INDIAN COUNCIL OF FORESTRY RESEARCH AND EDUCATION, DEHRADUN

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

ANNUAL REPORT
2020-21

Annual Report

2020-21

INDIAN COUNCIL OF FORESTRY RESEARCH AND EDUCATION (ICFRE)
(An Autonomous Council of Ministry of Environment, Forest and Climate Change, Government of India)
DEHRADUN (UTTARAKHAND)

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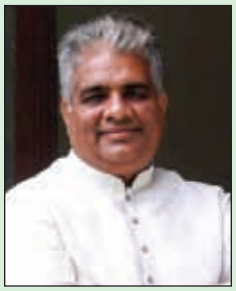
मंत्री
पर्यावरण, वन एवं जलवायु परिवर्तन,
और
श्रम एवं रोजगार
भारत सरकार

एक कदम स्वच्छता की ओर

सत्यमेव जयते

MINISTER
ENVIRONMENT, FOREST AND CLIMATE CHANGE
AND
LABOUR AND EMPLOYMENT
GOVERNMENT OF INDIA

भूपेन्द्र यादव
BHUPENDER YADAV



MESSAGE

Year 2020-21 was a year of many unexpected challenges as a result of COVID-19 pandemic. Throughout these unprecedented times Indian Council of Forestry Research and Education (ICFRE), an autonomous council under the Ministry of Environment, Forest and Climate Change (MoEF&CC) with its pan India presence was tirelessly rendering its services towards the forestry R&D needs of the country across various bio-geographical regions.

The ICFRE Annual Report for the year 2020-21 highlights the most important outputs of technical, scientific R&D programmes of the Council. The significant contributions include preparation of Detailed Project Reports (DPRs) that aimed at rejuvenating 13 major rivers in India through forestry interventions in association with various stakeholders; numerous capacity building programmes for stakeholders, preparation of REDD+ resources manuals for capacity building of State Forest Departments, publication of books, reports and pamphlets. ICFRE's continuous efforts in development of innovative scientific and technological inputs for the benefit of forestry stakeholders is praiseworthy.

I hope that ICFRE Annual Report 2020-21 will be useful to different stakeholders and boost the research and development in forestry sector.

(Bhupender Yadav)

Date : 16-02-2022

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Ashwini Kumar Choubey

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आहारशुद्धौ सत्त्वशुद्धिः

स्वच्छ भारत
एक कदम स्वच्छता की ओर

राज्य मंत्री
पर्यावरण, वन एवं जलवायु परिवर्तन
उपभोक्ता मामले, खाद्य और सार्वजनिक वितरण
भारत सरकार
MINISTER OF STATE
ENVIRONMENT, FOREST AND CLIMATE CHANGE
CONSUMER AFFAIRS, FOOD & PUBLIC DISTRIBUTION
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MESSAGE

The Indian Council of Forestry Research and Education (ICFRE), an autonomous council under the Ministry of Environment, Forest and Climate Change has stepped up with innovative outreach programme to help manage the R&D outputs during the year 2020-2021 in the times of the pandemic. The Annual Report 2020-21 highlights the important achievements such as development of technology for wood-based value addition product and fabrication; android-based farmer-friendly mobile app, wood yield calculator for yield estimation of *Melia dubia* for wider use, establishment progeny trails, demonstration plots and germplasm banks. The achievements of these R&D programmes may not realized without the dedication of the team of experets working on various domain experts of forestry.

I wish and congratulate the entire ICFRE team for their dedication in bringing out this informative report on time and I look forward for more such achievements in future.

(Ashwini Kumar Choubey)

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MESSAGE

It is a pleasure to see the India Council of Forestry Research and Education (ICFRE). Annual Report for the year 2020-21, which contains significant scientific achievements. The dedicated core research activities have contributed to non-exclusive License Agreements for commercial propagation and sale of planting stock of varieties/clones of *Melia dubia*, *Eucalyptus*, *Casuarina* aimed at production of trees outside the forest. The development of a novel process for isolation of fibre from pine needles, that was transferred to Uttarakhand Bamboo and Fibre Development Board, is truly worthy of appreciation.

ICFRE has also developed numerous grass root technologies for tribal people, particularly women, to enhance their livelihood opportunities. Under the Sustainable Land and Ecosystem Management (SLEM) initiative, best practices were scaled up in Chhattisgarh and Madhya Pradesh, thereby benefiting 4487 direct and 23737 indirect beneficiaries. Establishment of new VVKs for strengthening the outreach of Research and Development (R&D) activities of ICFRE and publication of reports, brouchers and pamphlets are measures that would significantly boost overall skill development.

I am sure that ICFRE would continue to excel in R&D, and thus cater to the needs of various stakeholders. I congratulate the ICFRE team for the timely and informative Annual Report of 2020-21, and wish them the very best.

(Leena Nandan)

New Delhi, the 7th February, 2022

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CHANDRA PRAKASH GOYAL

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DIRECTOR GENERAL OF FOREST & SPL. SECY.
GOVERNMENT OF INDIA
MINISTRY OF ENVIRONMENT, FOREST AND
CLIMATE CHANGE

MESSAGE

A glimpse of significant R&D activities and findings are presented in the Indian Council of Forestry Research and Education (ICFRE) Annual Report 2020-21 that include estimation of genome size of *Pterocarpus santalinus* for first time and predicted five novel barcodes for discriminating *P. Santalinus* and other species: eco geographical mapping of 150 Forest Genetic resources from various states, release of varieties of clones such as Eucalyptus, Poplar, *Dalbergia sissoo,* Calophyllum and Neem; fabrication of microwave wood dryer for efficient energy utilization and Nano materials. Additions to the new records were six species of insect from Uttar Pradesh and six new locality insect species from Madhya Pradesh.

The R&D extension include establishment of high-tech nursery, supply of quality planting material to various stakeholders and material transfer agreement, establishment of Agarwood based agroforstry model and publication of recent advances in *Melia dubia*. The Council has extended in house knowledge through 185 training for 9875 researchers, scientists, students and officials of all ICFRE institutes. 'Prakriti', a scientist- student connect programme has benefited many school and college students. ICFRE has produced fifteen documentaries on research and extension activities, established a photo gallery at FRI, Dehradun and seven Technology Demonstration Centres are in process at different ICFRE institutes.

I congratulate the entire ICFRE team for their dedication in planning and executing the R&D to address the need of various stakeholders in the country.

(Chandra Prakash Goyal)

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FOREWORD

Indian Council of Forestry Research & Education (ICFRE), Dehradun is an autonomous council under the Ministry of Environment, Forest and Climate Change (MoEF&CC), Government of India. ICFRE facilitates in sustainable development of the forestry sector through planning, promoting, conducting and coordinating research, education and extension activities in terms of biodiversity conservation, rural employment, and environmentally sustainable technologies such as global climate/environment challenges, tree improvement, wood /non wood forest produce, soil water conservation, sustainable natural resource management and livelihood for holistic development.

ICFRE laid emphasis on holistic coordinated national level research on specific species that are economically and ecologically important to enhance the productivity. As an outcome of the research work, the chloroplast genome of *Pterocarpus dalbergiodes* was re-constructed and the study provided first insight into the phylogenetic relatedness between *P. santalinus* and *P. Dalbergioides*. Genome size of *P. santalinus* was estimated for first time. Five novel barcodes were predicted for discriminating *P. santalinus* and other species i.e. *P. Indicus, P. Marsupium, P. dalbergioides* and *D. latifolia* which would facilitate in identification of species.

Modified a Steam Explosion Treatment Machine for extraction of fibre and preparation of shampoo from *Grewia optiva* (bhimal) also developed a mobile app for yield estimation of *Melia dubia*.

Agarwood based agroforestry model was developed and provenance- cum- progeny trials were established at Karnataka and Goa. The export quota of agarwood products was recommended to the CITES-Management authority based on growing stock available in non-forest lands, the number and capacity of the agarwood processing units, and also the trend in the exports for the last 10 years etc.

New records of insects has been documented which include four species of hymenopteran parasitoids belonging to family Platygastridae from Uttar Pradesh, one species of Aquifoliaceae from Kerala, and six species of Tettigoniidae from Madhya Pradesh.

With a view to enhance livelihood options for people in hilly areas, a novel process for isolation of fibre from pine needles which is simple, eco-friendly and does not demand large space, energy, instrumentation etc. has been developed. The isolated fibre can be spun into handloom cloth with which a variety of products can be made.

Systematic research has lead to filing of nine patents on medicinal plants, natural fibers, wood composite, bioprospecting etc.

ICFRE established three new VVKs at Mandi (H.P.), Gottipura, Hoskote, Bengaluru (Karnataka) and at Barapani, Umiyan (Meghalaya).

The Council is implementing Ecosystem Services Improvement and REDD+ projects wherein *Safeguards Information System for implementation of REDD+ in India* was drafted in consultation with stakeholders through nine regional workshops at different parts of the country. Also, organized 77 trainings for 5152 participants, *Sustainable Land and Ecosystem Management (SLEM)* best practices were upscaled in the project areas of Chhattisgarh and Madhya Pradesh which benefited 4487 direct and 23737 indirect beneficiaries.

ICFRE has also extented scientific services in the form of consultancies. During the year eleven consultancy projects were carried out in the field of Hydropower and mining.

The council has successfully prepared Detailed Project Report (DPR) for rejuvenation of 13 major river systems of India through forestry interventions for MoEF&CC. The replenishment studies of River Bed Material (RBM) to provide updated scientific bases for managing the unscientific mining have contributed to overall total extractable RBM for Yamuna and Ganga Rivers and their tributaries in Uttar Pradesh and Uttarakhand respectively.

ICFRE is executing National Compensatory Afforestation Fund Management and Planning Authority (CAMPA) funded programme with three schemes on strengthening of Forestry Research including Extension and Education, forest fire and REDD+.

Year 2020-21 was an exigent year due to COVID-19 pandemic which hampered the functioning to a large extent particularly extension activities. However, ICFRE successfully organized 185 trainings for 9875 stakeholders and 101 Seminars/Symposia/ Workshops/ meetings for 5238 participants through virtual mode as well as physical mode observing all COVID related protocols.

I am confident that this annual report will effectively provide an overview of the diverse activities of the council performed during the year 2020-21 which will serve the needs of researchers and policy makers both in the forestry sector.

(A.S. Rawat)

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

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OVERVIEW

OVERVIEW

Indian Council of Forestry Research and Education (ICFRE), Dehradun is an autonomous body under the Ministry of Environment Forests and Climate Change (MoEF&CC), Government of India (GoI). ICFRE is mandated to conduct holistic research, impart education, training on forestry and environment and extend solutions on the regional, national and global emerging issues to various stakeholders. The wide range of research includes forest productivity, genetic improvement, biodiversity conservation, silviculture, agroforestry, climate change, forest products, protection, combating desertification, sustainable development, and ecology and environment. The research outcomes and the technologies developed are extended from lab to land for the benefit of various stakeholders. This annual report 2020 -21 of ICFRE provides glimpse of significant findings made during the year in the form of physical achievements that consists of five chapters namely Introduction, Research Highlights, Education Vistas, Extension Panorama, and Administration and Information Technology. The financial achievements in the form of balance sheet is presented in chapter-6. Following are the physical and financial details executed during the year 2020-21:

Projects	Completed	Ongoing	Initiated
Physical targets			
Plan	48	93	26
Externally Aided	38	111	33
Budget (in Crore)			
Plan			
Allotment		Rs. 218.0252	
Expenditure		Rs. 220.18	
External aided			
Allotment		Rs. 89.65	
Expenditure		Rs. 64.20	

The major challenges that the year 2020-21 put before the world helped ICFRE to emerge as a forerunner in underscoring the critical role of Forestry and Environment in bringing positive transformations for a safe, secure and better society well prepared for the future. Some of the highlights during the year are grouped under priority areas of research and presented below:

ENVIRONMENT AND CLIMATE CHANGE

Regeneration of Mixed Deciduous forests in the canopy opening areas due to selection-cum-improvement (SCI) felling of Dindori Forest Division, Madhya Pradesh revealed that the proportion of new individuals was higher in SCI canopy openings than that of natural occurring gaps indicating that artificial canopy gaps trigger a set of new forest structure and composition.

Regeneration studies of *Dalbergia latifolia*, high valued Indian Rosewood, in Karnataka and Kerala in moist deciduous forests revealed that the regeneration were inconsistent, the absence of different girth class saplings and poles during population analysis indicated unhealthy sign of regeneration.

ECOSYSTEM SERVICES AND REDD+

Safeguards Information System for implementation of REDD+ in India was drafted in consultation with stakeholders through nine regional stakeholders' workshops conducted in various parts of the country.

Sustainable Land and Ecosystem Management (SLEM) best practices were upscaled in the project areas of Chhattisgarh and Madhya Pradesh and benefited 4487 direct and 23737 indirect beneficiaries, published four books, eight reports/ booklets and 22 brouchure/pamphlet/flyers. Overall 77 capacity building programmes for stakeholders were organized attended by 5152 participants under REDD+and SLEM.

BIODIVERSITY CONSERVATION

For *Paris polyphylla,* an important medicinal plant, 51 populations were explored in Arunachal Pradesh, Mizoram and Nagaland and identified four different forms of the species. The genetic resource of *P. polyphylla* was conserved.

RFRI as a CITES-Scientific Authority undertook Non-Detriment Finding (NDF) study and recommended the export quota of agar wood products to the CITES- Management Authority.

Developed allometric volume equations for *Aquilaria malaccensis* and *Bombax ceiba* for Trees outside the Forest (ToF) in upper Assam and for estimation of standing biomass and carbon accounting for the Indira Gandhi Nahar Pariyojna (IGNP) plantation of *E. camaldulensis* and *Vachelia tortilis* in Rajasthan.

Monitoring of avenue trees for the pathological, entomological and physiological parameters in Chandigarh revealed mainly pathological problems that are species specific.

Biological diversity assessment in Raj Bhawan, Jaipur and Mount Abu recorded 412 plant species and 39 faunal species.

For *Commiphora wightii* (Guggal) the yield of black viable and white non-viable seeds varied with the season and was highest during December and lowest in May.

Optimized non-destructive method for *in vitro* production of guggulsterone.

Standardized nursery and plantation techniques for *Juniperus polycarpos* species for better growth performance.

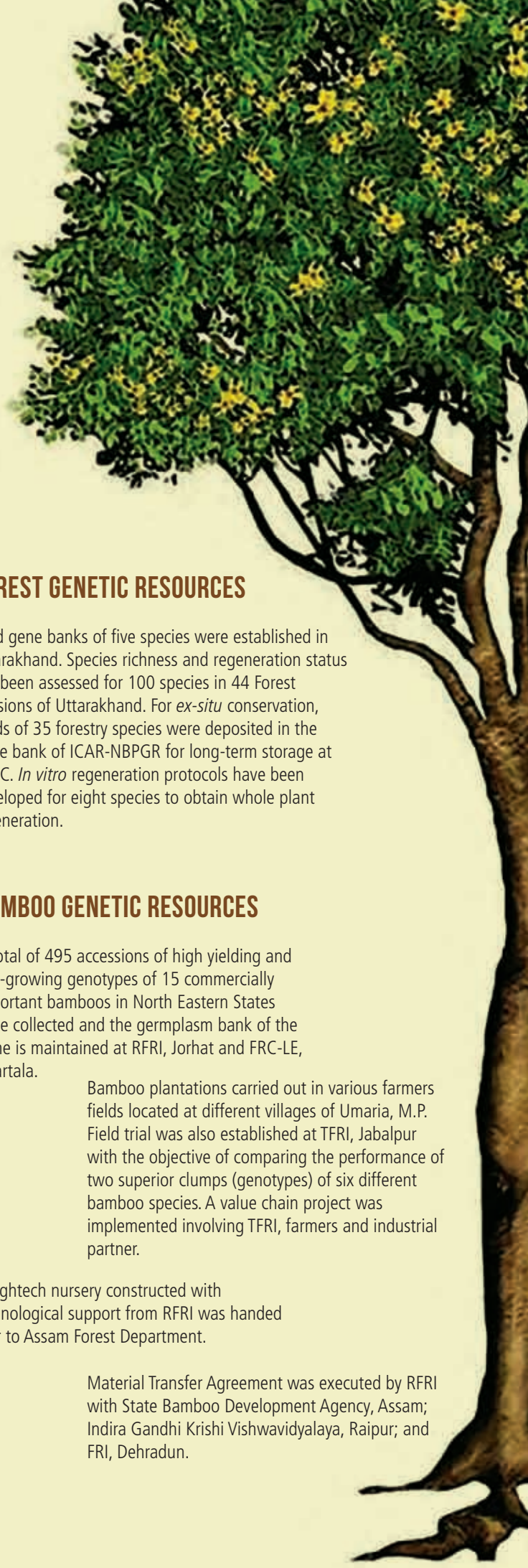
Established orchidarium at Tikok colliery; 65 orchid species were identified along with their host plants from Makum coal field and nearby area of Margherita. Restoration work of Orchid-Flora of Makum coal field area of Digboi Forest Division is being carried out.

TREE IMPROVEMENT

A germplasm bank of *Melia dubia* was established with 88 different accessions out of 110 different accessions collected from different parts of the country. Three field trials with 21 genotypes, one in Bihar and two in Jharkhand, five progeny trials at Jharkhand and demonstration trials at IARI Barhi, Hazaribagh and Jadua, Hajipur were also established.

WOOD PROPERTIES

Studies on phenology, molecular analysis and wood properties of *Tecomella undulata* with respect to three flower colour morphotypes revealed that wood of red flower color morphotypes found to have higher specific gravity, fibre stress at elastic limit, modulus of rupture, modulus of elasticity, hardness, and shear strength parallel to grain as compared to the wood of other flower colour trees.



FOREST GENETIC RESOURCES

Field gene banks of five species were established in Uttarakhand. Species richness and regeneration status has been assessed for 100 species in 44 Forest Divisions of Uttarakhand. For *ex-situ* conservation, seeds of 35 forestry species were deposited in the Gene bank of ICAR-NBPGR for long-term storage at -18°C. *In vitro* regeneration protocols have been developed for eight species to obtain whole plant regeneration.

BAMBOO GENETIC RESOURCES

A total of 495 accessions of high yielding and fast-growing genotypes of 15 commercially important bamboos in North Eastern States were collected and the germplasm bank of the same is maintained at RFRI, Jorhat and FRC-LE, Agartala.

Bamboo plantations carried out in various farmers fields located at different villages of Umaria, M.P. Field trial was also established at TFRI, Jabalpur with the objective of comparing the performance of two superior clumps (genotypes) of six different bamboo species. A value chain project was implemented involving TFRI, farmers and industrial partner.

A hightech nursery constructed with technological support from RFRI was handed over to Assam Forest Department.

Material Transfer Agreement was executed by RFRI with State Bamboo Development Agency, Assam; Indira Gandhi Krishi Vishwavidyalaya, Raipur; and FRI, Dehradun.

HEALTH/SKIN CARE

Antimicrobial activity of the methanol extract of the *Pterocarpus santalinus* bark and heartwood were effective with special reference to health care and skin care properties and showed significant zone of inhibition for *Klebsiella pneumonia, Staphylococcus aureus, Bacillus subtilis* and *Escherichia coli.*

WOOD AND NON-WOOD PRODUCTS

Studies were carried out on wood quality of *Borassus flabellifer* (Palmyra palm) for its utilization as timber. The findings revealed that the timber of Palmyra palm can be classified as extremely heavy, very strong, tough, moderately steady and exceptionally hard. The wood can be efficiently utilized for tool handles, construction, furniture, wooden flooring, pallets, oars and paddles, door and window shutters and frames.

For the extraction of fibre from Bhimal, the application of urea showed significant effect on fiber extraction and reduced time by 77.5% in retting of bhimal fiber against the traditional method which requires more than 90 days. Biological treatment of fiber was done and fiber was extracted within 14 days.

HYDROLOGY

Replenishment studies of River Bed Material (RBM) for Ganga river and its tributaries at Haridwar and for Yamuna River at Yamunanagar were done. Overall, total extractable RBM were estimated to be 67,72,350 m^3 for Ganga River and 6,64,624.97 m^3 for Yamuna River.

Studies on natural regeneration, diversity and distribution of soil seed banks in watershed of sacred Khecheopalri Lake of Sikkim indicated a total of 393 plant species from the above ground vegetation.

AGROFORESTRY

Standardized *Gmelina arborea* based agroforestry system in M.P. by utilizing shade of *Gmelina* tree for the selected intercrops i.e. *Asparagus racemosus, Curcuma longa, Zingiber officinale* and *Piper betle.* Betel vine farming was also standardized by conducting experiments on insect pest management by biocontrol method and constant supply of irrigation by drip irrigation system.

Five agroforestry demonstration plots were established with seedlings of *Cinnamomum zeylanicum, Zizyphus mauritiana*, *Citrus limon*, *Aquilaria malaccensis*, and *Areca catechu* along with five vermicompost units in Namsai district Arunachal Pradesh.

Agarwood based agroforestry model was developed with *Aloe vera, Homolomena aromatica*, *Zingiber officinale, Capsicum frutescens* (birds eye chilli) and *C. chinese* (king chilli/Manipuri chilli). One provenance trial of *Agarwood* was also laid at KVK, Jorhat, with 14 provenances. Provenance-cum-progeny trials of *Agarwood* with 42 families were established in two locations one in Karnataka and another in South Goa.

A *Melia dubia* based silvo-horticulture model has been established at Torpa (Khunti) to estimate economics of the model after harvest of the crop. A subsistence agroforestry model has been established at Lalgutwa for obtaining maximum return per unit area to demonstrate intensive agroforestry system to the farmers.

SEEDLING SEED ORCHARD (SSO) AND FIELD GENE BANKS (FGB)

Established one Seedling Seed Orchard of *Parkia timoriana* on 2ha. land at Chinkheiching Reserve Forest, Manipur.

Established Field Gene Bank at Field Research Station, Brundhar, Kullu with germplasm of *Trillium govanianum* from 29 different geographical locations of Himachal Pradesh and developed the vegetative propagation method of *T. govanianum*.

Field gene banks for the five prioritized species i.e. *Diploknema butyracea, Cinnamomum tamala, Rhododendron arboreum, Taxus wallichiana* and *Myrica esculenta,* were established at the Uttarakhand Forest Department sites.

Two Clonal Trials comprising of 40 clones of *Thespesia populnea* were established at Gudalur FRS, Chennai and at Thalavaipettai, Bhavani, Tamil Nadu respectively.

Bamboo demo plantation was established in 4 ha. land in Golaghat, Assam and a total of 1,600 bamboo seedlings of *Bambusa balcooa* and *B. tulda* were planted.

LIVELIHOOD ENHANCEMENT

A novel process for isolation of fibre from pine needles which is simple, eco-friendly and does not demand large space, energy, instrumentation etc. has been developed. This process is replicable on large scale and can be easily executed in remote areas having abundance of pine needles. The isolated fibre can be spun into handloom cloth. Technology has been transferred to Uttarakhand Bamboo and Fibre Development Board.

A green, economic, and facile method was developed for removal of anthraquinones from *Cassia tora* endosperm. The results were validated by HPLC analysis and *tora* gum was chemically modified via carboxymethylation and quaternization to prepare value added products.

Food products viz. biscuits, papad, noodles, vermicelli and nuggets enriched with *Moringa oleifera* leaves were developed. Nutritional values of the developed food products were analyzed. Products like Moringa biscuits and papads could be promoted as nutraceutical food products among the commercial producers.

Value addition in form of making gulal, chutney, jam, squash and pickle of some underutilized non-timber forest products were demonstrated to SHGs, villagers, NGOs by giving 12 trainings in tribal areas of Sirohi and Pali district of Rajasthan.

An ethnobotanical survey in Karbi Anglong has helped in identification of 12 plant species frequently used by the Karbi tribe in making of traditional liquor.

The process of formulation of medicines for 20 to 25 diseases/ ailments and methods of administration for treating each disease has been documented for 11 tribes covering 5 districts of Tripura.

PATHOLOGICAL/MYCOLOGICAL MANAGEMENT

Strains of *Micromonospora* (*M. maritama, M. chalceae and M. shwarzwladiensis*) with a combination of *Frankia* was found effective against wilt disease of *Casuarina equisetifolia* caused by *Ralstonia solanacerum.* Mona20, a bioformulation already developed by IFGTB, Coimbatore was supplied to Casuarina growers for control of bacterial wilt disease.

A consortium of fungi, PSBs and *Azospirillum* have been developed for enhancing growth and biomass productivity of *Dendrocalamus strictus* and *Bambusa bambos* in both nursery as well as field conditions. Biofertilizer inoculated seedlings performed better with 80% survival in both the species in field conditions.

Different strains of *Rhizobium* isolated from Khejri nodules showed adaptability to alkalinity, tolerance to 3% NaCl concentration, solubilise phosphorus and positive chitinase activity. Consortia of Rhizobium+Azotobacter+Bacillus were the best as compared to single isolate for raising quality planting material of Khejri.

NEW RECORDS

Four insect species of family Platygastridae: *Cremastobaeus indicus, Duta polita, Trissolcus orontes, T. barrow* have been recorded as new record from Uttar Pradesh. *Ooencyrtus pilosus* and *O. utuna* (Family: Encyrtidae) have been newly recorded from Uttar Pradesh which emerged out from the Coreidae bug eggs on *Dalbergia sissoo*.

Ilex denticulata Wall. ex Wight of Aquifoliaceae family is recorded to be a new distributional record to Palakkad district, Kerala.

Six insect species viz. *Himertula* sp., *Isopsera pedunculata*, *Mecopoda elongate*, *Phaneroptera nana*,*Phaneroptera falcate, Sathrophyllia fuliginosa* of Tettigoniidae (Orthoptera) are new locality records from Madhya Pradesh.

Revision of Osmaston's Forest Flora for Kumaon is underway. New addition to the Forest Flora of Kumaon are *Achyranthes aspera, Ageratum conyzoides, Biden spilosa, Eupatorium adenophorum, Ipomoea hederifolia*, *Trichosanthes cucumerina, Cajanus scarabaeoides, Cheilocostus speciosus, Senna tora*, *Ilex pseudo-odorata, Sapium insigne, Girardinia diversifolia, Rumex nepalensis, Dioscorea bulbifera, D. belophylla, D. deltoidea*.

Genome size of *Pterocarpus santalinus* was estimated for first time. Five novel barcodes were predicted for discriminating *P. Santalinus* and other species.

Malacosoma indica was reported for the first time in an epidemic form with intensity of average 2000 larvae per tree in about 10-15 km^2 forest, heavily affecting the Moru oak (*Quercus floribunda*) at altitudinal range 1800 to 2400 m in Tissa Forest range, Himachal Pradesh.

A species of grass was named as *Iseilema kunhikannanii* in the honor of Director, IFGTB, Dr. C. Kunhikannan's contribution in biodiversity studies by Dr. Chandramohan, FSI, Regional office, Nagpur.

NEW PRODUCTS DEVELOPED

"Dyecop"- A mask with microbial filtering capability produced with natural dye extracted from eucalypt leaves.

"**IFGTB Seed Cake Mix**" to support seed ball technology, and has been supplied to various stakeholders.

An android-based farmer-friendly mobile app for yield estimation of *Melia dubia* grown in plantations.

A scientific instrument "Steam Explosion Treatment Machine" (SETM) was modified for extraction of fibre and Shampoo in a single day for Bhimal.

SCIENTIFIC SERVICE IN THE FORM OF CONSULTANCIES

Works under eleven consultancy projects which includes preparation of R & R Plans for 37 mines out of 166 iron ore mines assigned by Government of Karnataka, Environmental Audit of 35 coal mines awarded by Coal India Limited, Kolkata etc.,and other projects awarded by Tehri Hydro Development Corporation India Ltd.; MoEF&CC, GoI, New Delhi; NTPC Ltd., Noida; NMDC Ltd., Hyderabad; Singreni Collieries Company Ltd., Kothagudem; Chhattisgarh State Forest Department, Raipur; Department of Forest and Environment, Govt. of Odisha, Bhubaneswar; M/s. R. Praveen Chandra (ML No. 2294), Bengaluru, Western Coalfield limited, Nagpur, were carried out. Four projects were awarded and initiated during the year 2020-21.

FORESTRY EDUCATION AND TRAINING

ICFRE plays a pivotal role in the field of forestry education. The FRI Deemed to be University extends M.Sc. course under four disciplines. 74 Research Scholars have been registered for Ph.D. degree and 36 Research Scholars have been awarded degree during the year. A total of 185 trainings were imparted to 9875 stakeholders that include researchers, scientists, students, officials of all ICFRE institutes.

ENHANCING THE OUTREACH

Training on prefabricated mountain solar water heating systems was extended to the selected households in collaboration with Himalayan Research Group. Installing of mountain solar water heating systems in 307 households has facilitated almost 40% fuel wood saving and also reduced women drudgery in fuel wood collections.

Three new VVKs were established at Longni, Mandi (H.P.), IWST Research Station, at Gottipura, Hoskote, Bengaluru (Karnataka) and Barapani, Umiyan (Meghalaya).

Organized 101 Seminars/Symposia/ Workshops/ meetings with 5238 participants; hosted online lecture series on the theme "*Tree cultivation for increasing farm income*" registered by 7,600 participants which was streamed online through Facebook live and the recorded version were also shared in social media groups. Nearly 70,000 views were recorded on Facebook.

DOCUMENTARIES

Fifteen documentaries on research and extension activities of institutes, Bamboo propagation, charcoal production and its utilization, compost out of waste, cultivation of medicinal plants and hill bamboo, reclamation and rehabilitation of open cast mine areas etc. were produced by ICFRE institutes under CAMPA and other projects.

GREEN SKILL DEVELOPMENT PROGRAMME (GSDP)

ICFRE imparted trainings to various stakeholders under Green Skill Development Programme (GSDP) of MoEF&CC. During the year 2020-21, 03 trainings comprising of 48 participants were conducted by IFGTB-ENVIS.

'PRAKRITI'

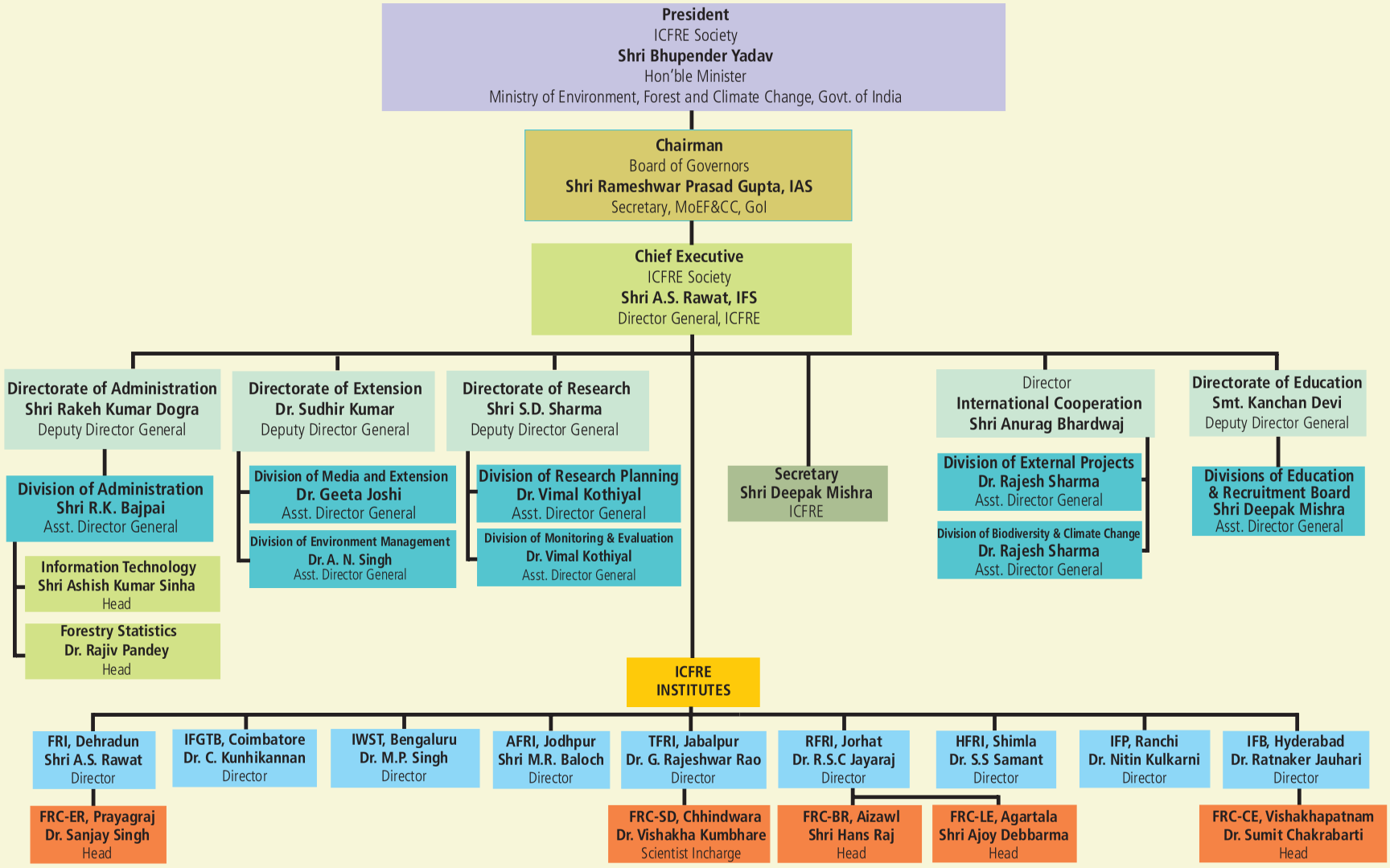
'*Prakriti*', a scientist – student connect programme, is operational with Kendriya Vidyalaya Sangathan (KVS) and Navodaya Vidyalaya Samiti (NVS) through all ICFRE institutes across the country. During the year, IFGTB hosted Online Knowledge Series to school and college students. "*Talk to Scientist*" was the main theme wherein the students interacted with Scientists and Officials of IFGTB. A total of 8 schools (579 students) and three colleges (532 students) participated in the Online Knowledge Series. 82 students from grade five to post graduation level from schools, colleges, and universities along with five faculties visited IWST, Bengaluru.

NATIONAL AUTHORITY COMPENSATORY AFFORESTAION FUND ACT (CAMPA)

CAMPA has funded three schemes to ICFRE on Strengthening Forestry Research for Ecological sustainability and Productivity Enhancement (it has six components); Estimation of economic losses in real term per hectare basis due to forest fire in Uttarakhand and Madhya Pradesh; and Execution of Readiness Activities for implementation of REDD+ in India. In component I of scheme one 31 AICRPs comprising of 13 species based projects and 18 subject area specific projects are being executed. Other components deal with Forest Genetic Resources; Policy studies; Capacity Building of State Forest Departments for developing "State REDD+ Action Plans; Human Resource Development and Forestry Extension.

Some of the significant work carried out in these projects are: designing, developing and fabricating a lab scale model of MW vacuum dryer; recording natural distribution of Red sanders spread over 3.38 lakh ha area in 136 Forest beats: establishment of plantation of Sandalwood, Casuarinas, Bamboos, Eucalyptus; selection CPTs of Red sanders, Shisham, Neem, Rosewood and *Madhuca longifolia*; publication of a resource manual for capacity building of State Forest Departments for developing State REDD+ Action Plans (SRAP), etc. Seven Technology Demonstration Centers are in process of establishment at different ICFRE institutes and a photo gallery has been established at FRI, Dehradun.

ORGANIZATIONAL STRUCTURE OF ICFRE SOCIETY



(As on 13.10. 2021)

Chapter-1

INTRODUCTION

1

INTRODUCTION

Indian Council of Forestry Research and Education (ICFRE) is an autonomous organization under the Ministry of Environment, Forest and Climate Change (MoEF & CC), Government of India (GoI) and is registered under the Societies Registration Act, 1860. The ICFRE Society, subject to guidelines as issued time to time by Government of India, has full authority to perform all acts and issues such directions as may be considered necessary incidental or conducive to the attainment of the objective of the Council. The Hon'ble Minister of MoEF&CC is the President and the Director General, ICFRE is the Chief Executive officer. 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 officers from various state governments, educational institutes, NGOs and scientific organizations. During the year two Annual General Body Meetings were held.

Vision

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

Mission

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

27TH ANNUAL GENERAL MEETING

The 27th AGM of the ICFRE was held under the Chairmanship of Shri Prakash Javadekar, Hon'ble Minister of MoEF&CC and President of ICFRE on 25 March 2021, through Video Conferencing. Shri R.P. Gupta, Secretary, EF&CC, Dr. Sanjay Kumar, DGF&SS and Shri Arun Singh Rawat, DG and Member Secretary of the ICFRE were present in the meeting at MoEF&CC, New Delhi.

The AGM members confirmed the Minutes of 26th Annual General Meeting of the ICFRE held on 27 April 2020 and noted the action taken on the decisions of previous meeting. Annual Report and Annual Audited Accounts of ICFRE for the year 2019-20 were approved.

ICFRE NATIONAL PRESENCE

26TH ANNUAL GENERAL MEETING (AGM)

The 26th AGM of the Indian Council of Forestry Research and Education (ICFRE) was held under the Chairmanship of Shri Prakash Javadekar, Hon'ble Minister EF&CC, Shri C.K. Mishra, Secretary, EF&CC, Dr. Sanjay Kumar, DGF&SS and other members on 27 April 2020. through Video Conferencing.

The AGM confirmed the Minutes of 25th AGM of the ICFRE held on 19 November 2018 and noted the action taken on the decisions of previous AGM. Annual Report and Annual Audited Accounts of ICFRE for the year 2018-19 were also approved.

58TH MEETING OF THE BOARD OF GOVERNOR (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 of administration and management of the affairs and funds of the Society. Secretary, MoEF&CC is the Chairman of the BoG of ICFRE.

The 58th BoG meeting of ICFRE was held through virtual mode under the chairmanship of Shri R.P. Gupta, IAS, Secretary, EF&CC, MoEF&CC on 22 January 2021; Shri A.S. Rawat IFS, DG, ICFRE and the Member Secretary welcomed the Secretary and other members.

The Chairman, BoG appreciated the innovative initiative research scheme "Strengthening Forestry Research for Ecological Sustainability and Productivity Enhancement" funded from National Authority CAMPA and All India Coordinated Research Projects (AICRP) in association with ICFRE and non ICFRE institutions for adopting a holistic approach for achieving the deliverables. The secretary informed the Board that ICFRE prepared Detailed Project Report (DPRs) for 13 major rivers in the country besides setting-up of Centre of Excellence on Sustainable Land Management on South-South Cooperation at ICFRE; implementation of World Bank project on Ecosystem Services Improvement in Madhya Pradesh and Chhattisgarh state for measuring and monitoring of forest carbon stock, scaling up of sustainable land and ecosystem management best practices for reducing land degradation and desertification.

The Board confirmed the minutes of 57th meeting of BoG of ICFRE and the action taken on the decisions in the previous meeting of BoG. The Board approved the Annual Report and annual Audited Accounts of ICFRE for the year 2019-20. The Board also approved the modifications in the Rules of ICFRE Awards for Excellence in Forestry; noted the developments with regards to the pensionary liabilities of the Central Government Employees absorbed into the service of ICFRE. Seven ICFRE publications were released by the Chairman.

ICFRE Annual Report 2019-20 was placed in both the houses of Parliament i.e. Lok Sabha and Rajya Sabha.

The planning and formulation of research projects are managed through Research Advisory Group (RAG) at institute level and a Research Policy Committee (RPC) meeting at National Level. Regional Research Conferences (RRCs) are organized to discuss the region specific research needs and to identify priority areas for research. The following four RRCs were organized by various ICFRE institutes during 2020-21:

RRCs organized in 2020-21

Sl. No.	Date	Conference	Venue/ Mode	Organizing institute
1	25.08.2020	Forestry Research in Western and Central India	Through VC	AFRI, Jodhpur
2	22.09.2020	Forestry Research in Eastern regions of India	Through VC	IFP, Ranchi
3	28.10.2020	Forestry Research in western Himalayan regions of India	Through VC	HFRI, Shimla
4	29.01.2021	Forestry Research in southern states of India	Through VC	IWST, Bengaluru

Details of meeting of Research Advisory Group (RAG) and Research Planning Committee (RPC) during 2020-21 are as follows:

- RAG meetings of ICFRE institutes were conducted between 21 September to 15 October 2020.
- XXI RPC of ICFRE was held on 22 & 23 February 2021. XXI RPC has approved 26 new and reviewed progress of 93 ongoing research projects.

ICFRE is expanding its research base through collaboration with organizations of National and International repute and during the year has signed MoUs as follows:

ICFRE SIGNED MOUS WITH FOLLOWING NATIONAL ORGANIZATIONS

- National Institute of Hydrology (NIH), Roorkee
- Indian Institute of Technology (ISM), Dhanbad
- Hemwati Nanadan Bahuguna Garhwal University, Central University
- Institute of Rural Management Anand (IRMA), Anand, Gujarat
- Botanical Survey of India (BSI), Kolkata

NEW INITIATIVES:

MoUs in Progress with International Organizations

- Beijing Forestry University (BFU), Beijing (with FRI Deemed to be University)
- Forestry and Environment Research, Development and Innovation Agency (FOERDIA), Indonesia
- Brazilian Forest Services (BFS), Brazil
- Kasetsart University (KU), Thailand
- Chinese Academy of Forestry (CAF), China (Extension for another five years)
- International Centre for Integrated Mountain Development (ICIMOD), Kathmandu, Nepal (Letter of Intent);
- Swedish Forest Agency (SFA), Sweden
- Wildlife Institute of India, Dehradun (National)

Chapter-2

RESEARCH HIGHLIGHTS

2

RESEARCH HIGHLIGHTS

2.1. ECOSYSTEM CONSERVATION AND MANAGEMENT

PROJECTS UNDER THE THEME

A. Plan

- Completed 01
- Ongoing 14
- Initiated 03

B. Externally Aided (except CAMPA)

- Completed 06
- Ongoing 24
- Initiated 05

2.1.1. Climate Change

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

Finalized the Biennial Update Report III on 'Mitigation Actions, Constraints, Gaps and related Financial, Technical and Capacity Needs to Address Climate Change Concerns in Forest Sector in India' and submitted to the NATCOM Project Management Cell of Ministry of Environment, Forest and Climate Change, Government of India for incorporation in Biennial Update Report III of India to the UNFCCC.

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

A total of 196 soil samples were collected from different tea gardens and reserved forests from Jorhat, Sibsagar, Dibrugarh, and Tinsukia districts of Assam and analyzed for pH, bulk density and moisture content. The mean values of analyzed samples for bulk density and soil pH were 1.38 (± 0.18) and 4.69 (± 0.67) respectively. The mean value of soil organic carbon was 0.77 percent.

Ecosystem Services Improvement Project

Forest carbon stocks measuring and monitoring – capacity building (BCC, ICFRE)

Organised three training programmes on measurement of forest carbon stocks for capacity building for the officials of Hoshangabad, Sehore and North-Betul Forest Divisions of Madhya Pradesh State Forest Department at Itarsi (MP). The objective of the training programmes was to train the forest officials as master trainers on forest carbon stock measurement. A total of 86 officials participated in the training programmes.

Organised nine training programmes on measurement of forest carbon stocks for the members of Joint Forest Management Committees (JFMCs) of Madhya Pradesh and Chhattisgarh at Banapura, Budhni, Bhaura, Itarsi and Sukhtawa Forest Ranges of Madhya Pradesh, and in West Pandariya, Raghunathnagar, Marwahi and Pali Forest Ranges of Chhattisgarh. A total of 402 members of JFMCs participated in the training programmes.

Develop, test, and pilot systems for measuring and monitoring of forest carbon stocks (BCC, ICFRE)

Two eddy covariance/ carbon flux towers with 42-meter height have been installed in the states of Madhya Pradesh (Khatpura Beat, Budni Forest Range, Sehore Forest Division) and Chhattisgarh (Sonhat Beat, Raghunathnagar Forest Range, Balrampur Forest Division) for measuring the carbon fluxes of forests. Eddy covariance technique provides the continuous measurement of the exchange rate of CO_2 across the interface between the atmosphere and vegetation by measuring the covariance between fluctuating vertical wind velocity and CO_2 mixing ratio.

Upscaling of SLEM best practices (BCC, ICFRE)

Some of the sustainable land and ecosystem management (SLEM) best practices such as lac cultivation for livelihood generation and biodiversity conservation, rainwater harvesting and augmentation of ground water resource, and integrated farm development for sustainable land productivity have been upscaled in the project areas of Chhattisgarh and Madhya Pradesh.

Organised sixty five training programmes on upscaling of SLEM Best Practices on 'Integrated Farm Development for Sustainable Land Productivity' and 'Lac Cultivation for Livelihood Generation and Biodiversity Conservation' for the local communities of villages under the Marwahi, Pandariya and Raghunathnagar Forest Ranges of Chhattisgarh, and Banapura, Bhaura, Sukhtawa, Itarsi and Budhni Forest Ranges of Madhya Pradesh. The objective of the training programmes was to build the capacity of the local communities for upscaling of SLEM best practice. A total of 4664 members of the local communities participated in the training programmes.

Carbon Flux Towers installed in Madhya Pradesh and Chhattisgarh

Prepared SLEM communication strategy (BCC, ICFRE)

National Database on SLEM Practitioners for the development of institutional and individual networks has been prepared. The database has detailed information on the SLEM best practices developed/ adopted in the country by institutions/ organizations and individuals. This database will also provide information on community-specific traditional/ indigenous practices for water conservation, land management, natural resource management including agriculture in the region. Database will be uploaded on knowledge sharing platform of ESIP in future.

Carbon sequestration potential of existing land-use systems in Lahaul Valley, Himachal Pradesh (HFRI)

Study on carbon sequestration potential was studied for *Salix* plantation, pure agriculture, agri-silviculture systems, *Hippophae rhamnoides* ssp. *turkestanica* forest, degraded area, alpine pasture, mixed forest and *Betula utilis* forest of Lahaul valley in Himachal Pradesh. The values of above ground and below ground biomass for pasture at Urgos were 1.57t/ha and 3.46 t/ha, respectively. The above ground and below ground biomass carbon stock was 0.80 t C/ha and 1.66 t C/ha, respectively. The soil carbon stock up to 30 cm depth was 66.39 tC/ha for Urgos pasture. For other land use systems the values for dry biomass, biomass carbon stock and total carbon stock are as follows:

System/Species/Place	Dry biomass	Biomass carbon stock	Total Soil carbon stock upto 30cm
Pure agriculture at Tino	7.980t/ha	4.066tC/ha	74.88tC/ha
Salix alba plantation at Lote	216.76/ha	119.38tC/ha	70.40tC/ha
Agri-Silviculture at Shooling for *Hippophae rhamnoides* ssp. *turkestanica* forest	193.82 t/ha	104.73tC/ha	62.94 tC/ha
Hippophae rhamnoides ssp. *turkestanica* forest at Gypsa	47.56 t/ha	23.25 tC/ha	59.48 tC/ha
Degraded area at Tandi	3.97 t/ha	1.94 tC/ha	29.54 tC/ha
(Pinus wallichiana, Picea smithiana and *Juniperus polycarpus)* Mixed forest type at Trilokinath	387.53 t/ha	140.71 tC/ha	68.69 tC/ha
Betula utilis forest at Kishorinala	71.66 t/ha	31.86 tC/ha	67.47tC/ha

2.1.2. Ecology and Environment

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

Lambidhar and Chunakhala restored sites were selected and thirty-seven plots, and twenty-five plots were laid respectively. The average carbon assimilation rate was recorded for Chunakhala (13.02 µmol CO_2 m^{-2} s^{-1}) and Lambidhar (11.86 µmol CO_2 m^{-2} s^{-1}). Average soil respiration rate varied between 1.45 and 5.38 µmol m^{-2} sec^{-1} for Chunakhala restored site and 0.3 and 6.39 µmol m^{-2} sec^{-1} in Chunakhala natural forest area, and the variation in the values may be attributed to difference/variation in soil temperature.

(a)

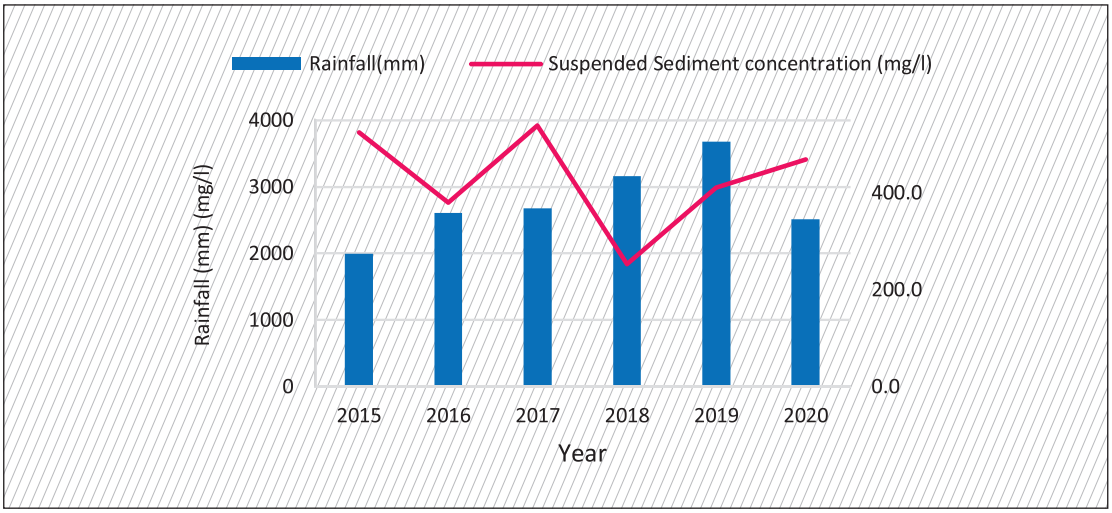
(b)

(a) Soil CO_2 flux monitoring at experimental restored site.

(b) Recording of carbon assimilation rate, transpiration rate and stomatal conductance

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

Meteorological parameters, physico-chemical properties of water, and soil parameters are being recorded periodically. Annual rainfall in the Kempty watershed was 2577 mm. The total run-off generated was 770 mm (30%), that consists of direct run off of 538 mm (21%) and base flow of 233 mm (9%) during the year 2020. Maximum (43%) direct runoff was measured during August and September and minimum runoff (18%) was recorded during summers. It was observed that the base flow and direct runoff contribution in the stream discharge was 41% and 69%, respectively, during monsoon. A significant change in the suspended sediment concentration (SSC) were recorded since 2017 which could be due to the construction of nine check dams at the interval of 200-400 m on 3rd order streams of Kempty watershed.



Annual trend of suspended sediment concentration

Replenishment study of River Bed Material (RBM) for Ganga river and its tributaries at Haridwar (FRI)

To understand the distribution and deposition of the river bed material for Ganga river and its tributaries at Haridwar, Kotawali (1.70 km), Rawasan-I (4.15 km), Bishanpur (6.40 km), Shyampur (2.65 km), and Chidiyapur (3.35 km) were divided into various segments by clustering cross-sections. An elevation difference of river bed was recorded for the segments and its distribution of deposition estimated. The difference in average deposition was negligible (0.10-0.15 m) for all sites. Overall, total extractable RBM (balance extractable and deposited during 2020) was calculated and the total extractable quantity (67,72,350 m^3) was estimated.

Replenishment study of River Bed Material (RBM) for Yamuna River at Yamunanagar (FRI)

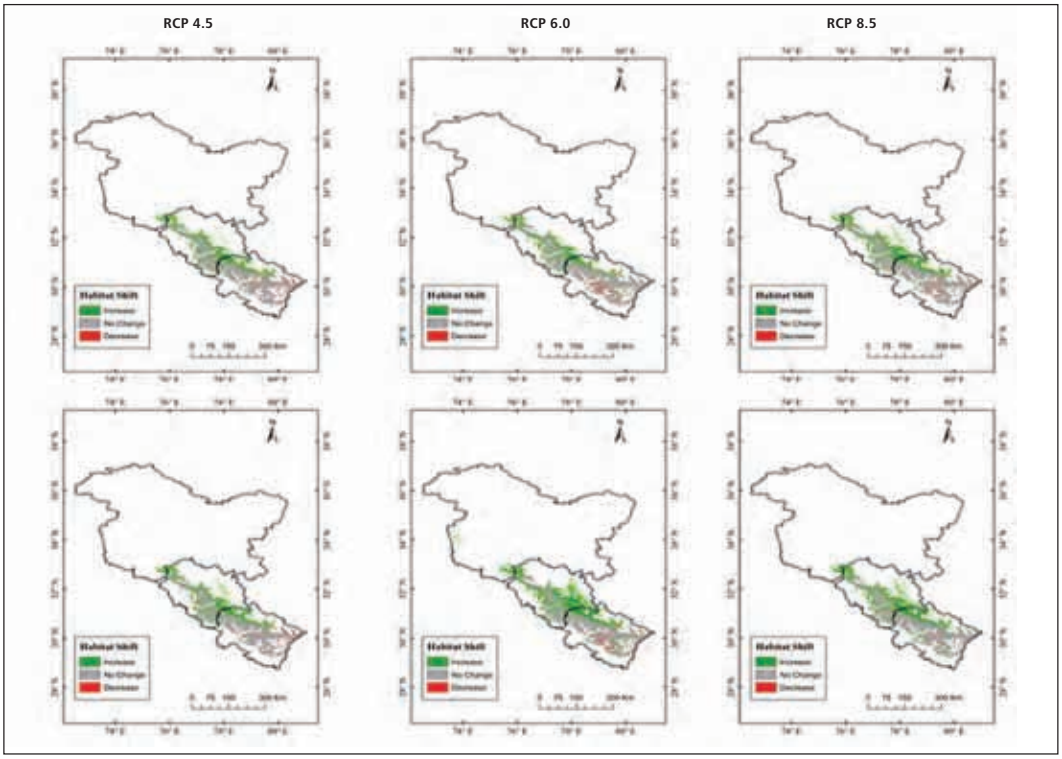
Pre- and post-monsoon (May and September 2020) periods were investigated for the deposition of river bed material (RBM). Cross-sections were made at an interval of 25 m along the Yamuna river stretch of over 2 km at Yamunanagar. Maximum quantity (164913.59 m^3) of RBM was observed along the 4th segment and minimum (23309.46 m)^3 along the 6th segment. The total estimated extractable RBM was 664624.97 m^3.

Topographical survey of the study area using Total Station

Topographical survey of the study area using Total Station

Predicting climatically suitable future habitats for the range-restricted Himalayan birds using species distribution modeling approach (FRI)

The impact of climate change on current and future prediction for mapping habitat suitability of Himalayan range-restricted species *Catreus wallichii*, in the western Himalayan states (Jammu Kashmir, Himachal Pradesh, and Uttarakhand) were made using factors such a as bioclimatic variables, land use (forest cover and forest type), soil characteristics, and topographic variables. The ensemble modeling showed that climatically suitable habitat for species were shifting towards the higher elevations in the wake of future climate change scenarios, i.e., Representative Concentration Pathways (RCPs). The study revealed that future climate change would likely change *C. wallichii* (cheer pheasant's) distribution pattern and suitable habitats.



