



Executive summary

A thorough revision of ICFRE research system took place during 2012-13 on the lines of the Government's priority for the sector and a completely people centric thrust areas were developed for achieving excellence in the field of Forestry Research, Education and Extension. Accordingly following thrust areas were developed during 2012-13:

1. Managing Forests and Forest Products for Livelihood Support and Economic Growth
2. Biodiversity Conservation and Ecological Security
3. Forests and Climate Change
4. Forest Genetic Resource Management and Tree Improvement
5. Forestry Education and Policy Research to Meet Emerging Challenges
6. Forestry Extension for taking Research to People

The Annual Report of 2012-13 describes the said thrust areas in six different chapters and the projects undertaken have been clustered in the relevant sections of six chapters. The information related to the Directorate of Administration and Information Technology have been presented in a separate chapter.

The chapter **Managing Forests and Forest Products for Livelihood Support and Economic Growth** identifies contribution of forests for improving livelihood and economic growth. *Gmelina arborea* and *Prosopis juliflora* have been tested by FRI as an alternative raw material for Pulp and Paper making and also assessed for their suitability for writing and printing paper. One modular plant for treatment of wood with ammonia vapours has been designed and fabricated under a completed Plan project. Five wood species, viz., Shahtoot (*Morus alba*), Khadig (*Celtis australis*), Benteak (*Lagerstroemia lanceolata*), Bakain (*Melia azedarach*) and Jamun (*Syzygium spp.*) have been studied for their bending nature for making hockey blades. Ultrasonic technique has been developed to detect defects in logs and using this technique, 60 trees

of different species in FRI campus were assessed for their current status. Finger jointing, by economically utilizing mill wastes, has been developed and to be priced in the Indian market. IWST, Bangalore has assessed *Eucalyptus tereticornis*, *E. eurograndis* and *Acacia hybrid* clones for physical, mechanical, anatomical properties and wood working qualities and recommended for various end uses and handicraft items. Finger Joints strength properties of *A. auriculiformis*, *A. Cunn. Ex Benth* of different age group trees were studied using different adhesives for demonstration purposes. *Acacia auriculiformis*, *Eucalyptus spp.* and *Hevea brasiliensis*, (Rubberwood) were tested under different temperatures for heat treatments to assess their physical properties.

In the effort to document Non- Nationalized Commercial NTFP species from few states, 80 species of NTFPs have been documented to be collected by communities. Phytochemical studies for *Diploknema butyraceae* have been made using characterization of its oil through Gas liquid chromatography and Gas chromatography Mass spectrometry. Natural Dyes were extracted from *Pinus roxburghii*, *Mallotus philippensis* and *Pycnoporos sanguinius* and dyeing trials on various fabrics viz. silk, wool and cotton carried out to produce different shades on the fabrics. IWST, Bangalore has developed Sandal (*Santalum album* Linn.) Information System and also developed eco-friendly wood preservatives from oils of *Pongamia pinnata*, *Jatropha curcas* and *Simarouba glauca* with copper ions. TFRI, Jabalpur has developed three value added products (A) Kusum concentrate (B) Kusum leather and (c) Kusum katmith from the pulp of immature and mature *Schleichera oleosa* (Kusum) fruits. It has also developed a data base of production of lac for lac yielding belts in Chotanagpur. TFRI, Jabalpur has also established two demonstration plots for selected medicinal plant in the farmer's field. A non destructive Ethephon - plant growth regulator injection



has been developed by AFRI for the tapping of oleogum resins from *Commiphora wightii*. The Institute has also standardized nursery techniques for cultivation of *Celastrus paniculatus* and *Vitex peduncularis*. To enhance the production of edible shoot of indigenous bamboos in Jharkhand, through cultural practices, survey in 225 villages and 93 markets were carried out by IFP Ranchi to document the data. RFRI has documented 88 species of mushrooms that were collected from the three districts of Nagaland through Ethnomycological survey.

Under farm forestry, IFGTB, Coimbatore has documented the supply chain existing between farmers and industries, particularly, paper and matchwood industries in Tamil Nadu. IFGTB, Coimbatore has established agro forestry systems with fast growing tree species under 15 ha farm land in three zones; North-eastern, Cauvery delta and Southern zones of Tamil Nadu.

