

# Annual Report 2010-2011



**Indian Council of Forestry Research and Education**  
**P.O. New Forest, Dehradun**  
**Uttarakhand, India**

# ANNUAL REPORT

2010-11



**INDIAN COUNCIL OF FORESTRY RESEARCH AND EDUCATION**  
(An Autonomous Council of Ministry of Environment and Forests, Government of India)  
**DEHRADUN (UTTARAKHAND)**

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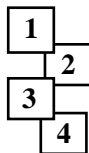
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**Front Cover:**

1. *Malaxis Muscifera*
2. *Dactylorhiza hatagirea*
3. Bamboo Shoots
4. Bamboo Product (Bari)

**Back Cover:** Teak Based Agroforestry

Inset : Field Level Biopesticidal Applications



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महानिदेशक, भा.वा. अ.शि.प.  
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(An ISO 9001:2000 Certified Organisation)  
(An autonomous body of Ministry of Environment and Forests,  
Government of India)  
P.O. New Forest, Dehra Dun - 248 006

## FOREWORD

Indian Council of Forestry Research & Education (ICFRE) is the premier forestry research organization undertaking programmes aimed at a holistic development of forestry research, education and extension for sustainable management and development of forestry resources in the country. The various activities of the Council focus on various synergistically linked domains that reflect the cross-sectoral nature of forest management.

I am delighted to present this Annual Report before our forestry sector organizations, other partners, stakeholders, and people at large. The year 2010-11 has been demanding and exciting with a number of new developments. Considering the domain expertise available with the officers and scientists, ICFRE has been awarded the status of Designated Operational Entity (DOE) by United Nations Framework Convention on Climate Change (UNFCCC) for validation, verification and certification functions of Afforestation and Reforestation projects under Clean Development Mechanism (CDM).


The Council, in pursuance of its regular plan programme, approved 168 new projects including 32 externally aided projects to cater to the need of various target groups. During the year, 130 projects were completed including 40 externally aided ones. Clones of eucalypts and casuarinas developed by the Council were released to the field aiming at enhancing farmers' income especially through their agroforestry practices. The Council undertook a wide range of consultancy works also right from conservation of heritage sites to conducting environmental impact assessment for various developmental projects.

Technologies and protocols developed in the fields of silviculture, biotechnology, agroforestry, tree improvement, wood technology, forest products, and environmental management practices by the Council were extended to various user agencies through training courses, workshops and awareness programmes including the activities of Van Vigyan Kendras and Demo Villages. Further, for better outreach of the research findings, the Council evolved Extension Strategies in Forestry Research 2010.

Countrywide, forestry education is promoted by providing Grants-in-Aid to various universities/institutions imparting forestry education with a view to strengthening their infrastructure to augment teaching and research capabilities. Towards this end, ICFRE released financial support to the tune of ₹ 204.00 lakh to 10 universities during the year.

In order to meet the new emerging challenges in the field of forest management, ICFRE is going to fine tune its research programme to meet the aspirations of the people.