Prediction of suitable future habitat of Cheer pheasant (*Catreus wallichii*) in the RCP 4.5, 6.0 and 8.5 for the year 2050 and 2070

Reclamation of coal mined land of North Eastern Coalfields, Assam through soil amendment and revegetation with native plant species using integrated biological approach (RFRI)

Seedlings of 41 native plant species were planted in Tikak Colliery over Burden Dump areas. In addition, 12,000 seed balls using *Crotalaria striata*, *Thysanolaena maxima*, *Dicranopteris linearis*, *Mimosa pudica*, *Ageratum houstonianum* and *Vetiveria zizanoides* seeds were dispersed. Successful establishment of the grasses along the slope that facilitated reduction in soil erosion were observed.

(a)

(b)

(a) Experimental plantation at Tikak Colliery (b) Visit of Director, RFRI to plantation site, Tikak Colliery

Studies on natural regeneration, diversity, distribution of soil seed banks and their relationship with above-ground vegetation in watershed of sacred Khecheopalri Lake of Sikkim (RFRI)

A total of 393 plant species belonging to 111 families were recorded from the above ground vegetation which consists of trees (109), shrubs (43), herbs (160), fern and its allies (44) and climber (37). Urticaceae with 20 species was the most dominant family followed by Asteraceae with 18 species. Amongst four different forest communities and Habitat/Farmland, plant species richness followed the order: Mixed Broadleaved forest (299 species)>*Alnus nepalensis* Forest (111 species) >Bog/Swamp (91 species)> Habitat/Farmland (67 species) >*Cryptomeria japonica* plantation (65 species). A total of 137 plant species of soil seed bank were documented by germination experiment. Diversity indices from germination experiment revealed that Broadleaved Mixed Forest was the most diverse while the least was Bog/Swamp Forest and it followed the order: Broadleaved Mixed Forest>*Alnus nepalensis* Forest >*Cryptomeria japonica* Plantation >Habitat/Farmland > Bog/Swamp, indicating a similar pattern in terms of diversity indices, showing that Broadleaved Mixed Forest was the most diverse while *Cryptomeria japonica* plantation the least diverse.

(a)

(b)

(a) Demonstration of usages of different instruments used in the field survey to students (b) Seeds of *Elaeocarpus lanceifolius* on the forest floor.

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

Five agroforestry demonstration plots were established in Khampti inhabitated villages, Namsai district Arunachal Pradesh. Seedlings of *Cinnamomum zeylanicum, Zizyphus mauritiana, Citrus limon, Aquilaria malaccensis* and *Areca catechu* were planted. Annual crops such as Ginger, turmeric, sesame, blackgram and maize were intercropped in the first phase followed by potato and mustard in the second phase. Further, five vermicompost units were established in demo plots of agroforestry plantation in Mankao, Piyong Khampti, Lathao, Pathargaon and Old Mohong village. Four Technical Brochures on *Thysanolaena latifolia* (jaru bon), *Schumannianthus dichotomus* (patidoi), *Phrynium capitatum* (Koupat) and *Livistona jenkinsiana* (Tokou pat) were published.

Vermicompost unit in Lathao village Agroforesty demo plot

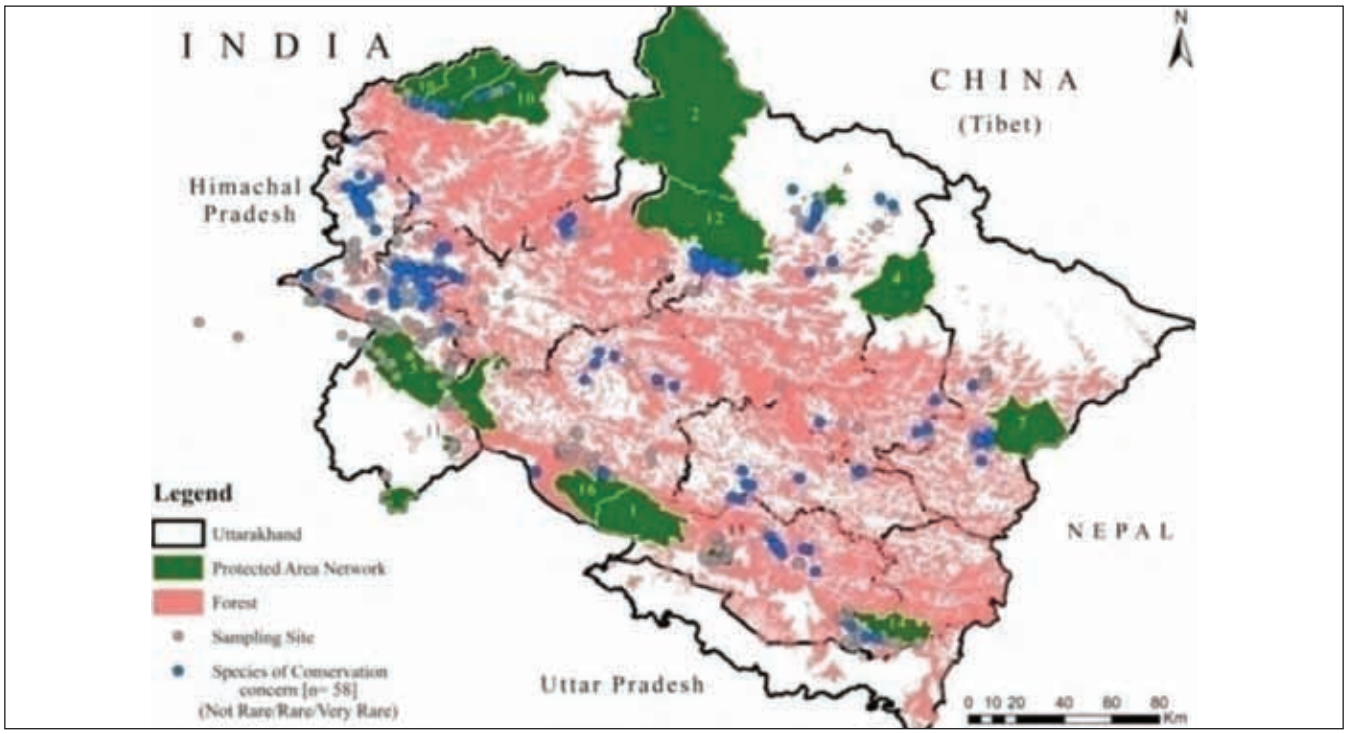
Vermicompost unit in Pathargaon village Agroforesty demo plot

2.1.3. Biodiversity

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

Extensive field surveys were carried out in four years (2017-2020) covering all seasons (spring, summer, pre-monsoon, monsoon, post-monsoon, autumn and winter) in 10 districts of Uttarakhand covering 20 forest sub-types and 307 transects, revealed 371 species of butterflies. GIS based maps were generated for all the 371 species depicting their seasonality, distribution and associated forest types. 870 larval food plants for 259 species (112 data deficient species) of butterflies were identified and listed from literature and field surveys. Life cycle of 15 species was studied in laboratory. 68 species were identified as protected and threatened under the Wildlife (Protection) Act, 1972. GIS based mapping of 58 species of conservation priority was generated by over laying the protected area network and forest types distribution which, revealed many areas/sites in the state supporting diversity of rare species in forests outside the protected area network.

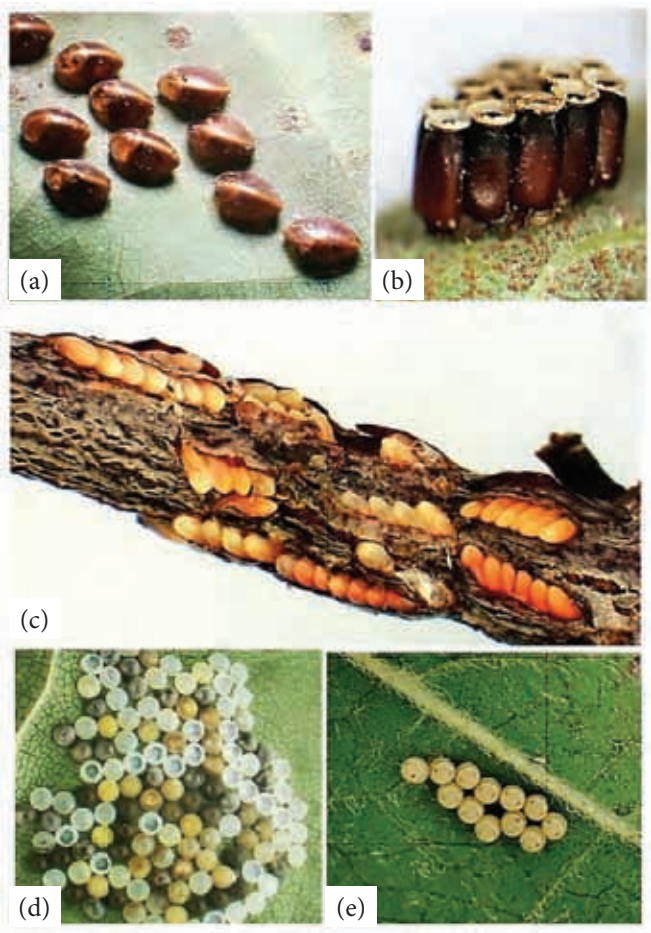
Golden Emperor, *Dilipa morgiana* (Westwood, [1851])-WPA 1972 protected species of conservation priority



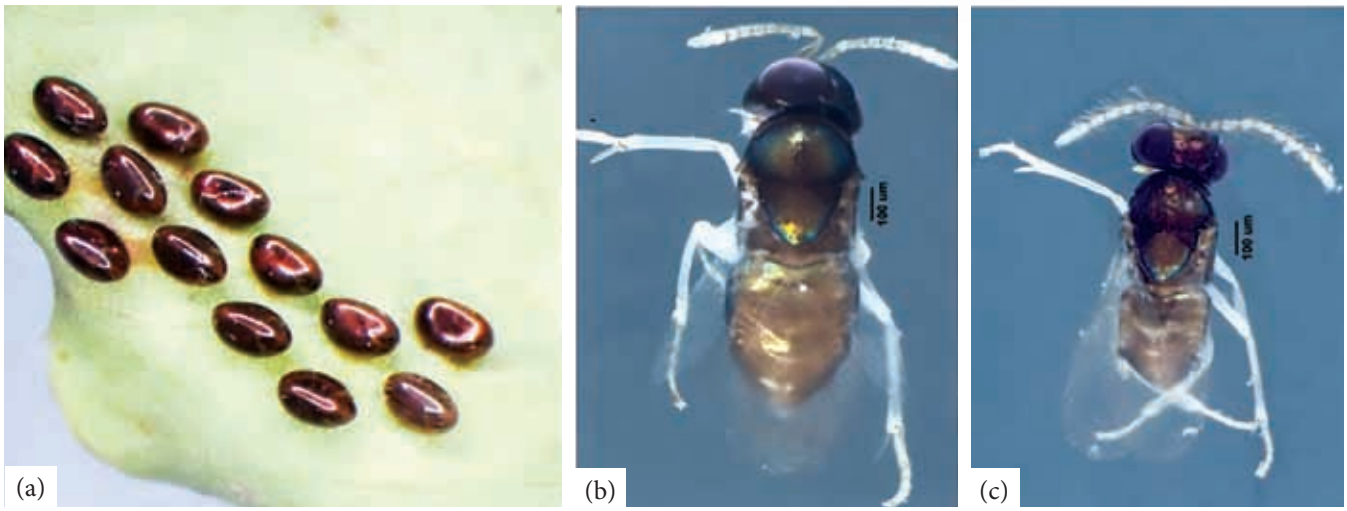
Spread of butterfly species (n=58) of conservation priority outside the protected area network in Uttarakhand

Studies on diversity and host range of hymenopteran egg parasitoids from northern India (FRI)

Hymenopteran egg parasitoids are important biological control agents, therefore screening of egg parasitoids were carried out from samples collected from Haryana, Uttar Pradesh and Uttarakhand. 120 sweeping and 65 egg samples of insect fauna for screening of egg parasitoids were collected from different forestry and agro-climatic zones. Out of 120 sweeping samples about 47 specimens of egg parasitoids were sorted out and identified up to species level. Four species of family Platygastridae: *Cremastobaeus indicus, Duta polita, Trissolcus orontes, T. barrow* have been recorded as new record from Uttar Pradesh. *Ooencyrtus pilosus* and *O. utuna* (Family: Encyrtidae) have been newly recorded from Uttar Pradesh which had emerged out from the Coreidae bug eggs on *Dalbergia sissoo.*



(a) Coreidae eggs on *Bauhinia variegata*; (b) Egg of *Arilus cristatus* on mulberry; (c) Eggs of *Oxyrachis tarandus* on *Santalum album*; (d) Eggs of *Clostera cupreata* on poplar; (e) Stink bug eggs on *Tectona grandis*



(a) Eggs of Coridae bug on *Dalbergia sissoo*; (b) Emerged parasitoid *Ooencyrtus pilosus* (female); (c) male

Assessment of species diversity of Heterocera (moths) across the Shiwalik Landscape of Northern India and development of a database (FRI)

Field surveys in the 3C/C2a Moist Shiwalik Sal Forest and 5B/C1a Dry Shiwalik Sal Forest recorded 74 species of moths belonging to 9 families; 15 specimens were also collected for identification besides baseline parameters of the sites and a moth database was initiated. Moths collected from Dehradun Shiwaliks during monsoon season were identified and identification keys for 22 moth families found in the Shiwalik range along with images were generated.

Brahmaea hearseyi

Sampling of moths using moth screen and CFL lamp

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

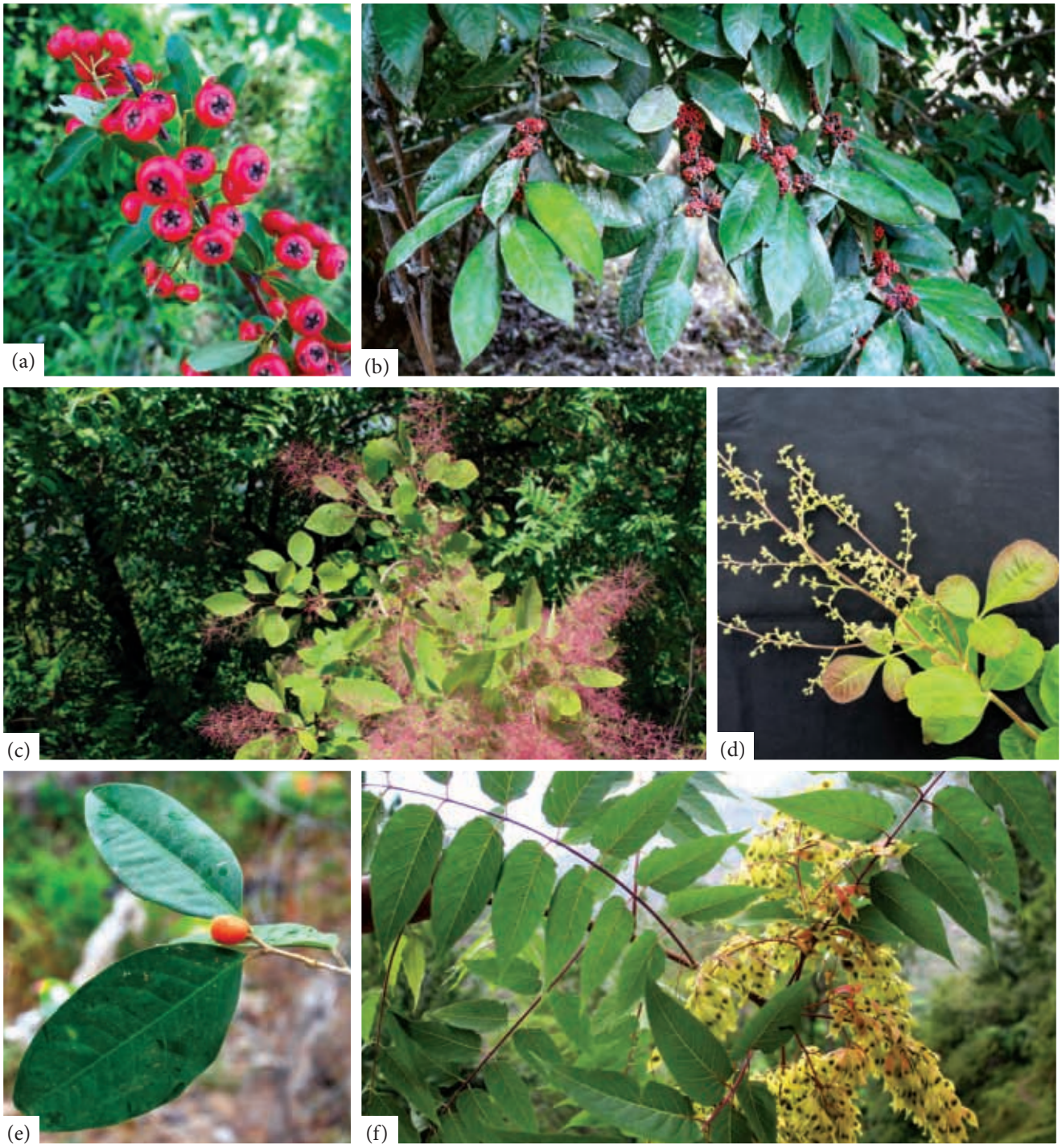
A total of 1267 primary and secondary types along with their labels of the orders Coleoptera, Diptera, Hemiptera, Hymenoptera and Lepidoptera present in NFIC were digitized. All the 5000 photographs of these species were edited and stored in JPEG and TIFF formats.

Photographs of a Paratype (Co-type) of *Bembidion babaulti* Andrewes, 1924 (Coleoptera: Carabidae).

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

A total of 281 samples of insect stages, infested plant and leaf parts were collected from Dehradun, Haridwar, Chamoli, Almora, Pauri, Tehri, Bageswar, Udham Singh Nagar and reared in the laboratory. 46 pteromalid species samples were collected and identified from the state. Parasitisation potential of six Pteromalidae species on different natural host insect pest has been evaluated.

Six new records of Pteromalidae (Hymenoptera) parasitoids from the state of Uttarakhand



(a) *Pyracantha crenulata* (b) *Ilex pseudo-odorata* (c) *Rhus cotinus* (d) *Rhus parviflora* (e) *Drypetes assamica* (f) *Aianthus altissima*

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

Random sites of Chakrata, Saharanpur, Kalsi and Dehradun Forest Divisions were surveyed for floristic composition. Invasive species such as *Lantana camara*, *Phyllanthus niruri*, *Parthenium hysterophorus*, *Euparotium adenophorum*, *Argemone Mexicana*, *Cassia tora*, *Cuscuta* spp. *Ipomea carnea*, *Leucaena leucocephala*, *Sida acuta*, *Tridax procumbens*, *Stevia ovate* etc. were recorded from the study area.

(a)

(b)

(c)

(d)

Characterization of grassland types of Uttarakhand and eco-distribution studies (FRI)

Forests of Dehradun, Mussoorie, Badrinath, Chakrata, Haridwar, Nainital Forest Divisions and Kedarnath Wildlife Sanctuary were surveyed for floristic documentation and sampling to identify the grassland types associated with different forest types of Uttarakhand. Wetlands of Kalapani, Asan, Karwapani, Baanganga and Jhilmil, were visited for documentation and vegetation sampling. Geo-coordinate points were recorded for geo-referencing and preparation of eco-distribution maps. Chemical characterization of 16 grass species was partially completed.

(e)

(f)

(g)

(h)

(a), (b): *Phragmites karka* dominance in Kalapani wetland, Rishikesh.

(c), (d): Entire area seen dominated with *Danthonia* grass in Kedarnath region.

(e), (f): *Eichhornia crassipes* (Invasive species) infestation in wetlands of Asan and Jhilmil.

(g), (h): Tussocks of *Danthonias chneideri* dominating cold desert region of Niti valley.


(a)


(b)


(c)


(d)


(e)


(f)

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

New addition to the Forest Flora of Kumaon are *Achyranthes aspera, Ageratum conyzoides, Biden spilosa, Eupatorium adenophorum* (Syn: *Ageratina adenophorum*), *Ipomoea hederifolia* (Syn: *Ipomoea coccinea*), *Trichosanthes cucumerina*, *Cajanus carabaeoides*, *Cheilocostus speciosus* (Syn: *Costus speciosus*), *Senna tora* (Syn.: *Cassia tora*), *Ilex pseudo-odorata*, *Sapium insigne, Girardinia diversifolia, Rumex nepalensis, Dioscorea bulbifera, Dioscorea belophylla, Dioscorea deltoidea* etc.

Invasive species reported were *Lantana camara, Ageratum conyzoides, Eupatorium adenophorum, Senna tora, S. occidentalis, Tridax procumbens, Parthenium hysteroporus, Sida acuta, Uren alobata* etc.

Some medicinal plants reported were *Berberis asiatica, Holarrhena pubescens, Phyllanthus emblica, Justicia adhatoda, Terminalia bellerica, Terminalia chebula, T. arjuna, Dysoxylum binectariferum, Zanthoxylum armatum, Cinnamomum tamala, Putranjiva roxburghii* etc. Threatened species reported were *Berberis osmastonii, Ilex pseudo-odorata, Trachycarpus takil, Aristolochia punjabensis, Gymnosporia rufa* and *Cleyera echnacea.*

(a) *Eurya acuminate* (b) *Cornus capitata* (c) *Euonymus tingens*
(d) *Euonymus tingens* (e) *Stranvaesia nussia* (f) *Saurauia nepalensis*

Cecidology and nursery establishment of *Pistacia integerrima* for exploring possibility of *in situ* leaf gall production (FRI)

Biology of the aphid *Baizongia pistaciae* was studied on the wheat as alternate host sown in 0.5 litre pots and also in the petri plates. Winter alates collected during November 2020 were reared in the laboratory until they laid apterous virginopare (primary). These virginoparae were released on the roots of the 10 days old wheat plants. Each virginopara went through five moultings before laying new generation of secondary virginoparae. There are four generations of apterous virginoparae on roots of alternate host plant (Dec.-March). Rearing of the aphid was successfully completed and alate sexupare (Spring alates) emerged from 15 March onwards. Sexupare lay 14-16 sexuals; with female: male ratio of almost 1:1. For mass multiplication of sexupare for release in the field, wheat was sown in 20 pots, each of 8-10 liter capacity. The wheat roots were inoculated with the primary virginoparae. In the first week April 2021, aphid infested plant pots were transferred to selected five sites.

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

A total of 110 species were identified from Silent valley Buffer Zone, among them 14 are rare, 12 ornamental and 10 edible species. *Ilex denticulata* Wall. ex Wight of Aquifoliaceae family is recorded to be a new record to Palakkad district, Kerala.

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

The impact of canopy openings created due to Selection-cum-improvement (SCI) operations in Mixed Deciduous Forests of Dindori Forest Division in Madhya Pradesh was studied using permanent quadrats and compared with control sites. The impact was assessed along (i) different gap sizes (small - 0.01-0.1 ha; large gaps > 0.1 ha) and (ii) two time periods i.e. pre-felling and post-felling, and their combined influence on population density, structure and regeneration. Observations from permanent quadrats in SCI with 895 stems ha^{-1} showed that *Diospyros melanoxylon* stems has the highest tree density (32%), followed by *Tectona grandis* (27%). Whereas highest basal cover was recorded for *T. grandis* (7.65 sqm ha-1) followed by *D. melanoxylon* (1.43 sqm ha^{-1}) and *Lagerstroemia parviflora* (1.10 sqm ha^{-1}).

The regeneration of species in control plot and SCI plot differed substantially. There were proportionally much less regenerating individuals originating from the natural gaps in control plot as compared to SCI.

Recording regeneration data in mixed forests of Dindori, Madhya Pradesh during January, 2021

Study of Flora and Fauna of Raj Bhavans of Rajasthan (AFRI)

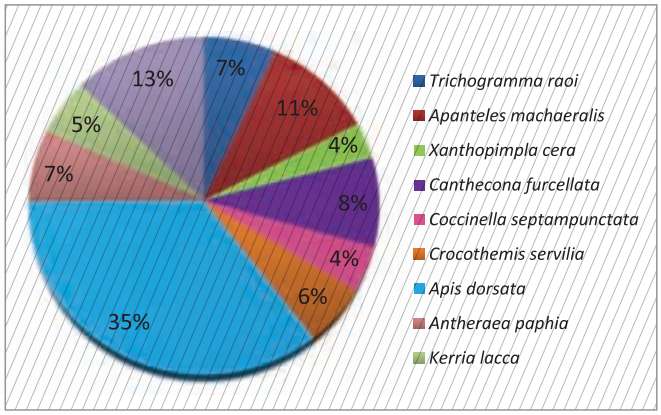
To monitor biodiversity and document the flora and fauna in the form of a coffee table book and to improve urban habitat Jaipur and Mount Abu Raj Bhavan areas were divided into 10 and 11 blocks, respectively. Based on the population of individual species different diversity variables were calculated for each block. Phenology of different species was recorded by visiting the sites four times a year. Visible avian faunal diversity was recorded. 1413 and 2438 available plants at Jaipur and Mt Abu respectively were enumerated and measured. At Jaipur, 215 numbers of plant species belonging to 62 families were recorded, of which Poaceae followed by Fabaceae dominated at both places. Raj Bhavan area of Mount Abu was more diverse in the number of herbaceous species as compared to Raj Bhavan area of Jaipur, but differed with respect of trees and shrubs. Altogether from both the areas, 412 species were recorded of which 85 species were common and 23 families had single species representation.

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

Survey and collection of microlepidopteran moths were carried out in Deodar forests of Chopal, Shimla, Theog, Jogindernagar, Gohar, Karsog, Chail, Jhungi and Charkhadi areas. 148 samples of microlepidoptera were collected and 32 species of micromoths belonging to the 5 families were identified. The data on various other parameters like associated flora, geo-coordinates, altitude, temperature, rainfall, humidity, etc. were also recorded for diversity and habitat association analysis.

Studies on the diversity of some beneficial insects in forest ecosystem in Madhya Pradesh (TFRI)

Survey on the diversity of beneficial insects in different agro climatic zones of Madhya Pradesh recorded 1907 individuals of ten different species of beneficial insects. Diversity indices observed that the diversity of beneficial insects in forest ecosystem in Madhya Pradesh is rich and diverse.



Percentage composition of each beneficial insect in forest ecosystem in Madhya Pradesh

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

As a part of AICRP, surveys were conducted to explore diversity status of long-horned grasshoppers of Madhya Pradesh, recorded16 species of long-horned grasshoppers; out of which ten species are known and six species viz. *Himertula* sp., *Isopsera pedunculata, Mecopoda elongate, Phaneroptera nana, Phaneroptera falcate, Sathrophyllia fuliginosa* are new records from Madhya Pradesh.

Holochlora sp.

2.1.4. Tribals and traditional knowledge system

Documentation of the Traditional Ecological Knowledge (TEK) and quantification of medicinal plants used by the Karbi tribe of Karbi Anglong hill district of Assam (RFRI)

Study on traditional alcoholic beverage of Karbi called *Hor* revealed that twelve plant species were used in making starter culture of traditional liquor. *Croton juofra* was the major ingredient of the traditional beer for adding a scent and sweetness. Karbi traditional fishing festival *okhi-pru* was documented and four piscicidal plants (*Derris elliptica, Catuneragum spinosa, Mimosa rubicaulis, Persicaria hydropiper*) were reported to be used in community fishing. Crafts like *Jambili Athon* (an auspicious item of good omen) and its method of preparation was recognized. Twenty medicinal folk healers were interviewed and 108 species of medicinal plants recorded. Study on the similarity of Karbi tribe with other tribes of Assam revealed highest similarity between Karbi and Dimasafor using similar piscicidal plants, in utilization of folk medicines and highest similarity with Bodo in composition of starter culture plants for traditional liquor preparation.

Karbi Traditional loom

Hor-alank (Fermented form)

Sun dried rice cake *thap*

Women wearing *pekok*

Documentation workshop regarding the uses of medicinal plants among Santal community in Brahmakunda Panchayat, West Tripura

Medicinal plants and herbs: Study on its uses amongst the tribal communities of Tripura (RFRI)

Eleven communities namely Reang, Darlong, Mog, Halam, Garo, Kalai, Jamatia, Santhal, Munda, Tripuri and Chakma communities were studied for use of medicinal plants by them and it is documented that more than 300 medicinal plants and herbs are used by them. About 20-25 diseases/ ailments treated using different crude formulations of medicinal plants and herbs were identified and documented for each tribe. The process of formulation of medicines and methods of administration for treating each disease was documented.

Traditional tribal medicine practices among the tribes of Tripura (RFRI)

Documented 150 important medicinal plants and herbs used by eight indigenous communities in Tripura namely; Halam, Kuki, Munda, Reang, Lushai, Orang, Uchoi and Murasing. By using crude formulations of medicinal plants more than 25 diseases/ailments can be cured. The availability of the medicinal plants, trends of utilization and process of preparation of formulations and their administration during treatment was documented.

Study on socio economic status of people in Nallamalais, Sheshachalam and North Coastal Eastern Ghats in relation with Forest Biodiversity (IFB)

Primary data on socioeconomic aspects and biodiversity were collected from three divisions Achampet, Tirupati and Paderu of Andhra Pradesh. Based on the importance value index (IVI), amongst the species *Albizia amara* followed by *Chloroxylon swietenia*, *Holoptelea integrifolia, Cassia fistula, Hardwickia binata, Wrightia tinctoria, Butea monosperma, Lannea coromandelica, Anogeissus latifoli*a and *Premna tomentosa*. Shrubs *Helictere sisora, Mundulea sericea, Grewia damine* and herb/grass species *Hyptis suavelons* were more in demand for socio economic use.

2.2.
FOREST PRODUCTIVITY

PROJECTS UNDER THE THEME

A. Plan

- Completed 03
- Ongoing 03
- New 01

B. Externally Aided (except CAMPA)

- Completed 02
- Ongoing 14
- New 01

2.2.1. Silviculture

Taxonomy, silviculture and management practices of selected Rattans of Karnataka (IWST)

Diversity assessment of Rattans in different forests of Karnataka was carried out to conserve and propagate the vulnerable Rattan species. Translocation experiments on *Calamus gamblei* Becc. were carried out in Biligiri Ranganatha Swamy Temple (BRT) Tiger Reserve. *Calamus gamblei* translocated in BRT showed 65 per cent survival.

Calamus nagbettai R.R. Fernald & Dey at Charmudi Ghat, Karnataka

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

2000 seedlings of *Dalbergia latifolia* and *Pterocarpus marsupium* were raised in nursery. Seedlings were graded according to the shoot height and planted in experimental area and evaluated for their performance.

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

A field trial was established for Eucalyptus, *Salix alba* and *Melia dubia* at two spacings of 1.2×1.2m and 1.5×1.5m in Saharanpur district, U.P.

Exploration of methods to enhance the shelf-life and fixative property of neem-based eco-friendly preservative (IWST)

Thirteen different formulations of the fatty oil and extracts containing azadirachtin with different adjuvants were evaluated for shelf life and fixative properties. Six short-listed formulations were tested in a field experiment on Rubber, Melia, and Mango wood.

Control, CCB and Six neem formulations treated samples installated in field experiment at Nallal, Karnataka

Standardization of Agro-Techniques and evaluation of growth parameters of *Juniperus polycarpos* (Shukpa, Shur) C. Koch under nursery and field conditions (HFRI)

Nursery requirement of *Juniperus polycarpos* w.r.t. potting media, containers, root pruning, irrigation schedules, fertilizer, shading,and spacing was standardized for raising its nursery stock. Seedlings planted at 30cmx30cm spacing in nursery resulted in the maximum value of various seedling growth parameters. It was observed that 30-40 cm tall Juniper seedlings should be planted in 45cm^3 pits in the field for better growth performance. Survival of *J. polycarpos* seedlings was >98% at demonstration plot in Tabo in Cold Desert Region of Spiti Valley. Summer as well as pre-winter season was found to be equally good for carrying out plantation of the species in the field. A booklet on '*Seed and Artificial Regeneration Technique of Juniperus polycarpos*' was published for the benefit of stakeholders.

Nursery trials of *Juniperus polycarpos* at model nursery, Baragaon

Investigation on factors responsible for Sal mortality in Jharkhand State (IFP)

Field survey and data collection on occurance of the species including incidence of mortality were performed in 11 forest divisions (Bokaro, Ranchi, Gumla, Khunti, Latehar, Lohardaga, Giridih East, Giridih West, Deoghar, Dumka, and Saranda) of Jharkhand. The division wise field training and testing of data was done. Land Use Land Cover (LULC) map for the entire state was prepared. Preparation of input for MaxEnt geo-statistical models for the 11 forest divisions was accomplished.

(a)

(b)

(c)

(d)

(a) Sal mortality due to anthropogenic reasons; (b) Phyto-sociological data recording; (c) Termite attack on the dead tree; (d) Incidence of top dying in Sal

2.2.2. Social Forestry, Agroforestry/Farm Forestry

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

Development of agroforestry models for enhancing the productivity of tree species like *Gmelina arborea* and *Emblica officinalis* with agriculture crops on fallow and degraded land in Uttarakhand and Uttar Pradesh at different spacings of 4x5m and 5x5m with replication at three sites namely Dhaluwala Majbata (Haridwar), Fatehpur Pelio (Saharanpur) and Kodapur (Prayagraj) was carried out. Various treatments assigned were T1 (Gmelina-Aonla control), T2 (Agriculture control), T3 (Gmelina+agri crop), T4 (Aonla + agri

Vegetable with *G. arborea* on boundary at Kodapur (Prayagraj)

Til and Wheat with Gmelina-Aonla at Dhaluwala (Haridwar)

crop) and T5 (Mixed Gmelina +Aonla +agri crop). After two years of planting, growth of *G. arborea* and *E. officinalis* was maximum at 5x5m spacing and both the species are performing well with agriculture crops on fallow lands at Dhaluwala and Kodapur sites. An awareness programme on Gmelina and Aonla based agroforestry was also organized for farmers.

Livelihood improvement through sustainable utilization of *Grewia optiva* (Bhimal) in Uttarakhand (FRI)

Three study sites viz. Kalsi, Amgaon, and Walna of naturally grown *Grewia optiva* were selected for standardization of harvesting techniques. Trees were lopped for 25%, 50%, 75% and 100% from existing strength of twigs on trees, second, third, and fourth-round for standardization of harvesting techniques. The quantity of leaf fodder available at each tree was measured and fiber and saponin content was determined. The saponin content of 40-48% was observed in *G. optiva* twigs. Various methods of fiber extraction were used including cow dung, urea, and thiourea. The application of urea showed significant effect on fiber extraction and reduced time by 77.5% in retting of bhimal fiber against the traditional method which requires more than 90 days. Biological treatment of fiber was done and fiber was extracted within 14 days. A scientific instrument "Steam Explosion Treatment Machine" (SETM) was modified, got fabricated, and trials demonstrated that using SETM, bhimal shampoo and fiber may be prepared in a single day.

Steam Explosion Treatment Machine

Development of *Gmelina arborea* based agroforestry system in M.P. (TFRI)

Standardized *Gmelina arborea* based agroforestry system in M.P. by utilizing shade of *Gmelina* tree for the selected intercrops i.e. *Asparagus racemosus, Curcuma longa, Zingiber officinale* and *Piper betle.* Betel vine farming was also standardized by conducting experiments on insect pest management by biocontrol method and constant supply of irrigation by drip irrigation system. Conducted biochemical analysis of the medicinal plants and extracted ginger oil and the content was maximum (1.9ml/100g) under sole plantation than that of intercropping (1ml/100g). Saponin content in satawar was maximum (1.5%) by intercropping than that of sole (0.9%) and similarly yield was found 321.66g/plant and 216.45g/plant in intercropping and sole crop respectively. The package and practices on 'Agroforestry models' developed were extended to different stakeholders through online training programmes.

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

Established *L. leucocephala* based agroforestry system in farmer's field of Chandiya and Umariya district of Madhya Pradesh. The plantation was maintained including periodic intercultural activities and intercropping of seasonal crops. Collected and analyzed soil samples for the estimation of nutrients. The growth performance of new improved var. of *L. leucocephala* species under agroforestry system was assessed. *L. leucocephala* based agro forestry system was established with its improved variety K-63 on 3 ha. land as per the MoU signed amongst TFRI, Orient Paper Mill and Farmers where TFRI supplied QPM and technical knowhow to the farmers, farmers offered their land for establishment of AFS and wood based industry (OPM) provided buy back guarantee with minimum support price.

Study on crop yield, soil fertility and gum production in *Acacia senegal* based traditional agroforestry system in the arid region of Rajasthan (AFRI)

Sample plots of tree densities 10-20 tree/ha, 20-30 tree/ha, and 30-40 tree/ha were laid out at nine sites in Jodhpur, Barmer, and Nagaur. Height and dbh of *A. senegal* were significantly ($p< 0.05$) greater at 20-30 trees ha^{-1} as compared to the other tree densities. Crop yield did not differ between tree densities. When compared with total canopy cover (m^2 ha^{-1}), crop yield reduction was significantly low at canopy cover 544 m^2 ha^{-1} (10-20 trees ha^{-1}) as compared to canopy cover 772 and 1298 m^2 ha^{-1} at tree density of 20-30 and 30-40 trees ha^{-1} respectively. Gum yield from trees ranged between 90 g to 1050 g/tree. Economic return was highest for Pearl millet (Rs. 28688/ha) under irrigated conditions

and it was lowest (Rs. 2360/ha) in the rainfed condition in Kharif season for the same crop. In Rabi season, the economic return was Rs.18742 - 29581/ha with cumin based system in irrigated condition. Seed production of *A. senegal* was 0.10-1.10 kg/trees.

A. senegal gum collected by farmers

Collection of Gum

Survey and evaluation of Silvipastoral systems in Himachal Pradesh and its role in sustaining community livelihood (HFRI)

Community dependency studies in H.P. revealed that in Agro-climatic zone-I & II Silvipastoral systems are more diverse in system units (54) and tree fodder species (36) along with high dependency for fodder. *Grewia optiva* and *Bauhinia variegata* in agro-climatic zone-I & II; *Quercus oblongata* and *Q. floribunda* in zone-III and *Salix* spp. in zone IV were the most preferred tree species irrespective of different farmer categories. In Silvipastoral systems maximum density of tree species was recorded in *Myrica esculenta* (980 trees/ha), *Grewia optiva* (660 trees/ha), and *Bauhinia variegata* (630 trees/ha) in agro-climatic zone-II.

Documentation of economic evaluation data at Kundi, Chamba

Measuring productivity of Silvipastoral System at Ghiaghi (Kullu)

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

Field surveys were conducted in Kinnaur and Pangi Forest Divisions of Himachal Pradesh and 16 natural populations of Chilgoza were identified. Population and natural regeneration data were recorded from identified populations. Associated trees species of Chilgoza in respective populations were identified and tree distribution data of 14 sites were analyzed. Soil samples collected from identified populations were studied for organic matter, organic carbon and nitrogen.

Evaluation of existing Sandalwood (*Santalum album*) plantations and development of agroforestry trials and capacity building to promote cultivation in Gujarat and Rajasthan (AFRI)

Agroforestry Model with Sandalwood was established at three sites at Jaipur National University (JNU), Jaipur; Anand Agriculture University (AAU), Anand and Van Vigyan Kendra (VVK), Rajkot. In this, the primary host was Lal Mehandi (*Lawsonia inermis*) and Arhar (*Cajanus cajan*), and the long-term hosts were Guava, Pomegranate, Casuarina, Aonla, Sitafal, and Nimbu planted at a distance of 5x5 meters. After 3 years, the survival rate in JNU, Jaipur; AAU, Anand; and VVK, Rajkot was 53.32%, 100%, and 90.17% respectively.

Assessment, ecological niche modelling and strengthening of Agroforestry systems for securing the livelihoods of inhabitants in Cold Desert region of Himachal Pradesh and Ladakh (HFRI)

Traditional agroforestry systems of different villages in Lahaul and Spiti district were assessed and agroforestry species grown by local communities were documented in selected villages of Lahaul and Spiti and Kinnaur districts. Soil samples were collected from the selected villages and analyzed for estimation of color, texture, moisture content, pH and electrical conductivity. Seedlings of *Prunus armeniaca* were raised and *Juniperus polycarpos* seedlings in the nursery were maintained.

Agri-Horticulture system at Gemur Village, Bhaga Valley, Lahaul

Agri-Silviculture system at Shooling village, Chandra Valley, Lahaul

Establishment of community fodder banks in forest fringe villages in Uttarakhand and Himachal Pradesh (HFRI)

High-density plantation of 426 plants of *Bauhinia variegata* at 1x1m spacing at Padli demonstration site and 700 plants of *Robinia* sp. and 200 plants of *Quercus floribunda* was done at demonstration site Maraog. The leaves were analyzed for fat, protein and carbohydrate content for suitability as fodder. Silage trials of grasses were successfully established in the laboratory with different conc. of urea 0.25, 0.50 and 1gm per 100 ml of water.

Silage preparation in laboratory

2.2.3. Forest Soils and Land Reclamation

Identification and Characterization of important bacterial groups from salt-affected soils of Haryana and Punjab (FRI)

Soil samples were collected from salt-affected sites under different landuses for autumn and spring seasons from the predetermined depth of 0-30, 30-60 and 60-90 cm. Soil samples were collected from nine villages in Kaithal and Fatehabad districts of Haryana and six villages of Muktsar and Bhatinda districts of Punjab. Total 1,277 bacteria were isolated from soil samples. Higher numbers of total bacterial colony-forming units (CFU) were observed in Khair forest (Kamalwala) from Haryana and maximum bacterial diversity was observed in the agricultural lands of Pandikalan village of Muktsar. Biochemical characterization of the isolated bacteria determined that 79% isolates utilized IAA, 67% utilized ammonium ion, 59% producing siderophore and 71% isolates utilizing Phosphorus. Salt-tolerant (halophilic) bacterial strains of N-fixers and phosphate solubilization bacteria (PSB) were isolated from the salt-affected soils of Indo-Gangetic plains. These strains were characterized for plant growth promotion and tested for their efficacy under different salinity levels.

Carbon sequestration and Carbon dioxide emission from the soils under different forest covers in Uttarakhand (FRI)

Higher CO_2 emissions ($CO_2 m^{-2} sec^{-1}$) was recorded in Sal vegetation 3.02 µmol as compared to 2.71 µmol CO_2 m^{-2} sec^{-1} in Chirpine vegetation. These average higher values of carbon dioxide emission in Sal vegetation correspond to the average higher soil temperature 19.50 ^{0}C and soil moisture 25.59 %. Seasonally higher soil respiration rates were recorded in the rainy season followed by the summer season and lowest in winter for both the vegetations studied. Soil organic carbon in Chirpine vegetation was 2.896 % at 0-30 cm depth and 1.568 % in 30-60 cm depth and in Sal vegetation 1.373 % at 0-30 cm depth and 0.765% at 30-60 cm depth.

Impact of harvesting on soil nutrients and carbon stock in canal-side plantations of Indira Gandhi Nahar Pariyojana (AFRI)

Massive-scale plantation of fast-growing tree species like *Eucalyptus camaldulensis*, *Dalbergia sissoo, Vachelia nilotica* and *V. tortilis* was done along Indira Gandhi Nahar Pariyojna (IGNP) area in northwestern Rajasthan to check siltation of the canal to make its flow continuous and to improve the environmental condition of the area. The impact of tree harvesting on soil nutrients and carbon stock in canal-side plantations of IGNP was studied. Study revealed that standing carbon stock in *E. camaldulensis* was 150.15 tons C ha^{-1}, whereas in *V. tortilis* stand it was 53.81 tons C ha^{-1} above ground.

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

Trials with biochar enriched super-compost were laid out. About 30 samples of growing media amended with biochar, compost and super-compost were analyzed for the physicochemical parameters including essential nutrients. The pyrolysis technology was demonstrated to the different stakeholders including farmers and NGOs. Various in-house extension activities through demonstration of pyrolysis of necromass were conducted at FRC-LE, Agartala. The study revealed that amending soils with biochar enriched organic compost does not show any negative impact on the growth and development of *Albizia procera*, *Gmelina arborea* and *Dipterocarpus turbinatus* during the hardening process in nursery conditions.

2.3.
GENETIC IMPROVEMENT

PROJECTS UNDER THE THEME

A. Plan

- Complete 12
- Ongoing 36
- New 06

B. Externally Aided (except CAMPA)

- Completed 09
- Ongoing 31
- New 10

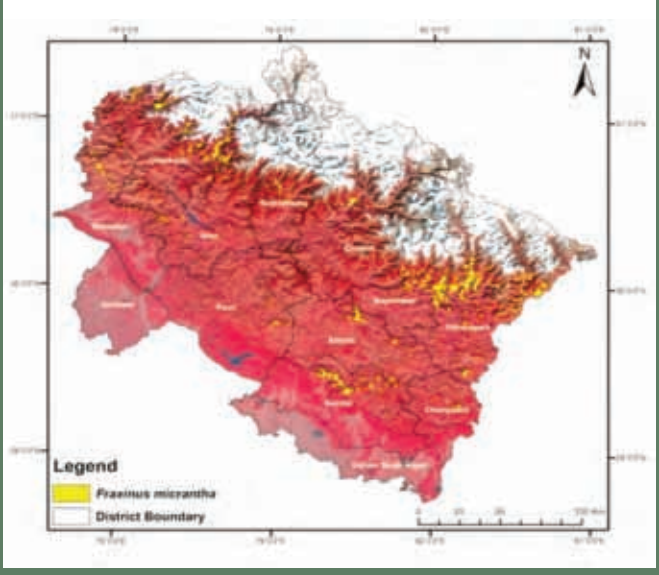
2.3.1. Conservation of Forest Genetic Resources

Pilot Project on 'Creation of Centre of Excellence on Forest Genetic Resources (CoFGR)' (FRI)

» **FGR species**

Surveys were conducted in 44 Forest Divisions of Uttarakhand to document and assess the species richness and regeneration status for 100 species. Verification of RET species were also carried out in various forest divisions.

Eco-distribution maps for 50 important FGRs species of Uttarakhand are being prepared through RS and GIS based tools.



Eco-distribution map of *Fraxinus micrantha*

A. FGR SEED AND GERMPLASM STORAGE

Seeds of 17 FGR species collected were processed for initial germination determination; and the stored seeds were tested for viability on quarterly basis.

(a)

(b)

(a) Seed collection in *Lyonia ovalifolia*;
(b) *Albizia lucidior* tree with pods

(a)

(b)

(a) Seed germination in *Myrica esculenta;*
(b) Seed germination in *Albizia lucidior*

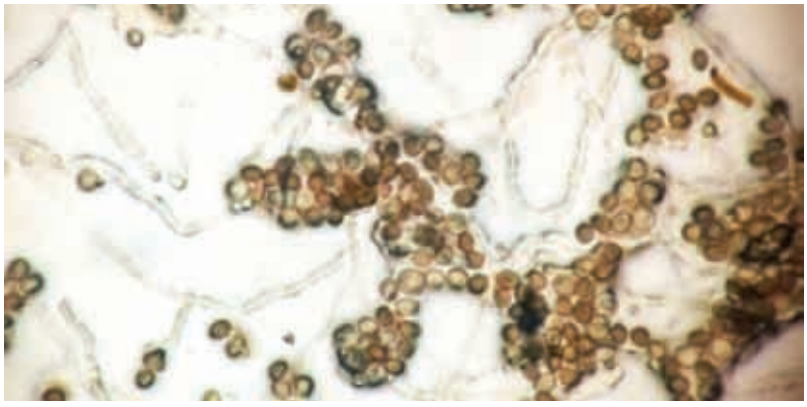
Seed germination test of FGR species

For *ex-situ* conservation the processed and viability determined seeds of 35 forestry species were desiccated up to safe moisture level and deposited in the Gene bank of ICAR-NBPGR with passport details for long-term storage at -18°C. A total of 70 forestry species has been deposited so far in the seed gene bank of ICAR-NBPGR.

To conserve forest genetic resources (FGRs) of very high conservation value or having recalcitrant seeds or both, *in vitro* regeneration protocols were developed for eight species to obtain whole plant regeneration for medium term storage. Different explants were used to induce callus formation which was then sub-cultured and multiplied.

In vitro propagation of *Taxus wallichiana*

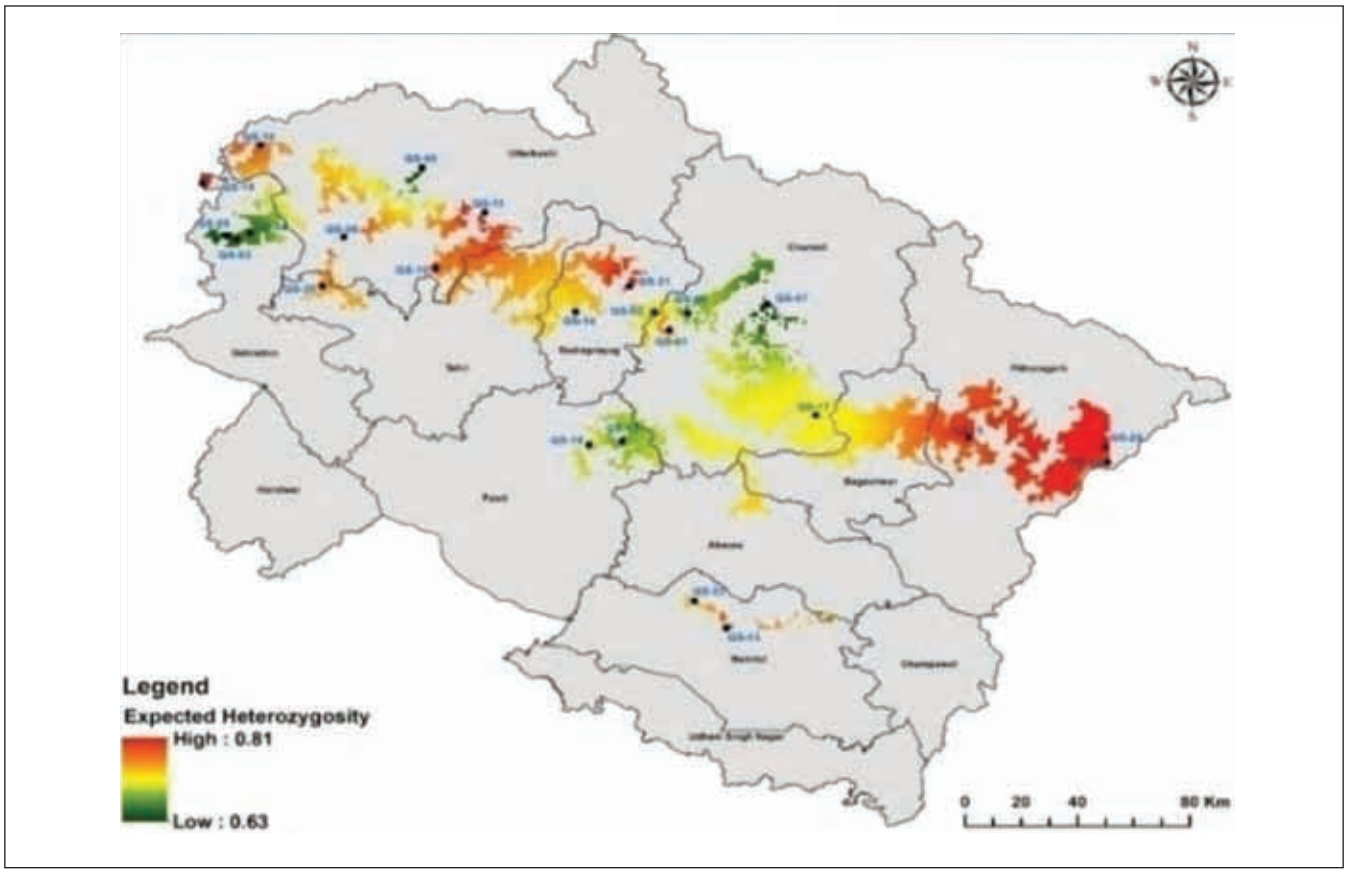
Pollens of the species of high conservation value i.e. *Heteropanax fragrans, Diploknema butyracea* and *Firmiana colorata* (*Sterculia colorata*) were collected, processed, stored in liquid nitrogen and viability tests were conducted periodically.



Germination of *Sterculia colorata* pollens after being stored in liquid nitrogen

B. FGR CHARACTERIZATION

Ten nSSR (nuclear Simple Sequence Repeat) markers were used to assess genetic diversity and population structure of 24 populations of *Quercus semecarpifolia* meta-population from Uttarakhand. Structure analysis indicated that the sampled populations shared their ancestry with two common ancestral gene pools. The gene pool from the eastern region i.e. the Pithoragarh forest area had the highest level of genetic diversity, allelic richness and maximum proportion of private alleles. Thus, *Q. semecarpifolia* in Pithoragarh forest region should be conserved *in situ* and could be considered for conservation programme on top priority.



Spatial distribution of genetic diversity in *Quercus semecarpifolia* populations

C. FGR CONSERVATION AND ESTABLISHMENT OF FIELD GENE BANKS

Germplasm of *Rhododendraon arboreum*, *Diploknema butyracea*, *Cinnamomum tamala* and *Taxus wallichiana* collected from different populations were propagated in the nursery for establishment of field gene banks.

Rooted cuttings of *Cinnamomum tamala*

Sprouted cuttings of *Rhododendron arboreum*

Field gene banks for the prioritized species were established at the following Uttarakhand Forest Department sites:

Species	Site
Diploknema butyracea	Kalikumao Range, Champawat Forest Division
Cinnamomum tamala	Manora Range, Nainital Forest Division
Myrica esculenta	Bhowali Range, Nainital Forest Division
Taxus wallichiana	Joshimath Forest Range, Nanda Devi National Park Forest Division, Joshimath
Rhododendron arboreum	Devidhura Range, Champawat Forest Division

Establishment of field gene bank at Champawat Forest Division

Genetic improvement of *Thespesia populnea* (IFGTB)

Two Clonal trials comprising of 40 clones of *Thespesia populnea* were established at Gudalur FRS, Chennai and Thalavaipettai farm land at Bhavani, Tamil Nadu respectively.

Selection and evaluation of *Haldina cordifolia* for higher wood productivity

IFGTB, Coimbatore identified 15 candidate plus trees of *Haldina cordifolia* in Kollam (Kerala) and seeds were collected for establishing progeny trials. Two candidate plus trees were selected by TFRI, Jabalpur during the surveys in four ranges of Dindori Forest Division, M.P for establishment of field trails.

