ANNUAL REPORT 2012-13

INDIAN COUNCIL OF FORESTRY RESEARCH AND EDUCATION

(An Autonomous Council of Ministry of Environment and Forests, Government of India)

DEHRADUN (UTTARAKHAND)

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

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DEHRADUN (UTTARAKHAND)

Patron:
Dr. S.S. Garbyal, IFS
Director General
Indian Council of Forestry Research and Education
Dehradun

Editors:
Saibal Dasgupta, DDG (Extension), ICFRE
Vivek Khandekar, ADG(M&Extn.), ICFRE
Ramakant Mishra, RO (M&Extn.), ICFRE

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1. Pollinator in *Ailanthus excelsa* - IFGTB, Coimbatore
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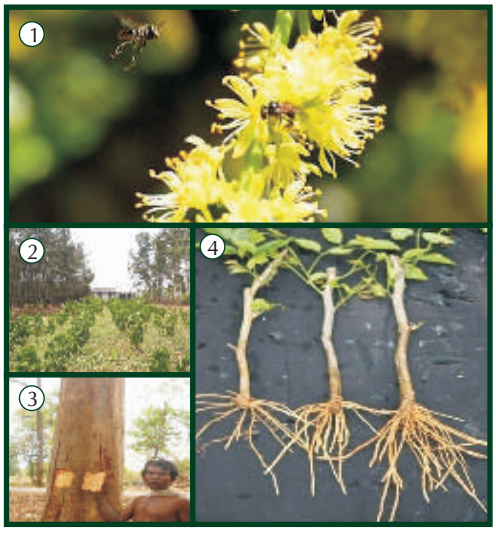


सत्यमेव जयते

डॉ एस. एस. गर्ब्याल, भा.व.से
महानिदेशक, भा.वा.अ.शि.प.
तथा कुलाधिपति, वन अनुसन्धान संस्थान–सम–विश्वविद्यालय
Dr. S.S. Garbyal,IFS
Director General, ICFRE
and Chancellor, FRI University

भारतीय वानिकी अनुसंधान एवं शिक्षा परिषद्
पर्यावरण एवं वन मंत्रालय, भारत सरकार
(आईएसओ 9001:2000 प्रमाणित संस्था)
पो.ओ. न्यू फॉरेस्ट, देहरादून–248 006 (उत्तराखण्ड)
Indian Council of Forestry Research and Education
Ministry of Environment and Forests,
Government of India
(An ISO 9001-2000 Certified Organisation)
P.O. New Forest, Dehra Dun - 248 006 (Uttarakhand)

FOREWORD

The Indian Council of Forestry Research and Education (ICFRE), Dehradun is a leading organization in the forestry sector which is actively engaged in holistic development of forestry research, education and extension for sustainable management and development of forestry resources based on scientific research, carried on in nine institutes and four centres spread over various geographical regions.

ICFRE carries out research with the twin objectives of addressing emerging issues of critical importance in forestry sector including climatic change, biodiversity and natural resource management on the one hand and for exploring new avenues of livelihood on the other aimed at economic upliftment of the poorer sections of society for a positive symbiotic relationship between the natural resources and their sustainable use. 'Vision: 2040' published this year lays out the roadmap and direction for research in future.

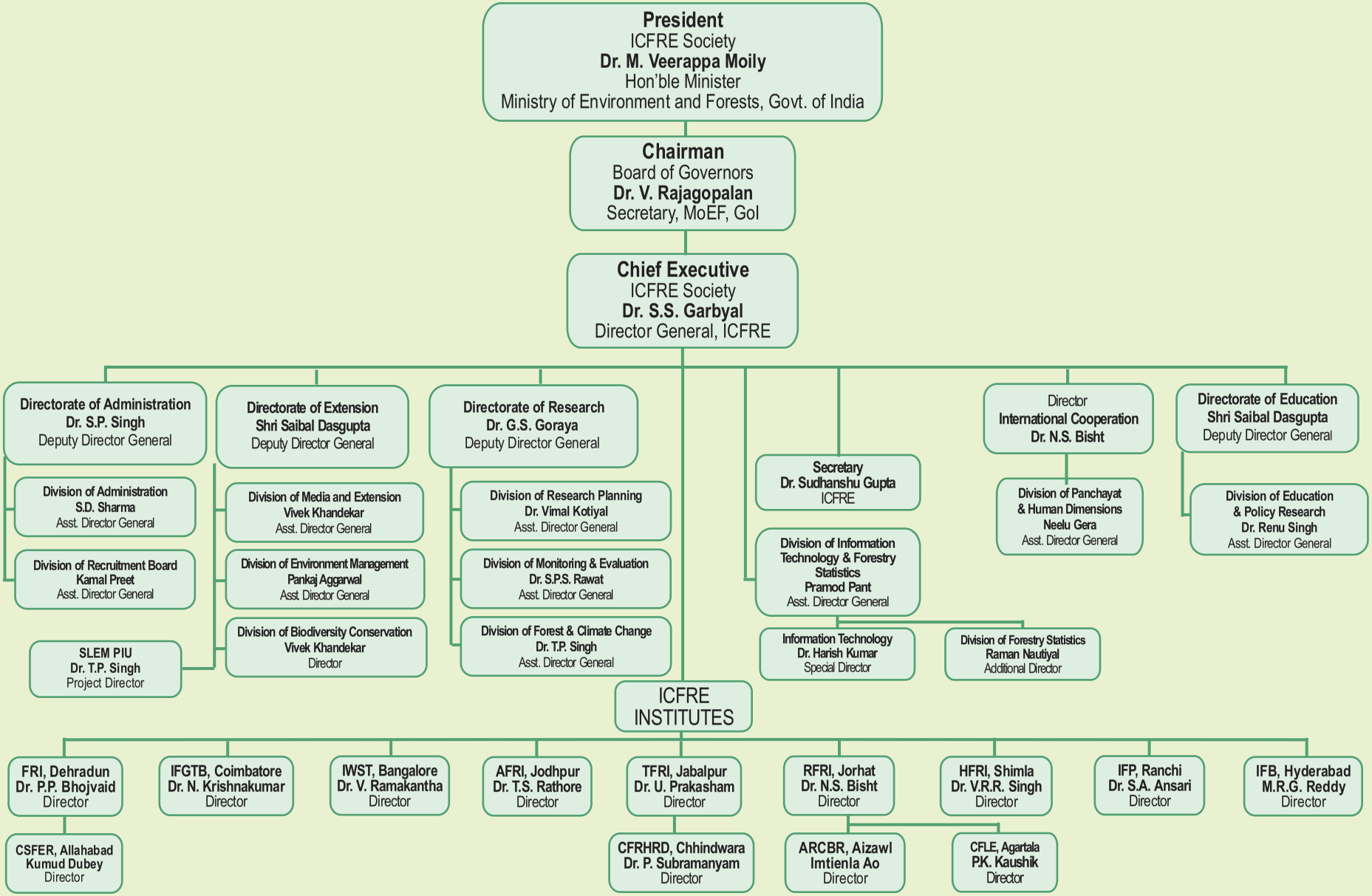
The research carried out by ICFRE is transferred to various stakeholders like forest departments, farmers & industries through its Van Vigyan Kendras in the form of simple innovative technologies. A strategy to link VVKs with Krishi Vigyan Kendras (KVKs) of ICAR for wider dissemination of research findings & technologies is paying good dividends. In addition, ICFRE also conducts a 'Tree Growers Mela' through its institutes for dissemination of products developed by ICFRE for farmers. The Council also provides consultancy services for conservation and eco-restoration ranging from Ta-prohm temple in Cambodia to Bodhgaya Bodh-Vriksha in India. ICFRE has been entrusted with the task of preparation of R&R Plans of mine affected areas of Bellary, Tumkur & Chitradurga districts of Karnataka by the Govt. of Karnataka. So far, 70 Recalamation & Rehabilitation (R&R) plans have been prepared by the Council & subsequently approved by the CEC of the Hon'ble Supreme Court.

In order to give a fillip to forestry education in India, monetary aid is provided to various universities teaching forestry for educational programmes and infrastructure development. The Council represented India in various national and international programmes for exchanging knowledge with other organizations. It also brought out some highly acclaimed publications including "Forest Biodiversity of India", "Forest Types of India: Revisited", and so on.

It is my pleasure to present Annual Report 2012-13, which contains a brief account of activities of ICFRE during 2012-13.

(Dr. S.S. Garbyal)

ORGANIZATIONAL STRUCTURE OF ICFRE SOCIETY



(As on 16th January 2014)

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 *Pycnoporous 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 quinqueseptatum, 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 Solublizing 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-Amarkanatk 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 Uttrakhand 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, *Azospirillium* 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 Uttarakhnad. 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 polysac-container in cold storage at -5^{0}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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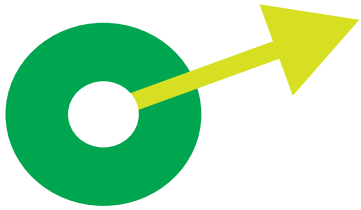
INTRODUCTION



Introduction

The Indian Council of Forestry Research and Education is an autonomous organization under the Ministry of Environment and Forests, Government of India. The Union Minster of Environment and Forests is the President of ICFRE and the Director General is its Chief Executive. The General Body is the supreme authority of the ICFRE, headed by the Union Minister, Environment and Forests, Government of India. Its members consist of serving and retried Officers from various State Governments, educational institutes, and scientific organizations (Annexure- I).

A. Structure

The organizational chart is presented at page iv. The Governing Body is headed by the Chief Executive i.e. the Director General who is the decision-making authority of the ICFRE. He is supported by four Deputy Director Generals (heading Administration, Research, Education and Extension Directorates); Director (Projects and International Cooperation); and Secretary, ICFRE. Further, the Deputy Director Generals are assisted by Assistant Director Generals at the headquarters. Each institute is headed by a Director and is supported by a Research Coordinator, scientists, officers and other staff.

Mission

To generate, preserve, disseminate and advance knowledge, technologies and solutions for addressing the issues related to forests and to 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.

Directorate of Research

It is responsible for conducting, Research Advisory Group (RAG) meetings at the Institute level, as per approved calendar at each Institute and Research Policy Committee (RPC) meeting at ICFRE level. It coordinates with all the institutes of ICFRE to formulate national level coordinated projects. Also, as a part of Bamboo Technical Support Group (BTSG), it conducts training programmes for various target groups.

Directorate of Education

This Directorate is responsible for capacity building of scientific and managerial cadre, through various training programmes. Also, enhances forestry education at national level through financial support to the state universities, imparting forestry education. This Directorate has also initiated accreditation process, in line with All India Council for Technical Education (AICTE) to improve the quality of forestry education. The Policy Research Division reviews and analyzes the existing forest policies, statutes and framework.

Directorate of Extension

The Directorate of Extension is responsible for extension of technologies, developed by the Council to various target groups, especially the farmers, through Van Vigyan Kendras (VVKs) and Demo Villages (DVs) through comprehensive extension strategies. The Environment Management Division extends scientific expertise, in the field of environment, to various agencies through consultancies. The Media & Extension Division facilitates various publications such as bulletins, brochures, pamphlets, newsletters and annual report and promotes Rajbhasha Hindi. The SLEM Project Unit acts as the Technical Facilitation Organization (TFO) to implement Global Environment Facility (GEF) funded and World Bank (WB) supported medium size projects on Policy and institutional reform for Mainstreaming and up scaling sustainable land and ecosystem management in India. The Statistics Division collects the data, pertaining to forestry, from all the states which is subsequently processed and disseminated through publication of yearly Forestry Statistics Report and Bulletin.

Directorate of Administration

The Directorate of Administration is responsible for financial planning and budget management of the Council. The IT Division caters to the Information Communication Technology needs of all Institutes under ICFRE and ICFRE HQ. The ICFRE Server Farm hosts the IFRIS Application and other allied key services like Messaging Service, Web Service, Database Service, Proxy Service, DNS Service, DHCP Service, FTP Service, Backup Service, Internet Service, MPLS-VPN service, Video conferencing, Antivirus Service, Helpdesk Service and CA EMS ISS.

Director, Projects & International Cooperation

The Director, Projects & International Cooperation, along with Panchayat and Human Dimensions Division, has the mandate of developing linkages with international and national organizations in respect of developing projects, MoUs and consultancies.

Institutes and Centres of ICFRE

ICFRE has nine Regional Research Institutes and four Research Centres located in different bio-geographical regions of the country in order to cater to the forestry research needs of the nation.

Forest Research Institute (FRI), Dehra Dun, established in 1906 is a premier scientific research and ISO 9001:2000 certified Institute. The Institute carries forward the high tradition of forestry research, carried out by erstwhile Imperial Forest Research Institute to cater to the forestry research needs of the states of Uttarakhand, Uttar Pradesh, Haryana, Punjab and National Capital Territory of Delhi. The advanced Centre for Social Forestry and Eco-Rehabilitation (CSFER), Allahabad, under the umbrella of FRI and with the aim on social forestry and eco-rehabilitation caters to the needs for Eastern Uttar Pradesh, North Bihar and Vindhya Region of Uttar Pradesh and Madhya Pradesh.

FRI has also been conferred with the status of "Deemed University" by the Ministry of Human Resource Development, Government of India, New Delhi to conduct M.Sc. Forestry, M.Sc. Wood

Science & Technology, M.Sc. Environment Management programmes beside conducting Post Masters diploma in Natural Resource Management and Non-Wood Forest Products, and Post Graduate diploma in Pulp & Paper Technology. It also runs Doctoral Programme leading to the award of Ph.D. degree.

The National Forest Library and Information Centre (NFLIC) of the Institute is the richest centre of forestry and allied sciences, document collection in South and South-East Asia.

Tropical Forest Research Institute (TFRI), Jabalpur focuses research activities in the states of central India, viz., Madhya Pradesh, Chhattisgarh, Maharashtra and Odisha. It has a satellite Centre, the Centre for Forestry Research and Human Resource Development (CFRHRD) at Chhindwara which conducts research, in the specialized areas of human resource development in forestry sector by imparting vocational training leading to poverty alleviation through self employment.

Arid Forest Research Institute (AFRI), Jodhpur focuses research activities in Rajasthan, Gujarat and Dadra & Nagar Havelli. The Institute carries out research in forestry and allied fields to enhance, arid and semi arid land productivity and vegetative cover, to conserve biodiversity and to develop technologies for the end-users.

Himalayan Forest Research Institute (HFRI), Shimla was established in 1987 from Conifer Regeneration Research Centre. The Institute caters to the research needs of the states of Jammu & Kashmir and Himachal Pradesh with focused research on Himalayan and cold desert areas. It has nine Field Research Stations for carrying out site specific research, including the one located at Tabo and Lahaul-Spiti (HP) to address specific research needs of cold deserts. The Institute has also been declared as the "Advanced Centre for Cold Desert Afforestation and Pasture Management" for taking up advanced research.

Rain Forest Research Institute (RFRI), Jorhat was established in 1988 to support forestry research in North-Eastern states. The Institute focuses on, conservation methods for restoration of degraded lands under shifting cultivation, management of community forests, and multi-facet use of bamboo and cane. Advanced Research Centre for Bamboo and Rattan (ARCBR) has also been established in Aizawl (Mizoram) as its unit in 2004, which conducts research for socio-economic upliftment of North-Eastern people, that revolve around Bamboos and Rattans.

Institute of Forest Productivity (IFP), Ranchi established in 1993 to cater to the forestry research needs and education in eastern region i.e. the states of Bihar, Jharkhand and West Bengal. The Institute also has Forest Research Centre at Mandar (Ranchi), Environmental Research Station at Sukna (West Bengal), and Forest Research & Extension Centre at Patna (Bihar) to carry out research and extension activities.

Institute of Forest Biodiversity (IFB), Hyderabad was established during December 2012 by way of up gradation of the erstwhile Forest Research Centre with the mandate to carry out research on forest biodiversity of Andhra Pradesh with special emphasis on the forest biodiversity of Eastern Ghats.

Institute of Wood Science and Technology (IWST), Bangalore was established in 1988. The Institute caters to the forestry research needs of the states of Karnataka and Goa. The Institute has

widened its research activities in the fields of tree improvement and wood energy in addition to conventional wood sciences. This Institute has also been widely recognized, as the centre for advanced studies in areas of, improved utilization of wood, Mangrove and coastal ecology and Sandal research of Western Ghats.

Institute of Forest Genetics and Tree Breeding (IFGTB), Coimbatore was formed during 1988 by up gradation of Forest Research Centre (FRC), working under the Forest Research Institute and Colleges since 1959. The Institute caters to the forestry research needs of the states of Tamil Nadu, Kerala, Andaman and Nicobar, and Lakshadweep Islands. It maintains seed production area and clonal orchards for important fast growing tree species such as teak, casuarinas, eucalypts, Pongamia, Jatropha and acacia. The institute has field units in Kerala, Tamil Nadu and Andaman and Nicobar islands.

B. Research Management

Directorate of Research

The Directorate of Research works under the guidance of Deputy Director General (Research) who is assisted by ADG (RP), ADG (M&E) and a number of scientists. The Directorate ensures that all the research projects taken up by ICFRE Institutes are need based and address the regional and national forestry research problems. The research prioritization by the Directorate is through participatory mechanism involving all the stakeholders and end users.

Research Planning Division under the Directorate of Research deals with the planning, formulation and finalization of plan funded forestry projects of nine research institutes and four research centers of ICFRE. The process involves stakeholders meets, Research Advisory Group (RAG) meetings at each institute and national level Research Policy Committee (RPC) meeting at ICFRE HQs under the chair of Director General, ICFRE keeping in view the balance among international, national, regional and state research requirements and decide investment in high quality forestry research/ emerging issues to meet the aspiration of the society with bottom-up, transparent and participatory approach. It also reviews the ongoing projects under five year rolling plan. Twenty one new plan projects with 53 components were initiated during the year.

Research Advisory Group (RAG) meetings of each of the nine ICFRE institute for 2012-13 were convened as per approved calendar at Institutes/ by circulation of the proposals to the RAG members.

Follow up meeting of XIII RPC:

The Follow up meeting of XIII RPC was convened on 11th May, 2012 at ICFRE HQs Board Room under the chairmanship of DG, ICFRE. In the earlier meeting of XIII RPC held on 14th -16th February, 2012 at ICFRE HQ, it was decided that the research system of ICFRE be tuned to the Programme mode for optimal manpower utilization, ensuring a proper delivery system for the forestry research results. As per the directives of the XIII RPC Meeting, the six NPDs of identified thrust areas were directed to formulate All India Coordinated Projects/ Net working and Inter Institutional Projects in their respective Thrust Areas. A total of 21 Programmes were taken up in four Thrust Areas of Research.

Release of Compendium "Changing Frontiers of Research Programmes in ICFRE based on XIII Research Policy Committee (RPC) 2012 Meeting"

Research Planning Division, Directorate of Research, ICFRE compiled the outcome of the new initiatives taken recently in the research planning and prioritization system and highlighting the process of formulation of bringing the scattered and piece meal projects into the National Programmes as All India Coordinated Projects/ Inter institutional Projects and Networking Projects.

Bamboo Technical Support Group (BTSG):

- Representatives of **BTSG-ICFRE** participated in the review meeting of National Bamboo Mission, Krishi Bhavan, Ministry of Agriculture on 5th November 2012.
- Three trainings of 5 days duration each on "Bamboo Handicraft and Jewellery Making for the Farmers/Artisans" were conducted under BTSG-ICFRE (National Bamboo Mission).

Monitoring and Evaluation Division under the Directorate of Research deals with the annual review and evaluation of all the ongoing research projects of ICFRE institutes. It suggests corrective measures for timely completion of the projects and achievements of the objectives with perfection. During July October, 2012, the annual review of 440 (347 ICFRE funded and 93 externally aided) ongoing and completed research projects of all ICFRE institutes was conducted and reviewed.

Half yearly Progress Reports of individual projects from Directors for the period ending March, 2012 and September, 2012 for ongoing and completed projects were scrutinized for conformity with the approved action plan and corrective measures were suggested for timely achieving the objectives.

Director (Project & International Cooperation)

The Director (Project & International Cooperation), assisted by the ADG, Panchayat and Human Dimensions Division, has the mandate of developing linkages with international and national organizations in respect of developing projects, MoUs and consultancies. The Division also organizes seminars, meetings and conferences, especially pertaining to forestry research and livelihoods. The major achievements / activities during the year 2012-13 are as follows:

- Formulated projects under the thrust area "Managing Forests and Forest Products for Livelihood Support and Economic Growth" with the vision to promote holistic growth and development of forest based resources through proper management strategies. The detailed concept notes of the following projects were developed and submitted to various funding agencies.
- Management of Forest Fringes for Sustenance, Livelihoods and Conservation
- Agro-forestry for Green Economy and
- NTFP based modules
- The following Conferences/Workshops were organized during the year
  - i) International Poplar Commission and Executive Committee meeting was held at Dehradun from 29th October to 2nd November 2012.
  - ii) Integrated Forest Based Enterprises with Rural Development for Livelihood Support

and Economic Growth was held on 21st March, 2013 at Dehradun.

- Twenty five MoUs/consultancies were signed by various ICFRE Institutes with international and national institutions were coordinated during the year.
- An international collaborative project "TREEPLANZ" was submitted to EU in collaboration/ partnership with eleven International Research Organizations. The project aims at the capacity building of the researchers.
- "The Integrated Community based Forest Management" Project in Bihar, which was launched in 2006, was implemented by IFP, Ranchi with collaboration with this Directorate. The highly successful project has been appreciated by the Planning Commission and Govt. of Bihar. During the period of project 2007 to 2013, a total of 83.5 lakh poplar plants and more than 16 lakh non-poplar plants have been produced by farmers in their Kisan Nurseries. Demonstration model plants, clonal seed orchards have been established at various places in Vaishali district. An agroforestry extension centre is also coming up.

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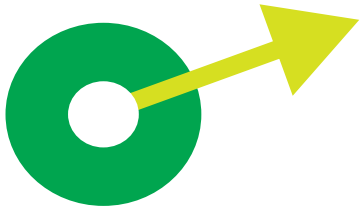


MANAGING FORESTS AND FOREST PRODUCTS FOR LIVELIHOOD SUPPORT AND ECONOMIC GROWTH

Managing Forests and Forest Products for Livelihood Support and Economic Growth

In view of the importance of forestry in livelihood support and economic growth of the people of the country, an ambitious programme has been envisaged with emphasis on areas including Agroforestry, Chemistry of Forest Products for Value Addition, Utilization of Forest Invasive Species, Wood Science and Technology, Wild Fruits, sustainable Management of Fringe Forests, microbes in service of mankind, Tree Resource Management for livelihood and economic growth with particular reference to species, including Bamboo, Rattans, *Buchanania lanzan, Madhuca latifolia, Juniperus, Hippophae, Melia composita* besides other target specific programmes. Also programmes were developed on tussar, lac and honey by the concerned institutes. Important outcomes of various components of the programmes are presented below.

2.1 Silviculture and Forest Management

Baseline Survey/Inventory of Guggal and Salai Guggal distribution in Haryana

This study aims at preparing districtwise availability of Guggal and Salai Guggal in forest and non-forest areas of Haryana for serving as baseline documentation for future conservation and potential utilization of *Commiphora wightii* and *Boswellia serrata*. Two districts namely Gurgaon and Mahendragarh have been surveyed so far. The study also involves documenting phyto associates of the species. Surveys in other districts is continuing.

Survey of Guggal

Natural population of Salai Guggal

Preparation of the management plan of Asola Bhatti Wildlife Sanctuary, New Delhi

Identification of flora and fauna of the PA carried out and vegetation survey for different sites including abandoned pits of Bhatti mines area conducted for biodiversity assessment. Sample plots have been laid for the assessment of tree species and estimation of tree population in both Bhatti and Asola areas. Mapping of PA boundaries, Forest roads, terrain etc has been done by using LISS-IV, Cartosat-I and Google Earth satellite data in association with IIRS. Forest cover and density class maps and Land use maps for the PA prepared. Estimation of faunal elements is aimed at by both Direct sighting and Indirect evidences. Line

Transect method adopted for both types of estimations.

Survey of Bamboo resources and quantitative assessment of their production and consumption in North India

Required data for the states of Punjab, Haryana, Chandigarh, Delhi, Uttarakhand and Uttar Pradesh have been collected through field visits. Data on demand, supply and market intelligence of bamboo have also been collected.

Revision of National Working Plan Code

With the objectives of incorporating Criteria & Indicators for Sustainable Forest Management, usage of modern technologies like GIS, GPS, etc., addressing new concepts like climate change, carbon sequestration, etc., inclusion of focused management of NWFPs in view of their high economic and livelihood importance in National Working Plan Code, this project was assigned to FRI by MoEF. FRI has initially conducted a consultative workshop cum- meeting at Dehradun, followed by three regional workshops at Kolkatta, Benguluru and Dehradun, inviting opinions and comments from various quarters of forest fraternity. The suggestions and comments received were communicated to all states. The comments received therein are likely to be discussed and deliberated at the national level in MoEF, New Delhi, for finalizing the national working plan code.

Development of Sandal (*Santalum album* Linn.) Information System

System Analysis for sandal web database has been completed. Collected inputs on various aspects from Sandal subject experts of the Institute for designing the database. Model web database created. Collection of information on sandal from various Forest Departments/Depots and Plantation areas has been completed. Sandal data have been collected from Andhra Pradesh, Chhattisgarh and Kerala and to be collected from the States of Tamil Nadu, Karnataka, Madhya Pradesh, Rajasthan and Gujarat. Data collection is under the progress through Internet from forest depots, university, journals and libraries.

Growth and yield studies on forest plantations of teak in Karnataka for their sustainable management

Annual measurements carried out in 27 sample plots laid out in Yellapur, Haliyal, Koppa, Madikere and Virazpet Forest Divisions and growth data recorded in all the sample plots. Data collected have been compiled and analyzed.

Lead Institution for Achanakmar-Amarkantak Biosphere Reserve, Chhattisgarh

Surveyed and collected a total of 558 insect samples which included butterflies, moths, beetles, bugs, grasshoppers, dragon and damsel flies. Identified 82 species of butterflies and moths, out of which 67 species were new addition to insect faunal composition of Achanakmar-Amarkantak biosphere reserve. Maintained periodical interface with Bioshpere Researve manager and assessed the research needs, such as tree mortality in Biosphere Reserve and other activity like monitoring and evaluation of developmental activities of MAP, 2011-12. Created web based information centre for Achanakmar-Amarkantak biosphere reserve and linked to the website of TFRI. Submitted project proposal for designation of Achanakmar-Amarkanatk Biosphere Reserve on World Network of BRs recognized by UNESCO. The International Council of UNESCO's Man and the Biosphere Programme (MAB) meeting in Paris from 9-13 July 2012 declared Achanakmar-Amarkantak Biosphere Reserve under the World Network of Biosphere Reserves (WNBR). Organized workshops/

trainings on Achanamar-Amarkantak Biosphere Reserve and training materials provided to the frontline staff of biosphere reserve. Published Biosphere Reserve Information Series BRIS 2(1 2): 158 pp. and 3 (1-2): 93 pp. and prepared Biosphere Reserve Information Series BRIS 4(1-2): 50 pp., for publication.