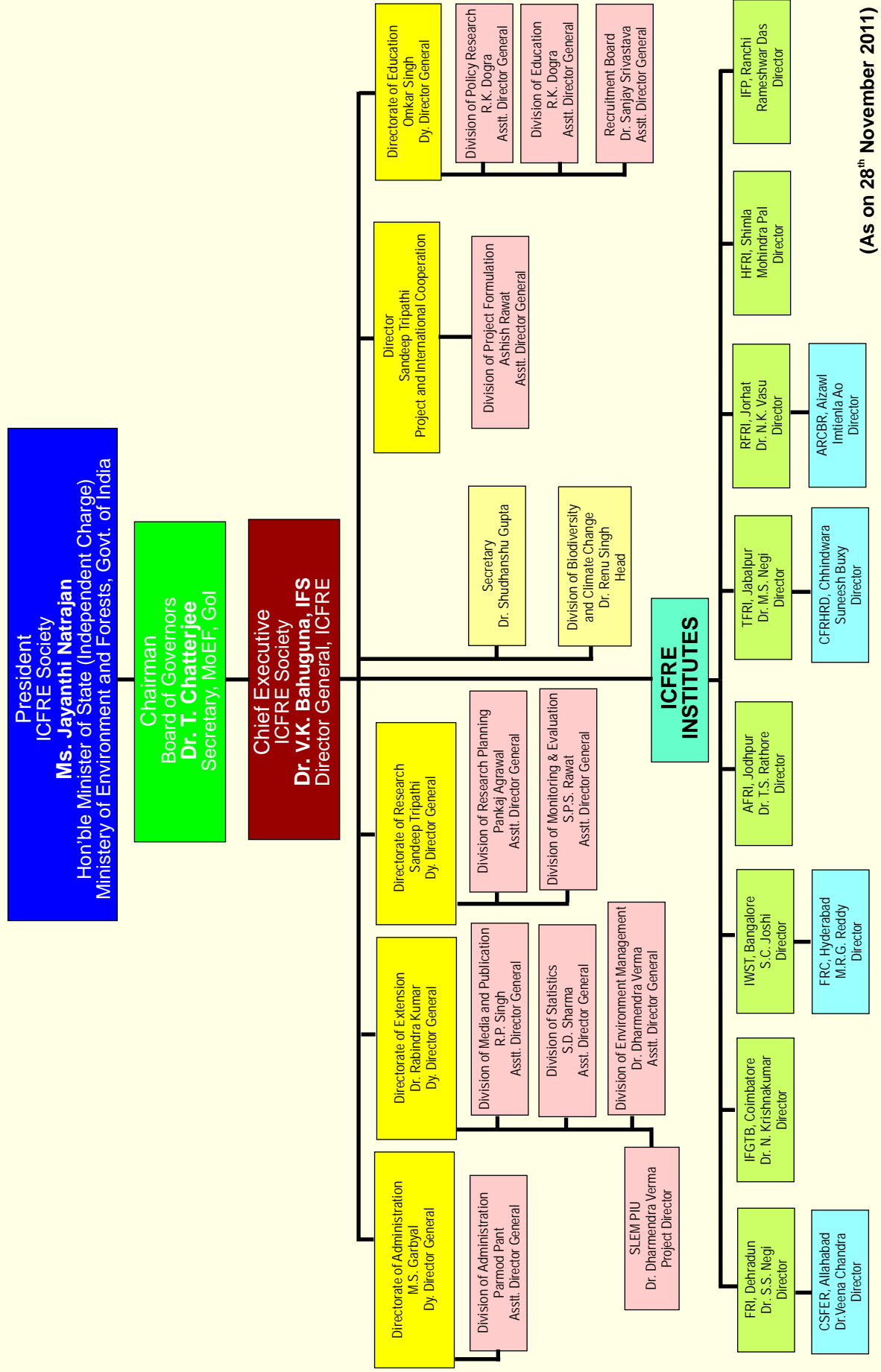
I am sure the report will provide an insight into research, education and extension activities of the Council undertaken during the year 2010-11 and will be of immense use to the readers.

  
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# ORGANIZATIONAL STRUCTURE OF ICFRE SOCIETY



(As on 28<sup>th</sup> November 2011)

## Executive Summary

Indian Council of Forestry Research & Education (ICFRE), an apex body in the National Forestry Research System, has been undertaking the holistic development of forestry research through need based planning, promoting, conducting and coordinating research, education and extension covering all aspects of forestry. The Council deals with the solution based forestry research in tune with the emerging issues in the sector, including global concerns such as climate change, combating desertification, conservation of bio-diversity and development of resources on the principles of sustainable management.

In the field of **Ecosystem Conservation and Management**, ICFRE has been awarded the status of Designated Operational Entity (DOE), the first ever in South Asia under the Clean Development Mechanism of the United Nations Framework Convention on Climate Change (UNFCCC) for validation and verification/certification functions for the sectoral scope of Afforestation and Reforestation.

An Air Pollution Biomonitoring Station for Air Quality Assessment was established in Dehradun. Study on biodiversity of parasitic Chalcidoidea (Hymenoptera) of Uttarakhand was carried out. Carbon Sequestration in soil and vegetation in 254 sites of 12 districts in Rajasthan and Vegetation carbon pool in 19 forest sites under Trees Outside Forest (TOF) was assessed in 6 districts in Rajasthan. An inventory of Soil Organic Carbon of Uttarakhand was also prepared. Eco-restoration works in Uranium Mines, Jadugoda, Jharkhand were carried out.

On the conservation front, ICFRE provided consultancy to Archaeological Survey of India for conservation of trees at Ta Prohm temple at Cambodia and to Bodhgaya temple Management Committee, Bodhgaya for the maintenance of Bodhi vriksha. Case of Achanakmar - Amarkantak Biosphere Reserve

was submitted to UNESCO for inclusion in World Network of Biosphere Reserve.