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

Nine populations of *Gmelina arborea* were identified from different parts of Tamil Nadu and selected 45 CPTs based on growth superiority and tolerance to pest and diseases. The biometric data on total height, GBH, crown diameter and clear bole height were collected. Five superior families were shortlisted based on growth performances from progeny trial at Salem FRS; and seeds were collected from selected 45 CPTs. Quality planting stock of *G. arborea* from 45 open pollinated families were collected and studied for variation in germination percentage and seedling parameters.

Germplasm assemblage of *Dalbergia*, its characterization and evaluation (IFGTB)

Twenty five *Dalbergia* clones were added to the existing collections in the germplasm assemblage established at Varavoor, Kerala. A set of 60 clones were planted in Vanavarayar Institute of Agriculture, Manakkadavu, Tamil Nadu. Molecular marker studies carried out using RAPD markers revealed variation among individual trees rather than between different populations – a typical condition exhibited by out-crossing forest tree species. Considerable variation in secondary metabolites was also recorded among different *Dalbergia* populations identified in Tamil Nadu and Kerala.

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

Sixty four trees were selected from different locations of North East India for establishment of provenance cum progeny trial. Fruits were collected from 42 trees. Significant variations were observed in the size of fruit and seeds collected from various locations. Seed storage experiments indicated that seeds stored at 15°C gave 30% germination after 21 days. Provenance cum progeny trials with 42 families were established in two locations; Iruvakki experimental station of University of Agricultural and Horticultural Sciences, (UAHS) Shimoga, Karnataka and near Valikini-Nursery (Goa Forest Department) Sanguem, South Goa. The progenies were planted in four replications, with three trees per family per replication with spacing of 3 x 3 meters in completely randomized block design.

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

Surveyed seven sandal reserves in Marayoor, Kerala and recorded passport data and growth data for the sandal reserves. A total of 225 core samples were collected using increment borer for estimating variation in bark thickness and the content and colour of heartwood. Oil extraction was done and samples were ranked based on oil content in 225 samples. Methodology for molecular analysis has been standardised. The mean girth at breast height and tree height of sample trees was recorded 71.5 cm and 11.2 m. The mean heartwood diameter and its cross – sectional areas (%) of core samples of samples was 17.6 cm and 87.9% found in the sandalwood reserves. The mean oil yield and santalol content of sandal trees was 4.16% and 39.2% respectively recorded in sandal reserves.

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

Diversity assessment using DNA markers was completed. One hundred and twenty one trees from different forest divisions of Madhya Pradesh were genotyped using 20 ISSR markers. Molecular diversity analysis detected 76.7% polymorphism indicating existence of moderately high amount of variability. Bayesian model-based STRUCTURE analysis revealed existence of two admixed genetic clusters of *P. marsupium*. Further, AMOVA result suggest that most of the variation exists within (91%), rather than among clusters.Samples from seven study sites were analysed for Pterostilbene (a marker compound) using HPLC. Analysis revealed that highest average percent of pterostilbene was recorded in samples from Sara (0.47%) followed by Lamta (0.42%) and Barha (0.41%).

Regeneration of *Pterocarpus marsupium* from Balaghat forest division

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

Survey conducted in different forest areas of Chhattisgarh for collection of planting material of *Plumbago zeylanica* and *Celastrus paniculatus*. In *C. paniculatus*, Nitrate Reductase Activity (NRA), flavanoid, carbohydrate, phenols and sugar was estimated during organogenesis through leaves. In *P. zeylanica*, protein, tannins and carbohydrates were estimated in leaves. Planting material was produced through stem cuttings; and shoot multiplication and rooting experiments were carried out in both species.

Shoot cultures of *Plumbago zeylanica*

Shoot cultures of *Celeastrus paniculatus*

Development of value chain for bamboos for mass multiplication, popularization in farmers field and industrial linkages in Central India (TFRI)

Bamboo plantations were established and maintained in various farmers fields located at different villages of Umaria, M.P. Field trial was established at TFRI, Jabalpur with the objective of comparing the performance of two superior clumps (genotypes) of six different bamboo species. *In vitro* shoot cultures *Pseudooxytenanthera stocksii* were established and maintained on MS medium supplemented with 4.5 mg l^{-1} kinetin. Inputs were taken from industrial partner M/s Orient Paper Mills, Amali for identification of more farmers for establishment of trails.

Selection and evaluation of natural population of *Terminalia bellirica* for its active ingredient content (TFRI)

Thirty two phenotypically superior candidate plus trees of *Terminalia bellirica* (Baheda) were selected from natural populations in Bhandara forest division, Maharashtra (14 trees) and Dhamteri forest division, Chhattisgarh (18 trees). GPS location, height, girth, spreading pattern of the tree and length and breadth of leaves and other morphological characters were recorded and seedlings were raised in the FRC-SD, Chhindwara nursery.

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

Fruit collection in winter season from two places namely Khari Khurd village and AFRI experimental field of, Jodhpur were carried out. Also sites with wild plants of Kair were selected for the collection of fruits. The data revealed that large, medium and small size fruits varied from 11.69mm to 18.22mm, 9.89mm to 11.68mm and 5.82mm to 9.88mm respectively, whereas the number of seeds ranged from 16 to 36, 18 to 62 and 2 to 6 in respective size class. Moisture per cent ranged from 42.63 to 69.79 % with the mean value of 55.25%.

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

A total of 495 accessions of high yielding and fast-growing genotypes of 15 commercially important bamboos in North Eastern States were collected. The germplasm bank of the same is maintained at RFRI, Jorhat and FRC-LE Agartala. For *Bambusa tulda* estimation of alcohol-toluene solubility test, lignin and holocellulose content was carried out, it ranged from 2.25-5.75%; 21.01 to 34.04% and 51.22 to 77.75% respectively.

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

51 populations of *Paris polyphylla* were explored from Arunachal Pradesh, Mizoram and Nagaland and collected ethno-botanical information for the species used by communities. Identified four different forms of *P. polyphylla* and conserved the genetic resources at FRC-BR, Aizawl.

Paris polyphylla collected from Tiwari village, Arunachal Pradesh

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

Identified superior trees from 30 districts covering five agroclimatic zones in association with Tamil Nadu Forest Department. Pods collected from the selected trees and seeds were extracted for raising seedlings. From each of selected 50 CPTs, 150 seedlings were produced for establishment of progeny trials in different locations of Tamil Nadu.

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

Germplasm collection was done in diverse areas falling in three agro climatic zones of Bihar, Jharkhand and West Bengal. A total of 227 CPTs were selected and seeds from 37 CPTs were collected and seedlings raised.

CPT of *Pterocarpus marsupium* form Bihar

Pterocarpus marsupium seedlings

CPT of *Pterocarpus marsupium* form Jharkhand

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

In order to select superior genotypes of Salix and to assess genetic variability survey of populations at Yeche, Darcha in Lahaul valley has been carried out. Observations on morphological traits viz., stem color and form, catkin formation, bark pattern and leaf formation were recorded in selected trees at FRS, Tabo. Isozyme analysis of 5-10 samples each of 10 populations for assessing genetic variability using four enzyme systems (6PGDH, SKDH, IDH and MNR) completed.

Attack of aphid (*Cavariella ageopodii)* was observed on *Salix* trees. Salix in Tailing, Guiling 1st and Giu sites were found highly susceptible for the aphid. Lepidoptera larvae (*Cerura vinula*) was reported on mud site.

The survival and growth data of nursery trials were recorded at Field Research Station, Tabo, where 450 cuttings of different sizes collected from local sites in Spiti valley-cold desert region were planted in nursery.

Salix variants showing difference in germplasm bank

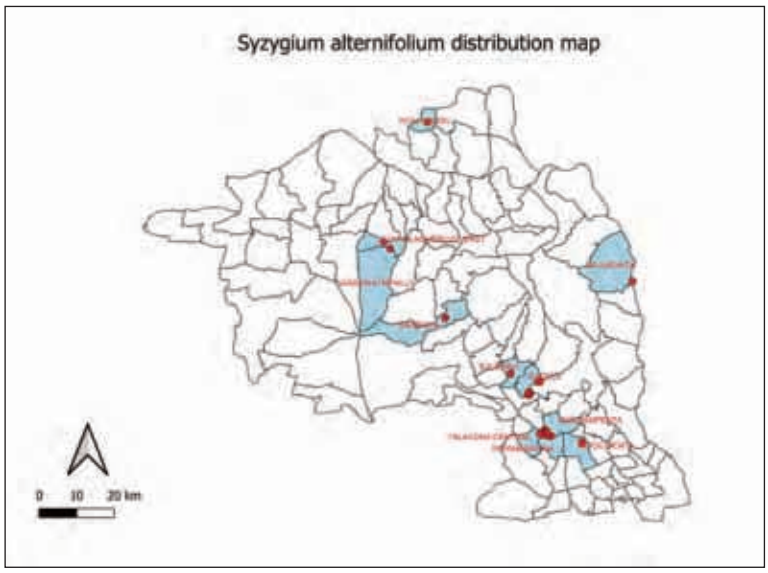
Salix variants showing difference in germplasm bank

Tabo village in cold desert of H.P.

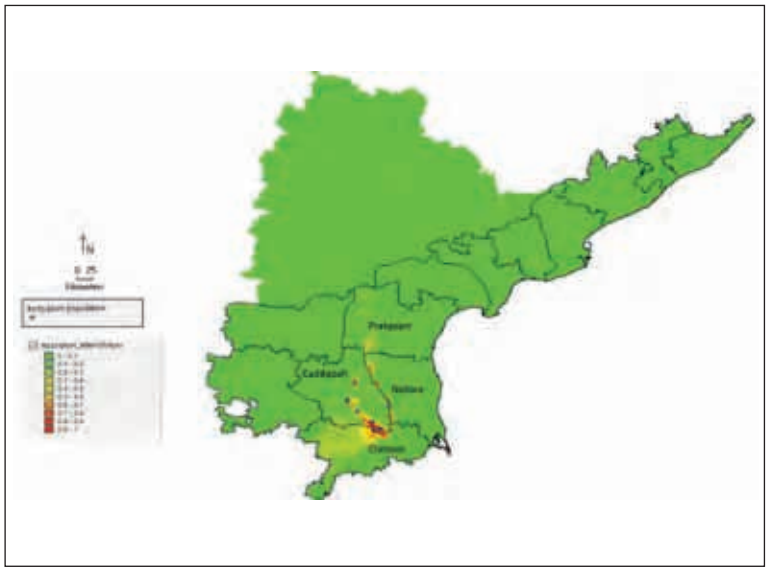
Recovery programme for *Syzygium alternifolium* -an endangered species from Eastern Ghats (IFB)

Distribution map were generated for *Syzygium alternifolium* populations to identify potential areas beyond the recorded locations having similar climatic conditions using Niche modeling and MaxEnt modeling algorithm. The generated model had an AUC (Area Under Curve) value >0.9, indicating excellent prediction.

A comparative chemical analysis was taken up for five samples of *S. alternifolium* and one sample of *S. cumini* recorded higher phenols, flavanoids and alkaloid content in bark for *S. alternifolium* as compared to *S. cumini* bark. Population variation was also observed for these parameters in *S. alternifolium.* Bark samples from Gadela and Sanipaya populations had higher phenols, flavanoids, alkaloid content as compared to Siddavatham population.



Population mapping of *S. alternifolium* in three Forest Divisions of Andhra Pradesh



Potential distribution modelling in *Syzygium alternifolium*

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

35 Teak Seed Production (TSP) areas in nine districts of Kerala were evaluated to understand the genetic diversity. Leaf samples collected from 30 TSP areas were tested for molecular characterization. Approximately 250 accessions were characterized from the TSP. A total of 20 SPA of Teak have been evaluated for biochemical and morphometric variations. Study on the variation in plantations and natural population revealed best plantations and populations for conservation in Ranni and Konni divisions.

(a) Aruva Pulam - Teak Plantation;
(b) Bourdillon's Teak Permanent Preservation Plot

2.3.2. Tree Improvement

Development of SSR markers and assessment of genetic diversity of natural populations of *Pterocarpas santalinus* distributed in the Eastern Ghats, lndia (IWST)

Sixteen leaf samples of *Pterocarpus santalinus* (Red sanders) were collected from natural populations of 17 forest ranges of Andhra Pradesh distributed in the Eastern Ghats of India based on the girth size. DNA extraction of all these samples was carried out. PCR was carried out with twelve DNA samples and 26 primers (24 SSRs and 2 RAPD). As the extracted DNA contained more impurities, purification steps (kit method and others like repalleting) are carried out at the University of trans-disciplinary Health Sciences of Technology, Bengaluru (TDU). Whole genome sequencing is also being carried out.

All India Coordinated Project on genetic improvement of *Melia dubia*

FRI, DEHRADUN

Evaluation of various progenies for the trials in the states of Haryana, Punjab, Uttarakhand and Uttar Pradesh was carried out. Low to moderate heritability coupled with moderate genetic advance and genetic gain was exhibited for CD and DBH. However, moderate to high heritability coupled with high genetic gain was exhibited for fiber length and specific gravity. The reproductive biology research work was carried out and various steps for hybridization were also made operational. Various wood related parameters and fiber length showed significant correlation with specific gravity with values ranging from 0.42 to 0.60. Non-significant correlation among growth and wood traits indicated that there was no influence of growth on wood properties upto age of 6 years.

RFRI, JORHAT

Fruits from selected 41 CPTs from Manipur and Nagaland were collected. Morphological characterization was carried out in the progeny trial at RFRI. Variation was observed in bark, drupe, and stone within the trial and also in the new selections. *In vitro* cultures were initiated successfully from nodal cuttings, getting multiple shoot formation in modified MS medium. *In vitro* root formation was obtained and thereafter rooted propagules were successfully hardened. To optimize the vegetative propagation techniques coppice shoots were used and success rate of 90% rooting within 30 days was obtained.

IFP, RANCHI

Around 110 different accessions of *M. dubia* from North, South and eastern parts of the country have been collected. Germplasm bank with 88 different accessions was established. Three field trials one in Bihar and two in Jharkhand with 21 genotypes were also established. Genetic diversity of the collected materials has been evaluated using 37 SSR primers (microsatellite markers) and the populations were found to group into two clusters. It was also observed that the genetic distance between South Indian germplasm and North Indian germplasm was more compared to the North Indian and Eastern Indian germplam.

The areas in Nuapada, Nabrangpur, Bolagir, Puri and Nayagarh in Odisha have been surveyed for the presence of *M. dubia* and seven CPTs in Nayagarh were identified. Collected one clone from Forest College, Mettupalayam under TNAU Tamil Nadu. Three progeny trials with six, 15 and 18 families have been established in June 2020 and two more trials including 18 families were established during September, 2020 at Torpa Khunti (Jharkhand). Demonstration plots have been established at IARI Barhi (Hajaribag) and FREC, Jadua Hajipur. A silvo-horticulture model has been established at Torpa (Khunti) to estimate economics of the model after harvest of the crop. A subsistence agroforestry model has been established at Lalgutwa to demonstrate intensive agroforestry system to the farmers and obtaining maximum return per unit area.

IFGTB, COIMBATORE

Established provenance resource stands, progeny trials, seed orchards and evaluation trials of *Melia dubia* to develop new high-yielding clones and seed sources. Pest and disease problems in nursery and plantations have been identified and control measures have been developed. A Vegetative Multiplication Garden (VMG) has been established from which clones are being vegetatively propagated for clonal trials. A field gene bank of *M. dubia* is being maintained in the VMG.

Development of seed production systems of commercially exploited trees species (IFGTB)

The species studied were five Dashamula tree species namely *Aegle marmelos, Gmelina arborea, Oroxylum indicum, Premna integrifolia and Sterospermum suaveolens*; two Triphala myrobalans namely *Terminalila bellirica* and *T. chebula* along with *Saraca asoca, Pterocarpus marsupium, Strychnos nux-vomica, S. potatorum* and *Santalum album*. Seedlings were raised to establish Seed production systems (SPS) for selected medicinal plants. SPS have been established at four locations in Kerala and Tamil Nadu in an area of about one ha at a spacing of 5 x 5 m in randomized design.

Genetic Diversity Analysis and Conservation of Threatened *Salvadora oleoides* (FRI)

The *S. oleoides* is a keystone and economically important species in the desert biome of the Indian subcontinent and the species decline has been observed during field surveys (2016–2019) conducted in states of Punjab, Haryana, Rajasthan and Gujarat. For species distribution mapping, geospatial data of 683 trees were recorded, out of which 70.28% were used for training the MaxEnt model and the rest to validate. The statistically significant AUC value ranged from 0.92 ± 0.02 (LGM) to 0.93 ± 0.01 Representative Concentration Pathways (RCPs) 2.6±70) with an average of 0.92 ± 0.00. The bioclimatic variables, contributed significantly for predicting the species distribution, which ranged from 60.3% (Last Glacial Maximum, LGM) to 85.5% (Current) with an average of 75.82%. For the climate change scenario (2050s and 2070s), a sharp decline in the species distribution area was observed for all Representative Concentration Pathways (RCPs) (when compared with the current estimate of 8638.01 km^2), which ranged from 2102.90 (RCP 2.6±70) to 5494.23 km^2 (RCP 8.5±70).

Robust microsatellite markers in *S. oleoides* using Illumina paired-end sequencing technology were developed. In total, 14,552 simple sequence repeat (SSR) markers were successfully designed from 21,055 microsatellite repeats detected in the 13 Gb raw sequence data. A subset of 101 SSRs were randomly selected and validated, 94 primers were successfully amplified and 34 showed polymorphisms. The developed SSRs were used to estimate the measures of genetic diversity in three natural populations from Rajasthan and Gujarat. Average number of alleles (Na), observed heterozygosity (Ho), expected heterozygosity (He), and polymorphism information content (PIC) were recorded as 2.4, 0.529, 0.357, and 0.326, respectively. This study has been conducted first time for *S. oleoides* and contributed to insights for suitable conservation and management plans for *S. oleoides* in arid zones of south Asian subcontinental climatic conditions.

Study of Structural Dynamics and Genetic Improvement of *Grevillea robusta* (Silver Oak) (FRI)

Field surveys were conducted regularly and the data were taken on spatial (latitude, longitude and altitude), morphological (tree height, diameter, disease and insect-pest incidence) and phenological (time of 1st flowering, time of 50% flowering, full blossoming) parameters. Habitat suitability maps have been completed for the States of Punjab, Haryana and Uttarakhand using MaxEnt modeling tool. The DNA Quality Control (QC) and quantification, sequencing SSR prediction and PCR primer designing, library preparation and shallow genome sequencing was completed.

For multilocation trials for progeny testing, seeds were collected from 52 CPTs and a total of 802 seedlings raised for multilocation trials. Field trials were established at two different geographical locations in Uttarakhand. Growth data has been taken from the trials located at Bithmara (Haryana), Maikhura Village (Chamoli, Uttarakhand) and Mathali Palli and 50% mortality was observed.

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

Various traits and their forms for Toona fruits, seeds and leaf were documented and digitized from 13 populations. Selection of 30 Candidate Plus Trees (CPTs) was carried out and a progeny trial has been established each at Maikhura and Chamoli during July-August, 2020. Leaf samples of 210 genotypes for molecular characterization and procedures for isolation of genomic DNA were standardized. Genome sequencing of *T. ciliata* was carried out. A total of 27207 SSRs were identified through MISA Perl script, out of which 15990 SSRs were successfully designed through Primer3 software.

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

Ailanthus excelsa DNA samples were sequenced 150 SSRs. Markers were tried for amplification and polymorphism. Genotyping of 216 samples have been carried out using selected 15 polymorphic SSR primers. Progeny trials have been established. Severe leaf blight outbreaks were recorded in the nursery of the Forest Research Institute, Dehradun, progeny trial and in a nearby farm field at Jhumpa, Haryana,. A small spored *Alternaria* with concatenated conidia was isolated consistently from the leaf samples with spot symptoms. Sequence analyses of fungal isolates confirmed the species as *A. alternata*. This work is the first to confirm that *A. alternata* is associated with leaf spot and blight disease of *A. excelsa* in India. Powdery mildew disease was also observed in the seedlings growing in the nursery. The fungus was confirmed as *Erysiphe quercicola*.

Genetic improvement of *Azadirachta indica* for developing high oil and azadirachtin yielding varieties (FRI)

Natural populations and plantations were intensively surveyed in neem growing states to select candidate plus trees (CPTs). A total of 75 samples were analyzed for oil related parameters; and the oil content varied from 16.43 to 67.31 per cent with an average of 35.13 per cent. Similarly, azadirachtin content was maximum of 15811 µg/g and minimum of 159 µg/g. The polyploidy plays an important role in developmental processes, and majority of samples were found to contain 14 small sized bivalents at diakinesis, metaphase-I, and 14:14 segregation at anaphase-I. The induced polyploidy resulted into doubling the chromosomes from n = 14 to n = 28 with 0.01 and 0.05 % colchicine treatment. Under tissue culture, MS and DKW medium were found to be the most suitable for bud induction in neem in combination with lower dosages of BAP. *In vitro* rooting of 74 % was obtained in least applied dose with 0.2 mg/l of IBA in half strength MS Medium.

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

Corymbia species and their hybrids can be used in short rotations of 6-8 years for wood-chips and in medium rotations of 10-13 years for sawlogs. Growth parameters were recorded for trials established in 2018 at Seonthi (Kurukshetra), Manakpur-Yamunanagar (Haryana) and in FRI Dehradun using tissue culture origin plantlets of accessions E2, E14, X11 and X 6 along with seedlings of *Corymbia citriodora* and *C. torelliana* planted and commercial clones 413 and P-23 of *Eucalyptus,* as control. Among genotypes, across three sites, E 14 performed best with average height 6.84 ± 0.51 m and dbh 4.95 ± 0.51cm. Maximum crushing strength was 565 kg/cm^2; compressive stress was 139.08 kg/cm^2; maximum shear stresses in radial and tangential directions were 127.11 and 132.22 kg/cm^2 respectively. Strength in screw pulling in radial-tangential direction and end face was 333.33 and 171.67 kg respectively and hardness in radial and tangential directions was found to be 747.5 and 758 kg respectively. This hybrid is suitable for timber for load bearing columns, flooring and other structural purposes.

Evaluation of Germplasm and Transcriptome studies in Eucalypts for Water logging and Salinity (FRI)

A total 88 clones of *Eucalyptus* were screened for waterlogging stress tolerance and 50 clones for salinity stress. Based on the physiological and morphological parameters 10 clones i.e. B-20, B-195,W-12, B-365, FRI-11, P-45, B-59, 71, 413, and ITC-2023 were shortlisted for field testing in waterlogged areas and 13 clones i.e. 413, B-44, B-148, 2070, B-195, SPM-32, 288, B-100, B-32, B-20, B-112, 411, and 71 for saline soils.

Root distribution studies in selected clones of Eucalypts

Screening clones for water logging stress

Tree improvement and biotechnological interventions to capture genetic and adaptive variations in *Rhizophora* to mitigate climate changes (IFGTB)

For assessing the floristic diversity three study sites (one in each of the mangrove form) were selected. Phenotyping of the selected individuals in all the study sites was carried out. Studies were also conducted on reproductive biology and the breeding systems of the target taxon. Pollination studies revealed that the target species is pollinated by mites (intra-floral pollinator). Seventy three putative hybrid individual trees and their pure species parents were selected and tagged for long term observations. The primer RM-121 showed allele sizes of 130bp and 160 bp in *Rhizophora mucronata* and *R. apiculata* respectively and its putative hybrid, *R. annamalayana* had both the alleles.

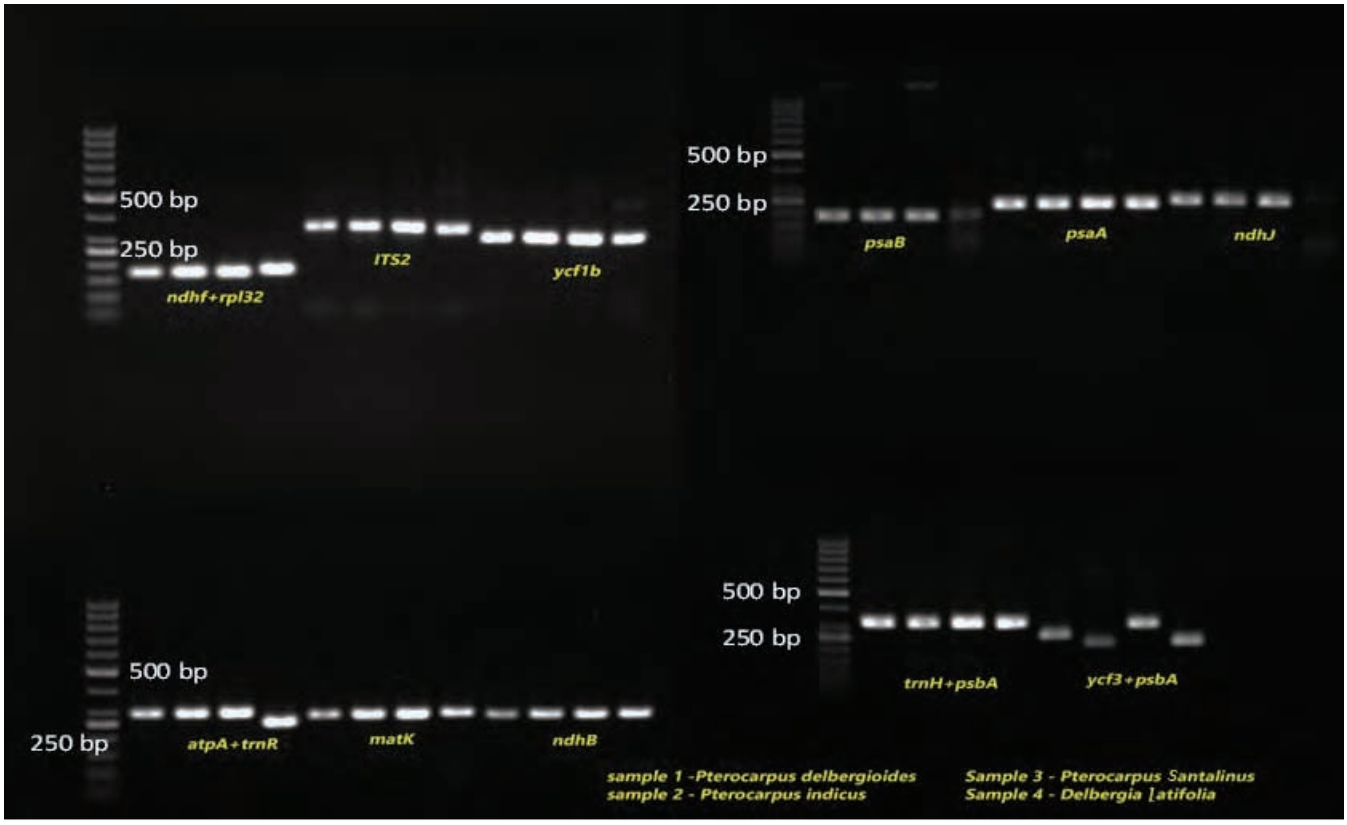
Deployment, demonstration and release of *Eucalyptus tereticornis x E. grandis* selections to farmers as a veneer and pulp tree crop (IFGTB)

Six selections were made for *E. tereticornis* (ATSC-13398 East of Kupiano, PNG Sub line TRT - 5) × *E. grandis* (ATSC-13017, Lorne, Australia) derived from a controlled cross full sib family developed by the Institute. At the same time six selections of *E. tereticornis* × *E. urophylla* (ATSC, South of Laura) were made from Karunya Nagar, Tamil Nadu. The ortets were harvested (1.3 meter/40-45 cm girth) and billets subjected to veneering. Selections yielded over 80-85 % core veneer. Propagation of inter specific crosses *E. tereticornis* (PNG) × *E. grandis* (13017: Lorene) has been successfully conducted. Two trials each with 480 ramets have been established at Panampally, Kerala and Neyveli FRS, Tamil Nadu.

Domestication, sustainable utilization and conservation of *Pterocarpus santalinus* (Red Sanders) genetic resources (IFGTB)

Reconnaissance survey was carried out in seven beats spread over six ranges of Chittoor East Division, Rajampet Division and Wildlife Management Division, Tirupati and other few plantations. Seeds were collected for nursery establishment. The micropropagation technique was refined from branch cuttings and *in vitro* grown seeds and plantlets were produced for subsequent hardening. Additionally, vegetative propagation using branch cuttings from six locations were successfully achieved with 86% rooting efficiency.

Further, the genome size of red sanders was estimated to be 0.787 picogram with 770 Mbp using flow cytometry. This is the first report on estimating genome size in the genus Pterocarpus. Analysis of leaf transcriptome predicted 5073 simple sequence repeats (SSRs) and 13 polymorphic EST-SSRs were genotyped in 43 accessions. Five plastome genomes of *P. santalinus*; *P. indicus*; *P. marsupium*; *P. dalbergioides* and *D. latifolia* were aligned and 17 diverse nucleotide hotspots were identified for species discrimination. Data analysis predicted five novel barcodes for discriminating *P. santalinus* from other species. The chloroplast genome of *P. dalbergioides* was re-constructed and the study provided first insight into the phylogenetic relatedness between *P. santalinus* and *P. dalbergioides.*



Amplification of barcodes in *Pterocarpus* species

Improvement of Teak for Higher Productivity in Central/Peninsular India: A Multi-institutional All India Coordinated Project (TFRI)

Surveyed forest areas of Kurai and Bahrai range of South Seoni forest division and Hathini forest area of Damoh forest division in Madhya Pradesh and selected nine Plus trees of Teak. Recorded morphometric data along with the GPS coordinates. Established a germplasm bank with 24 accessions of teak representing four states viz. Madhya Pradesh, Chhattisgarh, Maharashtra and Odisha and is being maintained.

Seedling Seed Orchard of Teak in TFRI Campus

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

Analysis of morphological and wood trait data revealed significant differences among teak populations for wood density, fibre length and fibre width. Coefficient of variation for wood density (12.56%) was higher than fibre width (11.30%) and fibre length (7.30%). Sambalpur population recorded highest wood density followed by Khariar. Longest fibre length and width was observed in Dhamtari followed by Amravati populations. Mean value of 582.99 kg/m^3 for wood density, 987.026 µm for fibre length and 24.806 µm for fibre width was recorded.

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

Branches were collected from selected trees of *Gmelina arborea* at different locations and cuttings were prepared. Cuttings were planted after treatment with various concentrations of IBA (200, 500 and 1000 ppm). Highest average rooting was obtained in cuttings treated with 200 ppm IBA. The sprouts from the cuttings were further utilized for production of planting material. A vegetative multiplication garden of selected trees was established.

Vegetative propagation of *Gmelina arborea*

Studies on phenology, molecular analysis and wood properties of *Tecomella undulata* with respect to three flower colour morphotypes (AFRI)

Based on the survey conducted in eight districts of Rajasthan, the percentage ratio of orange colour morphotypes was found more in comparison to yellow and red colour morphotypes. For testing mechanical and physical properties of wood of three morphotypes, nine wood logs from Mohangarh, Jaisalmer were collected and supplied to FRI, Dehradun. Wood of red flower morphotypes was found to have higher specific gravity (0.67±0.3), Fibre stress at elastic limit (62.4±11.2N/mm^2), Modulus of Rupture, Modulus of Elasticity Hardness, and Shear Strength Parallel to grain as compared to the wood of other flower colour trees. For molecular analysis, 43 shortlisted SCoT primers were used for PCR analysis for differentiating the three flower colour morphotypes against 45 samples of *Tecomella undulata.*

Testing of mechanical properties of wood of *T. undulata*

Development of seed production areas and haploid plants of *Commiphora wightii* (Arnott) a rare and threatened medicinal plant (AFRI)

The production of mature seeds per plant was calculated from pooled seed data of summer (March, May and July) and winter (November and December). The total mature seed yield per plant was 39 and 5.23 in winter and summer respectively. Seed data analysis of different months revealed that the highest mature seed yield per plant was 24.7 seeds in December and the lowest 0.7 seeds per plant in May. *C. wightii* (Guggal) plant produced two types of seed, i.e. black viable and white non-viable seed. The number of black seeds changed with the period of seed collection and seed sources. The highest black seeds were found in the December and lowest in July. Pollen radius, pollen perimeter and pollen area were recorded. The microscopic study of pollen grain revealed that number of pollen grains per anther was low (25-50). Total 7697 Guggul germplasm are available in AFRI out of these 714 are superior female progenies.

Genetic improvement of *Parkia roxburghii* (RFRI)

Surveyed the areas in Manipur, Nagaland, Tripura and Mizoram. Seeds were collected from selected CPTs of *P. roxburghii* and nursery experiments were conducted for standardization of propagation technique; seeds were screened for morpho-physiological characteristics and were given different pre-sowing treatments. Vegetative propagation through air-layering was also attempted. A Seedling Seed Orchard in 2 hectares at Chingkheiching Reserve Forest, Imphal, Manipur was established.

Characterization of the Hill Bamboo Species (Ringal) of the North-Western Himalayas for their Conservation and Genetic Improvement (FRI)

Probabilistic distribution of different hill bamboo (Ringal) species using the MaxEnt model and also eco distribution maps were developed for four hill bamboo species through the prediction modelling using geo-spatial data for species presence with environmental variables. Total of 26 populations for *Drepanostachyum falcatum,* nine populations of *Himalayacalamus falconerii*, five populations of *Yushania anceps* and 14 populations of *Thamnocalamus spathiflorus* were collected and characterized for population genetic analysis using SSR markers.

Molecular mechanism of rhizome growth and development in *Dendrocalamus strictus* (FRI)

For understanding the gene expression during various stages of the rhizome development, the sample collection for RNA sequencing for four stages of rhizome growth was done from the pot experiments. After RNA sequencing data analysis was done by using bioinformatics tools for comparative study using NCBI databases and gene ontology was generated for sequenced data. The analysis shows differential expression of some regulatory genes like IPT1-IPT9 which encode Cytokinins showing direct involvement in root to shoot ratio and also some Jasmonic acid related genes.

Genetic improvement and conservation of Chironji (*Buchanania cochinchinensis* Lour.) in central and eastern India

TFRI : Field visits were made to East Chhindwara, West Chhindwara, FRC-SD Plantation, Katni and Marwahi forest divisions of Madhya Pradesh and Chhattisgarh. Data on panicles and leaf morphology of Chironji was recorded. Seeds were collected from marked trees from Betul and Marwahi. Progenies of selected trees were maintained in nursery.

IFP : Distribution of the species has been identified in 15 districts of Jharkhand and one district of West Bengal for genetic improvement and conservation of the species and 210 plus trees selected. Seeds of 87 families have been raised and preparation of preservation plot for germplasm bank is underway.

2.3.3. Vegetative Propagation

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

Branch cuttings from 9-10 year old progenies of selected trees of *Dalbergia latifolia* exhibited variation in adventitious rooting from 10% - 56% with an average 27% rooting in cuttings planted during the month of April with basal dip treatment of 5mM IAA + 1mM Boric Acid for a period of 20 hrs on field planting survival was 100%. Seasonal variation noted in adventitious rooting, endogenous IAA and total soluble sugars. Growth performance of cutting raised plants was better than the seedlings in terms of height (14%) collar diameter (21%), number of primary branches 43% and crown diameter (15%).

Plantation of seedlings and cuttings raised plants of *Dalbergia latifolia*

2.3.4. Biotechnology

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

Engineering *Eucalyptus* genotypes for improved salt tolerance could help in productive utilization of India's vast stretches of salt affected waste lands. Partially down-regulating the *EcHKT1;1* gene in roots of composite transgenics correlates to higher salt tolerance. To evaluate root specific and salt inducible down regulation of EcHKT1;1 using the MsPRP2 promoter, 3 transformation constructs were generated to study the effect of complete knock-out, unknown regions of the EcHKT1;1 promoter was sequenced partially, and the regulatory sequences were identified by in silico analysis. Three transformation constructs for generating EcHKT1;1 knock outs in *Eucalyptus* were developed. These constructs would be evaluated for enhancing salt tolerance in Eucalyptus.

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

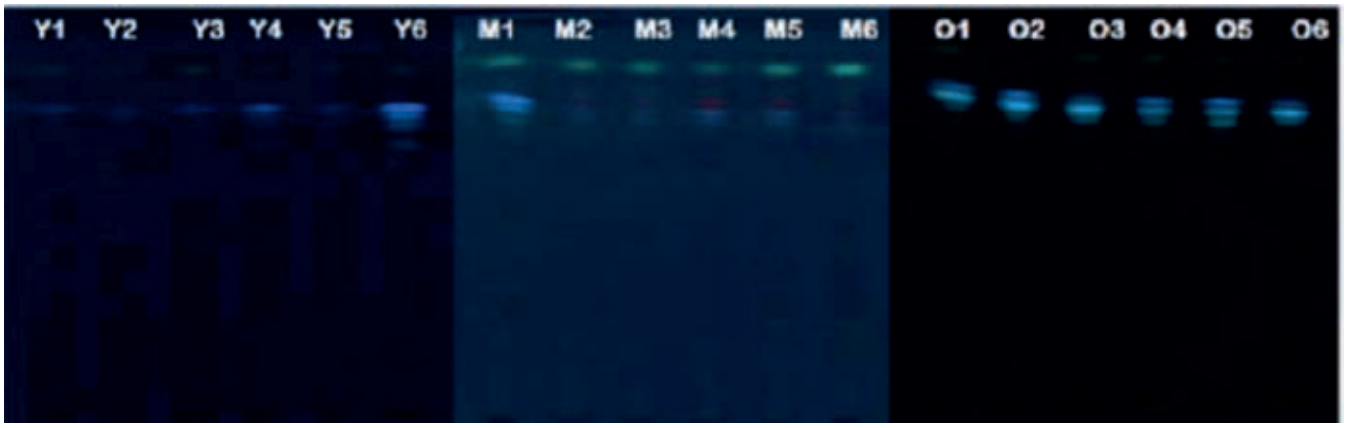
The mangrove species, *Rhizophora mucronata*, propagules were subjected to 250 mM salt stress. Shoot/ root ratio of Na^+ was higher at 0.97 ppm for *R. apiculata* when compared to *R. mucronata* 0.83 under NaCl stress indicating better regulation of Na+ uptake by *R. mucronata*. Transcriptome analysis has been initiated for differential expression analysis between *R. mucronata* and the crustacean animal, Artemia. In case of Artemia, the ClC gene has been cloned into transformation vector for evaluation in composite transgenic plants of *Eucalyptus*.

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

Protocols for hairy root culture (HRC) have been developed for tree species in which roots are the major source of medicinal extractives. Hairy root transformation protocols developed for *Aegle marmelos*, *Oroxylum indicum* and *Gmelina arborea* would help in conservation of medicinal trees as the pharmaceutical industries could use the hairy root cultures instead of the plants sourced from the wild. Two patents have been filed for callus induction in *A. marmelos* and hairy root transformation in all the three species.

Diversity assessment of *Saraca asoca* for selection of superior chemotypes and mass propagation (IFGTB)

Tissue culture protocol was successfully established for *Saraca asoca*. Microshoots were hardened in the nursery. To identify elite material, chemo profiling was done. Tannin was profiled in 150 samples collected from South India (Tamil Nadu, Karnataka and Kerala), through automated TLC applicator. The correlation coefficient, (R^2), for the marker compound in all TLC plates was > 0.99. Clear distinction could be observed in profiles of samples of varying ages.



Tannin profile of different aged Saraca bark: Y-Young (<7 years); M-Middle (7-15 years); O-Old (>15 years)

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

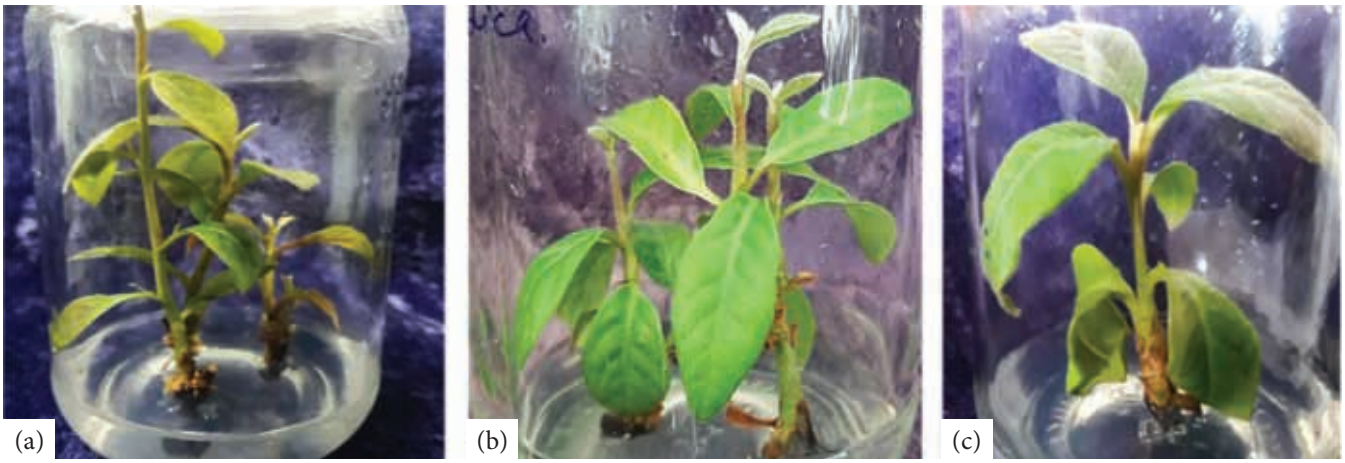
The study envisages *in vitro* production of guggulsterone-rich cell biomass from plant source in a bioreactor. Callus was initiated on Gamborg's B5 medium containing 0.5mg/l 2,4-D and was transferred to hormone-free B5 medium to induce embryogenesis. To obtain embryonic callus for guggulsterone production, about 3 g of non-embryogenic callus was placed on a circular disc in the vessel bioreactor containing hormone-free Gamborg's B5 medium. Growth of good callus without any contamination was achieved. The growth of callus was increased by 4 folds at the end of the 60th day of inoculation. For the quantification of guggulsterone this callus will be further analysed through HPLC.

Assembly of culture vessel to develop a prototype of bio-reactor containing medium and callus culture

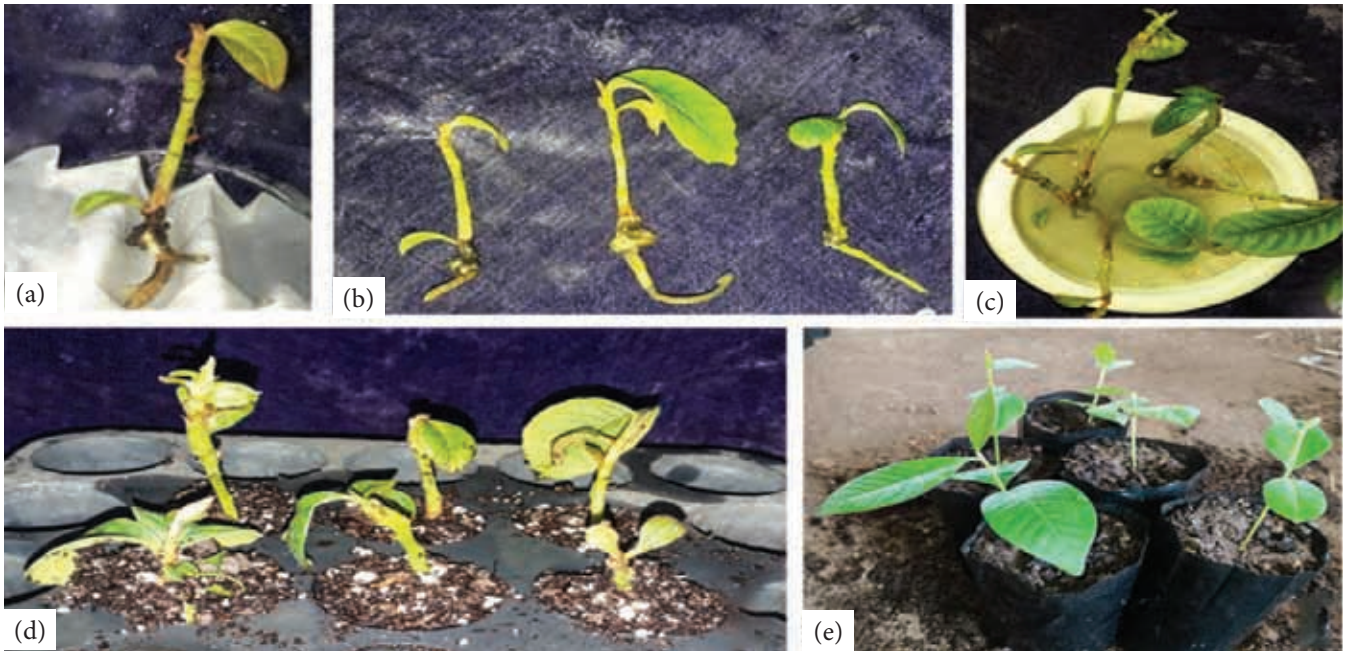
Growth of callus over a period of time: (A) 0 Day (B) 50th Day (C) Total callus after 2 months

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

Tissue culture protocol development is in progress for *Buchanania lanzan*, *Madhuca indica* and *Tamarindus indica.*



In vitro shoot multiplication in *Madhuca indica* on MS medium supplemented with (a) 3 mg l^{-1} BA, (b) 3 mgl^{-1} Kinetin, (c) 3 mg l^{-1} Zeatin after 40 days of inoculation



In vitro rooting and hardening of *M. indica* (a) rooting on MS medium supplemented with 2 mg l-1 IBA, (b) rooted plantlets, (c) treatment of plantlets with 0.2 % bavistin, (d) hardening of plantlets in soilrite in root trainers, (e) transfer of plants to in shade house.

2.4.
FOREST MANAGEMENT

PROJECTS UNDER THE THEME

A. Plan

- Completed 07
- Ongoing 16
- New 04

B. Externally Aided (except CAMPA)

- Completed 09
- Ongoing 10
- New 11

2.4.1. Sustainable Forest Management (SFM)

Studies on status of *Dalbergia latifolia* Roxb. – high valued Indian Rosewood in Karnataka and Kerala (IWST)

Field survey were carried out in natural forests, sacred grooves, as well as coffee estates in Madikeri, Virajpet, Madikeri Wildlife Sanctuary (WLS), Haliyal, Yellapur, Koppa, Sagar, Shimoga forest divisions, Rajiv Gandhi NP, Cauvery WLS, Bhadra Tiger Reserve and Bandipur Tiger Reserves of Karnataka, Wayanad (N&S), Palakkad and Kollam forest divisions of Kerala State using the line transect and total count methods. Good number of rosewood populations were observed in all locations except Cauvery WLS. The regeneration of rosewood trees was fairly consistent in moist deciduous forests. Population analysis revealed an absence of different girth class saplings and poles which indicate unhealthy sign of regeneration. Growth and development of the seedlings were found affected by grazing and trampling by wild animals, insect-pest attack, ground fire and competition from invasive weeds.

Study on ecophysiology of seed germination and seedling survival for restoration of natural regeneration of two threatened species of Central India (TFRI)

Seeds of *Dalbergia latifolia* and *Litsea glutinosa* were collected from three different locations, viability of seeds varied from 55%-100% and 90-100% respectively. Effect of light on seed germination indicated that it is not affected by open or dense forest. *L. glutinosa* seeds found to be physiologically dormant. During rain dormancy is naturally broken and 60-90% seeds germinated in field condition. Observation on germination indicates that intermittent rain at suitable temperature resulted in germination and subsequent dry season resulted in seedling mortality. Seeds of both species did not produce any soil seed bank after five months and one and half years of seed dispersal respectively. Seed predation resulted in loss of seeds for both species.

Restoration of Orchid Flora of Makum coal field areas of Digboi forest division (RFRI)

In total 65 orchid species were identified along with their host plants from areas near Makum coal field, Margherita, Assam. Conservation of collected orchid species was done at RFRI and other cultural management practices were followed. *In-vitro* seed culture of *Dendrobium lituiflorum, D. fimbriatum* var. *oculatum, D. aduncum, D. crysanthum, Aerides multiflora, Rhynchostylis retusa, Phalaenopsis mannii, Cleisocentron pallen, Phaius tankervilleae* and *Cymbidium aloifolium* were carried out. Sub-culture of selected species was done and maintained. Eight species were transferred for hardening. Altogether seven hundred seedlings were planted in pots, for transfer to the Orchidarium at the colliery. Construction of orchidarium at Tikok colliery was completed.

(a), (b): *In vitro* seed propagation and establishment of seeding of *Aerides multiflora;* (c), (d): *In vitro* seed propagation and establishment of seeding of *Cymbidium aloifolium;* (e): Construction of Orchid house in NEC, Margherita

2.4.2. Forest Economics

Establishing the correlation between fresh weight of green bamboo and dry weight of bamboo on seasonal basis for use by Assam Bio-Refinery Pvt. Limited (ABRPL), Numaligarh in business model (RFRI)

Bamboo culms were extracted from four age groups of four bamboo species namely *Bambusa tulda, B. nutans, B. balcooa* and *Dendrocalamus hamiltonii* in different seasons and weight was recorded immediately after extraction and thereafter on weekly basis, to estimate the moisture loss from the culms, in different seasons. The maximum weight fall was observed in wet season compared to dry season. In the wet season the maximum moisture loss was noticed in *D. hamiltonii* and minimum in *B. balcooa* in 16 days of air drying. Whereas, in the dry season maximum loss was observed in *B. nutans* and minimum in *B. balcooa* in 16 days.

The maximum weight loss was observed in 16 days of air drying for all four Bamboo species. The maximum moisture loss was observed in *D. hamiltonii* in 16 days followed by in *B. nutans, B. tulda* and in *B. balcooa* in comparison to fresh weight. In *D. hamiltonii* higher moisture loss was observed compared to other species and in *B. balcooa* it was lower than other three species.

Estimation of species wise bamboo resources and assessment of their utilization pattern in Mokokchung district of Nagaland, India (RFRI)

Surveyed 52 villages and 331 households, 108 sampling plots were laid and information regarding the utilization pattern of bamboo was collected. A total of 1,737 clumps of 14 bamboo species were measured. For 526 ground truthing points from Mangkolemba, Kubolong, Ongpangkong (S), Ongpangkong (N), Changtongya and Longchem blocks data were recorded. In total 120 culms of *B. tulda* were harvested for enumeration to develop the allometric equation specific to the region. From Mokokchung district 21 bamboo species were enumerated from out of which *B. tulda* and *D. hamiltonii* were found throughout the study site. Around 110 bamboo articles were recorded in the study area.

Monitoring and Evaluation of CAMPA project of Uttarakhand forest department (FRI)

Uttarakhand has sanctioned third party monitoring and evaluation of different components under CAMPA plantations for 2013-14, 2014-15, 2015-16 and 2016-17 to FRI. The 3 years project was initiated in 2018 and ended in March 2021. Teams from FRI carried out the data collection in 38 forest divisions of Uttarakhand. A total of 15,000 ha area of CAMPA plantation was surveyed. Total average survival of Uttrakhand CAMPA plantations was 33.51% with a minimum of 16.22% for Kalsi Soil Conservation Division and a maximum of 67.00% for Gangotri National Park.

Monitoring and Evaluation of CAMPA and GPM project of Punjab Forest Department (FRI)

Punjab has sanctioned third party monitoring and evaluation of different components under CAMPA and GPM plantations for 2014-15, 2015-16, 2016-17, 2017-18 and 2018-19 to FRI. The two years project was initiated in March 2019 and completed in March 2021. Teams from FRI have completed data collection in 16 forest divisions of Punjab. A total of 15,500 ha area of CAMPA and GPM plantation was surveyed. Total average survival of Punjab CAMPA plantations was 72.49% with a minimum of 65.02% for Jalandhar forest division and a maximum of 82.20% for Muktsar forest division.

2.4.3. Forest Biometric

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

A total of 23 villages situated in the fringe areas of Manas Tiger Reserve (MTR) in Baksa, Udalguri and Chirang districts were surveyed to assess their socioeconomic status and dependency on MTR. Observations showed that the maximum dependency of fringe villages was for grazing and fuel wood in buffer zone of MTR but having less dependency for other provisioning services like food and NTFPs.

Survey of households in Mayangpara village in MTR

Socioeconomic survey

Development of regression models, volume, biomass and carbon tables for *Quercus serrata* and *Pinus kesiya* in Manipur State (RFRI)

A total of 109 individual trees of oak and pine species were measured in different locations. Data analysis and frustum volume estimation for both the species was completed using Huber's and Smalian's formulae. Two volume equations for each species based on diameter only and both diameter and height have been developed to select the best fit volume prediction model.

Development of Allometric Models for estimating volume and aboveground biomass for important Tree Species of Outside the Forest (TOF) in Assam (RFRI)

A total of 4,305 trees in Trees outside of Forests (ToF) were measured with the help of Criterion RD 1000 BAF Scope and Gator Eye Calipers in Assam. Volume equations for *Aquilaria malaccensis* and *Bombax ceiba* were prepared for Upper Assam, besides regional volume equations.

Measurements of trees with the help of electronic BAF Scope

Measurements of trees of *Mangifera indica* with the help of tree caliper

2.4.4. Participatory Forest Management

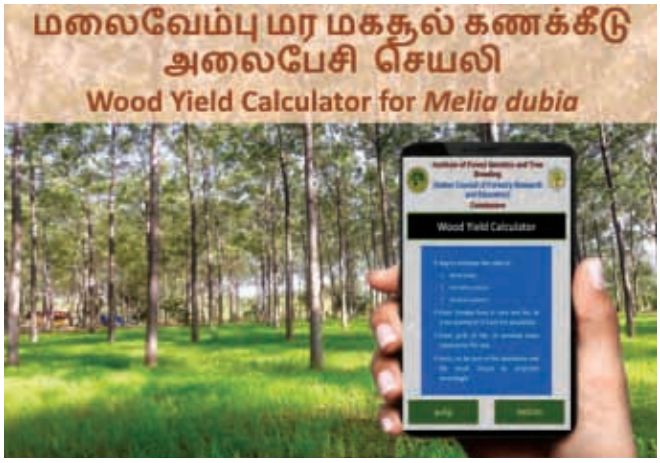
Establishment of Bamboo demo plantation by RFRI, Jorhat under National Bamboo Mission (NBM) (RFRI)

Demo Bamboo plantation was established in 4 ha lands in Golaghat district of Assam and a total of 1,600 bamboo seedlings of *Bambusa balcooa* and *B. tulda* were planted. Selected high yielding genotypes have been planted, to serve as a demonstration to the farmers in the neighbouring areas._

2.4.5. Information and Communication Technology (ICT)

Preparation of Volume and Yield Table for Indigenous Tree Species in Tamil Nadu (IFGTB)

Biomass sampling was done for *Melia dubia* by sampling a total of 122 trees from 41 plantations across Tamil Nadu. The best-fit model for wood yield estimation in *M. dubia* was developed using which, a farmer-friendly Mobile App ''Wood Yield Calculator" was developed for yield estimation in plantations of *M. dubia*.