On the forest protection front, the efficacy of the native pathogenic bacteria *Bacillus* sp., isolated from the infected larvae of *P. coclesalis* was evaluated by RFRI, Jorhat against the key pests of Bamboo species and was found effective in both the lab and field conditions. Crude extracts of *Acacia albida* leaves and bark were tested for antifungal activity, and its 0.5 per cent concentration was found effective against *Cylendrocladium quinquesepatum*, *Aspergillus niger* and *Rhizoctonia solanii*. IFGTB, Coimbatore has developed an antifungal activity from selected Tree Borne Oil seeds against five fungal pathogens, and a new product, named **Tree Pal (H)**, has been released during the Tree Growers Mela 2013. AFRI, Jodhpur has developed an innovative composting for bio fertilizer production, using Trichoderma and Phosphate Solubilizing Bacteria (PSB).

Different fungal genera were identified from collected soil samples and one fungal genus i.e. *Pestalotiopsis* was recorded to be associated in the disease sample for Pine mortality in Manipur. Larvae of lepidopteron insects, causing damage to the seeds were recorded in Juniper berries of Lahaul and Kinnaur in

Himachal Pradesh. The boundaries, forest roads, terrain forest cover and density class maps & Land use maps were prepared for Asola Bhatti Wildlife Sanctuary, New Delhi under Protected Area management. IFGTB, Coimbatore has developed productive clones from the Casuarina phenotypes, collected from western zone of Tamil Nadu for effective windbreak. TFRI, Jabalpur as a lead institution had submitted proposal for designation of Achanakmar-Amarkantak Biosphere Reserve on World Network of BRs recognized by UNESCO. Subsequently, the International Council of UNESCO's Man and the Biosphere Programme (MAB) meeting in Paris from 9-13 July 2012 have declared Achanakmar-Amarkantak Biosphere Reserve under the World Network of Biosphere Reserves (WNBR). A web-based information centre for Achanakmar- Amarkantak Biosphere Reserve has also been created and linked to the website of TFRI, Jabalpur. It has published Biosphere Reserve Information Series as well.

The chapter **Biodiversity Conservation and Ecological Security** mentions the effort to conserve biodiversity. The germplasm of *Ulmus wallichiana* was collected from the areas of Chakrata, Uttarakhand and Jammu & Kashmir and is maintained in FRI. Insect taxonomic studies for family Eulophidae with 380 specimens and Encyrtidae for 1584 specimens have been made through card mount and labelled. Also developed, digital database in windows with scanned documents from 900 articles for different types of insect species, maintained in FRI as National Forest Insect Collection. Study on reproductive biology has contributed to life cycle assessment of four Rare, Endangered and Threatened plant species by FRI in Dehradun and a good population of the species is maintained in Botanical Survey of India. 1739 Grass specimens were identified from Uttarakhand and Himachal Pradesh. Eleven sacred groves of Rajasthan were studied to assess the biological diversity. Botany Division of FRI has established molecular facility for characterization of selected bamboo species and developed digitization for 44693 specimens. Change of plant diversity in different age group of teak plantation in Barnawapara Project Division, Raipur, Chhattisgarh



was studied and compartment wise structural complexity was recorded. Ecological assessment of floristic composition has been made in seven Medicinal Plant Conservation Areas (MPCA) in Chhattisgarh. Taxonomy and molecular analysis, using Random Amplified Polymorphic DAN through Polymerase Chain Reaction (RAPD-PCR) have been made in Moths in cold desert to assess the changes in species diversity with reference to vegetation in the Himalyan region of Spiti and Leh. The species diversity in the selected sample plots of padauk, teak and mixed plantations in North to South Andaman were assessed to study the colonization of species in the plantation areas. Model Nursery in association with Andhra Pradesh Medicinal and Aromatic Plants Board has been established. Socio economic surveys, in identified villages of Tamil Nadu, Andaman and Rajasthan were made to assess the extent of forest lands and dependence of fringe villages.