Ethnobotanical Data on 197 plant species were collected under Traditional Knowledge System from Savara, Khond, Jatapu, Kondadora, Nukadora, Bagatha and Porja tribes of Srikakulam, Vizianagaram and Vishakhapatnam districts of Andhra Pradesh.

Phyto-sociological studies conducted in parts of Kalatop Khajjiar Wildlife Sanctuary, Himachal Pradesh revealed the presence of 232 plants species belonging to 76 families and 218 genera which showed the presence of 100 plants species of medicinal importance, 7 of which fall in the category of threatened plants. *Bambusa balcooa* was identified as potential species for rehabilitation of jhum land with reference to carbon sequestration and livelihood development.

In the field of **Forest Productivity**, package of practices were developed for the *Dalbergia sissoo* based Agri-Silviculture system under 3 years old sissoo plantation. Two varieties of *Phyllanthus emblica* i.e. NA7 and NA10 were transplanted to establish the multi-tier Silvi-Agri-Spice system at TFRI, Jabalpur. Sustainable clump management practices for economically important bamboo species for enhanced production of quality culms and edible shoots were developed. Results of agroforestry trials revealed that *Cordia myxa* is the best horticulture species and *Prosopis cineraria* is best silviculture species in Rajasthan. Impact of ban on green felling in deodar, kail, fir and spruce forests of Uttarakhand was also studied. Silvicultural studies of *Hippophae salicifolia* – A wonder and lesser known plant of Uttarakhand were carried out. Initiatives such as establishing field trials with preferred trees and crops along with suitable geometrical arrangements was taken for productivity enhancement in abandoned jhum land through agroforestry management and value addition in Mizoram and Meghalaya. At





RFRI, Jorahat nursery practices for production of quality planting stock of important bamboo species for North-East were developed.

Pursuing research in **Genetic Improvement**, twenty-one large contiguous deodar forests of Uttarakhand, Himachal Pradesh and Jammu & Kashmir were investigated for Genetic Diversity using Microsatellite (SSR) DNA markers. Artificial hybridization was done in *Eucalyptus pellita* and *E. urophylla* for production of F1 inter species hybrids and seeds collected for raising seedlings. In order to Develop DNA marker technique in *Cedrus deodara* for Timber Forensics, success achieved in isolation of DNA from the dead wood of *C.deodara*. One clone of *Eucalyptus* hybrid (*Eucalyptus camaldulensis* Dehn. X *E. tereticornis* Sm.) and one clone (resistant against wilt disease) of *Dalbergia sissoo* was identified and recommended for release by the Regional Variety Testing Committee.

Under the “Tree improvement programme”, two progeny trials of *Melia dubia* and *Melia azadirach* have been established at FRC, Hyderabad and IWST, Bangalore. Early growth performance evaluation of the progenies CPT's collected from Karnataka especially from Kushalnagar, Kodagu showed their superiority. At RFRI, Micropropagation technique was standardized for clonal multiplication of *Aquilaria malaccensis* Roxb. Developed protocol for in vitro propagation of *Jatropha curcus* through somatic embryogenesis and refined protocol for micro-propagation of *Commiphora wightii* through somatic embryogenesis and axillary shoot proliferation followed by field trial at AFRI. Identified 20 CPT's of *Prosopis cineraria* for the establishment of germplasm bank and tree improvement. Evaluated multilocational clonal trials of *Eucalyptus camaldulensis* and *Dalbergia sissoo* and identified best performing 3 clones in

each species, which performed better in all four locations in Gujarat. Eleven populations of *Dalbergia sissoo* were analysed for genetic variation and it was observed that as compared to the populations of Uttarakhand, the populations of Jammu & Kashmir and Himachal Pradesh have more genetic diversity.

A demonstration plot (50 ha.) of *Dendrocalamus hamiltonii* using both tissue cultured and cutting raised plants was maintained during the year by HFRI. The survival percentage of Tissue Culture raised plants was 88% whereas the plants raised through cuttings was up to 95%. The electrophoretic data of the selected clones of *Dalbergia sissoo* were analysed for genetic variation and studies including the stress resistance, insect-pest resistance in the field were also accomplished.

In the field of **Forest Management**, ICFRE hosted the National Forest Rights Committee, jointly constituted by the Ministry of Environment and Forests and the Ministry of Tribal Affairs which submitted its report “*MANTHAN*” to the Hon'ble Minister of Environment & Forests, Govt. of India in January 2011. Quarantine Clearance to 'Bo Tree' from Sri Lanka at Gaya Airport was mediated. Deodar and Kail maps of Uttarakhand state were prepared and verified by ground truthing.