Standardization of pruning practices and optimum doses of organic and inorganic fertilizers to increase leaf surface area of tendu

- Experiments on foliar spray of chemical fertilizers were conducted in Morga to observe the effect of different doses of fertilizers, either individually or in combination, on increment in size of tendu leaves using RBD factorial design.

Conducting Experiment on Application of Chemical Fertilizer on tendu leaves: (A) Foliar Spray and (B) Collecting Tendu Leaves from Experimental Site at Morga

- Experiments on chemical and biofertilizers viz. urea, single super phosphate, vermicompost and neem based biofertilizer on enhancement of quality and sustainable production of tendu leaves were conducted at Morga, Kotadol and Litipara using RBD factorial design.
- Experiments on pruning practices of tendu with treatments including time interval of pruning, height of pruning and girth classes were conducted at Morga, Kotadol and Litipara using RBD Factorial design.

Studies on the effect of different level of seed collection on natural regeneration of Sal (Shorea robusta) in Chhattisgarh

Three sites, Bastar, Raipur, Bilaspur and two sites at Koria Forest Division and Marwahi Forest Division were selected and laid out sample plots to study the effect of different level of seed collection, fire and grazing in pure, mixed and degraded sal forests. Experiments were also laid out in pure, mixed and degraded sal forest of the three sites.

Population dynamics of selected threatened medicinal plant species and conservation management through community participation in buffer and transition zone of Achanakmar-Amarkantak Biosphere Reserve, Madhya Pradesh

- A pilot survey of the East Karanjiya range, comprising 105 compartments and Amarkantak range with 47 compartments was undertaken to locate populations of the target species *viz. Celastrus paniculatus, Embelia tsjeriam-cottam, Peucedanum nagpurens, Rubia cordifolia* and *Thalictrum foliolosum*.
- The permanent plots for monitoring population dynamics were laid and marked with target plants. Nine species of medicinal plants *viz.* pudina, kali tulsi, bach, lemon grass, gwarpatha,

adusa, giloe, aonla, harra and bel of direct use to villagers, were distributed to encourage herbal homestead garden and promote use of herbals among them. Socio-economic profile of participants was assessed through a questionnaire. It was observed that 90% of participants had not harvested medicinal herbs and other NTFP's, commercially other than sal leaves, aonla, harra and mahul whenever available in last 2-5 years, mainly because of unavailability of the produce.

Standardization of sustainable harvesting practices of Mahul Patta (*Bauhinia vahlii*)

Different girth/age group populations of *Bauhinia vahlii* (Mahul) were selected to lay out experiments for standardization of sustainable harvesting practices. Different methods of drying (room temperature, oven and sun drying) were experimented. Sun drying was found to be the best method for drying of leaves followed by oven drying. The quality of leaves collected from study area was assessed by measuring their size (length and width), insect and fungal infestation.

Productivity study and modeling growth and yield in Teak Plantation in Gujarat state

The survey of teak plantations was conducted at Varodara, Narmada, Panchmahal, Baria, Vyara, Dangs, Rajpiplla, Dahod and Godhara divisions. Out of the thirty two sites visited, nine suitable sites were selected for studies. The PCCF, Gujarat State Forest Department has granted permission of lying out of nine permanent sample plots and also permission for felling of total 40 numbers of trees of *Tectona grandis* of different diameters classes, five each from the surrounding of each permanent sample plots of the plantations for productivity studies.

Market survey on selected species in selected markets

- Data pertaining prices of timber such as *Tectona grandis, Dalbergia sissoo*, fuel- wood of mixed species, bamboo and poles were collected from the private markets of Jaipur and Ahmedabad in the end of each of four quarters. Data were compiled on prescribed formats and submitted to ADG (Stat.), ICFRE, Dehradun for publication of Timber and Bamboo Trade Bulletin.
- **Application of GIS for identification and monitoring of lac host belts in Chotanagpur area -** surveys and marking of pockets of Lac yielding belts were done for ground truth verifications. Documentation of information regarding production of lac during the respective seasons were carried out. The production in an area has been documented for a general assessment of the areas, where lac hosts are used for lac production. Marking of pockets of lac yielding belts through GIS/RS has been done for confirmation through ground truth verifications and a distribution pattern of lac host areas has been obtained through imagery. Database regarding production of lac in different areas has been developed.
- **Integrated strategy for evaluation of indigenous fast- growing multipurpose trees of eastern India for plantation forestry-** protocol for successful root induction with >70% rooting in semi hardwood cuttings has been developed in *A. chinensis* and >50% rooting in case of *B. ceiba*. Hedging schedule has been standardized for obtaining perennial supply of vegetative propagules and optimized rooting for both the species. The experiment conducted in randomized block design with hedging treatments once in a year, twice in a

year and three times in a year. Regular tending and maintenance was carried out of vegetative multiplication gardens established under the project. Clonal techniques have been scaled up and perfected for these important plantation forestry species of Eastern India.

Determination of Morphological and Physiological Quality Parameters of Nursery Stock of Deodar (*Cedrus deodara*) and Ban Oak (*Quercus leucotrichophora*)

Raised and maintained nursery stock of Deodar and Ban Oak at Model Nursery, Shimla and also at Field Research Station, Shilly, Solan respectively. Visited nurseries (35nos.) of the State Forest Department of Himachal Pradesh and collected the relevant information from the field functionaries regarding nursery raising and quality parameters being adopted by them for raising Deodar and Ban Oak nursery seedlings. Interim minimum standards of quality of Deodar and Ban Oak nursery stock were developed in consultation with the field functionaries. Based upon their morphological gradings, initiated studies for judging quality of Deodar and Ban Oak nursery stock. Studies pertaining to Root Growth Potential (RGP) and chlorophyll grading were also taken up and related observations recorded.

Deodar Out planting in Gunny bags

Training programme at Chail (HP)

Development of Techniques for Raising Deodar (*Cedrus deodara*) Plantations through Tall Plants

- After extracting wildlings of deodar from the adjoining forests of Shillaru and Kandyali, district Shimla, an experimental plantation, using these wildlings on the basis of their height and root collar diameter classes was established near Shillaru.
- For reaching out more effectively amongst the end-users i.e. State Forest Department, a training and demonstration programme on 'Modern Nursery Techniques and Production of Tall Plants of Deodar' was successfully organized in active collaboration with Divisional Forest Officer, Shimla at Mashobra near Shimla. Data pertaining to field and

Raising of Deodar tall plants in nursery

Training programme at Mashobra (HP)

nursery trials were compiled and analyzed statistically for drawing logical conclusions. The final project report is under preparation.

Studies on Seed Germination and Longevity of *Abies spectabilis* (D.Don) Spach

- During the last two years of implementation of this project, extensive surveys were conducted for identifying the natural populations of *Abies spectabilis* in five forest divisions of Himachal Pradesh. In the process, identified nine natural populations of *Abies spectabilis* were selected and various edaphical and other physical parameters were recorded.
- During the year 2012-13, survey was continued for identifying the natural populations of *Abies spectabilis* and accordingly, added eight more natural populations of the species to the already existing data. Till date, a total of seventeen natural populations of *Abies spectabilis* have been identified from different Forest Divisions of Himachal Pradesh. The soil samples collected from the identified sites for estimation of soil pH, organic carbon, moisture content, electrical conductivity, nitrogen and potassium content to know the site characteristics of the identified locations. The germination trials of

Tress of *Abies spectabilis* gowing in Jani Beat and at Foktodar, Panvi Beat

the seeds carried out in the laboratory and germination data recorded. The seeds of *Abies spectabilis,* treated with different pre-sowing treatments recorded around 40 per cent germination under laboratory condition. It was, however, observed that almost 60-65 per cent seeds were found empty. The seed storage trials were maintained and viability of stored seeds tested periodically in laboratory. The seeds of *Abies spectabilis,* stored in air tight polysac container in refrigerator at -5^{0}C retained around 26 per cent viability after nine months of storage, as compared to other storage container and storage environment that showed less seed viability.

Determination of Nursery Requirements and Initial Planting Performance of *Diploknema butyracea* (Roxb.) H.J. Lam and *Myrica esculenta* Buch. Ham under Mid-hill Conditions of Himachal Himalayas

The project was initiated during April, 2012 and during the period, seeds of *Myrica esculenta* commonly known as Kaphal were collected from Shimla and Solan districts of Himachal Pradesh and subsequently, germination studies were initiated both in the nursery and in laboratory conditions. Also initiated vegetative propagation studies in Kaphal under semi-controlled conditions at Model Nursery Baragaon, Shimla. Similarily, seeds of *Diploknema butyracea* (Cheura) collected from Champawat district of Uttarakhand was sown in two nurseries, namely Shilly (Solan) and Bir Plassi (Nalagarh) falling in mid and lower Himalayas respectively.

Vegetative propagation studies in Kaphal and Cheura seeds collected from Champawat (UK)

Productivity and biometrics studies on some important species i.e. *P. cineraria* and *A. excelsa* in semi-arid regions of Rajasthan for their sustainable management was carried out.

2.2 Agroforestry and JFM

Study on status of existing Agroforestry systems in Punjab, Haryana, Uttarakhand and North-West region of Uttar Pradesh

Twenty villages were surveyed and data collected with regard to their socio-economic status and agroforestry practice systems in Baldi, Kuahedi, Ulheda, Narsankhurd, Saheedwala Gherpemma and Naukra Grant, (Haridwar) and Shergarh, Lakhanwala (Dehradun), Handesra, Sarangpur and Singhpur, Mohali (Punjab), Kheda jatan and Chhajjumajra (Ambala), Kotla, Lalpani, Bishanpur, Rawathawn, Beyal, Uphulda and Danga (Pauri Garhwal).

Studies on the enhanced fodder productivity through Silvi-Pasture system on degraded land of India is being done on selected sites of Kharakhet in district Dehradun

Development of Lac Based Agroforestry (Silvi-Agri-Lac) System

Kusumi strains were collected from Flemingia bushes planted at Kanker Forest Department on the new shoots of Flemingia species viz. *F. macrophylla* and *F. semialata* under the lac based Silvi-agri-lac system as an OSR trial during January, 2013. Agriculture crop *Cajanus cajan* were intercropped in the interspaces of *Flemingia* plants- a bushy lac host species. Leaf folder attack on the seedlings of the *Flemingia* was recorded. The affected plants were controlled by spraying of Spinosit.

Evaluation of *Madhuca indica* based Silvi-Agri system

The field was selected and established with Mahua seedlings (grafted as well as seed originated) in the experimental area of Agrofoestry Division. Soil samples from the experimental area were collected and the status of soil nutrient available in the field evaluated.

Development of Silvi-Agri-Medicinal and Agri-Medicinal systems in Vidharbha Region of Maharashtra

The adjoining villages of Chandrapur district of Vidharbha Region of Maharashtra state were surveyed to select the farmer's field, for the establishment of the Silvi-Agri-Medicinal system and to create awareness and adaptation of agroforestry system among the farmers of Maharashtra.

Introduction of selected genotypes of Karanj, Kusum and Bamboo as tree components in Agro-forestry models in lateritic belt of eastern India

Cultivation of five agricultural crops viz., ginger, turmeric, colocasis, black gram & ragi were done under the three tree components. Growth & yield data were recorded. To increase the yield of intercrops under bamboo, reduction of shade was done through removal of mature culms from clump. Soil analysis is going on.

Documentation of Agroforestry systems and wood flow to wood based industries in Tamil Nadu

Documented the supply chain existing between farmers and industries, particularly, paper and matchwood industries. The data on the supply chain were worked out for pulp, paper and match industries. The market demand and supply was looked into. The various agroforestry systems, practised in Tamil Nadu were documented and the socio-economic status of farmers practising agro and farm forestry was also attempted.

Evaluation of selected phenotypes of Casuarina for establishment of windbreaks in farmlands in the western zone of Tamil Nadu

Efforts initiated to select phenotypes of Casuarina which are suitable for developing a windbreak agroforestry system. The selected phenotypes will be useful to address the recurrent problem of crop damages, particularly in plantain growing belt of the Coimbatore District, which is caused by strong gusty winds, particularly during monsoon period. This damage costs about Rs. 5.0 crores annually. In this effort IFGTB has now developed productive clones of Casuarina, exclusively suitable for windbreak.

Introduction and evaluation of fast growing tree species under Agroforestry systems in different agro-climatic zones of Tamil Nadu

Established agroforestry systems, with fast growing tree species under 15 ha farm land in three zones (Northeastern, Cauvery delta and Southern zones of Tamil Nadu) *viz., Melia dubia, Gmelina arborea, Neolamarkia cadamba* and *Sweitenia macrophylla* over 5 ha each, in three zones. Allelopathy study has also been conducted with the exudates prepared from the fast growing tree species leaf, stem and root. Study completed in Maize, Sorghum and Black-gram. One training has been conducted on 'Capacity building on agroforestry plantation establishment and management to farmers' of Pudukottai District.

2.2.1 All India Coordinated Projects on Agro forestry

Development of Agro-forestry models in *Wrightia tinctoria* R. Br. and *Gmelina arborea* Roxb. as tree species in semi-arid tropics of Andhra Pradesh

The project aims at to develop *Wrightia tinctoria* R.Br and *Gmelina arborea* Roxb. based

agro-forestry models in semi-arid tropics of Andhra Pradesh and to Study the interactions of tree and crop combination of Agroforestry system based on *Wrightia tinctoria* R.Br and *Gmelina arborea* Roxb in combination with Pigeon pea and Sorghum.The aim has been defined into two long term and three short term objectives. The project has completed in fourth year and running in the fifth year. So far, the agri-crop and tree crop growth data had been collected three times. Pot culture and Bioassay experiment were conducted twice to study the allelopathic interactions between tree crops and agri crops. The soil samples were also analyzed twice for physical and chemical properties. The project is on the way to achieve all the proposed objectives.

Tree crop interaction study of existing MPTs based silvi-agri system in arid and semi-arid region of India

Managing resources to enhance productivity of Agroforestry system in dry areas of Rajasthan and carrying out agroforestry trials in the field, comprising of 17 years old *Hardwikia binata* and *Colophospermum mopane* trees at a spacing of 5 m x 10 m.

Development of model of some important medicinal plants with *Melia composita* and *Emblica officinalis* in degraded land of Punjab and Uttarakhand

The work of development of model of *Melia composita* and *Emblica officinalis* is being carried out at two selected sites at Naukra Grant (Buggawala) and Handesara (Punjab). Design layout On Farm Research (OFR) trials established at Handesra and Naukra grant.

Emblica officinalis with Sarpgandha at Buggawala

Melia composita plantation at Buggawala

2.2.2 Evaluation of Joint Forest Management in Northern India

A study was carried out on impact of Joint Forest Management in order to strengthened Joint Forest Management practices in north Indian states of J & K, Himachal Pradesh, Uttarakhand and Punjab.

Evaluation of Potentials and Constraints of Agroforestry Development of Uttarakhand based, on Econometric Analysis.

2.3 Wood Science and Technology

Utilization potential of timber from *Melia composita syn Melia dubia*

Composite wood discipline has initiated two new projects on *Melia composita*. First project is to develop Particle Board and medium density Fibreboard from lops and tops of *Melia composita*.

The second project on plywood from *Melia composite*, in which nano -clay as filler, is being used to improve the properties of plywood.

Utilization of *Bambusa bambos* (L.) and *Dendrocalamus strictus* (Roxb.) as an alternative of wooden dunnage pallets

Two bamboo species i.e. *Bambusa bambos* and *Dendrocalamus strictus* were studied for their various physical and mechanical properties to find the suitability of these two bamboo species to be used as dunnage pallets specially for warehousing corporations.

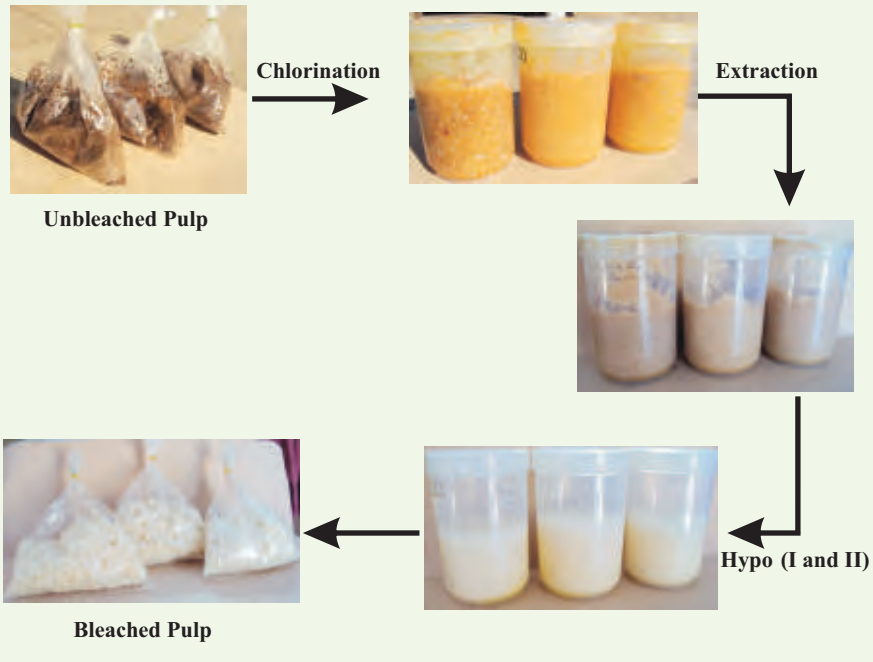
Study on constraints in the export of carved out wood products and its economical and social impact on the livelihood of, dependant people in north India

- To address the issues of distribution of Wood Carving Industry, its economic contribution and identification of problems, with focus on raw material procurement, manufacture of carved out wood products and their marketing, this study has been assigned to FRI by MoEF. Ten wood carving centres have been selected throughout North India *viz.* Srinagar and Rajouri in J&K, Chamba and Kullu in H.P., Hoshiarpur and Amritsar in Punjab, Saharanpur and Nagina in U.P., Udaipur and Jodhpur in Rajasthan, to assess the economic condition, literacy level, specialization, working tools or machines (technology) used, alternate sources of income, type of working and constraints.
- Various types of carving, the tools used there in, the range of products and the marketing channels and export of end products along with constraints have been studied and assessed.

Assessment of economic contribution of NTFP of Chir Pine in the economy of forest dwellers in North India is being done

Evaluation of the identified raw materials *Gmelina arborea* and *Prosopis juliflora* was carried out under the study "Alternative Raw Materials for Pulp and Paper Making". The results showed the suitability of *Gmelina arborea* and *Prosopis juliflora* for writing and printing paper.

Bleaching of *Prosopis juliflora and Gmelina arborea* using CEHH sequence



Effect of improved operational parameters on hydrolysis of lignocellulosic biomass to enhance total reducing sugar yield for bioethanol production was studied by carrying out the hydrolysis of *Lantana camara* and Pine needle at different temperatures for bioethanol production.

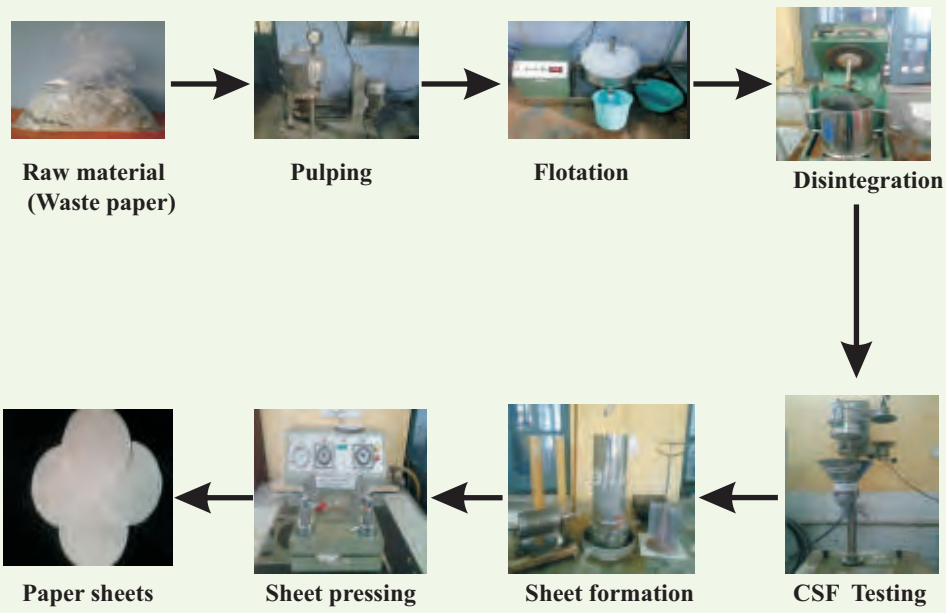
Evaluation of *Sesbania grandiflora* and *Lannea coromandelica* for papermaking was also done.

Biodeinking of waste paper was carried out to study biodeinking of mixed office waste paper with the enzymes produced by the best cellulose producer i.e. *Trichoderma viridae* and *Coprinus disseminates*.

Wood Science and Technology for livelihood and Economic growth- Following studies are being carried out-

- Composite wood products refer, to the family of engineered wood panels, and includes Particle board, Plywood, MDF and other hardboards. F.R.I has two ongoing projects in this direction. One project on Paper-mulberry, is being studied for plywood. In this project, a new species is being worked up upon as an alternative for commonly used plantation species of paper-mulberry and poplar at different pressure levels. The second ongoing project is to study LVL from different species combinations. A new project has also been initiated to study the suitability of lops and tops of poplar for medium density fibreboard.
- One modular plant for treatment of wood with ammonia vapours has been designed and fabricated under an already completed plan project. Five wood species, *viz.*, Shahtoot (*Morus alba*), Kharig (*Celtis australis*), Benteak (*Lagerstroemia lanceolata*), Bakain (*Melia azedarach*) and Jamun (*Syzygium* spp.) have been studied under this project, for their bending properties in making hockey blades.
- Under the Plan Project, an ultrasonic technique, developed for defect detection of logs, was modified for trees. Using this modified

Deinking of waste paper and paper sheet formation from deinked pulp



technique, more than 60 trees of different species situated along the road side in FRI Campus, were tested for assessing their current status.

- Finger jointing as a tool, for utilizing economically mill waste has been catching the imagination of solid wood industries worldwide. However, this technique is yet to be pierce in the Indian market. FRI has, therefore, initiated research into utilizing finger joints for structural and semi-structural uses. In this direction, a project on the role of L/P ratio of finger profiles in deciding the bending properties of finger joints has been completed.

Comparative study of clones of Eucalypts and Acacia hybrid for handicraft sector

Eucalyptus tereticornis, E. eurograndis and *Acacia Hybrid* clones were studied for their various physical, mechanical, anatomical properties and wood working qualities. The clones were recommended for various end uses based on their suitability indices. Various handicraft items of both the species (Eucalyptus and Acacia) were made with the help of artisans.

Products made from Eucalyptus and Acacia clones

Enhancing dimensional stability and durability of wood for flooring application by eco-friendly thermal processing

Heat treatments of wood of *Acacia auriculiformis, Eucalyptus* spp. and *Hevea brasiliensis,* (Rubberwood) were carried out using different temperature profiles under vacuum, nitrogen and atmospheric pressure in air. Various physical properties of control and treated specimens were evaluated and compared.

Heat treated Acacia woods at different temperatures

Evaluation of strength properties of Finger Joints of A. auriculaeformis A. Cunn. Ex Benth of different Ages (6-7 and 10-11 years old) for various end uses

Acacia auriculaeformis wood of two different age groups was evaluated for finger jointing using different adhesives and performance of finger joints

in terms of strength properties evaluated. Different finger jointed products viz, door and window frame were also made and kept for demonstration.

Screening and evaluation of selected members for Rutaceae from Southern India for anti-malarial activity

- Plant material of Ruta graveolens and *Zanthoxylum rhetsa* was dried, pulverized and secondary metabolites were extracted by different solvents and quantified. The extracts were subjected to phytochemical test and group test.
- The extracts of *Ruta graveolens* root, stem and leaves were used to evaluate larvicidal effect and ovi-position activity completed. Mosquito Repellent property by hand exposure method completed at NIMR.

Quantitative estimation of sandal oil from different locations, by colour reaction is done by carrying out a survey in sandal bearing areas of Karnataka, Tamil Nadu and Kerala States

Exploration of the efficacy of extractives of four plant species for developing eco-friendly marine wood preservatives

Four plant species, viz., *Ageratum conyzoides* L (Asteraceae), *Croton bonplandianum* L (Euphorbiaceae), *Lantana camara* L (Verbenaceae) and *Parthenium hysterophorus* L (Asteraceae) were selected for exploring the efficacy of their leaf extractives in preventing marine wood borer attack.

Effect of treatment with micronized copper preservative on the strength, treatability and durability of selected wood species

Preservative treatments of *Melia dubia* and *Acacia auriculiformis* species with micronized copper azole (MCA) wood preservative having different concentrations were carried out.

Screening of oil of *Pongamia pinnata* Linn., *Jatropha curcas* Linn. and *Simarouba glauca* D.C. for developing eco-friendly wood preservatives

Eco-friendly wood preservatives were prepared from oils of *Pongamia pinnata, Jatropha curcas* and *Simarouba glauca* by incorporating copper ions into the oils by refluxing with cupric oxide for different time periods to increase the biocidal properties.

Screening of certain plant extractives for developing eco-friendly wood preservatives

The aim of this project is to develop eco-friendly wood preservatives from plant origins. For this, barks of *Acacia auriculiformis* and *Acacia nilotica* and leaves of *Gliricidia sepium* were extracted, separately for studies.

Natural Fibre-PVC composites for light structural applications.

Natural fibre-Poly Vinyl Chloride (PVC) for light structure application, aims at composites, which can be used to manufacture door shutters, windows, railings, etc. are new screw profile, for processing wood-PVC, were taken up as a trial.

Nanoparticles based wood coatings for outdoor applications was also carried out

- Synthesis and Characterization of Hybrid Polypropylene - Montmorillonite -Wood Fibre Nanocomposites is being investigated.
- Wood quality variability in sawn timber from three plantation grown species was also carried out on wood quality of silver oak boards.
- Evaluation of the performance of Steam Volatile Creosote (SVC) as a wood preservative was done.

Determination of the treatability and durability of imported timbers as per Bureau of Indian Standards

Observation at 60 months after implantation, has been taken in all the testing sites, viz., Hyderabad, Jabalpur, Jodhpur, Nallal, Palode and Visakhapatanam on the durability of moderately resistant timber *Quercus robur*, and highly resistant timbers viz., *Dryobalanops aromatica, Tectona grandis* (from five countries), *Shorea laevis, S. marcoptera, S. robusta, Pterocarpus soyauxii* (from two countries) and *Xylia dolabriformis.* Highly susceptible timbers viz., *Fagus sylvatica, Fagus grandifolia, Fraxinus angustifolia, F. excelsior, Acer pseudoplatanus* were treated with CCB and Timber Protect and the experiment was laid at Nallal.

