses General Grant		
1	Infrastructure	6,16,48,624.15	8,14,20,797.32
	Rent & Taxes	19,48,321.00	2,55,62,887.00
	Electricity & Water Charges	5,55,84,693.15	5,15,08,402.32
	Vehicles Running Expenses (Fuel)	36,59,741.00	34,20,266.00
	Insurance	4,52,639.00	9,12,788.00
	TDS under GST	3,230.00	16,454.00
		-	-
2	Repairs/Maintenance of Infrastructure of Assets	3,11,55,574.00	7,45,31,197.64
	Roads/Buildings (Minor Works)	1,97,99,840.00	6,30,73,224.64
	Plant & Machinery (Scientific Equipment)	5,87,860.00	8,10,597.00
	Furniture & Fixtures	3,36,418.00	1,74,346.00
	Vehicles (Repair)	20,61,517.00	21,46,621.00
	Office/IT Equipment	83,69,939.00	74,04,021.00
	Transfer and rehabilitation of Mohali wild Testing Centre at FRI	-	9,22,388.00
		-	-
3	Communication	36,20,314.00	34,45,053.49
	Postage & Telephone	36,20,314.00	34,45,053.49
4	Others	17,68,16,339.51	20,36,35,330.11
	Newspapers & Periodicals	26,05,158.00	37,52,963.00
	Stationery	15,71,637.00	21,22,659.00
	Travel Expenses -- Domestic-Non-Research (T.E.)	1,18,51,133.00	85,48,780.00
	Legal & Professional Charges	13,47,290.00	31,80,560.00
	Auditor's Remuneration	3,04,702.00	4,52,738.00
	Hospitality Expenses	-	1,47,165.00
	Medicines & Medical Consumables	32,30,401.00	30,70,712.00
	Liveries	1,60,000.00	80,000.00
	Contingency	15,57,46,018.51	18,21,61,728.11
	Direct Recruitment	-	92,015.00
	MSME	-	26,010.00
		-	-
5	Research Expenses	2,85,54,700.00	3,04,99,584.00
	Travel & Conveyance -- Domestic-Research (T.E.)	45,81,059.00	41,45,975.00
	Other Consumables (M&S)	56,77,491.00	32,34,762.00
	Other Research Expenditure (FRE)	95,77,523.00	97,99,491.00
	Fellowship/ Scholarship/ Cash Award	82,31,059.00	1,14,29,218.00
	Maint. of Equipment	(62,304.00)	12,53,640.00
	Others (RAG/RPC Meetings)	5,49,872.00	6,36,498.00
		-	-
6	Extension	29,46,494.33	22,64,119.00
	> Normal	7,20,374.33	3,64,426.00
	> VVK	-	34,438.00
	Advertisement & Publicity	5,62,469.00	7,95,917.00
	Printing & Publication	16,63,651.00	10,69,338.00
		-	-
7	Education Expenses	8,80,932.00	2,62,297.00
	Seminar/ Conferences	7,85,719.00	1,29,377.00
	Human Resource Development	-	3,580.00
	ICFRE Awards	94,564.00	1,29,340.00
8	Bank Charges	649.00	1,708.00
	TOTAL	30,56,22,977.99	39,60,60,086.56
	Less: Prior Period Expenses	-	-
	Add: Expenses Payable As on 31.3.23	-	-
	TOTAL	30,56,22,977.99	39,60,60,086.56



INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION

P.O. New Forest, Dehradun

SCHEDULES FORMING PART OF INCOME EXPENDITURE ACCOUNT FOR THE YEAR ENDING 31ST MARCH, 2024

Schedule 12C	Expenses on Capital Goods	CURRENT YEAR 31.03.2024	PREVIOUS YEAR 31.03.2023
	Purchase Scientific Equipment	35,49,710.00	37,48,532.83
	Purchase Office Equipment	16,67,077.00	22,79,394.66
	Purchase IT Equipment	24,32,228.00	28,76,938.62
	Purchase Furniture	15,58,602.00	3,44,630.00
	Tools	-	18,25,967.00
	Books & Journal	34,909.00	3,36,962.00
	Building	8,53,972.00	5,40,96,440.00
	TOTAL	1,00,96,498.00	6,55,08,865.11
	Less: Prior Period Expenses	-	-
	Add: Expenses Payable As on 31.3.22	-	-
	TOTAL	1,00,96,498.00	6,55,08,865.11

Schedule 12D	Unutilized Grant & Others of Plan	CURRENT YEAR 31.03.2024	PREVIOUS YEAR 31.03.2023
	Unspent Grant For Next Year	8,63,37,148.76	8,76,40,452.98
	Add: Grant Lapsed	81,88,144.00	1,03,167.00
	Add: Transferred to Other Units/Centre	17,14,052.77	5,71,316.00
	Less: Opening Balance of Grant	8,76,40,452.98	10,58,39,509.23
	TOTAL	85,98,892.55	(1,75,24,573.25)



INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION

P.O. New Forest, Dehradun

SCHEDULES FORMING PART OF INCOME EXPENDITURE ACCOUNT FOR THE YEAR ENDING 31ST MARCH, 2024

Schedule 13	EXPENDITURE ON GRANTS (EXTERNALLY AIDED PROJECT)	CURRENT YEAR 31.03.2024	PREVIOUS YEAR 31.03.2023
			RS
1	Grants given to Institutions/Organisations	-	
2	Expenditure of External Aided Project		
	Capital Expenditure- EAP	6,69,60,494.91	9,20,91,941.81
	Revenue Expenditure -EAP	1,06,84,18,826.98	1,46,98,52,048.63
	TOTAL	1,13,53,79,321.89	1,56,19,43,990.44

Schedule 14	OTHER EXPENSES	CURRENT YEAR 31.03.2024	PREVIOUS YEAR 31.03.2023
1	Expenses on Services	36,26,099.84	56,06,909.09
2	Expenses Deemed University	-	1,31,784.00
3	Other Expenses	145.76	3,00,769.02
4	Bank Charges	10,328.20	10,272.71
5	Contribution PHS Scheme	1,51,31,961.00	1,00,00,000.00
6	Contribution to Pension Cell	17,69,82,664.00	18,96,16,982.62
7	Revenue trf to to MOEF- AO ICFRE DDO	-	1,04,466.00
8	Expenses on PHS-ICFRE HQ Pension	1,69,211.00	94,866.00
9	Maint. Of Rest House- SHIMLA	2,87,421.00	5,65,267.00
10	Interest Transfer to HO (MOEF)	68,92,591.40	1,51,37,891.00
11	Bank Interest transferred to D/FRI- PRAYAGRAJ	-	13,474.00
12	Guest House Expenses	36,400.00	-
13	Transfer to Institute	1,39,520.00	-
14	Expenses on Testing Charges	37,72,606.00	6,76,502.00
15	Recruitment Expenses	84,566.00	14,60,569.87
16	Interest Transfer to Funding Agency	11,79,967.44	30,40,181.77
17	Bank Interest sent to Strengthening CAMPA in 4th Main Project	-	14,96,864.00
18	Interest Transfer to icfre	25,55,322.54	26,86,456.00
19	Remitting amt. of bank int. - DEHRADUN PROJECT	-	7,327.00
20	Interest Transfer to EAP	-	-
21	Medical Claim ICFREPHS	1,35,61,075.30	1,90,44,557.40
22	Other Expenses	1,007.60	-
23	Expenses -Student Service Account	1,84,558.00	-
24	Expenses on Chair of Excellence Fund	9,38,509.48	2,24,059.00
25	Expenses DPR - Swarnrekha & Damodar -RANCHI	36,98,000.00	39,26,087.00
26	Expenses Forest Fire Project Fund -RANCHI	-	1,26,519.66
	TOTAL	22,92,51,954.56	25,42,71,805.14



CONSOLIDATED INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION

P.O. New Forest, Dehradun

CONSOLIDATED RECEIPT AND PAYMENT ACCOUNT FOR THE F.Y. 2023-24

RECEIPTS	AMOUNT RS.	T. AMOUNT RS.	PAYMENTS	AMOUNT RS.	T. AMOUNT RS.
Opening Balance of Cash & Bank	1,70,819.00				
Cash in hand	92,45,97,286.65				
Savings Account	54,69,743.00				
Current Account	46,48,01,000.00				
Deposits Account					
Maturity of Fixed Deposits		1,39,50,38,348.65		6,69,60,494.91	25,68,91,186.00
		17,47,70,000.00		1,29,76,70,781.54	
				4,01,11,083.46	
				1,14,21,614.42	1,41,61,63,974.33
Receipt of Grant Money					
PLAN	2,39,06,00,000.00				
EAP	1,22,03,84,100.67				
Others	2,28,02,00,000.00	5,89,11,84,100.67			
Receipts of Interest					
Interest received on Plan Grant & Revenue Account	10,70,01,658.97				
Interest on Income Tax Refund	2,41,180.00				
Receipts from Sale & Services					
Supply of Goods	9,29,65,315.28				
Supply of Services	10,56,69,456.24				
Other Receipts					
FCRA Receipts	2,27,82,754.00				
Income Tax Refund	37,63,830.00				
Utilized Funds, Current Liabilities & Advances	8,08,38,298.02				
		19,86,34,771.52		18,377.00	
		10,72,42,838.97		1,02,12,36,158.94	
				54,69,243.00	
				46,68,01,000.00	
		10,73,84,882.02			
TOTAL		7,87,47,54,941.83	TOTAL		7,87,47,54,941.83

"AS PER OUR SEPARATE REPORT OF EVEN DATE ANNEXED"
FOR M/S PARMITA & COMPANY,
CHARTERED ACCOUNTANTS



(CA PARMITA BHATT)
DATED: 23.10.2024
PLACE: DEHRADUN

KANCHAN DEVI (DIRECTOR GENERAL, ICFRE)

VINAY KUMAR DEPUTY DIRECTOR GENERAL, ADMIN, ICFRE

SUSHANTI KUMAR (ASSISTANT DIRECTOR GENERAL, ADMIN, ICFRE)

BRJESH KUMAR SHARMA, UNDER SECRETARY, BUDGET SECTION (ICFRE)

PENSION CELL ICFRE
P.O NEW FOREST
DEHRADUN

CONSOLIDATED RECEIPT & PAYMENT ACCOUNT FOR THE YEAR ENDING 31ST MARCH, 2024

RECEIPTS	RS.	PAYMENTS	RS.
To opening Balance:		Transfer to AO Account	51,51,90,158.00
Cash at Bank	16,42,60,037.06	Disbursement of Pension/Retiremt benefits	10,47,00,437.00
Amount Received from Budget Section (Grant), ICFRE (Disbursement of Pensionary benefits to C.G. Absorbed Employee)	60,40,50,000.00	Amount Transfer to AO Account No. 496902010089605 for the Disbursement of Pension to the ICFRE appointee pensioners	8,48,04,850.00
Amount Received from Budget Section	1,68,02,00,000.00	Commutation	2,82,53,102.00
Amount Received from DDOs of Institutes On account of Pension Contribution	5,59,81,514.00	Reimbursement to DDOs of Institutes on account of Gratuity	2,43,17,006.00
Pensionary Benefit Received from DDG(Admin), ICFRE On account of revenue	17,69,82,664.00	Transfer to LIC of India	8,50,00,000.00
NPS Contribution of employers:	7,98,69,973.00	Amount paid to NSDL on a/c of NPS Contribution of employer & employees	13,51,75,249.00
NPS Contribution of employees:	5,70,49,980.00	Refund amount to IFGTB	15,660.00
GPF subscription of Employees	15,49,57,434.00	GPF Advance Payment to the Employee(s) as Loan- Asset	1,36,30,254.00
Investment made for purchasing of Govt. Securities/Corporate Banks/Bonds/Mutual Funds	50,82,62,367.07	GPF Part Final Payment to the employee (non refundable)	10,75,37,600.00
FDRs Matured	40,26,00,000.00	GPF Final Payment to the employee(s) at the time of superannuation	8,30,07,311.00
HDFC MF	4,95,00,000.00	GPF TDS of Interest	8,315.00
Account of GSUS Contribution of employees	13,56,345.00	FDRs/ flexi	2,08,92,00,000.00
Received from LIC on a/c of saving fund Claim for retired employees of ICFRE	30,84,693.00	Investment made for purchasing of Govt. Securities/Corporate Banks/Bonds/Mutual Funds	55,78,62,367.07
Pensioner's Contribution	13,45,600.00	GSUS/GINP contribution of ICFRE Employees to LIC	13,46,348.00
Grant received (Rev.)	1,50,00,000.00	Accrued interest as on 31.03.2024	4,62,24,791.00
Amount received from selling of Govt. Securities	99,34,532.00	Paid to saving claim fund of retired employees	31,96,069.00
Interest Received on Govt. Security's	4,03,50,993.52	Advance FRI,ICFRE & other Institute	1,59,30,000.00
Interest FDR	2,96,00,037.00	FDR made	2,12,00,000.00
Bank Interest Received	23,44,938.00	SMS Charges	181.83
Accrued Interest	4,62,24,791.00	By Closing Balance:	
Recovery of Excess Payment Received, asset recovery	3,14,877.00	Cash at Bank	16,66,71,076.75
TOTAL	4,08,32,70,775.65	TOTAL	4,08,32,70,775.65