The major area of research in **Wood Products** was successful preparation of handmade paper from noxious weed *Lantana camara*. Drying of bamboo (*D. stocksii* and *D. strictus*) using microwave at different microwave intensity and exposure times was carried out. Ash elemental analysis of four selected bamboo species was carried out. An effort was made to develop eco-friendly wood preservative using naturally available plant by-products of *Cleistanthus collinus* and *Prosopis juliflora*. The plantation grown timber of *Acacia mangium* was observed for its durability in



the graveyard test and it was found that the controlled samples (untreated) were not attacked more than 2% after 3 years of exposure whereas treated samples were all intact without any damage. A non-destructive Ultrasonic method was found to be useful to assess the service life of used structures and as a guide for reuse of the timber structures in use. Timber should be properly seasoned by following proper kiln schedule which was revealed in the shrinkage studies carried out at IWST, Bangalore. In air-seasoning, care must be taken by painting/coating both the ends of timber to avoid defects like twist, cupping, crook and splits etc.

**Non Wood Forest Products (NWFP)** constitute a very important component of trade in forest products. The studies were carried out for better delignification through mechanical process to improve white rot fungus strains. Technology was developed for 'Reshaping the gums' and transferred to the firms of Chhattisgarh and Madhya Pradesh. A simple and facile process was developed to isolate Hederagenin from seed kernel extract of *Sapindus mukorossii*. Hederagenin is a potential bioactive compound known for its anticancer, anti-inflammatory, antidepressant, antihyperlipidemic, antityrosinase, skin lightening, cure of nephritis and prevention and treatment of bone diseases along with a number of other biological activities.

For sericulture industry, a novel green product named as “*Samriddhi*”- a silk productivity enhancer has been developed from the weeds and tested at Regional Sericulture Research Station, Sahaspur, Dehradun on Silkworm, *Bombyx mori* L. Application of “*Samriddhi*” brings down the silk production cost in terms of feed cost (mulberry leaves), lesser mandays (labour cost), space, infrastructure and time. Natural dyes and their different shades have been developed which are capable of dyeing different type of textiles (silk,

wool and cotton). At IWST, Nanoclay was compounded with polypropylene to study the effect of concentration of nanoclay, effect of coupling agent, and type of nanoclay. Specimens as per ASTM standards were prepared and mechanical properties (Tensile, flexural, compression and impact strength) were determined. Sandal oil content was determined by non destructive method by collecting core samples from standing trees from sandal bearing areas of Karnataka. Protocol was developed for cultivation of *Asparagus racemosus* (Shatawar). HFRI, Shimla identified 21 seed sources of *Jatropha curcus* from various parts of Himachal Pradesh with seed oil contents more than 30%, out of which 9 seed sources had oil content more than 35%. IFP, Ranchi has adopted ten villages in Khunti region with the community under UNDP project for establishing broodlac farms where production of lac has failed during last 5 – 6 years. Production of lac has become successful at Bari brood farm after providing (i) Lac cultivation training and demonstration (ii) Local good quality and disease free broodlac (iii) Pest control and (iv) technique demonstration from time to time to them.

On the **Forest Protection** front, artificial diet for conservation and utilization of praying mantis as biocontrol agents was developed. For Casuarinas, a biopesticide product, *Aegle marmelos* seed oil based biopesticide-“*Vilvekam*” a growth promoter formulation developed from the oil of *A.marmelos* and Nitrogen fixer *Frankia* sp. were released for the farmers at IFGTB. Biotreatment of industrial wastewaters using fungi was carried out. A new sandal seed borer *Araecerus fasciculatus* was found to cause serious damage to sandal seeds. Control of forest seed pathogenic fungi was achieved by using the leaf and bark extracts of *Prosopis juliflora* and *Cleistanthus*. Fifteen species of *Apanteles* have been recorded for the first time from Orissa, which





are promising biological control agents against defoliators of teak and sal forests. Twenty two Braconid larval parasitoids were recovered from key insect pests of forest tree species, with varied degree of field parasitisation, from Chhattisgarh and Maharashtra, which are important biological control agents of key forest insect pests. Diseases of medicinal plants, *Rauvolfia serpentina*, *Withania somnifera* and *Chlorophytum borivillianum* were identified from Madhya Pradesh and Chhattisgarh. The cause of culm rot and bamboo blight disease in Assam was identified as *Fusarium udum*. The most effective fungicides found *in vitro* are being tried for its management. Artificial inoculations of fungi carried out in Tezpur for inducement of agarwood in healthy agar trees resulted in formation of agarwood within a relatively shorter period. Sixteen species of insects, 2 species of mites, 3 species of parasitic nematodes and 13 species of disease infestation were recorded in *Acacia nilotica* and *Ravenella evansii*. Periodic fires in the Chir pine forests were found affecting the regeneration and stems of even pole size crop and big trees were found to be scorched, which subsequently resulted in their stunted growth and making these susceptible to insect attacks.