Chemical Derivatization of a-Cellulose into Value Added Products

Commercial cellulose procured from market (Sigma Aldrich) and analyzed for cellulose content, ash content and DP. The characterization of etherified cellulose is under process.

2.4 Non Wood Forest Products

Data compilation of R & D in Medicinal and Aromatic Plants by ICFRE Institutes and Other Institutional Projects funded by ICFRE

R&D researches on 55 medicinal and aromatic plant species conducted by ICFRE institutes and aided Institutions, under available 93 research projects and 72 published research publications have been collected and documented under the categories of **Nursery techniques** (Seed biology, Protocols for propagation through seed; Protocols for clonal propagation; Protocols for micro-propagation); **Genetic improvement** (Multi-locational trials of promising clones, Provenance trials, Germplasm conservation); **Agroforestry and intercropping** (Intercropping models, Organic cultivation protocols, Cultivation practices); **Value addition** (Phytochemical and biochemical screening for active constituents, Bio production of secondary metabolites, Quality assessment) and **Disease and pest management** (Diseases and insect pest of medicinal and aromatic plants; Testing of bio active constituents against insect pest and pathogens).

Field trials for increasing NWFP Productivity using *Piper pedicellatum*

Piper pedicellatum plant grows in moist subtropical and sub-tropical forest areas. The germ plasm was collected and nursery technique developed in FRI nurseries. Site developed was in FRI Central Nursery under, *Prunus cerasoides* and *Dalbergia sissoo* plantations and their trials carried out.

Female *Piper pedicellatum*

Male *Piper pedicellatum*

Creation of Seed Production Areas and Commercial Cultivation Trials of Uraria picta

Seed Production Area (SPA) of *Uraria picta,* an important ingredient of famous Ayurvedic Dashmula formulation has been established at FRI campus and is being maintained. The seed production from seed bank has been used for production of field planting stock and *ex-situ* conservation of this

species. Commercial cultivation trials have been undertaken in collaboration with farmers in Dehradun district. Final crop harvesting has been undertaken to estimate productivity and economic viability. Data analysis is in progress.

Field trial of borehole method of resin tapping for Chir pine of Uttrakhand for better oleoresin yield

Pinus roxburghii trees were selected for developing effective and non-harmful resin tapping technique in Mussoorie Forest Division (Magra Compartment). The site in the selected compartment was divided in three plots on the basis of altitude. The total resin yield was slightly higher in rill method of tapping as compared to bore hole method of tapping.

Bore Hole Method of tapping

Rill Method of tapping

Testing of Vegetative Multiplication Technique of *Microstylis wallichii* in its Natural Habitat

Vegetative propagation technique of *Microstylis Wallichii* was carried out in its natural habitat at Chakrata., Mussoorie and Dhanolti. Surveys were conducted for occurrence of species in Chakrata, Mussorie, Tehri, Narendra Nagar, Nainital, Almora, Badrinath, Pauri, Lansdowne and Uttar Kashi Forest Division and more than 50 sites were identified. The propagation by seed was also tried but the seed not germinated. Maintenance trials are on at three sites.

Jeevak in natural habitat

Jeevak in nursery beds

Diversification of hill agriculture through integration of medicinal/aromatic plants for livelihood using vegetative multiplication of *Thymus serpyllum* was tried directly in nursery bed.

Thymus serpyllum on stone walls of Farmer's field at Khirsu Pauri Garhwal

Harvesting of *Thymus serpyllum* from stone walls of Farmer's field at Khirsu Pauri Garhwal

Phytochemical screening of selected wild edible plants for exploration of new sources of Luteolin is being done

Edible parts of targeted species were studied for physicochemical values and phytochemical profile. Phenolic and non phenolic components were fractionated and total phenolics were quantified. Phenolic fraction was chromatographed, over

column chromatography, for isolation of pure compound.

Process refinement for extraction of quality fibre and optimal isolation of bioactive constituents from *Agave sisalana* is being carried out.

Screening of some forest tree species for their antioxidant properties.

Structural studies and utilisation of *Acacia tortilis* gum exudates.

Utilization of *Pinus roxburghii* needles for value added products

Wax was isolated from the pine needles using different extraction protocols and derivatisation of the extracted wax is being done.

Phytochemical studies on medicinally important *Diploknema butyracea* (Indian Butter Tree) Seeds'

Chemistry of ethno-botanically, unexplored medicinal plant, *D. butyracea* (Indian Butter Tree, Cheura butter) was worked out through characterization of its oil by GLC & GC-MS analysis.

Enzyme aided alternative process for the extraction of oil from *Cymbopogon citratus* (lemon grass)' was evolved by using enzymes and mechanical process that enhanced yield and superior quality of oil and reduced the artifacts formation.

Development of Category Shades of Natural Dyes of *Pinus roxburghii* and *Mallotus philippensis*

Condition for extraction of dye and then dyeing of various fabrics, using extracted dye was optimized. Dyes were extracted from two target species in acidic and alkaline medium. Dyeing trials on various fabrics viz. silk, wool and cotton was carried out which produced different shades on the fabrics.

Evaluation of *Santalum album* grown in plateau area of Uttar Pradesh adjoining Madhya Pradesh and Uttarakhand for yield, quality and composition of essential oil from sample of *Santalum album* provided by SFD, Uttarakhand.

Prospecting fungal resources for development of natural dye

- Dyes were extracted from the culture of *Pycnoporous sanguinius,* using distilled water as solvent. Silk, wool and cotton fabrics were dyed using extracted dyes. Different colours were produced on silk, wool and cotton fabrics by using different mordants.
- Initiated two new collaborative projects with State Agricultural Universities. (1) NTFP Network Project I: Survey, Documentation and Value Addition Studies in Selected NTFPs of Tamil Nadu. Collaborating institutes: FCRI, Mettupalayam (TNAU) & IFGTB and (2) NTFP Network Project II: Survey, Documentation and Value Addition Studies in Selected NTFPs of Kerala. Collaborating institutes: KAU, Thrissur & IFGTB. A status report on NTFPs of Tamil Nadu is being prepared in collaboration with TNAU. A status report on NTFPs of Kerala is being prepared in collaboration with KAU.

Studies on harvesting time of some medicinal plants for their natural antioxidants constituents

Surveys were conducted at Amravati, Akola, Buldhana and Nasik districts of Maharashtra for the collection of *Argyreia speciosa* (*Samudrashokh*), *Asparagus officinalis* (*Satavari*), *Asparagus racemosus* (*Satawar*) and *Curculigo orchioides* (*Kali Musli*). A. racemosus was found available, at all the above mentioned places.

Quality standardization of some important medicinal plants of Madhya Pradesh

Surveys were conducted in different agroclimatic zones of Madhya Pradesh for collection of plant samples of *Gymnema sylvestre* (Gudmar), *Ocimum* sp. (Tulsi), *Phyllanthus amrus* (Bhui aonla) and *Tinospora cordifolia* (Giloe). Samples were collected from Kymore Plateau and Satpura Hills, comprising Katni, Umaria, Panna, Satna, Rewa and Seoni districts; Gir Region, comprising of Gwalior, Shivpuri, Morena and Satpura Plateau comprising of Chhindwara and Balaghat.

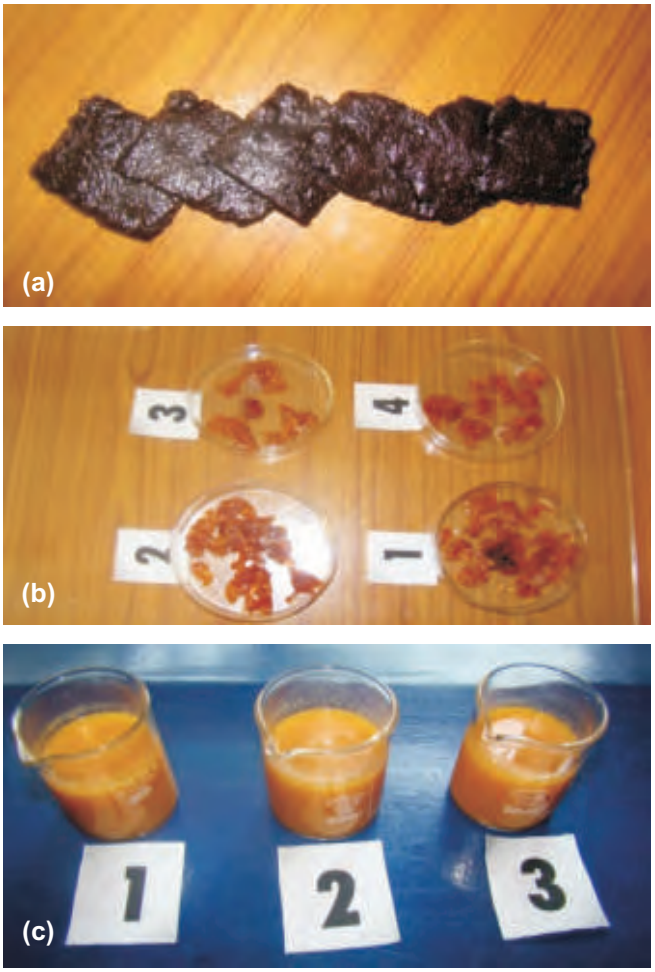
Tulsi plants were planted in nursery for carrying out experiments of harvesting limits. Plants were trimmed before flowering and after flowering for investigating the effect of flowering on the emergence of new branches.

Chemo-profiling of some Dasmoola species (*Uraria picta, Solanum indicum* and *Solanum xanthocarpum*) in Madhya Pradesh

A study was initiated to quantify the active ingredients of three Dashmoola species (*Solanum indicum, Solanum xanthocarpum* and *Uraria picta*) collected from different agroclimatic regions of Madhya Pradesh to locate the best areas/ populations.

Evaluation of *Schleichera oleosa* (Kusum) fruits for their nutritional value and development of value added products for economic development of local people

Immature and mature fruits were collected, processed fruit and separated their pulp. Three value added products (A) Kusum concentrate (B) Kusum leather and (c) Kusum katmith were prepared from the pulp.



Value added products of kusum: (a) Kusum leather, (b) Kusum concentrate and (c) Kusum khatmith

Evaluation on phyto-polymers as eco-friendly bioadhesives

Samples of *Shorea robusta* (seeds), *Madhuca indica* (seeds) and *Amorphophallus companulatus* (tubers), *Pheonix acularis tubers,* were collected. Starch was isolated from potato, and *Amorphophallus companulatus* for the preparation of bioadhesives. Starch, total phenols, protein and tannins were estimated in defatted *S. robusta*, *M.indica* and *J.curcas seeds*. The adhesive was prepared with alkali and acid as gelatinization modifier at different concentration and its effect on viscosity.

Evaluation of non edible oil seeds for development of surfactants and their utilization in pest management

Seeds of *Jatropha curcas, Sapindus mukrossi, Schleiochera oleosa* and *Pongamia pinnata* were collected and processed. Seeds biochemical were isolated. Physico-chemical properties of different oil seeds were also determined. Standardized modification i.e. saponification and diethanolamide of oil and protein of seeds was carried out.

Network research project on Guggal (*Commiphora- wightii* Arn. Bhandari)

Keeping in view the important medicinal properties and large scale demand of oleo gum resin, derived from *Commiphora wightii* (Guggal), experimental trials have been laid out to standardize various aspects of macropropagation of Guggal. The main finding of these experiment is that *Commiphora wightii* can also be propagated through micro cuttings, having diameter of <0.25-0.50cm , at large scale.

Component II - To develop methodology for enhanced/non-destructive gum production

A non destructive Ethephon (a plant growth regulator) injection based method was worked upon, in arid conditions for the tapping of oleogum resins from *Commiphora wightii*. The results of this method were very encouraging and Guggul plants survived even after three time gum exudations.

Making holes with the increment borer in *Commiphora wightii*

Gum oozing (first time) from *Commiphora wightii*

Gum oozing in healed plant (third time) of *Commiphora wightii*

Quantification, value addition of NTFP and improved agricultural productivity of the tribal belt of Sirohi district of Rajasthan

This project was initiated to document the extent of NTFP collection, processing, storage and marketing in selected villages of Mount Abu Block (Bhakhar area) of Sirohi District in Rajasthan.

Momordica diocia

Cassia tora

NTFP Selling in local market

Tapping the potential of some selected indigenous lesser known wild edible plants for food and nutrition in arid and semi arid regions

- Survey was carried out and sample was collected from 2-3 regions in Rajasthan. Morphological data were taken and samples analysed for their nutrient content.
- *Cassia tora, Haloxylon salicornicum, Cordia gharaf* and *Grewia tenax* species could be important biosources of protein, fibre, vitamins alongwith, providing essential micronutrients. The results have shown significance of wild edible species as important source of nutrient for rural poor.

Standardization & dissemination of complete package of cultivation & marketing in relation to principle active ingradient of ten selected medicinal plants of Jharkhand, Bihar, West Bengal and Orissa

Plants of six species [*Withania somnifera* (L.) Dunal (Ashwagandha), *Andrographis paniculata* (Burm. f.) (Kalmegh), *Rauvolfia serpentina* Benth. Ex Kurz. (Sarpagandha) in Jharkhand & *Stevia rebaudiana* Bertoni (Stevia), *Wedelia chinensis* Merrill (Bhringraj) and *Gloriosa superba* L. (Kalihari) in West Bengal] were cultivated using RBD design in Jharkhand and West Bengal. Complete optimized cultivation practice has been standardized in these species. Active-ingredient analysis is under progress. As per the marketing part, price and demand data from 30 companies have been taken and disseminated to the interested farmers. As per extension activities, two workshops have been carried out. Two demonstration plots of medicinal plants have been established in farmer's field in West Bengal.

Study of various factors effecting the quantity of active principles in some commercially important medicinal plants under cultivation

The seedlings *Rauvolfia serpentina, Asparagus racemosus, Gymnema sylvestre* have been raised under the shade of Sissoo and Teak.

Standardization of nursery techniques for cultivation of *Celastrus paniculatus* and *Vitex peduncularis*

Medicinal plants are highly exploited in Jharkhand. Sixteen sites of natural occurrence of *V. peduncularis* and *C. paniculatus* in Ranchi, Gumla, Simdega, Hazaribagh, Lohardaga districts of Jharkhand have been identified. *V. peduncularis* has been successively propagated from root stock and suckers. Nurseries have been developed of these two species from cuttings and air layering experiments. Fertilizer application and spacing schedules have been standardized.

Identification of Superior Chemotypes and *Ex-situ* Conservation of *Podophyllum hexandrum* Royle from Himachal Pradesh and Jammu & Kashmir (Nubra Valley)

- Identified superior genetic stock of *Podophyllum hexandrum* Royle. after carrying out extensive surveys in 30 sites falling in different geographical locations of Himachal Pradesh and in Ladakh Valley of Jammu & Kashmir.
- Each of the site was also geo-referenced and characterization of micro-habitat recorded. Field Gene Bank (FGB) to conserve the sources, as collected during various surveys was also established at Field Research Station, Brundhar, Jagatsukh (HP). Seed and vegetative propagation trials had been established to develop user friendly propagation trials of *P. hexandrum*.

Podophyllum hexandrum study site at Lahoul (HP)

Status, Survey and Mapping of Ashtavargha Group of Medicinal and Aromatics plants (MAPs) in Himachal Pradesh

A new research project initiated from April, 2012 and accordingly, detailed activity and implementation plan, including the design of floristic surveys was formulated. Besides, a questionnaire design and survey for ethno-botanical data was also prepared and finalised for collecing information from the stakeholders. Stress was also laid on the literature survey and collection of basic information of the Ashtavarga group of species growing in the region. Baseline survey was conducted in few locations falling in Shimla and Kullu districts of the state of Himachal Pradesh.

Habenaria intermedia

Malaxis muscifera

Orchid

National Medicinal Plants Board (NMPB)-Conservation Project

For effective implementation of this project, a Memorandum of Understanding (MoU) for active collaboration between Himachal Pradesh Medicinal Plant Society (HPMPS), an autonomous body of the Himachal Pradesh State Forest Department and Himalayan Forest Research Institute, as the collaborating institute was signed in the month of February, 2013. As an outcome of signing of this MoU, a dedicated project team was

constituted at the institute for undertaking the various works under the study as per the agreed terms. Also a detailed activity implementation plan was formulated including the design of floristic surveys. A field survey was undertaken in Sirmour district of Himachal Pradesh during March, 2013 to identify viable wild populations of medicinal plants, assessed as 'threatened' in Shimla CAMP Workshop, 2010. During this survey, *Gentiana kurroo* was found to be as the main species.

Gentiana kurroo Royle (Kutki) flower

Gentiana kurroo Royle (Kutki) plant

Arnebia benthamii (Wall. ex G. Don) John. (Ratanjot)

2.4 Diseases and Microbes

Assessment of disease problems of selected fast growing native tree species in Tamil Nadu and their management

The present project is proposed to investigate the economically important disease problems of fast growing native tree species such as *Ailanthus excelsa, Gmelina arborea, Melia dubia, Neolamarkia cadamba, Pongamia pinnata* and *Thespesia populnea* in nurseries and plantations, including agro-forestry system in Tamil Nadu and develop suitable management strategies for production of better planting stock to increase the productivity.

Interaction between *Pseudomonas fluorescens* and AM Fungi on *Dendrocalamus strictus*

Isolates from Uttarakhand, Haryana and Punjab were assessed for biocontrol properties against important forest pathogens, *A. alternate, Bipolaris sp., C. ovoidea, F. solani, Rhizoctonia* sp. and *S. rolfsii.* Interaction between the pathogen and bacterium were assessed in dual culture using PDA.

Eucalyptus germplasm used by forest department / industries were screened for disease resistance, against Cylindrocladium leaf and seedling blight.

Screening of poplar genotypes against *Alternaria alternata* toxin(s) were conducted in Uttarakhand (Paniyala) and Uttar Pradesh (Saharanpur).

Studies on macro wood deteriogens at Kakinada port and Narsapur Greenfield port, Andhra Pradesh is conducted by way of Marine exposure trials at Kakinada port and Narsapur test site.

Studies on the incidence and management of Pine mortality in Manipur

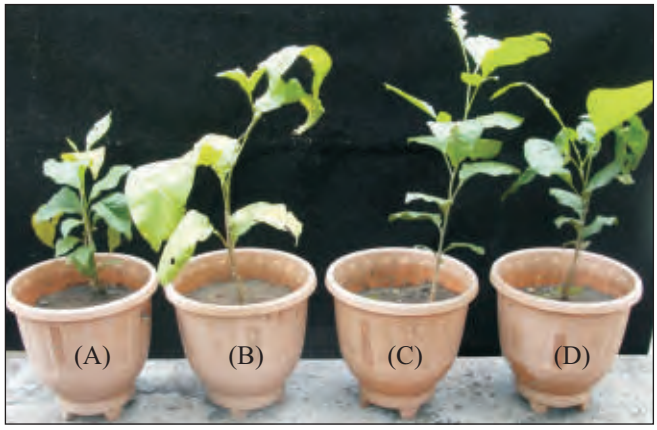
Surveys were conducted in Khasi pine inhabiting areas of Manipur to assess the disease incidence Maximum of 100 per cent disease incidence was recorded in Ukhrul. PH of the collected soil samples were found to be near neutral to slightly alkaline. Different fungal genera were identified from collected soil samples. One fungal genus (*Pestalotiopsis*) was found to be associated in the disease sample. The fungus, *Fomitopsis pinicola* was found to be associated with most of the diseased trees in Manipur. A control experiment was carried out at Ukhrul (Manipur), by using five treatments (three fungicides and two biocontrol agents i.e., *Trichoderma viridi and T harzianum*).

Microbial biosynthesis of polyhydroxy alkanoates (PHA) from wood waste

A project was started during 2011-12 on identification of a bacterial strain synthesizing high content of Poly Hydroxy Alkanoates (PHA). The speciality in this project was utilization of cellulosic material obtained by degradation of wood waste by lignicolous fungi, which was never attempted elsewhere. The long-term outcome would be focused on effective utilization of the microbes for production of PHA/bioplastics for commercial purpose. The objective of this project was to evaluate various white rot fungi for their efficacy to degrade wood waste under laboratory conditions.

Development of certification criteria and production of microbial inoculants for application in forest nurseries and plantations

Inocula of AM fungi and bacterial biofertilizers were produced for quantification of infective propagules. Infective propagules in different inocula regularly determined exhibited decline in infective propagules with the time. Decline in population of soilrite based inocula of *Rhizobium*



Effect of different growth promoting microbes on growth of bael seedlings in pot experiment (A) Control (B) AM fungi (C) *Azospirillum* (D) AM + *Azospirillum*

(isolated from tinsa nodules) was also recorded.

Induction of systemic acquired resistance in rohida against stem canker has been carried out with various tests performed on sugar, phenotic level, PAC etc.

When the seedlings were treated with JA (Jasmonic A), SA (Salicylic Acid) and Trichoderma, after 30 days, 60 days and 90 days, protein content in 1gm of leaves, treated with Salicyclic acid (5mM) 0.76 mg, 0.94 mg and 0.94 mg, treated with Salicyclic acid (10mM) was 0.52 mg, 0.68 mg and 1.00 mg, treated with jasmonic acid (10mM) was 0.61, 0.71 and 0.90, treated with Trichoderma (1 plate full growth population plate used at 500ml of water) was 0.42 mg, 0.63 mg and 0.80 mg and with pathogen 0.82 mg, 0.76 mg and 0.76 mg, respectively.

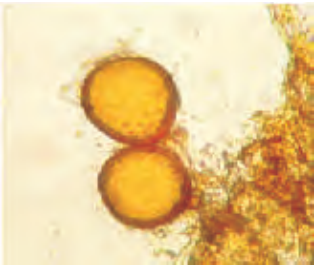
Evaluation and selection of efficient strains of AM fungi and Rhizobium for Acacia nilotica and Ailanthus excelsa in Western Rajasthan

- Rhizosphere soil of Acacia nilotica var. cupressiformis and Ailanthus excelsa were collected from Pali and Sojat. Soil samples were analyzed for pH, EC, (%) organic carbon (%OC) and phosphorous (P). The important five genera namely, *Glomus, Gygospora,*

Scutellospora Acaulospora & Sclerosystis and 12 sp. viz. G. aggregatum, G. constrictum, G. deserticola, G. fasciculatum, G. macrocarpum, G. microcarpum, G. occultum, G. pubescens, Glomus sp., Sclerosystis indica, Scutellospora bionarta, Acaulspora biculata were isolated and identified in natural plantations of *A. nilotica var. cupressiformis* from Jodhpur and Pali districts.

- The AM/Rhizobium treated plants performed better in increasing biomass (shoot height, root length, shoot and root fresh weight, shoot and root dry weight), percentage of root colonization than un-inoculated plants.

Glomus spores attached with root of *A. excelsa*



Two young sporse of *Glomus sp.* collected from *A. excelsa*

Sclerocystis sp. Collected from *A. nilotica cupressiformis*

Sclerocystis sp. Collected from *A. nilotica cupressiformis*

Innovative approaches for augmentation of composting and biofertilizer production in hot arid regions

- Litter decomposition mycoflora were isolated and identified as *Aspergillus niger, Aspergillus flavus, Trichoderma viride, Fusarium* sp and *Actinomycetes* and identified as *Streptomyces*. Three litter decomposing fungi, *Trichoderma viride*, *Aspergillus niger* and *Streptomyces* were selected for amendment for rapid composting process.
- Multiplications of bio-agents *Trichoderma viride* has been successfully maintained in sorghum seeds and are being used as amendment in aerobic and anaerobic composting process. The bacterial biofertilizers like, *Azospirillum leporum*, Bacillus coopilense and Azotobactor crucoccum are being maintained in nutrient broth medium and further mass multiplication in liquid media for experimentation.
- Aerobic composting (heap method) is being prepared in shade house by using indigenous strain of *Trichoderma viride* and dried leaves. The composting process has taken 90 days, whereas in traditional process, it takes 120 days. The nutrient status and microbial population was also recorded high with the amendment of *Trichoderma* and PSBs.

(A) *T. viride* (indigenous strain) and PSB suspension

(B) Mixing of *Trichoderma* culture in FYM

(C) Layering of *Trichoderma* culture on raw material

(D) Drenching with PSB suspension

(A-D). Aerobic composting by using Trichoderma viride and PSBs

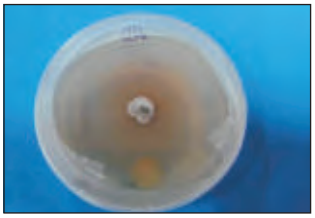
Evaluation of antifungal potential and identification of broad spectrum antifungal compound from selected tree/shrubs/weeds of Indian arid region

Name of plant Species:

i. *Balanites aegyptiaca* Linn
ii. *Tephrosia purpurea* (L.) pers
iii. *Citrullus colocynthis* L. (Tumba)
iv. *Tribulus terristis* L.

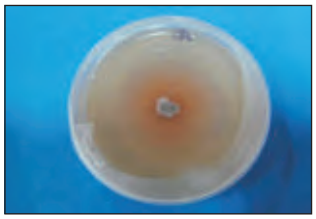
v. *Argemone maxicana*Linn. (Prickly poppy)
vi. *Solanum xanthocarpum* L. (Kantakari)
vii. *Datura stramonium* L. (Thorn apple)

Antifungal properties of selected plant parts were evaluated against fungal pathogen. Collection of leaf, root and flower bud of *Datura stramonium,* leaf and root of *Tribulus terrestris*, root, flower and fruit of *Argemone mexicana*, seeds of *Tephrosia purpurea* were carried out.