RANCHAN DEVI (DIRECTOR GENERAL, ICFRE)

VINAY KUMAR (DEPUTY DIRECTOR GENERAL, ADMIN, ICFRE)

SUSHANT KUMAR (ASSISTANT DIRECTOR GENERAL, ADMIN, ICFRE)

BRIJESH KUMAR SHARMA, (UNDER SECRETARY, BUDGET SECTION ICFRE)

"AS PER OUR SEPARATE REPORT OF EVEN DATE ANNEXED" FOR M/S PARMITA & COMPANY, CHARTERED ACCOUNTANTS



(CA PARMITA BHATT)
PROP. M. NO. 078018, FRN 0008751C
DATED: 23.10.2024
PLACE: DEHRADUN

CENTRAL GOVERNMENT EMPLOYEE PENSION ACCOUNT

ICFRE, P.O NEW FOREST
DEHRADUN

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31st MARCH, 2024

INCOME	SCHEDULE	CURRENT YEAR 31.03.2024	PREVIOUS YEAR 31.03.2023
		Rs.	R.s
INTEREST EARNED	4	12,59,863.00	2,01,527.00
TOTAL (A)		12,59,863.00	2,01,527.00

EXPENDITURE	SCHEDULE	CURRENT YEAR 31.03.2024	PREVIOUS YEAR 31.03.2023
		Rs.	R.s
OTHER EXPENSES		26.21	-
TOTAL(B)		26.21	-
EXCESS OF INCOME OVER EXPENDITURE TFD		12,59,836.79	2,01,527.00



Under Secretary Pension Cell, ICFRE

Under Secretary
Pension Cell
ICFRE, Dehradun

FOR M/S PARMITA & COMPANY,
CHARTERED ACCOUNTANTS



(CA PARMITA BHATT)
PROP., M. NO. 078018, FRN 0008751C

DATED:23.10.2024
PLACE: DEHRADUN

PENSION FUND ACCOUNT(PRIOR TO NPS)ICFRE, P.O NEW FOREST
DEHRADUN**INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31st MARCH, 2024**

INCOME	SCHEDULE	CURRENT YEAR	PREVIOUS YEAR
		31.03.2024	31.03.2023
		Rs.	R.s
INTEREST EARNED	4	3,11,24,374.00	14,99,207.00
TOTAL (A)		3,11,24,374.00	14,99,207.00

EXPENDITURE	SCHEDULE	CURRENT YEAR	PREVIOUS YEAR
		31.03.2024	31.03.2023
		Rs.	R.s
OTHER EXPENSES		38.06	-
TOTAL(B)		38.06	-
EXCESS OF INCOME OVER EXPENDITURE TFD		3,11,24,335.94	14,99,207.00


Under Secretary Pension Cell, ICFRE

Under Secretary
Pension Cell
ICFRE, Dehradun

FOR M/S PARMITA & COMPANY,
CHARTERED ACCOUNTANTS



(CA PARMITA BHATT)
PROP., M. NO. 078018, FRN 0008751C

DATED:23.10.2024
PLACE: DEHRADUN

NATIONAL PENSION SCHEME (NPS)

ICFRE, P.O NEW FOREST
DEHRADUN

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31st MARCH, 2024

INCOME	SCHEDULE	CURRENT YEAR 31.03.2024	PREVIOUS YEAR 31.03.2023
		Rs.	R.s
INTEREST EARNED	3	3,97,767.00	3,96,494.00
TOTAL (A)		3,97,767.00	3,96,494.00

EXPENDITURE	SCHEDULE	CURRENT YEAR 31.03.2024	PREVIOUS YEAR 31.03.2023
		Rs.	R.s
OTHER EXPENSES		37.01	1,003.00
TOTAL(B)		37.01	1,003.00
EXCESS OF INCOME OVER EXPENDITURE TFD		3,97,729.99	3,95,491.00


Under Secretary Pension Cell, ICFRE

Under Secretary
Pension Cell
ICFRE, Dehradun

FOR M/S PARMITA & COMPANY,
CHARTERED ACCOUNTANTS



(CA PARMITA BHATT)
PROP., M. NO. 078018, FRN 0008751C

DATED: 23.10.2024
PLACE: DEHRADUN


General Provident Fund Cum Pension Scheme (GPF)

ICFRE, P.O NEW FOREST
DEHRADUN

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31st MARCH, 2024

INCOME	SCHEDULE	CURRENT YEAR 31.03.2024	PREVIOUS YEAR 31.03.2023
		Rs.	R.s
INTEREST EARNED	6	7,22,54,535.52	5,11,26,871.51
TOTAL (A)		7,22,54,535.52	5,11,26,871.51

EXPENDITURE	SCHEDULE	CURRENT YEAR 31.03.2024	PREVIOUS YEAR 31.03.2023
		Rs.	R.s
OTHER EXPENSES	7	65,508.42	
TOTAL(B)		65,508.42	-
EXCESS OF INCOME OVER EXPENDITURE TFD		7,21,89,027.10	5,11,26,871.51


Under Secretary Pension Cell, ICFRE

Under Secretary
Pension Cell
ICFRE, Dehradun

FOR M/S PARMITA & COMPANY,
CHARTERED ACCOUNTANTS




(CA PARMITA BHATT)
PROP., M. NO. 078018, FRN 0008751C

DATED: 23.10.2024
PLACE: DEHRADUN

GROUP SAVINGS LINKED INSURANCE SCHEME (GSLIS)

ICFRE, P.O NEW FOREST
DEHRADUN

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31st MARCH, 2024

INCOME	SCHEDULE	CURRENT YEAR 31.03.2024	PREVIOUS YEAR 31.03.2023
		Rs.	R.s
INTEREST EARNED	4	49,496.00	71,022.00
TOTAL (A)		49,496.00	71,022.00

EXPENDITURE	SCHEDULE	CURRENT YEAR 31.03.2024	PREVIOUS YEAR 31.03.2023
		Rs.	R.s
OTHER EXPENSES	5	39.83	-
TOTAL(B)		39.83	-
EXCESS OF INCOME OVER EXPENDITURE TFD		49,456.17	71,022.00

FOR M/S PARMITA & COMPANY,
CHARTERED ACCOUNTANTS

[Signature]
Under Secretary Pension Cell, ICFRE

Under Secretary
Pension Cell
ICFRE, Dehradun

(CA PARMITA BHATT)
PROP., M. NO. 078018, FRN 0008751C

DATED: 23.10.2024
PLACE: DEHRADUN

ICFRE PENSIONER HEALTH SCHEME (PHS)ICFRE, P.O NEW FOREST
DEHRADUN**INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31st MARCH, 2024**

INCOME	SCHEDULE	CURRENT YEAR 31.03.2024	PREVIOUS YEAR 31.03.2023
		Rs.	Rs.
INTEREST EARNED	3	24,92,041.00	28,72,360.00
TOTAL (A)		24,92,041.00	28,72,360.00

EXPENDITURE	SCHEDULE	CURRENT YEAR 31.03.2024	PREVIOUS YEAR 31.03.2023
		Rs.	Rs.
OTHER EXPENSES	4	0.30	-
TOTAL(B)		0.30	-
EXCESS OF INCOME OVER EXPENDITURE TFD TO FUND ACCOUNT	(A+B)	24,92,040.70	28,72,360.00


FOR M/S PARMITA & COMPANY,
CHARTERED ACCOUNTANTS

(CA PARMITA BHATT)

PROP., M. NO. 078018, FRN 0008751C

DATED: 23.10.2024

PLACE: DEHRADUN


Under Secretary Pension Health Scheme, ICFRE
Under Secretary
Pension Cell
ICFRE, Dehradun

ACCOUNT SECTION ICFRE (Hqtr.)
(A Unit of Indian Council of Forestry Research and Education)
DEHRADUN

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2024

INCOME	SCHEDULE	CURRENT YEAR	PREVIOUS YEAR
		31.03.2024	31.03.2023
		Rs.	R.s
SUPPLY OF GOODS/SERVICES	8	79,52,608.67	3,21,32,536.00
GRANT RECEIVED	9	69,82,21,079.97	1,18,47,77,180.67
INTEREST EARNED	10	90,32,759.77	1,22,88,145.64
OTHER INCOME	11	-	-
TOTAL (A)		71,52,06,448.41	1,22,91,97,862.31

EXPENDITURE	SCHEDULE	CURRENT YEAR	PREVIOUS YEAR
		31.03.2024	31.03.2023
		Rs.	R.s
EXPENDITURE ON GRANTS (PLAN)			
Establishment Expenses	12A	17,77,07,727.73	15,47,69,383.00
Other Administrative Expenses, etc	12B	4,90,98,377.72	4,92,74,030.49
Capital Expenses	12C	12,39,500.00	2,42,231.00
EXPENDITURE ON GRANTS (EAP)	13	47,01,75,474.52	98,04,91,536.18
OTHER EXPENSES	14	55,30,012.20	1,42,99,257.00
DEPRECIATION ON FIXED ASSETS	5	-	-
TOTAL(B)		70,37,51,092.17	1,19,90,76,437.67
EXCESS OF INCOME OVER EXPENDITURE (A-B)		1,14,55,356.24	3,01,21,424.64

(Account Officer)
ACCOUNT SECTION ICFRE
DEHRADUN

लेखा अधिकारी
भा.व.अ.शि.प.
देहरादून

FOR M/S PARMITA & COMPANY,
CHARTERED ACCOUNTANTS
Dehradun
(CA PARMITA BHATT)
PROP., M. NO. 078018, FRN 0008751C

DATED: 23.10.2024
PLACE: DEHRADUN

VAN VIGYAN BHAWAN
(A Unit of Indian Council of Forestry Research and Education)
NEW DELHI

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2024

INCOME	SCHEDULE	CURRENT YEAR	PREVIOUS YEAR
		31.03.2024	31.03.2023
		Rs.	R.s
SUPPLY OF GOODS/SERVICES	8	45,03,108.00	38,87,594.00
GRANT RECEIVED	9	25,98,964.00	19,97,225.89
INTEREST EARNED	10	2,23,095.00	1,61,180.00
OTHER INCOME	11	-	-
TOTAL (A)		73,25,167.00	60,45,999.89

EXPENDITURE	SCHEDULE	CURRENT YEAR	PREVIOUS YEAR
		31.03.2024	31.03.2023
		Rs.	R.s
EXPENDITURE ON GRANTS (PLAN)			
Establishment Expenses	12A	-	-
Other Administrative Expenses, etc	12B	20,00,019.00	16,89,225.89
Capital Expenses	12C	5,98,945.00	1,08,000.00
EXPENDITURE ON GRANTS (EAP)	13	-	2,00,000.00
OTHER EXPENSES	14	9,45,143.50	10,04,437.61
DEPRECIATION ON FIXED ASSETS	5	-	-
TOTAL(B)		35,44,107.50	30,01,663.50
EXCESS OF INCOME OVER EXPENDITURE (A-B)		37,81,059.50	30,44,336.39


(Resident Director)
VAN VIGYAN BHAWAN
NEW DELHI

Resident Director
Van Vigyan Bhawan (ICFRE)

FOR M/S PARMITA & COMPANY,
CHARTERED ACCOUNTANTS

(CA PARMITA BHATT)
PROP., M. NO. 078018, FRN 0008751C

DATED:23.10.2024
PLACE: DEHRADUN

ICFRE-FOREST RESEARCH INSTITUTE (PLAN)

(A Unit of Indian Council of Forestry Research and Education)
DEHRADUN

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2024

INCOME	SCHEDULE	CURRENT YEAR	PREVIOUS YEAR
		31.03.2024	31.03.2023
		Rs.	Rs.
SUPPLY OF GOODS/SERVICES	8	4,07,03,704.14	3,07,57,703.14
GRANT RECEIVED	9	78,32,72,131.00	80,35,34,903.00
INTEREST EARNED	10	6,42,944.00	4,77,278.00
OTHER INCOME	11	-	-
TOTAL (A)		82,46,18,779.14	83,47,69,884.14

