

Executive Summary

Based on the revision of ICFRE research system that took place during 2012-13 in line with the Government's priority for various sectors and people centric thrust areas, following thrust areas were identified for the year 2013-14:

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 overall allotted budget for current financial year 2013-14 for Research, Extension and Education was Rs. 825.14 lakhs and the expenditure incurred was Rs 777.1 lakhs.

The Annual Report of 2013-14 describes the thrust areas in six different chapters and the projects undertaken have been grouped in the relevant sections of these six chapters. The information related to the Directorate of Administration and Information Technology has been presented in a separate chapter.

The research under **Managing Forests and Forest Products for Livelihood Support and Economic Growth** identifies contribution of forests for improving livelihood and economic growth. Forest Research Institute (FRI) developed cultivation protocol for enhancing productivity of fodder in degraded lands of Uttarakhand. A total of 275 forest fringe districts were identified in rain fed districts using GIS, and their forest types, area of each forest type and density classes were estimated. The socio-economic status and dependence of forest fringe villagers on forests and the ecological status were assessed in depth. Alternative raw materials from *Sesbania grandiflora* were tested in FRI for making strong craft paper Grade-I. A raw

material from *Lannea coromandelica* was tested and suggested to Indian Pulp and Paper mills for making good quality of bleached grade writing and printing paper. A new initiative was made by FRI for utilizing recycled waste gunny bags and pine needles in different proportions for manufacturing of handmade paper, having adequate strength properties of unbleached craft Paper Grade-I as recommended in IS:1397:1990. Further, processes were developed for preparation of nano cellulose, using Scanning Electron Microscope (SEM). FRI has also revised and prepared the National Working Plan Code 2014 which was approved by MoEF &CC and circulated to all the States and UTs for implementation from 1st April 2014.

Institute of Wood Science and Technology (IWST) assessed the mechanical properties of *Acacia auriculaeformis* and *Melia dubia*, treated with copper for wood density and termite resistance, respectively. IWST has also developed a useful tool of stand density diagram for designing, displaying and evaluating alternative density regimes for even-aged *teak* forests of Karnataka. Rheological studies on natural fibre-PVC composites for light structural applications, indicated increase in fibre content. IWST assessed nano particles based wood coating for outdoor applications indicated protection from harmful UV radiation. The whole pest spectrum of sandalwood in different agri-horti-silvi models in Karnataka was documented for farmers and foresters. A weed, *Lobelia nicotianaeifolia* based liquid formulation was tested as insect pesticide along with neem products. *Toddalia asiatica*, *Ruta graveolens* and *Zanthoxylum rhetsa* extracts of root, stem and leaves showed potential larvicidal and mosquito repellent properties. IWST has developed key identification with microstructure of 200 species of Indian shrubs and Lianas Species for the purpose of their efficient utilization for timber and pharmacological industry along with photomicrographs for understanding the anatomical features. Testing and evaluation of wood quality of Teak grown in Andaman and Nicobar Island was made for



anatomical, physical and mechanical properties for Forest Department.

Tropical Forest Research Institute (TFRI) has documented 63 invasive plant species growing in the forest areas of Jabalpur, Katni, Mandla and Seoni district for their spread and density. Foliar spray for nitrogen deficient soil treatment to increase leaf surface area of *Diospyros melanoxylon* were standardized in Chhattisgarh. A combined dose of nitrogen and phosphorus to enhance the tendu leaf size in Kotadol and Morga and an individual dose of nitrogen in Litipara were standardized. A combined dose of ranker neem granules and VAM in Morga and an individual dose of neem granules in Kotadol and Litipara were observed to enhance tendu leaf size. A total of 39,554 and 9,699 sal trees were marked under different categories of borer attack in Madhya Pradesh and Chhattisgarh respectively. Non-conventional alternative lac host species, such as, *Flemingia semialata* and *F. macrophylla* were established as an alternative to *Butea monosperma* and *Zizyphus mauritiana* as agroforestry model in the farmers field for income generation in Madhya Pradesh.