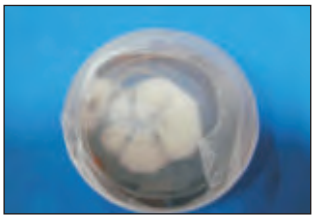


Datura root ethanolic extract against *Alternaria alternata*

Datura root ethanolic extract against *Fusarium solani*



Tephrosia purpurea seed aqueous extract against *Fusarium solani.*



Tephrosia purpurea seed aqueous extract against *Rhizoctonia solani*

Studies on ecological and ethno mycological aspects of wild mushroom of Nagaland

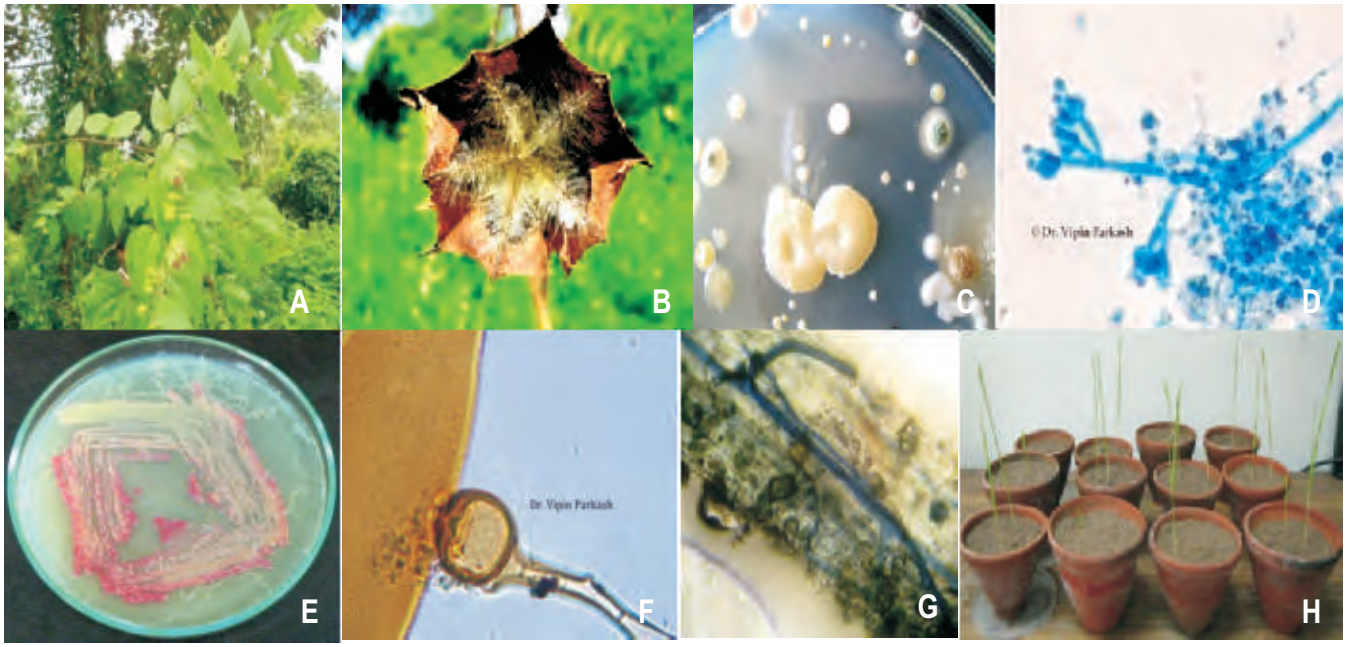
Ethnomycological survey and collection of wild edible mushrooms has been carried out from the selected areas of Kohima, Pulibezie forest, Mon and Mokokchung districts of Nagaland. Eighty eight species of mushrooms were collected from three districts of Nagaland. The collected samples are being analyzed in laboratory for their taxonomic identification. Some of the identified mushrooms include the species of Pleurotus (edible), *Schizophyllum* (edible), *Ganoderma* (medicinal), and some saprophytes/ wood decaying fungi are identified as the species of *Polyporus, Phelliunus, Xylaria, Pycnoporus, Clavaria, Auricularia, Russula,* Puffball, etc.

Russula sp.

2.4.1 Mycorrhizae, Rhizobia and Other Useful Microbes

Influence of beneficial microbes in conferring salt tolerance to *Casuarina* clones

Alleviating plant salt stress and remedying saline soils are of great economic interest. Beneficial microbes, such as, mycorrhizal fungi, Frankia and PGPRs are associated with many plants including trees. These beneficial microbes can cope up with salinity and help the plants to survive in such soils. Hence, in the present project, it is planned to investigate the status of beneficial micro flora from the samples of salt affected areas and also to test their tolerance against salinity *under in- vitro* and study the efficacy of these beneficial microbes on the growth improvement of selected *Casuarina equisetifolia* clones in nursery. Pure cultures of 51 isolates of Plant Growth Promoting Rhizobacteria (PGPR's) [18 isolates of Phosphate Solubilizing Bacteria (PSB), 16 isolates of *Azotobacter* sp. and 17 isolates of *Azospirillum* sp.] were isolated and identified from the samples collected from different salt affected areas in Tamil Nadu and Puducherry and maintained in culture bank of IFGTB. Biochemical characteristics of different isolates of PGPRs (*Azotobacter, Azospirillum* and Phosphobacteria) have been studied and species



A-*Abroma augusta* L. plant, B- Matured *A. augusta* fruit, C- Fungal colonies in media, D- *Trichoderma harzianum*, E- Culture of Bacterial colonies in media, F- *Gigaspora* sp. with bulbous attachment, G- Hyphae in *A. augusta* root, H- Trap culture of AM spores in earthen pots.

level identification of all the PGPR isolates and AM fungi were undertaken in laboratory. Experiments were conducted and tested for the efficacy of salt tolerance ability of all the beneficial microbes, isolated from salt affected areas, by using 3 different salts viz., sodium chloride, sodium citrate and sodium sulphate and short listed the best salt tolerant beneficial microbes for further study. An experiment was conducted by applying inoculum of selected isolates of beneficial microbes (AM & ECM fungi, Frankia and PGPRs) to the selected clones of *C. equisetifolia* under nursery condition and promising results obtained for growth and biomass enhancement of different clonal plants of *Casuarina equisetifolia* under nursery condition.

Effect of the endomycorrhiza along with other bio- agents on biomass production, conservation and accumulation of some phytochemicals in *Abroma augusta* L.

Field surveys were conducted to visit Titabor and Borhola, Joypur forest, Kaziranga and Amsoi Forest Range areas in which natural vegetation of *Abroma augusta* L. was found to occur. A total of 24 rhizospheric soil samples of *A. augusta* species from Titabor and Borhola, Joypur forest, Kaziranga and Amsoi Forest Range were collected for physical and qualitative analysis of parameters including GPS location, elevation, soil colour, soil pH, soil humidity, soil moisture content, organic carbon per cent and electrical conductivity. Sub-culturing of bacteria and fungi in respective media for pure culture is under progress. Colonization of root samples and their photography is under way. Fungal staining of isolated fungi is going on for identification. Trap culture of eighteen samples has been started and is under progress. The seedlings of *A. augusta* are raised with the help of VAM inoculation in bigger earthen pots along with bacterial and fungal bio-agents have been established and are under progress. The out planted seedlings were primarily established in field conditions through extension activity.

2.5 Insect Pests

Biology of hispine bamboo borer- *Estigmena chinensis* Hope. (Coleoptera: Chrysomelidae) damaging green standing bamboo and its management is being studied.

Collection of damaged bamboo species

Bioecology and management of the gall insect in Eucalyptus from roadside plantations was studied at three sites, viz. Chidiyapur, Shakumbhari Devi and Roorkee.

Survey and identification of insect pest associated with *Dalbergia sissoo*, *Gmelina arborea* and *Shorea robusta* of eastern states of India

The field survey was conducted in different district *viz.* Gumla, Khunti and Ranchi, Lohardaga, Garhwa, Ramgarh, Hazaribag. Collection of insect pest stages and plant samples of *D. sissoo*, *G.arborea* and *S. robusta* were done. From *S. robusta*- Green bug, Psylla, black weevil, leaf miner, and trunk borer, aphid were observed. From *G.arborea* trees leaf eating caterpillar, leaf folder, leaf miner, Thrips and trunck borer were collected and from *D. sissoo* seed feeder, leaf miner, leaf scrapper, small pod borer, cow bug and plant hopper were observed. Some of the insects were identified in the laboratory and some are in progress.

Population dynamics of pests and suitable control measures in selected silvi-horticultural models in Karnataka using different models

- **Model -1:** At Bevanahalli *Tectona grandis* (Teak and *Grevillea robusta* (Silver oak) with *Mangifera indica* (mango) (Sandal and silver oak with Mango, Pomegranate and guava) - *Coccid Aonidella orientalis* (Newstead) infestations were high, compared to the other coccids. Bark feeding termites were also high on sandal and silver oak. The red coffee borer *Zeuzera coffeae*- (Nietner) infestation was randomly distributed on *Santalum album*.
- **Model-2:** At Mudenahalli (Sandal with amla and tamarind). *Tectona grandis* with Mango Bark eating caterpillar *Indarbela quadrinotata* was dominant on both Sandal and Amla. Bark feeding termites were found on some sandal trees.
- **Model- 3:** At Kolar (*Tectona grandis*, *Terminalia arjuna*, *Dalbergia latifolia, Pterocarpus santalinus,* Eucalyptus, *Grevillea robusta* grown along with *Mangifera indica* (Mango), *Achras zapota* (Sapota), *Citrus maxima,* Pomergranate, *Citrus limonia* and guava) *Pterocarpus santalinus* was heavily infested by an unidentified membracid and unidentified weevils. *Tectona grandis* was infested by the teak defoliator and skeletonizer. *Dalbergia latifolia* was also heavily infested by unidentified weevils. Many *Grevillea robusta* showed severe infestation of termite and bark eating caterpillar *Indarbela quadrinotata. Tectona grandis, Psidium guajava* (Guava) was severely affected by white flies (*Aleurodicus dispersus*). The leaf gall wasp *Leptocybe invasa* was observed on the *Eucalyptus hybrid* trees.
- **Model-4 :** At Devanahalli, Teak with Mango and sapota. Termite infestation was severe on most of the trees of *Tectona grandis*.

Studies on hard substratum fauna in five major ports on the east coast of India

- Marine exposure trials at two major ports, i.e., Chennai and Tuticorin were initiated. Internal destruction of wooden test panels was assessed after splitting them open. Species of wood borers were identified. Voucher specimens were preserved for record.

2.5.1 Biological Control

Studies carried out on diversity of egg parasitoid wasps *Trichogramma* spp. from Punjab and Haryana and their application in biological control of important forest insect pests.

Biological control of Eucalyptus Gall wasp, *Leptocybe invasa*

- Obervation recorded on gall wasp infestation in different plantations in Punjab such as on Road side plantation of Eucalyptus at Dasuya road, Hoshiarpur, At Satyal Nursery, Hoshiarpur Vegetative Multiplication Garden and Phillaur nursery.
- Eucalyptus twigs, containing parasitized galls with two species of parasitoids, *Quadrastichus mendeli* and *Megastigmus viggiani* were brought from NBAII, Bangalore and their multiplication carried out at FRI, Dehradun, for biological control of Eucalyptus gall wasps *Leptocybe invasa*.

Megastigmus viggiani

Biological control of Forest pests

Efficient isolates of bacteria, *Bacillus* spp. and the fungi, *Beauveria* sp. and *Metarhizium* sp., selected through laboratory bioassay studies were tested for field bioefficacy against the targetted insect pests, viz. *Atteva fabriciella, Eligma narcissus* and *Lymantria ampula* of Ailanthus and Casuarina.

Influence of Eucalyptus species on the natural enemies incidence on the gall wasp *Leptocybe invasa* is being done.

Predatory Efficiency of *Stegodyphus Sarasinorum* Karsch (Arachnida: Araneae: Eresidae) against Insect Pests of Plants in the Forest- Nursery

- For the evaluation of predatory efficiency of the social spider, so far 25 mature colonies were reared in the laboratory as well as insectery of the Institute. Communal hunting and feeding as well as magnitude of prey-species were determined during this study.
- Experimental plots were set up in Nogli, near Rampur, district Shimla by taking approximately, 50 nos. nursery beds of oak, deodar and kail. New colonies were placed in and around beds on the bamboo poles. This was also observed that retaining hedges and shrubs around the nursery, encourage the establishment of spider colony when introduced, which would enhance trapping and killing of insect pest by this predatory social spider.

Development of coccinellids based biocontrol programmes for the management of sandal scales and mealy bugs

The study aimed to identify the more potential coccinellids in sandal dominated ecosystems of Karnataka revealed the presence of 25 coccinellids in selected provenances of sandal in Karnataka.

Feeding of *Cryptoplaemus montrouzieri* on *Nipaecoccus viridis* infesting sandal

Studies on the species diversity of whiteflies (Aleyrodidae: Homoptera) and their natural enemies in Mangrove habitats of India

Surveys were conducted in mangrove habitats of south India viz., Muthupet (Tamil Nadu), Vypeen Island (Kerala), Udupi, Karwar and Honnawar (Karnataka), Coringa (Andhra Pradesh) Chorao (Goa) and Thane (Maharashtra). The collected whiteflies were mounted and preserved. The host plants are being identified.

Development of Entomopathogenic Nematode based strategy for the management of termites and white grub pests of major forest tree species was carried out.

Biological control of teak leaf skeletonizer *Eutectona machaeralis*: studies clearly demonstrated the potentiality of egg parasitoid, *Trichogramma raoi*, as biocontrol agent for management of teak pest.

Damage assessment of gall making insect species of eucalypts and its management by pesticides

Developed insectary/nursery of eucalypts for experimental purpose to study the gall insect and its subsequent management at seedling stage. Results revealed that spraying of biopesticide and chemical pesticides on seedlings of eucalyptus effectively reduced the gall formation and increased the growth of seedlings, both in height and collar diameter.

Biological control of insect pests of medicinal plants-*Abelmoschus moschatus, Gloriosa superba* and *Withania somnifera* was investigated and studied.

Status of sal heartwood borer, *Hoplocerambyx spinicornis* Newman and its management

Surveyed sal forest areas of Mandla and Dindori Forest Division of M.P. for monitoring of sal borer and collection of information on borer incidence. Prepared leaflet and brochure on, sal heartwood borer for distribution to front line staff of M.P. Forest Department.

Biocontrol potential of native isolates of entomopathogenic nematodes for the management of insect pests of teak

The Greater waxmoth, *G. mellonella* was continuously cultured in laboratory, round the year for use as fictitious host for *in-vivo* culture of entomopathogenic nematodes. Determined optimum doses of native EPN populations against teak defoliator and skeletonizer. Experimented, innovative method of field application of EPNs and related parameters, affecting field applications. Pilot experiments carried out with individual and combination of EPNs with insecticides in field. Observations taken on other important related aspects, which can contribute to successful application of EPNs against defoliators, as a part of IPM programme. Further work is in progress.

Eco-friendly management of bark eating caterpillar, *Indarbela quadrinotata* on aonla (*Emblica officinalis*) in plantations was studied.

Development of rearing technique for production of insect predator, *Canthecona furcellata,* as biocontrol agent for larval defoliators

Surveyed nurseries / plantations and natural forests of teak, bamboo and aonla and collected eggs, nymphs and adults of *C. furcellata.* Carried out rearing of predator at different temperatures in laboratory. Observations recorded on predatory behaviour of *C. furcellata*

Studies on larval parasitoids, *Apanteles* spp. (Hymenoptera: Braconidae) of major defoliators of teak and sal forests of Odisha

Surveyed teak and sal forests of 106 localities belonging to 13 districts of Orissa (Angul, Bargarh,

Balangir, Boudh, Ganjam, Jharsuguda, Kalahandi, Koraput, Phulbani, Nawapara, Sambalpur, Sonepur, Sundargarh) for the collection of larvae and pupae of major defoliating insects. Collected 336 samples of larvae and pupae of teak and sal defoliators from field during their population outbreak. Identified 37 species of *Apanteles*, all *Apanteles* spp. are indigenous and these are being recorded for the first time from Odisha. Worked out natural field parasitisation of different species of *Apanteles*, parasitising the defoliators of teak and sal. Studied biology of *Apanteles machaeralis* on teak skletonizer, *E. machaeralis* and conducted laboratory tests of *Apanteles* species against target insect pests.

2.5.2 Seed Pests and its Management

Potential pathogens and insects responsible for the low seed production in Teak Seed Orchards (TSO) and their management

Microflora of teak (*Tectona grandis*) during inflorescence period were recorded from the Mandla and Jabalpur Forest Division during August 2012.The fungal flora recorded were *Absidia fusca, Alternaria alternata, Alternaria raphani, Ampulliferina fagi, Aspergillus flavus, A.fumigatus, A.niger, Cladosporium cladosporoides, Colletotrichum capsici, Curvularia lunata, Fusarium moniliformae, F.pallidoroseum, F.solani, F.oxysporum, Gliocladium deliquescens, Helminthosporium australiensis, Humicola grisea, Phialophora lagerbergii, Phoma glomerata, Rhizopus stolonifer, Rhizoctonia solani, Scytalidium sp., Septonema philippinum, Sporotrichum pruinosum, Sterile mycelium, Trichoderma koninghii* and *T. pseudokoninghii.* One field experiment, using biopestcides (*Bacillus thurengensis, B.amylolequifaciens*), insecticides (Monocotophos), Fungicide (Bavistin), Trace elements (Rallis tracel-2) and Growth hormone (Planofix) in different combinations was taken up.

Studies on seed insect pests of indigenous and exotic forest tree species and to develop IPM packages for major insect damages in Gujarat was carried out and suitable IPM packages developed for all known major pests.

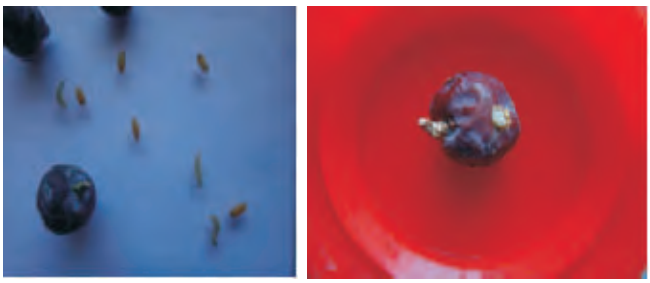
Regular surveys conducted during flowering, seed setting and monitoring during seed storage of eight fast growing species like *Ailanthus excelsa, Anthocephalus cadamba, Thespesia populnea, Melia dubia, Pongamia pinnata, Sapindus emaginatus* and *Gmelina arboria* resulted in identification of various species of insects infesting buds, flowers, maturing seeds and seeds during storage.

Integrated pest management methods, standardized for seed pests during seed storage including periodic monitoring, trapping and need based receptacle / seed treatment.

Biology and Management of Insect Pest of Seeds of *Juniperus polycarpos* C. Koch and Evaluation the Insect-pests Resistance Performance in the Nursery

The project has been initiated from April, 2012 and to accomplish the objectives under the project, field surveys were conducted to assess seasonal abundance and biology of pre and post-harvest insect-pests of berries and seeds of *Juniperus polycarpos*. The larvae are being monitored to study the complete biology and behavior of the insect and will be identified after emergence. To observe insect-pest incidences, the seeds were kept in different containers such as Cotton bag and airtight containers. Different concentrations of Neem based pesticides and safer chemicals were also applied to analyze the control of insect pests during storage. Nursery trials of healthy, infected and treated seeds are being established to study the impact of insect pests in developing nursery stock. Seeds were extracted from the Juniper berries collected from two sources of Lahaul and Kinnaur and the seeds,

thus, extracted were observed for the emergence of insect pests. Replications of treated Juniper Seeds have been kept under observation to study the impact of treatments. Field trial of treated seeds was established at Baragaon Model Nursery, Shimla and two similar trials will be initiated subsequently in the Field Research Stations located at Shill, Solan and Shillaru, Narkanda.



Larvae and pupae of infected Juniper berries

Lepidopteran Larvae, pupae and adult of infected Juniper berries

2.5.3 Integrated Pests and Disease Management

Assessment of insect pest problems of selected Bamboo species in Assam and their management

Field tours were undertaken to the SFD, JFM and homestead Bamboo plantations and nurseries of selected Bamboo species (*Bambusa tulda, B.nutans, B.balcooa* and *B.pallida*) to conduct the pest surveys in Assam. Recorded data on the incidence of insect pests in the selected bamboo species at regular intervals. Thirty four insect pests belonging to various orders have been recorded so far. Among the recorded pests, *Antonina* sp., *Psara licarsisalis, Crocidophora* sp., *Pyrausta coclesalis, Hexacentrus unicolor* and the aphid *Ceratovacuna silvestrii* were categorized as major pests. Field surveys conducted on natural enemies of the bamboo leaf rolling defoliator *P.coclesalis* resulted in detection of a species of pathogenic bacteria Bacillus sp. Two new hosts were recorded as the aphids *Ceratovacuna silvestrii, Myzus* sp. on *B. pallida* and *B.nutans*.

The efficacy of the native pathogenic bacteria *Bacillus* sp., isolated from the infected larvae of *P. coclesalis*, Neem oil, *Acorus calamus* rhizome powder methanol extract and the botanical pesticides *Adhatoda vasica* leaf aquous extract were evaluated against the key pests of Bamboo species and found effective in controlling the pests in both lab as well in field condition.

Predatory spider

P. coclesalis infected by *Bacillus* sp

Mealy bug attack on *Bambusa nutans*

Bamboo culm attacked by Termites

Studies on the incidence and management of culm rot and bamboo blight disease in Assam

Survey, carried out in different agroclimatic zones Assam revealed the highest disease percent of 55.26 in *Bambusa balcooa* in Bongaigaon district. The causal organism was identified as *Fusarium udum* Butler. Field experiment revealed Bavistine (0.1%) as the most effective fungicide against the disease.

Fungus associated with the diseased tree

Seeds with fungal infestation and unaffected seeds

Management of Insect-pest and Pathogens of Seeds of *Pinus gerardiana* Wall. in Storage

The project was aimed at developing management strategies for insect-pests and pathogens attacking the seeds of Chilgoza-pine by applying different methods in the laboratory conditions.

Regular data were recorded and during observations bio-pesticides and safe chemicals were used to test their impact in controlling the insect pests and pathogen attack. Heavy mite attack was also observed subsequently in the stored Chilgoza pine seeds even in controlled conditions. The data of seed damage were recorded.

The findings reflected the presence of seed borer during the month of July, which was, later, identified as *Cateremna tuberculosa* Meyrick and reported for the first time infesting the seeds of the Chilgoza pine. Due to its attack, upto 50 per cent of seeds were found damaged within a month and the borer attack was recorded in between the months of July and December. Different treatments were given to the seeds to test their efficacy against different insect-pests and diseases. Statistical analysis of the data on various treatments applied to stored Chilgoza seeds, revealed that the freezing treatments were very successful against insect pests attack since, there was no insect-pest attack in the seeds when stored at 0^0C and - 5^0C in all the stored conditions. Since, it is not feasible for a common farmer to store Chilgoza seeds in freezing conditions, it is, therefore, advised that they may use most suitable treatment for effective storage of Chilgoza seeds during the storage.

2.5.4 Bio Pesticides

The properties of modified products viz., solubility, surface tension, viscosity, foaming power, critical micelle concentration and alkalinity were assessed at 1-10% concentration. Viscosity of different dilutions varied from 1.19-47.7 MPa. The pesticidal activities, of products formulations were assessed against forest insect pest of *Tectona grandis* and *Albizia* spp. i.e. *Eutectona machealaris* and *Spirama retorta* and fungicidal activities, against *Fusarium oxysporum, Penicillium crysogenum, Alternaria alternate,Flavodon flavus, Ganoderma lucidum, Tramatis cingulated, Stachylidia* spp. *S. mukrossi* and *P. pinnata* surfactant formulations showed

Caryedon serratus attack on seeds of *A. nilotica*

Pupa of *Caryedon serratus*

5th instar larva of *Eligma narcissus* on *A. excelsa* leaves

Adult of *Eligma narcissus* on *A. excelsa* leaves

feeding deterrency, mortality and fungicidal activities.

2.5.5 Biological Control of Weeds

Based on the host range surveys at the field, two more insect species, viz. *Phycita* sp. and *Pachnephorus* sp. (a chrysomelid beetle) were prioritized and the cultures are maintained in the lab for further studies.

Feeding of a leaf webber larva, *Phycita* sp. on *A. nilotica*

Defoliation *A. nilotica* ssp. *indica* leaf by a chrysomelid beetle *Pachnephorus* sp.

Host specificity studies through no-choice method on live hosts were continued and completed for four prioritized insects (*Anomalococcus indicus, Isturgia disputeria, Dereodus denticollis, Physita* sp.) involving nine species of acacias and two other reported plant species of pepper and *Dilonix regia*.

Leaf rust on *A. nilotica* ssp. *indica*

Rust gall on *A. nilotica* ssp.*indica* fruit pod

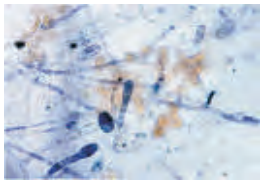
2.5.6 Botanical Fungicides and Pesticides

Phytochemical Examination of *Acacia albida*

Crude extracts of *Acacia albida* leaves and bark (Petroleum ether, Chloroform, Methanol, and ethyl acetate and butanol fractionated part of methnol extract) were screened for antifungal activity and it was found that extracts were effective against *Cylendrocladium quinqueseptatum, Aspergillus niger* and *Rhizoctonia solanii* at 0.5% concentration.

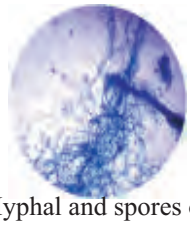
Powdery mildew disease symptom on *Ailanthus excelsa*

Pure culture of *Oidium* sp. isolated from powdery mildew on *Ailanthus excelsa*



Conidial spores of pathogen *Oidium* sp.

Root rot disease on *Melia dubia*



Hyphal and spores of *Sclerotium rolfsii* causing root-rot disease on *Melia dubia*

Conidial spores of *Fusarium oxysporum* causing root rot disease on *Melia dubia*

Biopesticide against papaya mealybug (DST)

Conducted extensive survey on mealy bug in teak agroforestry plantation, tapioca, eucalyptus, teak, casuarinas, *Ceiba pentandra,* ailanthus and *Thespesia populanis* plantations in Tanjore, Madurai, Dindugul and Viruthunagar, and papaya plantations and in other agriculture farms at Annadhasampalayam Sirumugai and Poondi hills and recorded the pest incidence and population pattern.

Contributory factor in the establishment of *Leptocybe* invasa (Fisher and aLaSalle) on Eucalyptus plantations in Tamilnadu (MoEF) was investigated.

Mealybug infestation in Papaya

Mealybug attack on teak

Swift of mealybug on Ailanthus

Extent of damage by mealybug on Casuarina

Evaluation of certain flora, based on ethno-botanical records for their pesticidal properties against important forestry insect pests

Ten plants have been short listed based on ethnobotanical records to identify their pesticidal properties against insect pests of forestry importance.

Studies on oil: chemical composition, antifeedant, insecticidal and antifungal activities of tree borne oil seeds

The selected Tree Borne Oil seeds (TBOs) were collected from the natural stands in Tamilnadu and Kerala. Seeds were processed and extracted oil fractions were tested for bioassays and chemical analysis. Antifungal activity of TBOs oils was tested against five fungal pathogens in comparison with fungicide and observed no antagonistic activity but found to have synergetic activity. New product Tree Pal (H) has been developed and released during the Tree Growers Mela 2013.

Tree Pal (H) oil based biopesticide developed and released to manage insect and disease attack

Studies on Essential Oils: Chemical constituents and toxicity assessment of the Leaf oil of *Lantana camara* from Tamil Nadu Regions

Essential oil was steam distilled from the leaves of *Lantana camara*, differing in flower colour (orange, pink, white pink, pink yellow, orange yellow) collected from different agro climatic zones. The bioefficacy of the bioactive compounds Aromadendrene and Caryophyllene identified from the essential oil of *L.camara* tested against *H.puera, Eligma narcissus* and *Atteva fabriciella*, showed significant larval mortality. Based on the significant insecticidal activity of the *L.camara* essential oil, against teak defoliators, developed preformulation. Developed preformulation, containing bioactive fractions, extracted from *Lantana camara*, *Hydnocarpus pentandra*, Neem, Pongamme were tested for its bioefficacy, against the defoliators of teak/ ailanthus, casuarina. A new product Tree Pal

(H) has been developed and released during the Tree Growers Mela 2013.