EXPENDITURE	SCHEDULE	CURRENT YEAR	PREVIOUS YEAR
		31.03.2024	31.03.2023
		Rs.	Rs.
EXPENDITURE ON GRANTS (PLAN)			
Establishment Expenses	12A	61,84,43,784.00	56,13,90,495.00
Other Administrative Expenses, etc	12B	11,15,87,285.00	17,88,68,081.00
Capital Expenses	12C	13,38,959.00	4,62,71,505.00
EXPENDITURE ON GRANTS (EAP)	13	4,03,09,250.00	-
OTHER EXPENSES	14	1,17,93,999.00	1,72,80,783.00
DEPRECIATION ON FIXED ASSETS	5	-	-
TOTAL (B)		78,34,73,277.00	80,38,10,864.00
EXCESS OF INCOME OVER EXPENDITURE (A-B)		4,11,45,502.14	3,09,59,020.14

(Director of वन अनुसंधान संस्थान/F.R.I. देहरादून/Dehradun)

(Account Officer)
ICFRE-FOREST RESEARCH INSTITUTE (PLAN)
DEHRADUN

सहायक अधिकारी/Accounts Officer
वन अनुसंधान संस्थान/FRI
देहरादून/Dehradun

Group Coordinator (Research)
Forest Research Institute
Dehradun

FOR M/S PARMITA & COMPANY,
CHARTERED ACCOUNTANTS



(CA PARMITA BHATT)

PROP., M. NO. 078018, FRN 0008751C

DATED: 23.10.2024
PLACE: DEHRADUN

ICFRE-FOREST RESEARCH INSTITUTE(PROJECT SECTION)

(A Unit of Indian Council of Forestry Research and Education)
DEHRADUN

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2024

INCOME	SCHEDULE	CURRENT YEAR	PREVIOUS YEAR
		31.03.2024	31.03.2023
		Rs.	R.s
SUPPLY OF GOODS/SERVICES	8	53,35,631.64	82,17,464.74
GRANT RECEIVED	9	16,57,02,160.30	10,18,88,627.46
INTEREST EARNED	10	36,56,429.12	35,84,354.00
OTHER INCOME	11	-	-
TOTAL (A)		17,46,94,221.06	11,36,90,446.20

EXPENDITURE	SCHEDULE	CURRENT YEAR	PREVIOUS YEAR
		31.03.2024	31.03.2023
		Rs.	R.s
EXPENDITURE ON GRANTS (PLAN)			
Establishment Expenses	12A	-	-
Other Administrative Expenses, etc	12B	-	-
Capital Expenses	12C	-	-
EXPENDITURE ON GRANTS (EAP)	13	16,57,02,160.30	10,18,88,627.46
OTHER EXPENSES	14	14,21,125.00	21,45,927.00
DEPRECIATION ON FIXED ASSETS	5	-	-
TOTAL(B)		16,71,23,285.30	10,40,34,554.46
EXCESS OF INCOME OVER EXPENDITURE (A-B)		75,70,935.76	96,55,891.74

Mogulley
Director
(Director of the Institute)
Dehra Dun-248 001

30/10/24
सिद्ध संन्ययक
(अनुसंधान)
वन अनुसंधान संस्थान, देहरादून

30/10
(Drawing & Disbursement Officer)
ICFRE-FOREST RESEARCH INSTITUTE(PROJECT SECTION)
DEHRADUN

लेखा अधिकारी
Accounts Officer
वन अनुसंधान संस्थान, देहरादून
Forest Research Institute, Dehradun

FOR M/S PARMITA & COMPANY,
CHARTERED ACCOUNTANTS

(CA PARMITA BHATT)

PROP., M. NO. 078018, FRN 0008751C

DATED:23.10.2024

PLACE: DEHRADUN

ICFRE-ECO-REHABILITATION CENTRE


(A Unit of Indian Council of Forestry Research and Education)
PRAYAGRAJ

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2024

INCOME	SCHEDULE	CURRENT YEAR	PREVIOUS YEAR
		31.03.2024	31.03.2023
		Rs.	R.s
SUPPLY OF GOODS/SERVICES	8	1,26,380.00	30,975.00
GRANT RECEIVED	9	76,42,011.64	2,70,84,041.13
INTEREST EARNED	10	55,099.00	45,308.00
OTHER INCOME	11	-	-
TOTAL (A)		78,23,490.64	2,71,60,324.13

EXPENDITURE	SCHEDULE	CURRENT YEAR	PREVIOUS YEAR
		31.03.2024	31.03.2023
		Rs.	R.s
EXPENDITURE ON GRANTS (PLAN)			
Establishment Expenses	12A	-	1,96,57,579.00
Other Administrative Expenses, etc	12B	44,03,148.66	37,45,680.61
Capital Expenses	12C	-	7,18,959.00
EXPENDITURE ON GRANTS (EAP)	13	32,38,862.98	29,61,822.52
OTHER EXPENSES	14	46,417.00	42,272.10
DEPRECIATION ON FIXED ASSETS	5	-	-
TOTAL(B)		76,88,428.64	2,71,26,313.23
EXCESS OF INCOME OVER EXPENDITURE (A-B)		1,35,062.00	34,010.90


(Head of the Institute)


(Drawing & Disbursement Officer)
ICFRE-ECO-REHABILITATION CENTRE
PRAYAGRAJ

D.D.O.
ICFRE-Eco Rehabilitation Centre
Prayagraj

FOR M/S PARMITA & COMPANY,
CHARTERED ACCOUNTANTS

(CA PARMITA BHATT)

PROP., M. NO. 078018, FRN 0008751C

DATED: 23.10.2024

PLACE: DEHRADUN

ICFRE-INSTITUTE OF FOREST GENETICS & TREE BREEDING

(A Unit of Indian Council of Forestry Research and Education)
COIMBATORE

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2024

INCOME	SCHEDULE	CURRENT YEAR	PREVIOUS YEAR
		31.03.2024	31.03.2023
		Rs.	R.s
SUPPLY OF GOODS/SERVICES	8	7,22,39,973.34	1,19,45,674.52
GRANT RECEIVED	9	37,27,53,405.43	34,32,22,730.75
INTEREST EARNED	10	14,30,832.00	11,74,500.00
OTHER INCOME	11	-	-
TOTAL (A)		44,64,24,210.77	35,63,42,905.27

EXPENDITURE	SCHEDULE	CURRENT YEAR	PREVIOUS YEAR
		31.03.2024	31.03.2023
		Rs.	R.s
EXPENDITURE ON GRANTS (PLAN)			
Establishment Expenses	12A	21,64,53,431.93	19,77,28,758.00
Other Administrative Expenses, etc	12B	2,00,08,000.00	2,38,87,654.00
Capital Expenses	12C	10,00,000.00	11,50,102.00
EXPENDITURE ON GRANTS (EAP)	13	13,52,91,973.50	11,94,02,877.75
OTHER EXPENDITURE ON GRANTS	14	20,79,363.23	39,66,449.59
DEPRECIATION ON FIXED ASSETS	5		
TOTAL(B)		37,48,32,768.66	34,61,35,841.34
EXCESS OF INCOME OVER EXPENDITURE (A-B)		7,15,91,442.11	1,02,07,063.93

Kus
28/10/2024
(Director of the Institute)

N.C.F.
(Drawing & Disbursement Officer)
ICFRE-INSTITUTE OF FOREST GENETICS & TREE BREEDING
COIMBATORE

FOR M/S PARMITA & COMPANY,
CHARTERED ACCOUNTANTS
Parmita Bhatt
(CA PARMITA BHATT)
PROP., M. NO. 078018, FRN 0008751C


ICFRE-INSTITUTE OF WOOD SCIENCE & TECHNOLOGY


(A Unit of Indian Council of Forestry Research and Education)
BENGALURU

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2024

INCOME	SCHEDULE	CURRENT YEAR	PREVIOUS YEAR
		31.03.2024	31.03.2023
		Rs.	Rs.
SUPPLY OF GOODS/SERVICES	8	3,38,15,140.00	1,40,53,756.00
GRANT RECEIVED	9	39,90,93,885.00	29,20,80,097.00
INTEREST EARNED	10	7,69,77,163.00	12,28,287.00
OTHER INCOME	11	-	-
TOTAL (A)		50,98,86,188.00	30,73,62,140.00

EXPENDITURE	SCHEDULE	CURRENT YEAR	PREVIOUS YEAR
		31.03.2024	31.03.2023
		Rs.	Rs.
EXPENDITURE ON GRANTS (PLAN)			
Establishment Expenses	12A	26,88,68,321.00	18,65,32,447.00
Other Administrative Expenses, etc	12B	3,04,88,957.00	3,52,89,726.00
Capital Expenses	12C	29,77,551.00	1,20,34,181.00
EXPENDITURE ON GRANTS (EAP)	13	9,58,84,662.00	5,77,75,131.00
OTHER EXPENSES	14	52,05,530.00	20,28,908.00
DEPRECIATION ON FIXED ASSETS	5	-	-
TOTAL(B)		40,34,25,021.00	29,36,60,393.00
EXCESS OF INCOME OVER EXPENDITURE (A-B)		10,64,61,167.00	1,37,01,747.00

(Director of the Institute) 
Institute of Wood Science & Technology
Street 7, Aerospace, IND 013

Drawn by 
(Drawing & Disbursement Officer)
ICFRE-INSTITUTE OF WOOD SCIENCE & TECHNOLOGY
BENGALURU

FOR M/S PARMITA & COMPANY,
CHARTERED ACCOUNTANTS


(CA PARMITA BHATT)
PROP., M. NO. 078018, FRN 0008751C

DATED: 23.10.2024
PLACE: DEHRADUN

ICFRE-TROPICAL FOREST RESEARCH INSTITUTE
(A Unit of Indian Council of Forestry Research and Education)
JABALPUR

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2024

INCOME	SCHEDULE	CURRENT YEAR 31.03.2024	PREVIOUS YEAR 31.03.2023
		Rs.	R.s
SUPPLY OF GOODS/SERVICES	8	44,02,709.22	34,92,459.81
GRANT RECEIVED	9	27,83,06,115.19	30,51,14,050.72
INTEREST EARNED	10	-3,81,742.32	18,74,815.00
OTHER INCOME	11	-	-
TOTAL (A)		28,23,27,082.09	31,04,81,325.53

EXPENDITURE	SCHEDULE	CURRENT YEAR 31.03.2024	PREVIOUS YEAR 31.03.2023
		Rs.	R.s
EXPENDITURE ON GRANTS (PLAN)			
Establishment Expenses	12A	20,39,72,929.34	17,56,27,986.00
Other Administrative Expenses, etc	12B	1,74,52,512.68	2,14,97,463.00
Capital Expenses	12C	7,25,997.00	98,960.00
EXPENDITURE ON GRANTS (EAP)	13	5,51,72,301.87	10,67,21,992.72
OTHER EXPENSES	14	10,56,567.31	18,60,727.00
DEPRECIATION ON FIXED ASSETS	5	-	-
TOTAL(B)		27,83,80,308.20	30,58,07,128.72
EXCESS OF INCOME OVER EXPENDITURE (A-B)		39,46,773.89	46,74,196.81

(Director of the Institute)


निदेशक
Director

उष्णकटिबंधीय वन अनुसंधान संस्थान
Tropical Forest Research Institute
जबलपुर (म.प्र.)/Jabalpur (M.P.)

(Drawing & Disbursement Officer)

ICFRE-TROPICAL FOREST RESEARCH INSTITUTE
JABALPUR


D.D.O.
T.F.R.I., JABALPUR

FOR M/S PARMITA & COMPANY,
CHARTERED ACCOUNTANTS




(CA PARMITA BHATT)
PROP., M. NO. 078018, FRN 0008751C

DATED:23.10.2024

PLACE: DEHRADUN

ICFRE-SKILL DEVELOPMENT CENTRE
(A Unit of Indian Council of Forestry Research and Education)
CHHINDWARA

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2024

INCOME	SCHEDULE	CURRENT YEAR 31.03.2024	PREVIOUS YEAR 31.03.2023
		Rs.	R.s
SUPPLY OF GOODS/SERVICES	8	5,48,687.00	2,14,604.00
GRANT RECEIVED	9	35,16,838.94	1,59,04,140.96
INTEREST EARNED	10	10,961.00	42,471.00
OTHER INCOME	11	-	-
TOTAL (A)		40,76,486.94	1,61,61,215.96

EXPENDITURE	SCHEDULE	CURRENT YEAR 31.03.2024	PREVIOUS YEAR 31.03.2023
		Rs.	R.s
EXPENDITURE ON GRANTS (PLAN)			
Establishment Expenses	12A	-	1,18,59,477.00
Other Administrative Expenses, etc	12B	15,09,115.00	13,99,976.00
Capital Expenses	12C	1,02,901.00	22,343.00
EXPENDITURE ON GRANTS (EAP)	13	19,04,822.94	26,22,344.96
OTHER EXPENSES	14	9,514.00	41,714.00
DEPRECIATION ON FIXED ASSETS	5	-	-
TOTAL(B)		35,26,352.94	1,59,45,854.96
EXCESS OF INCOME OVER EXPENDITURE (A-B)		5,50,134.00	2,15,361.00

Om
 वैज्ञानिक प्रभारी/ Scientist Incharge
 भा. व. प्र. शिक्षण संस्थान चिन्डवाड़ा (म.प्र.)
 (Head of the Centre)
 I.C.F.R.E; S.D.C. CHHINDWARA (M.P.)