Android based mobile app for wood yield estimation in plantations of *Melia dubia*

2.5.
WOOD PRODUCTS

PROJECTS UNDER THE THEME

A. Plan

• Completed	11
• Ongoing	07
• New	03

B. Externally Aided (except CAMPA)

• Completed	03
• Ongoing	05
• New	01

2.5.1. Wood and other Lignocellulosic Composites

Development of natural fiber and charcoal filled hybrid polymer composites (IWST)

Bamboo and coconut shell biomass were carbonized at different temperatures (300, 400, 600, and 900^{O}C); with 1 hour soaking time and at 5^{O}C^{-min} heating rates. The effect of carbonization temperature and charcoal content (0.5%, 1.0% and 1.5%) on mechanical, thermal and water absorption properties of BPCs have been investigated. The experimental results show that charcoal which is obtained at lower pyrolysis temperature (300^{O}C and 400^{O}C) improves the strength properties of BPCs, whereas, strength properties remain unaltered when charcoal prepared at elevated temperatures (600^{O}C and 900^{O}C) are added to BPCs. Compared to coconut shell charcoal (CSC) better mechanical properties were obtained through bamboo charcoal (BC).

Development of fire resistant particle boards (FRI)

Particle boards were prepared from lops and tops of poplar wood. Prepared particle boards were treated with four different combinations of fire retardant chemicals and particle boards. Testing of prepared particle boards with three different combinations of fire retardant chemicals and without fire retardant chemicals for their physical and mechanical properties was carried out. Some of the tested chemicals have shown promising results for development of fire resistant particle boards.

Multi-environment non-destructive phenotyping of wood property traits in interspecific hybrids of Eucalyptus (IWST)

Wood quality traits namely acoustic velocity, wood density, and dynamic modulus of elasticity (DMoE) were determined in wood samples derived from three mapping populations, *E. camaldulensis* X *E. tereticornis; E. tereticornis* X *E. camaldulensis*; and *E. tereticornis* X *E. grandis* established across six locations. Location effect was found to be highly significant in all wood quality traits. Hybrid clones were ranked based on their girth, air-dry density, and air dry DMoE.

Development of bamboo lumber using different bamboo species and evaluating its utilization potential as alternate to solid wood lumber for different structural applications (IWST)

High value composite materials from bamboo (in the form of lumber using laminated strips and crushed strands bonded with structural grade adhesives) have been developed which can be utilized as a potential substitute for quality timbers in structural applications. Besides having high durability against fungus and termite, the strength properties of these materials (bamboo lumber) are comparable or better than many commonly used timber species. Few products like tables, window frame, flooring tiles etc. have been made using bamboo lumber.

A documentary (https://youtu.be/5mg60NCzAx0) on process of making bamboo lumber has been made for wider publicity of the technology. A technical brochure has also been published for popularizing the use of bamboo lumber. Efforts are also being made for finding industrial partners for mass production and utilization of bamboo lumber in the form of furniture items.

Bamboo lumber (using bamboo strips and crushed bamboo) made from different bamboo species

Various products made from bamboo lumber

Wood Plastic Composites – Performance, sustainability, environmental impacts and life cycle assessment (IWST)

The objective of the project was to assess the life cycle of the wood plastic composite against the pure plastic material for understanding its sustainability, environmental impacts and its performance. In this study, bamboo powder was used as organic filler for developing Bamboo Plastic Composites (BPC). The life cycle study of the BPC shows a decreased environmental burden, human toxicity and environmental toxicity compared to the pure plastics.

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

About 100 wood samples belonging to over 30 lesser known tree species were studied for their fibre characteristics. The database for all trees or lesser known tree once developed shall be useful for various industries such as paper, pulp, timber, plantation, fabric etc.

Value-addition of low density woods by producing nano-wood-composites (NWC) with enhanced properties for high end applications (IWST)

Value addition of three low density plantation grown woods namely, *Maesopsis eminii, Ailanthus excela* and *Melia dubia* have been tried. Samples of these wood species were impregnated with Phenol Formaldehyde (PF) and Melamine Formaldehyde (MF) thermosetting resins blended with nanoparticles (nano clay and nano silica). Testing of different physical and mechanical properties of treated and control samples was carried out as per IS standards. Improvements in density and flexural strength ranging from 15-20% to 30-52% were observed after nano-resin impregnation. Dimensional stability and water resistance of impregnated wood have been enhanced. Flammability resistance is found to be increased due to presence of resin and nanoparticles in wood. Treated and control wooden stakes have been installed in graveyard test site and data collected regularly. Nano-resin treated wood samples have shown improved durability and decay resistance. Enhanced wood properties of nanowood composites are of great importance for successful application of low-density woods in various value-added applications such as furniture, tiles, paneling, siding and other applications.

Furniture items and flooring tiles produced from nanowood composites

2.5.2. Value Addition and Utilization

Performance of Southern Yellow Pine (SYP) and imported teak samples treated with CCA, CCB and ZiBOC (FRI)

The sample of *Eucalyptus* hybrid and *Melia dubia* were pre-treated with micro wave irradiation at 360, 480, 600, 720, 840 and 960 MJ/m^3 followed by treatment with CCA, CCB, ZiBOC and Borax boric acid preservatives at 6% concentration by full cell pressure treatment method. The treated samples along with control samples were installed in termite mound and timber test yard for durability tests. Periodic inspections of the samples, installed in test yard, were carried out. The treated samples show better protection as compared to the control after six months of installation.

Studies on Tree Biomechanics behavior with respect to the hollowness (decay) of urban trees in wind affected area (FRI)

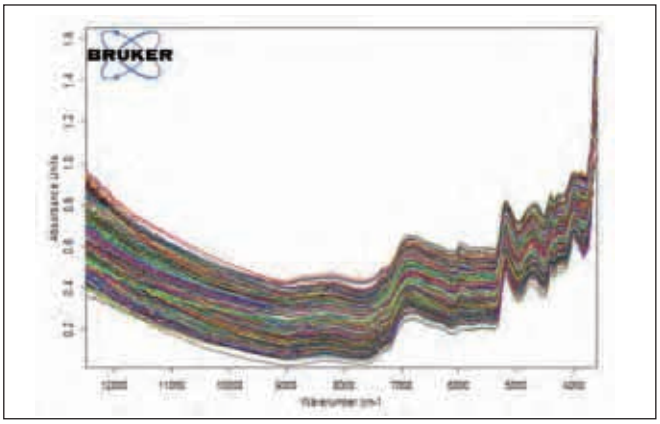
Hollowed logs of *Cinnamomum camphora* (Kapur), *Melia dubia* and *Lagerstroemia* sps. of different girth size were studied and their mechanical properties tests were conducted. Their breaking loads were recorded and maximum strengths were evaluated. Tree motion sensors were fitted to four trees to record the sway motion of the trees. Four hollowed logs of *M. dubia* with different lengths and girts were also tested for their bending strength under universal testing machine. Modelling software has been tested with real field data in order to predict the behavior of sway motion and breaking load of hollowed trees during cyclones. The aim of this study is to develop a model and identify the trees which can cause loss to human life and property during cyclones.

Wood anatomical studies of important mangrove species from Maharashtra Sea coast for the identification (IWST)

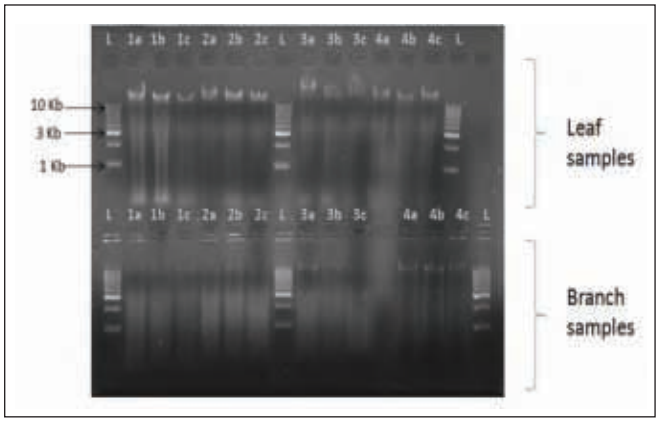
Anatomical description and codification of the data was done in accordance with card key features, International Association of Wood Anatomists (IAWA) list of microscopic features for hardwood identification for all the species studied. An attempt was made to prepare the key for separation of mangrove species based on wood anatomy and few important physical properties. Data generated through this project is summarized and published as a book entitled "Handbook of the Mangroves of Maharashtra-Morphology and Wood Anatomy".

Distinguishing *Dalbergia latifolia* and *D. Sissoo* woods using anatomy chromatography, near infrared spectroscopy and molecular marker techniques (IWST)

Data on various anatomical properties of *Dalbergia latifolia* and *D. sissoo* from the microscopic slides and macerated material have been collected, analysed and compared for identification and distinguishing two look-a-like wood species. Standardization of process parameter for HPLC finger printing of extracts of *Dalbergia latifolia* and *D. sissoo* continued and UV-Vis. spectra of each species were recorded and compared. Small blocks of *D. latifolia and D. sissoo* wood samples were processed for physical and chemical properties analysis. NIR spectra of wood blocks and powder samples of two species were collected for standardisation of identification procedure. Data on density, colour and per cent extractive were analysed using multivariate principal component analysis and partial least square (PLS) methods for development of NIR calibration models. Leaf and branch samples of *Dalbergia* spp. were collected and total genomic DNA was extracted for standardisation. Standardisation of PCR conditions for amplification of barcode regions (matK and rbcL) was also initiated. Nucleotide sequences of rbcL and matK genes of *D. sissoo* and *D. latifolia* were collected from NCBI and BOLD databases and performed multiple sequence alignment using KALIGN to study intraspecific variation.



NIR spectra of *D. latifolia* wood samples used for procedure standardization



Genomic DNA of *D. latifolia* following standardised protocol

Evaluation of palm wood (*Borassus flabellifer* and *Areca catechu*) and their suitability for various applications (IWST)

Studies were carried out on wood quality of *Borassus flabellifer* (Palmyra palm) and *Areca catechu* (Areca palm) for their utilization as timber. The findings revealed that the timber of Palmyra palm can be classified as extremely heavy, very strong, tough, moderately steady and exceptionally hard. The wood can be efficiently utilized for tool handles, construction, furniture, wooden flooring, pallets, oars and paddles, door and window shutters and frames. The low density core portion of both Palmyra palm and Areca palm was densified by impregnation of thermosetting resin and composite boards were made for value addition. The process can serve as a suitable method which can help in enhancing the utilization potential of inner soft portion of both the palms. Efforts are being made for finding industrial partners for mass production and utilization of Palmyra palm wood especially for furniture items.

Furniture items made from Palmyra palm wood

Composite boards made from densified Areca palm wood

Photo-stabilization of wood surfaces and coatings with nanoscale UV absorbers (IWST)

Spectral sensitivity of photo-degradation of wood was determined by exposing *Wrightia tinctoria* wood samples covered with different glass cut-off filters (280 nm to 550 nm) to a xenon light source in a weatherometer. Study indicates degradation of wood surfaces below 380nm. Stable dispersion of nanoparticles in PU coatings was prepared using ultrasonication. Coating of wood surfaces with PU coating embodied with nano particles of Zinc Oxide (ZnO) and Cerium Oxide (CeO_2) was found effective in suppressing photo-yellowing and degradation of wood surfaces. Synergistic effect of acetylation of wood and application of nano material on wood surfaces to enhance its UV stability was studied. Study on comparison of inorganic and organic UV absorbers indicate superiority of inorganic nano particles in providing UV and microbial resistance

Phytochemical studies of *Pterocarpus santalinus* bark for its potential utilization (IWST)

Red sanders bark was procured from Tirupati Forest Division, Andhra Pradesh. Extraction of samples was carried out using various solvent and HPLC fingerprinting of the methanol extract of bark and UV-Vis spectra of methanol extract of bark was recorded. Antifungal activities of the extracts were tested. Initially very good antifungal activities were observed. The mango wood impregnated with methanol extracts of *P. santalinus* bark exhibited very good brown shades.

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

Thermal modification of bamboo (*Dendrocalamus stocksii*, *Dendrocalamus brandisii*), cane (*Calamus thwaitesii*) and lantana (*Lantana camara*) was carried out in a vacuum oven and using hot linseed oil at 170-210 °C. Thermally modified bamboo, cane and lantana attained uniform dark colour with mass loss and some reduction in density. Thermally modified material was characterized using FTIR and NMR spectroscopy. The thermal modification increased hydrophobic nature and improved dimensional stability. Thermal modification results in loss in mechanical properties of bamboo and cane.

2.5.3. Pulp and Paper

Application of biobased polymeric blends as strength additives for papermaking (FRI)

First stage recycled pulp was evaluated for strength properties after the application of biobased blends. After treatments an increase of 36.91%, 38.53% and 56.62% was achieved after first recycling in comparison to untreated first stage recycle pulp. Applications of biobased additive blends were also found effective for second stage recycled pulp. Tear, tensile and burst indexes were enhanced effectively in case of second stage recycled pulp upto 34.74%, 34.74% and 55.36% respectively after treatments with various blends.

After third stage of recycling of pulp, there was a decrease up to 33.51%, 14.87% and 27.11% in tear, tensile and burst indexes respectively. Applications of bio blends have been found effective to enhance tear index (46.81%), tensile index (31.47%) and burst index (59.81%) of third stage recycled pulp. Among tear, tensile and burst indexes, maximum enhancement was recorded for burst index at each level of recycling by the application of bio blends. As a whole triblend of cationic cellulose: cationic starch: carboxymethyl cellulose was effective among all blends for tear enhancement. Bi-blend of oxidized starch: guar gum in 1:2 ratio and tri-blend of cationic cellulose: cationic starch: carboxymethyl cellulose were able to provide maximum enhancement in tensile index at each level of recycling and among other blends used in the study. Bi-blend of oxidized starch: guar gum in 1:2 was highly effective for burst enhancement at each level of recycling.

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

Two species, *Dendrocalamus calostachyus* and *Dendrocalamus asper* have been evaluated for initial screening. The chemical composition of a bamboo is an important parameter for its assessment for the production of dissolving grade pulp. Lower ash content is beneficial since it is an indicator of low inorganics which may interfere with subsequent chemical reactions. Finding low silica content (0.49%) in *D. calostachyus* is an initial achievement. High cellulose content (46.71%) in *D. calostachyus* makes it suitable for further processing of dissolving grade pulp production.

2.6.
NON-WOOD FOREST PRODUCTS (NWFP$_S$)

PROJECTS UNDER THE THEME

A. Plan

- Completed 05
- Ongoing 02
- New 07

B. Externally Aided (except CAMPA)

- Completed 06
- Ongoing 16
- New 03

2.6.1. Resource Development of NWFPs

Integrated approach for development of standard nursery techniques and value added products of some socio-economically important species of Madhya Pradesh (TFRI)

Nursery techniques for four forestry species viz. *Terminalia chebula, T. bellerica, Semecarpus anacardium* and *Madhuca indica* were developed. In *T. chebula* optimum germination and seedling growth was observed in depulped seeds soaked for 48 hours in water and sown in mixture consisting of Soil: Sand : Vermicompost in 1:2:2 ratio. In case of *T. bellerica m*edium size seeds soaked for 48 hours and sown in polypot mixture with 1:1:2 ratio of Soil: Sand: Vermicompost was found suitable for optimum germination and seedling growth. Treatment of seeds with sulphuric acid for five minutes and sowing in polypot mixture of 1:1:1 ratio of Soil: Sand : Farm Yard Manure was found best for germination and seedling growth in *Semecarpus anacardium* (Bhilwa). No pretreatment was required for germination of *Madhuca indica* seeds.

Bhilwa fruit powder was utilized for the development of value added food product viz. biscuits. Nutritional parameters of the developed biscuits were analyzed and found very nutritive and tested for consumer acceptability. The taste of developed biscuits were liked very much by the consumers. The shelf life study of the developed biscuits revealed that it was safe to consume the biscuits upto six months. There were no remarkable changes observed in chemical, microbiological parameters and organoleptic evaluation throughout the study period. Hence the developed value added product could be promoted as neutraceutical product.

Development of fast food products enriched with *Moringa oleifera* (Drumstick) leaves and skill upgradation training to rural women (FRCSD- Chhindwara)

Food products viz. blended biscuits, urad papad, rice papad, noodles, vermicelli and nuggets enriched with *M. oleifera* leaves were prepared. Nutritional values of the developed food products were analyzed for carbohydrates, proteins, fats, energy value, sodium, potassium, calcium and iron content. For consumer acceptability of the developed food products, clinical studies were conducted on human volunteers (female) for two products viz. Moringa biscuits and Moringa papads. An increase in haemoglobin per cent (Hb%) in volunteers was recorded. Both the products Moringa biscuits and Papads could be promoted as nutraceutical food products among the commercial producers.

Conservation of *Stereospermum suaveolens* (Roxb.) DC. – A rare species in Madhya Pradesh (TFRI)

Populations of rare dashmool species *Stereopermum suaveolens* were demarcated and mapping was done in 10 different districts of Madhya Pradesh. Root bark samples were analyzed for active chemical ingredient, triacontanol using HPTLC technique, it ranged from 0.126±0.01% to 0.545±0.03% among 10 locations. Morphological traits showed variability among the populations. Pretreatment of seed with hot water and sand as potting medium was observed suitable for seed germination and seedling growth. Germplasm bank was established in TFRI. Information on locations of *S. suaveolens* in Madhya Pradesh was communicated to forest department for seeds collection and its conservation.

Germplasm bank of *S. suaveolens*

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

Apical, distal, end and full part of tuber of *Curculigo orchioides* (Kali Musli) were sown in the field to standardize cultivation technique. The preliminary study revealed that apical part of tuber showed early germination and produced higher number of secondary roots. Preliminary phytochemical analysis of *C. orchioides* showed that methanolic extract was rich in phenolic content. Chemical marker cuculigoside was estimated using HPLC which was found higher in rhizome samples of Budhni, Sehore (M.P.).

Standardization of cultivation technique of *C. orchioides*

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

Artificial inoculation was carried out in 184 *Aquilaria malaccensis* trees in six locations *viz.*, Kharkutta (North Garo Hills), Goiragre (West Garo Hills), Katuligre (South West Garo Hills), Danakgre (West Garo Hills), Anangpara (South West Garo Hills), Umsaw Reserve Forest (Ri-bhoi), Dapokgre and Singwegre (East Garo Hills) of Meghalaya. Formation of agarwood has taken place in almost all the inoculated trees.

Formation of agarwood

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

The agarwood based agroforestry model was developed with *Aloe vera*, *Homolomena aromatica*, *Zingiber officinale, Capsicum frutescens* (birds eye chilli) and *C. chinese* (king chilli/manipurichilli) at FRCBR, Aizawl. One provenance trial of *Aquilaria malaccensis* was laid at KVK, Jorhat, with 14 provenances.

Rearing of insect *Neurozerra conferta* was tried on artificial diet and it was observed that 5-6 months duration was required to complete the life cycle. It was found that life cycle of *N. conferta* lasted for 153±10 days, which extended up to 170±15 days in winter season. In Assam two generations of *N. conferta* were recorded in a year. Five bacteria were isolated from the caterpillar's gut and its silk viz., *Brevibacterium frigoritolerans, Pseudomonas lactis, Bacillus marisflavi*, *Bacillus cereus* with one unidentified bacterium and used for artificial inoculation in healthy agar trees.

Non-Detriment Finding (NDF) study on agarwood species in India (RFRI)

As a CITES-Scientific Authority, RFRI undertook a NDF study and recommended the export of agarwood products to the CITES-Management Authority, taking into consideration the growing stock available in non-forest lands, the number and capacity of the agarwood processing units, and the proportion normally used for production of agarwood chips and agar oil, and also the trend in the exports of the last 10 years.

Propagation of improved bamboo clumps (RFRI)

The high yielding genotypes (assembled in the Germplasm bank) were used for multiplication through macro-proliferation. Twelve more candidate plus clumps were added to the collection; and the superior materials were supplied to the IFGTB, Coimbatore for further multiplication.

HI-TECH NURSERY

RFRI, Jorhat : Micropropagation was undertaken for *Bambusa tulda, B. balcooa* and *B. nutans* and produced quality planting materials. These Tissue Culture (TC) raised plantlets were further macro proliferated in nursery to increase the number and were supplied to the KVKs of Assam Agricultural University and Assam Forest Department for further multiplication and supply to the farmers.

Production of vermicompost was undertaken to meet the requirement of the nurseries. Three field nurseries were established under the project. A novel idea of providing shade with bamboo strips instead of the agro-shade net (HDPE) were employed in the construction of nursery. These nurseries are being utilized for macro proliferation of the hardened tissue cultured propagules to increase the number. Further, Material Transfer Agreement was executed with State Bamboo Development Agency, Assam; Indira Gandhi Krishi Vishwavidyalaya, Raipur; and FRI, Dehradun.

RFRI, Jorhat : The construction of hi-tech nursery was completed and handed over to the Assam Forest Department.

FRI, Dehradun : Hi-Tech bamboo Nursery was established for mass production of quality planting material of commercially important bamboo species. About 45000 plants of 14 bamboo species were raised for farmers and other Stakeholder's in Uttarakhand and other states in the northern and central India.

In-vitro culture with multiple shoots

IFGTB, Coimbatore : The Bamboo Hi-Tech Nursery was upgraded with additional infrastructure. Two Greenhouse structures were established. Around 50,000 plants of different bamboo species have been assembled for the production of quality planting materials.

SMALL BAMBOO NURSERY

RFRI, Jorhat : Raising of culm cuttings with two nodes of different bamboo species, collected from RFRI Germplasm Bank/ Bambusetum is being continued. Macroproliferation of different bamboo species is also being continued. A bamboo gazebo was constructed at Bambusetum of the institute.

FRI, Dehradun : The objective was to raise 50,000 seedlings every year of selected bamboo species and the nursery running on perpetual basis is self-sustainable through the proceeds from sales of bamboo seedlings. 13 bamboo species were raised and the macroproliferation of many bamboo species were completed.

FRC-LE, Agartala : One lakh bamboo seedlings/saplings were raised and supplied to farmers (funded by NBM)**.** Around 600 beneficiaries have been trained from Tripura on the nursery techniques and management for two bamboo species *Bambusa tulda* (Mritinga) and *B. teres* (Paora) (funded by TBM)

FRC-BR, Aizawl :16,000 seedlings of important bamboo species were raised.

Promotion of Paura (*Bambusa polymorpha*) Bamboo through Nursery and Plantation Management (RFRI)

To promote plantation of *Bambusa polymorpha* among communities for basketry in Tripura, 16,000 plants were raised in the nursery and maintained for better growth and survival, for field plantation in the next season.

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

Surveyed the protected areas of Assam and Mizoram and explored five populations of threatened rattan resources viz. *Calamus acanthospathus* and *C. nambareinsis* in Mawmrang CF and Kawlbem CF, Champhai district, Mizoram. One population each of *C. acanthospathus* and *C. nambareinsis* were reported from Hmuifang CF and Vanghmun Fan CF in Hmuifan area of Aizwal district. Collected 50 leaf samples from 25 individuals in each population for genomic study.

Evaluation of genetic superiority and stability of identified high active ingredient content accessions of *Picrorhiza kurroa* (Kutki), *Valeriana jatamansi* (Mushkbala) and *Sinopodophyllum hexandrum* (Bankakri) through multi-location trials and promotion of their cultivation amongst rural communities (HFRI)

Multiplied, and maintained the superior genetic stock of all the three selected medicinal plants at FRS, Brundhar. Significant variation was observed amongst different multilocation trial sites for active ingredient contents and different morphological characteristics. Organized two training programmes on the cultivation of important temperate medicinal plants for the benefit of different stakeholders.

Multilocation trial of *P. kurroa*

Standardization of nursery and propagation methods of *Trillium govanianum* (Nagchhatri) (HFRI)

Surveyed, collected germplasm of *T. govanianum* from 29 different geographical locations of Himachal Pradesh and established Field Gene Bank (FGB) at Field Research Station, Brundhar, Kullu. Assessed morphological characteristics and active ingredients to evaluate the variation among different sources. Developed the vegetative propagation method of *T. govanianum*. Treatment with IAA -200 ppm and IBA-150 ppm were found to be significantly better for rooting in rhizome cuttings of *T. govanianum*. Organized two training programmes on nursery and propagation of *T. govanianum* to different stakeholders at Manali and Rampur, Himachal Pradesh.

Nursery raising of *T. govanianum* plants

Programme support on elucidation of biosynthetic pathways and development of gene markers of high valued endangered medicinal herbs of NW Himalayas (Phase II) (HFRI)

Surveyed and collected 84 accessions/germplasm of *Picrorhiza kurroa* from different geographical locations of H.P. and U.K. and planted at Brundhar, Manali (H.P.). Multiplied and raised 12000 plants of *P. kurroa* for distribution amongst different stakeholders.

FGB of *P. kurroa*

Standardization of nursery techniques for mass multiplication of *Polygonatum cirrrhifolium* (Mahameda) and its extension among local communities (HFRI)

Fresh Mahameda seeds and rhizomes were collected in the month of September, 2021 from Nagani-Nichar, district Kinnaur and Cheog-Theog, district Shimla. Analyzed the samples collected from 15 locations for their phenol, protein, carbohydrates and reducing sugar contents. Trials of seed germination of Mahameda were carried out in various nurseries of the institute under poly-house conditions as well as in open nursery beds and observations recorded.

Seed germination of *Polygonatum cirrrhifolium* (Mahameda) in laboratoy and field

Mahameda fruit

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

Assessed the population status of *Fritillaria roylei* and collected germplasm from forest area of Seri, Ritirard of Kullu district (H.P.).

Established different spacing trials using bulbs of *F.roylei* at Field Research Station, Jagatsukh, Kullu. 78.66% germination were recorded in seeds sown during pre-winter season (November) while only 52.66% in post winter (March). Maximum of 69.3% germination recorded in seeds sown at 1.50 cm depth, followed by 56 % in depth of 1.00 cm and minimum germination of 48 % germination in seeds sown at 0.5 cm depth. In nursery,>95% sprouting recorded in freshly collected bulbs sown in the month of October whereas dried bulbs did not sprout.

Collection of capsules and bulbs of *F. roylei* from Chhitkul, Kinnaur

Potting media trial and intercropping trial of *F. roylei* at Jagatsukh (Manali), Kullu

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

Fifty Candidate Plus Trees were identified on the basis of phenology and the oil content and vegetative propagation trial was carried out. Air layering technique is found to be most successful technique amongst standardized cultivation technique. The estimation of the oil content work has been carried out for 30 CPTs.

Develop Germplasm Repository of Endangered Medicinal Tree *Oroxylum indicum* (Shyonak) (FRI)

Collected superior germplasm of *Oroxylum indicum* from 21 marked locations of four states Uttarakhand, Punjab, Haryana and Uttar Pradesh for propagation and multiplication.

2.6.2. Sustainable Harvesting and Management

Standardization of harvesting time and post harvesting techniques of *Helicteris isora* (Marorphali) and *Mucuna pruriens* (Kaunch) (TFRI)

Fruits of *Mucuna pruriens* (Kewanch) cause severe itching during collection and processing. Hence, collection method was developed using the ruptured bamboo stick. *Mucuna* fruits were processed by different methods (i) burning, (ii) dipping in cow dung and (iii) boiling in water at 100°C for 10 -15 minutes. Out of these methods, boiling in water at 100°C for 10 -15 minutes was found to be the best for processing of the fruits to extract the seeds. The seeds obtained from this method contained the highest chemical marker L-Dopa content (11.434±0.454%). Fruits of *Helicteris isora* (Marorphali) and seeds of *M. pruriens* (Kewanch) were processed and stored in different containers i.e. HDPE polythene bags, woven sacks, gunny bags, tin, air tight plastic, air tight glass, steel containers and open containers (control) to see the effect of storage containers on active ingredient for 14 months and were examined at bimonthly intervals for lupeol content in fruits of *H. isora* and L-Dopa content in seeds of *M. pruriens*. Microbial infestation was also observed. Preliminary studies showed that glass containers and HDPE polythene bags were found to be good for storage purpose.

Selection of CPTs, standardization of collection practices and quality evaluation of gum karaya (*Stercularia urens*) in Chhattisgarh state (TFRI)

Study sites in Janjgir-Champa forest divisions and Manendragarh of Chhattisgarh Plains Zone and Northern Hills Zone respectively were selected for standardization of harvesting practices of gum karaya. For standardization of harvesting technique for extraction of karayagum, experiments were laid out for trees of different girth classes (90 – 140, 141 – 190 and > 190 cm). Trees were tapped mechanically with different techniques (traditional, one semi-arc blazes and two semi-arc blazes on opposite sides). Initial observations recorded in March, April, May and June months revealed the oozing of gum increased with increasing GBH of the trees.

Width of initial blaze on *S. urens* tree

Length of initial blaze on *S. urens* tree

2.6.3. Chemistry of NWFPs, Value Addition and Utilization

Characterization and extraction of eco-friendly dyes from Eucalypts, Melia and Casuarina - leaves and bark; their application in textile industry (IFGTB)

Extractives from leaves and bark of *Eucalyptus* spp., *Melia spp.* and *Casuarina* spp were used as dye in textiles. Various pretreatments and dye fixing methods were tested. Soyamilk pretreatment enhances colour and gives better dye absorption capacity to the fabric. Different natural mordants like *Aloe vera*, myrobalan, pomegranate peel and amla were used along with different mordanting methods to test dye fixation on different fabrics like cotton, silk, wool and linen. Designed and fabricated a pilot scale dye extractor. Natural dyes from the species can be utilized commercially in small scale dyeing industries. Patent registration process and technology transfer have been initiated. A cost effective and ecofriendly facemask "DYECOP", a natural dyed, double layered with microbial filtration capacity cotton face mask were developed. It is cost effective and eco-friendly.

"Dyecop"- A natural dyed mask with microbial filtrations capacity

Processing and value addition of Terminalias for effective livelihood improvement of forest dwellers (IFGTB)

Market survey was conducted by visiting 14 wholesale and retail raw drug dealers in Coimbatore and surrounding districts. Five hundred tribal households were surveyed. Fruits were collected and separated manually into outer husk, pericarp and seeds manually by pounding. The pericarps of *Terminalia* species were powdered using a pulverizer into fine powder and used for fluorescence analysis. Gallic acid and chebulagic acid was documented for fruit and seed parts in both species. Processing technology for *Terminalia* (Harar and Bahera) is being developed and stage of harvest has been identified.

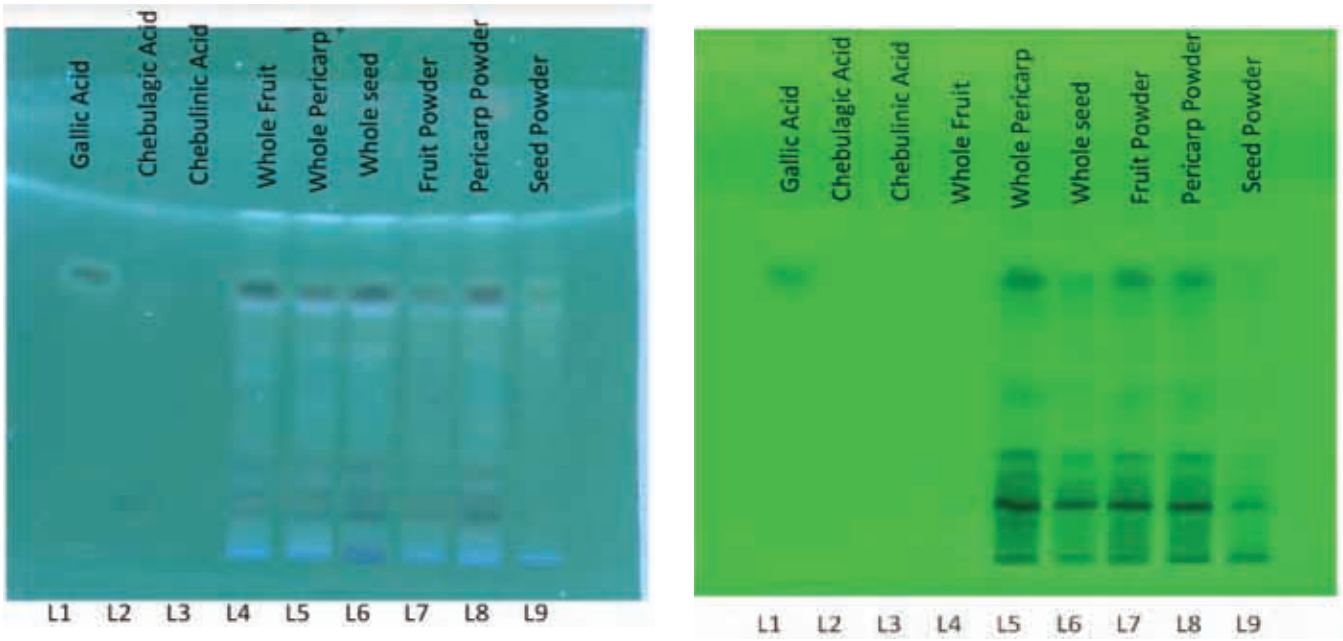


Photo documentation of Gallic acid and Chebulagic acid in *T. chebula* and *T. bellerica* methanolic extract

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

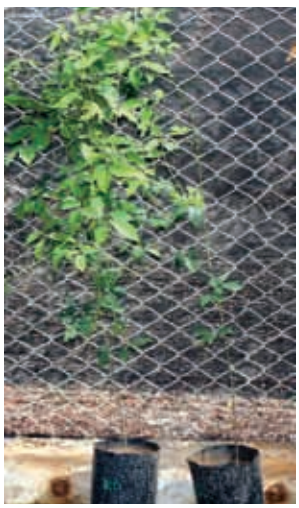
The bark and heart wood samples of *Pterocarpus santalinus* collected from four plantations located at different places in Tamil Nadu were processed and subjected to extraction using three different organic solvents viz. methanol, acetone and petroleum ether. Yield was high in bark than heartwood. Methanol gave more yield than acetone and petroleum ether. Qualitative analysis revealed that heartwood contains more phytochemicals than bark. Quantitative estimation revealed higher content of phenols followed by flavonoids and alkaloids. Evaluation of the antimicrobial activity of the methanol extract of the *P. santalinus* bark and heartwood showed significant zone of inhibition when tested against *Klebsiella pneumonia, Staphylococcus aureus, Bacillus subtilis* and *Escherichia coli*.

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

Nearly 25 accessions of *Annona muricata* and *Caesalpinia bonduc* from five locations namely Puducherry, Tamil Nadu (Attoor, Anaikatti, Pechiparai) and borders of Tamil Nadu (Kodanad) have been collected. The propagules collected were processed for propagation and soil samples collected were analysed for on physico chemical properties. A total of 13 accessions of *C. bonduc* from seven locations namely Kanyakumari, Dharmapuri, Salem and Coimbatore were collected. The seeds collected were germinated and growth parameters recorded. The fruits of *A. muricata* and |*C. bonduc* collected from different parts of Tamil Nadu were processed for quantification of primary and secondary phytochemicals present in *A. muricata* fruit flesh; *C. bonduc* seeds kernel and seed coat. Morphological characters of *C. bonduc* and *A. muricata* seeds were studied by image analyzer using Leica Qwin software.

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

Survey and collection of selected medicinal plants was carried out in Western Ghats and Eastern Ghats of Tamil Nadu. Phytochemical constituents were analysed in *Nigella sativa, Securine gavirosa, Entada scandens, Phyllanthus reticulatus, Breynia retusa* and *Ficus glomerata* and biomolecular characterization of selected germplasm is in progress. *F. glomerata, P. reticulatus, E. scandens* propagules have been raised. Germination period has been reduced by pre-treatment of seeds by acid scarification method.



Survey for *Entada scandens*, woody endangered climber in Kolli hills and its propagation for conservation

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

Populations of critically endangered *Dillenia pentagyn* were identified in four places of three forest divisions of Madhya Pradesh. Morphological data were recorded, plant part viz. leaves, stem and root bark were collected from each population and were being investigated for chemical ingredients using High Performance Thin Layer Chromatography (HPTLC). Experiments have been laid out to standardize propagation technique of this critically endangered species. Different concentrations of IAA, IBA, NAA hormones were tried for rooting in the species. Since it is a difficult to root species, adventitious rooting is achieved in few cuttings only. Further efforts are being made for improving the rooting percentage. Betulinic acid marker was quantified in fruit, leaf, root bark and stem bark of *D. pentagyna* from the regression equations of marker compound.

Dillenia pentagyna tree

Recording morphological data for *D. pentagyna* tree

FRI, DEHRADUN

» Fruits of *Rubus niveus* (Kala hinsalu) were investigated for nutrient composition and bioefficacy. The high values of essential nutrients and better antioxidant activity of the fruits revealed their potential for the value addition.

» Aerial biomass of *Prosopis juliflora* was investigated for dye yield and dyeing characteristics. Based on the yield of natural dye and their dyeing performance on silk, wool and cotton fabrics the plant has been established as promising source of natural dye thus, expanding the existing raw material source for natural dye production.

» A novel process for isolation of fibre from pine needles which is simple, eco-friendly and does not demand large space, energy, instrumentation etc has been identified. This process is replicable on large scale and can be easily executed in remote areas having abundance of pine needles. The isolated fibre can be spun into handloom cloth and products like jackets, coat, purse, wall curtains, lamp shade etc.

» A green, economic and facile method was developed for removal of anthraquinones from *Cassia tora* endosperm. The results were validated by HPLC analysis. Further, *C. tora* gum was chemically modified via carboxymethylation and quaternisation to prepare value added products.

» Zinc oxide nanoparticles were synthesized using extracts isolated from knotwood of *Mangifera indica, Azadirachta indica, Acacia nilotica,* and saw dust of *Shorea robusta* and *Dalbergia sissoo* and were characterized by FT-IR spectroscopy.

RFRI, JORHAT

» Shikimic acid, a potent pharmaceutical intermediate and sole building block for antiviral drug oseltamivir (Tamiflu) was screened in *Illicium griffithii* fruits from different areas of North-East India. The highest amount of shikimic acid found was 19.82% in fruits. The selected genotype has been suggested for propagation to collaborating institute, North Eastern Hill University, Shillong.

HFRI, SHIMLA

» Eight populations of *Taxus baccata* and four populations of *Betula utilis* occurring in Uttarakhand were characterized for their marker compounds namely 10-deacetylbaccatin-III and betulin, respectively. This information is new and useful in identifying the chemically superior genotypes of these species for their conservation.

» Seven populations of *Valeriana jatamansi* grown in Himachal Pradesh, Sikkim, Nagaland, and Meghalaya, respectively were characterized for composition of essential oils isolated from their rhizomes.

» Phytochemical evaluation and *in-vitro* biological investigation of two *Astavarg* species namely *Habenaria edgeworthii* and *H. intermedia* recorded high phenolic content and revealed their promising antioxidant activity.

2.7.
FOREST PROTECTION

PROJECTS UNDER THE THEME

A. Plan

- Completed 08
- Ongoing 15
- New 02

B. Externally Aided (except CAMPA)

- Completed 03
- Ongoing 11
- New 02

2.7.1. Insects pests, diseases and control

Insect pests of Western Himalayan oaks and their control (FRI)

A total of 235 species of insects infesting western Himalayan oaks species such as *Quercus semecarpifoli*a (Kharsu oak) , *Q. dilatata* (Moru oak), *Q. leucotrichophora* (Ban Oak), *Q. lanata* (Riyang oak) and *Q. glauca* (Ring-cupped Oak) were reported from Nanital, Almora, Pithoragarh, Bageshwar Forest Divisions of Kumaon and Chakrata, Uttarkashi, Chamoli, Mussoorie, Dehradun, Tehri, Haridwar and Lansdowne. 18 species of hymenopteran parasitoids of oak defoliators and borers were identified up to family level. Management trials were carried out for four Cerambycid borers larvae and adults on oak *Q. semecarpifolia* & *Q. leucotrichophora* through entomo-pathogenic fungi, *Beauveria bassiana* (1.15% WP; $1x10^8$ CFU/gm minimum) and fumigation using saturated sol of para- di-cholorobenzene in Kerosene oil.

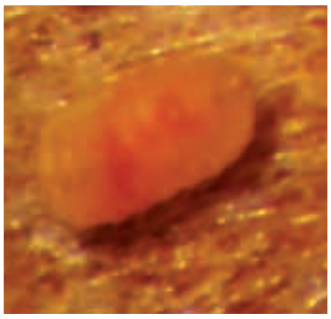
Kharsu oak, *Quercus semecarpifolia* stem borer, *Rosalia lateritia* larval gallery and the damage caused

Bio-ecology and management of Sal seed borer - *Dichocrocis leptalis* (Lepidoptera: Pyralidae) (FRI)

Bio-ecology of Sal seed borer *Dichocrocis leptalis* was studied in Timli, Langha, Kalsi, Lacchiwala, Thano and Malsi Deer park of Dehradun, district. Highest infestation was observed in Timli followed by Thano, Barkot and Kalsi. Borer completes 1st generation with 20-25% infestation during March-April within inflorescence and 2nd to 4th generation with 30-35%, 55-60% and 40-45% infestation during April-May, May-June and June-July respectively in seed. Insect behavior patterns with respect to feeding and reproduction is being monitored.

Rearing of borer

Female and male adult of *D. leptalis*



Egg

Larva

Pupa

Pupal cell

Effect of elevated CO_2 on the saplings of agroforestry tree species viz., Eucalyptus and Poplar inoculated with beneficial rhizospheric microbes (FRI)

Rhizospheric soil of Poplar and Eucalyptus collected from Dehradun, Yamunanagar, Roorkee, Rudrapur and Haldwani were isolated for bacterial strains. *In vitro* screening was conducted for different plant growth promotion activities *viz.*, phosphate solubilization, indole acetic acid (IAA), hydrogen cyanide (HCN), siderophore and ammonia production, on all the strains of which 41 strains showed strong plant growth promoting activities.

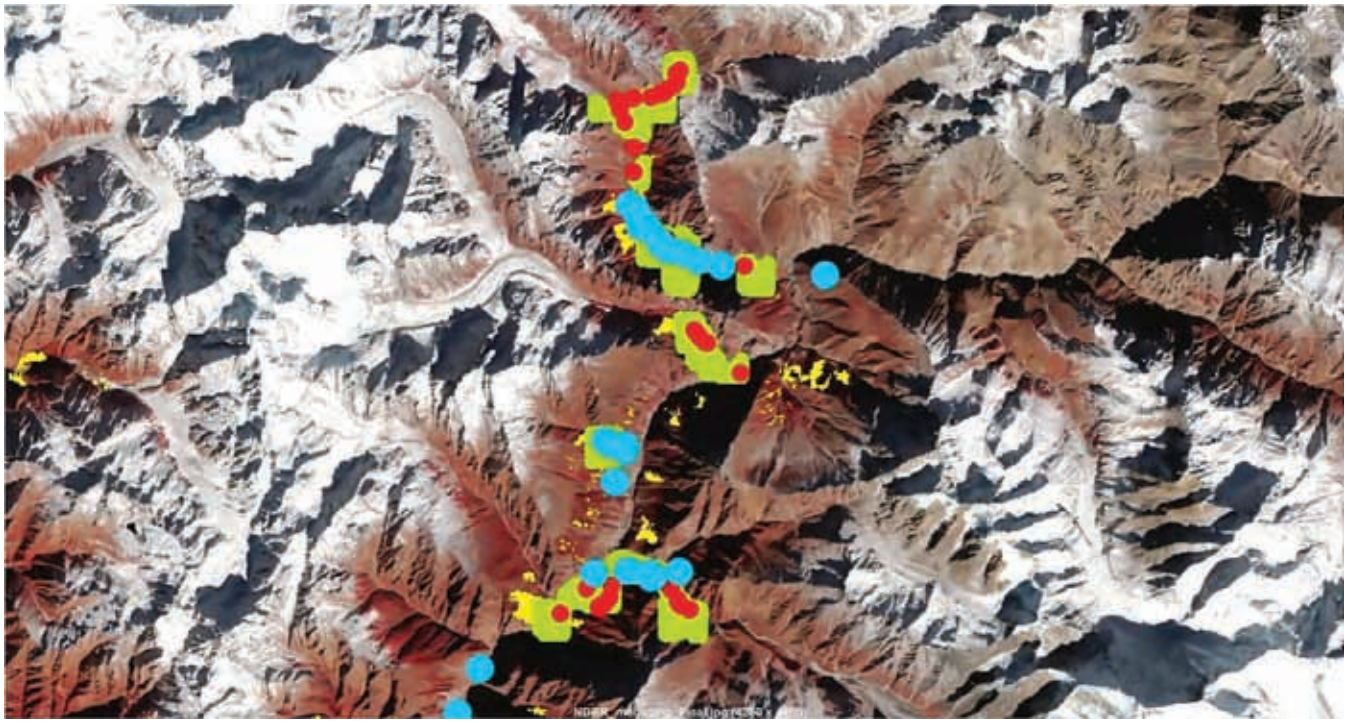
Health status assessment of avenue trees along major city roads of Chandigarh (Municipal Corporation, Chandigarh) (FRI)

Monitoring of avenue trees in Chandigarh for pathological, entomological and physiological parameters revealed that the trees were mainly affected by pathological problems and many of the problems were species specific such as poor architecture and root problem in *Ficus infectoria;* insect-pest attack and butt rot problem in *Alstonia scholaris*; root asphyxiation in *Enterolobium cyclocarpum,* weak branch unions in *Terminallia bellerica* and *Ganoderma* root rot, heart rot and cankers in *Grevillea robusta*. *Pterospermum acerifolium* trees were stressed due to less root space and fungal attack; whereas, *Sterculia alata* was badly affected by heart rot disease.

Mortality of *Pinus wallichiana* in Nandadevi Biosphere Reserve (FRI)

P. wallichiana eco-distribution maps were generated using Sentinel and MaxEnt for depicting the extent of mortality in Nanda Devi Biosphere. Majority of the trees were observed with severe infestation of *Arceuthobium minutissimum* (Himalayan dwarf mistletoe). Fungi, namely *Alternaria alternata*, *Lophodermium* sp., *Fusarium solani*, *F. oxysporum*, *Pestalotiopsis* sp., *Curvularia lunata*. *Sordaria fimicola*, *Colletotrichum gloeosporioides* were isolated from the symptomatic needles, decayed roots and identified using standard morphological features coupled with DNA sequence analysis. The pathogenicity of *F. solani* and *F. oxysporum* on *P. wallichiana* was proved. Four species of bark beetles viz., *Ips stebbingi*, *Polygraphus major*, *Pityogenes scitus* and *P. spessivtsevi* were found to be associated with the symptomatic trees. Two larval predators, namely *Thanasimus himalayensis* and *Platysoma rimarium* of the scolytid beetles were identified.

Mortality of *Pinus wallichiana* in Nandadevi Biosphere Reserve



MaxEnt model-based distribution map of *Pinus wallichiana* mortality in NDBR. (Red areas show mortality sites whereas, blue indicate healthy locations observed during field surveys. Parrot green color indicate the projected mortality distribution and yellow show current *P. wallichina* distribution)

Standardization of bio control mechanism to control diseases in forest nurseries (IFGTB)

An assessment of disease incidence at the five central nurseries of the Kerala Forest Department revealed that 22.8% of *Tectona grandis* seedlings were affected by leaf rust disease caused by *Olivia tectonae* and 21.3% seedlings by leaf blight disease caused by *Colletotrichum gleosporoides.* The pathogen also caused 22.6% of leaf blight disease in *S. macrophylla* seedlings. In the Shola forest nursery, only leaf spot disease was observed and the causal organism was identified as *Fusarium oxysporum. Saraca asoca* seedlings recorded 2.2% blight disease caused by *F. oxysporum*. Application of *Trichoderma viride* was found to have antagonistic effect against the soil pathogens such as *C. gleosporoides, O. tectonae* and *F. oxysporum*. *T. viride* was mass-produced and distributed to the nurseries. The forest staff were trained for the application of *T. viride* in combating seedling diseases.

Recovery of teak seedlings after application of *T. viride.*

Trichoderma viride application in central nursery Nilambur

Bioformulations of *Micromonospora* for biocontrol and biofertilization activity in *Casuarinas* (IFGTB)

Strains of *Micromonospora* were isolated from the root nodules of *Casuarina equisetifolia* and identified as *M. maritima, M. chalceae and M. shwarzwaldensis* by 16s r RNA sequence. The strains were used to control the wilt disease of *C. equisetifolia* caused by *Ralstonia solanacearum* in Tindivanam and Thondireddipalayam (Vilupuram district.). *C. equisetifolia* and *C. junghuhniana* seedlings inoculated with a combination of *Frankia* and *Micromonospora* showed better growth when compared to individual inoculations. 'Mona20', a bioformulation was supplied to Tamil Nadu Paper mill Limited, AP paper mills and Casuarina growers for control of bacterial wilt disease.

Development of Integrated Pest and Disease Management Practices for the Cultivating Medicinal plants in Karnataka (IWST)

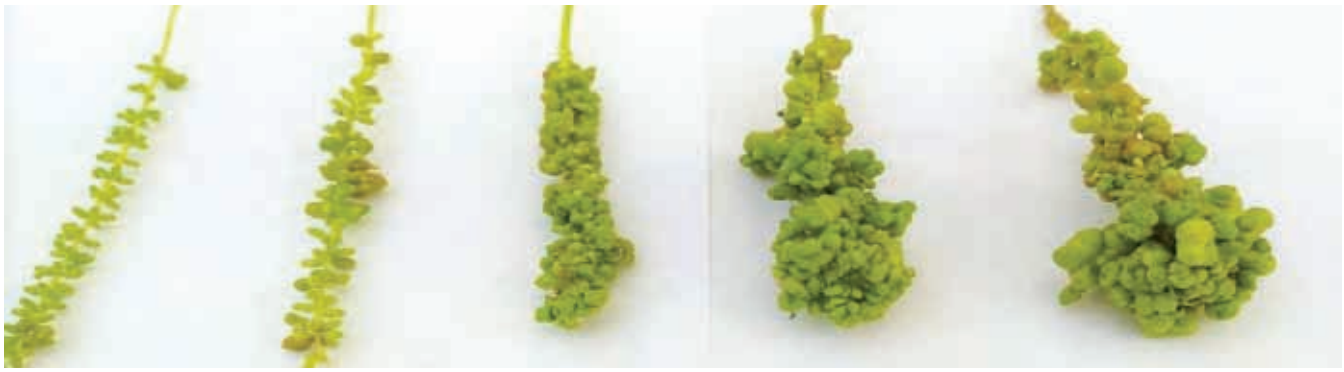
Major insect pests and diseases of medicinal plants cultivated in Karnataka were documented and various integrated management measures were standardised for the control of pests and pathogens. Pruning of branches with dieback symptom due to infestation of *Insignorthizia insignis* were recorded to be effective to manage *Ichneutica insignis* on *Adhatoda vasica.* Light traps were found very effective for the attraction and subsequent trapping of lepidopteran pests like *Haritalodes derogate* on *Hibiscus rosa-sinensis* and *Glyphodes glaucalis* on *Tabernaemontana divaricata.* Growing of *Duranta erecta* in border as traps crops in the cultivation of *Withania somnifera was found effective* for the *management of the invasive whitefly for A. trachoides.* Chemical control experiments with more focus on bio-pesticide were done for four pests viz., Eriophyid mites on *Gymnema sylvestre, Paracoccus marginatus* on *H. rosa-sinensis, Cochlochila bullita* on *Ocimum sanctum* and *Aleurothrixus trachoides* on *Withania somnifera.* The effect of release of the coccinellid beetle *Cryptolaemus montrouzieri* for the control of *Nippaecoccus viridis* infesting *O. sanctum* revealed that release of *C. montrouzieri* could control the mealybug *Nepenthes viridis* and therefore *C. montrouzieri* can be effectively used in biocontrol of potential mealybugs.

Development of Integrated Pest Management (IPM) strategies against the major defoliating pests of Mangroves in the Thane district of Maharashtra (IWST)

Developed biological control system for the key defoliating pests of Mangrove species *Avicennia marina* and *A.officinalis*, specifically using biocontrol agents, biopesticides (Hy-ACT), native microbial pesticide viz., entomopathogenic fungus (*Nomuraea rileyi)*, bacteria *Myroides odoratus* and HpNPV (*Hyblaea puera* nuclear polyhedrosis virus).

Development of integrated management strategy against flower gall inducers of *Prosopis cineraria* (L.) Druce (AFRI)

In khejri severe incidences of flower gall was recorded at Phalodi, Lohawat and Osian as compared to Baori and Pipar areas of Rajasthan. Average numbers of flower gall per inflorescence were higher at Phalodi followed by Lohawat in comparison to Osian, Baori and Pipar areas. Pod setting was very low in heavily infested trees (0-2 pods per inflorescence) in comparison to un-infested trees with 12-16 pods per inflorescence. Biochemical analysis (carbohydrate, phenols and protein) of the flower of gall infested khejri trees and uninfested khejri trees showed high levels of phenol and proteins in infested trees. The level of carbohydrates did not differ significantly between infested and uninfested trees. Two rounds of management trial with botanicals, chemicals and entomopathogenic fungi was given at five different sites viz., Phaludi, Lohawat, Baori, Pipar and Osian at bud initiation stage in last fortnight of February and first fortnight of March at an interval of 15 days to selected khejri trees. Botanicals exatracted from leafs of *Putranjiva roxburgii* and *Balanites egyptica* and chemicals Abamectin and Germentech showed efficacy against khejri gall inducing mite, *Eriophyes prosopidis*.



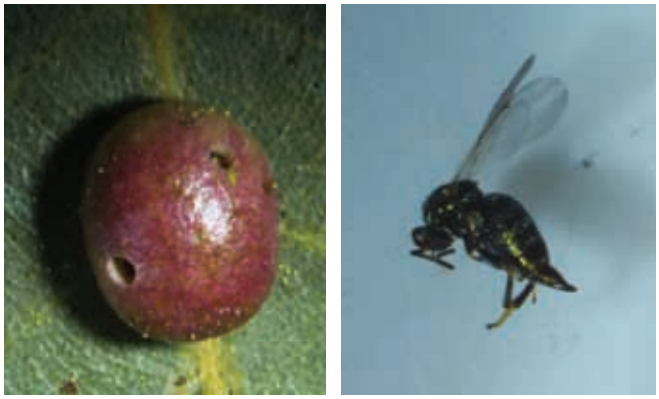
Different levels of flower gall formation in *P. cineraria*

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

Current population status of insect pests were studied in the selected forest types i.e., Rohtang, Chansal Pass, Sach Pass and Indrahar Pass of high altitudinal transitional zones of H.P. 33 insect species belonging to different insect orders were identified and the analysis of population abundance revealed Lepidoptera to be the most abundant attacking trees of high altitudinal transitional zone followed by Coleoptera and Hymenoptera. Lepidopteron leaf defoliator, *Malacosoma indica* was reported for the first time in an epidemic form with intensity of average 2000 larvae per tree in about 10-15 km^2 forest, heavily affecting the *Q. floribunda* (Moru oak) at altitudinal range 1800 to 2400 m in Tissa Forest range. Similarly, profound beetle attack was observed on *Juniper communis* and aphids attack on *Quercus semecarpifolia* (Kharshu Oak). Natural insect predator *Chrysoperla carnea* and parasitoid *Trichogramma chilonis* were identified as control agents feeding on larvae of *Malacosoma indica*.