A new record, of wood decay fungi species namely *Phlyctaeniella indica* and two species namely *Leucocoprinus birnbaumii* and *Mycena rosella* on different host in forest and wood depots of Chhattisgarh and Orissa has been made by TFRI, Jabalpur. Bio-mixtures have been developed using VAM, *Azospirillum* and *Phosphobacteria* to evaluate the efficacy on germination of selected tree species. Growth and biomass enhancement of clonal plants of *Casuarina equisetifolia*, inoculated with Mycorrhizae, Rhizobia and other useful microbes have been recorded under nursery condition by IFGTB, Coimbatore. Vegetation surveys in mangrove areas in Andaman Islands were undertaken to document the species composition and for identifying suitable species for recovery of Tsunami impacted mangroves. Nurseries have also been established to assist natural and artificial regeneration for the recovery of these areas. Visiting pollinators have been studied to determine the fruit setting pattern for few mangrove species with floral morphology and season. A rare model of seed dispersal by wasp *Vespa affinis* L. has been recorded to assess the reproductive biology of critically endangered species of *Aquilaria malaccensis*. *Dalbergia sissoo* recorded as the potential species for

the use in phytoremediation and reclamation of heavy metal contaminated sites.

On the International Heritage Conservation front, ICFRE provided consultancy in preserving twenty five trees of culturally important Ta Prohm temple of Cambodia and imparted training to the officials there at.

To provide insight into the unique treasure of India's forest biodiversity, a coffee table book "**Forest Biodiversity in India**" was published by ICFRE. The book is first of its kind in the field of forest biodiversity depicting various dimensions through photographs will be of tremendous value to the readers in understanding the unique heritage of our country. The book was released by the Hon'ble Minister of Environment and Forests, Government of India during COP-11 at Hyderabad in November 2012.

A model plantation has been developed for eco-restoration in Coal Mine Areas of BCCL, Dhanbad by identifying suitable site specific trees, grasses and horticulture species. Site specific regeneration augmentation plans have been developed for potential degraded areas in Western Ghats. A field guide book has been published by IFGTB, Coimbatore on seed biology and bio inoculants for shola species in Nilgiris.

Thirty nine invasive species have been documented from forest area of four districts of Madhya Pradesh. Impact of invasive species on plant diversity in selected forest sites of Uttarakhand, Haryana and Punjab are being studied. Nutritional values for two commonly used rattan species of North East India, *Calamus flagellum* Griff., and *C. floribundus* Griff shoots were studied to correlate it with the soil micro-environment for conservation and management purposes. Utilization potential of *Sphagnum* species for their taxonomical characters and as air layering substrate media for raising important commercial trees species in the nursery was evolved and demonstrated to farmers of Meghalaya.

Under **Forests and Climate Change**, an All India Coordinated Programme has been initiated involving all institutes of ICFRE. Guidebook on Afforestation and Reforestation CDM Projects in India has also been published by ICFRE. GIS based maps were prepared for



different densities of forest, slope classes, aspects, altitudes and climatic zones for forest fire incidents in Uttarakhand for the period from 2001 to 2012. Plant diversity in Bhimashankar permanent preservation plot of Sub tropical hill forest of Maharashtra, is being monitored to assess the impact of climate variables. Carbon stock in forest soils and in above-ground and below-ground biomass were studied to provide an estimated carbon stock in forests of Rajasthan for planning and execution of afforestation/ reforestation programme. AFRI, Jodhpur has developed site specific shelterbelts in shallow calcareous soils to improve the aesthetic value of Indian Institute of Technology campus, Jodhpur. HFRI, Shimla has conducted three-generation study for assessing the Influence of Climate on Bionomics of *Pityogenes scitus* Blanford (Coleoptera: Scolytidae) in Himachal Pradesh. High Altitude Transition Zones in Himachal Pradesh have also been studied to assess the effect of Global Warming by relating it to the changes in floristic composition of the area over a period of time. TFRI, Jabalpur has prepared fourteen documents of interesting fungi of which *Lophodermium shoreae* has been recorded to be a dominant sal litter colonizer from central India.