Biotransformation of some secondary metabolites by sporulate surface cultures of Frankia strains for nodulation capacity in *C. equisetifolia* and *C. junghuhniana* was carried out.

Studies on the impact of *Indarbela quadrinotata* on growth of *Casuarina equisetifolia*, factors influencing the pest infestation and developing eco-friendly management practices

Two plant based formulations developed were evaluated against the bark eating caterpillar, *Indarbela quadrinotata* in the Casuarina plantation, raised at Pitchavaram Forest Range, Cuddlaore Forest Division, Tamil Nadu.

2.6 Biodiesel

Production of synthetic biodiesel from wood wastes was investigated, using different wood wastes.

- The effect of microwave assisted heating and seed storage conditions on quality of *Pongamia pinnata* (L.) seed oil for cost effective production of biodiesel was studied
- The study on production of biodiesel from different acid value oil is under progress.

Refining of process for detoxification of Jatropha seed oil

A number of experiments were performed for developing a facile process for the removal of phorbol from *Jatropha curcas* oil.

Establishment of multilocational trials of 100 superior accessions of *Jatropha curcas* under the network programme of DBT

A multilocational trial comprising 100 superior accessions of *Jatropha curcas,* received from DBT network partners was established in July-August 2010 at GRC Farm House, Sita Pahad, Jabalpur.

Fruiting in Jatropha plants

National Network on Integrated Development of Jatropha and Karanja

One hundred seventy five (175) Candidate Plus Trees (CPTs) of *Jatropha curcas* were selected from Jabalpur, Chhindwara, Seoni, Balaghat, Dindori, Mandla, Betul, Katni, Shahdol, Satna, Rewa, Panna, Gwalior, Shivpuri, Sagar, Damoh and Sheopur-Kala districts of Madhya Pradesh. CPTs were selected on the basis of seed yield, oil yield and germination percentage. Thirty six accessions in national trials and 14 accessions in zonal trial of Jatropha were established at Institute's campus, Jabalpur. Data on growth performance, seed yield and seed characters were recorded at regular intervals and oil estimation of the samples was done.

Field Evaluation of Superior Accessions of *Jatropha Curcas* L. Under Micro-Mission Programme in Himachal Pradesh

- Department of Biotechnology, New Delhi funded project under its micro-mission programme where field evaluations of superior accessions of *Jatropha curcas* L. are being carried out simultaneously in various parts of the country by the network partners and HFRI,

Shimla, is being one of them, executing this project in the state of Himachal Pradesh. Under this project, first multi-locational trial was established at Solag village of Bilaspur district, Himachal Pradesh in October 2008. The material for this trial *i.e.* rooted plants of ten accessions were brought from Bio-tech Park Lucknow (UP) and other partners. The experiments, thereafter, continued for studying the superior accession of *Jatropha curcus*.

- During the year 2012-13, maintained the trials and the realted observations pertaining to growth and survival data of field trials were recorded regularly. Compiled the progress of the project during February, 2013 and submitted the detailed report to Jatropha National Coordinator of DBT, New Delhi.

Half-sib Progeny Trial at Jwalaji, HP

2.7 Livelihood

Identification of extent of forest land in forest fringe villages and conductance of anthro-botanical as well as social survey in 230 rainfed districts.

Development of sustainable model for enrichment of selected Medicinal Plant Conservation Areas (MPCAs) of Uttarakhand Himalayas

Survey for identification of habitats of target species at Khuliya and Kandara MPCAs has been done. Collection of seeds of Kutki, Atish done from Kandara and Khuliya. Enrichment field trials of Atish (seed sowing), Kutki (seed sowing and rhizome cuttings) and Jatamansi (seedling transplantation) were laid out at identified sites at Kandara and Khuliya. Gap filling and weeding, in enrichment trials was also done. Data recorded on habitat types, frequency and density of target species from experimental sites.

Enrichment trails *Nardostachys jatamansi,* and *Picrrohiza kurroa* in MPCAs

National Study on Commercial Production of Non-Timber Forest Products for Ensuring Fair Economic Returns to Primary Collectors

The study aims at documenting the diversity and estimating production of various Non-Nationalized Commercial NTFPs in selected States of India and is sponsored by Ministry of Environment & Forests, Govt. of India. Under this programme, Household level primary data collection has been organized in states of Chhattisgarh, Gujarat, Himachal Pradesh, Jharkhand, Madhya Pradesh, Maharashtra, Orissa,

Data collection in Rajasthan

Phoenix leaves being traded in Jharkhand

Sabai grass traded in Jharkhand

Rajasthan, Uttarakhand and West Bengal. More than 80 NTFP species have been recorded to be collected by communities in the surveyed states. Data analysis is in progress

Augmentation of medicinal plant resources for primary health care practices by the tribal communities in the Nilgiris and enabling their livelihood enhancement

The project was initiated during February 2013 in Kathagiri taluk for further detailed study pertaining to documentation of traditional and indigenous knowledge, socio-economic status of the villages and propagation of RET medicinal plants/ NTFPs.

Empowering Tribal Community through Lac Cultivation in Madhya Pradesh

To revive the lac cultivation in the villages of Jabalpur, through training and demonstration, for additional income generation of the villagers/ farmers and for the sustainable production of lac on conventional host (*S.oleosa, B.monosperma* and *Z.mauritiana*) as well as non-conventional host (*Flemingia species*) in the selected ten villages, interacted and explained the objective of the Project to the villagers of Narai-Sohad, Bahmnoda and Ranipur village and sensitized them towards lac cultivation.

Productivity enhancement of Kair (*Capparis decidua*) to generate livelihood in rural area of 'Thar Desert"

- This project was sanctioned in March 2013 for three years. Fruits of *C. decidua* are valuable products which yield supplementary income to the rural people. Project aims to develop technology for fruit yield enhancement of Kair.
- Kair has the ability to survive in various habitats under extreme condition of temperature of arid region. Preliminary survey was undertaken in Khari Khurd Jode, Forest Range Luni, Grass Jode A, Hariyada in Bilada and Panchayat land at Joliyadi phanta near Bambore, Jodhpur for site selection, at Khari Khurd Jode Forest Range Luni and Grass Jode A, Hariyada in Bilada.

Studies on edible shoot production potential of selected indigenous and introduced bamboos in Jharkhand and enhancement of production period through cultural practices

A total of 225 villages and 93 markets in Jharkhand have been covered during field survey and information on quantity of edible shoot consumed by villagers, species used, persons engaged in collection, self bamboo utilization, quantity marketed, persons involved in shoot trade, average quantity sold and earnings etc. have been collected. Conducted field trials with *Bambusa nutans, Dendrocalamus asper* and *D. strictus* in

order to enhance duration of shoot season and shoot yield by improving soil health through soil working, mulching, irrigation and organic and inorganic amendments and also through clump management. Effect of shoot removal at different intensities have also been studied on quality and quantity of edible shoot production and on the general health of the clumps of the said species so as to standardize shoot extraction method.

Studies on nutrient management practices in *Flemingia* species for lac cultivation and promotion of rural livelihood

The field experiment conducted for nutrient effect on lac is being conducted. Brood lac, inoculated in July 2012 had been harvested in the month of February, the observations on predation, parasitisation and nutrient effect has been recorded. The growth data of plant have been completed, weeding and irrigation and other management practices are carried out as per the requirement.

Quality and yield improvement in agroforestry based food products under integrated nutrient management

Quality and yield improvement of Rabi (Lady's finger, Cucumber) and Kharif (Spinach, Cabbage) crops under agro forestry trial were studied by applying different concentration of Iodine and Iodate (KI and KIO3) in the soil and foliar. Iodine with integrated nutrient management is also tried in different rainfall zones of Assam. This study revealed that although there is no direct evidence on the essentiality of iodine to plant growth, low concentration is beneficial for uptake of plant, whereas, high concentration is detrimental for plant growth. Different plant species responded differently in iodine uptake. Iodine applied as iodate had a significant effect over the biomass production and uptake of leafy vegetables like spinach and cabbage. Soil application was found

Iodine application in spinach and cabbage

better than foliar application. Moreover, iodine application in soil with integrated nutrient management increased the yield and also the iodine content significantly in spinach followed by cabbage, lady's finger and cucumber respectively.

Identification of Extent of Forest lands in Forest Fringe Villages, Funded by NRAA, Govt. of India

NRAA funded project for the North Eastern states was initiated at RFRI in the month of October, 2011. The project aims to identify forest fringe villages with the aim of Socio-economic survey and ecological studies in North-Eastern region, except Sikkim. During this year, twelve districts have been completed with socio-economic information and vegetation sampling of fringe forest, which includes Manipur, Mizoram, Tripura, Assam and

Ecological sampling and Socio-economic survey in Darang (Assam)

Socio-economic survey in Agartala (Tripura) and soil sampling in Sibsagar (Assam)

Nagaland. Data collected from field were entered on NRAA portal, developed by Forest Research Institute.

Extension strategy to "Improvement of degraded shifting cultivation lands through introduction of *Thysanolaena maxima* (Broom grass) along with *Cajanas cajan* as N_2 fixing plant" Under "Direct To Consumer" scheme of ICFRE

Survey was conducted for identifying the areas and selection of various villages of Assam and Meghalaya. PRA exercise was carry out to evaluate the problems and prospects of Broom grass cultivation in the selected villages. Strength, weaknesses, opportunities and threats (SWOT) were explored regarding existing practices of broom grass cultivation during the interactive session with farmers, villagers and elderly people. The team built a good rapport with the target groups and willing farmers were identified to participate in the extension activity.

PRA exercise and SWOT analysis in Karbi Anglong, Assam

Broom grass plantation in Dawki, Meghalaya

Calculating economics of broom grass

Rehabilitation of jhum land through potential bamboo species with reference to carbon sequestration and livelihood development

- Progressive growth data of 22 months old *Bambusa balcooa, Bambusa nutans* and *Bambusa tulda* raised from both the rhizome and seedling showed maximum length and GBH in *B. balcooa* followed by *B. tulda* and *B. nutans* in both the experimental plot studied.
- Analysis of plant carbon has been carried out by collecting plant samples of *B. balcooa, B. tulda* and *B. nutans* from experimental plot at regular intervals. Percentage of organic carbon was recorded higher in *B. balcooa* followed by *B. tulda* and *B. nutans*.

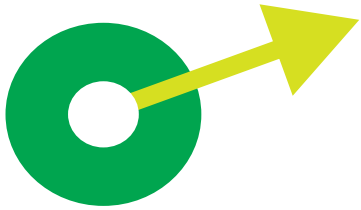
Preparing bundle of broodlac

Bundles of broodlac ready for inoculation

Inoculation of broodlac on new host kusum trees

3

BIODIVERSITY CONSERVATION AND ECOLOGICAL SECURITY



Biodiversity Conservation and Ecological Security

Indian Council of Forestry Research and Education, Dehradun, has created an independent entity as Biodiversity Conservation Division at Hqs. for developing state-wise biodiversity profile, celebration of International Biodiversity Day, capacity building through trainings, awareness and extension programmes on biodiversity and its conservation, organizing seminars/workshops on biodiversity related issues, publication of biodiversity related books/ brochures, etc.

The Division organized a training workshop on "The Significance and Scope of REDD/REDD+ for India's Forests" on 7 and 8 November 2012. Sixteen IFS officers from different states attended the training workshop. Another training programme on Climate Change and Carbon Mitigation for Scientists and Technologists, Government of India, was organised from 19 to 23 November 2012. Nineteen scientists/technologists from different government organizations participated in the training programme.

The Division also organized a training programme on Climate Change, Forest Ecosystems and Biodiversity: Vulnerabilities and Adaptation Strategies for Scientists and Technologists, Government of India, from 17 to 21 December 2012. Twenty two scientists/ technologists from different government organizations participated in the training programme.

To provide insight into the unique treasure of India's forest biodiversity, a coffee table book on **"Forest Biodiversity in India"** has been published. The book is first of its kind in India in the field of Forest Biodiversity, depicting various dimensions through photographs and 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, Govt. of India during COP-11 at Hyderabad, in November 2012.

A training workshop on "The Significance and Scope of REDD/REDD+ for India's Forests" at ICFRE

Forest Biodiversity in India

International Biodiversity Day

The International Day for Biological Diversity, 2012 on "Marine Biodiversity" was celebrated at different regional institutes of ICFRE, namely, Institute of Forest Biodiversity (IFB), Hyderabad; Institute of Forest Genetics and Tree Breeding (IFGTB), Coimbatore; Rain Forest Research Institute (RFRI), Jorhat; Tropical Forest Research Institute (TFRI), Jabalpur; Institute of Forest Productivity (IFP), Ranchi; Institute of Wood Science and Technology (IWST), Bangalore; Arid Forest Research Institute (AFRI), Jodhpur; Himalayan Forest Research Institute (HFRI), Shimla. Many publicity and competition/ awareness programme, like painting competition, essay competition, elocution competition and quiz competition, on the subject of marine biodiversity were conducted. During the IBD celebration at Forest Research Institute (FRI), Dehradun, the chief guest was Dr. Aziz Qureshi, Governor of Uttarakhand who stressed upon the importance of the relationship between human life and biodiversity. The Governor distributed prizes to twenty students for winning in the essay and painting competition held on 20 May 2012 by the Uttarakhand Biodiversity Board.

3.1 Biodiversity Conservation

Establishing germplasm garden of some rare and endangered plants

Locations of five species viz. *Catamixis baccharoides, Ulmus wallichiana, Rauvolfia serpentina, Berberis aristata* and *Mahonia jaunsarensis* were identified and collection of propagation material (seeds/ cuttings/wildlings) was done from Chakrata, Haridwar and Dehradun area for their multiplication and conservation. Wildlings of *Catamixis baccharoides* have been successfully established in germplasm garden. Propagation of *Mahonia jaunsarensis* and *Berberis aristata* have been done through cuttings. Accessions from CMAP have been received and added to the Garden. Germplasm of *Ulmus wallichiana* has been collected from Chakrata (Uttarakhand) and Kashmir (J & K), and plants have been produced successfully through cutting.

Reassignment of forest types

The data on forest compositions of different forest types of UP, Punjab, Haryana, Uttarakhand, Delhi and Chandigarh were collected by the teams of scientists and officers. Data from 375 designated points of different forest types of the states were compiled, analysed and published in the form book "Reassignment of Forest Types".

Taxonomic studies on parasitoids belonging to subfamily Braconinae (Hymenoptera: Braconidae) of Uttarakhand

Survey and collection of parasitoids and their hosts was carried out from Gwaldham, Bageshwar, Gairsen, Karanprayag, Gaucher, Herbal garden (Muni ki Reti, Rishikesh) and Thano Forest Division and Kalsi, Karwa Pani, Thano, Barkot forest nurseries of Uttarakhand.

Rearing of hosts samples was carried out for emergence of parasitoids. Similarly, the study of seven species of genus *Bracon* present in NFIC has been done. Study of the morphological characters of *Iphiaulax immsi* Cam., emerged from wood of *Terminalia tomentosa* and *Iphiaulax spilocephalus* Cam., emerged from wood of *Calotropis procera* and identification of three species has been carried out up to genus level which are belonging to the

genus *Ipobracon.* Updating of specimens present in NFIC has been done. These were *Coeloides melanostigma* Strands (*Coeloides stigmaticus* Hellen); *Eurobracon tripligiatus* (Cameron) (syn. *Exobracon maculipenennis* Cameron); *Hybogaster xanthopsis* (Cameron) (syn. *Iphiaulax spilocephalus* Cameron); *Pseudovipio castrator* (Fabricius) (syn. *Glyptomorpha castrator* Fabricius); *Stenobracon (Stenobracon) deesae* (Cameron) (syn. *Glyptomorpha deesae* Cameron).

Studies on taxonomy of the family Eulophidae (Hymenoptera: Chalcidoidea) present in National Forest Insect Collection (NFIC) except Doon Valley

Card mounted specimens of Eulophidae were sorted out from NFIC. A total 380 Eulophids, collection from Arafwala, Terah, Nowshera, Shahdara, Dipalpur (Punjab, Pakistan stored in NFIC), Sitabani, Tanda Range Haldwani, Halduya, Barat Rao (Nainital Distt) and NFIC were identified as *Aprostocetus* sp., *Aprostocetus gala*, *Elasmus brevicornis*, *Euderus* sp., *Euplectrus niblis, Neotrichoporoides* sp., *Pediobius agantha*, *Pediobius bethylicidus, Pleurotropopsis* sp., *Tetrastichus* spp., *Tetrastichus epilachnae, Tetrasticus pantnagrensis, Tetrasticus tunicus* and *Tetrastichus triozai*. Identified specimens were card mounted and labelled.

Studies on taxonomy of the Family Encyrtidae (Hymenoptera: Chalcidoidea) present in National Forest Insect Collection (NFIC) except Doon Valley

A total 1584 Encyrtids, collection of NFIC and different locations including Bairangna, Mandal, Kanchula, Anusuiya (Chamoli Distt.), Badshahi Thaul, Munikereti (Distt.Tehri), Pothi Basa (Rudraprayag Distt), Pragatinagar, Dangan (Uttarkashi Distt), Sitabani, Baratrao, Halduya, Lal Kuan (Nanital Distt.), and Kirsu (Pauri Distt.) were identified as follows:

Anagyrus spp., Anicetus spp., *Ageniaspis spp.*, *Apoleptomastix bicoloricornis, Cerapteroceroides similes*, *Cerchysiella* sp., *Copidosoma spp.*, *Copidosoma floridanum*, *Copidosoma gracilis*, *Copidosoma indicum*, *Copidosoma oreinos*, *Gyranusoidea* spp., *Homalotylus spp., Metaphycus spp.*, *Microterys spp., Neodusmetia sangwani*, *Ooencyrtus aethes, Parablatticida spp.*, *Rhopus spp. Ruanderoma* sp. and *Trechnites manaliensis.*

The four species of genus *Ooencyrtus* were found to be different from the known species on the basis of detailed morphology.

Three species were micro photographed and measured for their 75 different body parts.

Studies on thrips of forest and medicinal plants, problems caused by them and their management in Uttarakhand

Survey for the collection of thrips has been carried out from Gwaldham, Bageshwar, Gairsen, Karanprayag, Gaucher, Herbal garden (Muni ki Reti) Rishikesh, Thano Forest Division, NWFP Nursery FRI and Kalsi. Collected thrips species were identified as: *Gynaikothrips uzeli* from *Schefflera actinophylla* plant, *Scirtothrips dorsalis* from *Chilli* plants, *Thrips flavus* from *Albizia lebbeck* and Citrus fruits; *Thrips tabaci* from *Plumbago zeylanica* (Chitrak); *Hoplothrips gowdeyi* and *Scirtothrips dorsalis* were associated with *Aloe barbadensis;*

Hoplothrips gowdeyi

Thrips flavus was associated with *Ocimum sanctum; Thrips tabaci* from *Terminalia chebula*; *Mycterothrips ruvidus* was reported from *Eucalyptus* galls.

Digitization of the type material (E-typing) present in National Forest Insect Collection, F.R.I., Dehradun using Auto -Montage 3-D imaging system

A database was developed in windows application for the entry of data of types of NFIC. The various records of type specimens have been entered into the database which includes many relevant information such as name of the species, their accession numbers, collection date, holotype/ paratype, male/ female, taxonomic position, host, collector, identifier etc. which were earlier hand written in various records like accession register, index cards etc.

The information related to type specimens available in the form of hard copy as books, journals, monographs etc. has been scanned and saved in PDF format. About 900 articles of different types of insect species have now been scanned and digitally entered into the database.

Study of the reproductive biology of endangered taxa, "*Trachycarpus takil Becc.*(Arecaceae), *Mahonia jaunsarensis* Ahrendt (Berberidaceae), *Pittosporum eriocarpum Royle* (Pittosporaceae) and Eremostachys superba Royle ex Benth(Labiatae)"

In this study, life cycle of four RET plant species *Eremostachys superba*, *Mahonia jaunsarensis, Trachycarpus takil* and *Cinnamomum glanduliferum* have been critically examined in actual forest locations to find out the cause of their poor regeneration and distribution in nature. With the beginning of the flowering season, survey was conducted for studying the reproductive biology of the species. Survey was also conducted during the vegetative stages of the species. In the year 2013, with the beginning of the flowering period, survey was conducted in various sites. For *Eremostachys superba* Royle ex Benth. (Lamiacae), regular visits were made to type locality Mohand, Dehradun to monitor the flowering of the plants. But no flowering was observed in the area this year also. As the species has also been reported from Rajaji National Park, several visits were made to locate the species but the species could not be located. A good population of the species is growing in the garden of Botanical Survey of India, Dehradun.

Study on grasses of Uttrakhand and Himachal Pradesh

Exploration cum collection tours have been organized to Chamoli, Nainital, Jaunsar Bawar, Uttarkashi, Rudraprayag, Haridwar, Rishikesh, Mussoorie, Champawat, Chakrata, Kalsi, Saiya, Chamba, Udham Singh Nagar, Narender Nagar, Almora, Ranikhet, Mohand, Herbertpur, Badkala Range, Pithoragarh and in and around New Forest campus in Uttarakhand and Solan, Paunta Saheb, Nahan (Sirmour), Mandi, Una, Great Himalayan National park (Tirthan valley, Oat, Siang valley, Thari Beat)in Himachal Pradesh. Total 2415 specimens have been collected from which 1739 specimens identified.

Inventorization, characterization and conservation strategies of selected rare and endangered plant species of India

Rare and threatened species such as *Ilex pseudo-odorata, Catamixis baccharoides, Sophora*

mollis and *Pittosporum eriocarpum* were studied. Extensive field survey was carried out in the Mussoorie, Jharipani, Hathipaon, Rishikesh and adjoining area, Rajaji National Park etc. *Pittosporum eriocarpum* was found in the Jhari Pani and Hathipaon area. Population of the species was very less in the area. Seed of the plants were collected. *Ilex pseudo-odorata* was found in the Hathipaon, only 5 trees could be traced in the whole of Mussoorie and adjoining areas. *Sophora mollis* was found in the Sahastradhara area. Population of the species was found very less.

Butterfly diversity in relation to landscape changes in the Walayar Valley, at Palakkad Gap in the Western Ghats

Enumerated the butterfly species occurring in different vegetation types in the Walayar Valley. About 35 species of butterflies were recorded so far, from teak plantations; 36 species from moist deciduous forests and 27 species from dry deciduous forests. Data were collected on the seasonality of different butterfly species and their nectar and larval host plants. It was noticed that the shruby undergrowth in plantations and moist deciduous forests provide suitable habitats for many species of butterflies. Occurrence of some butterfly species like *Troides minos* (Southern Birdwing) (Endemic) *Arhopala psuedo-centaurus*(Western centaur oakblue) (Not common) and *Melanitis phemida* (Great evening brown) (Rare) in the study area is interesting.

Biology and conservation of endemic plants of Kalakad Mundanthurai Tiger Reserve, Tamil Nadu

Intensive field surveys were carried out to locate 5 endemic species and to study their distributions, association, population and phenology status by repeated perambulation in the Kalakad Mundanthurai Tiger Reserve, Tamil Nadu. Phenological observations, distribution and recording of plant associations for the species *Eugenia singampattiana, Phyllanthus singam-pattianus, Palaquium bourdillonii* and *Sonerilla kanyakumariana* are in progress.

The population of *Sonerilla kanyakumariana* is not much and only few individuals are recorded. For the study of vegetation propagation and seed germination, two nurseries were established.

Phyllanthus singampattinus- stem cuttings raised in nursery

Impact of forest plantation on ground flora diversity under soil characteristics including the prescription of management practices

For the study of ground flora diversity and soil properties, *Eucalyptus grandis* and *Acacia mearnsii* (Berijam Range) plantations in Kodaikanal area were selected and enumerated the ground flora diversity. It is found that *Shola species*

like *Neolitsea scorbiculata, Rhododendron* etc regenerate sporadically in the plantations. Thirty two species of ground flora were recorded from *Eucalyptus grandis* plantation and 24 species in *Acacia mearnsii* plantation including tree regeneration. Herbarium specimens were made for species which could not be identified in the field. Soil samples were collected from all these plantations for studying soil micro flora and physical and chemical properties. Details on population density of arbuscular mycorrhizal (AM) fungi, PGPR's and other fungi were recorded.

A total of 44 species of Orthoptera, belonging to three different families was recorded from seven different habitat types viz., scrub jungle, deciduous forest, evergreen forest, grassland, plantations, sholas and swamp forests in NBR. Seven habitats namely scrub jungle at Masinagudi; Deciduous forest at Mudumalai; Shola forest at Kothagiri; Grassland at Kodanadu; Teak Plantation at Kargudi and Evergreen forest at Gudalur have been surveyed at regular interval to observe the incidence and seasonality of Orthopteran insects. The species *Xenocatantopshumilis, Conocephalusmaculatus* and *Phlaeobainfumata* are common in all habitat types surveyed. Studied the host range of *Xenocatantopshumilis, Phlaeobainfumata, Oxya sp. Acrida sp. Gastrimargus sp.* and *Orthacrismaindroni*. Conducted extensive study on orthopteran diversity of high altitude shunted wet evergreen forests, called shola to understand the impact of landscape changes. The upland forests act as refuges for highly mobile polyphagous insects like grasshoppers. *Oxyapuscovitata, Phaleobainfumata, Oxyanitidula* and *Xenocatantopshumilis s*pecies were recorded during the orthopteran population survey conducted in shola forest, grasslands and swamps at Kotagiri and Kodanaad. Diversity of grasshoppers in Nilgiris shola forests at three different locations each in Nilgiris North and Nilgiris South divisions respectively, based on anthropogenic pressure and climate change have been studied. A total of 15 species including an unknown gryllid and two unidentified Acridid have been recorded from Nilgiris Shola forests and grasslands.