In the field of Training, ICFRE has been entrusted with Mid Career Training (MCT) Project for Indian Forest Service officers for Phase-III, by providing best institutional arrangement and partnership with Institutions like WII, Dehradun, FSI, Dehradun, IIM-Ahmedabad, Colorado State University, USA and Swedish University of Agricultural Sciences (SLU), Sweden. ICFRE has the distinction of organizing second such programme as lead training provider from 31<sup>st</sup> January to 4<sup>th</sup> March 2011. As part of the HRD initiatives for capacity building of scientific personnel, 11 training programmes (including 1 training of MCT Phase-III) were

organized in 8 Institutions of repute, in which 207 participants (including 60 participants of MCT) were trained.

In order to provide wide national exposure to the scientists, a total of 71 scientists were allowed to participate in national level seminars, workshops, symposia etc. Forty four cases of foreign visits were approved by the Government of India and funded by various sources to provide a much needed international exposure to the scientific cadre.

A five days training course on 'CDM Validation and Verification' by M/S TÜV SÜD South Asia Pvt. Ltd, New Delhi at ICFRE, Dehradun was organized from 9<sup>th</sup> to 13<sup>th</sup> August 2010. One week training programme for Scientists and Technologists on "Climate Change and Carbon Mitigation" from 6<sup>th</sup> to 10<sup>th</sup> September 2010. One Week Training programme for women scientists and technologists from institutions outside ICFRE on "Climate Change and Carbon Mitigation" from 4<sup>th</sup> to 8<sup>th</sup> October 2010 and one week Training Course on "Climate Change and Forests" from 31<sup>st</sup> January to 4<sup>th</sup> February 2011) were organized at ICFRE, Dehradun. At IFGTB, Coimbatore, a Training Workshop on "Management of Forest Genetic Resources" for Indian Forest Service officers from 18<sup>th</sup> to 19<sup>th</sup> October 2010, An International Training Workshop on "Conservation and Management of Forest Genetic Resources" from 5<sup>th</sup> to 9<sup>th</sup> July 2010 were organized. The 2<sup>nd</sup> National Seminar on Casuarinas was conducted from 3<sup>rd</sup> and 4<sup>th</sup> March 2011 and a Consultative Workshop on "Strategies for Formulation of Forest Genetic Resources Management Net work (FGRMN)" from 9<sup>th</sup> to 10<sup>th</sup> March 2011 was conducted. A National Seminar on "Tropical Ecosystems: Structure, Function and Services (TESFS -2010)" from 28<sup>th</sup> and 29<sup>th</sup> December 2010) was also conducted. At IWST, Training on bamboo macroproliferation and vegetative propagation was provided for officials of Goa Forest



Department (GFD), Andhra Pradesh Forest Development Corporation (APFDC) and Karnataka Forest Department (KFD) during February 2010, September 2010 and January 2011 respectively as a part of Packages of practices for high yield plantations for bamboo.

A field workshop was organized in association with Karnataka State Handicrafts Development Corporation Limited, for the benefit of the handicraft artisans of Multicraft, Metugally, Mysore. It was a lab to land extension programme conducted for extending the newer findings on the methods of production and protection of wooden handicrafts. At TFRI, Jabalpur, ten training programmes including the trainings to the trainers from State Forest Services were conducted during the year.

In the field of Forestry Education, ICFRE is providing Grant-in-Aid for promoting Forestry Education in the Country to various forestry research universities/ institutions under Agricultural universities offering undergraduate and postgraduate courses to strengthen their infrastructure and facilities and for giving impetus to forestry education in the country. Towards this objective, ICFRE released Grant-in-aid to the tune of ₹ 204 lakh to 10 Universities in the financial year 2010-11. Universities were encouraged to get accreditation by ICFRE, as a new initiative of quality control in forestry education for the first

time through Accreditation Board of ICFRE. The accreditation process was completed for 9 Universities and certificates issued. The proposals for accreditation of 9 more Universities have been received during the year.