Om
 (Drawing & Disbursement Officer)
ICFRE-SKILL DEVELOPMENT CENTRE
CHHINDWARA D.D.O.
 I.C.F.R.E.- S.D.C.
 CHHINDWARA (M.P.)

FOR M/S PARMITA & COMPANY,
 CHARTERED ACCOUNTANTS
 Dehradun
 (CA PARMITA BHATT)
 PROP., M. NO. 078018, FRN 0008751C


DATED: 23.10.2024
 PLACE: DEHRADUN

ICFRE-ARID FOREST RESEARCH INSTITUTE
(A Unit of Indian Council of Forestry Research and Education)
JODHPUR

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2024

INCOME	SCHEDULE	CURRENT YEAR	PREVIOUS YEAR
		31.03.2024	31.03.2023
		Rs.	R.s
SUPPLY OF GOODS/SERVICES	8	1,20,55,375.39	1,20,89,152.00
GRANT RECEIVED	9	20,15,31,760.92	20,63,90,800.13
INTEREST EARNED	10	3,83,144.81	8,70,882.00
OTHER INCOME	11	-	-
TOTAL (A)		21,39,70,281.12	21,93,50,834.13

EXPENDITURE	SCHEDULE	CURRENT YEAR	PREVIOUS YEAR
		31.03.2024	31.03.2023
		Rs.	R.s
EXPENDITURE ON GRANTS (PLAN)			
Establishment Expenses	12A	14,60,08,860.00	13,88,25,235.00
Other Administrative Expenses, etc	12B	2,18,02,794.00	2,59,98,656.00
Capital Expenses	12C	3,65,807.00	6,11,943.00
EXPENDITURE ON GRANTS (EAP)	13	3,33,54,299.92	4,09,54,966.13
OTHER EXPENSES	14	4,73,409.05	6,68,097.00
DEPRECIATION ON FIXED ASSETS	5	-	-
TOTAL(B)		20,20,05,169.97	20,70,58,897.13
EXCESS OF INCOME OVER EXPENDITURE (A-B)		1,19,65,111.15	1,22,91,937.00


(Director of the Institute)


(Drawing & Disbursement Officer)
ICFRE-ARID FOREST RESEARCH INSTITUTE
JODHPUR

FOR M/S PARMITA & COMPANY,
CHARTERED ACCOUNTANTS



(CA PARMITA BHATT)
PROP., M. NO. 078018, FRN 0008751C

DATED: 23.10.2024
PLACE: DEHRADUN

ICFRE-HIMALAYAN FOREST RESEARCH INSTITUTE

(A Unit of Indian Council of Forestry Research and Education)
SHIMLA

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2024

INCOME	SCHEDULE	CURRENT YEAR	PREVIOUS YEAR
		31.03.2024	31.03.2023
		Rs.	R.s
SUPPLY OF GOODS/SERVICES	8	14,07,012.64	31,65,064.80
GRANT RECEIVED	9	14,28,28,203.11	15,22,83,105.50
INTEREST EARNED	10	3,91,444.59	7,59,858.54
OTHER INCOME	11	-	-
TOTAL (A)		14,46,26,660.34	15,62,08,028.84

EXPENDITURE	SCHEDULE	CURRENT YEAR	PREVIOUS YEAR
		31.03.2024	31.03.2023
		Rs.	R.s
EXPENDITURE ON GRANTS (PLAN)			
Establishment Expenses	12A	9,98,66,667.00	9,90,70,055.00
Other Administrative Expenses, etc	12B	96,73,502.34	1,31,45,000.00
Capital Expenses	12C	6,02,136.00	23,65,006.00
EXPENDITURE ON GRANTS (EAP)	13	3,26,24,647.77	3,76,08,178.50
OTHER EXPENSES	14	6,03,641.34	13,41,097.36
DEPRECIATION ON FIXED ASSETS	5	-	-
TOTAL(B)		14,33,70,594.45	15,35,29,336.86
EXCESS OF INCOME OVER EXPENDITURE (A-B)		12,56,065.89	26,78,691.98

(Director of the Institute)
 हिमालयन फॉरेस्ट रिसर्च इंस्टीट्यूट
 Shimla-171013

(Drawing & Disbursement Officer)

ICFRE-HIMALAYAN FOREST RESEARCH INSTITUTE
 SHIMLA

ड्रॉइंग एवं डिस्पेंसिंग अधिकारी
 Drawing & Disbursing Officer
 भारतीय वन्यजीव-विरासत विभाग (ICFRE)
 ICFRE- HFRI, Shimla (H.P.)

FOR M/S PARMITA & COMPANY,
 CHARTERED ACCOUNTANTS



(CA PARMITA BHATT)

PROP., M. NO. 078018, FRN 0008751C

DATED: 23.10.2024


PLACE: DEHRADUN


ICFRE-INSTITUTE OF FOREST PRODUCTIVITY
(A Unit of Indian Council of Forestry Research and Education)
RANCHI

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2024

INCOME	SCHEDULE	CURRENT YEAR	PREVIOUS YEAR
		31.03.2024	31.03.2023
		Rs.	R.s
SUPPLY OF GOODS/SERVICES	8	52,63,780.95	26,53,993.22
GRANT RECEIVED	9	16,27,29,874.02	16,08,50,564.88
INTEREST EARNED	10	6,82,635.91	13,99,882.39
OTHER INCOME	11	-	-
TOTAL (A)		16,86,76,290.88	16,49,04,440.49

EXPENDITURE	SCHEDULE	CURRENT YEAR	PREVIOUS YEAR
		31.03.2024	31.03.2023
		Rs.	R.s
EXPENDITURE ON GRANTS (PLAN)			
Establishment Expenses	12A	10,07,59,561.00	10,27,83,554.57
Other Administrative Expenses, etc	12B	92,34,986.15	1,01,51,165.94
Capital Expenses	12C	5,00,790.00	6,87,488.28
EXPENDITURE ON GRANTS (EAP)	13	4,74,86,573.39	4,27,71,908.03
OTHER EXPENSES	14	50,48,100.53	61,20,433.94
DEPRECIATION ON FIXED ASSETS	5	-	-
TOTAL(B)		16,30,30,011.17	16,25,14,590.76
EXCESS OF INCOME OVER EXPENDITURE (A-B)		56,46,279.71	23,89,849.73


 (Director of the Institute)
 Director
 Institute of Forest Productivity
 Ranchi-835303


 (Drawing & Disbursement Officer)
ICFRE-INSTITUTE OF FOREST PRODUCTIVITY
RANCHI
 DRAWING & DISBURSEMENT OFFICER
 ICFRE-IFP
 RANCHI-JHARKHAND-835303

FOR M/S PARMITA & COMPANY,
 CHARTERED ACCOUNTANTS

 (CA PARMITA BHATT)
 PROP., M. NO. 078C18, FRN 0008751C

DATED: 23.10.2024
 PLACE: DEHRADUN


ICFRE-INSTITUTE OF FOREST BIODIVERSITY
(A Unit of Indian Council of Forestry Research and Education)
HYDERABAD


INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2024

INCOME	SCHEDULE	CURRENT YEAR	PREVIOUS YEAR
		31.03.2024	31.03.2023
		Rs.	R.s
SUPPLY OF GOODS/SERVICES	8	5,38,155.37	3,09,549.41
GRANT RECEIVED	9	7,74,67,196.88	8,40,99,693.60
INTEREST EARNED	10	2,27,299.00	6,52,931.00
OTHER INCOME	11	-	-
TOTAL (A)		7,82,32,651.25	8,50,62,174.01

EXPENDITURE	SCHEDULE	CURRENT YEAR	PREVIOUS YEAR
		31.03.2024	31.03.2023
		Rs.	R.s
EXPENDITURE ON GRANTS (PLAN)			
Establishment Expenses	12A	5,30,53,674.46	5,70,50,861.01
Other Administrative Expenses, etc	12B	90,58,220.33	78,50,709.00
Capital Expenses	12C	4,99,987.00	1,15,000.00
EXPENDITURE ON GRANTS (EAP)	13	1,47,47,354.09	1,89,56,239.59
OTHER EXPENSES	14	1,41,345.42	8,71,432.40
DEPRECIATION ON FIXED ASSETS	5	-	-
TOTAL(B)		7,75,00,581.30	8,48,44,242.00
EXCESS OF INCOME OVER EXPENDITURE (A-B)		7,32,069.95	2,17,932.01


(Director of the Institute)


(Drawing & Disbursement Officer)
ICFRE-INSTITUTE OF FOREST BIODIVERSITY
HYDERABAD

FOR M/S PARMITA & COMPANY,
CHARTERED ACCOUNTANTS

(CA PARMITA BHATT)
PROP., M. NO. 078018, FRN 0008751C

DATED: 23.10.2024
PLACE: DEHRADUN

ICFRE-COASTAL ECOSYSTEM CENTRE

(A Unit of Indian Council of Forestry Research and Education)
VISHAKHAPATNAM

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2024

INCOME	SCHEDULE	CURRENT YEAR	PREVIOUS YEAR
		31.03.2024	31.03.2023
		Rs.	R.s
SUPPLY OF GOODS/SERVICES	8	-	-
GRANT RECEIVED	9	15,55,801.68	16,48,208.46
INTEREST EARNED	10	6,713.00	8,595.00
OTHER INCOME	11	-	-
TOTAL (A)		15,62,514.68	16,56,803.46

EXPENDITURE	SCHEDULE	CURRENT YEAR	PREVIOUS YEAR
		31.03.2024	31.03.2023
		Rs.	R.s
EXPENDITURE ON GRANTS (PLAN)			
Establishment Expenses	12A	-	-
Other Administrative Expenses, etc	12B	13,43,951.06	11,99,815.63
Capital Expenses	12C	-	2,99,986.83
EXPENDITURE ON GRANTS (EAP)	13	2,11,850.62	1,48,406.00
OTHER EXPENSES	14	16,718.00	-
DEPRECIATION ON FIXED ASSETS	5	-	-
TOTAL (B)		15,72,519.68	16,48,208.46
EXCESS OF INCOME OVER EXPENDITURE (A-B)		-10,005.00	8,595.00

ICFRE-CEC (Coastal Ecosystem Centre) विशाखपट्टनम - तमिळुनाडु, भारत
 Indian Council of Forestry Research and Education
 Ministry of Environment, Forest & Climate Change, Government of India
 via Vengal Rao Road, Andhra University East Gate, Visakhapatnam
 Andhra Pradesh, India - 530 015

(Head of the Institute)

(Drawing & Disbursement Officer)
 ICFRE-COASTAL ECOSYSTEM CENTRE
 VISHAKHAPATNAM

FOR M/S PARMITA & COMPANY,
 CHARTERED ACCOUNTANTS



(CA PARMITA BHATT)

PROP., M. NO. 078018, FRN 0008751C

DATED: 23.10.2024

PLACE: DEHRADUN

ICFRE-RAIN FOREST RESEARCH INSTITUTE
(A Unit of Indian Council of Forestry Research and Education)
JORHAT

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2024

INCOME	SCHEDULE	CURRENT YEAR 31.03.2024	PREVIOUS YEAR 31.03.2023
		Rs.	Rs.
SUPPLY OF GOODS/SERVICES	8	91,13,137.16	1,18,86,535.00
GRANT RECEIVED	9	23,30,10,191.21	23,94,14,532.60
INTEREST EARNED	10	7,53,974.09	20,17,483.00
OTHER INCOME	11	-	-
TOTAL (A)		24,28,77,302.46	25,33,18,550.60