Rain Forest Research Institute (RFRI) has collected 750 numbers of tested clones of *Morinda citrifolia* L. (Noni) from CARI, Port Blair for improving the livelihood option for the people of North East India. Carbendazim (Trade name-Zoom) was found to be the most effective fungicide in checking further spread of the disease in Ukhrul District of Manipur. AFRI studied the antifungal properties of *Datura stramonium* leaf extract and evaluated eight lesser known wild edible plant species for food and nutrient from Rajasthan. It established *Hardwicke binata* and *Colophospermum mopane* tree based agroforestry trials using *Cymopsis tetragonoloba* as a crop species. It developed model for estimation of total and, merchantable volume for *Prosopis cieneraria* and *Ailanthus excelsa* plantations in Indira Gandhi Nahar Project (IGNP) area in Rajasthan. HFRI recorded the extent of distribution, abundance and associations of medicinal plants of Ashtavarga group with other species in five districts viz. Sirmour, Solan,

Kinnaur, Shimla and Kullu of Himachal Pradesh. Nursery trials for assessing the optimum harvest limits of *Picrorhiza kurrooa* and *Valeriana jatamansi* were laid out at three different locations. IFP introduced genotypes of karanj, kusum and bamboo as Agroforestry models in lateritic belt of Eastern India. Five year old plantation of karanj and mahua plots were converted into Tree Borne Oilseeds (TBO) demonstration plots.

Institute of Forest Genetics and Tree Breeding (IFGTB) established Mangrove nurseries of *Rhizophora* sp, *Ceriops* sp, *Bruguiera* sp, *Xylocarpus* sp in South Andaman and middle Andaman for undertaking restoration ecology and species recovery studies in tsunami impacted mangrove areas. It has also established 15 ha agroforestry systems in three zones of Tamil Nadu with fast growing tree species of *Melia dubia*, *Gmelina arborea*, *Neolamarkia cadamba* and *Sweitenia macrophylla*. Seven agroforestry systems demo units in all talukas of Ramanathapuram district in Tamil Nadu were established. It completed two collaborative projects with State Agricultural Universities on NTFP Network Project on selected NTFPs of Kerala.

In the area of **Biodiversity Conservation and Ecological Security**, FRI assessed the impact of human induced disturbances on regeneration and population structure of *Rhododendron arboreum* and *Myrica esculanta* in mid hills of Garhwal Himalaya. FRI has also supplied quality seeds of 15 species to Punjab State Forest Department. IWST assessed the floral morphology, flowering season and pollination biology of five major mangrove species namely *Avicennia officinalis*, *A. alba* and *A. marina* (Avicenniaceae) and *Sonneratia caseolaris* and *S. alba* (Sonneratiaceae). TFRI prepared vegetation change matrix for the preservation plots of Bhimashankar Sub Tropical Hill Forest of Maharashtra for future trend analysis. Density and distribution of medicinal plant species viz; *Uraria picta* and *Andrographis paniculata* in the buffer region of Tadoba Andhari Tiger Reserve (TATR) were also studied. Grafted strain of *M. indica* were procured

from the State Forest Research Institute, Jabalpur for producing seed originated seedlings and planted in the experimental area of TFRI, Jabalpur. RFRI prepared a data base of 365 species of butterflies along the altitudinal gradients of forest ecosystem of Eastern Himalaya of Arunachal Pradesh, in 13 districts. Distribution of different species of *Garcinia* (Clusiaceae) and its ecology and utilization in the upper Brahmaputra valley of Assam were studied by RFRI. IFP has developed agro- techniques for organic cultivation of *Tribulus terrestris* L. and *Cissus quadrangularis* L.- medicinal plants.