On the Extension front, Tree Growers' Mela (fair), workshops and trainings were conducted for the benefit of farmers covering various themes. A workshop on "Best Practices in Tree Farming and an Exhibition on Plantation Technologies" was organized which was attended by more than 700 farmers and other stakeholders. In order to conduct relevant and responsive research, stakeholder meets were organised at all the institutes with the State Forest Departments. Training programme on seed production and nursery techniques, quality planting stock production, biofertilizers and biomanures, climate change and forestry, reproductive and floral biology of mangroves, and on plantation technologies were organized at the various Van Vigyan Kendras. Trainings were imparted to various the field staff of State Forest Departments on identification, conservation and sustainable utilization of medicinal plants to create awareness on medicinal plants. During the year under report 168 new projects were initiated including 32 externally aided projects whereas 130 projects were completed including 40 externally aided projects.

### Summary of projects\*

Projects	Completed Projects	Ongoing Projects	New Projects initiated during the Year
Plan	90	157	136
Externally Aided	40	60	32
<b>Total</b>	<b>130</b>	<b>217</b>	<b>168</b>

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

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# INTRODUCTION

The Indian Council of Forestry Research and Education (ICFRE) is an autonomous body under the Ministry of Environment and Forests, Government of India. The Council is an apex body in the national forestry research system to develop holistic forestry research through planning, promoting, conducting and coordinating research, education and extension on all aspects of forestry. ICFRE ensures scientific management of forest, tree improvement, forest productivity through scientific and biotechnological research, bioremediation of degraded land, efficient utilization of forest produce, value addition, conservation of biodiversity, effective agroforestry models for various agroecological zones, policy research, environmental impact assessment and integrated pest and disease management. The mission of ICFRE is to carry out research of forests, forestry and forest products at national level, and disseminate the results of this research to all concerned parties, including State Forest Departments, forest based industries, traders, farmers and other user groups. ICFRE carries out research under various research programmes eight research institutes and coordinate research in different parts of the country.

## Mission Statement

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

## Vision

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

## Objectives

- To undertake, aid, promote and coordinate forestry education, research and their applications.

- To develop and maintain a national library and information centre for forestry and allied sciences.
- To act as a clearing-house for research and general information related to forests and wildlife.
- To develop forestry extension programmes and propagate the same through mass media, audio-visual aids and extension machinery.
- To provide consultancy services in the field of forestry research, education and allied sciences.
- To undertake other jobs considered necessary to attain these objectives.