EXPENDITURE	SCHEDULE	CURRENT YEAR 31.03.2024	PREVIOUS YEAR 31.03.2023
		Rs.	Rs.
EXPENDITURE ON GRANTS (PLAN)			
Establishment Expenses	12A	18,18,26,986.00	17,47,96,737.00
Other Administrative Expenses, etc	12B	1,49,89,386.15	1,70,76,526.00
Capital Expenses	12C	50,000.00	5,85,000.00
EXPENDITURE ON GRANTS (EAP)	13	3,60,11,858.06	4,68,39,421.60
OTHER EXPENSES	14	6,12,596.21	18,72,072.02
DEPRECIATION ON FIXED ASSETS	5	-	-
TOTAL (B)		23,34,90,826.42	24,11,69,756.62
EXCESS OF INCOME OVER EXPENDITURE (A-B)		93,86,476.04	1,21,48,793.98

(Director) the Institute 
 भारतीय वनस्पति अनुसंधान संस्थान
 ICFRE-Rain Forest Research Institute
 जोरहाट, असम/Jorhat, Assam

(Drawing & Disbursement Officer)
ICFRE-RAIN FOREST RESEARCH INSTITUTE
 JORHAT
 आहरण एवं संचितगत अधिकारी
 Drawing & Disbursing Officer
 भारतीय वनस्पति अनुसंधान संस्थान
 ICFRE-Rain Forest Research Institute
 जोरहाट, असम/Jorhat, Assam

FOR M/S PARMITA & COMPANY,
 CHARTERED ACCOUNTANTS

 (CA PARMITA BHATT)
 PROP., M. NO. 078018, FRN 0008751C

DATED: 23.10.2024
 PLACE: DEHRADUN

ICFRE-BAMBOO & RATTAN CENTRE
(A Unit of Indian Council of Forestry Research and Education)
AIZWAL

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2024

INCOME	SCHEDULE	CURRENT YEAR 31.03.2024	PREVIOUS YEAR 31.03.2023
		Rs.	R.s
SUPPLY OF GOODS/SERVICES	12	6,27,848.00	4,10,641.00
GRANT RECEIVED	13	40,02,038.83	1,26,84,952.00
INCOME FROM INVESTMENT	15		
INTEREST EARNED	17	74,423.00	1,06,428.00
OTHER INCOME	18	-	-
TOTAL (A)		47,04,309.83	1,32,02,021.00

EXPENDITURE	SCHEDULE	CURRENT YEAR 31.03.2024	PREVIOUS YEAR 31.03.2023
		Rs.	R.s
EXPENDITURE ON GRANTS (PLAN)			
Establishment Expenses	20A	-	91,36,167.00
Other Administrative Expenses, etc	20B	22,57,722.90	28,43,038.00
Capital Expenses	20C	93,925.00	1,98,160.00
EXPENDITURE ON GRANTS (EAP)	21	16,50,390.93	5,07,587.00
EXPENDITURE ON CONSULTANCY PROJECT	22	-	-
OTHER EXPENSES	23A	3,63,129.36	560.50
INTEREST PAID	23B	25,251.00	23,157.00
DEPRECIATION ON FIXED ASSETS	8	-	-
TOTAL(B)		43,90,419.19	1,27,08,669.50
EXCESS OF INCOME OVER EXPENDITURE (A-B)		3,13,890.64	4,93,351.50

(Head of the Centre)

(Drawing & Disbursement Officer)
ICFRE-BAMBOO & RATTAN CENTRE
AIZWAL

Sandey
DDO
ICFRE-BRC
AIZWAL : MIZORAM

FOR M/S PARMITA & COMPANY,
CHARTERED ACCOUNTANTS
Parmita Bhatt

(CA PARMITA BHATT)
PROP., M. NO. 078018, FRN 0008751C

DATED: 23.10.2024
PLACE: DEHRADUN

ICFRE-LIVLIHOOD EXTENSION CENTRE
(A Unit of Indian Council of Forestry Research and Education)
AGARTALA

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2024

INCOME	SCHEDULE	CURRENT YEAR 31.03.2024	PREVIOUS YEAR 31.03.2023
		Rs.	R.s
SUPPLY OF GOODS/SERVICES	8	1,520.00	12,612.00
GRANT RECEIVED	9	17,87,048.00	98,48,798.00
INTEREST EARNED	10	1,02,726.00	1,03,009.00
OTHER INCOME	11	-	-
TOTAL (A)		18,91,294.00	99,64,419.00

EXPENDITURE	SCHEDULE	CURRENT YEAR 31.03.2024	PREVIOUS YEAR 31.03.2023
		Rs.	R.s
EXPENDITURE ON GRANTS (PLAN)			
Establishment Expenses	12A	5,40,791.00	66,65,847.00
Other Administrative Expenses, etc	12B	7,15,000.00	10,90,000.00
Capital Expenses	12C	-	-
EXPENDITURE ON GRANTS (EAP)	13	16,12,839.00	20,92,951.00
DEPRECIATION ON FIXED ASSETS	5	-	-
	14	38,866.59	
TOTAL(B)		18,25,914.59	98,48,798.00
EXCESS OF INCOME OVER EXPENDITURE (A-B)		65,379.41	1,15,621.00

(Head of the Centre)

(Drawing & Disbursement Officer)
ICFRE-LIVLIHOOD EXTENSION CENTRE
AGARTALA

डीडीआ
DDO
भा.वा.अ.शि.प.-आ.वि.४
ICFRE-LEC
अगरतला / Agartala

FOR M/S PARMITA & COMPANY,
CHARTERED ACCOUNTANTS
Dehradun
(CA PARMITA BHATT)
PROP., M. NO. 078018, FRN 0008751C

DATED: 23.10.2024
PLACE: DEHRADUN

Statement of Allotment & Expenditure for the year 2023-24 (Rs.in lakh)

Sl. No.	Budget Sub-Head	Name of Institutes/Centres	Salaries				General				Capital					
			Budget Allot.	Opening balance	Total	Exp. 2023-24	Budget Allot.	Opening balance	Total	Exp. 2023-24	Budget Allot.	Opening balance	Total	Exp. 2023-24		
1	ICFRE/Pension		22802.00	0.00	22802.00	22048.42	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	0.00	20.00	20.00	20.00	0.00	0.00	0.00	6.00	6.00	5.99
3	DDO, ICFRE		1860.39	166.70	2027.09	1754.80	390.00	390.00	390.00	485.70	12.41	12.41	12.39	12.41	12.39	12.39
4	FRI, Dehradun		6223.20	390.58	6613.78	6144.51	1086.18	1086.18	1086.18	1086.18	13.39	13.39	13.39	13.39	13.39	13.39
5	FRC-ER, Prayagraj		0.00	0.00	0.00	0.00	44.02	44.02	44.02	44.02	0.00	0.00	0.00	0.00	0.00	0.00
6	IFGTB, Coimbatore		2182.00	158.45	2340.45	2153.86	200.08	200.08	200.08	200.09	10.00	10.00	9.99	10.00	10.00	9.99
7	IWST, Bangalore		2680.94	190.61	2871.55	2654.47	304.87	304.87	304.87	304.87	29.77	29.77	29.77	29.77	29.77	29.77
8	TFRI, Jabalpur		2045.54	146.15	2191.69	2033.29	174.53	174.53	174.53	174.52	7.26	7.26	7.26	7.26	7.26	7.26
9	FRC-SD, Chhindwara		0.00	0.00	0.00	0.00	14.75	14.75	14.75	15.10	0.00	0.00	1.08	1.08	1.03	1.03
10	AFRI, Jodhpur		1456.65	127.14	1583.79	1446.45	193.05	193.05	193.05	218.06	3.67	3.67	3.65	3.67	3.65	3.65
11	HFRI, Shimla		1080.66	0.00	1080.66	987.51	96.76	96.76	96.76	96.75	6.00	6.02	6.03	6.02	6.03	6.03
12	IFP, Ranchi		1033.48	66.76	1100.24	987.22	92.34	92.34	92.34	92.33	5.00	5.00	5.01	5.00	5.01	5.01
13	IFB, Hyderabad		523.35	53.15	576.50	521.51	90.21	90.21	90.21	90.59	5.00	5.00	5.00	5.00	5.00	5.00
14	FRC-CE, Vishakhapatnam		0.00	0.00	0.00	0.00	13.65	13.65	13.65	13.44	0.00	0.00	0.00	0.00	0.00	0.00
15	RFRI, Jorhat		1819.79	133.74	1953.53	1804.11	150.16	150.16	150.16	150.15	0.50	0.50	0.50	0.50	0.50	0.50
16	FRC-LE, Agartala		0.00	0.00	0.00	0.00	7.15	7.15	7.15	7.14	0.00	0.00	0.00	0.00	0.00	0.00
17	FRC-BR, Aizawl		0.00	0.00	0.00	0.00	22.25	22.25	22.25	22.63	1.00	1.00	1.02	1.00	1.02	1.02
	Total		43708.00	1433.28	45141.28	42536.15	2900.00	2900.00	2900.00	3021.58	100.00	101.10	101.03	101.10	101.03	101.03

[Signature]
Under Secretary (Budget)
ICFRE

[Signature]
Assistant Director General (Admin.)
ICFRE

Statement of Revenue received in Budget Section, ICFRE for the year 2023-24 (Rs.in lakh)

Sl. No.	Name of Institutes/Centres	Revenue Generated										Total
		Externally Aided Projects	Consu-llancy	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			
1	ICFRE	0.00	0.00	0.00	0.00	0.00	1.49	40.05	0.00	41.54		
2	VVB, New Delhi	0.00	0.00	0.00	0.00	0.00	1.59	21.82	0.00	23.41		
3	DDO, ICFRE	653.13	0.00	0.00	0.00	0.00	0.39	13.97	0.00	667.49		
4	FRI, Dehradun	36.40	0.00	0.00	25.49	40.49	3.99	356.18	0.08	462.63		
5	IFGTB, Coimbatore	13.73	0.00	0.00	2.72	3.64	0.59	33.82	3.21	57.71		
6	IWSI, Bangalore	149.59	47.78	0.00	49.41	0.59	3.51	32.47	0.19	283.54		
7	TFRI, Jabalpur	85.63	5.50	0.00	0.46	0.86	4.32	20.26	3.17	120.20		
8	AFRI, Jodhpur	4.05	0.00	0.00	0.00	3.86	0.76	114.98	0.01	123.66		
9	HFRI, Shimla	22.90	0.00	0.00	0.48	0.27	0.40	10.40	0.99	35.44		
10	IFP, Ranchi	9.13	0.00	0.00	22.49	21.72	25.98	8.01	0.04	87.37		
11	FRC-ER, Prayagraj	0.29	0.00	0.00	0.02	0.00	0.00	0.07	0.00	0.38		
12	FRC-SD, Chhindwara	0.00	0.00	0.00	4.40	0.03	0.01	1.15	0.00	5.59		
13	IFB, Hyderabad	5.33	0.00	0.00	6.06	0.05	0.25	1.35	0.01	13.05		
14	RFRI, Jorhat	62.29	3.81	0.00	0.03	2.71	2.78	15.82	0.58	88.02		
15	FRC-IE, Agartala	1.59	0.00	0.00	0.00	0.01	0.00	1.75	0.00	3.35		
16	FRC-BR, Aizawl	0.00	0.00	0.00	0.12	0.42	0.04	4.22	0.02	4.82		
	Total	1044.06	57.09	0.00	111.68	74.65	46.10	676.32	8.30	2018.20		


Assistant Director General (Admin.)
ICFRE

Under Secretary (Budget)
ICFRE

Statement of Allotment & Expenditure upto September 2024

(Rs.in lakh)

Sl. No.	Budget Sub-Head Name of Institutes/Centres	Plan (GC)					
		Salaries		General		Capital	
		Budget Allot.	Exp. upto Sept. 2024	Budget Allot.	Exp. upto Sept. 2024	Budget Allot.	Exp. upto Sept. 2024
1	ICFRE/Pension	8912.59	3664.79	118.01	0.00	6.23	0.00
2	VVB, New Delhi	0.00	0.00	21.80	8.33	3.50	0.65
3	AO, ICFRE	1925.00	1108.87	418.60	222.09	19.22	19.22
4	FRI, Dehradun	6830.17	3550.67	1052.90	438.58	15.00	3.38
5	FRC-ER, Prayagraj	0.00	0.00	37.08	14.78	2.30	1.00
6	IFGTB, Coimbatore	2300.00	1088.94	180.47	75.00	6.75	3.00
7	IWST, Bangalore	3174.08	1619.58	259.29	134.90	8.00	0.00
8	TFRI, Jabalpur	2322.66	1295.04	167.43	72.73	8.00	1.96
9	FRC-SD, Chhindwara	0.00	0.00	12.00	5.21	0.00	0.57
10	AFRI, Jodhpur	1789.01	959.57	166.07	78.91	2.00	0.00
11	HFRI, Shimla	1192.00	627.58	119.68	87.41	4.00	1.40
12	IFP, Ranchi	1119.49	636.45	84.87	32.42	9.00	0.00
13	IFB, Hyderabad	660.00	368.67	74.26	29.02	8.00	0.00
14	FRC-CE, Vishakhapatnam	0.00	0.00	10.00	4.15	0.00	0.00
15	RFRI, Jorhat	2175.00	1161.81	147.54	61.21	8.00	8.00
16	FRC-LE, Agartala	0.00	0.00	8.00	3.16	0.00	0.00
17	FRC-BR, Aizawl	0.00	0.00	22.00	9.86	0.00	0.00
Total		32400.00	16081.97	2900.00	1277.76	100.00	39.18

Budget allocation under salary component during 2024-25 is Rs. 270 Crores, demand for additional budget has already been sent to MoEF&CC, New Delhi under RE 2024-25. The budget allocation will be revised after receipt of RE 2024-25.