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

Field studies were conducted to identify and assess the damage by insect pests on five different oak species in Himachal Pradesh. Leaves of *Quercus oblongata* (Ban Oak) were observed to be attacked by three species of gall insect (*Cynips* spp.) and leaf defoliator (*Cerace* sp.); whereas, acorns were infested by acorn weevil (*Curculio* spp.). *Q. floribunda* (Mohru oak) leaves were found attacked by leaf gall insect. Green aphids were found infesting leaves of *Q. semecarpifolia* (Kharshu Oak).



Leaf gall and adult of *Cynips* sp.

Identification of indigenous species of *Trichogramma* and their assessment against major insect pest of Teak in Telangana and Andhra Pradesh (IFB)

Rice moth and egg parasitiod cultures were maintained; and millions of egg parasitoids on Tricho-cards (7x4cm) prepared for field release in Telangana and Andhra Pradesh. Releasing the wasps of parasitoid *T. chilonis* resulted in significant ($P<0.05$-$P<0.01$) reduction of percentage defoliation/ skeletonization, incidence of pests, *H. puera* and *E. machaeralis;* and significant ($P<0.001$) growth enhancement of teak trees, both in natural forests and plantations of teak.

2.7.2. Mycorrhizae, rhizobia and other useful microbes

Evaluation of plant growth promoting (PGP) activity of *Rhizobium* from native legumes and development of consortia with other PGP Rhizobacteria (AFRI)

Eighty four isolates of *Rhizobium* were isolated from *Prosopis cineraria* (Khejri) nodules. Characterization experiments showed that most of the strains had adaptability in the pH range of 5 to 11. Some strains can tolerate upto 3% NaCl concentration. Three strains can solubilise phosphorus apart from fixing atmospheric nitrogen, whereas three strains showed positive chitinase activity. Phenotypic, biochemical and molecular characterizations of these isolates formed 23 groups based on the similarity index. One isolate from each group was selected and nursery experiment with compatible isolates of *Azotobacter* and *Bacillus* was laid out in isolation as well as in combinations. The results showed that consortia of the isolates *Rhizobium+Azotobacter+Bacillus*, performed better as compared to single isolate in raising quality seedlings of tree species.

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

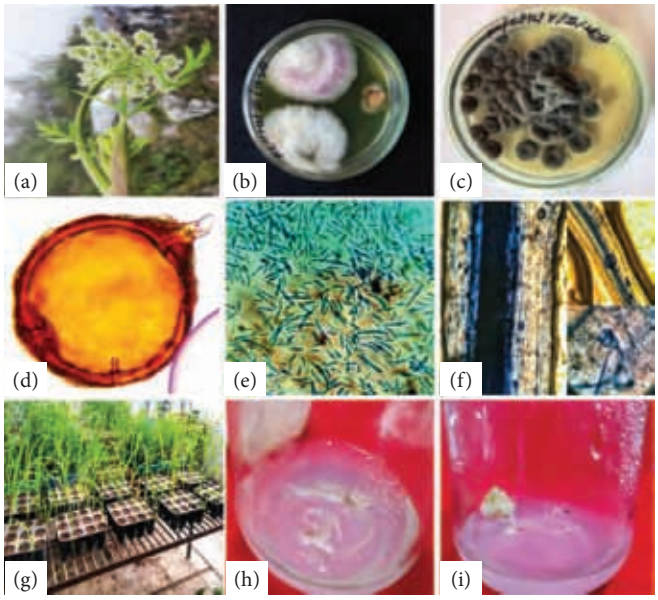
Rhizobium strains isolated and identified from wild plant/tree species such as *Acacia catechu* and *Erythrina veriegata* to assess their efficacy on biological nitrogen fixation. Four *Rhizobium* strains from *A. catechu* and two *Rhizobium* strains from *E. variegata* were isolated from samples collected at Almora, Dehradun and Uttarkashi. Total of six Rhizobial strains were identified from the collected nodule samples and were found to be Gram negative in nature. For identification of strains, some biochemical tests were carried out of which four *Rhizobium* strains have shown positive results. Motility test was also carried out and highly motile, moderately motile and slow motility strains were identified.

Root nodules of *A. catechu*

Root nodules of *E. variegata*

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

Soil and plant samples of *Angelica glauca* were collected from Himalayan region of Uttarakhand and Himachal Pradesh. A total of 24 fungal endophytes were isolated and 15 were identified. *Geotrichum candidum* was found to be the dominant endophyte and nine isolates were found to produce sterile mycelia. The Gas Chromatography Ion Mobility Spectometry (GCMS), of the extracted oil from roots of *A. glauca* revealed thirty-five compounds in which Ligustilide <(Z)-> was found to be the most copious phytocompound. The dominant endophyte *e.g. G. candidum* isolated from roots of *A. glauca* was mass produced, screened through GC-MS analysis and the result illustrated the presence of thirty-six compounds in which 2-Tetradecene was found to be the most abundant compound. For rootlet biomass production maximum rootlet callus formation was observed in MS medium supplemented with NAA (0.1mg/l) and BAP (2 mg/L).



a. Wild sample of *Angelica glauca*, B&C isolated endophytes from wild samples **b.** *Fusarium oxysporum* & **c.** *Cladosporium ispecies*), **d.** *Glomus macrocarpum*, **e.** *Fusarium oxysporum*, **f.** Root colonization in *Angelica glauca*, **g.** Inoculum production and mass multiplication of selected bioinoculant/s, **h&i.** Callus formation and initiation of rootlet biomass

Selection of efficient Arbuscular Mycorrihzal (AM) fungi, Phosphate Solublising Bacteria (PSBs) and *Azospirillum* for productivity enhancement of *Dendrocalamus strictus* and *Bambusa bambos* (AFRI)

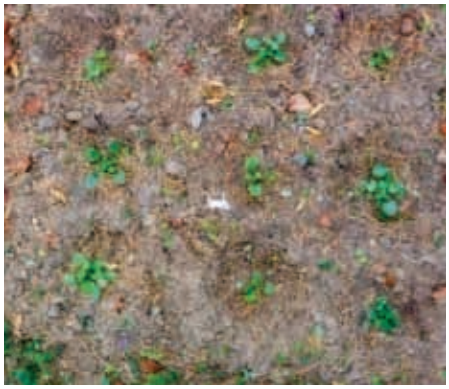
Nursery experiment on the selection of efficient AM fungi, PSBs and *Azospirillum* for enhancing growth and productivity of *D. strictus* and *B. bambos* was carried out using growth parameters and phosphorous content. All AM fungi/PSBs/*Azospirillum* treated plants performed better in terms of growth and biomass production as compared to the uninoculated *D. strictus* and *B. bambos* plants. Field trial was established at Ghata Nadi, Devla Range of Udaipur (North) Division to demonstrate the impact of biofertilizers on growth of *D. strictus* and *B. bambos* plants. Total 384 plants (192 plants of each species) were planted under 16 treatments combinations in triplicate. Biofertilizer inoculated seedlings performed better with 80% survival in both the species in field conditions indicating its utility under various afforestation programmes.

Mass production of *D.strictus* and *B. bambos* seedlings after inoculation with biofertilizer. Field trial at Ghata Nadi, Udaipur

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

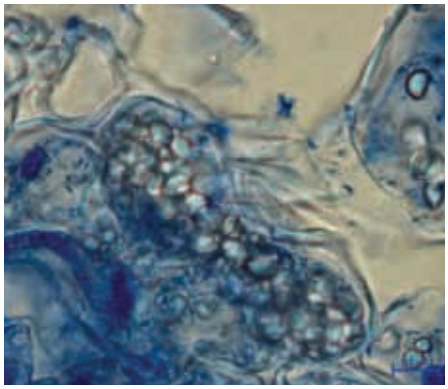
From the rhizosphere of *Angelica glauca* and *Valeriana jatamansi*, 29 arbuscular mycorrhizal fungi (AMF) belonging to nine genera were identified. In *A. glauca*, maximum frequency of occurrence was recorded for *Glomus* spp. (7.6-100 %) followed by *Acaulospora* sp. (7.6-42.8%), *Rhizophagus* (8.3- 33.33%), *Gigaspora* (10%) and *Entrophospora* spp. (7.6 %). In *V. jatamansi*, maximum frequency of occurrence was recorded for *Glomus* spp. (9-50%) followed by *Acaulospora* sp. (7.6-14.28%), *Rhizophagus* (16.6 %) and *Scutellospora* (27.2%). Growth parameters of outplanted *V. jatamansi* plants demonstrated maximum plant height, leaf number and leaf area in seedlings inoculated with *Glomus constrictum*.

Maintenance AMF inoculum



V. jatamansi under field trial

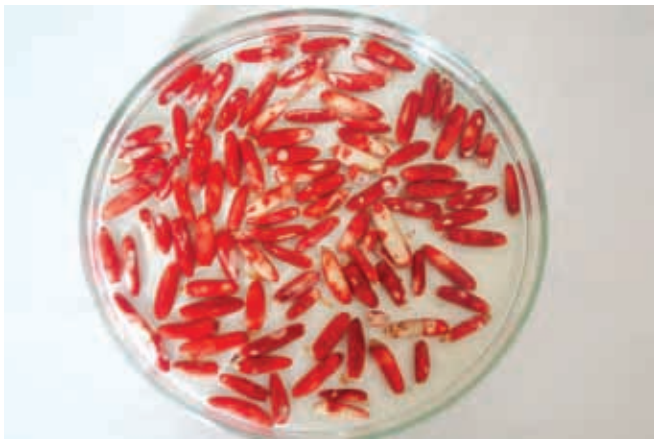
Seeds sowing of *A. glauca*



AMF structures in the roots cells of *A. glauca*

Studies on improving livelihood generation through scientific intervention in *Pinus gerardiana* and important wild mushrooms in Himachal Pradesh (HFRI)

Methods of harvesting practices of Chilgoza (*Pinus gerardiana*) cone in Kinnaur and Chamba districts revealed that in Kinnaur district, local people collected the cones from the Chilgoza trees by lopping the branches using traditional harvesting tools like Axe (*Lasta*), Sickle (*Kutham*, *Preshtang*) and using Adge (*Basing*, *Kyuth, Basola*) for nut extraction. However, in Pangi and Bharmour region



Viability testing of *P. gerardiana* seeds in laboratory

of Chamba district, cones of Chilgoza Pine are collected by using traditional harvesting equipment locally called as "*Khungu*" – a Hook attached to long wooden stick. Based on the percentage of development of new shoots, collection of cones by the use of long reach pruner is the proper method for harvesting of Chilgoza cones as compared to crude traditional methods. Optimum time of collection of seeds of *P. gerardiana* is during the first half of October because the seed collected during this period recorded maximum germination. The maturity indices studies, assessment of moisture content of seeds and storability studies were conducted to assess the suitable storage methods and temperature for enhancing seed longevity and shelf life of *Pinus gerardiana* seeds. Effect of seed source variability on germination, morphological and biochemical parameters of seeds of *P. gerardiana* was compared. Natural populations and the density of trees per hectare was assessed.

Cones collected during different time of collection

Ethnomycological documentation

Documentation of ethnomycological information based on a predesigned questionnaire was carried out in 57 villages of Kinnaur district and 18 villages of Bharmour region of Chamba district. 522 samples of wild mushrooms collected from the study area were taxonomically identified into 102 species in 61 genera belonging to 39 families. 14 wild edible and medicinal mushrooms have been analysed for their nutritional components and other phytochemical screening. Pure cultures of 61 culturable wild mushrooms were raised and are maintained in the laboratory besides depositing with National Type Culture Collection (NTCC), Forest Research Institute, Dehradun.

Fruiting body of *Ganoderma lucidum*

Utilization of ectomycorrhizal diversity for the quality stock production of Juniperus, Quercus and Castanopsis in Sikkim, India (RFRI)

Seven Ectomycorrhizal (ECM) species from 27 Rhizosphere soil samples of *Juniperus*, *Quercus* and *Castanopsis* were recorded. Growth parameters of treated plants were collected on completion of two months. Identification of ECM fungi were made, *Russula, Lactarius, Boletus, Amanita* and *Cortinarius* were found associated with targeted species. *Bacillus*, *Coccus* and *Pseudomonas* sp. were isolated from Rhizosphere soils of targeted species. Six microfungal genera such as *Cunninghamela*, *Aspergillus*, *Penicillium*, *Curvularia*, *Bipolaris* and *Mucor sp.* were isolated and identified. Physico-chemical properties of soil were studied. Carbon content varies from 0.523% to 4.25%. N, P and K were found in normal range.

Research Activities Performed under National Authority Compensatory Afforestation Fund Management and Planning Authority (CAMPA) funded schemes

ICFRE has undertaken need based futuristic studies to meet the emerging challenges in the field of forestery research, policy, extension, forest fire and REDD+, under National Authority CAMPA, for addressing the requirement of creation and strengthening of ecosystem services and sustainable use of resources through various scientific and technological interventions. Work has been initiated on following three schemes with six components in first scheme:

Scheme 1: Strengthening forestry research for ecological sustainability and productivity Enhancement

COMPONENT-I: All India Coordinated projects	**COMPONENT-II:** Conservation and development of Forest Genetic Resources	**COMPONENT-III:** Policy studies under Centre for Forest Policy Research
COMPONENT-IV: Capacity Building of State Forest Departments for developing "State REDD+ Action Plans" under National REDD+ strategy	**COMPONENT-V:** Operationalization of Human Resource Development Plan of ICFRE	**COMPONENT-VI:** Operationalization of Forestry Extension Strategy and Action Plan of ICFRE

Scheme 2: Estimation of economic losses in real term per hectare basis due to forest fire in Uttarakhand and Madhya Pradesh

Scheme 3: Execution of readiness activities for Implementation of REDD+ in India

SIGNIFICANT BRIEF OUTCOMES

Scheme 1: Strengthening forestry research for ecological sustainability and productivity enhancement

COMPONENT-I:

All India coordinated research projects

There are 31 AICRPs comprising of 13 species specific projects and 18 subject specific projects.

Testing and deployment of Clones and Seed Sources of *Casuarina* for different planting environments and end-use applications

The ICFRE institutes have established five clonal trails at Ariyalur and Palapattu, Tamil Nadu; Arid, Jharkhand; Battemallapa, Karnataka and Dulapally, Telangana. Plant material for all the trials to the respective institutes were supplied by IFGTB.

Clonal trial of *Casuarina* at Arid, Jharkhand

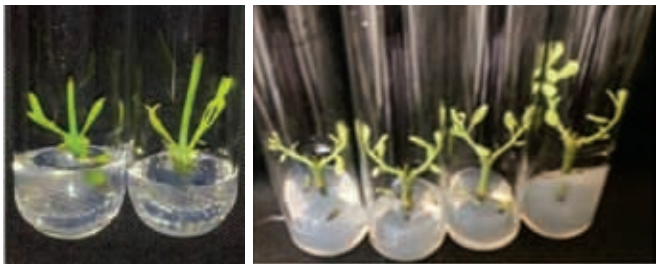
Bamboos

New bamboo clumps/accessions of *Bambusa nutans, B. tulda, B. vulgaris* var. *green, B. balcooa* and hill bamboo were selected from Northeast, Himachal and central India. Plantation of *Dendrocalamus strictus* and *B. vulgaris* have been established at Kashipur and Dhakrani in Uttarakhand; and two Multipurpose Wind Breaks of bamboo established at Champaknagar (West Tripura) and Gaburcherra (South Tripura).

Bamboo field gene bank at IFGTB, Coimbatore

Conservation, improvement, management and promotion of Sandalwood (*Santalum album* Linn.) cultivation in India

Drafted manual for collection and evaluation of sandalwood germplasm; and framed guideline/methodology for collection of tree core samples. Optimized mass propagation protocol through root suckers. Established one sandalwood block plantation at Regional Research Station, Bathinda (PAU). Standerdized protocol for RNA and small RNA isolation from wood tissues. Genotyping using microsatellite markers were standardized for 12 SSR primers. Standardized Isotope-ratio mass spectrometry (IRMS) method for determining carbon isotope composition (13C/12C) for sandalwood samples and data acquisition was carried out for 25 samples.



Axillary bud sprouting

Sandalwood based agroforestry trial at RRS Bathinda

Eucalyptus Improvement

IFGTB established germplasm bank with 249 clones and multiplied 23500 clonal plants. 8000 clonal plants were transported to IFP, TFRI, FRC-ER, Prayagraj and FRI. One trial of *Eucalyptus camaldulensis* using 924 ramets of 153 clones in six replications has been established at Mulugu Research Station by IFB, Hyderabad. TFRI, Jabalpur, established one clonal trial consisting of 151 clones with six replications. Collected 1400 stem cuttings of 25 selected Eucalyptus clones from CSO, Karunya and CSO Kurumbapatty. Wedge grafting was carried out and obtained 252 grafts which are being hardened. Developed vectors transferred to AGL1 by electroporation and confirmed with PCR. Existing *Li*hpRNA transgenics were PCR confirmed using CaMV and *Li*hpRNA primers.

Trial at Mulugu Research Station by IFB, Hyderabad

Eucalyptus trial in the campus of TFRI, Jabalpur

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

Designed, developed and fabricated a lab scale model of Microwave (MW) vacuum dryer. In preliminary experimentation the efficiency of MW energy utilisation was around 55-62 % and the distribution of the MW energy was highly ununiform. Carried out initial experiments on bending of green and dry bamboo strips (8-10 mm thick) using domestic microwave. In green condition, bamboo strips (300 mm long) could be bent after 90 sec of microwave treatment at 900W power level. Such bending could not be achieved in dry bamboo.

Eucalyptus hybrid and *Melia dubia* samples were heated at various MW intensity followed by preservative treatment with ZiBOC, CCB, CCA and Borax-boric preservatives at different pressure. Anatomical studies showed increase in vessel diameter with the increase in MW intensity. Upto 15% decrease in Modules of rupture (MoR) and upto 20% decrease in Modules of elasticity (MoE) in case of *Eucalyptus* hybrid and upto 14.81% decrease in MoR and upto 17.73% decrease in MoE in case of *M. dubia* was recorded.

A lab scale model of Microwave vacuum dryer

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

AFRI documented 50 invasive species including trees, shrubs and herbs from Rajasthan. The most important invasive species were *Prosopis juliflora*, *Lantana camara* and *Leucaena leucocephala.* From Infloresence and pod samples of *P. juliflora* collected from six districts, two species of seed infesting bruchids *Algarobius prosopis* and *Caryedon serratus* were recorded. FRI conducted field visit for collection of geo-coordinates of the patches of *L. camara* within Dehradun district, Uttarakhand.

Map showing extent of *L. camara* in Dehradun district using sub pixel classification of Sentinel II image

HFRI conducted reconnaissance survey for selection of sites invaded with *L. camara* in Bharoli, Dehra and Jawalmukhi Block in Dehra Forest division and Jowar Block in Una Forest Divisions of H.P. Observation were recorded on associated species of *L. camara* and soil samples collected.

Photograph of the sites invaded by *L. camara* in Jawalamukhi and Jowar Block by HFRI, Shimla

IFP, Ranchi has prepared satellite imagery using GIS, RS, Landsat 8 OLI and over laying of bioclimatic layers ranging from Bio_1 to Bio_19 and SRTM DEM data for entire India. Field data from CG (30 sites), Jharkhand (25sites), Bihar (26 sites) and WB (15 sites) and soil samples have been collected. To map the spatial extent of *P. juliflora* invasion in Tamil Nadu, IFGTB collected data from about 450 points in various districts and satellite images for 14 sites have been downloaded and processed, to predict the future spread of *P. juliflora*.

Views of *M. micrantha* invasion and other IAPS

RFRI, Jhorat initiated work on *Mikania micrantha* and downloaded/collected some of the old satellite images of Assam, procured Satellite image from NRSC, Hyderabad and preliminary GIS layers created/ updated. In pilot trial data on presence/absence of invasive sps from 20 grids (10X10 km) out of 900 (approx.) were collected. Collected different disease sample of *Mikania* species in Jorhat district and isolation and identification of Bio-control agents under *in vitro* condition infecting *M. micrantha* was carried out.

Directorate of Weed Research (DWR), Jabalpur surveyed around Jabalpur to assess the infestation of Lantana and to collect the insect bioagent for biological control. Severe *Mikania micrantha* infestation was recorded in Sarni locality of Betul district of Madhya Pradesh, a new occurrence to the central region

M. micrantha invasion in Jabalpur

Value addition of wood and wood based composites using nano-material

IWST prepared stable nanoemulsions of linseed oil using ultra sonication technique. Zinc oxide (ZnO) nanoparticles were incorporated in the nanoemulsions to improve UV resistance. Addition of ZnO nanoparticles into linseed oil nanoemulsion significantly enhanced UV resistance of coated wood.

IWST further carried out studies to improve quality of low-density woods. Nano-filler blended resins were impregnated into wood and weight percent gain (WPG) was found to increase by 26.7% and wood density was increased by 27.3%, when impregnated with 30% resin. Tangential swelling of wood decreased by 35.7% when impregnated with 30% Polyvinyl acetate (PVAc) compared to control samples. After treatment with PVAc, hardness (end surface) of Poplar wood increased by 30% from 3.94 kN of control to 5.13 kN of 25% PVAc treated wood. Compared to control, MoR was increased by 7% at 20% PVAc.

To improve properties of wood composites using nano materials, FRI prepared different formulations using nanomaterials (ZnO, SiO_2, Nanoclay) under different sonication and homogenisation parameters. Increasing the sonication time had shown considerable changes in swelling behaviour and water absorption by wood and also its density. Finger jointed segments with 1%, 2%, 3%, and 4% nanoclay loading were prepared. Samples with higher nanoclay loading showed better strength properties than samples with lower nanoclay loading.

M. dubia fibres

MDF Board

Conservation and productivity improvement of Red sanders

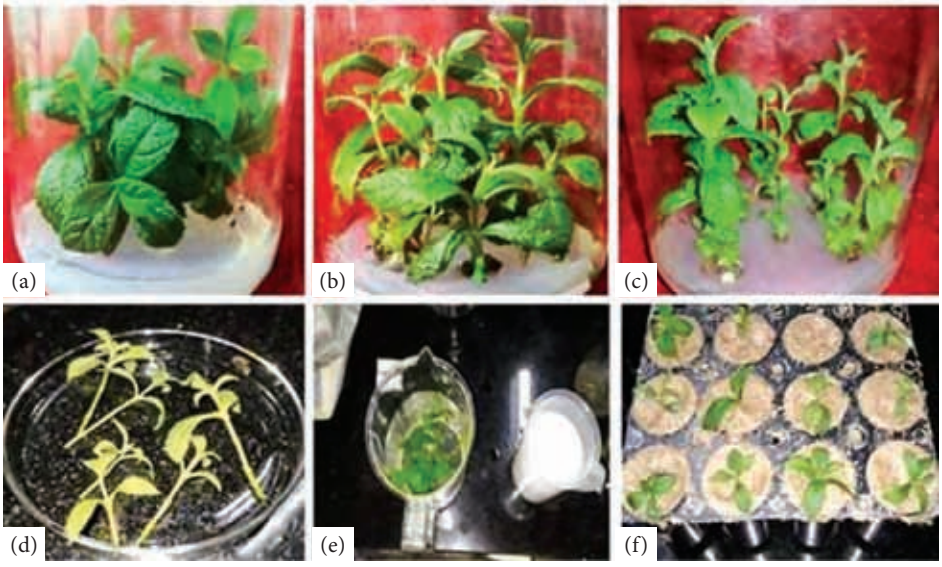
Natural distribution of Red sanders spread over in an area 3,38,285.44 Ha in 136 Forest beats of eight Territorial Divisions in five districts of Andhra Pradesh was recorded. Two provenance sampling sites have been identified in Rajampeta and Tirupati Wildlife management division. Identified plantation selection in Andhra Pradesh, Karnataka, Tamil Nadu and Rajasthan. Seed germplasm from fourteen seed sources was collected by IFB. Two strains of Rhizobium, three species of AM fungi (*Glomus geosporum, G. fasciculatum, G. aggregatm*) and one species of Phosphobacteria (*Bacillus megaterium*) were isolated from the rhizosphere soils of which *P. santalinus* was identified as superior strains for inclusion in Red sanders nursery and plantations. Standardized Istope ratio mass spectrometry (IRMS) process and 25 Red sanders wood samples from two populations were analysed for stable carbon isotope composition (13C/12C) and 32 CPTs and have been identified and seeds were collected.

IFGTB conducted preliminary rooting trial with cuttings from mature trees and observed 55% rooting success in softwood cuttings, kept inside poly tunnels and treated with 2000 ppm of IBA. For vegetative propagation with air layering technique laid at IFB Hyderabad 70% rooting success was observed in air layers treated with NAA 1000 ppm along with vermiculite as media to wrap the ring incision made on the coppice shoots.

Air layering experiment with coppiced shoots of *Pterocarpus santalinus* by IFB, Hyderabad

Quality teak production: capitalizing on cloning

IFGTB provided start up cultures of five clones of teak to the four participating Institutes TFRI, Jabalpur; IFP, Ranchi; FRI, Dehradun and AFRI Jodhpur. *Ex vitro* rooting experiments were initiated and 66.6% success achieved in FRI laboratory. Standardization of protocol for genetic fidelity testing of the tissue culture (TC) raised plants has been initiated by IFGTB.



Tissue culture of *T. grandis* (a-c) *in-vitro* shoot cultures of clones 1, 4 & 2
(d-f) *Ex-vitro* rooting of shoots of clone 2

Developing seed testing and seed storage protocols

Seed sources were identified for, *Albizia julibrissin*, *A. odoratissima*, *Sterculia villosa, Pterospermum acerifolium, Kydia calycina*, and *Erythrina suberosa* in Uttarakhand, for *Memycylon umbellatum, Cipadesa baceifera, Elaeocarpus serratus, Leea indica, Bischofia javanica* and *Murraya paniculata* in Kunjapanai, Siruvani, Yercaud forest areas of Tamil Nadu; for *Dipterocarpus retusus, Magnolia champaca, Mesua ferrea, Shorea robusta* from Karbi Anglong, Jorhat and Sivasagar districts of Assam; for *Putranjiva roxburghii, Mallotus philipensis, Semecarpus anacardium* and *Buchnania lanzan* from Jabalpur and Mandla districts of M.P.; for *Garcinia indica* and *G. gummi-gutta*) from Sirsi and Virajpet in Karnataka; for *Betula utilis, Rhododendron campanulatum, Sorbus lanata* and *Prunus cerasoides* in Kinnaur, Shimla and Lahaul districts of Himachal Pradesh.

Dalbergia sissoo

Point based score method was developed by FRI for selection of suitable phenotype of *Dalbergia sissoo* as candidate plus trees (CPT). Twelve shisham populations in Himachal Pradesh were surveyed for selection of disease resistant genotypes and sample collection. Macroscopic and microscopic characteristics of *Ganoderma lucidum* and *Trichoderma* spp. were recorded. TFRI, Jabalpur conducted survey, collected soil samples and isolated *Trichoderma* sp. and *Fusarium* sp. RFRI, Jorhat conducted field survey in three districts of Assam viz. Jorhat, Golaghat and Sivasagar and 48 Shisham trees data were recorded.

Sporophores of *G. lucidum* at the collar region of a dead Shisham tree

Shisham plants inoculated with mycelium showing wilt symptoms 14-days post inoculation

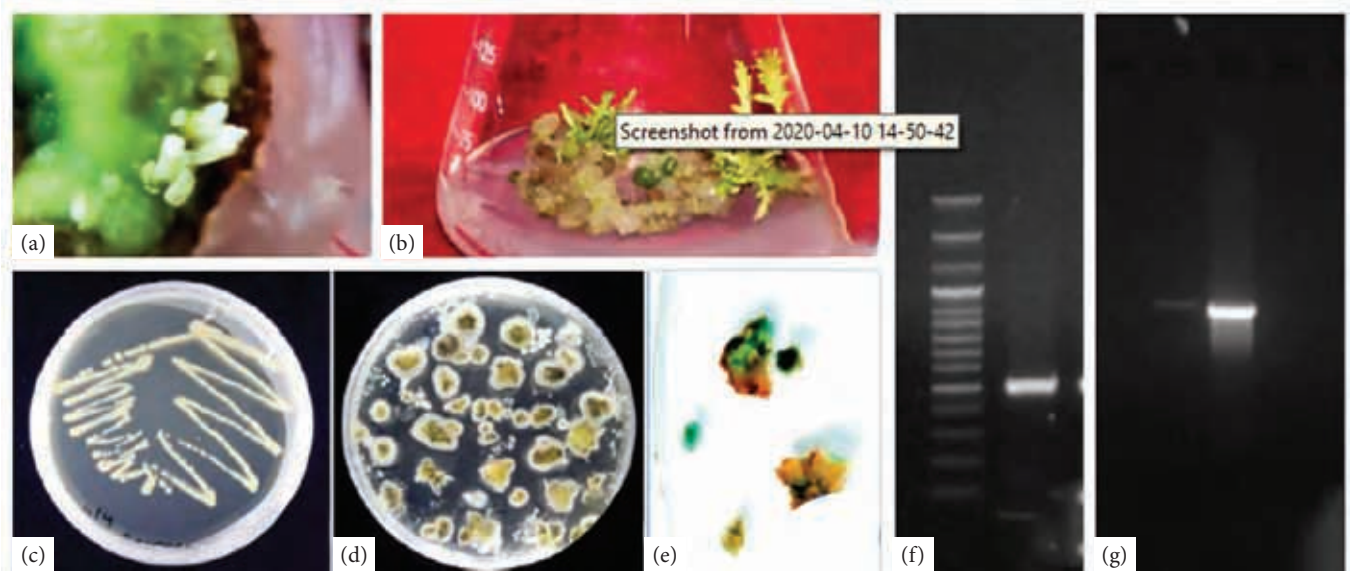
Genetic improvement and value addition of *Madhuca longifolia*

TFRI conducted surveys in Dhamtari and Mahasamund in Chhattisgarh and Shahpura and Jabalpur in Madhya Pradesh. Morphometric data of trees were recorded for 20-30 trees in each location. Seeds of 35 selected trees were collected and sown in nursery. IFGTB, carried out survey and selected 12 trees from Coimbatore and one from Madurai. IFP, Ranchi selected 18 phenotypically superior trees from Bero, Palkot, Jonha, Dasm, Saraikela, Kharsowa, Mahuadanr areas in Jharkhand. FRC-ER, Prayagraj selected 256 CPTs in Meja range of Prayagraj forest division. Seed data have been collected from 10 CPTs and seedlings are being raised in nursery.

Raising of seedlings of Mahua at IFP, Ranchi

Genetic Improvement of *Azadirachta indica*

A total of 387 neem trees were selected by different participating institutes across different agroclimatic zones. Phenological data was reorded from three different regions by AFRI, TFRI, and IFGTB. Pollen storage techniques for long term storage standardized. Successful Gene transfer event through Agrobacterium harbouring pCAMBIA1304 vector was ascertained through molecular confirmation (PCR) by AFRI. Neem cell lines transformed with Agrobacterium containing pCAMBIA1304 vector were recovered and tested for integration of marker gene gus-A. Callus initiated using flowers, leaf explants and immature embryos in ten media combinations was initited and good callus (~250mg) was produced through flowers. Suspension cultures were successfully inititated from the induced callus.



Neem Genetic Transformation. a. Somatic embryos in Neem; **b.** Shoot formation in vitro from neem callus; Agrobacterium culture maintenance; **d.** Agro- Neem cocultivation plate; **e.** GUS positive callus of Neem; **f.** Expression of hpt-II gene introduced in Neem; **g.** Expression of gus- A gene introduced in Neem callus

Domestication, genetic characterization, improvement and diversified utilization of poplars

Natural populations of *Populus ciliata* were surveyed at Shillaroo, Narkanda, Batnal, Thandar, Oddi (Kotgarh Forest Division), Fagu (Theog Forest Division) and Shimla local. Recorded morphometric traits and geo-coordinates of *P. ciliata* for all the sites. Seed was collected from above sites and germination studies were conducted. Protocol was standardised by HFRI for isolation of DNA from *P.ciliata.* RFRI maintained Germplasm bank of *P. gamblei* and intiated studies on macro propagation through mini cuttings.

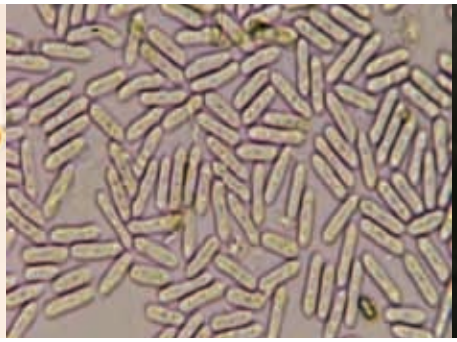
Combating desertification by enhancing vegetation cover and people livelihoods in degraded dry lands and deserts of India

Detailed work plan, methodology and tentative list of species for plantation work finalized by AFRI. Sidhnath and Mehrangarh hilly region of Jodhpur were visited for taking up degraded hill restoration work. HFRI surveyed in Cold Desert area at Tabo, Poh and Maine areas of H.P. for knowing tree, shrub and associate species. The dominating tree species were *Juniperus polycarpos, Salix alba, Populus ciliata, Rosa webbiana, Colutea nepalensis, Hippophae rhamnoides,* etc. Base line data on numbers of households/ villages and general statistics of land uses existing in the state of Madhya Pradesh were collected from primary and secondary sources. IFP, Ranchi raised ~3000 seedling of *Terminalia bellirica, Delonix regia, Emblica officinalis, Melia azadirach* and *Azadirachta indic*a in the nursery.

Population status, collection, characterization and evaluation of genetic resources of Indian Rosewood, *Dalbergia latifolia*

Seventeen superior trees were selected from Jabalpur, Tikaria, Dobhi and Katni areas of MP and 14 superior trees from Coimbatore, TN. Mophometric parameters and other baseline information on these trees were recorded. Survey was undertaken in Ranchi, Ramgarh, Khunti, Latehar, Garhwa, Hazaribagh and Bokaro districts of Jharkhand to identify superior trees. Vegetative propagation through, shoot cuttings and root suckers from the identified superior trees was carried out. Survey was carried out and progeny trials established at Lal Kuan, Haldwani and trees in FRI Campus to record disease incidence. The fungal pathogens infecting leaves caused yellowing, spots and blight, the pathogens were identified as *Neopestalotiopsis* sp. and *Colletotrichum* sp.

Spores of *Neopestalotiopsis* sp.



Spores of *Colletotrichum* sp.

Leaves showing symptoms after inoculation with *Neopestalotiopsis* sp.

Sustainable management of NTFP's through conservation and value addition

Survey was conducted at Chakrata, (Dehradun), Narendra nagar, (Tehri), Mussoorie forest divisions, Nainital, Bageshwar and Pithauragarh Forest Division of Uttarakhand State and collected samples of *Gentiana kurroo, Dioscorea deltoidea*, *Desmodium gangeticum* and *Diploknema butyracea*. Soil samples of different forest divisions were collected and analyzed for pH, EC, NPK, Organic matter, organic carbon. The data on harvesting techniques/ methods of economically important NTFPs viz. Jhula ghass and *Diploknema butyreaceae* seeds from Nainital and Bageshwar Forest Division of Uttarakhand were recorded. Germplasm of *Taxus wallichiana*, *Thymus serphyllum* and *Rheum austral* was collected from Kullu and Shimla districts of Himachal Pradesh for establishing feld Gene Bank and evaluation of germplasm.

Documented harvesting techniques and method of collection of *Madhuca indica* seeds, *Momordioca dioica* and *Syzygium cummuni* fruits by Garasia tribes in Sirohi district of Rajasthan. Secondary data on traditional knowledge of ethno-medicinal plants used by tribes (Bhil, Damor, Garasia, Meena, Kathodia and Kalbelia) in different formulations to cure different diseases from Pali, Sirohi, Alwer, Bhilwara, Udaipur, Dungarpur and Banswara districts of Rajasthan were collected. Documented the traditional methods of processing and value addition of selected species from different regions.

Processing of Mahua seeds

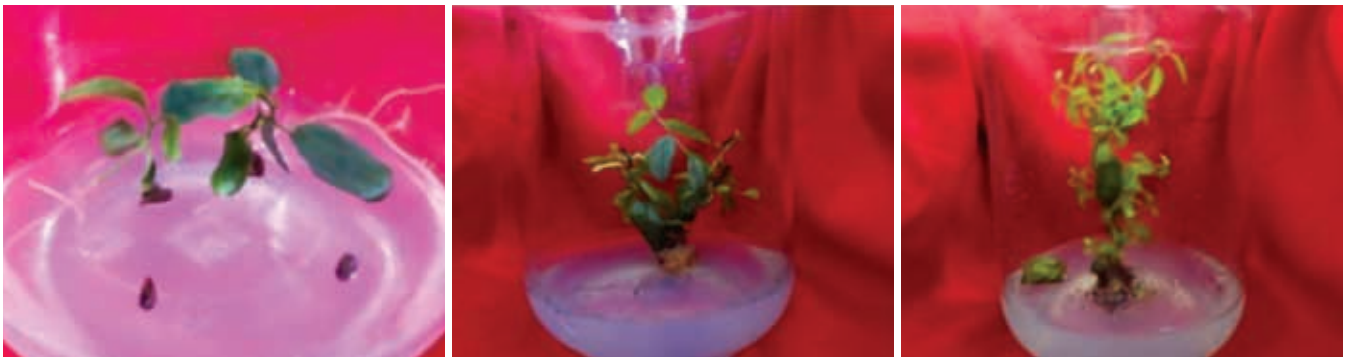
COMPONENT II:

Programme for Conservation and Development of Forest Genetic Resources (FGR)

Work co-ordinated by two FGR centres at FRI and IFGTB. FRI, Dehradun and its partner institutes (AFRI, HFRI, IFP, RFRI) prepared prioritized list of 650 FGR species based on the criteria viz. indigenous species, woody perennial, economic and ecological value, threat perception etc. A pictorial guide of 20 prioritized species were prepared for field working staff for the authentic identification. Work has been initiated on eco-geographical mapping of 150 FGRs species of Haryana, Uttar Pradesh, Punjab, Jharkhand, West Bengal, Himachal Pradesh, Jammu and Kashmir, Rajasthan, Gujarat and North Eastern states using species RS and GIS tools. For seed and germplasm storage, 15 tree seeds were collected from Rajasthan and Gujarat; six species from U.P., Haryana and Punjab, seven species from Himachal Pradesh, Jammu and Kashmir and 18 species from Jharkhand and Orissa. Cultures were established for development of protocols for *in vitro* medium term storage of germplasm of species having very high conservation concern and those having recalcitrant seeds (*Commiphora wightii, Rhamnus triquetra, Aegle marmelos* and *Embelia ribes)*.

Intiated, extensive survey and population sampling work for FGR characterization of the selected species. Foliage samples have been collected from their natural zone of occurrence and stored at -80˚C for chemical examination and DNA fingerprinting. Standardied DNA extraction protocol for *Terminalia arjuna, Terminalia bellerica, Terminalia chebula, Acacia catechu,* and *Pterocarpus marsupium,Tecomella undulate*, *Prosopis cineraria*, *Buchanania cochinchinensis, Michelia champaca,* and *Shorea robusta*.

IFGTB and its partner institutes IWST, TFRI and IFB prioritized the species. Selected 30 species needing conservation using feedback from stakeholders belonging to state forest departments and various research organizations. IFGTB initiated documentation of improved germplasm available at IFGTB and prepared distribution maps with the available geocoordinates for three species to orient with mapping.



In-vitro multiplication of shrub *Rhamnus triquetra*

Natural plantation of *Terminalia arjuna*

COMPONENT IV:

Capacity Building of State Forest Departments for developing "State REDD+ Action Plans" under National REDD+ strategy

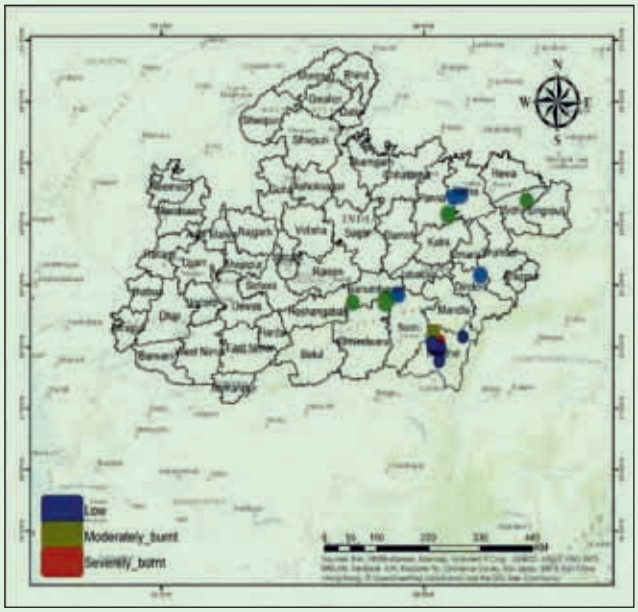
Prepared and published a resource manual for capacity building of State Forest Departments for developing State REDD+ Action Plans (SRAP). The manual addresses five main stages for developing SRAP, i.e., prepare, analyse, plan, monitor and budget. Hindi version of the Resource Manual is in final stage of publication. For building the capacity of the officials of the State Forest Departments for developing State REDD+ Action Plan eight Nodal Officers/ trainers have been nominated by the ICFRE's institutes. Stakeholder consultation workshop and expert consultation workshop for building the capacity was organized for four days in Chhattisgarh, two days for Karnataka State Forest Departments and for 18 Nodal officers of ICFRE institutes (two from each institute). Documentary for developing state REDD+ action plan is being prepared.

Scheme 2: Estimation of economic losses in real term per hectare basis due to forest fire in Uttarakhand and Madhya Pradesh

In financial year 2020-2021 five coordination meetings were held online by ICFRE headquaters to ensure the smooth working of all the project partners and to exchange data and all required information.

To quantify the forest loss in terms of total economic value i.e., monetary value on per hectare basis for the forest types in the States of Uttarakhand and Madhya Pradesh

G.B. Pant National Institute of Himalayan Environment institute (GBPNIHEI) has so far has covered 32 polygons of selected 42 polygons in Uttarakhand. Likewise out of 49 polygons in Madhya Pradesh so far 31 polygons in all selected polygons for estimation of economic loss due to forest fire such as timber, NTFPs, fuel wood, fodder and others.



Completed 24 burnt and unburnt (control) sites in forests of Madhya Pradesh

Economic loss assessment of faunal diversity due to forest fire on per hectare basis for the respective states

Wild Life Institute, Dehradun has covered Binsar Wildlife Sanctuary in Uttarakhand and Kanha National Park in Madhya Pradesh. For Uttarakhand, pre-fire and post-fire data collection has been done. The species recorded through camera traps are as follows: Goral, Barking deer, Sambhar deer, Leopard, Jackal, Wild pig, Flying squirrel, Himalayan yellow-throated marten and Kalij pheasant. A total of 11 transects were run to count the ungulates and birds in the study area.

Completed 11 burnt and unburnt (control) sites in forests of Uttarakhand

Economic loss assessment of hydrological changes due to forest fire on per hectare basis for the respective states

National Institute of Hydrology, Roorkee is assessing the economic losses due to hydrological changes caused by forest fires in different types of forests in Uttarakhand and Madhya Pradesh. So far the field investigations at 11 burnt polygons in Uttarakhand and 24 burnt polygons in Madhya Pradesh alongwith equal number of neighbouring unburnt plots have been completed. The field investigations (including double ring infiltrometer tests and Guelph Permeameter Tests and soil sample collection for texture, soil moisture retention, organic matter content etc.) at the burnt and unburnt plots are going on. The laboratory investigations for the analysis of collected soil samples are also going on in parallel.

Economic loss assessment of terrestrial flora due to forest fire on per hectare basis for the respective states

Forest Research Institute, Dehradun has collect vegetation and carbon pool data from 22 burnt and unburnt in different Forest Types of Uttarakhand viz. Himalayan Moist Temperate Forests and Subtropical Pine Forests, Tropical Moist Deciduous Forest, Tropical Dry Deciduous Forest, at Haridwar Forest Division, Rajaji National Park, Binsar Wildlife Sanctuary, Almora Forest Division, Civil Soyam Almora, Nainital Forest Division, Tarai West Forest Division, Tons Forest Division, Chakrata forest Division, Tehari Forest Division and Bageshwar Forest Division. Tropical Forest Research Institute, Jabalpur has covered 33 sites out of 49 polygons of Madhya Pradesh.

Scheme 3: Execution of Readiness Activities for Implementation of REDD+ in India (BCC, ICFRE)

Draft of Safeguards Information System (SIS) for implementation of REDD+ in India has been prepared and nine regional stakeholder's consultation workshops (Bengaluru, Jabalpur, Shimla, Dehradun, Jorhat, Jodhpur, Ranchi, Coimbatore and Hyderabad) were organized on the draft Safeguards Information System (SIS) for REDD+ implementation in India. Relevant comments/ inputs of the stakeholder consultation workshops on draft safeguards information system for REDD+ have been incorporated in the draft which was presented before the Expert Committee on 22 March 2021 for further finalization.

Chapter-3

EDUCATION VISTAS

3

EDUCATION VISTAS

3.1.
FRI DEEMED TO BE UNIVERSITY

Forest Research Institute Deemed to be University, Dehradun is recognized as a premier institution in the field of forestry education in India. Ministry of Human Resource Development, Government of India, New Delhi granted the Deemed University status to FRI *vide* Notification No. F.9-25/89-U.3 dated 06-12-1991. The University has been fostering pioneering research in specialized areas under Ph.D. Programme. The FRI Deemed to be University has been offering the following academic courses on a regular basis:

1. **M.Sc. Forestry**
2. **M.Sc. Wood Science & Technology**
3. **M.Sc. Environment Management**
4. **M.Sc. in Cellulose & Paper Technology**

Entrance Tests for M.Sc. courses and Ph.D. programme were conducted well in time. 133 Indian students and 11 foreign students joined the postgraduate programmes, while 122 Indian students and 10 foreign students completed the M.Sc. Programmes. Seventy four Research Scholars were registered for Ph.D. at the FRI Deemed to be University and a total of 36 Ph.D. degrees have been awarded during the year. Other prominent achievements made during the year are:

- Syllabus was revised for all courses.
- Laboratory & Library facilities improved.
- Computer Lab upgraded.
- Sports and Hostel facilities were improved.
- The Academic Course Plan for all the M.Sc. courses was prepared.
- Students' profile & Placement Brochures for all the M.Sc. courses were prepared.
- The University awarded Scholarship to the toppers of all the courses.
- Special lectures were arranged from time to time by the Incubation Cell to improve the entrepreneurial skills of the students.

3.2. TRAINING PROGRAMMES ORGANIZED

Sl. No.	Name of Institute	No. of Training Programmes	Duration (in days)	No. of Participants
1.	ICFRE HQ, Dehradun	77	83	5152
2.	FRI, Dehradun	16	92	550
3.	IFGTB, Coimbatore	09	115	214
4.	IWST, Bengaluru	11	29	1613
5.	TFRI, Jabalpur	24	35	629
6.	AFRI, Jodhpur	07	34+	592+
7.	RFRI, Jorhat	16	66	353
8.	HFRI, Shimla	12	18	371
9.	IFP, Ranchi	08	24	214
10.	IFB, Hyderabad	05	11	187
	Total	**185**	**507+**	**9875+**

BCC Division of ICFRE has conducted 12 training programmes on capacity building of State Forest Departments and Joint Forest Management Committees on Measurement of Forest Carbon Stocks in which 86 forest personnel and 402 JFMC members participated.

Sixty five training programmes on capacity building of local communities on Upscaling of SLEM Best Practices were also carried out in which 4,625 villagers participated.

One Day Training and Demonstration Programme was conducted on Nursery and Propagation Techniques of Nagchhatri (Trillium govanianum) for progressive farmers and representative of Mahila Mandal at Rampur, Shimla (H.P.) on 14 March 2021. Thirty- two (32) participants from Rampur region participated.

A training Programme on **"चिलगोजा के संरक्षण और इसके स्थायी प्रबंधन की आवश्यकता"** at Labrang, Kinnaur under the NABARD funded "Chilgoza Project" on 1 December 2020, which was attended by 40 participants including field functionaries of SFD of HP, farmers and the Panchayat Pradhans.

One Week Compulsory Training Programme for IFS Officers

One-week compulsory training for IFS Officers was organized at Arid Forest Research Institute (AFRI), Jodhpur on the theme – 'Integrated Approach for Sustainable Development of Fragile Desert Eco-system'. The one-week refresher IFS training course was conducted in online format from December 14 to 18, 2020. Thirty four IFS officers participated in the training.

IFS Training: Online sessions

IFS Training: Group Collage of IFS officers (Trainees)

3.3. HRD PLAN

Under HRD plan nine training programmes for scientists of the Council were organized in which 186 scientists participated. For technical staff 9 training programmes were organized, which were attended by 277 staff. Three training programmes organized for Administrative staff were attended by 63 personnel. Induction training courses were conducted for 17 technicians, 16 administrative staff and five forest protection staff.

3.4. AWARDS

To promote and motivate the professional competence in the scientific community in the field of forestry for the year 2019, ICFRE Awards of Excellence in Forestry were awarded to the following candidates for the year 2019:

S.No.	Category of Awards	Name and Designation of Candidates
(A) ICFRE Personal serving in ICFRE (HQ) and its Institutes/Centres		
	ICFRE Outstanding Research Award	Shared by 1. Dr. Kannan C.S.Warrier Scientist-F, IFGTB, Coimbatore and 2. Dr. R.S. Rawat Scientist-D, HQ ICFRE, Dehradun
(B) Awards for Non-ICFRE Individuals, Institutions and Organizations		
	ICFRE Forestry Research Award for State & UTs, Forest Departments/ Forest Corporations /State Agricultural University	College of Forestry, University of Agricultural Sciences, Dharwad, Sirsi (Karnataka)
	ICFRE Forestry Research Award for individual/NGO	Shared by 1. Dr. Hitendra Padalia, Scientist and Head (Forestry & Ecology Department), IIRS, Dehradun and 2. Sh. Joju P. Alappatt Director, Forest Training Institute, Andaman & Nicobar Administration
(C) ICFRE Lifetime Achievement Award for ICFRE & Non ICFRE Individuals		
	ICFRE Lifetime Achievement Award in Forestry	Sh. Himtaram Bhambhu, Nagour, Rajasthan

3.5. PARTICIPATION IN SEMINARS/SYMPOSIA/WORKSHOPS/TRAININGS

Sl. No.	Name of Institutes	No. of Seminars/ Symposia/ Workshops/ Trainings	Duration (in days)	No. of participants
1.	ICFRE HQ	22	7	200
2.	FRI, Dehradun	102	30	615
3.	IFGTB, Coimbatore	55	94	1003
4.	IWST, Bengaluru	40	81	102
5.	TFRI, Jabalpur	32	15	47
6.	AFRI, Jodhpur	42	85	58
7.	RFRI, Jorhat	52	82	133
8.	HFRI, Shimla	49	95	170
9.	IFP, Ranchi	64	99+	489
	Total	**458**	**588+**	**2817**

Activities performed under National Authority CAMPA

SCHEME- 1 : Strengthening forestry research for ecological sustainability and productivity Enhancement

Centre for Forest Policy Research Studies

The Centre for Forest Policy Research (CFPR) has been established at ICFRE HQ which was approved by the Board of Governors (BoG) in its meeting held on 9 January 2018 and was notified *vide* ICFRE Notification dated 6 February 2018 to take up policy research studies, for providing inputs to Government of India for policy decisions and appropriate interventions. During 2020-21 following studies were initiated by the Centre.

COMPONENT-III:

Policy studies under Centre for Forest Policy Research

There is a proposal to undertake 11 policy research studies, presently only two research studies have been awarded to two agencies. Study on, "Institutions of community participation including Joint Forest Management Committees (JFMs) and Eco-Development Committees (EDCs), linkages with Panchayati Raj Institutions, review of their working in various regions of the country and identification of successful models and shortcomings", has been awarded to The Energy and Resource Institute (TERI), New Delhi and study on, "Policy issues in agroforestry including market mechanism, forward and backward linkages, regional availability, transit of forest produce, linkages with National Determined Contribution (NDC) targets, choice of species and utilization", has been awarded to Network for Certification and Conservation of Forest (NCCF), Noida.

COMPONENT- V:

Operationalization of Human Resource Development Plan of ICFRE

Based on the approved HRD plan of the council a total 21 yearly scheduled trainings and 3 induction trainings for new incumbents were conducted for 571 participants through online/ offline mode and first phase of Induction training for newly recruited Scientist-B (30 Nos.) intiated in March, 2021 and two weeks programme out of 12 weeks were completed in March, 2021.

Chapter-4

EXTENSION PANORAMA

4

EXTENSION PANORAMA

4.1. LAB TO LAND

Innovative technologies for climate change mitigation and biodiversity conservation with alternate livelihood opportunities for mountain communities in North Western Himachal Himalaya (HFRI)

Pre-fabricated mountain solar water heating systems, seeded button mushroom compost, planting tufts of improved fodder, vermiculture, planting material of fuel and fodder tree species along with NTFPs was provided in collaboration with Himalayan Research Group after training to the selected households.

(a) Interaction with stakeholders at the onset of project activities in Kullu District (b) Distribution of *Taxus* (Thuno) to the villagers for community plantation

A total of 335 households (HH) were involved in saving of almost 40% fuel wood by using mountain solar water heating systems of which 307 households reduced women drudgery in fuel wood collections. Imparted skill development for 335 HH on sustainable harvesting and *ex-situ* propagation of selected NTFPs e.g., *Swertia cordata* (Chirayita), *Taxus wallichiana* (Thuno) and *Picrorhiza kurroa* (Karu) and planted 3000 rooted cuttings of *Taxus wallichiana*.

A total of 307 women participants were provided with vermiculture (2 Kg each) for initiating improved composting, 80-100 improved fodder tufts for bund plantation and 40 plants of *Quercus oblongata* (Ban) each for planting in and around their houses.