Under **Forests and Climate Change**, ICFRE has published *Forest Types of India: Revisited* with the data generated from extensive survey made at national level. NATCOM had entrusted ICFRE for conducting India's first biennial update report – "Forestry Sector – Mitigation and Gaps & Constraints". ICFRE delegation participated in eleventh session of the Committee for the Review of the implementation of the United Nations Convention to Combat Desertification (UNCCD) in Bonn, Germany; thirty-eighth session of the SBSTA/SBI meetings of the United Nations Framework Convention on Climate Change (UNFCCC) in Bonn, Germany and in the nineteenth session of the Conference of Parties and the thirty ninth session of SBSTA/SBI meetings of the UNFCCC in Warsaw (Poland). ICFRE delegation also participated in the International Expert Group Meeting on *Geospatial Information Systems for Multi-scale Forest Biomass Assessment and Monitoring in the Hindu Kush-Himalayan Region* at the International Centre for Integrated Mountain Development, Kathmandu, Nepal. FRI studied the soil organic carbon store under different land uses in Haryana. Soil Quality Index and data base for different land uses for Tehri Garhwal district of Uttarakhand and a Soil Health Card was also prepared.

In the area of **Forest Genetic Resource Management and Tree Improvement**, FRI established field trials of promising clones of *Populus deltoides*. Germplasm banks were established for *Grewia optiva* at Dudhli,

Lachhiwala Range, Dehradun Forest Division and for *Quercus leucotrichophora* at Magra, Jaunpur Range, Mussoorie Forest Division. IFGTB has been identified as the "Distinctness, Uniformity and Stability (DUS) Centre for *Casuarina* and *Eucalyptus*". It was also entrusted with the responsibility of developing descriptors and DUS guidelines for teak and *Melia dubia* by the Protection of Plant Varieties and Farmers Rights (PPV&FR) authority. The Ministry of Environment, Forests and Climate Change has recognized IFGTB for establishment of ENVIS for Forest Genetic Resources and Tree Improvement (FGR-TIP) thematic area. Seventeen different clones of *Eucalyptus camaldulensis*, *Casuarina equisetifolia* and *C. junghuhniana* were released for public having superior growth, resistance to gall infestation, and windbreak properties. An FGR centre has been established at Neyveli, covering an area of 25 ha with a state of art infrastructure facility for large scale vegetative multiplication of tropical hardwood species. A Vegetative Multiplication Garden (VMG) and shade house with mist chambers, hardening chamber and office building were established at Walayar, Kerala for mass production and supply of teak planting stock. A Geomatics Lab covering Geographical Information System and Remote Sensing facilities has been setup at IFGTB and a website on *Silico Gene Bank for Adaptation to Abiotic stress* has also been launched.

Institute of Wood Science and Technology established *Melia dubia* progeny trials consisting of 21 progenies and standardized protocol for extraction of DNA for assessment of genetic diversity. FRI has established demonstration plot for four species of bamboo, such as, *Dendrocalamus asper*, *Dendrocalamus hamiltonii*, *Bambusa balcooa*, *Bambusa nutans* in Desuya, Mohali, Ludhiana and Ropar Forest Division, Punjab. A total of 102 genotypes of *Dendrocalamus stocksii* were evaluated, offsets/ culm cuttings were collected for establishing Multilocational trials. Micropropagation of *Embelia ribes* was achieved through proliferation of auxiliary shoots obtained from mature plants. DNA purity index and wood fibre length for



Boswellia serrata were analysed for 12 populations collected from Madhya Pradesh. A multilocal trial comprising of 100 superior accessions of *Jatropha curcas* received from the Department of Biotechnology (DBT) network partners were established in GRC Farm House Sita Pahad, Jabalpur.

Rain Forest Research Institute studied the phenology and population dynamics of selected Rattans in Assam. It has also standardised methodology for extraction of DNA from *Melia compostia* fruits collected from Assam, Nagaland, Manipur, and Tripura. AFRI conducted population density and selection of candidate plus plant (CPP) of Guggal (*Commiphora weightii*), in Rajasthan for conservation and improvement. Multilocal progeny trials of *Melia composita* (*M. dubia*) in Rajasthan (one) and Gujarat (two) were also established and four progeny trials of *Tectona grandis* in Rajasthan and Guajrat were evaluated. HFRI established a Field Gene Bank (FGB) for *Podophyllum hexandrum*, an important medicinal plant. A Field Research Station at Brundhar, Himachal Pradesh was also established. HFRI has initiated DUS trait trails for *Pinus roxburghii* and *Cedrus deodara* in Himachal Pradesh.