Statement of Revenue Generated upto 21st October, 2024.

(Rs.in lakh)

Sl. No.	Name of Institutes/Centres	Approved Revenue Target for 2024-25	Revenue Generated upto 21 Oct. 2024
1	VVB, New Delhi	20.00	14.92
2	AO, ICFRE	500.00	192.68
3	FRI, Dehradun	500.00	187.64
4	FRC-ER, Prayagraj	15.00	2.50
5	IFGTB, Coimbatore	200.00	38.15
6	IWST, Bangalore	300.00	124.63
7	TFRI, Jabalpur	200.00	21.68
8	FRC-SD, Chhindwara	10.00	0.00
9	AFRI, Jodhpur	200.00	50.30
10	HFRI, Shimla	150.00	11.98
11	IFP, Ranchi	150.00	0.00
12	IFB, Hyderabad	75.00	0.70
13	FRC-CE, Vishakhapatnam	10.00	0.00
14	RFRI, Jorhat	150.00	18.66
15	FRC-LE, Agartala	10.00	0.26
16	FRC-BR, Aizawl	10.00	0.54
Total		2500.00	664.66

Section Officer (Budget)
ICFRE

Assistant Director General (Admin.)
ICFRE

**Proposed Budget Estimate for the
Financial Year 2025-26**

(Rs.in lakh)


Sl. No.	Budget Component	Proposed BE 2025-26
1	Grant-in-aid "Salary"	320.00
2	Grant-in-aid "General"	75.00
3	Grant-in-aid "Capital"	10.00
Total		405.00

**Target Proposed for Revenue ICFRE (Hqtr.)
Institutes/Centres for the year 2025-26**

(Rs.in lakh)

S.No.	Name of Institutes/Centres	Target Proposed
1	VVB, New Delhi	20.00
2	DDO, ICFRE	500.00
3	ICFRE-FRI, Dehradun	500.00
4	ICFRE-ERC, Prayagraj	15.00
5	ICFRE-IFGTB, Coimbatore	200.00
6	ICFRE-IWST, Bangalore	300.00
7	ICFRE-TFRI, Jabalpur	200.00
8	ICFRE-SDC, Chhindwara	10.00
9	ICFRE-AFRI, Jodhpur	200.00
10	ICFRE-HFRI, Shimla	150.00
11	ICFRE-IFP, Ranchi	150.00
12	ICFRE-IFB, Hyderabad	75.00
13	ICFRE-CEC, Vishakhapatnam	10.00
14	ICFRE-RFRI, Jorhat	150.00
15	ICFRE-LEC, Agartala	10.00
16	ICFRE-BRC, Aizawl	10.00
Total		2500.00


Under Secretary (Budget)
ICFRE


Assistant Director General (Admin.)
ICFRE



ANNEXURES



ICFRE



ANNEXURES

Annexure - I

Right to Information

A Public Information Officer and Appellate Authority are functioning in Public Authority, ICFRE under the RTI Act 2005. During the year 2023-24, RTI application (455) and RTI Appeals (54) 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
1 st Quarter	62	117	11	--	168
2 nd Quarter	36	127	19	--	144
3 rd Quarter	53	103	12	--	144
4 th Quarter	75	108	05	--	178
Total	226	455	47	--	634
RTI First Appeals			--	--	
1 st Quarter	N/A	12	N/A	--	12
2 nd Quarter	N/A	15	N/A	--	15
3 rd Quarter	N/A	10	N/A	--	10
4 th Quarter	N/A	17	N/A	--	17
Total	--	54	--	--	54

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	Dr. Sudhir Kumar Dy. Director General (Education) Phone (O) : 0135-2224832, 0135-2758571 E-mail : dir_edu@icfre.org	Dr. Rajiv Pandey, Phone (O) : 0135-2224811, E-mail : pio_icfre@icfre.org	All matters related to ICFRE Hqrs., Dehradun
ICFRE-Forest Research Institute, P.O. New Forest, Dehradun-248 006	Dr. Renu Singh, IFS Director Forest Research Institute P.O. New Forest Dehradun- 248006 Phone: 0135-2224444, 2755277 Fax: 0135-2757021 E-mail: dir_fri@icfre.org	Dr. N.K. Upreti Group Coordinator Research, ICFRE-FRI, P.O. New Forest Dehradun- 248 006 Phone :0135- 2224316, 0135-2752670, 0135-2757021 Email: groupco_fri@icfre.org	All Research & Account matters
		Sh. R. Anand, IFS Registrar, ICFRE-FRI Phone: 0135- 2757021-26 (O) Email: registrar_fri@icfre.org	Establishment, Administrative & all other matters
		Dr. A.K. Tripathi, Registrar & PIO, ICFRE-FRI (D) University Phone: 0135-2224439 (O) 0135-2751826 (O) Email: tripathiak@icfre.org	University matters
ICFRE- Eco-Rehabilitation Centre (ERC), 3/1, Lajpath Rai Road, New Katra, Prayagraj-211 002	Dr. Sanjay Singh Head Phone: 0532-2440795, E-mail: head_frccer@icfre.org	Dr. Anita Tomar Scientist -F Phone:0532-2440796 E-mail:anitatomar@icfre.org	All matters related to ICFRE-ERC, Prayagraj
ICFRE- Institute of Forest Genetics and Tree Breeding, Forest Campus, P.B.No 1061 R.S.Puram, Coimbatore - 641 002	Dr. C. Kunhikannan, Director, ICFRE-IFGTB, Coimbatore, Phone: 0422-2484100 (O) E-mail: dir_ifgtb@icfre.org	Dr. R. Yasodha Scientist 'G' & GCR ICFRE-IFGTB, Coimbatore Phone: 0422-2484102 (O)	All matters related to ICFRE-IFGTB, Coimbatore
ICFRE- Institute of Wood Science & Technology, PO Malleswarum, Bengaluru -560003	Sh. Rajesh S. Kallaje, IFS, Incharge-Director, ICFRE-IWST, Bengaluru Phone :080-23341731, E-mail: dir_iwst@icfre.org	Dr. H.R. Prabhudha ICFRE-IWST, Bengaluru, Phone: 080-22190107(O) Email: prabuddhahr@icfre.org	All matters related to ICFRE-IWST, Bengaluru
ICFRE- Tropical Forest Research Institute, Jabalpur P.O. – R.F.R.C., Mandla Road, Jabalpur – 482 021	Dr. H.S. Ginwal, Director, ICFRE-TFRI, Jabalpur Phone :0761-2840483 Fax: 0761-4044002 E-mail: dir_tfri@icfre.org	Shri Nahar Singh Mawai, CTO, ICFRE-TFRI, Jabalpur. Phone: 0761-2744119(O)	As per provision and guidelines provided under RTI Act, 2005

Headquarters / Institutes	Appellate Authorities	Public Information Officers	Subject matter(s) allocated
ICFRE- Skill Development Centre (SDC) P.O. Kundalikala, Poama, Chhindwara- 480001	Director, ICFRE-TFRI, Jabalpur Phone :0761-2840483 Fax: 0761-4044002 E-mail: dir_tfri@icfre.org	Shri N.D. Khobragade, Scientist -E Phone :8458847402 E-mail:khobragadend@icfre.org	As per provision and guidelines provided under RTI Act, 2005
ICFRE- Rain Forest Research Institute Post Box No. 136, Deovan, Sotai, A.T. Road, Jorhat- 785 001(Assam)	Dr. Nitin Kulkarni Director, ICFRE-RFRI, Jorhat Phone: 0376-2305101(O) Fax. 0376-2305130 E-mail: dir_rfri@icfre.org	Dr. R.K. Borah GCR ICFRE-RFRI, Jorhat Phone: 0376-2305103 (O)	All matters related to ICFRE-RFRI, Jorhat
ICFRE- Bamboo & Rattan Centre (BRC), P.O. Box 171, KulikawnAizwal-796001	Director ICFRE-RFRI, Jorhat Phone: 0376-2305101(O) Fax. 0376-2305130 E-mail: dir_rfri@icfre.org	Head ICFRE-BRC, Aizwal Phone: 0389-2301157 (O) E-mail:head_frcbr@icfre.org	All matters related to ICFRE-BRC, Aizwal
ICFRE- Livelihoods Extension Centre (LEC) Sal Bagan Forest Campus PO – Gandhigram Agartala- 799 012 Tripura	Director ICFRE-RFRI, Jorhat Phone: 0376-2305101(O) Fax. 0376-2305130 E-mail: dir_rfri@icfre.org	Dr. R.K. Borah GCR ICFRE-RFRI, Jorhat Phone: 0376-2305103 (O)	All matters related to ICFRE-LEC, Agartala
ICFRE- Arid Forest Research Institute, P.O. Krishi Upaz, Mandi, New Pali Road, Jodhpur, 342005.	Dr. Tarunkant Incharge-Director, ICFRE-AFRI, Jodhpur Phone: 0291-2742549 (O) Fax. 0291-2722764 E-mail: dir_afri@icfre.org	Shri K.C. Gupta, ICFRE-AFRI, Jodhpur. Phone: 0291-2729122	All matters related to ICFRE-AFRI, Jodhpur
ICFRE- Himalayan Forest Research Institute, Conifer Campus, Panthaghati, Shimla – 171 009.	Dr. Sandeep Sharma, Director, ICFRE-HFRI, Shimla Phone :0177-2626778 (O), Fax :0177-2626779 E-mail: dir_hfri@icfre.org	Smt. Shilpa, CTO ICFRE-HFRI, Shimla Phone: 0177-2626778(O) Fax: 0177-2626779	All matters pertaining to HFRI, Shimla
ICFRE- Institute of Forest Productivity, NH 23, Gumla Road, Lalgutwa, Ranchi-835303.	Dr. Amit Pandey Director, ICFRE-IFP, Ranchi, Ph- 0651-2526140 8986608161 E-mail: dir_ifp@icfre.org	Dr. Yogeshwar Mishra Scientist-E, ICFRE-IFP, Ranchi, Phone :8986608161 E-mail: mishray@icfre.org	All matters related to ICFRE-IFP, Ranchi
ICFRE- Institute of Forest Biodiversity, Dulapally, Kompally, Post Hyderabad- 500100	Sh. E. Venkat Reddy, IFS Director, ICFRE-IFB, Hyderabad Phone: 040-66309501(O) Fax :040-66309521 E-mail: director_ifb@icfre.org	Shri M.B. Honnuri Scientist-C ICFRE-IFB, Hyderabad Phone: 040-66309503 Email: mbhonnuri@icfre.org	All matters related to ICFRE-IFB, Hyderabad
ICFRE- Coastal Ecosystem Centre (CEC), HPCL Colony, Panduranga Puram Visakhapatnam- 530 003	Dr. E. Venkat Reddy, IFS Director, ICFRE-IFB, Hyderabad Phone: 040-66309501(O) E-mail: director_ifb@icfre.org	Shri M.B. Honnuri Scientist-C, ICFRE-IFB, Hyderabad Phone: 040-66309503 Email: mbhonnuri@icfre.org	All matters related to ICFRE-FRC-CE, Visakhapatnam

Annexure - II

Information on Vigilance Cases

A Chief Vigilance Officer is functioning at ICFRE, Dehradun. During the year 2023-24, 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
01	01	01	01	Violation of conduct rules

Name and address of Chief Vigilance Officer, ICFRE is as follows:

Dr. Sudhir Kumar
 Chief Vigilance Officer
 Indian Council of Forestry Research and Education
 PO New Forest, Dehradun – 248 006
 Phone: 0135-2224851