Afforestation with Fodder- Fuel wood-NTFP plants with community

Distribution of improved fodder tufts for bund plantation, Kwar (Shimla District)

A short video film on *'Bamboo charcoal production and its utilization'* was prepared in English, *Assamese* and *Karbi* languages for wider publicity. A series of training programme were conducted at RFRI, Jorhat for the beneficiaries of Karbi Anglong district on bamboo charcoal production and briquetting. Trainees were also taken to Nagaland Bamboo Resource Centre, Dimapur on exposure visit.

Imparted training to 250 circle level field nursery staff of forest department on preparation of organic fertilizer and its application.

One day online training programme on 'Capacity building on seed, plantation and management techniques of commercially important tree species' was organized for the forest officials of Raipur, Bilaspur, Durg, Jagdalpur and Ambikapur circles of Chhattisgarh.

Training programme on bamboo charcoal making

Practical demonstration during training programme

Six training programmes on biological control of Teak skeletonizer / defoliator insects through egg parasitoid, Trichogramma raoi (TFRI-Trichocards) were imparted to frontline staff of Forest Circles Bilaspur, Durg, Raipur, Ambikapur and Korba, Chhattisgarh.

Six training programme on 'Management of Sal Borer *Hoplocerambyx spinicorni'* were conducted for the frontline staff of four Forest Circles (Ambikapur, Durg, Raipur and Bilaspur, Korba), State Forest Department, Chhattisgarh.

Promotion of bamboo based agroforestry system for economic upliftment and livelihood security of farmers in Madhya Pradesh

Organized a hands-on training programme on 'Bamboo-based agroforestry system: harvesting and management' at farmer's field. Prepared extension material on *'Baans Adharit krishivaniki padhatti evam iska prabandhan*'. Established and maintained bamboo-based agroforestry in 15 farmers' fields at Jabalpur district; recorded the growth and yield parameters of the bamboo - intercrops.

Release of information leaflet for the beneficiaries during the program management at farm field

Hands-on training on bamboo

Empowering tribal communities through Lac cultivation in M.P. (TFRI)

Revived lac cultivation in ten villages of Jabalpur and Mandla districts of Madhya Pradesh. Organized two days training cum demonstration programme on 'Lac cultivation: its management, processing and value addition for 12 women Self Help Groups (more than 100 beneficiaries) of Mandla and Jabalpur districts.

Value-added articles prepared by the Women SHGs during the program

Demonstration of making raw lac into bangles to Women SHGs

Training of the rural women of Rajasthan on use of biofertilizer for crop productivity enhancement (AFRI)

Technology Development and Utilization Programme for Women' funded by Department of Scientific and Industrial Research, Ministry of Science & Technology, Govt. of India a collaborative project of AFRI, Jodhpur and Amity University, Noida was undertaken.

Four training programme for 72 women farmers on application of *Piriformospora indica* an endophytic fungus (a biofertilizer) were organized at different places in Jodhpur district.

(a)

(b)

(c)

Training of women farmers on biofertilizer inoculation in (a) Osian, (b) Falodi and (c) Bilara in Jodhpur district

Value addition of selected underutilized NTFPs for enhanced livelihood opportunities in arid and semiarid Rajasthan (AFRI)

Six-training cum demonstration programmes on value addition of *Tamarindus indica*(pods-chutney, jam & squash), *Butea monosperma* (flowers- Herbal gulal), *Diospyros melanoxylon* (fruits-jam) for Bhurki Devi Mahila SHG in Jamboori and Mahadev SHG in Surpagla villages (three days each) were organized. Total 240 members (in each district) including SHG/VFPC members and Rajasthan State Forest Department officials participated in the programme. Acceptability of these products was tested on 9-point Hedonic scale.

Training on value addition of NTFPs to different stakeholders in Rajasthan

Conservation of *Pinus gerardiana* (Chilgoza) through scientific intervention in Moorang forest range of district Kinnaur, Himachal Pradesh (HFRI)

Established demonstration plot of Chilgoza (*Pinus gerardiana*)in one hectare near Pangi village, Kalpa forest range followed by consultative meeting with different stakeholders.

Published booklet on Chilgoza entitled 'चिलगोजा :जिला किन्नौर का पारिस्थितिक, सामाजिक एवं आर्थिक रूप से एक महत्वपूर्ण वृक्ष वर्तमान स्थिति, संरक्षण एवं प्रबंधन की आवश्यकता' for the benefit of different end-users. Four field demonstration cum awareness training programmes conducted in Kinnaur Forest Division, for 160 farmers and front line staff of Pooh Forest Range and distributed twenty Multi-angular long reach pruners (5/trainings) to the respective Panchayats of Pooh Forest Range, Kinnaur.

Training Programme at Dubling Panchayat of Kinnaur

Field demonstration on Sustainable Harvesting of Chilgoza Cones

Development of compost out of waste involving tribal for their livelihood support: a part of Swachh Bharat Mission (IFGTB)

Thirteen Women Self Help Groups (WSHGs) comprising 204 members in 31 tribal settlements were formed involving the Tribal Welfare Department and State Forest Department of Tamil Nadu, to impart training on the development of Tree Rich Biobooster.

Fifty tonnes of tree biomass, 34 tonnes of flower waste, 36 tonnes on vegetable waste and 24 tonnes of plant biomass waste were converted into 40, 15, 17 and 8 tonnes of compost respectively. Imparted 6 onsite training programmes at Senkuttai, Kondanur, Kondanur Pudhur, Kandivazhi, Panapalli and Jambukandi tribal villages for 360 women.

Establishment of bamboo shoot processing unit at Jorhat (RFRI)

Established bamboo processing unit at RFRI and conducted training programme for 25 participants from different parts of Assam.

Workshops/ seminars/webinars

IFGTB collaborated with *Pasumai Vikatan*, Chennai for hosting an online lecture series on '*Tree cultivation for increasing farm income*'. The main objective of the online series was to popularize the technologies developed by IFGTB with the tree growers of Tamil Nadu. Nearly 7,632 participants registered for the programme while 1,276+ participants attended the webinar. All the lectures were streamed online through *Facebook* live and the recorded version was shared in social media groups. More than 70,000 views in *Facebook* were recorded for the programmes. The online lectures were also documented as a review article in *Pasumai Vikatan* magazine.

Stakeholders' workshop was organized on 26 March 2021 at IFGTB, Coimbatore for developing and popularizing digital interactive platform for tree growers and other stakeholders of Tamil Nadu.

- A teaser of short film on 'Development of compost out of waste involving tribal for their livelihood support: A part of Swachh Bharat Mission' was released to publicize the bioproduct, 'Tree Rich Biobooster' an organic growth promoter.
- The Assistant National Focal Point for Forest Genetic Resources attended the regional online event on forest genetic resources on 26 and 27 October 2020, conducted by Food and Agriculture Organization of the United Nations (FAO).
- Regional variety testing committee meeting was held on 25 September 2020 to deliberate on the release of two clones of *Eucalyptus* and four clones of *Calophyllum inophyllum*.

Seminars/Symposia/Workshops Organized

Institutes/HQ	No. of Seminars/ Symposia/ Workshops/ Meetings organized	No. of days	No. of participants
ICFRE HQ	03	31	70
FRI	09	09	330
IFGTB	06	06	1276
IWST	11	12	1011
TFRI	08	08	526
AFRI	04	04	-
RFRI	05	05	126
HFRI	19	19	678
IFP	16	16	795
IFB	20	28	426
Total	**101**	**138**	**5238**

Regional workshop on Forestry Research, Sustainable Forest Management and Livelihood at HFRI, Shimla

Online national seminar on Propagation, Management and Development of Value Chain in Bamboo at TFRI, Jabalpur

Stakeholder consultation meeting for Preparation of Safeguards information system at HFRI, Shimla

Atamnirbhar Bharat 2021

AFRI participated in 'Atamnirbhar Bharat 2021' during 11 and 12 January 2021 organized by Friendz Exhibitions & Promotions Pvt. Ltd. New Delhi.

Azadi ka Amrut Mahotsava

- FRI, Dehradun organized 'Forest Productivity Enhancement - a virtual technical talk to Forestry students' as part of 'Azadi Ka Amrut Mahotsava' on 19 March 2021.
- IFGTB, Coimbatore conducted one day programme on 'Wealth out of waste-An IFGTB initiative for tribal development' with the Irular tribe in Anaikatti range of Coimbatore Forest Division under *'Azadi ka Amrut Mahotsav'* on 19 March 2021.
- TFRI, Jabalpur organized training on 'Value chain in Agro-forestry' under *'Azadi ka Amrut Mahotsava'* on 26 March 2021.
- IFP, Ranchi organized programme on *'Azadi ka Amrut Mahotsava'* on 12 March 2021.

Green Skill Development Programme (GSDP)

- As ENVIS Resource Partner on 'Forest Genetic Resources and Tree Improvement' IFGTB, Coimbatore imparted three GSDP courses (1) Plant Tissue Culture Techniques and its Applications; (2) Forest Entomology and Pest Control and (3) Quality Planting Material Producer from 22 February to 26 March 2021. Forty-eight participants from various parts of the country sucessfully completed the certificate courses. One hundred and twelve participants were trained under the GSDP so far.
- 'Green Skill Development Programme Process Demonstration on Designing and Production of Plastic Free Broom' was organized by FRC-LE, Agartala.
- A training programme on bamboo at Green Skill Development Programme was organized by Arunachal University of Studies, Namsai was conducted on 21 to 22 December 2020.

'Prakriti' – Student Connect Programme

- IFGTB hosted Online Knowledge Series as part of '*Prakriti* – Student Connect Programme' to school and college students. "*Talk to Scientist*" was the main theme wherein the students got a chance to interact with Scientists and Officials of IFGTB. A total of eight schools (579 students) and three colleges (532 students) participated in the Online Knowledge Series.
- Under *Prakriti* Programme 82 students from grade 5 to post graduation level from schools, colleges and universities along with 5 faculties visited IWST, Bengaluru.
- E-copy of eight publications have been distributed to various KVKs by AFRI, Jodhpur.
- AFRI team visited KV, Air force and KV, Tivari, Jodhpur and held meetings with Principal. Also deliverd lectures to students and provided extension material.

4.2. VAN VIGYAN KENDRAS (VVKS) AND DEMO VILLAGE (DV)

- HFRI, Shimla established new VVK at Forest Inspection Hut, Longni and Demonstration Nursery in the area of 4.83 ha. at Shivdwala, Tehsil Dharampur, District Mandi, Himachal Pradesh.
- IWST, Bengaluru established a new VVK at IWST Research Station, Gottipura, Hoskote.
- RFRI, Jorhat has signed MoU to establish a VVK at Barapani, Umiyam, Meghalaya.
- VVK- Jammu**:** organized Van Mahotsava involving farmers of Jammu region and carried out plantation of Amla (*Phyllanthus emblica*) on 22 July 2020.
- Raised about 5000 poplar plants in the demo nursery at Nagbani under VVK, Jammu and distributed 3100 poplar plants amongst progressive farmers of Jammu region.
- IFB, Hyderabad conducted four training programmes under '*Van Vigyan Kendra*'. More than 120 farmers and Stakeholders participated in the trainings.

'Implementation of biennial extension plan - Networking of VVK with KVK – ICFRE and ICAR MoU

» FRI, Dehradun successfully established bamboo plantation in an area of 2.0 ha in total in three KVK's *viz.* Kashipur (0.8 ha), Panipat (0.5 ha) and Dhakrani (0.7 ha) during September 2020.

» IFGTB signed a MoU with ICAR KVK MYRADA, Gobichettipalayam, Erode, Tamil Nadu for establishment of new Van Vigyan Kendra. Consequent to signing of MoU a clonal cum demo trial of *Neolamarckia cadamba* was planted in 0.5 ha; and 300 Windbreak Clones of *Casuarina* also planted in the boundaries of the station.

Demo Village

» An MoU was signed on 30.01.2021 between Director, AFRI, Jodhpur and DFO, IGNP, Jaisalmer to establish a new Demo village at Mohangarh, Jaisalmer.

4.3. TECHNOLOGIES TRANSFERRED

» FRI, Dehradun demonstrated onsite propagation techniques of *Litsea glutinosa* (Maida-lakri) to the trainees of different Forest Divisions of different states.

» A non-exclusive License Agreement was signed between Forest Research Institute, Dehradun, Uttarakhand and ITC Limited, PSPD, Unit Wimco Seedlings, Rudrapur, Uttarkahand on commercial propagation and supply / sale of planting stock of ten released varieties of *Melia dubia* of FRI on June 02, 2020. This is a first ever royalty based agreement of ICFRE on living material whereby WIMCO Seedling, ITC limited would pay Rs. 1.50 (Rupee one and fifty paisa only) per plant multiplied by WIMCO Seedling and sold, either using seed sources or clonal stocks of different varieties. The FRI would supply seeds of released varieties @ Rs.1,000/- (Rupees one thousand only) per kg. The agreement is expected to boost supply of genetically improved planting stock for increasing the productivity of agro-forestry and social-forestry plantations, substantially.

» The technology 'Chirbandh, Isolation of fiber from the pine needles' developed by FRI, Dehradun, has been transferred to Uttarakhand Bamboo and Fibre Development Board.

» A License Agreement has been signed by IFGTB and Seshasayee Paper and Boards Limited, Erode, Tamil Nadu on 22 February 2021 for commercial use of IFGTB's *Eucalyptus* clone *IFGTB-EC-06* for farm forestry programmes. The Company has paid a one-time fee of Rs. 1.25 lakhs for assigning a non-exclusive license.

» A product *'IFGTB Seed Cake Mix'* to promote and facilitate seed ball technology was released in the webinar on 28 January 2020 and the product was supplied to various stakeholders.

» HFRI, Shimla dessiminated/transferred the following technologies to various stakeholders including SFDs, Mahila Mandals, NGOs in Himachal Pradesh,J&K & Ladakh:

- Nursery and plantation techniques of *Juniperus polycarpos*
- Macro-proliferation technique of *Picrorhiza kurroa* (Kutki) and *Valeriana jatamansi* (Mushkbala).
- Intercropping of high temperate medicinal plants with horticultural plantation.

Patents

(a) Granted :

Vacuum Kiln- fabrication and performance study of vacuum based wood dryer for fast and efficient drying of Indian timbers. Patent No. 349042 dated 12.10.2020.

(b) Applied for :

During the year following patents were filed by ICFRE institutes.

FRI, Dehradun

» "Natural fibre from *Pinus Roxburghii* (Chir Pine) needles and a process of preparation thereof has been filed as Indian Patent *vide* Application No. 202011051242.

» 'Removal of Quinones from *Cassia tora/obtusifolia* gum and endosperm' has been filed as Indian Patent *vide* No. 202111012654.

» A process of wood quality enhancement of plantation grown *Melia dubia* for furniture and joinery has been filed as Indian Patent vide No. 20202111001559.

IFGTB, Coimbatore

» 'A multilocus high resolution melting analysis as diagnostic tool for detection of viral genes' with Application number 202041018705.

» 'Hairy root culture protocols for the bio-production of secondary metabolites/ biomolecules' with application number 202041054370.

» 'Cell culture protocol for *in vitro* production of secondary metabolites from *Aegle marmelos*' with the application number 202041053835.

IWST, Bengaluru

» 'Simple pretreatment of oil seeds for de-acidification of natural oil' with provisional patent number 202041041681.

» 'Novel wood veneer and natural fiber reinforced thermoplastic based hybrid composite panels' with provisional patent number 202041040266.

» 'Eco friendly treatment for colour and durability of natural fibers and products' with provisional patent number 202041047876.

4.4. NATIONAL FOREST LIBRARY AND INFORMATION CENTRE (NFLIC)

The National Forest Library and Information Centre (NFLIC) is richest in document collection on forestry and allied sciences in South and Southeast Asia. The NFLIC has been providing all types of library and information services, *viz*, reference, referral, lending, reprography, current awareness, inter-library loan, retrieval of information from Online Public Access Catalogue, *etc.* to its users. During the year (2020-21), 5971 books were lent to the users for outside reading. Besides 12528 documents were consulted inside the library.

The document collection of the NFLIC was enriched by the addition of 732 latest books and other documents. The NFLIC subscribed to 26 Indian periodical titles and 01 foreign journal and 322 issues of the periodicals were received as *gratis*.

The NFLIC has been selling ICFRE publications through its Book Depot. During the year 63 books were sold to the State Forest Departments, universities, *etc*.

NFLIC started user orientation programme for M.Sc. students. In this programme lectures were delivered on various services of NFLIC and various information sources available free of cost in digital environment.

Environmental Information System (ENVIS)

FRI, Dehradun

The Centre is involved in activities such as preparing databases on Indian Forestry Abstracts, Participatory Forest Management, *Prosopis juliflora*, Poplars, Environment and Forests that are also accessible through the website of the Centre at URL: www.frienvis.nic.in.

Compiled six issues of *Environment and Forests News Digest* and published in CDs. The issues are also accessible through the website of the Centre at URL: www.frienvis.nic.in.

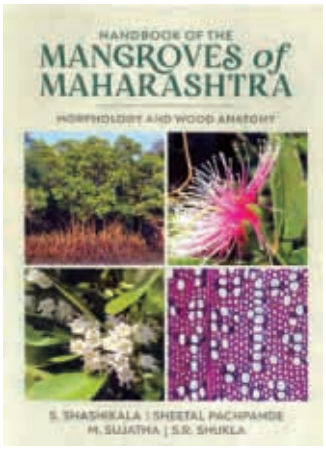
IFGTB, Coimbatore

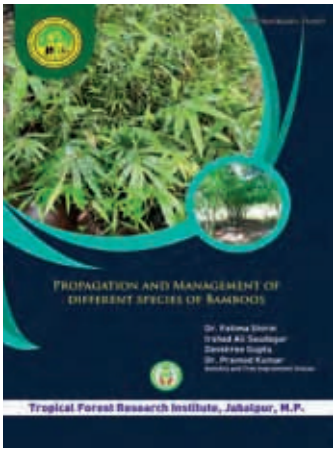
A database on the available forest genetic resources with various stake holders in South India is available on the website www.ifgtbenvis.in. Published four issues of the quarterly newsletter *'Van Vigyan'* (ISSN: 2394-7543). Various online awareness programmes were organized on the occasion of Green Days and registered in the respective global networks. Periodical updates were made in the mobile apps released by IFGTB ENVIS on tree pests of India and forest tree diseases (English and Tamil version).

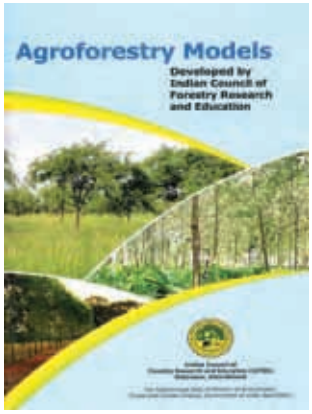
4.5. RESEARCH PUBLICATIONS

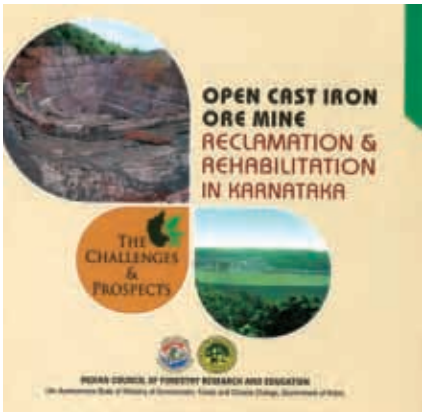
Publications are important tools for communicating the research output to the target audience. ICFRE has brought out a number of publications in this directions in different forms as follows:

HQ/ Institutes	Books	Booklets/ Brochures/ Bulletins/ Pamphlets	Articles in Seminars/ Conferences/ Workshops *etc.*		Popular Articles	Research Papers in Journals		Chapters in Books/ Proceedings
			Articles	Abstracts		Foreign	Indian	
ICFRE HQ	06	30	00	01	00	00	01	02
FRI	02	08	11	38	12	83	84	31
IFGTB	05	12	26	23	3	12	23	18
IWST	02	08	03	06	14	27	16	1
TFRI	03	21	06	14	22	10	29	00
AFRI	03	13	02	08	03	03	09	01
RFRI	02	02	03	02	01	06	07	06
HFRI	00	18	11	09	10	10	23	02
IFP	00	20	01	01	00	05	08	02
IFB	00	00	00	01	11	01	01	00
Total	**23**	**132**	**63**	**103**	**76**	**157**	**201**	**63**







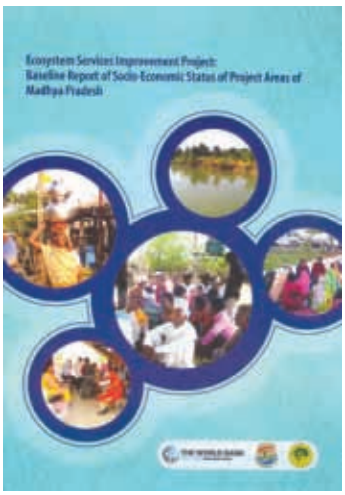


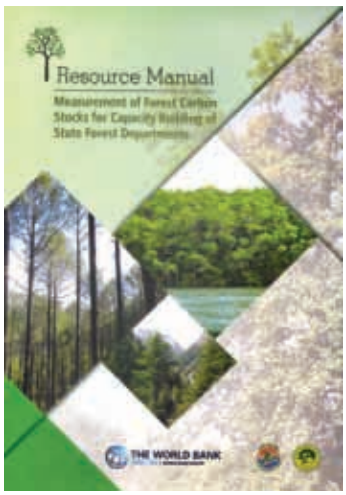
REDD+ Himalaya: Developing and Using Experience in Implementing REDD+ in the Himalaya following are the publication made:

- Himachal Pradesh State REDD+ Action Plan & Sikkim State REDD+ Action Plan
- A book titled 'REDD+ Readiness in Hindu Kush Himalaya'
- A report on 'Integration of REDD+ in the land use planning activities of North Eastern States of India with reference to the Mizoram State'
- A report on 'Scoping and feasibility studies of bamboo plantation for implementation of REDD+ activities in the North Eastern States of India'

The following documents were prepared and published under the project Ecosystem Services Improvement Project (ESIP) Publications:

- Baseline reports of forest carbon stocks of ESIP areas of Madhya Pradesh and Chhattisgarh
- Resource manual (in Hindi & English) on measurement of forest carbon stocks for the capacity building of SFDs
- Brochure on forest carbon stocks measurement for Joint Forest Management Committees (in Hindi)
- Baseline Report of Socio-economic status of ESIP areas of Chhattisgarh & Madhya Pradesh
- Flyers in Hindi and English on Sustainable Land and Ecosystem Management (SLEM) best practices
- Pamphlets (in Hindi) on SLEM Best Practices





4.6. CONSULTANCIES

ICFRE, Dehradun

- Works under eleven consultancy projects which includes preparation of R & R Plans for 37 mines out of 166 iron ore mines assigned by Government of Karnataka, Environmental Audit of 35 coal mines awarded by Coal India Limited, Kolkata and other projects awarded by Tehri Hydro Development Corporation India Ltd.; MoEF&CC, GoI, New Delhi; NTPC Ltd., Noida; NMDC Ltd., Hyderabad; Singreni Collieries Company Ltd., Kothagudem; Chhattisgarh State Forest Department, Raipur; Department of Forest and Environment, Bhubaneswar; M/s. R. Praveen Chandra (ML No. 2294), Jayanagar, Bengaluru, Western Coalfield limited, Nagpur were carried out. Among the 11 ongoing scientific consultancy projects, four projects were awarded and initiated during the year 2020-21.
- A total of eight (08) scientific consultancy study reports and five observations on the R&R Plan Reports related to iron ore mines in Bellary, Chitradurga and Tumkur districts of Karnataka were prepared and submitted to the project proponent and Central Empowered Committee (CEC) of Honorable Supreme Court during the year 2021.
- Out of consultancy projects, revenue of approx. Rs. 168.38 Lakh was generated and deposited in ICFRE revenue account.

FRI, Dehradun

- Provided technical advice for the upkeep and maintenance of Holy Bodhivriksha; funded by Bodhgaya Temple Management Committee (BTMC), Bodhgaya.
- Provided technical advice, support and back-up for the upkeep and maintenance of an old heritage peepal tree at village Main Bellaganj, District Gaya, Bihar; funded by Bihar Govt.
- Conservation of heritage tree Vat Vriksha at Jyotisar, Kurukshetra; funded by Kurukshetra Development Board.
- Carried out Health Status assessment of Avenue trees along major city roads of Chandigarh funded by Municipal Corporation, Chandigarh.

IFGTB, Coimbatore

- Technical consultancy is provided to Andhra Paper Limited (APL, formerly International Paper APPM Limited) to increase the productivity of *Casuarina* and *Leucaena* pulpwood plantations in the catchment area of the Company spread in the East and West Godavari Districts of Andhra Pradesh. During the year, the Company has produced around 45 lakh plants of Casuarina clones and supplied to farmers to raise plantations.
- IFGTB is providing technical consultancy to Seshasayee Paper and Boards Limited (SPB), Erode, Tamil Nadu to become self-sufficient in seed requirement by establishing its own seed orchards. The superior clones developed by IFGTB through its long-term breeding programmes have been made available to SPB to establish orchards.

IWST, Bengaluru

- One collaborative consultancy titled 'Development and standardization of non-destructive method for detection of anomalies using ultrasonic techniques in redwood' sponsored by M/S Wipro Limited, Bengaluru being executed.
- Field inspection and submission of report on 'Health assessment of trees at Fair Field Layout Park, High Grounds, Bengaluru' to Shuchita Bihani, Bengaluru.
- Advisory consultancy on 'Urban Tree Management" has been provided to Community living people of "Laughing Waters' located at Whitefield.

» 'Monitoring of National Thermal Power Corporation (NTPC) accelerated afforestation programme of plantation of 10 million trees' - in Karnataka State, detailed survey was conducted in all the 18 land parcels raised in Shimoga, Sagar, Hunsur and Mandya forest divisions by Karnataka Forest Department to study the survival percentage.

TFRI, Jabalpur

» Received consultancy worth Rs. 120 lakhs from CAMPA, Chhattisgarh State Forest Department for 'Monitoring and Evaluation of Plantations' established under CAMPA funding for the year 2021-22.

» Preparation of Wildlife Conservation Plan for Endangered Species in and around Dhelwadih Under Ground (UG), Bagdeva and Singhali UG mines of Dhelwadih-Singhali-Bagdews Sub Area of SECL Korba Area funded by South Eastern Coalfields Limited (SECL).

» Monitoring of NTPC Ltd. Accelerated Afforestation Programme of Plantation of 10 Million Trees – in States of M.P. and Maharashtra.

» Implementable forestry research for ash utilization promotion and development of research park at Adani Power Maharashtra Limited (APML).

RFRI, Jorhat

» Monitoring and Evaluation of NAP Activities in Tripura, Forest Fire Prevention and Management, Protected Area Management, Protected Area Management under Integrated Development of Wildlife Habitat (IDWH) funded by Govt. of Tripura.

» Farmers' Training on Bamboo Propagation and Promotion of Paura Bamboo (*Bambusa polymorpha*) though Nursery and Plantation Management under Tripura Bamboo Mission Artificial Inoculation of Agar Wood (*Aquilaria malaccensis*) in West Bengal was carried out.

IFP, Ranchi

Five projects were implemented in the year 2019-20 funded by various funding agencies, as below:

» Biodiversity (Floral & Faunal) Study in Kaimur Sanctuary, Bihar.

» Third Party Evaluation of Plantation Work under Centrally Sponsored Scheme Namami Gange Programme in Sahebganj Division.

» Follow up planning for biodiversity park Lalkhatanga.

» Documentation of Work carried out for the conservation of wild animals of Tirkut mountains under Deoghar Forest Division.

» Consultancy work regarding improvement of biological rehabilitation at Rajrappa OCP, Ramgarh.

Cactus Zone of Biodiversity Park

Biodiversity studies and collection of soil

HFRI, Shimla

» Under Japan International Cooperation Agency (JICA) consultancy after carrying out extensive survey in 10 VFDCs of Rampur Clusters, Shimla district, Himachal Pradesh; prioritized the important Medicinal and Aromatic Plants (MAP) for each respective VFDCs for taking up commercial cultivation of the same for augmentation and sustainable income generation among rural communities.

» Establishment of Western Himalayan Temperate Arboretum (WHTA)- landscaping, initiation of establishment of a temperate shrubbery and germplasm collection.

Preparation of Detailed Project Report (DPR) of 13 major Indian rivers for the period 2020-21

National Afforestation and Eco-Development Board (NAEB), Ministry of Environment Forest and Climate Change (MoEF&CC), Govt. of India entrusted Indian Council of Forestry Research and Education (ICFRE) with preparation of DPR for 13 major Indian rivers namely Beas, Brahmaputra, Cauvery, Chenab, Godavari, Jhelum, Krishna, Luni, Mahanadi, Narmada, Ravi, Satluj and Yamuna through forestry interventions. The project cost was Rs. 12.75 crores for a period from April 2019 to May 2021. All the nine Institutes of ICFRE were involved in preparation of the DPRs. The rivers along with their tributaries are proposed for forestry interventions in the riverscape under different landscapes namely natural, agricultural and urban landscape based on the consultative meetings with different stakeholders including subject matter experts and line departments.

Different models of forestry plantations including timber species, medicinal plants, grasses, shrubs and trees to augment water, ground water recharge and containment of erosion are the main features encompassed. The DPRs focus on protection, afforestration, catchment treatment, ecological restoration, moisture conservation, livelihood improvement, income generation, and regulated tourism by developing river fronts, eco-parks and bringing awareness amongst the masses.

During the year 2020-21, the DPRs of 13 rivers were prepared and submitted to NAEB, MoEF&CC.

4.7. TECHNICAL SERVICES

FRI, Dehradun

New specimens incorporated in DD Herbarium

a. *Trichosanthes dunniana* subsp. *clarkei* collected from Sikkim is newly incorporated in DD Herbarium as ISOTYPE

b. *Ficus laminosa, Mallotus albus, Ficus auriculata* newly incorporated in DD Herbarium collected from Bihar.

» Culture supply, assistance in plant disease control, conservation of urban and heritage trees, bioinoculants/ PGPR/ *Rhizobium* spp./ Pseudomonas/ecto-endo *Mycorrhiza*, phytosanitary certification, biocontrol of plant diseases, edible & medicinal mushroom cultivation.

» Eighty wood samples received from Central Public Works Department (CPWD), Ordinance Factory, MES, Prasar Bharati, Power Grid Corporation of India Ltd. (PGCIL), National Thermal Power Corporation (NTPC), Railway, National Building Construction Corporation (NBCC), Police, Customs, Commission and various private firms were identified and Rs.9,79,000 /- revenue was generated.

» Six plant samples received from different organization/ universities were identified and Rs 3,540/- revenue was generated.

IFGTB, Coimbatore

Extended plant taxnomical services to following institutions:

- Department of Biochemistry, Biotech and Bioinformatics, Avinashilingam Institute of Home Science and Higher Education for Women, Coimbatore.
- Department of Biochemistry, Sree Narayana Guru College, K.G. Chawadi, Coimbatore.
- Department of Pharmacy, Sanjo College of Pharmaceutical studies, Palakkad, Kerala.
- Department of Microbiology, Dr. NGP College of Arts and Science, Coimbatore.
- Department of Bioscience, Union Christian College, Aluva, Kerala.
- Vinayaka Mission's College of Pharmacy, Salem, Tamil Nadu
- Department of Industrial Biotechnology, Govt. College of Technology, Coimbatore.
- Sri Ramakrishna Institute of Paramedical Sciences, Coimbatore.

IWST, Bengaluru

- A total number of 208 wood samples were tested for wood properties and wood identification.
- Supply of bottles of tissue culture bamboo shoots: *B.tulda*-59 bottles, *D. stocksii*- 44 bottles, *D. asper*- 19 bottles, *D.brandisii*- 14 bottles, *B.balcooa*- 30 bottles were sold to various stakeholders (KFD, MUSA plant Gene Tech, Mangalore, Almaq Biotech Latur, Maharashtra and Srujan Biotech Nasik, Maharashtra).

TFRI, Jabalpur

- Soil and forest floor samples (1272) received from FSI, Nagpur were analyzed for organic carbon content and dry weight of plant samples, by FRCSD.

HFRI, Shimla

- Soil and plant samples analysis carried out for Forest Survey of India, Regional Office, Shimla.

IFP, Ranchi

- Soil analysis services to various agencies. 581 soil samples (FSI, Kolkata – 571 nos. and Jharkhand Pollution Control Board, Jharkhand – 10 nos) were analyzed.

4.8. ACTIVITIES OF RAJBHASHA

ICFRE is actively engaged in promoting *Rajbhasha Hindi* across the ICFRE Headquaters and its Institutes. Following are the regular activities conducted pertaining to implementation of *Rajbhasha Hindi*:

- 36 Quarterly meetings of official language implementation committees.
- 24 Quarterly training workshops on implementation of official language Hindi.
- *Rajbhasha* inspections of subordinate offices.

ICFRE and its Institutes enthusiastically observed Hindi Day/ Week/ Fortnight during the month of September 2020.

ICFRE personnel were nominated for online Hindi Prabodh, Praveen, Pragya Classes and Hindi Typing course.

A Town Official Language Implementation Committee (TOLIC) meeting was conducted at IFGTB, Coimbatore.

In addition to R&D publications periodicals such as ICFRE annual Hindi magazine *Taruchintan*, monthly *Vaniki Samachar*, e- magazine *Van Anusandhan*, *AFRI Darpan* and Hindi – Asamese bilingual magazine *Varsharanyam* were published regularly.

DG, ICFRE lighting the lamp during opening ceremony of Hindi Fortnight 2020

Closing ceremony of Hindi Fortnight 2020

4.9. AWARDS AND HONOURS

» Dr. Vipin Parkash, Scientist-F of FRI received 'Outstanding Scientist Award-2020' by Indian Professional Associations (IPA), Tamil Nadu, India given in 5th International Scientist Awards in Engineering, Science and Medicine held on June 2020 through virtual mode.

» Dr. Vipin Parkash, Scientist-F bestowed with 'Research Excellence Award-2020' conferred by SBER (Society of Biotic & Environmental Research), India through virtual mode.

» Dr. Vipin Parkash, Scientist-F awarded with 'Certificate of Membership' as a member of Asian Council of Science Editors (ACSE) by the council for his contribution.

» Dr. Hukum Singh, Scientist C, got the 'Excellence Research Fellow Award' and elected as a Fellow Member of Association of Plant Science Researchers.

A species of grass was named as ***Iseilema kunhikannanii*** in the honor of Director, IFGTB, Dr. C. Kunhikannan's contribution in biodiversity studies by Dr. Chandramohan, FSI, Regional office, Nagpur.

Dr. D. Thangamani, Scientist, IFGTB, Coimbatore was awarded 'Dr.APJ Abdul Kalam Award for Scientific Excellence -2020'. The award has been instituted by Marina Labs, Chennai.

Dr. K. K. Pandey, Scientist-G, IWST, Bengaluru was listed among top 2% scientist in the Field of Forestry by Stanford University (90th Rank in world and 1st rank among Indians in the field of Forestry).

ICFRE Outstanding Employee Award

» Shri R.B. Manjhi, CTO, TFRI, Jabalpur
» Shri Manoj Sharma, Assistant, TFRI, Jabalpur
» Shri Kartar Singh, FRO, HFRI, Shimla
» Dr. P.K. Rana, ACTO, TFRI, Jabalpur
» Shri Sanjay Mishra, LDC, TFRI, Jabalpur

Brandis Prize of the year 2018 was awarded to Dr. G. Singh, Scientist-G, Dr. Bilas Singh, CTO and Dr. T.S. Rathor Ex Director AFRI, for the best paper on Forest Management, 'The effect of woody hosts on *Santalum album* L. tree growth under agroforestry in semi-arid region of Gujarat' published in '*The Indian Forester*'.

4.10. VISITS OF DIGNITARIES

» Sri S. Niranjan Reddy, Hon'ble Minister of Agriculture, Horticulture & Allied Sectors along with a delegation of 12 members from Telangana State Government including Agriculture Production Commissioner (APC) & Secretary to Govt. Vice-Chancellor, Sri Konda Laxman Bapuji Telangana State Horticulture University (SKLTSHU) and other officers from Horticulture Department visited IWST, Bengaluru on 28 January 2021.

» Dr. Akhilesh Pandey, Vice Chancellor, Vikramaditya University, Ujjain (MP) visited TFRI, Jabalpur on 12 March 2021.

» Sh. Rajiv Banerjee, Hon'ble Minister of Forest, Government of West Bengal, visited AFRI, Jodhpur on 27 October 2020.

» Shri Kamakhya Prasad Tasa, Hon'ble Member of Parliament (Rajya Sabha) visited RFRI, Jorhat on 05.06.2020 on the occasion of 'World Environment Day' and inaugurated a 'Mushroom Production Unit'.

» Shri Mevar Kr. Jamatia, Hon'ble Forest Minister of Tripura visited FRCLE, Agartala on 31.08.2020.

» Shri Mrinal Saikia, Hon'ble MLA, Khumtai, Golaghat (Assam) visited RFRI, Jorhat on 18.09.2020 on the occasion of World Bamboo Day.

» Vice Chancellor of Tripura University Prof. Ganga Prasad Prasain visited FRCLE, Agartala on 11.10.2020.

» A team of High-level officials from the Industries Department, Government of Jammu & Kashmir visited RFRI, Jorhat on 26.02.2021 to know the various activities related to bamboo.

» Dr. Rajeshwar Singh Chandel, Executive Director, Zero Budget Natural Farming, Department of Agriculture, Himachal Pradesh visited HFRI, Shimla on 23 September 2020.

» Dr. Savita, IFS, PCCF &HoFF, Himachal Pradesh visited HFRI, Shimla on 17 March 2021.

» Director, Sardar Vallabhbhai Patel National Police Academy visited FRI, Dehradun on 17 March 2021.

» Dr. Nalinimohan Denduluri, IFS, Principal Chief Conservator of Forests and Member Secretary, Andhra Pradesh State Biodiversity Board visited IFB, Hyderabad on the occasion of Van Mahotsava on 06 July 2020.

» Mrs. R. Sobha, PCCF & HoFF and team of Tamil Nadu State Forest Department (TSFD) visited IFB, Hyderabad on 17 November 2020 to see the research and development work of the Institute.

Dr. Nalinimohan Denduluri, IFS, PCCF and MS, Andhra Pradesh State Biodiverstiy Board at IFB, Hyderabad

Mrs. R. Sobha, PCCF and HoFF at IFB, Hyderabad

4.11. SPECIAL ACTIVITIES

Van Mahotsava, Forestry Day and Other important days

World Environment Day

All ICFRE Institutes celebrated World Environment Day on 5 June 2020.

FRI, Dehradun celebrated World Environment Day

Himalayan Day

FRI, Dehradun and HFRI, Shimla celebrated Himalayan Day on 9 September 2020.

International Forestry Day

FRI, Dehradun; IFGTB, Coimbatore; TFRI, Jabalpur; AFRI, Jodhpur and HFRI, Shimla observed International Forestry Day on 21 March 2020

World Ozone Day

IFGTB, Coimbatore and HFRI, Shimla observed World Ozone Day on 16 September 2020.

Vigilance Awareness Week

IFGTB, Coimbatore; TFRI, Jabalpur; AFRI, Jodhpur; RFRI, Jorhat; IFP, Ranchi; IFB, Hyderabad observed Vigilance awareness week on 27 October 2020.

International Yoga Day

IWST, Bengaluru and IFP, Ranchi observed International Yoga Day on 21 June 2020.

Constitution Day

FRI, Dehradun; RFRI, Jorhat; IFP, Ranchi and IFB, Hyderabad observed Constitution Day on 26 November 2020.

Wildlife Week

FRI, Dehradun and HFRI, Shimla observed World Wildlife Week during the month of October 2020.

World Wildlife Day

FRC-CE, Visakhapatnam observed World Wildlife Day on 3 March 2021.

National Forest Martyrs Day

FRI, Dehradun and HFRI, Shimla observed National Forest Martyrs Day on 11 September 2020.

AFRI, Jodhpur observed International Forestry Day

IFP, Ranchi observed Constitution Day

DG, ICFRE paying homeage to Forest Martyrs on National Forest Martyrs Day at FRI, Dehradun

HFRI, Shimla observed National Forest Martyrs Day

Van Mahotsava

FRI, Dehradun; IFGTB, Coimbatore; TFRI, Jabalpur; AFRI Jodhpur; HFRI, Shimla; IFP, Ranchi and IFB, Hyderabad celebrated Van Mahotsava during the month of July 2020.

Van Mahotsava at HFRI, Shimla

International Biological Diversity Day 2020

IFB, Hyderabad; IFP, Ranchi; RFRI, Jorhat, HFRI, Shimla and AFRI, Jodhpur celebrated International Biological Diversity Day on 22 May 2020.

HFRI, Shimla observed International Biological Diversity Day

National Unity Day

FRI, Dehradun, HFRI, Shimla and IFP, Ranchi organized National Unity Day on 31 October 2020.

DG, ICFRE addressing the gathering on National Unity Day

National Handloom Day

IFP, Ranchi celebrated National Handloom Day on 7 August 2020.

World Day to Combat Desertification

AFRI, Jodhpur celebrated World Day to Combat Desertification on 17 June 2020.

Activities performed under CAMPA

SCHEME- 1 : Strengthening forestry research for ecological sustainability and productivity Enhancement

COMPONENT- VI:

Operationalization of Forestry Extension Strategy and Action Plan of ICFRE

Technology Demonstration Centre (TDC): Seven TDCs are being established at IFP, IWST, HFRI, IFB, FRI, TFRI and RFRI.

» **Van Vigyana Kendras:** Three new VVKs established at Gottipura (Karnataka), Barapani (Meghalaya) and Gorakhpur (Uttar Pradesh); Memorandum of Understanding (MoU) signed between HFRI, Shimla and (Himachal Pradesh State Forest Department) HPSFD for establishing a new VVK and Demonstration Nursery at Longni, Dharampur, District Mandi (H.P.). IFGTB carried out infrastructure improvement works at Field Research station, Gudal. Field Inspection of *Neolamarkia cadamba* clonal cum demo plantation at ICAR-KVK, Gobichettipalayam, MYRADA and Stakeholders Workshop was conducted. One week Training Programme on "Agroforestry" was organized by FRCER-Prayagraj, at Van Vigyan Kendra, Gorakhpur. HFRI established Demonstration Nursery (4.83 ha) at Shivdwala Tehsil Dharampur, District Mandi, Himachal Pradesh.

» **Publication :** HFRI printed seven pamphlets on various medicinal plants. TFRI published 10 Technical bulletins and two brochures. IWST printed five technical bulletins. IFP, Ranchi, compiled a technical bulletin.

» **Preparation of Documentaries :** IFGTB prepared documentary film on "*Walking Tall with Trees*" and Created IFGTB's YouTube Channel. IWST prepared one documentary on research activities and 10 short films/documentaries (3-5 minutes) on various research works carried out by the Institute. HFRI prepared a documentary film on Cultivation of Medicinal Plants and Hill Bamboo. AFRI prepared a short film and TFRI a documentary on research and extension activities the institute.

Chapter-5

ADMINISTRATION AND INFORMATION TECHNOLOGY

5

ADMINISTRATION AND INFORMATION TECHNOLOGY

5.1. INFORMATION TECHNOLOGY

Introduction

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.

5.1.1. ICFRE Data Centre (Server Farm)

ICFRE Data Centre services are available 24x7x365 at ICFRE Headquarters, ICFRE Institutes and Centres across the country since 01.02.2010. Some of services provided by Data Centre are Mail, Internet, Web, Video Conferencing, Antivirus, FTP, Network Security System, Databases, Building Management System (BMS), Virtual Private Network (VPN) services, Push Mail Service, Web casting etc. More than 60 Web applications/websites are hosted on Data Centre. More than 1500 active email accounts are on Mail server. Service Desk and IFRISdesk are Institutional framework for the resolution of issues across ICFRE.

5.1.2. Following new applications/websites were developed / implemented

A. Video Conferencing Booking Portal: The application has been designed and developed for officials of ICFRE HQ and its institutes to provide facility to book video conferencing (VC) sessions / meetings at the available venues at ICFRE HQ and institutes. This application has facilitated in the overall management of the VC at ICFRE HQ. and the institutes. URL of application is https://vcbooking.icfre.org. The application has been made live on 30th July 2020 and more than 250 number of VC sessions have been booked in year 2020-21 through this application.

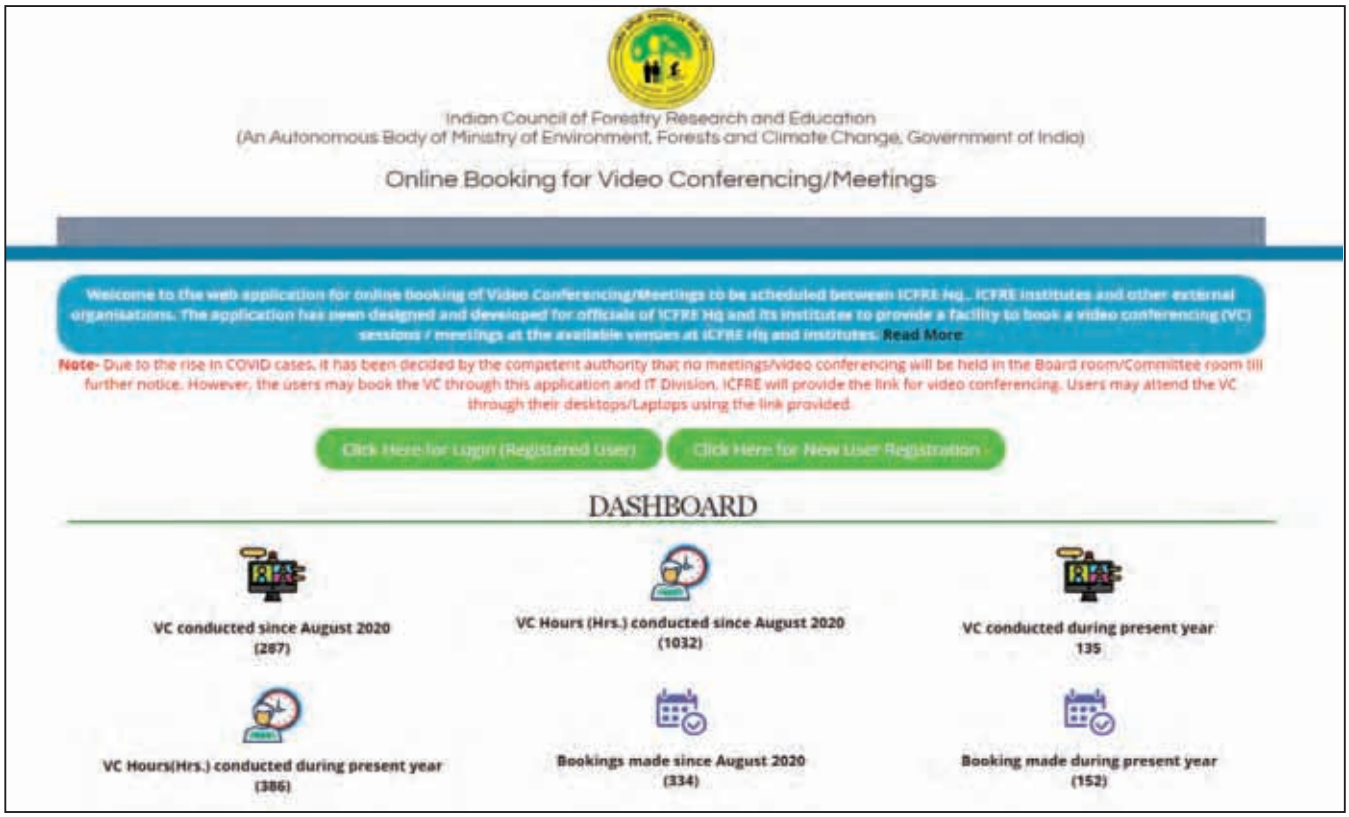


Fig: Screenshot of Video Conferencing Booking Portal

B. Website of FRC-ER, Prayagraj: Website of FRC-ER, Prayagraj was designed, developed and implemented on live server. URL of the website is https://frcer.icfre.org/

Fig: Screenshot of website of FRCER Prayagraj

C. **Development of ICFRE Pensioners' Portal :** Development of a web and mobile application "ICFRE Pensioners portal" for preparing the pension of ICFRE pensioners and providing the details of pension to the ICFRE pensioners was started. The memorandum of agreement has been signed with M/s Vidya Online Services, Pune for the development of the same. The Pensioner portal will provide the facility for processing the pension, taking out various reports of pension to the pension cell and will provide the pension related details to the pensioners through web and mobile phones.

D. **Website of IFGTB Coimbatore :** Website of IFGTB Coimbatore was designed and developed.

E. **Implemented web application of DPR Godavari.**

F. **Implemented web portal of FRI Visitors registration.**

5.1.3. Maintenance of Software Applications/websites

Already developed applications are being maintained and updated time to time. In all, around 60 websites/Database/CMSs/ applications including applications and websites of ICFRE institutes which are on live server are being maintained.

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

ICFRE's website is updated on regular basis. Total number of 1243 updations were made in the ICFRE website during 1 April 2020 to 31 March 2021

5.1.5. Upgradations of applications and website in PHP 7

The work of upgradation of the applications hosted at ICFRE Data Center and website to PHP 7 from older versions is underway. Some of upgraded applications/website are:

- Bilingual website of Indian Council of Forestry Research & Education (ICFRE).
- English Website of Institute of Forest Biodiversity (IFB), Hyderabad.
- English Website of Tropical Forest Research Institute (TFRI), Jabalpur.
- English website of Rain Forest Research Institute (RFRI), Jorhat.
- Website and application of Detailed Project Report (DPR) for rejuvenation of major rivers in the country through forestry interventions

5.1.6. e-Office

Efforts are on for implementation of eOffice at ICFRE and its institutes. Communications have been made with MoEF&CC to onboard ICFRE in the existing eOffice instance of MoEF&CC. Data of employees of ICFRE and its institutes has been provided to MoEFCC to provide NIC email id's to all the employees of ICFRE as a prerequisite to onboarding on eOffice.

5.1.7. Social Media

Twitter and facebook accounts of ICFRE HQ have been made operational. Updates are being regularly uploaded on these platforms.

5.1.8. SSL Certificates

Configuration of SSL Certificates in the websites/ web applications hosted at ICFRE Data Centre has been completed in the month of July2020.

5.1.9. Security Audit of ICFRE website

Security Audit of ICFRE website was started in the month of December 2020 after observing the codal formalities and has been completed through CERT-In empaneled vendor.

5.1.10. Video conferencing (VC) Services

Most of meetings have been organized through video conferencing during 2020-21 due to COVID-19 pandemic. Video Conferencing can be conducted with all the ICFRE institutes as well as with external agencies using the new MCU installed in December 2019 through the Desktop/Laptop computers as well as mobile phones. In addition to this, a new PTZ camera and mike system have been installed for conducting VC sessions through the web platforms like Cisco Webex/Google Meet. Two parallel sessions of the video conferencing can be held now both from Committee Room and Board Room of ICFRE. VCs can be booked through online application developed by IT Division, ICFRE.

More than 300 video conferencing sessions were organized during the year 2020-2021. Online interviews of the candidates at different locations of ICFRE Institutes have been successfully conducted for the recruitment of Scientists-B at ICFRE from the month of August 2020 to Oct – Nov 2020 through video conferencing.The assessment of the scientists for promotions has also been conducted twice during June 2020 and December 2020 through video conferencing apart from the important meetings with MoEF&CC, project monitoring meetings etc.

5.1.11. Maintenance of LAN

Upgradation of LAN was completed successfully at ICFRE Head Qtr and eight Institutes in the month of August 2017. The LAN of ICFRE and its institutes has been maintained successfully during the year 2020-21.

5.1.12. National Knowledge Network (NKN) connectivity

NKN connectivity was provided to 12 institutes and centers of ICFRE with more than 99% uptime, The 1 Gbps internet leased line is provided under NKN through RailTel India at ICFRE HQ and 1 Gbps internet leased line through BSNL

5.1.13. Maintenance Contract of IT Hardware (Computers, laptop, Printer, Scanner and Franking machine) at ICFRE Head Qtr.

The Computers, Printers, Scanners, Laptops and Franking Machine were being maintained successfully at ICFRE Hq. during the year 2020-21.

At ICFRE Institutes

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

FRI, Dehradun : The IT & GIS Discipline hosts state-of-art-laboratories cum class rooms for implementing and supporting IT and RS-GIS based services to various ongoing projects of the institute and imparting trainings to the students of FRI Deemed to be University and other institutes through tailored training courses. New initiatives by the discipline includes: (a) testing and development of dynamic forest vegetation models for the assessment of impacts of various drivers (primarily socio-economic and climate change) on the forest ecosystems, (b) to act as a research centre of FRI Deemed to be University, Dehradun for the students pursuing PhD in the discipline of "Forest Geo-informatics".

IWST, Bengaluru: The role of the IT cell is to provide/maintain network (LAN and WAN) facilities and to strengthen the computer activities with latest facilities in the Institute by procuring the necessary Hardware and Software. The cell is also responsible for arranging training to the Officers/Scientists/Staff members of the Institute whenever it is required.

TFRI, Jabalpur : The web pages of institute's website (http://tfri.icfre.org) have been updated and also for the institute's online open access e-magazine 'Van Sangyan' (ISSN 2395 - 468X), institute's journal "Indian Journal of Tropical Biodiversity" linked with institute's web site on regular basis and issues have been uploaded on monthly basis over it for easy access to the users.

AFRI, Jodhpur : An online portal for new recruitments for various posts at AFRI was developed with the help of RISL, a Government of Rajasthan owned company.

RFRI, Jorhat : The Scientist Hostel was made BSNL WiFi Hot Spot zone with an aerial coverage of 80 mtr.High end web cameras along with screen were installed in two conference halls of RFRI to conduct webinars smoothly.

HFRI, Shimla : IT Cell is maintaining/updating Institute's website (http://hfri.icfre.gov.in). Institute has launched Hindi website (http://hfrihindi.icfre.org) during March, 2017 and also actively involved in its maintenance and updating from time to time for quick dissemination of information into public domain. The IT Cell has been actively involved in e-procurement and running. Video Conferencing facility of the Institute is also being maintained by IT Cell.

IFP, Ranchi : The IT Cell is actively involved in the process of imparting in-house training to the officers and staff. Successful implementation of IT technology for Online meetings, webinars and training courses was carried out throughout the year.

5.2 ADMINISTRATION

The Directorate of Administration of ICFRE undertakes preparation of budget estimates, allocation of budget and preparing annual mandatory financial statements; filing of mandatory financial and administrative returns of ICFRE; disbursement of payments and TDS It also deals with inventory management and procurement for stores, maintains support services and official infrastructure. Besides handling general administration, the Directorate looks after civil and technical works of the Council and its Institutes. ICFRE Pension cell and ICFRE Pensioners Health Scheme are also administered by the Directorate.