In the area of **Forest Genetic Resource Management and Tree Improvement**, ICFRE facilitated coordinated projects to address regional specific issues for *Melia composita*, *Eucalyptus*, *Casuarina*, and teak. FRI, Dehradun has released clone of *Dalbergia sissoo* through Variety Release Committee of Ministry of Environment and Forests, Govt. of India. It has also established field trials of 30 clones of *Populus deltoids* in western Uttar Pradesh, Punjab and Uttarakhand. Assessment of wood properties and growth of the progenies of different clones of *Populus deltoides* has indicated the impact of cambial age on the tree-wood properties. Seed Production Area (SPA) of *Uraria picta* has been established at FRI campus and the seeds from seed bank have been used for production raising field planting stock, *ex-situ* conservation and commercial cultivation trials in collaboration with the farmers in Dehradun district. FRI, Dehradun collected germ plasm

and developed nursery technique for *Piper pedicellatum*. IFGTB, Coimbatore developed guidelines for DUS testing in *Casuarina* and validated it with all available clones. IWST, Bangalore has analyzed wood samples for the clonal Plus Trees of Red sander for heartwood content. To study the variability in *Hardwickia binata*, core samples were collected from natural populations and molecular marker studies are being carried out to estimate the genetic variability. Improvement of *Neolamarckia cadamba*, through selection in the natural population and existing plantation in different parts of Tamil Nadu, Kerala, A & N Islands and Assam was carried out and 114 Candidate Plus Trees (CPTs) have been identified. TFRI, Jabalpur has identified 175 Candidate Plus Trees (CPTs) of *Jatropha curcas* from identified districts of Madhya Pradesh and established 36 accessions in national trials and 14 accessions in zonal trial of *Jatropha* in the campus. HFRI, Shimla has identified superior genetic stock of *Podophyllum hexandrum* Royle from 30 sites falling in different geographical locations of Himachal Pradesh and in Ladakh Valley of Jammu & Kashmir and has established Field Research Station at Brundhar, Jagatsukh (HP). It has also identified 17 natural populations of *Abies spectabilis* from different Forest Divisions of Himachal Pradesh and their seeds were stored in air tight polysaccharide container in cold storage at -5°C for assessing their viability. The seeds were recorded to retain 26 per cent viability after 9 months of storage.

On the biotechnological front, IFP, Ranchi has identified variability and genetic fingerprinting for *Pongamia pinnata*, through microsatellite markers for genotyping in West Bengal and Odisha. DNA testing has been an important part of forensic methods for decades in tracing back the origin of a timber. FRI, Dehradun has standardized molecular based technique for timber tracing back with DNA isolated, from the woody tissues with allelic variations across the populations for few woody species. Molecular based characterization and quantification of the twisted and normal pine accessions have also been studied. FRI, Dehradun has validated chemical markers conferring *Cylindrocladium* leaf and



seedling blight resistance in *Eucalyptus*. The partial gene sequence information for the teak insect pest *Hyblaea puera* Chitinase gene (480 bp), Ecdysone receptor gene (751 bp), and Chitin synthase gene (204 bp and 741 bp) were sequenced and published with accession Numbers, JX101956.1, JX644041.1, KC121027.1 and KC121028.1 at the Gene Bank Database of the National Centre for Biotechnology Information (NCBI), National Library of Medicine, National Institute of Health, USA. Recombinant mannose binding lectin was isolated from the leaves of *Withania somnifera* and designated as *WsMBP1* and gene expressed was tested for antifungal/ antipest activity. A DNA fingerprint database has been developed by IFGTB, Coimbatore for *Eucalyptus*, *Casuarinas* species using ISSR/FISSR, RAPD, and AFLP markers. Tissue culture technology was developed for *Podophyllum hexandrum* through leaf explants. FRI, Dehradun has developed micro-propagation protocols for mature superior recombinants emanating from F2 generations of *Eucalyptus* hybrid (*E. citrodora* × *E. torelliana*). AFRI, Jodhpur has developed micro propagation protocol using auxiliary shoot derived and somatic embryo pathway for *Commiphora wightii* and successfully planted in field.

Under **Forestry Education and Policy Research to Meet Emerging Challenges**, ICFRE actively engaged in enhancing national forestry education programme through financial support, in the form of Grant-in Aid to the State Universities imparting forestry education. Since its inception in 1991, ICFRE has provided financial assistance to the tune of ₹5406.82 lakhs to 27 Agricultural Universities for infrastructure development. In the year 2012-13, ICFRE has provided Grant-in-aid to the tune of ₹115.00 lakhs to ten Universities. To improve the quality of forestry education, ICFRE has initiated accreditation process in line with All India Council for Technical Education (AICTE) and 18 universities have been accredited by ICFRE so far. In the effort to improve action oriented Research and Development involving universities and institutes in the areas of NTFPs marketability, ICFRE

has initiated preparation of Status Reports on NTFPs of the States in collaboration with ICFRE Institutes and State Universities.