Investigation on floristic diversity in teak plantation of various age groups in Barnawapara Project Division, Raipur, Chhattisgarh

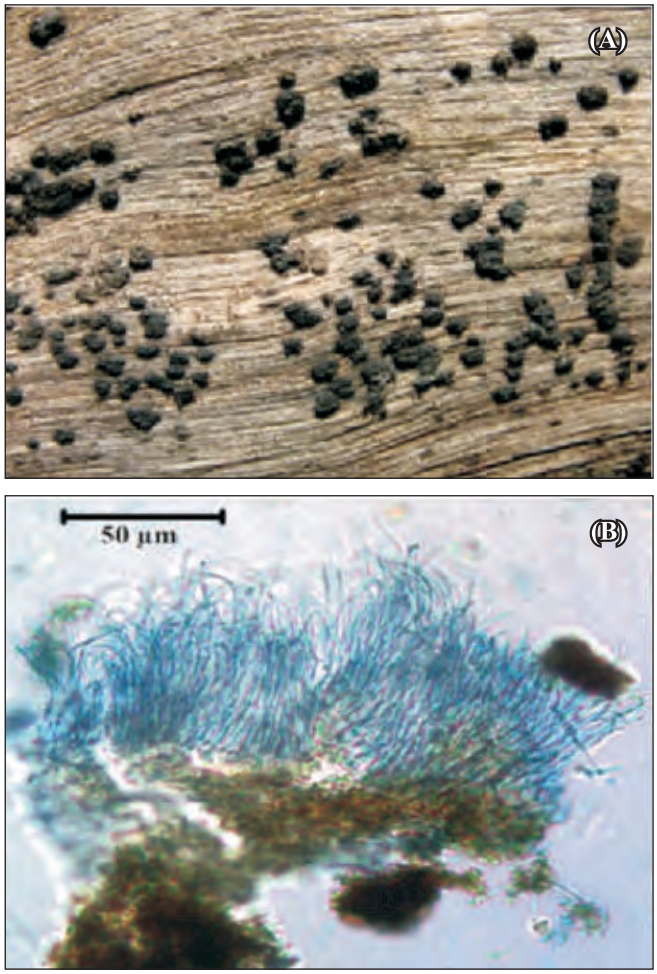
Plantations promote understory regeneration by shading out grasses and other light-demanding species, changing understory microclimates, improving soil properties and increasing vegetation structural complexity. With this view, the project was started to determine the changing of plant diversity in different years plantations, changing of soil properties in teak plantation and the similarities between plant species in each of teak plantations and plant species in natural forest of teak.

Enumeration of vegetation was carried out in three ranges viz. Rawan Range, Raikera Range and Sirpur Range of Barnawapara Project Division, Raipur (CG). 48 trees, 12 shrubs and 36 herbs species were recorded in different years aged plantations from selected three ranges. The compartment wise, dominant tree species were- Teak, Sinha, Karra, Saja, Char, Bija, Mahua, Tendu, Dhawara, Kasai, Bhilwa, Kusum, Moyan, Baheda, Kumbhi, Amaltas, Dhaman, Ghont and Chimti in 12 compartments of Rawan Range.

Taxonomy and documentation of wood decay fungi of Chhattisgarh and Odisha

Survey was conducted in the rainy season of the year 2010, 2011and 2012, 59 forest areas under

districts were visited in Chhattisgarh (41) and Odisha (18) and from their 727 specimens of wood decaying were collected on thirty five timber tree species. The following species of wood decaying fungi were identified- *Auricularia polytricha, Daldinia concentrica, Daedalea flavida, Ganoderma lucidum, Favolus sp., Flavodon flavodon, Hymenochaete rubiginosa, Polyporus sp., Hypoxylon sp., Mircroporus xanthopus, Hexagonia teneuis, Ramaria sp., Pycnoporus sanguineus, Stereum sp., Coriolopsis sp., Necteria sp., Lenzites elegans, Schizophyllum commune, Phellinus sp., Boletus sp., Pyrofomes tricolor, Trametes cingulata, Trichaptum bisogenum, Xylaria polymorpha, Earliella scabrosa, Navisporus floccosa, Leucocoprinus birnbaumii, Mycena rosella, Helvella sp., Phlyctaeniella sp.* and *Hapalopilus nidulans*. One new species *Phlyctaeniella indica* and two species namely *Leucocoprinus birnbaumii* and *Mycena rosella* were recorded as new record to India. The occurrence and distribution of wood decaying fungi on different host in forest and wood depots of Chhattisgarh and Odisha was also reported. The maximum number of wood decaying fungi recorded from Chhattisgarh and minimum from Kopriya, Odisha. Three species common to all places viz. *Flavodon flavus* (Kolt) Ryv. *Trametes cingulata* Berk and *Schizophyllum commune* Fr. with 100 per cent occurrence and frequency.



New species: (A)- *Phlyctaeniellaindica:* Symptoms on wood and (B)- Pycnidia with conidiophores and attached conidia

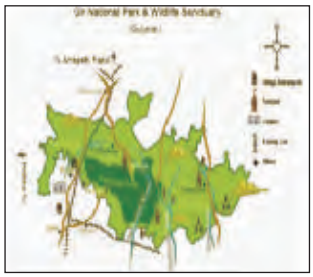
Documentation of sacred groves of Rajasthan and assessment of biological diversity in some of them for improved management and people livelihoods

A survey done for 11 sacred groves which showed that high plant and animal diversities were available in these areas.

Screening, identification and preparation of a comprehensive check- list of the Lepidopteron fauna of Sasan Gir Wildlife Sanctuary of Gujarat state

The survey had been conducted in Gir Wild Life Sanctuary to identify the suitable sites, where the prominent population of butterflies and moths are found had been identified. Periodical visits had been made in selected sites (East &West Gir) in order to collect systematic and random sampling. Detailed record and description of various sampling sites had been maintained and displayed in the map. The record sheet of butterflies and moth had been

maintained along with the photographic documentation. Sixteen species of Nympalidae, ten species of Pieridae, four species of Papilionidae, two species of Arctiidae, two species of Sphingidae, two species of Noctuidae and two species of Lycaenidae have been identified in sixty eight locations of East and West Gir. The detailed life history of *Danais chrysippus* (Nymphalidae) had been studied.



Map of Gir wild life sanctuary

Hypolimnas misippus (Nymphalidae) Schedule-II Indian wildlife protection Act 1972

Euploea core (Nymphalidae) Schedule-IV Indian wildlife protection Act 1972

Castalius rosimon (Lycaenidae) Schedule-I Indian wildlife protection Act 1972

Taxonomy and molecular analysis (through RAPD-PCR) of Moths (Lepidoptera) in Cold Deserts (Spiti and Leh) of Indian Himalayas

A total of 170 specimens of moth (Lepidoptera) species have been collected from various localities of cold deserts of Leh and Spiti till date. Ten species moths have been identified i.e. *Agrois ypsilon*, *G. operculella*, *Y. rorella*, *S. litura Plusia orechalsea,* Diamond back moth*, Polyphaenis confecta, Helicoverpa armigera, Xestia C-nigrum* and *Ochropleur avallesioca* .

On the basis of the results obtained from the data colletcted and analysed till date, it is observed that many species which look similar, when seen from the naked eye but vary in their genetic constitution, which interprets that these may be very closely related to each other morphologically but are entirely different and may not be designated as the same species.

Ecological studies on the distribution patterns and food plant resources of butterflies along with the altitudinal gradients in different forest ecosystems of the Eastern Himalaya

Surveys were carried out in forest areas of Arunachal Pradesh covering 13 districts from East to West (Changlang, Lohit, Anjaw, Upper and lower Dibang valleys; Upper, West and East Siang, Upper and Lower Subansari, Popumpare, East and West Kameng) from Dec 2011- March 2013, to collect ecological data on butterflies. Data on 300 species of butterflies collected so far, including rare and very rare species, many are yet to be identified, along with their ecological parameters/ correlates i.e. GPS coordinates, altitude, slope, aspect, temp,

The very rare-Empress, *Sasakia funebris* in mixed sub-tropical broadleaf forest of Upper Dibang Valley, Arunachal Pradesh which was rediscovered after 88 years in India

The very rare- Ludlow's Bhutan Glory, *Bhutanitis Ludlowii*, a Papilionidae thought to be endemic to Bhutan was discovered in moist temperate forests in West Kameng district of Arunachal Pradesh

humidity, habits and forest type habitat, some food plants, plant associates, biotic disturbances, canopy cover, etc. The data are being incorporated in a GIS database of Arunachal Pradesh for elevation gradient and forest type, distribution districtwise, etc. Some rare butterflies species include the Empress, *Sasakia funebris*; Ludlow's Bhutan Glory, *Bhutanitis ludlowii*; Manipur Jungle Queen, *Sticopthalma sparta*; Peal's palmfly, *Elymnias pealii*; Yellow Gorgon, *Meandrusa payeni; Panther, Neurosigma siva; Brown Prince, Rohana parvata,* etc.

Exploration of diversity and utilization potential of *Sphagnum* species of forestry importance in N.E. India

Eight species of S*phagnum* species collected from various localities of Meghalaya and from Sikkim *viz., S. pseudocymbifolium* C. Muell, *S. papillosum* Lindt., *S. squuarrosum* Crom., *S. khasianum Mitt., S. cuspidatulum* C. Muell., and *S. subsecundum Nees, S. junghuhnianum* Doz. & Molk, and *S. plumulosum* Roell. The taxonomic characterization of all species completed with their habitat etc. The water holding capacity of all collected species analyzed in lab.

Experiments on orchids, *Sphagnum* used as substrate media

The air-layering trials laid down on several commercially important trees of the region *viz., Cinnamomum zeylanicum* (Dalchini), *C.tamala(Tezpat), Gmelina arborea* (Gamari) *Elaeocarpus (Rudraksh), Aquilaria malaccensis* (Sasi), *Litchi chinensis*, *Heteropanax fragrans* (host plant of Moonga silkworm), *Guadua angustifolia, Citrus reticulata, C. lemon* and *C. maxima* for air layering experiment. However, two species of Bamboos (*Bambusa balcooa* and *Bambusa vulgaris* 'Wamin'*),* and two orchids (*Dendrobium* and *Rhynchostylis)* have been selected for substrate media experiment.

Several training-cum -demonstrations were organized to the farmers and the officers of several states of Northeast India including Assam, Meghalaya, Tripura and Manipur. A training programme was organized in Nokahara village of Ri-Bhoi District of Meghalaya to demonstrate farmers' friendly technique of Air-layering.

3.2 Forest Botany

Establishment of molecular taxonomy facilities and molecular characterization of selected bamboo species

DNA extraction, quantification, and RAPD analysis of Bamboo species collected from FRI Bambusetum, Pant Nagar and Lalkuan were carried out. Bamboo leaf samples of 13 species were

collected from Bambusetum, RFRI Jorhat. Voucher specimens of the samples were prepared. DNA extraction and analysis of samples, collected from different locations were carried out. A number of ISSR primers were used for their suitability. Suitable primers were identified. Species were characterized using RADP and ISSR markers.

Digitization of Herbarium of Forest Research Institute

The Dehra Dun Herbarium contains approximately 3,30,000 specimens and nearly 1400 valuable Type specimens. The oldest collection dates back to 1807. Besides collections from the Indian region, herbarium contains specimens from all over the world. In addition to the phanerogams, the herbarium has valuable collections of Pteridophytes. It also includes 40 'Types' specimens of newly described taxa. In all 2,973 genera, 17,573 species, 44,693 specimens, more than 1,00,000 scanned photographs and 45,173 nos. edited photographs were digitized.

Dehradun Herbarium, Specimen Sheet (above)

Revision of Indian Woods-their identification, properties and uses- Volume-II

Writing of book is well underway. This reference book 'Indian Woods- Volume II' is being revised by adding microstructure data of 23 families and upgrading information on properties and uses.

Study on wood anatomy of Indian shrubs for the purpose of their identification and efficient utilization

Wood anatomical structure of 200 Indian shrubs was studied. The species identification key for these shrubs has been developed. Correct identification of these shrub-woods shall lead to their efficient utilization, both in timber and in pharmaceutical industry. Interesting structural patterns were observed with few families having different anatomy of shrub and trees, reflecting upon homogeneity and heterogeneity in taxonomic classification.

Pollination Entomology Dynamics and role of insect pollinators in fruit-set of species of Sonneratiaceae and Avicenniaceae in mangroves of Karnataka

The main aim of the study is the determination of insect pollinators in fruit-set of species of family Sonneratiaceae and Avicenniaceae of mangrove plant. Study of floral morphology and flowering season was made, May month is the peak flowering season in Avicenniaceae and July in Sonneratiaceae. Anthesis, Anther dehiscence were studied, stigma receptivity, pollen longevity, and viability of pollen was studied. Pollination biology of all the mangrove plants was studied by Bagging, Emasculation and natural pollination experiment. Insects responsible for fruit-set i.e. visitors and pollinators were collected and identified and preserved in laboratory. Visit frequency of insect has also been recorded.

Reproductive biology of *Aquilaria malaccensis* Lamk., a critically endangered and economically important species for effective conservation

Studies were carried out on pollination ecology, pollen biology, pollen-pistil interaction; natural

Aquilaria malaccensis. a. Flowering branch. b. Fruiting branch. C. Dehisced fruits, the seed is still hanging in one of them. d, Wasp feeding on the caruncle e. Wasp landing on the seed.

recruitment from soil seed bank and on pollinators across their distributional ranges in NE India.

Studies on seed dispersal were carried out. A rare mode of seed dispersal by a wasp, *Vespa affinis* L. was reported. The present study reports wasp dispersal of seeds, not only in a tropical forest species, but also in a tree species.

3.3 Ecology and Environment

Development of Biomass Expansion Factor (BEF) for some tree species of Garhwal Himalaya, Uttarakhand

Forests of *Shorea robusta* (sal) and *Pinus roxburghii* (chir) of Garhwal Himalaya were surveyed to note the diameter range of both the species to work out the diameter classes and mean tree diameter of both the species for harvesting as per Stratified Tree Technique method of Art and Marks (1971).

Ecological study of watershed in Mussoorie hills of Dehradun

Grasses diversity during all seasons from degraded sites was dominant. Soil moisture percentage within 0-30 cm were observed more during all seasons than 30-60 cm depth under plantation and degraded landscapes whereas it was vice-versa in the case of natural forests. Infiltration rate (cm hr^{-1}) in natural forest was more than plantation and degraded landscape. Microclimatic status under natural forest was more than plantation.

Impact of human induced disturbances on regeneration and population structure of *Rhododendron arboreum* and *Myrica esculenta* in mid hills of Garhwal Himalaya

Regeneration of *R. arboreum* and *M. esculanta* was monitored under human induced disturbed and undisturbed condition in the field. Field survey was

also conducted for seed maturity indices. Seed viability test of *R. arboreum* was also monitored in laboratory. A consistence reduction in seed viability of *R. arboreum* was recorded from the beginning to the subsequent months. Seeds were found viable only for two years. Seed germination of *R.arboreum* and *M. esculanta* was recorded higher under open exposed sites than under thick canopy cover.

Population structure, regeneration status and pollination ecology of *Dalbergia latifolia* and *D. sissoides*

Assessment of populations of *Dalbergia* sp. was made in Coimbatore Forest Division (Tamil Nadu) and Mannarkkad Forest Division (Kerala), Palakkad Forest Division (Kerala) and Vazhachal Forest Division (Kerala). In most of the locations, both *Dalbergia latifolia* and *D. sissoides* were found to occur together, in varying proportions. There was a preponderance of mature trees of higher girth classes in all the locations studied, with very less number of pole stages and saplings. The regeneration was found to be scanty and generally it was seen in the open areas, away from the mother trees. Regeneration through root suckers (i.e. from damaged root) was noticed in one location in Coimbatore Forest Division.

Tree rich Biobooster: A novel approach to synergise growth and pest management

Mass culture of VAM, *Azospirillium* and *Phosphobacteria* was established under laboratory to test the efficacy of biomixtures. About twelve treatments of tree rich biobooster (FYM, effluent compost, vermicompost, and green manure) along with coir pith and vermiculite as base material were prepared and

Preparation of Tree rich Biobooster

Evaluation on eucalyptus biomass

conducted to examine the effect of bioinnoculants with biomanure on *Casuarina* and *Eucalyptus* biomass. *Casuarina* sp., *Eucalyptus* sp, *Tectona grandis, Ailanthus excelsa* and *Ailanthus tryphysa* germination studies has been conducted on tree rich biobooster as coir pith and vermiculite base media to evaluate the effect of biobooster on germination. FYM and effluent compost along with coir pith as base material found to enhance the biomass when compared to vermiculite, green manure, all composts and all composts with PGPR as coir pith as base material.

Development of models for conversion of plantations into secondary forests in Andaman Islands

Conducted the plantation surveys from North to South Andaman and selected sample plots of 5ha each in teak plantations, padauk plantations and mixed plantations located adjacent to moist deciduous forests, semi evergreen forests and evergreen forests. A total of 12 sample plots of 5 ha each have been selected. Each sample plot was further subdivided into 5 plots of 1ha each for various treatments and control. The species diversity present in sample plots of padauk, teak and mixed plantations have been carried out. Similarly, the species diversity, relative density, dominance and frequency have been worked out. Thinning was carried out in the plantations and seeds collected to raise nursery.

Identification of extent of forest lands in forest fringe villages

Socio economic survey have been completed for Dharmapuri, Villupuram, Namakkal, Salem, Tiruvannamalai and Coimbatore. In Dindugal, 15 villages have been covered. Ecological survey has been completed for Salem, Villupuram and Tiruvannamalai and data entry made. In Kerala, the socioeconomic survey has been initiated in Palakkad and Malapuram. In Andaman, 58 villages have been surveyed for socio-economic study.

Structure, diversity and regeneration studies in permanent preservation plots in moist deciduous and evergreen forests of Western Ghats in Karnataka

Despite the importance of the forests in Western Ghats, information on their original condition tend to be more descriptive than subjective. Most of the studies undertaken in the field of conservation biology pertain to the current status of the ecosystems. Information on past vegetation composition and how they have been transformed over a period with respect to species composition, structure etc. is scanty. This study is expected to throw some light on structure, diversity and regeneration studies in permanent preservation plots in tropical wet evergreen forests in Ketlekan, Uttar Kannada District and in moist deciduous forests of Western Ghats in Karnataka in Karka, Bhagavati, and Kuligi in Dharward and Belgaum districts. The study will utilize secondary data in PPP records of these five sites as baseline data and utilizing past data on history and management for which no reports are currently available in public domain.

Vegetation Carbon Pool Assessment Project in India

The project envisages temporal inventory of the forest and soil carbon stocks as well as measurement and modelling of carbon exchange along the atmosphere-vegetation boundary. Six carbon flux measurement towers using eddy covariance

Collection of herb/shrub biomass, litter collection net and litter decomposition bags

techniques are installed in five major forest types of the country.

Conservation, Management and Utilization of selected Rattans of Assam

Analyzed 101 soil samples collected from different rattan growing areas for macro and micro nutrients. Nutritional value of the shoots of two commonly used rattan species of North East India, *Calamus flagellum* Griff. and *C. floribundus* Griff. was also studied.

Tribal people selling the rattan shoots in a local market at forest village near Dehing Patkai WLS.

3.4 Wetland

Ecological study of wetland forest ecosystem of Doon Valley (Uttarakhand)

Jhilmil Jheel wetland is known for conservation of *Cervus duvauceli* (*Barasingha*). The habitat is located at the junction of Bhabar and Terai formations representing a very unique and species rich eco-system which encompasses spectacular landscapes, tall grasslands, secondary shrubs and tropical moist deciduous forests. The present study revealed that 56 plant species belonging to 28 families are present in the area. The floral diversity includes 28 tree species, 16 shrub species and12 herb species. *Shorea robusta* (IVI 28.3) is the dominant tree species, whereas, *Adhatoda vasica* is recessive.

The study of Asan wetland revealed that the 57 plant species belonging to 27 families were recorded in the study area. Out of this, 10 tree species, 21 shrub species, 26 herb species have been recorded. *Acacia catechu* (IVI 116.19) is the dominant tree species whereas *Morrya koenzii* (IVI 107.85) and *Ageratum conyzoides* (IVI 48.44) are the dominant shrub and herbs species respectively. The aquatic vegetation of the Asan reservoir mainly comprises of *Typha elepantina, Photamogeton pectinatus, Ceratophyllum demersum* and *Eichhornia crassipes* of these *Typha elphantia* is dominated community covers the largest area.

3.5 Invasive Species

Impact of invasive species on plant diversity in selected forest sites of Uttarakhand, Haryana and Punjab

Impact of invasive species using quadrat method in the Jhajhra and Asharodi Range was carried out. The dominant species of the area is the *Shorea robusta*. Other important species of the area were *Mallotus philippensis, Syzygium cumini, Jasminum pubescens, Murraya koenigii*, *Vallaris solanacea, Ardisia solanacea, Clerodendrun viscosum, Miliusa velutina, Coffea bengalensis, Flacourtia indica* etc. Vegetative analysis was carried out in the control, *Lantana* and *Ardisia* infested areas. It was observed that *Lantana camara* was heavily invading the open areas. However, its impact was less inside natural forest. *Ardisia solanacea* was dominant in the shrubby layer. Very few species other than *Ardisia* were observed. Above ground wet and dry biomass of *Lanata camara* was estimated using destructive harvesting.

Documentation and distribution of Forest Invasive Species (FIS) of Jabalpur, Katni, Mandla and Seoni districts of Madhya Pradesh

Thirty nine invasive species have, so far, been documented and identified from forest area of four districts of M.P.

Impact of *Prosopis juliflora* on biodiversity, rehabilitation of degraded community lands and as a source of livelihood for people in Rajasthan State

Extensive studies were carried out in Jodhpur, Pali, Jaipur (Sambhar) and Bharatpur districts of Rajasthan state to study the impact of *P. juliflora* on biodiversity, rehabilitation of degraded lands and as a source of livelihood. Recorded 38 species of herbs, shrubs and trees associated with *P. juliflora*. Thirty species of invertebrates and 72 species of vertebrates were also found associated and dependent on *P. juliflora*. *P. juliflora* was recorded as new host for two species of insects belonging to Order Coleoptera (*Mylabris* sp.) for the first time. Twelve faunal species under various conservation status were found associated and dependent on *P. juliflora*.

Studies on utilization aspect revealed that *P. juliflora* is a tree of innumerable uses. The main utilization of *P. juliflora* was as fuel wood and bio-fencing. It is utilized as fodder by the human for cattle. Pods are utilized by herbivores as food. Dry twigs were found to be utilized by 18 species of birds for making nests. The tree provides shade to both humans and animals including wildlife for their dwelling beneath it. Tender leaves are of medicinal value. *P. juliflora* can be utilized for rearing of cantharidin producing beetles *Mylabris* species.

3.6 NTFP Resource Development

Population dynamics of threatened medicinal plants species growing in buffer and transition zone of Tadoba National Park, Maharashtra

Following species were suggested for the study after discussion with officials of Forest Department

Chlorophytum borivilianum Santapau & R.R.Fern, *Dipcadi ursulae* Blatt, *Eulophia nuda* Lindl, *Uraria picta* (Jacq.) DC, *Eulophia ramentacea* Wight, *Rauvolfia serpentina* (L.) Benth.ex Kurz, *Desmodium gangeticum* (L.) DC.

Ecological assessment of diversity of medicinal plants in conservation areas of Chhattisgarh and strategies for their protection

Seasonal data for floristic composition were collected from 7 Medicinal Plant Conservation Areas (MPCA) established in Chhattisgarh. Phytosociological studies showed that there was a marked seasonal variation in ground flora of these Conservation Areas. 251 plants were identified and documented from the conservation areas of Chhattisgarh. Herbarium for 132 species of medicinal importance was prepared and submitted to Funding Agency, Chhattisgarh State Medicinal Plant Board, Raipur, Chhattisgarh.

Important medicinal plants growing in MPCA, Chhatisgarh

Raising of Model Nursery under the project of A.P. Medicinal and Aromatic Plants Board with Species such as Myrobalans (*Terminalia spp.*), Sandal wood, Red sanders etc.

A target was set to raise two lakhs seedlings under the model nursery project. Seeds of *Santalum album*, *Pterocarpus santalinus*, *Terminalia bellirica* and *Terminalia chebula* were sown on beds and seedlings were transplanted to polybags. Seedlings of *Santalum album*, *Pterocarpus santalinus,Terminalia bellirica*, *Terminalia chebula*, *Aloe vera* and other medicinal species like *Ocimum sanctum*, *Andrographis paniculata, Asparagus racemosus,* etc. were raised. ASSO of Myrobalans (*Terminalia*) is raised in four hectare area.

3.7 Bioremediation

Study of bioaccumulation of heavy metals and its impact on different plant species

Results showed that *Dalbergia sissoo* has potential for their use in phytoremediation and reclamation of heavy metal contaminated sites; other tree species like *Alstonia scholaris, Holoptelia integrifolia* have also showed positive response towards accumulation of heavy metals so that they can also be used for the same purpose.

Results also showed that protein, total chlorophyll and amino acid contents were reduced with increased dose of different heavy metals. Proline content showed different response in different doses of different heavy metals (Co, As, Pb, Cu, and Cr). The Bioconcentration Factor (BCF) is an index of the ability of the plant to accumulate a particular metal with respect to its concentration in the soil. The BCF for Cobalt was maximum in *Grevilia robusta* at the concentration of 30mg/l. The BCF for Arsenic was at 30mg/l in *Holoptelia integrifolia*, maximum among all the tree species. In *Dalbergia sissoo,* results showed that maximum BCF was for lead at 40mg/l.

Translocation Factor is an indication of the ability of the plant to translocate metals from the roots to the aerial parts of the plant. Maximum Translocation Factor was seen for Lead in *Alstonia scholaris* at 40mg/l treatment.

Integrated nutrient management for improved growth of trees on overburden dumps

Study was conducted in Kanhan region of Western Coal Fields Limited, Junnardeo and Pench area of Western Coal Fields Limited, Shivpuri for selection of coal mine overburden site for laying out experiment. Shivpuri open cast coalmine at Haranbhata was then selected for taking up the experiment.

3.8 Seed Science and Technology

Germination and ecophysiology of two important tropical forest tree species: *Schleichera oleosa* and *Pterocarpus marsupium*

Mature seeds of *Pterocarpus marsupium* and *Schleichera oleosa* were collected from Jabalpur (MP), Chindwara (MP) and Korba (Chattisgarh). Effect of soil type and depth, light and temperature on germination of these two species was evaluated. Sampling for germination showed that both species were orthodox in nature and dormancy of *Schleichera oleosa* overcame after one year of storage. Deterioration of seeds of *Schleichera oleosa* was observed at different temperatures, if stored at high moisture content. Viability of seeds of *Pterocarpus marsupium* was maintained for more than one year at all temperatures and moisture content (as high as 10.5%). Effect of maturation on dormancy and germination of seeds of *Schleichera oleosa* and *Pterocarpus marsupium* seeds was also evaluated. Seeds of *Pterocarpus marsupium*

acquired germination capacity and desiccation tolerance well before shedding.

Standardization of the techniques for germination, collection and maintenance of maximum viability of four important tropical species: *Bridelia retusa, Sterculia urens, Boswellia serrata* and *Saraca* indica

Fruits of *Sterculia urens and Bridelia retusa* were collected during March-May. Seeds were pretreated to increase the germination of *Sterculia urens* and *Bridelia retusa.* Removal of germination inhibitor in seed coat resulted in the increase in germination of *Sterculia urens.* No treatment was successful to induce germination of *Bridelia retusa.* Maturation studies are continued in *Sterculia urens* and *Bridelia retusa.*

Optimization of seed germination methods and Clonal Multiplication Area Management of *Ailanthus excelsa* Roxb.

The aim of the project was to optimize seed germination studies and clonal multiplication by establishing vegetative multiplication area. Accordingly, different treatments were given to seeds. The seeds treated with IBA were found to be suitable for high seed germination. Further, macro propagation protocol was standardized using coppice shoots from vegetative multiplication area. The facilities like Mist Chamber, seed germinator, Vermicompost pit, and shade house had been created and are being utilized for other projects too.