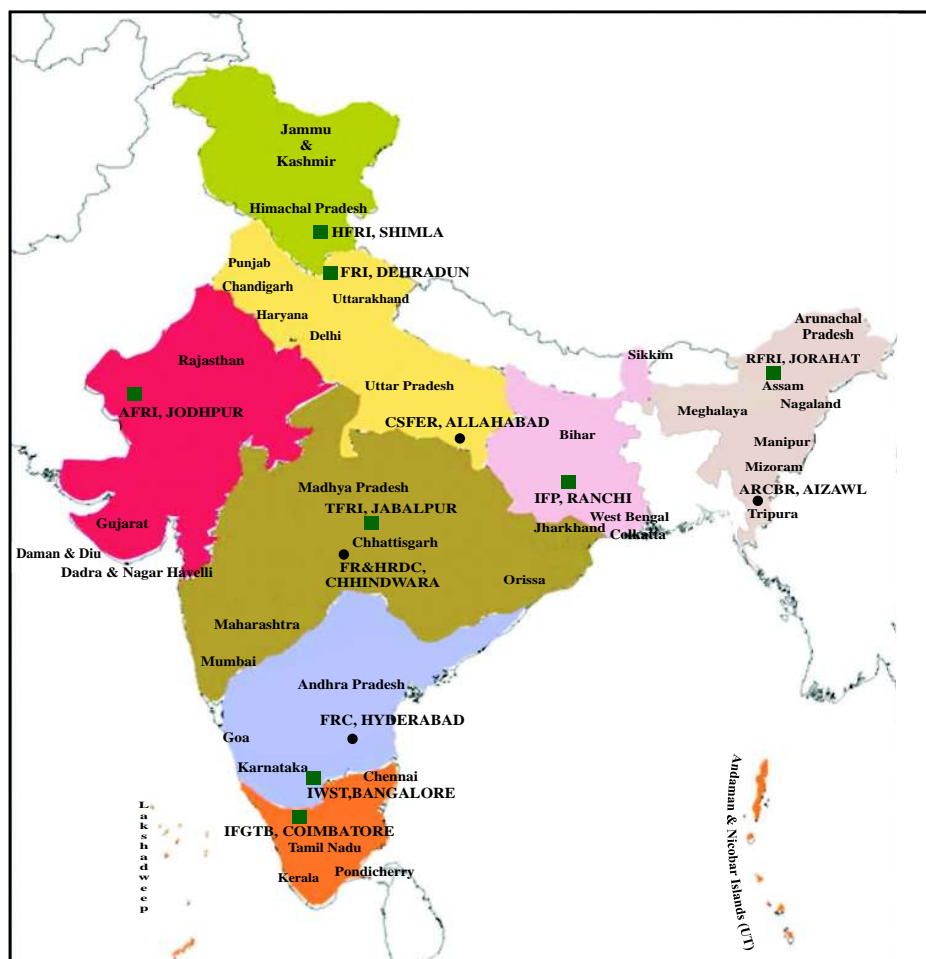
## Institutes and Centres

Indian Council of Forestry Research & Education (ICFRE) with headquarters at Dehradun has eight research institutes and four research centres spread over across the country to facilitate the forestry research, education and extension.

**Forest Research Institute (FRI)**, Dehradun established in 1906 is a premier scientific research institute under the aegis of Indian Council of Forestry Research & Education (ICFRE). FRI has established itself on global arena of forestry and related allied sectors through its persistent innovative and rigorous research approach to foster the needs of the forestry for entire India and even other subcontinent. At present, its research is prioritized on the basis of needs in its working jurisdiction of Uttarakhand, Uttar Pradesh, Haryana, Punjab and National Capital Territory of Delhi. The institute carries forward the high tradition of forestry research carried out by erstwhile Imperial Forest Research Institute. Research on various aspects of forestry like silviculture, ecology, pathology, entomology, chemistry, non-wood forest products, genetics and



### Map showing Institutes, Centres and their Jurisdiction



tree breeding and forest soil and land reclamation. The Institute is involved in meticulous research works related to improvement and management of forests and other associated issues. It also undertakes the research in other allied sectors of environment, climate change, soil reclamation, extension etc. based upon the needs and precedences. The Institute also has a field research station at Khirshu, Pauri Garhwal and a centre for social forestry and eco-rehabilitation at Allahabad.

Forest Research Institute, Dehradun has also been conferred the status of “Deemed University” by the Ministry of Human Resource Development, Government of India, New Delhi

and at present conducts courses on M.Sc. Forestry, M.Sc. Wood Science & Technology, M.Sc. Environment Management, Post Masters diploma in Natural Resource Management Post Masters diploma in Non Wood Forest Products and Post Graduate diploma in Pulp & Paper Technology. It also has Doctoral programme leading to award of Ph.D. degree. The institute has excellent laboratory facilities for conducting advanced research. The National Forest Library and Information Centre (NFLIC) of the Institute is richest in document collection on forestry and allied sciences in South and South-East Asia. At present Institute enjoys the status of ISO 9001:2000.





**Institute of Forest Genetics and Tree Breeding (IFGTB)** at Coimbatore is a national institute and focuses activities in the states of Tamil Nadu and Kerala. The institute was formed by upgradation of the erstwhile Forest Research Centre (FRC), Coimbatore working under the Forest Research Institute and Colleges ever since 1959. The institute focuses research on various aspects of forestry like genetics and tree breeding, plant biotechnology, forestry, land use and climate change, seed technology, forest protection, biodiversity and bioprospecting etc. The institute has DNA finger printing laboratory, Genomics laboratory, Phytochemistry laboratory, Genetic transformation laboratory, Tissue culture laboratory, Soil and water testing laboratory, and modern Seed Testing laboratory. The institute also has field units at Walayar and Panampally in Kerala; Karunya Nagar, Bharathiyar University Campus, Veerapandi, Kurumbapatty, Gudalur and Chennai in Tamil Nadu. IFGTB is in the process of establishing more field units across agroclimatic zones in the mandated states. The institute maintains one of the country's oldest herbaria established in 1911. The oldest forest museum in the country, the Gass Forest Museum established in 1906 maintains 4500 exhibits related to forestry and wildlife. The institute also has a botanical garden recognized by the Botanic Gardens Conservation International (BGCI) and the Indian Botanic Gardens Network (IBGN) which was established in 1973 over an area of 3.7 ha. to support *ex-situ* conservation activities.