Under the human resources development plan for capacity building of scientific and managerial cadre and research support staff, ICFRE has been organizing various training programmes. A total of 142 scientific and managerial cadre have been given training during the year through induction, orientation or on-the-job training. ICFRE is proactive in participating in national and international conferences /workshops /seminars for effective interaction and participation for delivery of research findings. During the year, a total of 167 representatives have attended various national level and 59 have attended international conferences/ seminar/ symposium and workshops. ICFRE has assessed and upgraded 32 scientist of different grade under Flexible Complementing Schemes (FCS).

Under **Forestry Extension for taking Research to People**, ICFRE developed network through twenty-six Van Vigyan Kendras (VVKs) in different states and nine Demo Villages (DVs) in different eco-climatic zones for transfer of technology, training and exposure visit to various target groups. A guideline has also been prepared for networking VVKs with Krishi Vigyan Kendras (KVKs) for effective extension of the technologies developed by ICFRE for the farmers. ICFRE has published a total of 359 research articles in reputed national and international scientific journals and books. Also, 72 research articles were presented in seminar/conferences/ workshops; 62 abstracts and 19 popular articles were published by ICFRE Institutes during the year.

ICFRE is successfully operating a GEF funded project on Sustainable Land and Ecosystem Management as a Technical Facilitation Organization (SLEM-TFO) under the Ministry of Environment and Forests (MoEF). In addition, ICFRE has also successfully completed the task of compilation of 5th National Reporting to UNCCD on behalf of MoEF.

ICFRE also organized the 24th Session of International Poplar Commission (IPC) at Dehra Dun in



which a total 227 delegates from 23 countries participated.

In the field of Environment Management, ICFRE extended scientific services to the Government of Karnataka in preparing Reclamation and Rehabilitation Plans for the mine leases in Bellary, Chitradurga and Tumkur districts. The same has been approved by the Hon'ble Supreme Court of India. ICFRE is also drafting Cumulative Environmental Impact and Management Plan for these three mine districts of Karnataka. ICFRE has also been assigned the consultancy services for preparing Cumulative Environmental Impact Assessment of Hydropower at Basin level for Sutlej by Department of Energy by Government of Himachal Pradesh and in Yamuna basin for Uttarakhand Jal Vidyut Nigam Ltd. In all, a total of 213 Consultancy Projects of which 166 pertains to preparation of R&R Plans for the three districts of Karnataka have been undertaken by ICFRE which are in various stages of completion.

To promote Rajbhasha Hindi, ICFRE conducted series of training workshops and trained 400 persons including officers, scientists, and staff and also organized a *Hindi Kavya Goshthi*.

Under **Administration and Information Technology** the Sevottam i.e. to emphasize the

relationship between service providers and service receivers and to standardize the Services Delivery Excellence Model, ICFRE implemented citizen/client charter and performed various activities to ensure proper publicity and enactment of the charter. Welfare measures, for SC/ST/OBC and minority communities, including establishment of Grievance and Redressal Cells, organizing regular interactive meetings of the Cells, training workshops on various aspects of reservation policy and observing 56th *Parinirvan Diwas* of Bharat Ratna Dr. B.R. Ambedkar etc. were made.

During the current financial year (2012-2013), the Government of India allocated a total Budget of ₹ 13699.12 lakhs that included ₹ 11362.82 lakhs under Plan Fund, including one-time special grant of ₹337 lakhs; and ₹ 2337.30 lakhs under Non-plan Fund to ICFRE. ICFRE under the allocated plan budget of ₹ 1086.54 lakhs for Research, Extension and Education has made expenditure for ₹ 1079.6 during the year 2012-13 under reseptive areas.

During the year under report, 88 new projects were initiated including 32 externally aided projects; whereas, 121 projects were completed including 27 externally aided projects.



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