Annexure - III

Information on Audit Objections

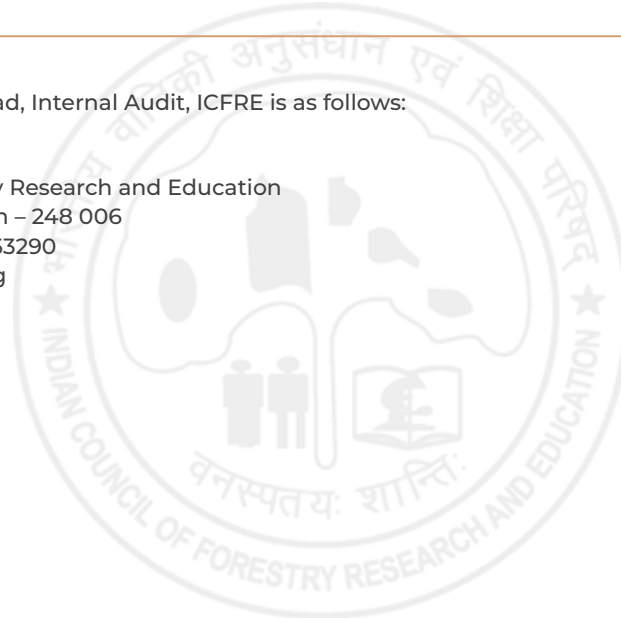
An Internal Audit Cell is functioning at ICFRE, Dehradun under the Head, Internal Audit, ICFRE. During the year 2023-24, the audit objections handled were as follows:

Information on the Audit Objections raised by Principal Director of Audit (Scientific Department), New Delhi

Audit objections carried forward from previous year	Audit objections initiated in the year	Audit objections disposed	Audit objections pending	Nature of Audit objections	Remarks, if any
97 (1994 to 2021)	19 (2021-23)	46	70	Paras on Research/ Projects/ Admin/ Accounts	Reply of audit para are pursued from different Directorates and Director of Institutes of ICFRE. Efforts for settlement of these CAG audit paras are under process

Name and address of Head, Internal Audit, ICFRE is as follows:

Head, Internal Audit Cell
 Indian Council of Forestry Research and Education
 PO New Forest, Dehradun – 248 006
 Phone: 0135-2224860/ 2753290
 Email: head_iac@icfre.org



Annexure - IV

E-Mail and Postal Addresses of ICFRE and its Institutes

Director General

Indian Council of Forestry Research and Education,
P.O. New Forest, Dehradun-248 006
E-mail: dg@icfre.org
Phone: 0135-2759382; 2224333/2224855

Deputy Director General (Research)

Indian Council of Forestry Research and Education,
P.O. New Forest, Dehradun-248 006
E-mail: ddg_res@icfre.org
Phone: 0135- 2757775, 2224836

Deputy Director General (Administration)

Indian Council of Forestry Research and Education,
P.O. New Forest, Dehradun-248 006
E-mail: ddg_admin@icfre.org
Phone: 0135- 2758295, 2224856

Deputy Director General (Extension)

Indian Council of Forestry Research and Education,
P.O. New Forest, Dehradun-248 006
E-mail: ddg_extn@icfre.org
Phone: 0135- 2750693, 2224830

Deputy Director General (Education)

Indian Council of Forestry Research and Education,
P.O. New Forest, Dehradun-248 006
E-mail: ddg_edu@icfre.org
Phone: 0135- 2758571, 2224832

Director (International Cooperation)

Indian Council of Forestry Research and Education,
P.O. New Forest, Dehradun-248 006
E-mail: dir_res@icfre.org
Phone: 0135- 2756497, 2224831

Secretary, ICFRE

Indian Council of Forestry Research and Education,
P.O. New Forest, Dehradun-248 006
E-mail: sec@icfre.org
Phone: 0135- 2758614, 2224867

Assistant Director General (Administration)

Indian Council of Forestry Research and Education,
P.O. New Forest, Dehradun-248 006
E-mail: adg_admin@icfre.org
Phone: 0135- 2750297, 2224869

Assistant Director General

(Biodiversity & Climate Change)
Indian Council of Forestry Research and Education,
P.O. New Forest, Dehradun-248 006
E-mail: adg_bcc@icfre.org
Phone: 0135- 2755399, 2224823

Assistant Director General

(Education & Recruitment Board)
Indian Council of Forestry Research and Education,
P.O. New Forest, Dehradun-248 006
E-mail: adg_edu@icfre.org
Phone: 0135- 2758348, 2224850

Assistant Director General

(Media and Extension)
Indian Council of Forestry Research and Education,
P.O. New Forest, Dehradun-248 006
E-mail: adg_mx@icfre.org
Phone: 0135- 2755221, 2224814

Assistant Director General

(External Project)
Indian Council of Forestry Research and Education,
P.O. New Forest, Dehradun-248 006
E-mail: adg_pf@icfre.org
Phone: 0135- 2754882, 2224827

Assistant Director General

(Environment Management)
Indian Council of Forestry Research and Education,
P.O. New Forest, Dehradun-248 006
E-mail: adg_eia@icfre.org
Phone: 0135- 2753882, 2224813

Assistant Director General

(Research Planning)
Indian Council of Forestry Research and Education,
P.O. New Forest, Dehradun-248 006
E-mail: adg_rp@icfre.org
Phone: 0135- 2753290, 2224807

Assistant Director General

(Monitoring and Evaluation)
Indian Council of Forestry Research and Education,
P.O. New Forest, Dehradun-248 006
E-mail: adg_me@icfre.org
Phone: 0135- 2757485, 2224810

Director

ICFRE-Forest Research Institute, Dehradun
P.O. New Forest
Dehradun-248006
E-mail: dir_fri@icfre.org
Phone: 0135- 2224444, 2755277
Fax: 0135-2756865

Director

ICFRE-Institute of Forest Genetics and Tree Breeding, Coimbatore
Forest Campus,
P.B.No. 1061, R.S.Puram,
Coimbatore - 641 002.
Email : dir_ifgtb@icfre.org
Phone: - 0422-2431540, 2484100 (O)
Fax : 0422-2430549

Director

ICFRE-Institute of Wood Science and Technology, Bengaluru
P.O. Malleswaram,
Bengaluru-560 003
Email: dir_jwst@icfre.org
Phone: 080-23347131
Fax: 080- 23340529

Director

ICFRE-Tropical Forest Research Institute, Jabalpur
P.O. – R.F.R.C, Mandla Road,
Jabalpur – 482 021 (M.P)
E-mail: dir_tfri@icfre.org
Phones: 0761 – 2840483(O)
Fax : 0761 – 2840484,4044002

Director

ICFRE-Rain Forest Research Institute, Jorhat
P. Box – 136, Deovan, Sotai, A. T. Road
Jorhat – 785 001 (Assam)
Email: dir_rfri@icfre.org
Phone: 0376-2305101 (O)
Fax: 0376-2305130

Director

ICFRE-Arid Forest Research Institute, Jodhpur
P.O. Krishi Upaz Mandi
New Pali Road, Jodhpur 342 005
Email : dir_afri@icfre.org
Phone : 0291-2742549 (O)
Fax : 0291-2722764

Director

ICFRE-Himalayan Forest Research Institute, Shimla
Conifer Campus, Panthaghati,
Shimla- 171 009 (HP)
E-mail : dir_hfri@icfre.org
Phone :0177-2626778 (O)
Fax : 0177-2626779 (O)

Director

ICFRE-Institute of Forest Productivity, Ranchi
NH23, Gumla Road, Lalgutwa
Ranchi-834 002
E-mail: dir_ifp@icfre.org
Phone: 0651-2948505 (O)

Director

ICFRE-Institute of Forest Biodiversity
Dulapally, Kompally, Post
Hyderabad- 500 100
Email: director_ifb@icfre.org
Phone: 040- 66309501 (O)
Fax : 040- 66309521

Head

ICFRE-Skill Development Centre (ICFRE-SDC),
P.O. Kundalikala, Poama
Chhindwara (M.P.)-480 001
Email : head_cfrhrd@icfre.org
Phone: 07162-292061 (O)

Head

ICFRE-Eco-Rehabilitation Centre (ICFRE-ERC),
3/1, Lajpath Rai Road, New Katra
Prayagraj- 211 002
Email: dir_csfer@icfre.org
Phone: 0532-2440437

Head

ICFRE-Coastal Ecosystem Centre, (ICFRE-CEC),
HPCL Colony,
Panduranga Puram
Visakhapatnam - 530 003
E-mail: head_frcce_vizag@icfre.org
Phone: 040- 66309500 (O)

Head

ICFRE-Livelihoods Extension Centre (ICFRE-LEC),
Sal Bagan Forest Campus,
PO- Gandhigram
Agartala- 799 012
E-mail: head_frcle@icfre.org
Phone/ Fax: 0381-2397097

Head

ICFRE-Bamboo & Rattan Centre (ICFRE-BRC),
P.O. Box 171,
Kulikawn Aizwal-796001
(Mizoram)
E-mail: head_frcbr@icfre.org
Phone: 0389- 2301157
Fax: 0389-2301159

Annexure - V

List of Abbreviations

ADG	–	Assistant Director General
AGF	–	Agroforestry
AGM	–	Annual General Meeting
AICRP	–	All India Coordinated Research Project
AMF	–	<i>Arbuscular mycorrhizal</i> Fungi
ANR	–	Assisted Natural Regeneration
APL	–	Andhra Paper Limited
APP	–	Ammonium poly phosphate
ARS-TNAU	–	Agricultural Research Station-Tamil Nadu Agricultural University
ASRLM	–	Assam State Rural Livelihood Mission
ATBC	–	Association for Tropical Biology and Conservation
ATMA	–	Agricultural Technology Management Agency
AYUSH	–	Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homeopathy
BAF	–	Basin Area Finder
BHTN	–	Bamboo Hi-Tech Nursery
BIMSTEC	–	Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation
BIS	–	Bureau of Indian Standards
BM	–	Bamboo Mat
BMRC	–	Bamboo Mat Ridge Cap
BoG	–	Board of Governors
BPL	–	Below Poverty Line
CA	–	Compensatory Afforestation
CAMPA	–	Compensatory Afforestation Fund Management and Planning Authority
CC	–	Calcium Carbonate
CCF	–	Chief Conservator of Forest
CFD	–	Chandigarh Forest Department
CFEES	–	Centre for Fire, Explosive and Environment Safety
CG	–	Chattisgarh
CGM	–	Chopped Glass Fiber Mat
CIL	–	Coal India Limited
CLT	–	Cross Laminated Timber
CNCs	–	Cellulose Nano Crystals
CNFs	–	Cellulose Nano Fibers
CoE	–	Centre of Excellence
CPCs	–	Candidate Plus Culms
CPTs	–	Candidate Plus Trees
CSIRO	–	Commonwealth Scientific and Industrial Research Organization
CSO	–	Clonal Seed Orchard
CSPOD	–	Coconut Shell Pyrolytic Oil Distillate
CTO	–	Chief Technical Officer
CV	–	Coefficient of Variation
DBH	–	Diameter at Breast Height
DDG	–	Deputy Director General
DG	–	Director General
DGF&SS	–	Director General of Forests and Special Secretary
DNA	–	Deoxyribonucleic acid

DPR	-	Detailed Project Report
DRDO	-	Defence Research and Development Organisation
DUS	-	Distinctness Uniformity and Stability
DV	-	Demo Village
EC	-	Electrical Conductivity
EDB	-	Ethylene Dibromide
EIACP	-	Environmental Information Awareness Capacity Building and Livelihood Programme
EKCB	-	Environment Knowledge and Capacity Building
EMC	-	Equilibrium Moisture Content
ENVIS	-	Environmental Information System
EPF	-	Entomopathogenic Fungi
ESIP	-	Ecosystem Services Improvement Project
EW	-	Epicuticular Wax
FAQs	-	Frequently Ask Questions
FCRI	-	Forest College and Research Institute
FGR	-	Forest Genetic Resource
FRD	-	Fire Retardant Doors
FRS	-	Field Research Station
FSHC	-	Forest Soil Health Card
FSSAI	-	Forest Safety and Standards Authority of India
FTCB	-	Forest Training and Capacity Building
FTPW	-	Fluorescent Transparent Wood
FYM	-	Farmyard Manure
GAF	-	Guangxi Provincial Academy of Forestry
GBH	-	Girth at Breast Height
GBIIF	-	Global Biodiversity Information Facility
GC-FID	-	Gas Chromatography with Flame Ionization Detection
GC-MS	-	Gas Chromatography-Mass Spectrometry
GDP	-	Gross Domestic Product
GEA	-	Genotype-Environment Associations
GHGs	-	Green House Gases
GIS	-	Geographic Information System
GLIS	-	Government Land Information System
GLT	-	Glued Laminated Timber
GM	-	Glass Fiber Mat
GoI	-	Government of India
GPS	-	Global Positioning System
HAPPRC	-	High Altitude Plant Physiology Research Centre
HATZ	-	High Altitude Transition Zones
HoFF	-	Head of Forest Forces
HPCL	-	Hindustan Petroleum Corporation Limited
HPFD	-	Himachal Pradesh Forest Department
HPLC	-	High Performance Liquid Chromatography
HPSFD	-	Himachal Pradesh State Forest Department
HPTLC	-	High Performance Thin Layer Chromatography
HRD	-	Human Resource Development
HRRL	-	HPCL Rajasthan Refinery Limited
IAA	-	Indole Acetic Acid
IBA	-	Indole Butyric Acid
ICAR	-	Indian Council of Agricultural Research
ICFRE	-	Indian Council of Forestry Research and Education