3.9 Eco-restoration

Development of Model Plantation/Eco-restoration in Coal Mine Areas of BCCL, Dhanbad

A total 34 number of plant species including 16 tree species, 7 shrubs, 7 grasses, 3 herbaceous and one Bamboo species were planted by way of various means, such as, seed broadcasting, seed mixed with soil ball, seedling planting, stem cutting, Bulbils and culm/slip. These species are of multi uses like timber, fodder, medicinal, edible, soil binder, soil enrichment etc.). Among planted species, *Dalbergia sissoo, Azadirachta indica, Phyllanthus emblica* were recorded to be highly successful species. Similarly, among grasses *Cenchrus ciliaris* and *Cenchrus setigerus* were found to be the promising species. Besides these, a number of horticulture species such as *Mangifera indica* (Aam), *Artocarpus heterophyllus* (Kathal) and *Psidium guava* (Amrud) were also planted in the areas.

Treatment of heritage trees

Twenty five trees were treated at Ta Prohm temple, Cambodia with training to Cambodian officials. Bodhivriksha at Bodhgaya was examined for its health status and given treatment. Vat vriksha at Jyotisar, Kurukshetra, Haryana was attended and found under stress due to human activities. Suggestions for its conservation and longevity were given.

Conservation of trees at Ta Prohm temple, Combodia

Standardization of plantation techniques for major forest plant species in Madhya Pradesh

Project initiated from January, 2013. Jungle / site clearance and staking works were completed.

Seedling preparation / procurement and pit digging work is in progress.

Development of site specific regeneration augmentation plan for potential degraded areas in Western Ghats

Experimental trials established at four sites in Attapaddy Reserve Forests (Siruvani and Pudur) and Silent Valley National Park buffer zone (Thathengalam and Panthanthodu) with selected pioneer species, such as, *Maesa indica*, *Macaranga peltata*, *Clerodendrum viscosum*, *Olea dioica* and *Syzygium cumini* for wet sites; *Clerodendrum viscosum, Holarrhena pubescens, Helicteres isora, Macaranga peltata and Glycosmis mauritiana for moist sites; Tarenna asiatica, Dodonaea viscosa, Glycosmis mauritiana, Clausena dentata* and *Mundulea sericea* for dry sites in Pudur area were visited and survival recorded.

Seedlings of canopy species like *Palaquium ellipticum, Dimocarpus longan, Mesua ferrea, Prunus ceylanica, Euodia lunu-ankenda* (wet site); *Terminalia bellirica, Adina cordifolia (Haldina cordifolia), Gmelina arborea, Xylea xylocarpa, Pterocarpus marsupium* (Moist sites); *Holoptelia integrifolia, Azadiracta indica, Chloroxylon sweitinia* (Dry sites) were planted within the pioneer species in experimental plots with spacing of 3m x 3m.

Better survival of pioneer species, *Sysygium cumini, Olea dioica and Measa indica* in wet sites; *Helicteres isora* and *Macarenga peltata* in moist site; *Tarenna asiatica* and *Dodonaea viscosa* in dry site was observed. Among canopy species planted, very few individuals of *Melicope lunu-ankenda* and *Dimocarpus longan* in wet site; *Xylea xylocarpa, Terminalia bellirica* and *Gmelina arborea* in moist site; *Chloroxylon sweitenia* in dry site survived.

Exploitation and utilization of beneficial microflora from the sholas for restoration of degraded shola forests in the Nilgiri Hills, Tamil Nadu

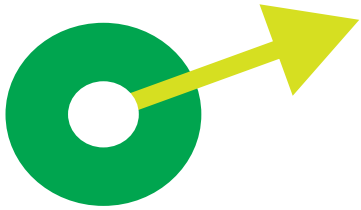
Fruits of shola species namely, *Michelia nilagirica, Mappia foetida, Viburnum erbuscens, Photonia notoniana, Michelia champaca, Berberis tinctoria, Syzigium cumini, Syzigium arnottianum, Dysoxylon malabaricum, Neolitsea zeylanica, Meliosma wightii, Hydnocarpus alpina, Litsea wightiana, Euodia Lunu-ankenda, Elaeocarpus oblongus* and *Symplocos cochinsinensis* were collected from Naduvattam, Glenmorgan, Kariamandhu, Kodanadu and Kotagiri areas of Nilgiris. Seed extraction and processing methods were standardized. Conducted germination studies and recorded seedling vigour parameters in the germinated seedlings, and transplanted.

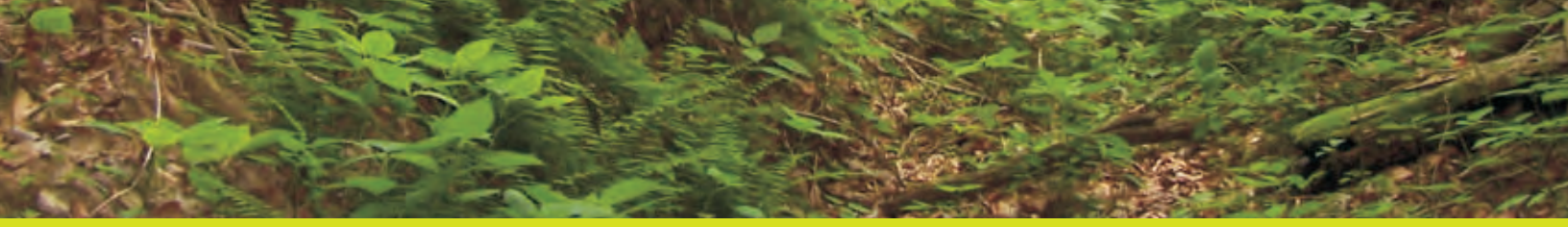
Restoration ecology and species recovery studies in Tsunami impacted mangroves of Andaman Islands

The project is about restoration of the mangrove ecosystem impacted due to Tsunami and to recover mangrove species that are rare, endangered and threatened. A total of 12 sample plots of 2 ha each have been selected in North Andaman, Middle Andaman, Baratang and South Andaman. The vegetation surveys in adjoining mangrove areas have been undertaken. Species composition, abundance and size of mangrove stands, have been documented. Life history traits, such as, patterns of reproduction, propagule distribution and successful seedling establishment are being documented. Mangrove nurseries have been established in all locations. Assisted natural regeneration and artificial regeneration has been carried out in two locations.

4

FOREST AND CLIMATE CHANGE





Forest and Climate Change

Systematic and scientific studies in respect of forest ecology have become inescapable in the present times when climate change is impinging upon the dynamics of forest ecosystem. It is important to understand the behaviour of ecosystems in the wake of changing climatic patterns. Climate change has multi-faceted implications, accordingly, addressing the related issues in a scientific manner requires good scientific understanding in maintaining the flow of goods and services from existing forests both at national as well as at global level. The efforts and the provisions in the past under United Nation's Framework Convention on Climate Change in Kyoto-Protocol are mainly at broader levels and are inadequate to address the challenges and adaptive capacity of communities (human floral & faunal) at ground level especially in the developing countries. Even as per the prediction by Intergovernmental Panel on Climate Change (IPCC), the GDP of the country like India can decline up to 9 per cent due to shifting of growing seasons, which will have catastrophic impact on more than 400 million people, largely India's poor. The available studies have pointed out average increase in the temperature of 2° C in last over two decades, resulting in drying of rivers, vanishing of glaciers from the locations where forest dependent communities are habited and, thus, the food production is falling in such situations. Most vulnerable to such drastic changes in climatic factors are the poorest vulnerable population of forest dependent rural poor, apart from negative impact on downstream productivity. Accordingly, ICFRE has developed programmes including All India Coordinated Climate Change Forestry Research Programme (ALCFP- INDIA) to address the various challenges of this important sector. The initiatives of the Council have been presented in the following paras:

Satellite based assessment of fire severity and its validation in Uttarakhand

The maps containing information on forest fire incidences in Uttarakhand state for the period 2001 to 2012 were prepared in GIS environment. The data have been analysed to provide information on the occurrence of forest fire at different administrative units i.e. state, forest circle, forest division, range and compartment on monthly basis, annual basis and cumulative fire incidence basis. The information on forest fire, in the form of maps and tables, has also been developed for different densities of forest, slope classes, aspects, altitudes and climatic zones.

Climate Change and Forest Influence Division of FRI has launched an All India coordinated research programme "All India Coordinated Climate Change and Forestry Research Programme"; AICFP, involving all ICFRE institutes in their respective states of domain. Currently following research projects are going on:

(i) Process based carbon sequestration study.
(ii) Assessment of ecosystem services imparted by forests of Uttarakhand.
(iii) Carbon Footprint Mapping of Forest Research Institute, Dehradun.
(iv) Forest ecosystem studies in change environment conditions of elevated CO_2 and temperature by free air CO_2 enrichment (FACE) and Open Top Chamber (OTC).

4.1 Environmental Influence

Effect of elevated CO_2 on active principles of important medicinal plants

Seedlings of *Withania somnifara, Ocimum sanctum, Catharanthus roseus* and *Coleus forskohlii* kept under different elevated CO_2 levels in the nursery. Medicinal plants,when exposed to higher elevated CO_2 levels, they showed higher production of biomass, and bio-chemicals viz. the total protein, tannin, etc.

Response of mycorrhizae and microbial symbionts to elevated CO_2 in commercially important tree species

Rhizosphere soil samples of selected tree species were collected, and Arbuscular Mycorrhizal (AM) fungi and plant growth-promoting rhizobacteria (PGPRs) isolated. Root colonization of AM fungi in Dalbergia *sissoo*, *Melia dubia, Gmelina arborea* and *Ailanthus excela* was 90-95 per cent. AM fungal root colonization in these trees was cultured and inoculated in *Casuarina junghuhniana* and *C. equisetifolia* cuttings and exposed to higher CO_2 supply in open top chambers. After 15 days of incubation, both the species showed nodule formation exposed in 600 ppm of CO_2/day. This study showed that the elevated CO_2 enhanced the growth of *Frankia* root nodules in both the species. The microbial biomass of beneficial microbes, such as, *Azospirillum* and *Bacillus* and *Pseudomonas* (Phosphate solubilizing bacteria) were increased from 2 x 10^5 to 5 x10^5 due to increased supply of CO_2. The inoculation of cultured *Rhizobium* in the rooted stem cuttings of *Acacia auriculiformis* resulted in formation of root nodules within seven days after inoculation in 600 ppm CO_2/day.

Formation of root nodules in rooted stem cuttings of *Acacia auriculiformis*

Monitoring the impact of climate variables on plant diversity in Bhimashankar permanent preservation plot of Sub tropical hill forest of Maharashtra

Enumeration of vegetation was carried out in three permanent preservation plots. Enumeration of trees (number, height and girth), shrubs, herbs and

Some of the prominent flora found in preservation plot (A)- *Entada phaseoloides* (B)- *Lasiosiphon eriocephalus,* (C)- *Maytenus rothiana* and (D)- *Xantolis tomentosa*

grasses were done. 25 species of trees, 1 shrub, 4 climber, and 6 herb species were documented and identified from the preservation plots. Vegetation analysis is in progress.

Utilization of Automatic weather station/ Agrometeorological station data for agriculture, forestry and hydrological applications in Madhya Pradesh

Ten (10) study plots of 0.1 ha size each, were selected in three Tiger Reserves of Madhya Pradesh namely, Satpuda, Panna and Pench. Growth data (e.g., height, girth) of trees, litter biomass and herbaceous biomass recorded from quadrats. Soil samples were also collected from the selected quadrats and their physico-chemical properties analysed.

Tectona grandis, Acacia catechu, Anogeissus pendula, Chloroxylon swietenia, Zizyphus xylopyrus and *Boswellia serrata* are main tree species recorded from Panna Tiger Reserve. *Tectona grandis, Pterocarpus marsupium, Buchanania lanzan, Syzygium cumini, Zizyphus xylopyrus* and *Chloroxylon swietenia* tree species were abundantly found in Pench Tiger Reserve while *Shorea robusta, Soymida febrifuga,*

Laying out quadrate for data collection on herbaceous biomass

Diospyros melanoxylon, Emblica officinalis, Hardwickia binata, Saccopetalum tomentosum, Chloroxylon swietenia and *Gardenia latifolia* were the main tree species recorded from Satpuda Tiger Reserve.

Study on the influence of climate on bionomics of *Pityogenes scitus* Blanford (Coleoptera: Scolytidae) in Himachal Pradesh

Pityogenes scitus completed three generations, starting from February and thereafter, by the end of October. Insect life-cycle was completed within the period varying from 56 to 75 days and entered into hibernation in pupal stage. It passes about 80 per cent of time during its life cycle (egg, larval and pupal stages) under the bark of the tree. Forest stand of selected tree species below 80 cm GBH was found to be highly susceptible to the attack of *P. scitus* as compared to the higher girth classes. Larval Growth Index was reported to be the maximum (4.0) in *Pinus wallichiana (Kail)* and a minimum of 1.6 in *Pinus gerardiana*. Maximum damage (65.3%) was reported in *P. wallichiana* in comparison to the other pine species with its minimum (1.0%) in *Cedrus deodara*. Insect lives in association with other bark and wood borer species i.e., *Polygraphus longifolia, Cryptorhynchus rufescens* and *Platypus biformis.*

High Altitude Transition Zones in Himachal Pradesh: Long-term studies to assess the effects of global warming and trials to rehabilitate degraded sites in this zone

The prime objective of the project is to study the floristic composition in carefully selected plots in high altitude transition zones and to monitor any changes in its composition over a period of time so as to arrive at any conclusion about the impact of climate change in the area. A reconnaissance survey of transition zones in the project area was

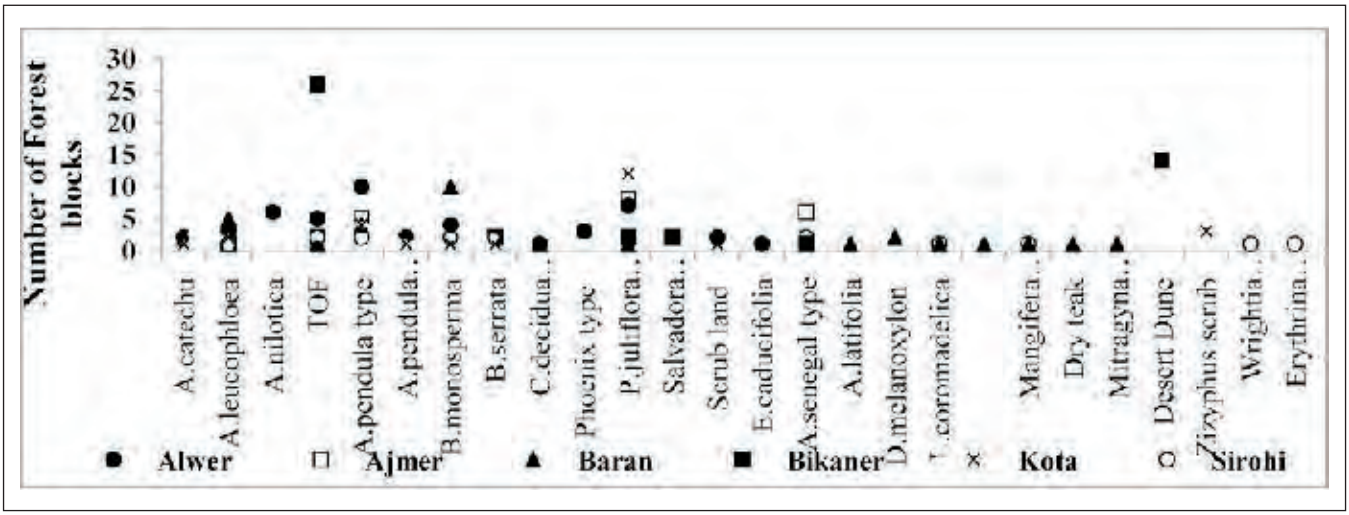
Glimpses of the survey and selection of sites under the project

undertaken. Five permanent plots with GPS coordinates (3 in the Satluj Basin and 1 each in Ravi and Beas Basins) were laid down for carrying out the detailed studies. During reconnaissance survey, broad floristic composition, especially with respect to the occurrence of keystone tree line species, occurrence of any red listed plant species and their population status, incidence of biotic pressures and degradation status recorded. Glimpses of the survey and selection of sites under the project are given above.

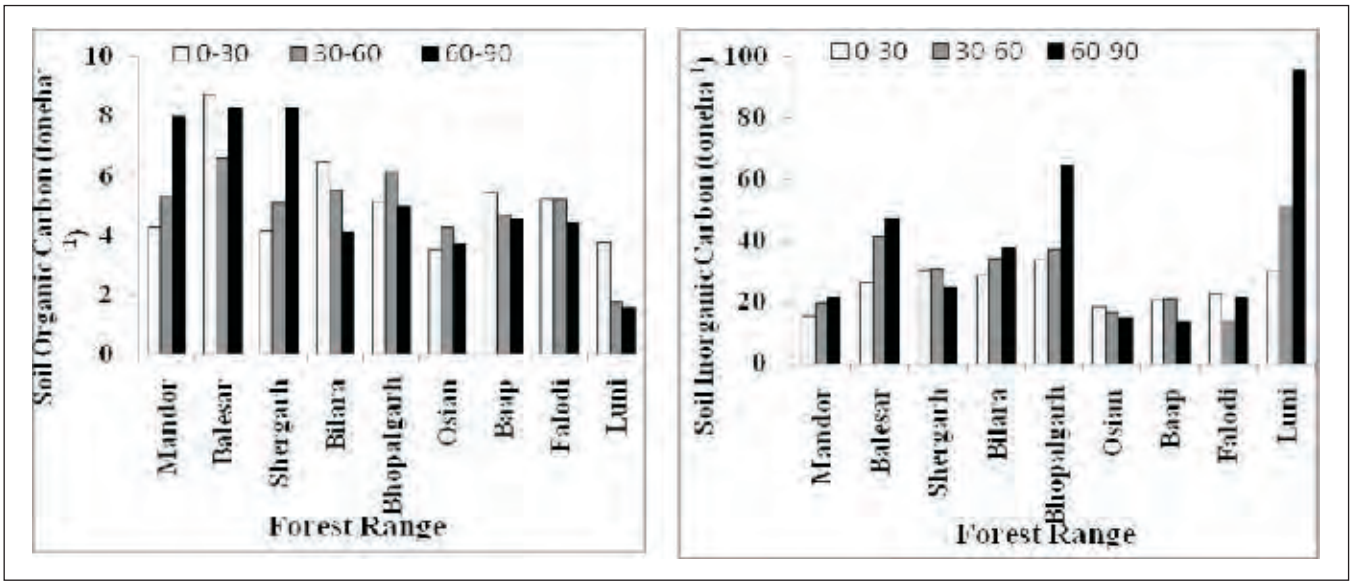
4.2 Carbon Sequestration

Studies on carbon sequestration in different forest types of Rajasthan

Study was started with an overall objective 'to provide an estimate of carbon stock in forests of Rajasthan' for its utilization in planning and execution of afforestation/ reforestation programme, in particular, to estimate carbon stock in forest soils, and in above ground and below ground biomass. In the year 2012-13, data compilation on dominant vegetation (tree/shrubs) in 196 forest blocks of six districts (Alwar, Ajmer, Baran, Bikaner, Kota and Sirohi) indicated 26 dominant types of forest (including TOF). Out of the total, 36 forest blocks dominated by TOF, 32 forest blocks by *Prosopis juliflora*, 25 by *Anogeissus pendula* forests, 17 by *Butea monosperma*, 14 by Desert Dune scrub, 12 by *Acacia leucophloea* - *Z. nummularia* and 10 forest blocks by *Acacia senegal* trees. Other dominant types, covered less than 5 forest blocks.



Number of forest blocks dominated by different tree/shrubs in the six districts of Rajasthan.



Distribution of soil organic carbon (left) and soil inorganic carbon (right) stock in the forests of Jodhpur district.

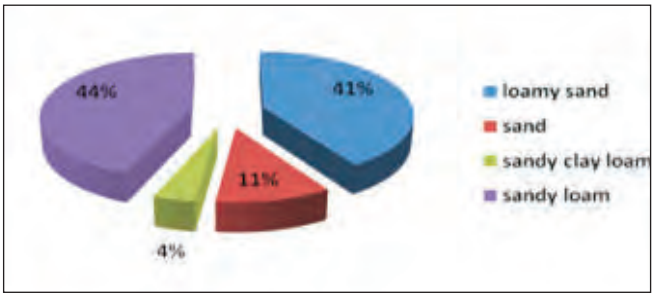
Carbon study in 1 m soil layer of 139 forest blocks in Jodhpur indicated that soil organic carbon stock ranges from 11.4 mg ha^{-1} (in Osian) to 26.2 mg ha^{-1} (in Balesar Range). Soil carbon stock was greater in 0-30 cm soil layer in Baleser, Bilara, Baap, Falodi and Luni ranges, in 30-60 cm soil layer in Bhopalgarh and Osian range and in 60-90 cm soil layer in Mandore and Shergarh ranges. Higher soil organic carbon stock in deeper soil layer is attributed to sand deposition on surface soil. Substantial amount of carbon is also available in inorganic form, which ranges from 50.6 mg ha^{-1} in Osian to 229.6 mg ha^{-1} in Luni Range. Soil inorganic carbon was greater in 0-30 cm soil layer in Osian and Falodi ranges, in 30-60 cm soil layer in Shergarh and Baap ranges and in 60-90 cm soil layer in rest of the ranges.

4.3 Forest Soils

Characterization and classification of forest soils of Rajasthan

Soil samples were analysed for physico-chemical propersties. Soils were analysed for soil texture, structure, consistency, colour, pH, electrical conductivity, organic carbon, inorganic carbon, NO_3 and NH_4, nitrogen and phosphorus. Data on species composition, regeneration status, forest floor litter, carbon stock in soils in different forest blocks were compiled and tabulated.

Analysis of 556 soil samples from different districts revealed that soil pH was ranging from 6 to 7 in Alwar, Baran and Pratapgarh., whereas, it was 7 to 8.58 in Hanumangarh, Sri Ganganager and Pali. In Bikaner soil pH was as high as 9.04 at Mehrasar block. Forest soils of Jalore district was in the range of 7 to 8.3. Electrical Conductivity (EC) of soils of Jalore varied from 0.06 to 1.75 dSm^{-1} indicating their non saline status. High EC was observed in



Relative abundance of different soil textural class

soils of Sri Ganganagar (0.26 to 1.31 dSm^{-1}). Soil organic carbon was low in Bikaner, Hanumangarh, Tonk and Sri Ganganagar, ranging between 0.02 and 0.3 per cent. It was higher in Alwar (0.04 to 1.06%), Baran (0.23 to 1.01%, Jaipur (0.02 to 2.21%), Pali (0.12 to 1.28%) and Pratapgarh (0.26 to 0.74%). High SOC was observed in soils of Kotputli in Jaipur. Soils are mostly sandy in nature (44% sandy loam, 41% loamy sand, 11% sand and 4% sandy clay loam).

Carbon stock and soil classification mapping for Rajasthan Forest

GIS laboratory has been established in AFRI with work stations and facilities like plotter and printer. Integrated GIS software has been procured having the capabilities of spatial analysis, image processing, RADAR analysis, hyper spectral analysis, photogrammetry, network analysis, GIS modelling, surface analysis, watershed modelling and atlas creation, publishing geo-referenced image/map in printable format and also in a format easily readable in the systems not having GIS software.

Measurement of Vegetation and biomass parameters under vegetation Carbon Pool Assessment (VCP)

An assessment of terrestrial vegetation biomass was carried out in 30 plots in the districts of Warangal, Karimnagar, Nizamabad and Adilabad. Soil samples were also collected, along with tree data, shrubs and herbs biomass samples.

Identification of soil-vegetation relations and indicator species for assessment and rehabilitation in lower Aravalli of Rajasthan

Study being carried out at five different locations with annual rainfall of 988, 961,950, 568 and 424 mm in Banaskantha (Trisulia), Motimori (Sabarkantha), Banaswara (Bara Nandra kho), Rajasmand (Sabalia) and Pali (Borvad forest block) respectively *to study* (i) physical properties and nutrient status of soil derived from different parent material, and (ii) vegetation structure and indicator species on dominant soil types. The sites were dominated by *Wrightia tinctoria*, *Tectona grandis*, *Lanea coromadelica* and *Anogeissus pendula* (trees) *Nyctanthes arbor-tristis*, *Lantana camara*, *Rhus mysorensis* and *Euphorbia caudicifloia* (shrubs). For herbaceous species, decrease in number of species, population, biomass and dominance was observed, whereas, species

Adiantum lunulatum in Trisulia forests of Ambaji Palanpur, Gujarat

Tectona grandis and *Nyctanthes-arbor-tristis* dominated forest in Motimori in Sabarkantha

Vernonia scinerescence dominated at Borvad, Pali (Rajasthan)

Acacia catechu and *Dendrocalamus* strictus dominated at Sabalia, Rajasamand (Rajasthan)

richness, diversity (P>0.05) and species evenness (P<0.05) increased in 2012 as compared to 2011. Soil properties in 2012 showed a slight increase in soil pH, EC and SOC as compared to 2011.

Phyto-remediation of soil for productivity enhancement during land disposal of effluent (SFD Rajasthan)

Survey was conducted in (i) Luni river basin starting from Ajmer (near Govindgarh, Pushkar), Pali, Nagaur, Barmer, Jalor and up to its merging area *i.e.* Rann of Kutch, (ii) Jojri river in Jodhpur and (iii) Bandi river in Pali district. Water and soil

Alhagi maurorum

samples in effluent disposal area were collected and dominant plant species alongside the river bank were recorded. Most prominent plant species observed were *Acacia nilotica*, *Aerva persica, A. pseudotomentosa, Argemone mexicana Azardirachta indica, Alhagi maurorum, Haliotropium curassavicum, H. supinum, H. marifolium, Cassia angustifolia, C. italica, Crotalaria burhia, Cressa cretica, Echinops echinatus, Eclipta prostrata, Fagonia bruguierii, Glinus lotoides, Leptadenia pyrotechnica, Oligochaeta ramosa Prosopis juliflora, Pulicaria crispa, P. wightiana, Salvadora oleoides, S. persica, Solanum surattense, Sueada fruticosa*, *Tamrix aphylla, T. species, Tephrosia purpurea* and *Zizyphus nummularia.*

Cassia angustifolia

Effluent water samples were collected from Pali, Balotra and Jodhpur. Sample collected from CETP Pali was found alkaline (8.67). Highest Electrical conductivity (EC) was found in effluent sample collected from Punayta (Pali) which was 100.89 mS cm-1, whereas, lowest was found in water collected from Pali out skirts (0.83 mS cm-1).

Fagonia bruguierii

Highest Dissolved Oxygen (DO) was found in Pali outskirts sample (4.56 mg/l), whereas, lowest is found in sample collected from Salawas Steel Rolling mills i.e. 1.63 mg/l. Highest amount of TDS was recorded in sample collected from Jasol (17,500 mg/l), whereas, lowest (78 mg/l) was found in water sample collected from Pali outskirts.