Institute of Forest Productivity assessed the variability and genetic fingerprinting for *Pongamia pinnata* (L.) Pierre using microsatellite markers. *Dalbergia sissoo* Roxb., clones were evaluated for large-scale clonal forestry in Gangetic plains and Chotanagpur plateau. Propagation method and germplasm conservation for *Machilus villosa* (Roxb.) & *Quercus lineata*, promising timber & fuel wood in North West Bengal were standardised. Twenty five phenotypically superior trees of both the species were selected for future improvement and conservation programme. Collection, conservation and evaluation of *Melia dubia* germplasm was made in North-Bengal, Orissa hills and other parts of India for identification and release of superior clones. *Jatropha curcas* was taken up for multilocal trial in different agroclimatic zones for agronomic practices.

Under **Forestry Education and Policy** Research to meet Emerging Challenges, FRI Deemed University conducted all India Competitive Entrance Test for admission in Post Graduation. Course plan was prepared and internal and external faculties were invited for conducting classes. During the current year, 57 research scholars were registered for Ph.D and a total 64 Ph.D degrees were awarded. Placement Brochures & students' profiles were prepared for all M.Sc. courses. Various Industries/organizations visited the campus for campus interview and 46 students were selected. Five students from SAARC joined for various M.Sc. and PhD programmes. Two students of Forest Research Institute (Deemed) University were awarded International Tropical Timber Organization (ITTO) Fellowship in the autumn cycle under 'Human Resources to enhance Professional Expertise in Sustainable Management of Tropical Forests'.

Under **Forestry Extension for taking Research to People**, IFGTB launched interactive meetings at Thrissur, Kerala and in Coimbatore as a part of networking initiatives of VVK and KVK. It has also undertaken training / refresher course for IFS officers, and officials from Revenue, Agriculture, Horticulture, Animal husbandry, NGOs and farmers on various forestry and environment related topics. Web application for 160 important plant species of arid and semi arid region were hosted on the URL <http://www.seracharidplants.in>. HFRI imparted training programmes to different stakeholders. A training manual for sustainable harvest for selected medicinal plants was developed in Hindi and was distributed to end users. ICFRE imparted trainings and conducted workshops for various stakeholders in close coordination with FRI, IFGTB, RFRI, HFRI and TFRI under Bamboo Technical Support Group (BTSG). ICFRE conducted series of training workshops and trained around 400 persons including officers, scientists, and staff. *Hindi Saptah* was also organised at ICFRE and its institutes.

Under scientific services in the form of consultancies, FRI conducted midterm

Monitoring and Evaluation of PUNCAMPA plantations and FDA plantations in all the districts and Forest Divisions of Punjab. ICFRE extended consultancy service for hydropower sector to Tehri Hydropower Development Corporation (THDC), Himachal Pradesh Power Corporation Limited (HPPCL) and Directorate Energy, Himachal Pradesh; in the mine sector for Ankua Iron ore mine, West Singhbhum district of Jharkhand state for M/s JSW Steel Ltd. It has also prepared 32 individual Reclamation and Rehabilitation (R&R) Plans of category A and B for the mines in Bellary, Chitradurga and Hospet Districts as per the directions of the Honourable Supreme Court during 2013-14 in line with Central Empowered Committee (CEC) guidelines to Department of Mines and Geology, Government of Karnataka. Under Sustainable Land and Ecosystem Management (SLEM),

ICFRE, as technical facilitation organization (TFO), imparted training-cum- workshop for scientists and frontline forest officials at Himachal Forest Research Institute, Shimla; Tropical Forest Research Institute, Jabalpur and Institute of Forest Genetics and Tree Breeding, Coimbatore. It also conducted two National Steering Committee meetings to monitor and evaluate the Sustainable Land and Ecosystem Management (SLEM) programme at Bhopal; and two regional (state) level and a national level consultative workshops to finalise the impact indicator for issues related to desertification, land degradation and drought. A series of publications under SLEM-TFO in the form SLEM e-Newsletter, proceedings of the seminar on *Drought and Water Scarcity*, eight flyers on best practices of SLEM and semi-annual report SLEM - TFO Project were also published.