5.2.1. Sevottam

The Council deals with the solution based forestry research with the larger objective of providing improved services and opportunities to the people. "Sevottam" is an assessment improvement framework targeted to improve the quality of services to the citizens. The Council using the framework of "Sevottam" is committed to continuously improve quality of service in ICFRE (HQ) and its Institutes. The 'Sevottam' framework consists of three components viz. the Citizens' Charter, Public Grievance lodging and redressal mechanisms and service delivery capability.

Based on the guidelines issued by Government and, as a part of the Performance Monitoring and Evaluation System (PMES) for Government Departments, ICFRE has formulated the Citizen Charter for the Council. It is a document, which represents systematic efforts to focus on the commitment of the organization towards its citizens/ clients in respect of standard of services, information, choice and consultation, non-discrimination and accessibility, grievances redressal, courtesy and value for money. It also includes expectations of the organization from the citizens/ clients for fulfilling the commitment of the organization.

5.2.2. Welfare measures for the SC / ST/ backward / minority communities/women

ICFRE (Hq.) has the Grievance Redressal Cell for SC/ST/ OBC employees to address the grievances of SC/ST/OBC personnel. A separate committee is in place for addressing the grievances of women personnel.

BALANCE SHEET

BALANCE SHEET

ASHISH KUMAR GUPTA & ASSOCIATES
Chartered Accountants

Independent Auditor's Report

To
The Members
Indian Council of Forestry Research and Education
Dehradun-248006
Uttarakhand

Report on the Financial Statements

We have audited the financial statements of Indian Council of Forestry Research and Education, which comprised the Balance Sheet as at March 31, 2021 and the Income and Expenditure Account for the year ended 2021 and notes to the financial statement including summary of significant accounting policies.

In our opinion, and to the best of our information and according to the explanations given to us the aforesaid financial statements, subject to the audit observations provided below, the consequential impact, if any, whereof is not quantifiable, give a true and fair view, in conformity with the accounting principles generally accepted in India, of the financial statement of the entity for the financial year 2020-21.

Responsibilities of Management and Those charges with Governance for the Financial Statements.

Management is responsible for the preparation and presentation of these financial statements that give a true and fair view of the financial position and financial performance of the entity in accordance with the accounting principles generally accepted in India.

In preparing the financial statements, management is responsible for assessing the entity's ability to continue as going concern and also includes design implementation and maintenance of adequate internal financial controls that were operating effectively for ensuring the accuracy and completeness of the accounting records, relevant to the preparation and presentation of the financial statements that give a true and fair view and are free from material misstatement, whether due to fraud or error.

Auditors Responsibility

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

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

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Mob. : 9358111116 9997431932
e-mail : akgupta70@gmail.com, akgupta70@outlook.com

As part of an audit in accordance with SAs, we exercise professional judgment and maintain professional skepticism throughout the audit. We also:

- Identify and assess the risks of material misstatement of the financial statements, whether due to fraud or error, design and perform audit procedures responsive to those risks, and obtain audit evidence that is sufficient and appropriate to provide a basis for our opinion. The risk of not detecting a material misstatement resulting from fraud is higher than for one resulting from error, as fraud may involve collusion, forgery, intentional omissions, misrepresentations, or the override of internal control.
- Obtain an understanding of internal control relevant to the audit in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the entity's internal control.
  Evaluate the appropriateness of accounting policies used and the reasonableness of accounting estimates and related disclosures made by management.
- Conclude on the appropriateness of management's use of the going concern basis of accounting and, based on the audit evidence obtained, whether a material uncertainty exists related to events or conditions that may cast significant doubt on the entity's ability to continue as a going concern. If we conclude that a material uncertainty exists. We are required to draw attention in our auditor's report to the related disclosures in the financial statements or, if such disclosures are inadequate, to modify our opinion. Our conclusions are based on the audit evidence obtained up to the date of our auditor's report. However, future events or conditions may cause the entity to cease to continue as a going concern.
- We communicate with those charged with governance regarding, the planned scope and timing of the audit and significant audit findings, including any significant deficiencies in internal control that we identify during our audit.

We believe that we have obtained sufficient and appropriate audit evidences to provide a basis for our audit opinion that the financial statements are true and fair from material misstatements, subject to the observations provided as under -

1. Due to ongoing pandemic situation we were unable to verify the record thoroughly as it was done remotely. Therefore we now suggest that ICFRE headquarter along with all ICFRE institutes should be connected on a single ERP based accounting software, which will help ICFRE to control and monitor all accounting transactions centrally at ICFRE headquarter and Audit can also be conducted smoothly and in a fair and proper manner.

2. We observed that despite many instructions from ICFRE Headquarters to various institutes to close their savings account, most institutes have not complied with the instructions and still balances are reflecting in their savings accounts.

3. In case of Outsourced employees, the concerned agencies providing such staff have not discharged their statutory liabilities such as EPF and ESI of their employees on a timely manner resulting in negative impact on ICFRE. Therefore we suggest that ICFRE should ensure proper timely compliance by such agencies on regular basis.

4. Keeping in the size of the Organization we recommend that ICFRE should implement a system of internal audit by an outside agency preferably by a CA firm, in order to ensure effective internal control comprises of statutory compliances and audit on regular basis.

Scope Limitation due to COVID-19

The disclaimer of opinion provided in the above report is based on the information, facts and reports made available to us by ICFRE. We wish to highlight that due to COVID-19 induced restrictions on physical movements and strict timelines. the institute from various location could not be present physically for conducting the audit work.

FOR ASHISH KUMAR GUPTA & ASSOCIATES
(CHARTERED ACCOUNTANTS)

Preeti Gupta

(CA PREETI GUPTA)
FCA, PARTNER
MEMBERSHIP NO. 408004
DATED: 15/09/2021
PLACE: DEHRADUN
UDIN: 21408004AAAABP5267

CONTENTS

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN

BALANCE SHEET AS AT 31ST MARCH, 2021

(Amount in Rs.)

GENERAL/CAPITAL FUND AND LIABILITIES	SCHEDULE	CURRENT YEAR AS ON 31.03.2021		PREVIOUS YEAR AS ON 31.03.2020	
		RS.	RS.	Rs	RS.
GENERAL/CAPITAL FUND	1		1,084,407,492.19		1,181,589,487.39
RESERVES AND SURPLUS	2		-		-
EARMARKED/ENDOWMENT FUNDS :	3		1,120,317,047.31		861,370,801.30
a) One Time Special Grant		-		-	
b) Project Unspent Balance		959,156,825.31		704,567,821.30	
c) Chair of Excellence		161,160,222.00		156,802,980.00	
SECURED LOANS AND BORROWINGS	4		-		-
UNSECURED LOANS AND BORROWINGS	5		-		-
DEFFERRED CREDIT LIABILITIES	6		-		-
CURRENT LIABILITIES AND PROVISIONS					
(A) CURRENT LIABILITY:	7		148,072,403.05		136,839,682.00
(B) PROVISIONS:			-		-
TOTAL			2,352,796,942.55		2,179,799,970.69

ASSETS	SCHEDULE	CURRENT YEAR AS ON 31.03.2021		PREVIOUS YEAR AS ON 31.03.2020	
		RS.	RS.		RS.
FIXED ASSETS	8		1,097,887,242.73		1,055,877,127.38
INVESTMENTS-FROM EARMARKED/ENDOWMENT FUNDS					
a)F.D.R.(For One Time Special Grant)	9		160,354,894.00		156,693,442.00
bF.D.R.(With Institutes)			-		-
INVESTMENTS-OTHERS	10				
a) F.D.R.(With Institutes)			-		-
CURRENT ASSETS, LOANS, ADVANCES ETC.	11		1,094,554,805.82		967,229,401.31
MISCELLANEOUS EXPENDITURE			-		-
a)(to the extent not written off or adjusted)					
TOTAL			2,352,796,942.55		2,179,799,970.69

SH ARUN SINGH RAWAT, (Director General, ICFRE)

SH RAKESH KUMAR DOGRA, (Deputy Director General, Admin., ICFRE)

SH RAJ KUMAR BAJPAI, (ASSISTANT DIRECTOR GENERAL, Admin, ICFRE)

SH BRIJESH KUMAR SHARMA, (SECTION OFFICER, BUDGET SECTION, ICFRE)

AS PER OUR SEPARATE REPORT OF EVEN DATE ANNEXED

FOR ASHISH KUMAR GUPTA & ASSOCIATES
(CHARTERED ACCOUNTANTS)

(CA PREETI GUPTA)
FCA, PARTNER,
MEMBERSHIP NO. 408004
DATED: 15.09.2021
PLACE: DEHRADUN

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2021

INCOME	Schedule	Current Year 31.03.2021	Previous Year 31.03.2020
		RS	RS.
Income from sales/services	12	63,608,744.00	62,289,109.93
Grants/Subsidies	13	2,120,000,000.00	2,250,000,000.00
Fees/Subscriptions	14	46,523,147.80	16,693,439.00
Income from Investments (Income on Invest .from earmarked/endow. Funds transferred to Funds)	15	528,582.00	-
Income from Royalty, Publications etc	16	13,630,287.00	58,133,965.17
Interest Earned	17	35,471,916.97	25,611,688.80
Other Income	18	35,142,644.35	176,599,287.31
Revenue earn in plan account		4,639,424.58	14,800,975.46
Revenue earn in other than plan accounts		295,146.00	47,513.00
EAP/SFRESPE Funds utilized during the year		641,967,048.06	-
Increase/(decrease) in stock of finished goods and works-in-progress	19	-	-
Total(A)		2,961,806,940.76	2,604,175,978.67

EXPENDITURE	Schedule	Current Year 31.03.2021	Previous Year 31.03.2020
		RS.	RS.
Establishment Expenses	20	2,067,432,123.04	2,015,814,112.00
Other Administrative Expenses etc	21	359,976,713.51	608,356,519.23
Expenditure on Grants, Subsidies etc	22	26,907,651.00	-
Interest	23	-	-
EAP/SFRESPE Expenses		507,467,367.66	-
Revenue earn transfer to own revenue account		-	15,671,823.22
Depreciation(Net Total at the year end-corresponding to Schedule 8)		156,346,080.75	151,291,420.20
TOTAL(B)		3,118,129,935.96	2,791,133,874.65
Balance being excess of Income over Expenditure(A-B)		(156,322,995.20)	(186,957,895.98)
Transfers to Special Reserve(Specify each)		-	-
Transfer to/from General Reserve		-	-
BALANCE BEING DEFICIT CARRIED TO CORPLUS FUND		(156,322,995.20)	(186,957,895.98)
SIGNIFICANT ACCOUNTING POLICIES	24		
CONTINGENT LIABILITIES AND NOTES ON ACCOUNTS	25		

SH ARUN SINGH RAWAT, (Director General, ICFRE)

SH RAKESH KUMAR DOGRA, (Deputy Director General, Admin., ICFRE)

SH RAJ KUMAR BAJPAI, (ASSISTANT DIRECTOR GENERAL, Admin, ICFRE)

SH BRIJESH KUMAR SHARMA, (SECTION OFFICER, BUDGET SECTION, ICFRE)

AS PER OUR SEPARATE REPORT OF EVEN DATE ANNEXED

FOR ASHISH KUMAR GUPTA & ASSOCIATES
(CHARTERED ACCOUNTANTS)

(CA PREETI GUPTA)
FCA, PARTNER,
MEMBERSHIP NO. 408004
DATED: 15.09.2021
PLACE: DEHRADUN

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH, 2021

Amount-(Rs)

SCHEDULE 1-CORPUS/CAPITAL FUND	CURRENT YEAR 31.03.2021		PREVIOUS YEAR 31.03.2020	
	RS.	RS.	RS.	RS.
Balance as at the beginning of the year	1,181,589,487.39		1,296,816,112.37	
Op.Balance of Capital Fund Account	-		-	
Op.Balance of General Fund Account	-		-	
Add: Receipt from CPWD Guwahati	70,122.00	1,181,659,609.39	-	1,296,816,112.37
Add: Contributions towards Corpus/Capital Fund		60,252,000.00		50,000,000.00
Add: Fixed Assets Capitalized during the year		-		23,398,271.00
Less: Refund to Ministry		(1,181,122.00)		(1,667,000.00)
Add/Less: Surplus/ (Deficit) income over expenditure for the year		(156,322,995.20)		(186,957,895.98)
BALANCE AS AT THE YEAR-END		**1,084,407,492.19**		**1,181,589,487.39**

SCHEDULE 2-RESERVES AND SURPLUS	CURRENT YEAR 31.03.2021		PREVIOUS YEAR 31.03.2020	
	RS.	RS.	RS.	RS.
1. **Capital Reserve:**				
As per last Account		-	-	-
Addition during the year		-	-	-
Less: Deductions during the year		-	-	-
2. **Revaluation Reserve:**		-	-	-
As per last Account		-	-	-
Addition during the year		-	-	-
Less: Deductions during the year		-	-	-
3. **Special Reserves:**		-	-	-
As per last Account		-	-	-
Addition during the year		-	-	-
Less: Deductions during the year		-	-	-
4 **General Reserve:**		-	-	-
As per last Account		-	-	-
Addition during the year		-	-	-
Less: Deductions during the year		-	-	-
TOTAL		-	-	-

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH, 2021

Amount-(Rs)

SCHEDULE 3-EARMARKED/ENDOWMENT FUNDS	FUND –WISE BREAK UP			TOTALS	
	ONE TIME SPECIAL GRANT	PROJECT ACCOUNTS	Chair of Excellence	Current Year 31.03.2021	Previous Year 31.03.2020
	RS.	RS.		RS.	RS.
a)Opening balance of the funds	-	704,567,821.30	156,802,980.00	861,370,801.30	626,385,938.50
b)Additions to the Funds:					
i) Donations/grants					
One Time Special Grant (General)	-	-	-	-	-
One Time Special Grant (Creation of Assets)	-	-	-	-	-
ii) Income from investments made on account of funds	-	-	4,857,242.00	4,857,242.00	11,019,814.00
iii) Other additions (specify nature)	-	-	-	-	-
iv) Project Receipts	-	896,556,052.07	-	896,556,052.07	777,271,189.59
TOTAL(a+b)	-	**1,601,123,873.37**	**161,660,222.00**	**1,762,784,095.37**	**1,414,676,942.09**
C) Utilisation/Expenditure towards objectives of funds					
i) Non Recurring Expenditure					
- Fixed Assets	-	134,499,680.40		134,499,680.40	23,398,271.00
- Others	-	-		-	-
ii) Refunded to Ministry/Funding Agency					
- Amount refunded to Ministry/Funding Agency	-	-	-	-	-
- Amount transferred to Chair of Excellence Fund	-	-	-	-	-
iii) Recurring Expenditure					
- Salaries, Wages and allowances etc.	-	21,648,633.00	500,000.00	22,148,633.00	-
- Rent	-	43,966.00	-	43,966.00	-
- Other Administrative expenses	-	169,744,533.58	-	169,744,533.58	-
- Project Payments	-	316,030,235.08	-	316,030,235.08	529,907,869.79
iv) Amount wrongly entered	-	-	-	-	-
TOTAL(C)	-	**641,967,048.06**	**500,000.00**	**642,467,048.06**	**553,306,140.79**
NET BALANCE AS AT THE YEAR END(a+b-c)	-	**959,156,825.31**	**161,160,222.00**	**1,120,317,047.31**	**861,370,801.30**

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH, 2021

Amount-(Rs)

SCHEDULE 4-SECURED LOANS AND BORROWINGS:	CURRENT YEAR 31.03.2021		PREVIOUS YEAR 31.03.2020	
	RS.	RS.	RS.	RS.
1. Central Government	-	-	-	-
2. State Government(Specify)	-	-	-	-
3. Financial Institutions				
a) Term Loans	-	-	-	-
b) Interest accrued and due	-	-	-	-
4. Banks:				
a) Term Loans	-	-	-	-
-Interest accrued and due	-	-	-	-
b) Other Loans(specify)	-	-	-	-
-Interest accrued and due	-	-	-	-
5. Other institutions and Agencies	-	-	-	-
6. Debentures and Bonds	-	-	-	-
7. Others(specify)	-	-	-	-
TOTAL	-	-	-	-

Note: Amount due within one year

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH, 2021

Amount-(Rs)

Schedule 5-UNSECURED LOANS AND BORROWINGS	Current Year 31.03.2020 RS.	Previous Year 31.03.2019 RS.
1. Central Government	-	-
2. State Government	-	-
3. Financial Institutions	-	-
4. Banks:	-	-
a) Term Loans	-	-
b)Other Loans (specify)	-	-
5. Other Institutions and Agencies	-	-
6. Debentures and Bonds	-	-
7. Fixed Deposits	-	-
8. Others(specify)	-	-
TOTAL	-	-
Note: Amount due within one year		

SCHEDULE 6-DEFERRED CREDIT LIABILITIES:	Current Year 31.03.2020 RS.	Previous Year 31.03.2019 RS.
a) Acceptances secured by hypothecation of capital equipment and other	-	-
b) Others	-	-
TOTAL	-	-
Note: Amounts due within one year		

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH, 2021

Amount-(Rs)

SCHEDULE 7-CURRENT LIABILITIES AND PROVISIONS	CURRENT YEAR 31.03.2021		PREVIOUS YEAR 31.03.2020	
	RS.	RS.	RS.	RS.
A.CURRENT LIABILITIES				
1.Acceptances		-		-
2.Sundry Creditors:				
a)For Goods	-		-	
b)Others	-	-	-	-
3.Advances Recovery from staff on behalf of ICFRE		-		-
4.Interest accrued but not due on:				
a)Secured Loans/borrowings	-		-	
b)Unsecured Loans/borrowings	-	-	-	-
5.Statutory Liabilities:				
a)Overdue	-		-	
b)Others	6,450,676.00	6,450,676.00	-	-
6.Other Current Liabilities				
Security & EMD Account		17,264,276.04		16,563,691.00
Amount Payable to Controller, Pension Cell, ICFRE		9,892,246.01		6,027,279.00
Amount Payable to Other offices on behalf of staff deputaion		(18,660.00)		(18,660.00)
Amount Payable to PAO (F), NEW DELHI		-		579,003.00
Amount Payable to Other Units				
Saving Fund	89,361.00		89,361.00	
Death Claim	44,013.00		44,013.00	
Advance Recovery	541.00		541.00	
Other	1,540,971.00		1,540,971.00	
CGEIS	(1,941.00)	1,672,945.00	(1,941.00)	1,672,945.00
Salary Payable Account				
Opening Balance	112,015,424.00		107,705,985.00	
Add: Salary of March 2021 paid in April 2021	112,810,920.00		112,015,424.00	
Total	224,826,344.00		219,721,409.00	
Less: Paid in April, 2020	112,015,424.00	112,810,920.00	107,705,985.00	112,015,424.00
TOTAL(A)		**148,072,403.05**		**136,839,682.00**
B.PROVISIONS				
1.For Taxation		-		-
2.Gratuity		-		-
3.Supernnuation/Pension		-		-
4.Accumulated Leave Encashment		-		-
5.Trade Warranties/Claims		-		-
6.Others(Specify)		-		-
TOTAL(B)		-	-	-
TOTAL(A+B)		**148,072,403.05**		**136,839,682.00**

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN
SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH, 2021

Amount-(Rs)

SCHEDULE 8 -FIXED ASSETS													
DESCRIPTION	GROSS BLOCK					Rate of depreciation	As at the beginning of the year	Depreciation During The Year			Total up to the Year-end	NET BLOCK	
	As on 01.04.2020	Addition during the year before 30.09.2020	Addition during the year after 30.09.2020	Transfer During the Year	As on 31.03.2021			Upto 30.09.2020	After 30.09.2020	Capitalized		As at the Current year-end	As at the previous year-end
	RS.	RS	RS.	RS.	RS.	RS.	RS.	RS.	RS.		RS.	RS.	RS.
A. Fixed Assets:													
1.LAND:													
a)Freehold	10,879,420.00	-	-	-	10,879,420.00	0%	-	-	-	-	-	10,879,420.00	10,879,420.00
b)Leasehold	-	-	-	-	-	-	-	-	-	-	-	-	-
2.BUILDINGS:													
a)On Freehold Land	1,227,998,381.00	42,643,420.00	1,222,759.00	-	1,271,864,560.00	10%	434,641,590.13	83,600,021.09	61,137.95	-	518,302,749.17	753,561,810.83	793,356,790.87
EQUIPMENT													
a) Scientific Equipment	281,574,866.00	52,135,487.30	61,098,225.69	-	394,808,578.99	15%	162,521,008.29	25,678,401.75	4,582,366.93	-	192,781,776.97	202,026,802.02	119,053,857.71
b) I.T.Equipment	116,530,422.00	8,873,726.08	9,921,487.52	-	135,325,635.40	40%	72,120,486.36	21,313,464.69	1,984,297.46	-	95,418,248.51	39,907,386.89	44,409,935.64
4.VEHICLES	12,872,987.00	-	3,000,123.00	-	15,873,110.00	15%	8,154,079.27	707,836.16	225,009.23	-	9,086,924.65	6,786,185.35	4,718,907.73
5.FURNITURE,FIXTURES	26,833,208.00	2,495,282.00	1,206,183.00	-	30,534,673.00	10%	11,469,420.70	1,785,906.93	60,309.15	-	13,315,636.78	17,219,036.22	15,363,787.30
6.OFFICE EQUIPMENT	110,204,993.00	3,627,192.28	3,852,971.44	-	117,685,156.72	15%	64,349,384.55	7,422,420.11	288,972.86	-	72,060,777.52	45,624,379.20	45,855,608.45
8.ELECTRIC INSTALLATIONS	2,203,690.00	-	-	-	2,203,690.00	15%	1,483,946.13	107,961.58	-	-	1,591,907.71	611,782.29	719,743.87
9.LIBRARY BOOKS	89,177,982.00	482,454.00	70,000.00	-	89,730,436.00	40%	70,264,759.00	7,758,270.80	14,000.00	-	78,037,029.80	11,693,406.20	18,913,223.00
10.TUBEWELLS & W.SUPPLY	923,616.00	-	-	-	923,616.00	0%	-	-	-	-	-	923,616.00	923,616.00
11. MUSEUM	-	3,066,569.00	4,857,669.00	-	7,924,238.00	10%	-	306,656.90	242,883.45	-	549,540.35	7,374,697.65	-
12.TOOLS & EQUIPMENTS	3,550,280.00	27,252.00	220,918.00	-	3,798,950.00	15%	2,314,066.20	189,594.87	16,568.85	-	2,520,229.92	1,278,720.08	1,236,213.80
TOTAL OF CURRENT YEAR	1,882,749,845.00	113,351,882.66	85,450,336.45	-	2,081,552,064.11		827,318,740.63	148,870,534.88	7,475,545.87	-	983,664,821.38	1,097,887,242.73	1,055,431,104.37
PREVIOUS YEAR													
II.CAPITAL WORK-IN-PROGRESS	446,023.00	-	-	-	446,023.00		-	-	-	446,023.00	446,023.00	-	446,023.00
TOTAL	1,883,195,868.00	113,351,882.66	85,450,336.45	-	2,081,998,087.11	-	827,318,740.63	148,870,534.88	7,475,545.87	446,023.00	984,110,844.38	1,097,887,242.73	1,055,877,127.37

SH ARUN SINGH RAWAT, (Director General, ICFRE)

SH RAKESH KUMAR DOGRA, (Deputy Director General, Admn., ICFRE)

SH RAJ KUMAR BAJPAI, (ASSISTANT DIRECTOR GENERAL, Admn, ICFRE)

SH BRIJESH KUMAR SHARMA, (SECTION OFFICER, BUDGET SECTION, ICFRE)

FOR ASHISH KUMAR GUPTA & ASSOCIATES
(CHARTERED ACCOUNTANTS)

(CA PREETI GUPTA)
FCA, PARTNER,
MEMBERSHIP NO. 408004
DATED: 15.09.2021
PLACE: DEHRADUN

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH, 2021

Amount-(Rs)

SCHEDULE - 9 INVESTMENTS FROM EARMARKED/ENDOWMENT FUNDS	CURRENT YEAR 31.03.2021	PREVIOUS YEAR
	RS.	RS.
1. In Government Securities		
> F.D.R.(For One Time Special Grant)	160,354,894.00	156,693,442.00
> F.D.R.(With Institutes)	-	-
2. Other Approved Securities	-	-
3. Shares	-	-
4. Debentures and Bonds	-	-
5. Subsidiaries and Joint Ventures	-	-
6. Others(to be specified)	-	-
TOTAL	**160,354,894.00**	**156,693,442.00**

SCHEDULE 10- INVESTMENTS-OTHERS	CURRENT YEAR 31.03.2021	PREVIOUS YEAR
	RS.	RS.
1. In Government Securities		
> F.D.R.(With Institutes)		-
2. Other approved Securities	-	-
3. Shares	-	-
4. Debentures and Bonds	-	-
5. Subsidiaries and Joint Ventures	-	-
6. Others(to be specified)	-	-
TOTAL	-	-

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH, 2021

Amount (Rs)

SCHEDULE - 11 CURRENT ASSETS,LOANS, ADVANCES ETC.	CURRENT YEAR 31.03.2021		PREVIOUS YEAR 31.03.2020	
	RS.	RS.	RS.	RS.
A.CURRENT ASSETS:		-		-
1.INVENTORIES:				
> Stores and Spares		-		-
> Loose Tools		-		-
> Stock in trade		-		-
> Finished Goods		-		-
> Work-In- Progress		-		-
> Raw Materials		-		-
2.Sundry Debtors:				
> Debts Outstanding for a period exceeding six		-		-
> Others		-		-
4.Cash balances in hand(including cheques/drafts and imprest)		549,537.00		262,085.00
5.Bank Balances:				
a)With Scheduled Banks:				
> On Current Accounts	66,854,612.64		9,493,366.42	
> On Deposit Accounts	54,241,521.00		61,921,521.00	
> On Savings Accounts	952,459,773.18	1,073,555,906.82	780,924,059.90	852,338,947.32
b)With non-Scheduled Banks:				
> On Current Accounts	-		-	
> On Deposit Accounts(includes margin money)	-		-	
> On Savings Accounts	-	-	-	-
6.Cheque in Transit				
Revenue t/f by IFGTB-Coimbtore		-		2,959,484.00
Revenue t/f by ARCBR		-		182,166.00
TOTAL (A)		**1,074,105,443.82**	-	**855,742,682.32**

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH, 2021

Amount-(Rs)

SCHEDULE 11 – (A) CURRENT ASSETS,LOANS,ADVANCES ETC.(Cont.)	CURRENT YEAR 31.03.2021		PREVIOUS YEAR 31.03.2020	
	RS.	RS.	RS.	RS.
B.LOANS,ADVANCES AND OTHER ASSETS				
1. Loans:				
a) Staff Advance	1,351,105.00		7,183,143.00	
b) Other Entities engaged in activities/ objectives similar to that of the Entity	-		-	
c) Other(Statuotry Dues)	-	1,351,105.00	6,545,184.00	13,728,327.00
2. Advances and other amounts recoverable in cash or in kind or for value to be received:		194,000.00		-
a) On Capital Account				
CPWD-TFRI	-		-	
CPWD-NE RFRI	425,000.00		425,000.00	
CCU- NE BUDGET SECTION	1,148,000.00		4,250,000.00	
CCU- (PLAN ACCOUNT)FRI	-		(2,579,500.00)	
CCU-(OTSG) BUDGET SECTION				
CCU- IFGTB	964,895.00		1,283,413.00	
CCU-IWST	-		15,105.00	
SCIENTIFIC EQUIPMENTS- IWST	-		-	
ADVANCES FOR MUSEUM RENOVATION- FRI	-		3,000,000.00	
ADVANCES FOR BUILDING RENOVATIONS-	6,213,882.00	8,751,777.00	6,363,084.00	12,757,102.00
b) Others				
Amount Recoverable From Controller, Pension Cell, ICFRE		-		9,622,628.00
Amount Recoverable From PAO (F) NEW DELHI		1,896,964.00		2,475,967.00
Amount Recoverable From Other Units				
Inter unit accounts	-		60,834,226.00	
Misc Recoveries	6,171,926.00		6,171,926.00	
Payable to contoller ICFRE	-		3,898,615.99	
Other Unit	-	6,171,926.00	(85,663.00)	70,819,104.99
3. Income Accrued:				
a) On Investments from Earmarked/Endowments Funds	-		-	
b) On Investments-Others	-		-	
c) On Loans and Advances	2,083,590.00		2,083,590.00	
d) Others (includes income due unrealized - Rs.....)	-	2,083,590.00	-	2,083,590.00
4. Claims Receivable		-		
TOTAL(B)		**20,449,362.00**		**111,486,718.99**
TOTAL(A+B)		**1,094,554,805.82**		**967,229,401.31**

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN

SCHEDULES FORMING PART OF INCOME EXPENDITURE ACCOUNT

FOR THE YEAR ENDING 31ST MARCH, 2021

SCHEDULE 12 – INCOME FROM SALES/SERVICES	Current Year 31.03.2021	Previous Year 31.03.2020
1) Income from Sales		
a) Sale of Finished Goods	-	11,794,641.00
b) Sale of Raw Material	-	38,762.00
c) Sale of Scrap	-	-
d) Sale of Forest Products	15,098,650.00	-
e) Sale of Publication	159,883.00	-
f) Sale of Tender Documents	242,690.00	-
g) Sale of Unserviceable Stores	19,919,302.00	-
2) Income from Services		
a) Service Charges	2,706,059.00	30,384,736.41
b) Professional /Consultancy Services	4,709,062.00	20,059,170.52
c) Agency Commission and Brokerage	-	-
d) Maintenance Services(Equipment/Property)	-	-
e) Others(Specify)	12,740,867.00	11,800.00
f) Shairing Cost received from Other Users of KV	-	-
g) Treatment Charges	1,978,183.00	-
h) Testing Charges	6,054,048.00	-
TOTAL	**63,608,744.00**	**62,289,109.93**

SCHEDULE 13 –GRANTS/SUBSIDIES	Current Year 31.03.2021	Previous Year 31.03.2020
(Irrevocable Grants& Subsidies Received)		
1) Central Government	-	-
- To Plan (Salary & General)	2,120,000,000.00	2,250,000,000.00
- Refund from KV	-	-
- To North East (GC-General)	-	-
2) State Government	-	-
3) Government Agencies	-	-
4) Institutions/Welfare Bodies	-	-
5) International Organisations	-	-
6) Others(Specify)	-	-
	-	-
TOTAL	**2,120,000,000.00**	**2,250,000,000.00**

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN

SCHEDULES FORMING PART OF INCOME EXPENDITURE ACCOUNT FOR THE YEAR ENDING 31ST MARCH, 2021

SCHEDULE 14 –FEES/SUBSCRIPTION	Current Year 31.03.2021	Previous Year 31.03.2020
	RS.	RS.
1) Entrance Fees	-	-
2) Annual Fees/Subscription	-	-
3) Seminar/Program Fees/Recruitment fees	-	-
4) Consultancy Fees	46,523,147.80	16,693,439.00
5) Others(Sharing Cost)	-	-
TOTAL	**46,523,147.80**	**16,693,439.00**

SCHEDULE 15-INCOME FROM INVESTMENTS	Investment -Others	
(Income on Invest .from Earmarked/Endowment funds transferred to Funds)	Current Year 31.03.2021	Previous Year 31.03.2020
	RS.	RS.
1) Interest	-	
a) On Govt. Securities	-	-
b) Other Bonds/Debentures	-	-
2) Dividends:	-	-
a) On Shares	-	-
b) On Mutual Fund Securities	-	-
3) Rents	528,582.00	-
4) Others(Specify)	-	-
TOTAL	**528,582.00**	-

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN

SCHEDULES FORMING PART OF INCOME EXPENDITURE ACCOUNT FOR THE YEAR ENDING 31ST MARCH, 2021

(Amount – Rs.)

SCHEDULE 16 – INCOME FROM ROYALTY, PUBLICATION ETC.	Current Year 31.03.2021	Previous Year 31.03.2020
	RS.	RS.
1) Income from Royalty	-	-
2) Income from Publications	-	-
3) Others (specify)	937,286.00	21,740,068.00
4) Revenue Received (House Licence Fees,Guest House,Mandap etc.	12,693,001.00	36,393,897.17
TOTAL	13,630,287.00	58,133,965.17

SCHEDULE 17 – INTEREST EARNED ETC.	Current Year 31.03.2021	Previous Year 31.03.2020
	RS.	RS.
1) On Term Deposits:		
a) With Scheduled Banks	2,903,644.00	1,120,518.00
b) With Non-Scheduled Banks	-	-
c) With Institutions	-	-
d) Others	-	-
2) On Saving Accounts:		
a) With Scheduled Banks	32,292,908.97	24,091,612.80
b) With Non—Scheduled Banks	-	-
c) Post Office Savings Accounts	-	-
d) Others		
3) On Loans:		
i) Interest accrued during the year		
a) Employees/Staff	-	-
ii) Interest earned during the year		
a) Employees/Staff	275,364.00	399,558.00
4) Interest on Debtors and Other Receivables	-	-
TOTAL	35,471,916.97	25,611,688.80

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN
SCHEDULES FORMING PART OF INCOME EXPENDITURE ACCOUNT
FOR THE YEAR ENDING 31ST MARCH, 2021

(Amount – Rs.)

SCHEDULE 18 – OTHER INCOME /PRIOR PERIOD ITEMS:	CURRENT YEAR 31.03.2021 RS.	PREVIOUS YEAR 31.03.2020 RS.
1) Profit on Sale/disposal of Assets:		
a) Owned assets	-	-
b) Assets acquired out of grants, or received free of cost	-	-
2) Revenue (Excluding interest on bank deposits, loans and	-	140,194,415.25
2) Recovery of various amount from OTSG	-	-
3) Fees for Miscellaneous Services	2,271,534.00	1,367,168.00
4) Miscellaneous Income	24,726,756.35	34,234,925.06
5) Revenue earn but not yet transfer	-	802,779.00
6) Income Tax Refund	8,144,354.00	-
7) Prior Period Items	-	-
Income under booked	-	-
Bank interest over capitalised	-	-
TOTAL	**35,142,644.35**	**176,599,287.31**

SCHEDULE 19 – INCREASE/(DECREASE) IN STOCK OF FINISHED GOODS & WORK IN PROGRESS	CURRENT YEAR 31.03.2021 RS.	PREVIOUS YEAR 31.03.2020 RS.
a) Closing stock		
- Finished Goods	-	-
- Work-in-progress	-	-
b) Less: Opening Stock	-	
- Finished Goods	-	-
- Work-in-progress	-	-
NET INCREASE(DECREASE) [a-b]	-	-

SCHEDULE 20 – ESTABLISHMENT EXPENSES	CURRENT YEAR 31.03.2021 RS.	PREVIOUS YEAR 31.03.2020 RS.
a) Salaries and Wages		
Plan (General Components-General)		
Salaries	1,471,004,790.47	1,482,629,498.00
Grant to KV	87,366,000.00	100,264,000.00
b) Allowances and Bonus	-	20,888,104.00
c) Contribution to Provident Fund	-	-
d) Contribution to other Fund (specify)	-	296,188,000.00
Revenue Paid to pension cell ICFRE	201,517,842.00	105,799,000.00
Grant Paid to pension cell ICFRE	263,425,000.00	-
Revenue transfer to ICFRE PHS	10,000,000.00	10,000,000.00
e) Misc Expenditure in Revenue Account	-	-
f) Expenses on Employees' Retirement and Terminal Benefits	-	-
g) Bank Interest Refunded to Ministry/Funding Agencies	34,118,490.57	45,510.00
h) Salary paid in excess than provision of previous year	-	-
TOTAL	**2,067,432,123.04**	**2,015,814,112.00**

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN
SCHEDULES FORMING PART OF INCOME EXPENDITURE ACCOUNT
FOR THE YEAR ENDING 31ST MARCH, 2021

(Amount – Rs.)

SCHEDULE 21 – OTHER ADMINISTRATIVE EXPENSES ETC.	CURRENT YEAR 31.03.2021		PREVIOUS YEAR 31.03.2020	
Administrative Expenses	RS.		RS.	
A. Infrastructure		-		
a. Rent and Taxes	2,137,745.00	-	13,235,618.00	
b. Elect./Water Charges	37,308,674.00	-	39,825,758.00	
c. Veh. Running Exp. (Fuel)	3,153,260.00		3,809,644.00	
d. Insurance	969,194.00	43,568,873.00	625,972.00	57,496,992.00
B. Repairs and Maintenance of Infrastructure of Assets				
a. Roads and Building (Minor works)	35,203,422.40		54,165,620.33	
b. Plants & Mach. (Equ. Secentific)	2,655,543.00		297,504.00	
c. Furniture and Fixtures	39,534.00		271,333.00	
d. Vehicle (Repair)	2,733,681.00		4,652,595.00	
e. Office/IT Euipment	8,296,234.00	48,928,414.40	11,232,483.00	70,619,535.33
C. Communication				
a. Postage and Telephone		2,948,865.00		3,055,534.00
D. Others				
a. Newspaper and Periodicals	2,090,152.00		3,063,448.00	
b. Stattionary	1,857,750.00		2,512,507.00	
c. Travel & Convey (N. Res.) Dom (TE)	2,355,450.00		13,265,027.00	
d. Legal and Prof. Charges	702,699.00		3,012,025.00	
e. Auditor's Renumeration	199,231.00		202,132.00	
f. Hospitality Expenses	-		-	
g. Medicines & Medical Consu.	3,078,887.00		4,755,504.00	
h. Liveries	105,000.00		130,000.00	
i. Contingency	162,648,641.05		180,191,681.19	
j. Others	12,983,612.36	186,021,422.41	7,159,716.23	214,292,040.42
E. Research Expenses				
Travel & Conv. (Res.)- Dom. (T.E.)	6,620,567.95		12,871,666.00	
Others Consumables (M&S)	9,438,818.55	-	9,444,313.00	
Other Research Expenditure(FRE)	8,577,056.50		25,242,902.50	
Fellowship	28,157,541.00		34,170,151.00	
Maint. Of Equipment	1,765,346.00		2,677,146.00	
Others (RAG,RPC meeting)	668,871.00		1,315,614.00	
Contingency	2,775,652.85		-	
Demo Plantation	694,440.85		-	
Training	42,467.00		-	
Salary	385,826.00		-	
Consultancy	79,783.00		-	
FRE	6,955,799.00		-	
Human Resource Development	38,837.00		5,316,310.00	
Testing Charges	6,292,616.00		-	
Seminar/ Conferences	-		3,439,779.00	
Other (Specified)	-		3,570,661.12	
ICFRE Awards	-			
Policy Research Studies	-	72,493,622.70		98,048,542.62
F. Education Expenses		717,177.00		
G. Extension				
Direct to Consumers- Projects	5,788.00		608,191.00	
Ext. Activities- VVK Demo. Training etc.	84,406.00		-	
Normal	1,367,033.00		3,767,983.00	
VVK	701,734.00		3,494,557.00	
Advertisement and Publicity	1,090,242.00		3,064,798.00	
Printing & Publication	2,049,116.00	5,298,319.00	5,083,488.00	16,019,017.00
Revenue paid to others		-		8,297,709.01
Revenue Paid to DDG ICFRE		-		140,194,415.85
Revenue t/f to others		-		332,733.00
Prior Period Expenses		-		-
TOTAL		**359,976,713.51**		**608,356,519.23**

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN
SCHEDULES FORMING PART OF INCOME EXPENDITURE ACCOUNT
FOR THE YEAR ENDING 31ST MARCH, 2021

(Amount – Rs.)

SCHEDULE 22 – EXPENDITURE ON GRANTS, SUBSIDIES ETC..	CURRENT YEAR 31.03.2021	PREVIOUS YEAR 31.03.2020
	RS.	RS.
a) Grants given to Institutions/Organisations	-	-
> Grants to Universities	26,907,651.00	-
b) Subsidies given to Institution/Organisations	-	-
TOTAL	26,907,651.00	-

SCHEDULE 23 – INTEREST.	CURRENT YEAR 31.03.2021	PREVIOUS YEAR 31.03.2020
	RS.	RS.
a) On Fixed Loans	-	-
b) On Other Loans (including Bank Charges)	-	-
c) Other (specify)	-	-
TOTAL	-	-

INDIAN COUNCIL FORESTRY RESEARCH AND EDUCATION

NOTES TO ACCOUNTS FOR THE YEAR ENDED MARCH 31, 2021

Schedule 24: Significant accounting policies and notes to accounts

Significant accounting policies

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

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

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

4. **Revenue Recognition**
   Revenue is recognized when income is actually transferred to 'own revenue account' maintained by centers.

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

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

7. Earmarked Fund

Project Accounts: The receipts and payments of consultancy projects and externally aided projects are included in this head.

8. Employee Benefits

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

9. Taxation

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

10. Contingencies Liabilities and assets

A disclosure for a contingent liability is made when there is a possible obligation or a present obligation that probably will not require an outflow of resources or where a reliable estimate of obligation cannot be made.

Contingent liabilities are not recognized in the financial statements nor disclosed in the notes to the financial statements.

SH ARUN SINGH RAWAT, (Director General, ICFRE)

FOR ASHISH KUMAR GUPTA & ASSOCIATES
(CHARTERED ACCOUNTANTS)

SH RAKESH KUMAR DOGRA, (Deputy Director General, Admin, ICFRE)

(CA PREETI GUPTA)
FCA, PARTNER
MEM. NO. 408004
DATED: 15.09.2021
PLACE: DEHRADUN

SH RAJ KUMAR BAJPAI, (Assistant Director General, Admin, ICFRE)

SH BRIJESH KUMAR SHARMA, (Section Officer, Budget Section, ICFRE)

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, EDUCATION
RECEIPT AND PAYMENT ACCOUNT FOR THE YEAR ENDING ON 31 MARCH 2021

Receipts	Amount	Amount	Payment	Amount	Amount
To Opening Cash & Cash Equivalent			By Refund to Ministry		11,81,122.00
- Cash in hand	2,62,085.00				
- Saving Account Balance	78,09,24,059.90		By Establishment Expenses	2,06,66,36,627.04	
- Current Account Balance	94,93,366.42		By Other Administrative Expenses	34,87,80,583.51	
- Deposits Balance	6,19,21,521.00		By Grant to Universities	2,69,07,651.00	
- Cheque in Transit	31,41,650.00	85,57,42,682.32	By EAP/SFRESPE Expenses	50,74,67,367.66	2,94,97,92,229.21
To Grant in Aid			**By Loan, Advances and Other Assets**		
- Salary	1,80,00,00,000.00		- Advances Recoverable in Cash or Kind	1,94,000.00	
- General	32,00,00,000.00		- CCU- (PLAN ACCOUNT)FRI	25,79,500.00	
			- ADVANCES FOR BUILDING RENOVATIONS-		
- Capital	6,02,52,000.00	2,18,02,52,000.00	CCU(IWST)	1,07,28,410.00	1,35,01,910.00
To Chair of Excellence			**By Chair of Excellence**		
- Interest on FDR	48,57,242.00		- FDR Created	17,36,37,371.00	
- FDR Matured	16,99,75,919.00	17,48,33,161.00	- Expenses Incurred	5,00,000.00	17,41,37,371.00
To Reimbursment from PAO New Delhi	5,60,91,245.00		By Reimbursment from PAO New Delhi	4,53,22,195.00	
			By Reimbursment from under secretary Pension		
To Reimbursment from under secretary Pension cell	5,07,79,392.00		cell	5,74,05,121.00	
To Recovery from staff on behalf of under secretary			By Recovery from staff on behalf of under		
Pension cell (deduction from salary)	8,89,69,966.00		secretary Pension cell (deduction from salary)	8,88,85,305.00	
To Recovery from staff on behalf of other offices in			By Recovery from staff on behalf of other offices		
deputation (Deputation from Salary)	76,62,093.28		in deputation (Deputation from Salary)	74,73,116.28	
			By Recovery of Advances from staff on behalf of		
To Recovery of Advances from staff on behalf of ICFRE	3,37,78,357.00		ICFRE	2,79,46,319.00	
To Recovery from staff on behalf of other offices			By Recovery from staff on behalf of other offices		
(Deductions from salary)	6,77,04,807.00	30,49,85,860.28	(Deductions from salary)	5,91,25,906.00	28,61,57,962.28
To Security & EMD Received		74,48,309.04	By Security & EMD Paid		67,47,718.00
To Projects Receipts		89,65,56,052.07	**By Fixed Assets Purchased**		
			- Plan Capital	5,94,95,540.70	
By Recovered From Controller, Pension Cell, ICFRE		1,73,86,211.00	- EAP/SFRESPE	13,44,99,680.40	19,39,95,221.10
By Loan, Advances and Other Assets			**To Closing Cash & Cash Equivalent**		
- CCU- NE BUDGET SECTION	18,11,147.00		- Cash in hand	5,49,537.00	
- CCU-IWST	15,105.00	18,26,252.00	- Saving Account Balance	95,24,59,773.18	
			- Current Account Balance	6,68,54,612.64	
By Inter Units Accounts		5,76,06,913.00	- Deposits Balance	5,42,41,521.00	1,07,41,05,443.82
To Income from sales/services	6,36,08,744.00				
To Fees/Subscriptions	4,65,23,147.80				
To Income from Investments	5,28,582.00				
To Income from Royalty, Publications etc	1,36,30,287.00				
To Interest Earned	3,54,71,916.97				
To Other Income	3,51,42,644.35				
To Revenue earn in plan account	46,39,424.58				
To Revenue earn in other than plan accounts	2,95,146.00	19,98,39,892.70			
By Cheque in Tranist Realised		31,41,650.00			
Total		**4,69,96,18,977.41**	**Total**		**4,69,96,18,977.41**

SH ARUN SINGH RAWAT, (Director General, ICFRE)

SH RAKESH KUMAR DOGRA, (Deputy Director General, Admin., ICFRE)

SH RAJ KUMAR BAJPAI, (ASSISTANT DIRECTOR GENERAL, Admin, ICFRE)

SH BRIJESH KUMAR SHARMA, (SECTION OFFICER, BUDGET SECTION, ICFRE)

FOR ASHISH KUMAR GUPTA & ASSOCIATES
(CHARTERED ACCOUNTANTS)

(CA PREETI GUPTA)
FCA, PARTNER,
MEMBERSHIP NO. 408004
DATED:
PLACE: DEHRADUN

BALANCE SHEET OF CONTROLLER,PENSION CELL, OF (GPF, GSLIS, PENSION SCHEME AND NEW PENSION SCHEME) INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN AS ON 31ST MARCH, 2021

ANNEXURE 1

GENERAL FUND AND LIABILITIES	CURRENT YEAR AS ON 31.03.2021	PREVIOUS YEAR AS ON 31.03.2020
GENERAL PROV.FUND A/C	901,020,805.89	894,552,826.89
GSLIS A/C	1,637,027.11	1,093,685.00
PENSION A/C	749,691,753.69	734,761,836.69
PENSION A/C OF CG EMPLOYEES OPTED FOR ICFRE SERVICES	-	-
NEW PENSION FUND A/C	8,297,720.46	10,795,385.00
ICFRE PHS	39,555,593.59	38,731,352.61
TOTAL	1,700,202,900.74	1,679,935,086.19
ASSETS	**CURRENT YEAR AS ON 31.03.2021**	**PREVIOUS YEAR AS ON 31.03.2020**
FIXED ASSETS		
CURRENT ASSETS LOANS & ADV.	-	-
INVESTMENTS-OTHERS		
- FIXED DEPOSITS	1,562,899,953.00	1,260,900,000.00
CASH & BANK BALANCES:	137,302,947.74	419,035,086.19
TOTAL	1,700,202,900.74	1,679,935,086.19

SH. ARUN SINGH RAWAT (Director General, ICFRE)

SH RAKESH KUMAR DOGRA, (Dy. Director General, Admin., ICFRE)

SH RAJ KUMAR BAJPAI (Asstt Director General, Admin, ICFRE)

SH BRIJESH KUMAR SHARMA (Section Officer, Budget Section, ICFRE)

FOR ASHISH KUMAR GUPTA & ASSOCIATES
CHARTERED ACCOUNTANTS

CA Preeti Gupta
(Partner, FCA)
Membership No: 408004
Dated: 15.09.2021

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN

ANNEXURE 2

PENSION-INCOME & EXPENDITURE ACCOUNT FOR THE YEAR ENDING 31ST MARCH 2021

INCOME	AMOUNT
Received from Revenue ICFRE	464,942,842.00
Pension Contribution	46,798,701.00
Interest	28,883,980.00
TOTAL:.....	540,625,523.00
EXPENDITURE	**AMOUNT**
Reimbursment to ICFRE(AO) a/c 9605	58,906,465.00
Reimbursement to other insitute	10,378.00
Payment to Institutes (AO) for Gratuity Payments	21,063,215.00
Miscellaneous Expenses	295.00
Excess Of Income Over Expentiture	460,645,170.00
TOTAL:.....	540,625,523.00

PENSION A/C OF CG EMPLOYEES OPTED FOR ICFRE SERVICES-INCOME & EXPENDITURE ACCOUNT FOR THE YEAR ENDING 31ST MARCH 2021

INCOME	AMOUNT
Miscellaneous Receipts	25,716.00
Pension Contribution	263,425,000.00
Interest	485,208.00
TOTAL:.....	263,935,924.00
EXPENDITURE	**AMOUNT**
Reimbursment to ICFRE(AO) a/c 9605	30,988,078.00
Reimbursement to other insitute	81,494.00
Payment to Institutes (AO) for Gratuity Payments	62,156,842.00
Reimbursment to ICFRE(AO) a/c 9824	352,999,763.00
Excess Of Income Over Expentiture	(182,290,253.00)
TOTAL:.....	263,935,924.00

GPF-INCOME & EXPENDITURE ACCOUNT FOR THE YEAR ENDING 31ST MARCH 2021

INCOME	AMOUNT
Interest	30,017,621.00
GPF Subscription	174,693,304.00
TOTAL:.....	204,710,925.00
EXPENDITURE	**AMOUNT**
GPF Advance to Institutes	17,491,156.00
GPF Expenditure	180,751,790.00
Excess Of Income Over Expentiture	6,467,979.00
TOTAL:.....	204,710,925.00

GSLIS-INCOME & EXPENDITURE ACCOUNT FOR THE YEAR ENDING 31ST MARCH 2021

INCOME	AMOUNT
Interest	54,240.00
GSLIS Contribution from Institutes	1,379,159.00
Amount receive from LIC on account of saving fund	3,576,480.00
Amount receive from LIC on account of Insurance claim	648,705.00
TOTAL:.....	5,658,584.00
EXPENDITURE	**AMOUNT**
Amount paid to LIC on account of GSLIS subsription	1,380,434.00
Amount paid on a/c of saving funds	3,282,038.00
Amount paid on account of insurance claim	452,770.00
Excess Of Income Over Expentiture	543,342.00
TOTAL:.....	5,658,584.00

NEW PENSION ACCOUNT INCOME & EXPENDITURE A/C FOR THE YEAR ENDING 31ST MARCH, 2021

INCOME	AMOUNT
Interest	443,205.00
NPS Contribution from Institutes	57,134,371.00
TOTAL:.....	57,577,576.00
EXPENDITURE	**AMOUNT**
Paid to NSDL on account of NPS contribution	60,075,241.00
Excess Of Income Over Expentiture	(2,497,665.00)
TOTAL:.....	57,577,576.00

ICFREPHS INCOME & EXPENDITURE A/C FOR THE YEAR ENDING 31ST MARCH, 2021

INCOME	AMOUNT
Received from Revenue ICFRE	10,000,000.00
Amount received from pensioner's under ICFRE Contribution	3,581,400.00
Interest	2,792,840.98
TOTAL:.....	16,374,240.98
EXPENDITURE	**AMOUNT**
Reimbursment to ICFRE(AO) a/c 9824	1,000,000.00
Reimbursement to other insitute	14,550,000.00
Excess Of Income Over Expentiture	824,240.98
TOTAL:.....	16,374,240.98

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN
DETAILS OF PENSION FUND AS ON 31ST MARCH 2021

ANNEXURE 3

	GPF (3491)	GSLIS (3498)	PENSION FUND (3660)	PENSION FUND (89822)	NEW PENSION (4994)	ICFREPHS (7440)	TOTAL
Opening Cash & Cash Equivalent	**894,552,826.89**	**1,093,685.11**	**734,761,836.69**	-	**10,795,385.46**	**38,731,352.61**	**1,679,935,086.76**
Receipts							
Bank Interest	30,017,621.00	54,240.00	28,883,980.00	485,208.00	443,205.00	2,792,840.98	62,677,094.98
GPF Subscription from Individuals deputed to other institutes	1,323,280.00	-	-	-	-	-	1,323,280.00
GPF Subscribtion and GPF Advances from Institutes (AO)	173,370,024.00	-	-	-	-	-	173,370,024.00
GSLIS Contribution from Institutes	-	1,379,159.00	-	-	-	-	1,379,159.00
Amount receive from LIC on account of saving fund	-	3,576,480.00	-	-	-	-	3,576,480.00
Amount receive from LIC on account of Insurance claim	-	648,705.00	-	-	-	-	648,705.00
Pension received from Budget ICFRE	-	-	201,517,842.00	-	-	-	201,517,842.00
Pension Contribution from Institutes	-	-	45,910,067.00	-	-	-	45,910,067.00
Pension Contribution from Individuals deputed to other institutes	-	-	888,634.00	-	-	-	888,634.00
Pension received from Budget ICFRE for CG Employees (Part of GRANT)	-	-	-	263,425,000.00	-	-	263,425,000.00
NPS Contribution from Institutes	-	-	-	-	57,186,259.00		57,186,259.00
Amount received from pensioner's under ICFRE Contribution	-	-	-	-	-	3,581,400.00	3,581,400.00
Amount received from DG Admin (Budget)	-	-	-	-	-	10,000,000.00	10,000,000.00
Inter Divisional Transfer	-	-	(182,290,253.00)	182,290,253.00			-
Miscellaneous Receipts	-	-	-	25,716.00	-	-	25,716.00
TOTAL:A	**204,710,925.00**	**5,658,584.00**	**94,910,270.00**	**446,226,177.00**	**57,629,464.00**	**16,374,240.98**	**825,509,660.98**
Payments							
GPF Advance to Institutes	17,491,156.00	-	-	-	-	-	17,491,156.00
GPF Expenditure	180,751,790.00	-	-	-	-	-	180,751,790.00
Amount paid to LIC on account of GSLIS subscription	-	1,380,434.00	-	-	-	-	1,380,434.00
Amount paid on a/c of saving funds	-	3,282,038.00	-	-	-	-	3,282,038.00
Amount paid on account of insurance claim	-	452,770.00	-	-	-	-	452,770.00
Reimbursment to ICFRE(AO) a/c 9605	-	-	58,906,465.00	30,988,078.00	-	-	89,894,543.00
Reimbursement to other institute	-	-	10,378.00	81,494.00	-	-	91,872.00
Payment to Institutes (AO) for Gratuity Payments	-	-	21,063,215.00	62,156,842.00	-	-	83,220,057.00
Reimbursment to ICFRE(AO) a/c 9824	-	-	-	352,999,763.00	-	-	352,999,763.00
Paid to NSDL on account of NPS contribution	-	-	-	-	60,075,241.00	-	60,075,241.00
Refund of Contribution Received	-	-	-	-	51,888.00	-	51,888.00
Reimbursment to ICFRE(AO) a/c 9824	-	-	-	-	-	1,000,000.00	1,000,000.00
Reimbursement to other institute	-	-	-	-	-	14,550,000.00	14,550,000.00
Misc payments	-	-	295.00	-	-	-	295.00
TOTAL:B	**198,242,946.00**	**5,115,242.00**	**79,980,353.00**	**446,226,177.00**	**60,127,129.00**	**15,550,000.00**	**805,241,847.00**
Balance (C=A-B)	**6,467,979.00**	**543,342.00**	**14,929,917.00**	-	**(2,497,665.00)**	**824,240.98**	**20,267,813.98**
Total = C + Opening Cash & Cash Equivalent	**901,020,805.89**	**1,637,027.11**	**749,691,753.69**	-	**8,297,720.46**	**39,555,593.59**	**1,700,202,900.74**
Closing Balance Flexi	22,500,000.00	-	-	-	7,000,000.00	-	29,500,000.00
FDR's	877,199,970.00	-	617,199,983.00	-	-	39,000,000.00	1,533,399,953.00
Cash at Bank Account	1,320,835.89	1,637,027.11	132,491,770.69	-	1,297,720.46	555,593.59	137,302,947.74
Closing Cash & Cash Equivalent	**901,020,805.89**	**1,637,027.11**	**749,691,753.69**	-	**8,297,720.46**	**39,555,593.59**	**1,700,202,900.74**