**Institute of Wood Science and Technology (IWST)** at Bangalore is a national institute to conduct research on wood sciences and technology focuses activities in the states of Karnataka, Andhra Pradesh and Goa. Taking into consideration the expertise available and contributions made, the Indian Council of Forestry Research and Education (ICFRE) has

assigned the institute the status of "Centre for Advanced Studies" in the areas of improved utilisation of wood, mangroves and coastal ecology, and research on sandal. The institute aims to develop strategies for use and production of wood and other forest products in a way that sustains, their supply. A Shore Laboratory at Visakhapatnam and a Forest Research Centre at Hyderabad are parts of the institute with field stations at Gottipura and Nallal.

**Tropical Forest Research Institute (TFRI)** located at Jabalpur focuses activities in the states of central India, viz., Madhya Pradesh, Chhattisgarh, Maharashtra and Orissa. The institute conducts research on non-wood forest produce, rehabilitation of mined areas and other stress sites, development and demonstration in agroforestry models, planting stock improvement, sustainable forest management, biodiversity conservation and control of forest diseases and pests. The institute is actively involved in extension activities through its Van Vigyan Kendras. The Centre for Forestry Research and Human Resource Development (CFRHRD), Chhindwara came into existence as a centre to conduct research in the specialized areas like biodiversity conservation, non-wood forest products, forest protection, silviculture and tree improvement.

**Rain Forest Research Institute (RFRI)** at Jorhat was established in 1988 with an aim to extend knowledge on forestry related issues through research, education and extension and supports forestry research of north-eastern states including Sikkim. The institute focuses on conservation methods to restoration of degraded lands under shifting cultivation, management of community forests, preservation of unique heritage of the region for eco-restoration and multi-facet use of bamboo and cane, without damaging the ecological characters. To maintain economy and productivity to the farmers, RFRI



has been developing viable agroforestry models for North-East region of India. Research on tree improvement programme, field provenance trials, germplasm collection, standardizing macropropagation technique in nursery of important species have also been conducted and significant achievements made. Recently an Advanced Research Centre for Bamboo and Rattan (ARCBR) has been constituted at Aizawl, Mizoram by RFRI, specially for handling research problems on Bamboo and Rattans.

**Arid Forest Research Institute (AFRI)** at Jodhpur focuses activities in Rajasthan, Gujarat and Dadra & Nagar Haveli. The institute carries out research in forestry and allied fields to enhance land productivity and vegetative cover to conserve biodiversity and to develop technologies for the end-users. The main thrust areas of the institute are soil, water and nutrient management, technologies for afforestation of stress sites, management of plantations, growth and yield modelling, planting stock improvement, biofertilizers and biopesticides, agroforestry, JFM and extension, phytochemistry and non-timber forest products, integrated pest and disease management and forestry education and extension.

**Himalayan Forest Research Institute (HFRI)** at Shimla was established as High Level Conifer Regeneration Research Centre in May 1977 with an aim to carry out research on the problems associated with natural regeneration of silver fir and spruce. But after becoming part of the Council in 1987 it caters to the needs of J&K and Himachal Pradesh with focused research on

eco-rehabilitation of cold deserts, mined areas rehabilitation, insect-pests and disease incidences and management, besides studies on agroforestry practices in hills and regeneration of coniferous and high altitude broadleaved forests. The institute has well developed infrastructure of laboratories, library, herbarium, nurseries and experimental field areas for conducting research and training programmes and has nine Field Research Stations for carrying out site specific/objective research. The institute has also been declared as the “Advanced Centre for Cold Desert Afforestation and Pasture Management” by the ICFRE for taking up advanced research in eco-restoration of these difficult sites. Research Station located at Tabo and Lahaul-Spiti (HP) caters to the specific research needs of the cold deserts and the institute will soon start its research operations from Field Research Station, Leh (J&K).

**Institute of Forest Productivity (IFP)** at Ranchi came into existence in 1993 with the objective to formulate, organize, direct, manage and carry out forestry research and education in eastern region of the country i.e. the states of Bihar, Jharkhand and West Bengal. It has well developed infrastructure of laboratories, nurseries and demonstration/experimental field areas for conducting research and training programmes. The institute has Forest Research Centre, Mandar, Ranchi; Environmental Research Station, Sukna, West Bengal and Forest Research & Extension Centre, Patna, Bihar to cater the state research needs and extension activities.