ICFRE-AFRI	–	ICFRE-Arid Forest Research Institute
ICFRE-BRC	–	ICFRE-Bamboo and Rattan Centre
ICFRE-CEC	–	ICFRE-Coastal Ecosystem Centre
ICFRE-ERC	–	ICFRE-Eco-Rehabilitation Centre
ICFRE-FRI	–	ICFRE- Forest Research Institute
ICFRE-HFRI	–	ICFRE-Himalayan Forest Research Institute
ICFRE-IFB	–	ICFRE-Institute of Forest Biodiversity
ICFRE-IFGTB	–	ICFRE- Institute of Forest Genetics and Tree Breeding
ICFRE-IFP	–	ICFRE-Institute of Forest Productivity
ICFRE-IWST	–	ICFRE-Institute of Wood Science and Technology
ICFRE-LEC	–	ICFRE-Livelihood Extension Centre
ICFRE-RFRI	–	ICFRE-Rain Forest Research Institute
ICFRE-SDC	–	ICFRE-Skill Development Centre
ICFRE-TFRI	–	ICFRE-Tropical Forest Research Institute
ICP-OES	–	Inductively Coupled Plasma Optical Emission Spectroscopy
ICRAF	–	International Center for Research in Agroforestry
IFFCO	–	Indian Farmers Fertiliser Cooperative
IGNFA	–	Indira Gandhi National Forest Academy
IGNP	–	Indira Gandhi Nahar Pariyojana
IIA	–	Indian Industries Association
IIRS	–	Indian Institute of Remote Sensing
IISS	–	Indian Institute of Soil Science
IPCC	–	Intergovernmental Panel on Climate Change
IPIRTI	–	Indian Plywood Industries Research and Training Institute
ISRO	–	Indian Space Research Organization
ISSA	–	International Scientific Symposium on Agarwood
ISSR	–	Inter Simple Sequence Repeats
ITK	–	Indigenous Technical Knowledge
IUCN	–	International Union for Conservation of Nature
IUFRO	–	International Union of Forest Research Organizations
JFMC	–	Joint Forest Management Committee
JICA	–	Japan International Cooperation Agency
JNV	–	Jawahar Navodaya Vidyalaya
KIA	–	Kumaraguru Institute of Agriculture
KVK	–	Krishi Vigyan Kendra
KVS	–	Kendriya Vidyalaya Sangthan
LC	–	Least Concern
LiFE	–	Lifestyle of Environment
LKFP	–	Lesser Known Forest Plants
LSD	–	Least Significant Difference
LU/LC	–	Land Use/ Land Cover
MC	–	Moisture Content
MDF	–	Medium Density Fiber Board
MIT-CAT	–	Musiri Institute of Technology-College of Agriculture and Technology
ML	–	Maximum Likelihood
MLTs	–	Multi-location Trials
MNP	–	Manas National Park
MODIS	–	Moderate Resolution Imaging Spectroradiometer
MoE	–	Modulus of Elasticity
MoEF&CC	–	Minister of Environment Forest and Climate Change
MoR	–	Modulus of Rupture

MoU	–	Memorandum of Understanding
MP	–	Madhya Pradesh
MPCA	–	Medicinal Plant Conservation Area
MR	–	Moisture Resistance
MS	–	Maharashtra
MS	–	Murashige and Skoog medium
MSP	–	Minimum Support Price
MTR	–	Manas Tiger Reserve
MW	–	Microwave
MWVD	–	Microwave Vacuum Dryer
NAA	–	Naphthyl Acetic Acid
NAAC	–	National Assessment and Accreditation Council
NABARD	–	National Bank for Agriculture and Rural Development
NAEB	–	National Afforestation and Eco Development Board
NBPGR	–	National Bureau of Plant Genetic Resources
NCBI	–	National Centre for Biotechnology Information
NCDC	–	National Cooperative Development Corporation
NDMC	–	New Delhi Municipal Committee
NDVI	–	Normalized Difference Vegetation Index
NFLIC	–	National Forest Library and Information Centre
NFRT	–	Natural Fiber Reinforced Thermoplastic
NGOs	–	Non-Government Organizations
NIRS	–	Near Infrared Spectroscopy
NKN	–	National Knowledge Network
NMPB	–	National Medicinal Plant Board
NPV	–	Net Present Value
NSO	–	Neem Seed Oil
NTFP	–	Non Timber Forest Products
NTGB	–	National Tamarind Germplasm Bank
NTPC	–	National Thermal Power Corporation Limited
NTPS	–	National Transit Pass System
NTR	–	National Tamarind Registry
NTU	–	Nephelometric Turbidity Unit
NWC	–	Nano-Wood Composites
NWFPs	–	Non-Wood Forest Products
OF	–	Open Forest
OL	–	Official Language
OSFD	–	Odisha State Forest Department
OTU	–	Operational Taxonomic Unit
PB	–	Particle Board
PBR	–	People's Biodiversity Register
PCCF	–	Principal Chief Conservator of Forests
PCR	–	Polymerase Chain Reaction
PDCB	–	Paradichlorobenzene
PF	–	Phenol-formaldehyde
PF	–	Protected Forest
PHS	–	Pensioners Health Scheme
PLF	–	Phenol Lignin Formaldehyde
PM	–	Particulate Matter
PMES	–	Performance Monitoring and Evaluation System
PPB	–	Pre-laminated Particle Board

PPM	–	Parts Per Million
PPP	–	Public Private Partnership
PPV&FRA	–	Protection of Plant Varieties and Farmers' Rights Authority
PSB	–	Phosphate Solubilizing Bacteria
PSO	–	Pongamia Seed Oil
PVA	–	Poly Vinyl Acetate
PVC	–	Polyvinyl Chloride
PW	–	Plywood
PWPR	–	Preliminary Working Plan Report
QGF	–	Quarter Girth Formula
QPM	–	Quality Planting Material
QTOF-MS	–	Quadrupole Time of Flight Mass Spectrometry
RAG	–	Research Advisory Group
RBD	–	Randomized Block Design
RBM	–	River Bed Material
RDF	–	Rehabilitation of Degraded Forest
REDD+	–	Reducing Emissions from Deforestation and Forest Degradation
REM	–	Riley Encased Methodology
RET	–	Rare Endangered Threatened
RF	–	Reserved Forest
RFO	–	Range Forest Officer
RLVL	–	Reinforced Laminated Veneer Lumber
RNA	–	Ribonucleic Acid
RP	–	Research and Planning
RPC	–	Research Planning Committee
RT	–	Research and Training
RWE	–	Round Wood Equivalent
SCCL	–	Singareni Collieries Company Limited
SECL	–	South Eastern Coalfields Limited
SEM	–	Scanning Electorn Microscopy
SEM	–	Structural Equation Modelling
SFDs	–	State Forest Departments
SFM	–	Sustainable Forest Management
SHGs	–	Self Help Groups
SKUAST	–	Sher-e-Kashmir University of Agricultural Sciences and Technology
SLEM	–	Sustainable Land and Ecosystem Management
SMA	–	Seed Multiplication Area
SNPs	–	Single Nucleotide Polymorphisms
SOC	–	Soil Organic Carbon
SPA	–	Seed Production Area
SPS	–	Seed Production System
SR	–	Short Roatation
SSD	–	Sandal Spike Disease
SSO	–	Seedling Seed Orchard
SSR	–	Simple Sequence Repeats
STO	–	Senior Technical Officer
TANU	–	Tamil Nadu Agricultural University
TC	–	Tissue Culture
TDC	–	Technology Demonstration Centre
TDS	–	Total Dissolve Solids
TGM	–	Tree Growers Mela

TGR	-	Tamarind Genetic Resources
THDC	-	Tehri Hydro Development Corporation Limited
THM	-	Thermo-hygro-mechanical
TLC	-	Thin Layer Chromatography
TNAU	-	Tamil Nadu Agriculture University
TNPL	-	Tamil Nadu Newsprint and Papers Limited
TNSRLM	-	Tamil Nadu State Rural Livelihood Mission
TOFI	-	Tree Outside Forests of India
TPS	-	Thermos-plasticized Starch
TRB	-	Tree Rich Biobooster
TRIFED	-	Tribal Co-operative Marketing Development Federation of India
TSFA	-	Telangana State Forest Academy
TSS	-	Total Soluble Solids
TWC	-	Transparent Wood Composite
UF	-	Urea-formaldehyde
UNCCD	-	United Nations Convention to Combat Desertification
UNFCCC	-	United Nations Framework Convention on Climate Change
UPLC	-	Ultra High Performance Liquid Chromatography
USAID	-	United States Agency for International Development
UTs	-	Union Territories
UV	-	Ultra Violet
VAM	-	Vesicular Arbuscular Mycorrhiza
VMG	-	Vegetative Multiplication Garden
VPN	-	Virtual Private Network
VPTI	-	Vacuum Pressure Treatment Units
VVK	-	Van Vigyan Kendra
WB	-	West Bengal
WBI	-	Wood Based Industries
WCL	-	Western Coalfield Limited
WHO	-	World Health Organization
WLS	-	Wildlife Sanctuary
WPC	-	Wood Polymer Composite
WTP	-	Willingness to Pay
ZiBOC	-	Zinc, Boron and Copper

Acknowledgement

The arduous efforts made by the following scientists and officers in editing the allowed chapter of ICFRE Annual Report 2023-24 are thankfully acknowledged.

S.No.	Name of the Chapter	Chapter Editors
1.	Ecosystem Conservation and Management	Dr. R.S. Rawat, Scientist (E), ICFRE, Dehradun
		Dr. Shilpa Gautam, Scientist-E, ICFRE, Dehradun
2.	Forest Productivity	Dr. Manisha Thapliyal, Scientist –G, ICFRE-FRI, Dehradun
		Dr. C. Buvaneswaran, Scientist-G, ICFRE-IFGTB, Coimbatore
3.	Genetic Improvement	Dr. Modhumita Dasgupta, Scientist-G, ICFRE-IFGTB, Coimbatore
		Dr. A. Nicodemus, Scientist-G, ICFRE- IFGTB, Coimbatore
4.	Forest Management	Dr. Jagdish Singh, Scientist-F, ICFRE-HFRI, Shimla
5.	Wood Products	Dr. N.K. Upreti, Scientist- G, ICFRE-FRI, Dehradun
6.	Non-wood and Forest Products (NWFPs)	Dr. Neelu Singh, Scientist-G, ICFRE-TFRI, Jabalpur
		Dr. Rakesh Kumar, Scientist-F, ICFRE-IWST, Bengaluru
7.	Forest Protection	Dr. Arun Pratap Singh, Scientist-G, ICFRE-FRI, Dehradun
		Dr. Vipin Prakash, Scientist-F, ICFRE-FRI, Dehradun
8.	CAMPA	Dr. Geeta Joshi, ADG (M&Extn.), ICFRE
		Dr. Ishmita Nautiyal, Scientist-E, ICFRE
9.	Education Vistas/ Activities	Shri Vinay Kant Mishra, ADG (Edu. & RB), ICFRE
		Shri Sunil Waman Bhondge, CTO, ICFRE
10.	Extension Panorama/ Activities	Dr. Geeta Joshi, ADG(M& Extn.), ICFRE, Dehradun
		Dr. Vishwajeet Sharma, STO, ICFRE
11.	Administration and Information Technology	Shri Sushant Kumar, ADG(Admin,), ICFRE, Dehradun
		Shri. A.K. Sinha, Head (IT), ICFRE, Dehradun



Published by: *Media and Extension Division*, Directorate of Extension

**Indian Council of Forestry
Research and Education**

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

P.O. New Forest,
Dehradun- 248 006
Uttarakhand, India
www.icfre.gov.in