Annexure-37

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN
INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2021
DDO (Admin.), ICFRE (Hqtr.), Dehradun

INCOME	Current Year 31.03.2021	Previous Year 31.03.2020
	RS	RS.
Income from sales/services	5,08,80,540.00	60,78,887.00
Grants/Subsidies-Salary and General	16,69,86,000.00	18,26,50,000.00
Fees/Subscriptions	17,05,000.00	1,19,16,000.00
Income from Investments (Income on Invest .from earmarked/endow. Funds transferred to Funds)		
Income from Royalty, Publications etc.		4,500.00
Interest Earned	58,53,485.00	59,40,662.00
Other Income	1,00,34,515.40	2,45,97,170.00
Increase/(decrease) in stock of finished goods and works-in-progress	-	-
Total	23,54,59,540.40	23,11,87,219.00

EXPENDITURE	Current Year 31.03.2021	Previous Year 31.03.2020
	RS.	RS.
Establishment Expenses	12,78,87,433.92	13,80,36,759.00
Other Administrative Expenses etc.	3,68,61,756.37	5,13,91,648.00
Creation of assets under Capital	17,04,592.40	1,19,08,456.00
Expenditure on Grants, Subsidies etc.		
Interest paid	64,66,217.00	53,27,930.00
Depreciation(Net Total at the year end-corresponding to Schedule 8)		
prior period item (Depreciation for last year).		
Other Income	2,20,00,220.40	1,26,31,465.00
Institutional Charges	5,13,55,540.00	56,03,887.00
Income from Royalty, Publications etc.	4,500.00	
Total	24,62,80,260.09	22,49,00,145.00

Signature of DDO with Seal

लेखा अधिकारी
भा.वा.अ.शि.परि.
देहरादून

Annexure-37

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN
INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2021
VAN VIGAYN BHAWAN, NEW DELHI

INCOME	Current Year 31.03.2021	Previous Year 31.03.2020
	RS	RS.
Income from sales/services		
Grants/Subsidies-Salary and General	1,285,016.42	2,950,886.04
Grants/Subsidies-Capital	1,768.00	226,248.00
Rent receipts	528075.24	1,810,922.00
Intrest from maintenance charge receive in rent	170,961.00	120,390.00
Intrest received from bank	3,263.00	4,954.00
Income from maintenance charges	330,439.00	1,457,800.00
Intrest earned in Maintenance charges	169,135.00	170,961.00
Increase/(decrease) in stock of finished goods and works-in-progress	-	
	-	-
Total	**2,488,654.66**	**6,742,161.04**

EXPENDITURE	Current Year 31.03.2021	Previous Year 31.03.2020
	RS.	RS.
Establishment Expenses from service charges	238,710.33	613,382.28
Other Administrative Expenses etc.	1,266,479.30	2,813,869.62
Creation of assets under Capital	283.20	224,480.00
Intrest paid	170,961.00	120,390.00
Revenue transferred to DG ICFRE	686,893.24	1,747,076.21
Total	**2,363,327.07**	**5,519,198.11**

Signature of DDO with Seal

Van Vigyan Bhawan
Sector-6, R K Puram
New Delhi-110022

Annexure-37

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN
INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2021
FOREST RESEARCH INSTITUTE, DEHRADUN

INCOME	Current Year 31.03.2021	Previous Year 31.03.2020
	RS	RS.
Income from sales/services	38,598,156.12	38,373,436.24
Grants/Subsidies-Salary and General	673,043,914.00	721,129,247.00
Grants/Subsidies-Capital	32,764,629.00	14,414,000.00
Fees/Subscriptions		
Income from Investments (Income on Invest .from earmarked/endow. Funds transferred to Funds)		
Income from Royalty, Publications etc.		
Interest Earned		
Other Income		
Increase/(decrease) in stock of finished goods and works-in-progress	-	-
Total	744,406,699.12	773,916,683.24

EXPENDITURE	Current Year 31.03.2021	Previous Year 31.03.2020
	RS.	RS.
Establishment Expenses	502,430,387.00	514,020,740.00
Other Administrative Expenses etc.	135,074,952.00	167,689,471.00
Creation of assets under Capital	32,764,629.00	14,357,216.00
Expenditure on Grants, Subsidies etc.		
Interest paid		
Depreciation(Net Total at the year end-corresponding to Schedule 8)		
prior period item (Depreciation for last year).		
Other Income (Revenue transferred to DG ICFRE)		36,344,655.24
Institutional Charges		
Income from Royalty, Publications etc.		
Total	670,269,968.00	732,412,082.24

12/4/2021
अनुभाग अधिकारी
बजट एवं अंकेक्षण अनुभाग
वन अनुसंधान संस्थान, देहरादून

Signature of DDO
With Seal
लेखा अधिकारी
वन अनुसंधान संस्थान
देहरादून

Annexure-37

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN
INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2021
Forest Research Centre for Eco Rehabilitation, Prayagraj

INCOME	Current Year 31.03.2021	Previous Year 31.03.2020
	RS	RS.
Income from sales/services	1,39,802.00	22,353.00
Grants/Subsidies-Salary and General	1,93,86,000.00	1,73,34,000.00
Grants/Subsidies-Capital	1,00,000.00	5,39,000.00
Fees/Subscriptions	14,000.00	52,000.00
Income from Investments (Income on Invest .from earmarked/endow. Funds transferred to Funds)	-	-
Income from Royalty, Publications etc.	600.00	-
Interest Earned	41,083.88	1,47,311.00
Other Income	100.00	28,000.00
Other Income (Account Balance)	360.77	8,23,442.52
Increase/(decrease) in stock of finished goods and works-in-progress		
Total	**1,96,81,946.65**	**1,89,46,106.52**

EXPENDITURE	Current Year 31.03.2021	Previous Year 31.03.2020
	RS.	RS.
Establishment Expenses	1,51,37,344.00	1,19,98,682.00
Other Administrative Expenses etc.	40,74,785.10	39,77,753.00
Creation of assets under Capital	99,839.00	5,39,703.00
Expenditure on Grants, Subsidies etc.	-	10,07,346.00
Interest paid	41,083.88	1,47,311.00
Depreciation(Net Total at the year end-corresponding to Schedule 8)	-	-
prior period item (Depreciation for last year).		
Other Income	-	11,60,172.00
Institutional Charges	-	28,000.00
Income from Royalty, Publications etc.	-	8,23,442.52
Total	**1,93,53,051.98**	**1,96,82,409.52**

Signature of DDO
with Seal

Annexure-37

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN
INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2021
Institute of Forest Genetics & Tree Breeding, Coimbatore

INCOME	Current Year 31.03.2021	Previous Year 31.03.2020
	RS	RS.
Income from sales/services	21,96,275.00	20,92,218.00
Grants/Subsidies-Salary	16,00,83,000.00	15,82,06,000.00
Grants/Subsidies- General	2,48,25,000.00	4,41,47,000.00
Grants/Subsidies-Capital	15,46,000.00	43,29,000.00
Fees/Subscriptions		
Income from Investments (Income on Invest .from earmarked/endow. Funds transferred to Funds)		
Income from Royalty, Publications etc.	16,613.00	38,214.00
Interest Earned	15,93,406.97	21,88,731.00
Other Income	33,70,568.50	48,10,581.93
Grants received from EAPs	6,73,39,709.20	6,41,09,696.32
Service Charges Account	3,74,253.00	4,03,947.00
AICRP CAMPA Projects	9,12,49,000.00	2,45,00,000.00
	-	-
Total	**35,25,93,825.67**	**30,48,25,388.25**

EXPENDITURE	Current Year 31.03.2021	Previous Year 31.03.2020
	RS.	RS.
Establishment Expenses	16,23,64,723.00	17,23,17,270.00
Other Administrative Expenses etc.	1,78,18,699.00	2,64,64,017.00
Researech & Operational Expenses	73,20,521.00	1,73,71,397.00
Creation of assets under Capital	15,52,432.00	43,23,553.00
Expenditure on Grants, Subsidies etc.		
Revenue transferred to ICFRE HQ	54,03,200.47	90,23,658.93
Expenditure under EAPs	6,91,17,960.43	6,11,03,823.32
Expenditure under Serevice Charges A/c	1,48,029.00	1,44,300.00
Expenditure on AICRP-CAMPA Projects	3,49,49,389.70	24,39,532.20
Income from Royalty, Publications etc.		
Total	**29,86,74,954.60**	**29,31,87,551.45**

23/01/2021.

(C. Kunhikannan)
Director
IFGTB, Coimbatore

(N. Usha)
Accounts Officer
IFGTB, Coimbatore

Annexure-37

INSTITUTE OF WOOD SCIENCE AND TECHNOOGY, BANGALORE
INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2021

INCOME	Current Year 31.03.2021	Previous Year 31.03.2020
	RS	RS.
Income from sales/services	94,83,269	2,67,000
Grants/Subsidies-Salary and General	15,88,52,000	15,58,44,000
Grants/Subsidies-Capital	1,22,00,000	55,28,000
Fees/Subscriptions	5,000	17,85,549
Income from Investments (Income on Invest .from earmarked/endow. Funds transferred to Funds)	21,59,334	
Income from Royalty, Publications etc.	5,66,454	
Interest Earned	12,37,256	19,84,139
Other Income	-	27,98,573
EAP	-	55,26,208
Increase/(decrease) in stock of finished goods and works-in-progress	-	
	-	-
Total	18,45,03,313.00	17,37,33,469.00

EXPENDITURE	Current Year 31.03.2021	Previous Year 31.03.2020
	RS.	RS.
Establishment Expenses	13,14,25,846.00	14,02,16,567.00
Other Administrative Expenses etc.	2,39,99,767.00	3,36,36,655.00
Creation of assets under Capital	1,21,99,205.00	55,27,510.00
Expenditure on Grants, Subsidies etc.		
Interest paid		
Depreciation(Net Total at the year end-corresponding to Schedule 8)		
prior period item (Depreciation for last year).		
Other Income		
Institutional Charges		
Income from Royalty, Publications etc.		
Total	16,76,24,818.00	17,93,80,732.00

Drawing & Disbursing Officer
Institute Of Wood Science & Technology, Bengaluru
Signature of DDO with Seal

Annexure-37

TROPICAL FOREST RESEARCH INSTITUTE, JABALPUR
INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2021

INCOME	Current Year 31.03.2021	Previous Year 31.03.2020
	Rs	Rs.
Income from sales/services	61,20,964.63	66,19,213.00
Grants/Subsidies-Salary and General	16,26,15,000.00	19,09,33,000.00
Grants/Subsidies-Capital	53,30,000.00	23,71,000.00
Fees/Subscriptions		
Income from Investments (Income on Invest .from earmarked/endow. Funds transferred to Funds)		
Income from Royalty, Publications etc.		
Interest Earned	31,31,159.57	32,23,162.00
Other Income	35,53,997.46	66,81,229.17
Increase/(decrease) in stock of finished goods and works-in-progress	-	-
	-	-
Total	18,07,51,121.66	20,98,27,604.17

EXPENDITURE	Current Year 31.03.2021	Previous Year 31.03.2020
	Rs.	Rs.
Establishment Expenses (Inculuding KVS)	15,02,81,401.00	16,63,00,566.00
Other Administrative Expenses etc.	1,97,61,840.75	3,35,09,919.50
Creation of assets under Capital	53,25,965.30	23,69,491.00
Expenditure on Grants, Subsidies etc.		
Interest paid	31,43,461.57	38,92,427.10
Depreciation(Net Total at the year end-corresponding to Schedule 8) prior period item (Depreciation for last year).		
Other Income	74,38,680.41	
Institutional Charges	9,60,880.00	
Income from Royalty, Publications etc.		
Total	18,69,12,229.03	20,60,72,403.60

Signature of Director
with Seal

D.D.O.
Signature of DDO

Annexure-37

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN
INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2021

FOREST RESEARCH CENTRE FOR SKILL DEVELOPMENT, CHHINDWARA

INCOME	Current Year 31.03.2021	Previous Year 31.03.2020
	RS	RS.
Income from sales/services(Total Grants Received)	96,50,000.00	1,47,83,000.00
Grants/Subsidies-Salary and General		
Grants/Subsidies-Capital		
Fees/Subscriptions		
Income from Investments (Income on Invest .from earmarked/endow. Funds transferred to Funds)		
Income from Royalty, Publications etc.		
Interest Earned	92,707.00	1,05,271.00
Other Income	3,87,074.00	3,70,422.00
Increase/(decrease) in stock of finished goods and works-in-progress	-	
Total	1,01,29,781.00	1,52,58,693.00

EXPENDITURE	Current Year 31.03.2021	Previous Year 31.03.2020
	RS.	RS.
Establishment Expenses(Salary)	1,03,35,423.00	1,12,47,524.00
Other Administrative Expenses etc.(General)	11,26,885.60	16,35,461.00
Creation of assets under Capital(Capital Assets)	-	10,49,146.00
Expenditure on Grants, Subsidies etc.		
Interest paid		
Depreciation(Net Total at the year end-corresponding to Schedule 8) prior period item (Depreciation for last year).		
Other Income		
Institutional Charges		
Income from Royalty, Publications etc.		
Total	1,14,62,308.60	1,39,32,131.00

Signature of DDO
with Seal

D.D.O.
FRC-SD, Chhindwara

Annexure_37

Income & Expenditure Account for the Year ended 31st March, 2021

Name of Institute **: Arid Forest Research Institute, Jodhpur**

2020-21

(Amount in Rs.)

Income	Current Year 31.03.2021	Previous Year 31.03.2020
Income from Sales/ Service	0	0
Grants/ Subsidies -- Salary & General	142919000	150342000
Grants/ Subsidies -- Capital	4954000	1824000
Fee/ Subscriptions	0	0
Income from Investments (Income on Invest from Earmarked/ Endowment Funds transferred to Funds)	0	0
Income from Royalty, Publications etc.	0	0
Interest Earned	678566	262544
Other Income	0	0
Increase/ Decrease in Stock of Finished Goods and Works-in-Progress	0	0
Total	**148551566**	**152428544**

Expenditure	Current Year 31.03.2021	Previous Year 31.03.2020
Establishment Expenses	124118141	124154476
Other Administrative Expenses etc.	21997667	33819530
Creation of Capital Assets	5157868	1621139
Expenditure on Grants, Subsidies etc.	0	0
Interest paid	678566	262544
Depreciation (Net Total at the year end - Corresponding to Schedule B) Prior-Period Item (Depreciation for Last year)	0	0
Other Expenditure	0	0
Institutional Charges	0	0
Expenditure incurred on Royalty, Publications etc.	0	0
Total	**151952242**	**159857689**

Signature of DDO with Seal

Annexure-37

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN
INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2021
Himalayan Forest Research Institute, Shimla

INCOME	Current Year 31.03.2021	Previous Year 31.03.2020
	RS	RS.
Income from sales/services	42,220.00	1,04,140.00
Grants/Subsidies-Salary and General	8,72,35,000.00	8,98,98,000.00
Grants/Subsidies-Capital	4,61,665.00	10,17,097.00
Fees/Subscriptions	5,37,721.00	
Income from Investments (Income on Invest .from earmarked/endow. Funds transferred to Funds)		
Income from Royalty, Publications etc.		
Interest Earned	31,840.00	2,05,078.00
Other Income	34,91,262.51	2,61,189.40
Increase/(decrease) in stock of finished goods and works-in-progress	-	-
Total	9,17,99,708.51	9,14,85,504.40

EXPENDITURE	Current Year 31.03.2021	Previous Year 31.03.2020
	RS.	RS.
Establishment Expenses	7,92,96,166.00	7,32,07,174.00
Other Administrative Expenses etc.	1,09,91,510.00	1,30,56,623.00
Creation of assets under Capital	4,60,680.00	12,33,111.00
Expenditure on Grants, Subsidies etc.		
Interest paid		
Depreciation(Net Total at the year end-corresponding to Schedule 8)		
prior period item (Depreciation for last year).		
Other Income		
Institutional Charges		
Income from Royalty, Publications etc.		
Total	9,07,48,356.00	8,74,96,908.00

प्रशासन एवं संस्थागत अधिकारी
वानिकी अनुसंधान एवं शिक्षा परिषद्, देहरादून

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN Annexure-37

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2021

Name of the institute: *Institute of Forest Productivity, Ranchi*

INCOME	Current Year 31.03.2020 RS	Previous Year 31.03.2020 RS.
Income from sales/services		
Grants/Subsidies-Salary and General		
Grants/Subsidies-Capital		
(1.) Salaries	6,57,02,000.00	6,88,01,000.00
(2.) General	1,13,75,000.00	1,34,78,000.00
(3.) Capital	10,00,000.00	26,65,000.00
Fees/Subscriptions		
Income from Investments (Income on Invest .from earmarked/endow. Funds transferred to Funds)		
Income from Royalty, Publications etc.		
Interest Earned	4,88,932.00	7,78,221.00
Other Income		
Revenue Income	-	46,94,366.15
Increase/(decrease) in stock of finished goods and works-in-progress		
Total	**7,85,65,932.00**	**9,04,16,587.15**

EXPENDITURE	Current Year (31.03.2020) RS.	Previous Year 31.03.2020 RS.
Establishment Expenses	7,06,80,703.00	7,05,06,889.00
Other Administrative Expenses etc.	95,31,630.00	1,10,42,310.00
Research and operational Expenses	21,21,352.00	21,55,874.00
Creation of assets under Capital	9,80,401.00	26,74,996.00
Expenditure on Grants, Subsidies etc.		
Interest paid	4,88,932.00	8,88,791.00
Revenue Income transferred to ICFRE HQ	-	45,59,568.15
Depreciation(Net Total at the year end-corresponding to Schedule 8) prior period item (Depreciation for last year).		
Other Income		
Institutional Charges		
Income from Royalty, Publications etc.		
Total	**8,38,03,018.00**	**9,18,28,428.15**

आहरण एवं संवितरण अधिकारी
Signature of DDO & Disbursing Officer with Seal
Institute of Forest Productivity

Director/Director
Signature of Director with Seal
Institute of Forest Productivity

Annexure-37

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN
INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2021
INSTITUTE OF FOREST BIODIVERSITY, HYDERABAD

INCOME	Current Year 31.03.2021	Previous Year 31.03.2020
	RS	RS.
Income from sales/services		-
Grants/Subsidies	3,88,72,054.00	9,15,84,073.00
Fees/Subscriptions		
Income from Investments (Income on Invest .from earmarked/endow. Funds transferred to Funds)		
Income from Royalty, Publications etc.		
Interest Earned	9,59,014.00	7,14,746.00
Other Income	1,25,914.00	25,04,183.00
Increase/(decrease) in stock of finished goods and works-in-	-	-
	-	-
Total(A)	**3,99,56,982.00**	**9,48,03,002.00**

EXPENDITURE	Current Year 31.03.2021	Previous Year 31.03.2020
	RS.	RS.
Establishment Expenses	87,12,438.00	4,73,42,946.00
Other Administrative Expenses etc.	1,35,32,662.75	2,20,03,938.22
Expenditure on Grants, Subsidies etc.		
Interest paid	4,48,340.00	
Depreciation (Net Total at the year end-corresponding to Schedule 8) prior period item (Depreciation for last year).	92,96,576.10	31,85,526.00
TOTAL(B)	**3,19,90,016.85**	**7,25,32,410.22**
Balance being excess of Income over Expenditure(A-B)	79,66,965.15	2,22,70,591.78
Transfers to Special Reserve(Specify each)		
Transfer to/from General Reserve		
BALANCE BEING DEFICIT CARRIED TO CORPLUS FUND	**79,66,965.15**	**2,22,70,591.78**
SIGNIFICANT ACCOUNTING POLICIES		
CONTINGENT LIABILITIES AND NOTES ON ACCOUNTS		

Drawing and Disbursing Officer

29

Director

Annexure-37

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN
INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2021
Rain Forest Research Institute

INCOME	Current Year 31.03.2021	Previous Year 31.03.2020
	RS	RS.
Income from sales/services		
Grants/Subsidies-Salary and General	136,308,106	164,882,000
Grants/Subsidies-Capital	270000	2,268,000
Fees/Subscriptions	139750	
Income from Investments (Income on Invest .from earmarked/endow. Funds transferred to Funds)		
Income from Royalty, Publications etc.		
Interest Earned	736679	1,417,367
Other Income		
Increase/(decrease) in stock of finished goods and works-in-progress		
Total	137,454,535.00	168,567,367.00

EXPENDITURE	Current Year 31.03.2021	Previous Year 31.03.2020
	RS.	RS.
Establishment Expenses		
Other Administrative Expenses etc.		
Creation of assets under Capital		
Expenditure on Grants, Subsidies etc.	139,960,938.00	176,553,955.00
Interest paid		
Depreciation(Net Total at the year end-corresponding to Schedule 8) prior period item (Depreciation for last year).		
Other Income		
Institutional Charges		
Income from Royalty, Publications etc.		
Total	139,960,938.00	176,553,955.00

Signature of DDO with Seal

Drawing & Disbursing Officer
Rain Forest Research Institute
Jorhat (Assam)

Annexure-37

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN
INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2021
FOREST RESEARCH CENTRE FOR LIVELIHOOD EXTENSION , AGARTALA

INCOME	Current Year 31.03.2021	Previous Year 31.03.2020
	RS	RS.
Income from sales/services		
Grants/Subsidies-Salary and General	64,11,000.00	54,75,000.00
Grants/Subsidies-Capital	50,000.00	75,000.00
Fees/Subscriptions	-	
Income from Investments (Income on Invest .from earmarked/endow. Funds transferred to Funds)		
Income from Royalty, Publications etc.		
Interest Earned	90,046.00	74,539.00
Other Income (Sale of Plants, Tender Docs, Guest House Rent Etc)	59,828.00	84,405.00
Increase/(decrease) in stock of finished goods and works-in-progress	-	
	-	-
Total	**66,10,874.00**	**57,08,944.00**

EXPENDITURE	Current Year 31.03.2021	Previous Year 31.03.2020
	RS.	RS.
Establishment Expenses	49,97,782.00	43,80,100.00
Other Administrative Expenses etc.	15,47,899.00	22,96,226.00
Creation of assets under Capital	50,000.00	24,610.00
Expenditure on Grants, Subsidies etc.	-	-
Interest paid	90,046.00	74,539.00
Depreciation(Net Total at the year end-corresponding to Schedule 8)	59,828.00	84,405.00
prior period item (Depreciation for last year).		
Other Income	-	-
Institutional Charges	-	
Income from Royalty, Publications etc.	-	
Total	**67,45,555.00**	**68,59,880.00**

Signature of DDO
with Seal

DDO
Forest Research
Centre For Livelihood,
Extension (FRC-LE)

Annexure-37

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN
INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2021
FOREST RESEARCH CENTRE FOR BAMBOO & RATTAN, AIZAWL, MIZORAM

INCOME	Current Year 31.03.2021	Previous Year 31.03.2020
	RS	RS.
Income from sales/services	1,585.00	-
Grants/Subsidies-Salary and General	85,58,000.00	97,22,000.00
Grants/Subsidies-Capital	-	3,00,000.00
Fees/Subscriptions	-	-
Income from Investments (Income on Invest .from earmarked/endow. Funds transferred to Funds)	-	-
Income from Royalty, Publications etc.	-	-
Interest Earned	90,050.00	1,01,666.00
Other Income	96,368.00	4,47,072.00
Increase/(decrease) in stock of finished goods and works-in-progress	-	-
	-	-
Total	87,46,003.00	1,05,70,738.00

EXPENDITURE	Current Year 31.03.2021	Previous Year 31.03.2020
	RS.	RS.
Establishment Expenses	50,30,596.00	50,67,705.00
Other Administrative Expenses etc.	34,29,771.00	44,03,967.00
Creation of assets under Capital	1,29,388.00	1,69,855.00
Expenditure on Grants, Subsidies etc.	-	-
Interest paid	90,050.00	1,01,666.00
Depreciation(Net Total at the year end-corresponding to Schedule 8)	-	-
prior period item (Depreciation for last year).		
Other Income	99,953.00	2,34,046.00
Institutional Charges	-	2,09,000.00
Income from Royalty, Publications etc.	-	-
Total	87,79,758.00	1,01,86,239.00

Signature of DDO
with Seal

Drawing & Disbursing Officer
Forest Research Centre
for Bamboo and Rattan
Aizawl : Mizoram

Statement of Allotment & Expenditure for the year 2020-21

(Rs.in lakh)

Sl. No.	Budget Sub-Head / Name of Institutes/Centres	Plan (GC)											
		Salaries				General				Capital			
		Budget Allot.	Opening balance	Total	Exp. 2020-21	Budget Allot.	Opening balance	Total	Exp. 2020-21	Budget Allot.	Opening balance	Total	Exp. 2020-21
1	ICFRE/Pension	2634.25	0.00	2634.25	2634.25	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	11.48	1.37	12.85	12.85	0.00	0.02	0.02	0.00
3	DDO, ICFRE	1292.93	132.58	1425.51	1278.86	376.93	-16.38	360.55	368.38	17.05	0.03	17.08	17.05
4	FRI, Dehradun	4988.47	391.19	5379.66	5024.31	1350.72	0.07	1350.79	1350.75	327.07	0.58	327.65	327.65
5	FRC-ER, Prayagraj	153.15	11.48	164.63	151.39	40.71	0.30	41.01	40.77	1.00	0.00	1.00	1.00
6	IFGTB, Coimbatore	1600.83	177.16	1777.99	1618.74	248.25	3.26	251.51	250.99	15.46	0.06	15.52	15.52
7	IWST, Bangalore	1348.52	96.48	1445.00	1314.25	240.00	0.00	240.00	240.00	122.00	0.00	122.00	121.99
8	TFRI, Jabalpur	1434.88	140.87	1575.75	1498.90	192.27	6.77	199.04	197.40	53.30	0.05	53.35	53.26
9	FRC-SD, Chhindwara	90.15	24.10	114.25	103.36	6.35	5.67	12.02	11.27	0.00	0.01	0.01	-0.19
10	AFRI, Jodhpur	1215.54	130.46	1346.00	1241.17	213.65	6.35	220.00	219.98	49.54	2.05	51.59	51.58
11	HFRI, Shimla	776.61	79.18	855.79	792.97	95.74	14.89	110.63	109.92	4.40	0.22	4.62	4.61
12	IFP, Ranchi	657.02	118.52	775.54	706.80	113.75	2.83	116.58	116.43	10.00	0.00	10.00	9.80
13	IFB, Hyderabad	492.21	46.15	538.36	499.93	82.00	0.00	82.00	80.48	0.00	0.00	0.00	0.00
14	RFRI, Jorhat	1219.34	117.67	1337.01	1221.95	174.94	0.06	175.00	174.96	2.70	0.01	2.71	2.70
15	FRC-LE, Agartala	48.49	5.66	54.15	49.97	15.24	0.77	16.01	15.48	0.00	0.50	0.50	0.50
16	FRC-BR, Aizawl	47.61	11.31	58.92	50.31	37.97	0.03	38.00	37.96	0.00	1.30	1.30	1.29
	Total	18000.00	1482.81	19482.81	18187.16	3200.00	25.99	3225.99	3227.62	602.52	4.83	607.35	606.76

Statement of Revenue received in Budget Section, ICFRE for the year 2020-21

(Rs.in lakh)

Sl. No.	Name of Institutes/Centres	Revenue Generated								
		Externally Aided Projects	Consu-ltancy	Scientific Consultancy charges other than consultancy projects	Internal Resource Generation	Sale of Forest Products	Income from Interest	Misc. Income	Any other source which have not been mentioned above	Total
1	ICFRE	0.00	0.00	0.00	0.00	0.00	20.56	81.43	0.00	101.99
2	VVB, New Delhi	0.00	0.00	0.00	0.00	0.00	0.03	6.84	0.00	6.87
3	DDO, ICFRE	741.49	0.00	0.00	0.00	0.00	8.69	12.88	0.00	763.06
4	FRI, Dehradun	120.46	0.00	0.00	22.07	34.37	14.44	284.29	0.31	475.94
5	IFGTB, Coimbatore	47.01	0.00	0.00	3.40	7.48	3.20	21.77	0.76	83.62
6	IWST, Bangalore	12.17	9.63	0.08	12.85	77.45	5.66	23.00	0.45	141.29
7	TFRI, Jabalpur	31.23	50.00	0.00	0.16	0.13	4.91	23.09	0.50	110.02
8	AFRI, Jodhpur	6.71	0.00	0.00	0.00	21.12	1.55	107.67	0.03	137.08
9	HFRI, Shimla	18.89	0.00	0.00	7.99	0.27	1.05	8.81	0.41	37.42
10	IFP, Ranchi	0.00	0.00	0.00	0.00	0.29	0.03	1.29	0.04	1.65
11	FRC-ER, Prayagraj	0.30	0.00	0.00	0.14	0.00	0.11	1.41	0.00	1.96
12	FRC-SD, Chhindwara	0.00	0.00	0.00	0.96	0.08	0.30	2.69	0.15	4.18
13	IFB, Hyderabad	0.00	0.00	0.00	0.00	0.00	1.63	2.10	0.00	3.73
14	RFRI, Jorhat	8.42	0.23	0.00	0.20	13.77	3.52	15.13	1.37	42.64
15	FRC-LE, Agartala	1.00	0.00	0.00	0.01	0.48	0.68	0.12	0.00	2.29
16	FRC-BR, Aizawl	0.50	0.00	0.00	0.00	0.02	1.74	1.47	0.00	3.73
	Total	988.18	59.86	0.08	47.78	155.46	68.10	593.99	4.02	1917.47

Section Office (Budget)
ICFER

Assistant Director General (Admin.)
ICFRE

Statement of Allotment & Expenditure upto September 2021

(Rs.in lakh)

Sl. No.	Budget Sub-Head Name of Institutes/Centres	Plan (GC)					
		Salaries		General		Capital	
		Budget Allot.	Exp. upto Sep. 2021	Budget Allot.	Exp. upto Sep. 2021	Budget Allot.	Exp. upto Sep. 2021
1	ICFRE/Pension	1118.91	1118.91	0.00	0.00	0.00	0.00
2	VVB, New Delhi	0.00	0.00	7.25	6.84	3.39	3.39
3	AO, ICFRE	794.13	794.06	238.93	238.92	13.53	13.15
4	FRI, Dehradun	2827.31	2826.22	798.67	896.59	11.20	11.20
5	FRC-ER, Prayagraj	96.17	96.12	22.64	19.46	0.00	0.00
6	IFGTB, Coimbatore	1020.39	1007.70	172.90	171.65	6.00	5.97
7	IWST, Bangalore	776.19	773.76	141.06	141.06	6.00	5.97
8	TFRI, Jabalpur	747.61	746.83	113.10	113.00	2.09	1.80
9	FRC-SD, Chhindwara	67.14	66.80	6.23	4.40	0.70	0.45
10	AFRI, Jodhpur	745.11	744.60	111.65	116.72	2.01	2.00
11	HFRI, Shimla	450.87	450.84	73.11	72.80	2.01	1.97
12	IFP, Ranchi	470.29	461.81	69.87	67.68	2.70	2.67
13	IFB, Hyderabad	256.82	275.52	45.93	45.08	0.36	0.36
14	FRC-CE, Vishakhapatnam	43.61	23.82	7.00	6.91	0.56	0.56
15	RFRI, Jorhat	781.77	774.48	101.42	93.70	0.01	0.00
16	FRC-LE, Agartala	49.53	49.45	9.78	1.95	0.00	0.00
17	FRC-BR, Aizawl	35.72	35.00	18.04	17.87	0.00	0.00
	Total	10281.57	10245.92	1937.58	2014.63	50.56	49.49

Statement of Revenue Generated upto September, 2021.

(Rs.in lakh)

Sl. No.	Name of Institutes/Centres	Approved Revenue Target for 2021-22	Revenue Generated upto Sep. 2021
1	VVB, New Delhi	20.00	5.13
2	AO, ICFRE	400.00	87.53
3	FRI, Dehradun	400.00	112.26
4	FRC-ER, Prayagraj	15.00	0.03
5	IFGTB, Coimbatore	160.00	32.65
6	IWST, Bangalore	180.00	20.89
7	TFRI, Jabalpur	180.00	17.49
8	FRC-SD, Chhindwara	15.00	0.22
9	AFRI, Jodhpur	180.00	55.90
10	HFRI, Shimla	120.00	14.46
11	IFP, Ranchi	120.00	0.00
12	IFB, Hyderabad	60.00	3.15
13	RFRI, Jorhat	120.00	9.64
14	FRC-LE, Agartala	15.00	0.49
15	FRC-BR, Aizawl	15.00	0.37
	Total	2000.00	360.21

Section Office (Budget)
ICFER

Assistant Director General (Admin.)
ICFRE

Proposed Budget Estimate for the Financial Year 2022-23

(Rs.in lakh)

Sl.No.	Budget Component	Proposed BE 2022-23
1	Grant-in-aid "Salary"	24000.00
2	Grant-in-aid "General"	6000.00
3	Grant-in-aid "Capital"	2000.00
	Total	**32000.00**

Target Proposed for Revenue ICFRE (Hqtr.) Institutes/Centres for the year 2022-23

(Rs.in lakh)

S.No.	Name of Institutes/Centres	Target Proposed
1	VVB, New Delhi	20.00
2	DDO, ICFRE	400.00
3	FRI, Dehradun	400.00
4	FRC-ER, Prayagraj	15.00
5	IFGTB, Coimbatore	160.00
6	IWST, Bangalore	180.00
7	TFRI, Jabalpur	180.00
8	FRC-SD, Chhindwara	15.00
9	AFRI, Jodhpur	180.00
10	HFRI, Shimla	120.00
11	IFP, Ranchi	120.00
12	IFB, Hyderabad	60.00
13	RFRI, Jorhat	120.00
14	FRC-LE, Agartala	15.00
15	FRC-BR, Aizawl	15.00
	Total	**2000.00**

Section Office (Budget)
ICFER

Assistant Director General (Admin.)
ICFRE

ANNEXURE

ANNEXURE

ANNEXURE – I

RIGHT TO INFORMATION

A Public Information Officer and Appellate Authority are functioning in Public Authority, ICFRE under the RTI Act 2005. During the year 2020-21, RTI application (535) and RTI Appeals (41) are disposed off. Consolidated Quarterly RTI returns of the Public Authority are regularly uploaded by the ICFRE on CIC website (*rtir.nic.in*).

RTI Applications/ Requests	No. of applications received as transfer from other P/As u/s 6(3)	Received during the month (including cases transferred to other Public Authority)	Number of cases transferred to other Public Authorities u/s6(3)	Decisions where requests/ Appeals rejected	Decisions where requests/ Appeals accepted
1st Quarter	43	66	06	--	60
2nd Quarter	17	136	05	--	131
3rd Quarter	26	79	02	--	77
4th Quarter	33	167	06	--	161
Total	**119**	**448**	**19**	--	**535**
			--	--	
RTI First Appeals			--	--	
1st Quarter	N/A	02	N/A	--	02
2nd Quarter	N/A	10	N/A	--	10
3rd Quarter	N/A	12	N/A	--	12
4th Quarter	N/A	18	N/A	--	18
Total	**--**	**41**	**--**	--	**41**

NAME AND ADDRESS OF PUBLIC INFORMATION OFFICERS AND APPELLATE AUTHORITIES UNDER THE RIGHT TO INFORMATION ACT 2005 IN ICFRE AND ITS INSTITUTES

Headquarters / Institutes	Appellate Authorities	Public Information Officers	Subject matter(s) allocated
Indian Council of Forestry Research and Education (ICFRE Hq.), P.O. New Forest Dehradun-248 006	Smt. Kanchan Devi, IFS Dy. Director General (Education) Phone (O) : 0135-2224832, 0135-2758571 E-mail : dir_edu@icfre.org	Dr. Rajiv Pandey, Phone (O) :0135-2224811, E-mail : pio_icfre@icfre.org	All matters related to ICFRE Hqrs., Dehradun
Forest Research Institute, P.O. New Forest, Dehradun-248 006	Shri A.S. Rawat, 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, FRI, P.O. New Forest Dehradun- 248 006 Phone : 0135- 2224315, 0135-2752670, 0135-2757021-26 (O) Email: groupco_fri@icfre.org	All Research & Account matters
		Smt. Neelima Shah, IFS Registrar, FRI Phone: 0135-2224222 0135-2752678 Email: registrar_fri@icfre.org	Establishment, Administrative & all other matters
		Dr. A.K. Tripathi, Registrar & PIO, FRI (D) University Phone: 0135-2224439 (O) 0135-2751826 (O) Email: tripathiak@icfre.org	University matters
Forest Research Centre - Eco-Rehabilitation (FRC-ER), 3/1, Lajpath Rai Road, New Katra, Prayagraj-211 002	Dr. Sanjay Singh Head Phone: 0532-2440795, Fax: 0532- 2440797 E-mail: dir_csfer@icfre.org	Dr. Kumud Dubey Scientist -E Phone:0532-2440796 Fax :0532-2440797 E-mail:kdubey_csfer@icfre.org	All matters related to FRC-ER, Prayagraj
Institute of Forest Genetics and Tree Breeding, Forest Campus, P.B.No 1061 R.S.Puram, Coimbatore - 641 002	Dr. C. Kunhikannan, Director, IFGTB, Coimbatore, Phone: 0422-2484100 (O) Fax. 0422-2430549 E-mail: dir_ifgtb@icfre.org	Dr. John Prasant Jacob Scientist 'G', IFGTB, Coimbatore Phone: 0422-2484102 (O)	All matters related to IFGTB, Coimbatore
Institute of Wood Science & Technology, PO Malleswarum, Bengaluru -560003	Dr. M.P. Singh, IFS, Director, IWST, Bengaluru Phone : 080-23341731, E-mail: dir_iwst@icfre.org	Dr. N. Palanikanth, IFS IWST, Bengaluru, Phone: 080-22190132(O)	All matters related to IWST, Bengaluru
Tropical Forest Research Institute, Jabalpur P.O. – R.F.R.C, Mandla Road, Jabalpur – 482 021	Dr. G. Rajeshwar Rao, Director TFRI, Jabalpur Phone : 0761-2840483 Fax: 0761-4044002 E-mail: dir_tfri@icfre.org	Shri AJK Asaiya, Scientist-C, 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
Forest Research Centre - Skill Development, (FRC-SD) P.O. Kundalikala, Poama, Chhindwara - 480001	Dr. Vishakha Kumbhare, Scientist In-charge Phone : 07162-292061 E-mail:head_cfrhrd@icfre.org	Dr. Vishakha Kumbhare, Scientist In-charge Phone : 07162-292061 E-mail:head_cfrhrd@icfre.org	As per provision and guidelines provided under RTI Act, 2005
Rain Forest Research Institute Post Box No. 136, Deovan, Sotai, A.T. Road, Jorhat- 785 001(Assam)	Dr. R.S.C. Jayraj Director, RFRI Jorhat Phone: 0376-2305101(O) Fax. 0376-2305130 E-mail: dir_rfri@icfre.org	Dr. R.S.C. Jayraj Director, RFRI Jorhat Phone: 0376-2305101(O) Fax. 0376-2305130 E-mail: dir_rfri@icfre.org	All matters related to RFRI, Jorhat
Forest Research Centre - Bamboo & Rattan (FRC-BR), P.O. Box 171, Kulikawn Aizwal-796001	Dr. R.S.C. Jayraj Director, RFRI Jorhat Phone: 0376-2305101 (O) Fax: 0376-2305130 E-mail: dir_rfri@icfre.org	Shri Gautam Banerjee, DCF Public Information Officer (PIO) Phone: 0376-2350273 (O) Fax: 0376-2350274	All matters related to FRC-BR, Aizwal
Forest Research Centre - Livelihoods Extension (FRC-LE) Sal Bagan Forest Campus PO – Gandhigram Agartala- 799 012 Tripura	Ajoy Debbarma Head Phone: 9612721598 (O) E-mail: head_frcle@icfre.org	Shri Ravi Dutt LDC Phone: 0381-2397097 (O) E-mail: duttr@icfre.org	All matters related to FRC-LE, Agartala
Arid Forest Research Institute, P.O. Krishi Upaz, Mandi, New Pali Road, Jodhpur, 342005.	Sh. M.R. Baloch, IFS Director, AFRI Jodhpur Phone: 0291-2742549 (O) Fax. 0291-2722764 E-mail: dir_afri@icfre.org	Shri K.C. Gupta, AFRI Jodhpur. Phone: 0291-2729122	All matters related to AFRI, Jodhpur
Himalayan Forest Research Institute, Conifer Campus, Panthaghati, Shimla – 171 009.	Dr. S.S Samant, Director, HFRI, Shimla Phone : 0177-2626778 (O), Fax : 0177-2626779 E-mail: dir_hfri@icfre.org	Smt. Shilpa, CTO HFRI Shimla Phone: 0177-2626778(O) Fax: 0177-2626779	All matters pertaining to HFRI, Shimla
Institute of Forest Productivity, NH 23, Gumla Road, Lalgutwa Ranchi-835303.	Dr. Nitin Kulkarni, Director, IFP Ranchi, Ph- 0651-2526140 8986608161 E-mail: dir_ifp@icfre.org	Mr. Sanjeev Kumar Scientist- E, IFP Ranchi, Phone : 9798967363 E-mail: san.forester@gmail.com	All matters related to IFP, Ranchi
Institute of Forest Biodiversity, Dulapally, Kompally, Post Hyderabad- 500100	Dr. Ratnaker Jauhari, IFS Director, IFB, Hyderabad Phone: 040-66309501(O) Fax : 040-66309521 E-mail: director_ifb@icfre.org	Shri M.B. Honnuri Scientist -C IFB, Hyderabad Phone: 040-66309503 Email: mbhonnuri@icfre.org	All matters related to IFB, Hyderabad
Forest Research Centre - Coastal Ecosystem, HPCL Colony, Panduranga Puram Visakhapatnam- 530 003	Dr. Ratnaker Jauhari, IFS Director, IFB Phone: 040-66309501(O) E-mail: director_ifb@icfre.org	Shri M.B. Honnuri Scientist -C, IFB, Hyderabad Phone: 040-66309503 Email: mbhonnuri@icfre.org	All matters related to FRC-CE, Visakhaptnam

ANNEXURE - II

INFORMATION ON VIGILANCE CASES

A Chief Vigilance Officer is functioning at ICFRE, Dehradun. During the year 2020-21, 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
08	00	04	04	Violation of conduct rules

Name and address of Chief Vigilance Officer, ICFRE is as follows:

Shri Anurag Bhardwaj, IFS
Chief Vigilance Officer
PO New Forest, Dehradun – 248 006
Phone: 0135-2224851

ANNEXURE - III

INFORMATION ON AUDIT OBJECTIONS

An Internal Audit Cell is functioning at ICFRE, Dehradun under the Head, Internal Audit, ICFRE. During the year 2020-21, 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
73	NIL	NIL	73	Paras of Research / Projects/Admin./ Accounts	Reply of the all Audit Paras have been submitted

Name and address of Head, Internal Audit, ICFRE is as follows:

Dr. V.S. Senthilkumar, IFS
Head, Internal Audit
PO New Forest, Dehradun – 248 006
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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,
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Secretary, ICFRE
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Head
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Head
Forest Research Centre - Coastal Ecosystem, (FRC-CE),
HPCL Colony,Panduranga Puram
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Head
Forest Research Centre - Livelihoods Extension (FRC-LE)
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Head
Forest Research Centre - Bamboo & Rattan (FRC-BR)
P.O. Box 171, Kulikawn Aizwal-796001
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ANNEXURE - V

LIST OF ABBREVIATIONS

6PGDH	:	6 Phosphogluconate dehydrogenase
AAU	:	Anand Agricultural University
ABRPL	:	Assam Bio-Refinery PVT. Limited
ACSE	:	Asian Council of Science Editors
AGM	:	Annual General Meeting
AICOPTAX	:	All India Co-ordinated Project on Orthoptera Taxonomy
AICRP	:	All India Co-ordinated Research Project
AM	:	Arbuscular Mycorrhizal
AMF	:	Arbuscular Mycorrhizal Fungi
APC	:	Agriculture Production Commissioner
APL	:	Andhra Paper Limited
APML	:	Adani Power Maharashtra Limited
ASCI	:	Administrative State College of India
ATREE	:	Ashoka Trust for Research in Ecology and the Environment
ATSC	:	Advanced Television Systems Committee
AUC	:	Area under Curve
BC	:	bamboo charcoal
BCC	:	Biodiversity and Climate Change
BFS	:	Brazilian Forest Services
BFU	:	Beijing Forestry University
BoG	:	Board of Governors
BPC	:	Bamboo Plastic Composites
BRT	:	Biligiri Ranganatha Swamy Temple
BSI	:	Botanical Survey of India
BTMC	:	Bodhgaya Temple Management Committee
CAF	:	Chinese Academy of Forestry
CAMPA	:	Compensatory Afforestation Fund Management and Planning Authority
CCA	:	Chromated copper arsenate
CCB	:	Copper chrome boron
ZiBOC	:	Zinc Boron Cobalt
CEC	:	Central Empowered Committee
CFPR	:	Centre for Forest Policy Research
CFU	:	Colony Forming Units
CIMAP	:	Central Institute of Medicinal and Aromatic Plants
CITES	:	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CoFGR	:	Creation of Centre of Excellence on Forest Genetic Resources
CPT	:	Candidate Plus Trees
CPWD	:	Central Public Works Department
CSC	:	Coconut Shell Charcoal

CSFER	:	Centre for Social Forestry and Eco-Rehabilitation
CSIR	:	Council of Scientific & Industrial Research
Dbh	:	Diameter at breast height
DFO	:	Divisional Forest Officer
DG	:	Director General
DGF&SS	:	Director General of Forest & Special Secretary
DMoE	:	Dynamic Modulus of Elasticity
DNA	:	Deoxy Ribo Nucleic Acid
DPR	:	Detailed project report
DST	:	Department of Science and Technology
DV	:	Demo Village
DWR	:	Directorate of Weed Research
EAP	:	Externally Aided Projects
ECM	:	Ectomycorrhizal
EDCs	:	Eco-Development Committees
ENVIS	:	Environmental Information System
ESIP	:	Ecosystem services improvement project
FGB	:	Field Gene Bank
FGR	:	Forest Genetic Resource
FOERDIA	:	Forestry and Environment Research, Development and Innovation Agency
FRCBR	:	Forest Research Centre for Bamboo and Rattan
FRCSD	:	Forest Research Centre for Skill Development
FRS	:	Field Research Station
FSI	:	Forest Survey of India
FTIR	:	Fourier Transform Infrared
GBH	:	Girth at Breast Height
GBPNIHEI	:	Govind Ballabh Pant National Institute of Himalayan Environment Institute
GCMS	:	Gas Chromatography ion Mobility Spectometry
GIS	:	Geographic Information System
GoI	:	Government of India
GPM	:	Greening Punjab Mission
GPS	:	Global Positioning System
GSDP	:	Green Skill Development Programme
HDPE	:	High-Density Polyethylene
HNBGU	:	Hemwati Nanadan Bahuguna Garhwal University, Central University
HoFF	:	Head of Forest Force
HPLC	:	High Performance Liquid Chrometography
HpNPV	:	Hyblaea puera Nuclear Polyhedrosis Virus
HPTLC	:	High Performance Thin Layer Chromatographic
HRC	:	Hairy Root Culture
HRD	:	Human Resources Development
IAA	:	Indole Acetic Acid
IAPS	:	Invasive Alien Plant Species
IARI	:	Indian Agricultural Research Institute
IAS	:	Indian Administrative Service
IAWA	:	International Association of Wood Anatomists

IBA	:	Indole Butyric Acid
ICAR	:	Indian Council for Agricultural Research
ICIMOD	:	International Centre for Integrated Mountain Development
ICT	:	Information and Communication Technology
IDH	:	Isocitrate dehydrogenase
IDWH	:	Integrated Development of Wildlife Habitat
IFS	:	Indian Forest Service
IGNP	:	Indra Gandhi Nahar Pariyojana
IIRS	:	Indian Institute of Remote Sensing
IPA	:	Indian Professional Associations
IPM	:	Integrated Pest Management
IRMA	:	Institute of Rural Management Anand
IRMS	:	Istope Ratio Mass Spectrometry
ITC	:	India Tobacco Company Limited
JFMC	:	Joint Forest Management Committee
JICA	:	Japan International Cooperation Agency
JNU	:	Jaipur National University
JPEG	:	Joint Photographic Experts Group
KU	:	Kasetsart University
KVK	:	Krishi Vigyan Kendra
KVS	:	Kendriya Vidyalaya Sangathan
LGM	:	Last Glacial Maximum
NDC	:	National Development Council
LULC	:	Land Use Land Cover
MEF	:	Minimum Essential Force
MF	:	Melamine Formaldehyde
MNR	:	Menadione Reductase
MoR	:	Modules of Rupture
MoU	:	Memorandum of Understanding
MTR	:	Manas Tiger Reserve
MW	:	Microwave
NAA	:	Napthyl Acetic Acid
NAEB	:	National Afforestation and Eco-Development Board
NATCOM	:	National Communication
NBCC	:	National Building Construction Corporation
NBM	:	National Bamboo Mission
NCBI	:	National Centre for Biotechnology Information
NCCF	:	National Cooperative Consumers' Federation of India Limited
NDBR	:	Nandadevi Biosphere Reserve
NDC	:	National Determined Contribution
NDF	:	Non-Detriment Finding
NEC	:	North Eastern Coalfields
NFIC	:	National Forest Insect Collection
NGOs	:	Non Governmental Organizations
NIH	:	National Institute of Hydrology
NIR	:	Near Infrared

NMR	:	Nuclear Magnetic Resonance
NP	:	Nahar Pariyojana
NPK	:	Nitrogen Phosphorous Potassium
NRA	:	Nitrate Reductase Activity
NRSC	:	National Remote Sensing Centre
nSSR	:	nuclear Simple Sequence Repeat
NTCC	:	National Type Culture Collection
NTFP	:	Non Timber Forest Produce
NTPC	:	National Thermal Power Corporation
NVS	:	Navodaya Vidyalaya Samiti
NWC	:	Nano Wood Composites
NWFP	:	Non Wood Forest Products
PCCF	:	Principal Chief Conservator of Forests
PCR	:	Polymerase Chain Reaction
PF	:	Phenol Formaldehyde
PGCIL	:	Power Grid Corporation of India Ltd.
PGP	:	Plant Growth Promoting
PIC	:	Polymorphism Information Content
PLS	:	Partial Least Square
PNG	:	Portable Network Graphics
PSB	:	Phosphate Solubilizing Bacteria
QC	:	Quality Control
RAG	:	Research Advisory Group
RAP	:	Random Amplified Polymorphic
RBM	:	River Bed Material
RCP	:	Representative Concentration Pathways
REDD+	:	Reducing Emissions from Deforestation and Forest Degradation
RET	:	Rare Endangered and Threatened Species
RNA	:	Ribonucleic Acid
RPC	:	Research Policy Committee
RRC	:	Regional Research Conference
RS	:	Remote Sensing
SBER	:	Society of Biotic & Environmental Research
SCI	:	Selection cum Improvement
SCoT	:	Start Codon Targeted
SECL	:	South Eastern Coalfields Limited
SETM	:	Steam Explosion Treatment Machine
SFA	:	Swedish Forest Agency
SFD	:	State Forest Department
SHGs	:	Self Help Groups
SKDH	:	Shikimate Dehydrogenase
SKLTSHU	:	Sri Konda Laxman Bapuji Telangana State Horticulture University
SLEM	:	Sustainable Land and Ecosystem Management
SPA	:	Seed Protection Area
SPB	:	Seshasayee Paper and Boards Limited
SPS	:	Seed Production Systems

SSC	:	Suspended Sediment Concentration
SSO	:	Seedling Seed Orchard
SSR	:	Simple Sequence Repeats
SYP	:	Southern Yellow Pine
TAPPI	:	Technical Association of the Pulp and Paper Industry
TDC	:	Technology Demonstration Centre
TDU	:	University of Trans-Disciplinary Health Sciences and Technology
TEK	:	Traditional Ecological Knowledge
TERI	:	The Energy and Resources Institute
TGM	:	Tree Growers Mela
TIFF	:	Tag Image File Format
TLC	:	Thin Layer Chromatography
TNAU	:	Tamil Nadu Agricultural University
TOF	:	Tree Outside Forests
TOLIC	:	Town Official Language Implementation Committee
TSFD	:	Tamil Nadu State Forest Department
TSP	:	Teak Seed Production
UAHS	:	University of Agricultural and Horticultural Sciences
UBFDB	:	Uttarakhand Bamboo and Fiber Development Board
UNFCCC	:	United Nations Framework Convention on Climate Change
UV	:	Ultra violet
VC	:	Video Conferencing
VFDCs	:	Village Forest Development Committees
VMG	:	Vegetative Multiplication Garden
VVK	:	Van Vigyan Kendra
WHTA	:	Western Himalayan Temperate Arboretum
WII	:	Wildlife Institute of India
WLS	:	Wildlife Sanctuary
WSHGs	:	Women Self Help Groups

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