Prosopis juliflora

Highest (204.8 mg/l) amount of SS was found in the effluent sample collected from CETP Balotra, whereas, lowest in water sample collected from Pali outskirts (12.4mg/l). Highest COD was recorded from Jhawarya village in Pali (310 mg/L), whereas, lowest was from Pali outskirts (22.6 mg/L).

Soil samples from Sindri showed highest pH (9.41) and EC (80.33 mS cm-1). Lowest pH was recorded from Jhawarya village Pali (5.24), whereas, Lowest EC (0.11 mS cm-1) was recorded from Guda malani (Barmer district) soil sample. Highest (22.4 ppm) phosphorus content was found

Tamarix sp.

Pulicaria crispa

in soil sample collected from Jhalamand (Jodhpur), whereas, lowest (3.15 ppm) in Laadpura sample. Highest (13.88 ppm) Ammonia content was recorded from Doli, whereas, lowest ammonia content (2.06 ppm) recorded from Kankani sample. Lowest (1.76 ppm) nitrate content was found in Pali outskirts sample, whereas, highest (29.51 ppm) in sample collected from Doli.

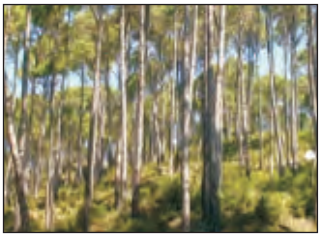
In a field experiment using Lysimeter (2m x 2m x 2m), seven forestry tree species *viz*. *Prosopis cineraria, Prosopis juliflora, Azadirachta indica, Eucalyptus camaldulensis, Tamarix aphylla, Salvadora persica and S. oleoides* with four irrigation levels and three control, implying Completely Randomized Design (CRD) were planted.

Assessment of Carbon Stock in Forest Types of Shimla Forest Circle, Himachal Pradesh

During first year of the project survey was undertaken to identify the sites representing different forests in Shimla Forest Circle. The major forest types identified were chir pine forest, ban oak, deodar, silver fir & spruce, kharsu oak and alpine pasture. The data collected from alpine pasture of Chansel, Kawar and Talra were analysed for biomass and soil carbon stock. Total biomass for Kawar, Chansel and Talra pasture was 3.80, 5.5 and 10.40 mg/ ha whereas, carbon stock for these pastures was 1.99, 2.75 and 5.40 mg C/ ha respectively. Total soil carbon stock for Kawar, Chansel and Talra pasture was 133.11, 160.00 and 132.16 mg C/ha respectively.

Assessment of soil quality indicators for different forest stands in Uttarkashi district through collection and analysies of soil samples

Chir pine forest, Dhami (Shimla Division)



Close View of Chirpine forest, Dhami

Deodar forest, Koti (Shimla Division)

Ban oak forest, Taradevi (Shimla Division)

from different forest stands viz. fir spruce , deodar, oak, chir, and miscellaneous forests from the sites in Naugaon, Shrukhet, Barkot, Radee Oonchaband, Jankichatti, siyanchatti and Hanuman Chatti (Upper Yamuna forest division), Uttarkashi.

Soil organic carbon store under different land uses in Haryana

- The Intergovernmental Panel on Climate Change, identified creation and strengthening of carbon sinks in the soil as a clear option for, increasing the removal of CO_2 from the atmosphere and has recognized soil organic carbon pool as one of the five major carbon pools for the land use and land use change in Forestry sector.
- This project was undertaken in Haryana to estimate SOC pool under different land uses *viz.* forests, block plantations, horticulture and agroforestry, as per the IPCC guidelines to

generate the authentic and scientific information.

- During the year, field works including site selection, soil sampling from 17 districts were carried out in Faridabad, Palwal, Rewari, Ambala, Panipat and Sonipat districts of Haryana.
- Assessment of soil microbial community and soil quality under poplar and eucalypts plantations in Haryana was carried out.
- Soil Quality Index (SQI) for different land uses of Tehri Garhwal district of Uttarakhand (Externally aided project of UCOST) is being carried out for different landuse to assess 'Soil Health'. So far the areas of Anand Chowk, Kodiyala, Tapovan, Narendranagar and Agrakhal of Tehri district of Uttarakhand have been surveyed and soil samples collected from these areas.

Study on beneficial microbial interaction with trees in heavy metal contaminated sites in Tamil Nadu

Heavy metal pollution of soil and water is a significant environmental problem. The present study deals with isolation, identification and characterization of heavy metal tolerant microbes from different polluted sites in Tamil Nadu. Surveys undertaken in different heavy metal contaminated sites (Textile dye; Paper industry; Tannery effluent) in Tamil Nadu and recorded the plant diversity status in contaminated and adjacent areas. Soil samples were analyzed and physico-chemical properties such as pH, E.C., macro and micro nutrients estimated.

Studies on the dynamics of litter decomposition in sal forest of Central India and its impact on the nutrient status of soil

Lophodermium shoreae, a dominant sal litter colonizer was recorded from the experimental sites of MP, CG and Odisha. Combination of *Trichoderma harzianum*, *Cladosporium* sp. and *Aspergillus niger,* accelerated decomposition of litter and also contributed nutritional substances to the soil. Fourteen documents of interesting fungi were prepared. Seasonal influence of micro fauna, during litter decomposition of sal was also evaluated.

Under the project 'Enhancement of Soil Carbon and Nitrogen Sequestration Potential of Different Land Use in Jharkhand, through Recommended Management Practices' the study on effect of green manuring on physical, chemical and biological properties of coalmine soil was done. The performance of jamun, sal and mahua in the reclaimed mine soils were studied. Biometric parameters viz. height, collar diameter, shoots and root biomass were recorded. Soil organic carbon and nitrogen content in the mine soil were

Some mycorrhizal fructifications of sal forest

Table 1. District wise list of dominant tree species, tribes and crops

	District	Dominant tree species	Dominant tribes	Major Crops
1	Pali	*Prosopis julliflora*	Rawat and Raika	Bajra
2	Sirohi	*Acacia pendula, Butea monosprema*	Ghrasiya and Meena	Maize, Wheat
3	Kota	*Acacia pendula, Acacia senegal*	Bheel and Meena	Wheat
4	Jaipur	*Acacia tortlis, T. undulata*	Meena, Keer and Gurjar	Jau, Mustard, Wheat and Bajra
5	Bundi	*A. pendula, B. monosprema*	Gurjar and Jhala	Maize and Wheat
6	Baran	*A. pendula, B. monosprema*	Ahir and Ghrasiya	Dhaniya and Wheat
7	Swaimadhopur	*A. leucophoea, A. pendula, B. monosprema*	Meena and Gurjar	Mustard
8	Dholpur	*A. pendula, S. cumini*	Gurjar	Wheat and Cicer
9	Chittorgarh	*A. pendula, A. catechu, Dyospyros melanoxylon*	Gurjar and Meena	Soybean and Wheat
10	Banswara	*A. latifolia, A. ferruginea*	Bhil, Damor and Meena	Maize, Rice and Cotton
11	Jhalawar	*A. pendula, M. parviflora*	Gurjar and Meena	Wheat and Mustard

estimated periodically. The changes in physical, chemical and biological properties of coal mine were studied and documented at specified time interval.

4.4 Fringe Forest, Urban Forestry

Identification of extent of forest land in forest fringe villages

Socio-economic survey and vegetation studies done in 11 districts of Rajasthan. The dominant tree species in forest fringe villages are given in Table 1 Among shrubs, undershrubs and grasses, *Capparis desidua, Zizyphus numularia, Lantana camara, Lasiurus sindicus, Leptadenia pyrotechnica, Saccharum munja* etc. are prevalently growing there. Almost every village has primary school, electricity and sufficient irrigation facility. They grow peanuts, maize, soybean and pulses as cash crop.

Designing and Development of Urban Forestry Model For Indian Institute of Technology (IITJ), Jodhpur, Rajasthan

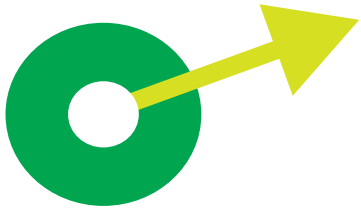
This project has been funded by Indian Institute of Technology, Jodhpur, (Rajasthan) for developing shelterbelt with aesthetic value on a very shallow calcareous soil of IIT(J) campus. The objectives were (i) to design a model shelterbelt plantation for urban forestry; (ii) to study the bio- remediation effect of shelterbelt plantation on soil properties; and (iii) to increase carbon stock of a land with low

productivity. Plantation of trees and flowering shrubs in a stretch of 5000 m along the roads and the institute boundary was carried out in September-October, 2012. Plantation was done after complete replacement of soil along with the calcium carbonate aggregates (murram layer) and refilling of pits with a mixture of sand, farmyard manure and pond silt. 4000 seedlings of different species were planted. The tree species planted are *Azadirachta indica*, *Tabebuia aurea*, *Terminalia catappa*, *Millingtonia hortensis*, *Peltophorum ferrugineum*, *Bauhinia racemosa* and *Butea monosperma*. The shrubs are *Ceasalpinea pulcherima*, *Bougainvillia glabra*, *Plumeria alba*, *Nyctanthes arbore-tristis*, *Tabernaemontana divaricata, Nerium oleander* and *Tecoma stans.*

Plantation at IIT (J)

5

FOREST GENETIC RESOURCE MANAGEMENT & TREE IMPROVEMENT



Forest Genetic Resource Management and Tree Improvement

Tree improvement and breeders in India are facing new demands to cope with the changing needs of forest industry and changing climate. To address these issues, dedicated tree breeding programme has to be reoriented towards development and deployment of productive and adaptive populations and varieties across the sites. Clonal propagation is one of the indispensable components in tree improvement programme by means of mass multiplication of superior genotypes for clonal forestry programme and, thereby, improving productivity. Therefore, selection of superior trees, their propagation, clonal testing, and establishment of production populations, clonal deployment and production of improved germplasm have been taken up in ICFRE institutes. Development of productive and drought adaptable, site matched varieties/ clones, identification of underutilized species/varieties adapted to harsh environments are some of the priorities to be taken up. Field tested genetically superior clones of Eucalypts and Poplars have revolutionized the productivity and profitability of plantations in many countries and results from Indian endeavours also quite encouraging. These plantations sustain most of the wood based pulp and paper mills and plywood/veneer factories in the country and thus saving precious foreign exchange. The same is yet to happen with regard to some other under-utilized fast growing tree species which requires proper evaluation and domestication.

Biotechnology have been an integrated tool in the ongoing tree improvement programmes and in characterization of germplasm for their enhanced and systematic utilization. The ICFRE has initiated genomic research towards facilitating conservation and management of natural forest resources since forest genetic resources are provider of products and services for economic development.

5.1 Conservation of Forest Genetic Resources

Garcinia

Distribution of different species of *Garcinia* (Cluciaceae), its ecology, utilization in the upper Brahmaputra valley of Assam and its conservation was studied in detail. During the first year of the study, extensive survey was made in Nambar Reserve Forest and Kaziranga National Park in Golaghat District; Disoi Valley reserve Forest and Gibbon Wild Life Sanctuary in Jorhat District; Jokai and Joypore Reserve in Dibrugarh District; Panidehing Wild Life Sanctuary and Abhoipur Reserve Forest in Sivasagar District. The traditional

Fruits of *Garcinia cowa* in patch vegetation

knowledge of the people on the use of the different species of *Garcinia* was evaluated by interviewing the common villagers and the local medicine man, who were dealing with treatments of different disease by using plant products. Altogether, seven species of *Garcinia G. pedunculata*, *G, peniculata*, *G. xanthochymus*, *G. lanceofolia,* G. *cowa, G. kydia* and *G. morella* were found to be distributed throughout the study area. Except *G. lanceofolia,* all the species are evergreen trees distributed mostly in the forest areas. The species *G. lanceofolia* is a shrub, restricted to the homestead gardens as domesticated plant. All the species of Garcinia bears edible fruits which are eaten for its sour taste. The ripe flashy exo-carp and mesocarp of the fruits (berry) of *G pedunculata, G. cowa, G. kydia,* and *G. lanceolata* is edible and eaten its ripe flashy part as sour vegetables or as prickles and also in dried form. The aril part of the seeds of *G pedunculata, G. cowa and G. kydia* and *G. xanthochymus* has sweet taste and are eaten by the people, raw or as shorbat. It is also reported by some villagers that the juice extracted from the dry sliced fruits of *G. cowa* and *G. kydia* is used as shorbat and as the cooling agent for the patients suffering from fever and stomach pain.

Quercus leucotrichophora

Oaks (*Quercus* spp.) are among the dominant vascular plants of the Himalayas, ranging from the subtropical to the sub-alpine zones. In the Himalayan region, extensive oak forests occur between 1500 and 3300 m elevations. Banj oak (*Quercus leucotrichophora*) which is the most preferred tree species in the temperate region, mainly used for fodder, fuel, and small timber. *Q. leucotrichophora* forms an extensive belt along the middle elevation (1200-2200 m), facing excessive pressure for existence. In order to study the genetic diversity and population structure of Himalyan Ban Oak forests, a project has been initiated. Eighteen populations each with 30 individual trees covering Himachal Pradesh and Uttarakhand has been sampled for DNA marker based study. DNA extraction techniques were standardized and genomic DNA isolated from 12 populations (360 samples). Polymorphic ISSR/RAPD markers were screened and used for molecular characterization work. RAPD fingerprinting of 300 samples, representing ten populations, using 10 selected primers has been completed. Their scoring work has also been completed. For SSR marker analysis, a total of 10 polymorphic microsatellite markers have been screened for population genetic analysis work.

Commiphora wightii

Commiphora wightii (Guggal, Guggul or Mukul myrrh tree) is one of the very important medicinal plants. Many commercial products have been marketed nationally and internationally, therefore, the demand of Guggal has increased and the plant is subjected to destructive tapping procedures. Thus, the Guggal has become so scarce, due to overexploitation that World Conservation Union (IUCN) has declared it as an endangered species. It was very essential to study population density and record the present status of this valuable species and assessment of its germplasm. In all the 33 districts of Rajasthan surveyed, Guggul density was found high in Sawai Madhopur (≈74 ha^{-1}) and Jhunjhunu (≈69 ha^{-1}) districts. The survey also revealed that Bikaner, Banswara, Churu, Shri Ganganagar, Hanumangrah and Pratapgrah districts were lacking in natural guggul population. Male plants were available in only at few places

with female and male plants ratio of 99.9: 0.01. In other words, male plants were less than 0.01% in Rajasthan State. Germplasm was also collected for *ex-situ* conservation from identified trees. About 1428 vegetative cuttings with source details (GPS locations) were collected and raised in the vegetative propagation area for rooting.

Field germplasm bank of *Grewia optiva* and *Quercus leucotrichophora*

The survey for identification of suitable land for establishing field germplasm bank was done in collaboration with Uttarakhand Forest Department. The collection of seeds from 79 selected trees of *Quercus leucotrichophora* and 107 selected trees of *Grewia optiva* was carried out from Uttarakhand, Jammu & Kashmir and Himachal Pradesh. The drying, cleaning and storage of individual tree seed was done and the morphological characterization of seed and their germination studies carried out. One day training was organized in the month of August, 2012 for the village women and farmers of Maldevta, Raipur block Dehradun to enrich their knowledge about all nursery and field plantation of fodder trees. A total of 64 women/farmers participated in the training. The *Grewia optiva* seedlings were distributed to the villagers of Maldevta and adjacent areas for planting in the bunds of the agriculture fields and panchayat lands to meet their fodder requirement.

Teak

For exploration of Teak genetic resources, its populations have been selected in different forest divisions of Kerala namely Thrissur, Chalakkudy, Malayatoor and Kothamangalam, on the basis of topography, soil factors, and morphological characteristics, such as tree form, branching pattern, canopy, leaf, flowering and fruit. The details of Teak and Eucalyptus clones available with various stakeholders have been recorded and the clones will be collected for establishing National Gene Bank. In addition, a vegetative multiplication garden of teak with 56 clones and clone bank of teak are also being maintained.

View of teak population at Kannimangalam, Kerala

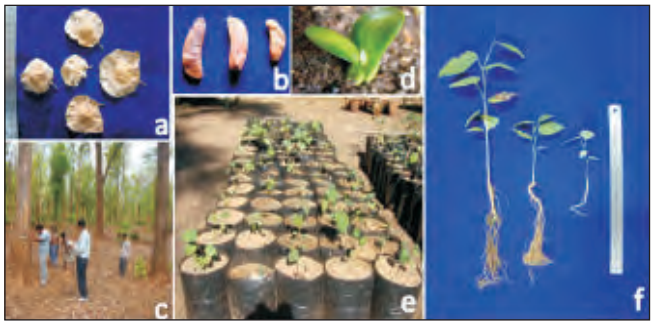
A teak tree showing numerous holes on trunk at Illithodu, Kerala

Variation in bark color of Teak at Kodanad and Evergreen outpost beat in Kerala.

Ex- situ conservation of *Pterocarpus marsupium*

The work of germplasm collection was completed in three localities of Basart region, namely, Bhanupratappur, Antagarh, and Narayanpur and one locality of Hati, Dhramjaygarh Range. In each locality, 20 trees were marked as superior trees on the basis of phenotypic characters. The pods and bark from a total of 60 trees were also collected.

Selection of phenotypically superior trees, collection of bark and recording of field data of *Pterocarpus marsupium*



Germination in *Pterocarpus marsupium:* (a & b) variation in pod and seed size (c) selection of phenotypically superior trees from Antagarh range in Bastar Forest Division, Chhattisgarh (d) emergence of cotyledons and (e & f) variation in germination of seeds of different size classes

NTFP species

Data were recorded on *Pongamia pinnata, A. marmelos*; *P. marsupium*, *Nux-vomica* and *S. suaveolens* for number of traits i.e. Plant height, girth, number of primary branches, 100-seed weight, crown diameter, clear bole height, crown height, crown volume, 100-pod weight etc. Recorded data were analysed statistically for finding the correlation between the traits and also to find out the traits having direct effect on economic produce.

Based on the results of correlation and path coefficient analysis in *Pterocarpus marsupium*, the highest score has been awarded to the clear bole height in the rating scale, followed by girth and plant height. Correlation and path analysis revealed the importance of the clear bole height, plant height and GBH in selection of superior plants. Similarly for *Stereospermum suaveolens,* clear bole height, plant height, GBH and crown volume were found to be important for increasing timber and heartwood, used for medicinal purpose.

In *Strychnox nux-vomica*, *Aegle marmelos* and *Pongamia pinnata* fruits and/or seeds are the economically important produce. From correlation and path analysis, it became clear that crown diameter, number of branches and GBH had positive correlation with the crown volume, imparting higher direct and indirect effect on the parameter. Therefore, these traits along with crown volume deserved more weightage during selection of superior plants, where fruits/seeds are important.

A package of simple and scientific vegetative propagation method was developed for Guggul. Detailed guidelines in Hindi for vegetative propagation of Guggul plants in mist chamber have been prepared and sent to the State Forest Department for implementation in their nurseries.

For selection and improvement of natural dye yielding plants, both *M. philippensis* and *W. tinctoria* possess fairly good amount of natural variability in the present population as well as in selected genotypes. 19 CPTs were selected, based on good crown size, higher fruiting capacity, high dye yield and good colour intensity of dye powder.

The dye yielding parts- fruits in *M. philippensisis,* highly varied with dye content. Sexes are separate and male plants occur rarely, thus creating physical barriers like large distance for pollination. However, in spite of this, female plants are profuse seed bearers and exhibit good amount of variation, indicating existence of alternate breeding mechanisms. Similarly, in *W. tinctoria*, most of the populations are confined to forests and that species did not acclimatized to agricultural or wastelands. A total of seven CPTs are selected, based on higher clear bole and good foliage. Leaves are source of green dye and some genotypes possess anthocyanin pigments in the leaves indicating were premature nature of genotypes and non-domestication. Laboratory protocols developed and improved dyeing techniques added to enhance colour intensity and consistent dyeing.

Population Assessment and Identification of Superior Genetic Stock of *Picrorhiza kurrooa* Royle Ex. Benth and *Valeriana jatamansi* Jone by Screening Different Populations From North-Western Himalayas (Himachal Pradesh and Uttarakhand).

Identified the Superior Genetic Stock of *P. kurroa* and *V. jatamansi* from different geographical locations all along the zones of these species from the states of Himachal Pradesh and Uttarakhand. Geo-referencing along with charaterization of micro-habitat has been carried out. Besides, Field Gene Banks (FGBs) in the Field Research Stations/ Nurseries of HFRI, Shimla (HP) and High Altitude Plant Physiology Research Centre (HAPPRC), Garhwal (UK) were also established. Infact, the Institute along with its network partners identified the superior genetic stock of *Picrorhiza kurroa* Royle ex Benth and *Valeriana jatamansi* Jones by screening different populations throughout from North-Western

One of the study site of *P. kurroa* in HP

Himalayas (Himachal Pradesh and Uttrakhand). Similarly, the superior chemo-types of *Podophyllum hexandrum* Royle, by screening different populations throughout from Himachal Pradesh and Jammu & Kashmir (Ladakh Valley) were also identified.

5.2 Tree Improvement

Dalbergia sissoo

The Forest Research Institute, Dehradun has been working on the genetic improvement programme of *Dalbergia sissoo* since 1990. Though this species has a number of promising attributes, it exhibits poor stem form (crooked stem), forking, ramicorn branching and susceptibility to the dieback. In genetic improvement programme of the species, a number of plus trees from various locations have been selected and assembled in the gene/clone bank. Initially the selection of promising trees was carried out in the states of undivided UP, Rajasthan, Bihar, Nepal and other shisham growing regions. The genetic worth of these genotypes is being tested in the field. The field trial consisting of 49, 36 and 24 clones respectively have been established at different locations following proper statistical

design in the states of Punjab, Haryana, Uttarakhand and Uttar Pradesh. The evaluation of earlier trials consisting of 36 clones, planted at Hoshiarpur, Ludhiana and Bithmeda were made as per schedule on various morphometric and wood traits. The wood samples were collected and tested for anatomical and wood properties.

A few selected clones were analysed for genetic variation in quantitative traits and through isozyme analysis as well. Resistance of these were also tested for stress and for their insect-pest. These clones have been found to possess genetic variation which has also been reflected in their growth performance in the field at two different sites. Advance generation orchards, raised with these selected clones are being maintained and growth data recorded periodically.

Dalbergia sissoo clones were also screened for their nitrogen utilization and biomass production. A total of 9 clones were multiplied in desired quantity from single plant and then, N assimilation, nodulation and biomass production study carried out.

Populus deltoides

Field trials of 30 clones of *Populus deltoides* were established at four sites in western Uttar Pradesh, Punjab and Uttarakhand. Cellulose content of 30 clones was estimated and wood anatomical studies made on 24 clones. Assessment of wood properties and growth of the progenies of different clones of *Populus deltoides* was also studied. Within tree, radial variations in wood properties, indicated the impact of cambial age on the wood properties of these progenies. Non-significant variations in replication for wood properties indicated that similar wood properties could be achieved from the population of the same progeny. Significant variations due to progeny for wood properties indicated that these progenies were genetically different for wood traits.

Tecomella undulata

Survey and selection of candidate plus trees (CPTs) of *Tecomella undulata* were carried out in seven districts viz. Sikar, Churu, Jaipur, Nagaur, Bikaner, Pali and Jalore of Rajasthan. A total of 41 CPT's were identified on the basis of quantitative (height, girth, clear bole and crown diameter) and qualitative traits (straightness and health). Phenological observations like flowers initiation time, its color variation and seed setting were recorded from all the identified CPT's of *Tecomella undulata* in Rajasthan. Along with this, the growth parameters of the existing progeny trial of *Tecomella undulata* were also evaluated.

Identified Candidate plus trees of *Tecomella undulata* from Rajasthan

Ailanthus excelsa and Ailanthus triphysa

Study on breeding systems and reproductive biology in *Ailanthus excelsa* and *Ailanthus triphysa* was made. In *Ailanthus triphysa,* Karyotyping work was done with root tips and FAA fixed pollens. Pollen viability and male & female structural

Pollinator in *Ailanthus excelsa*

variation in *Ailanthus triphysa* have been studied. Indian Honey bee (*Apis cerena indica)* and Dammar bee *(Trigona iridipennis)* have been identified as key pollinators of Ailanthus.

Tamarindus indica

For evaluation and identification of optimal parameters for flowering and fruit set in different Tamarind (*Tamarindus indica* L.) orchards, the orchards located at Neyveli, Thoppur, Theni and Mullangaddu have been evaluated for flowering and fruiting. Soil of the orchards was analyzed for micro and macro nutrients status. The tamarind orchards were given 30 different treatments like ploughing, mulching, light shoot pruning, heavy shoot pruning, root pruning, girdling, notching, application of organic, inorganic, micro nutrient, spraying of KNO_3, K_2 HPO_4, SADH, Thoiurea and Cultar in different concentration for improving flowering and fruiting. Among different treatment soil drenching of Cultar @3000 ppm and spraying of 2% KNO_3 were found giving positive implication on enhancing fruit productivity.

Gmelina arborea

Intensive survey conducted in the natural forest of Siruvani, Anaikatti, Anthiyur, Sathiyamangalam, Dindugal, Kodaikanal, Sirumalai, Theni and in the Farmers' plantation in Pudhukottai. Identified natural population of *Gmelina arborea* in the above set locations and 50 CPTs selected based on growth superiority, clear bole and pest and disease resistance. Data was collected on bio-metric on phenology characters of *Gmelina arborea.* The reproductive traits like flowering phenology, pollen fertility, pollen germination on stigma and pollinator interaction of *Gmelina arborea* were studied on the selected CPTs. Wood sample (core) were also collected and wood parameters analyzed.

Pongamia pinnata

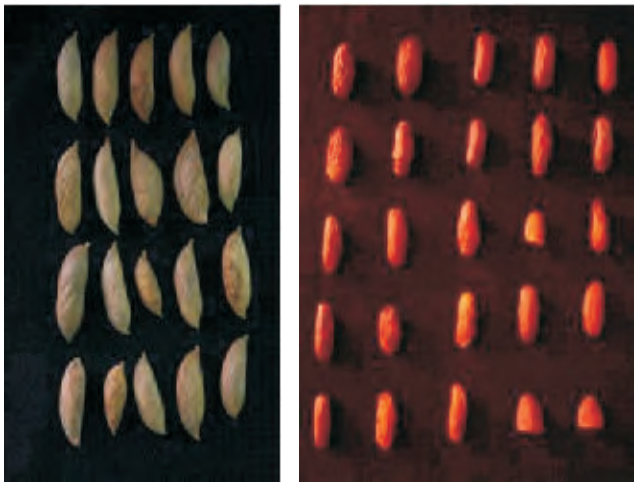
The plantations of *Pongamia pinnata* were surveyed in the states of Punjab, Uttarakhand, Uttar Pradesh and Haryana and promising genotypes for higher seed productivity and oil content identified. Field trials have been raised with 49 selected families at Jhumpa (Haryana) and

Rooted cuttings of selected CPT's of *Pongamia pinnata*

View of CPT-44 (*Pongamia pinnata*) from Velankanni, Nagapattinam district

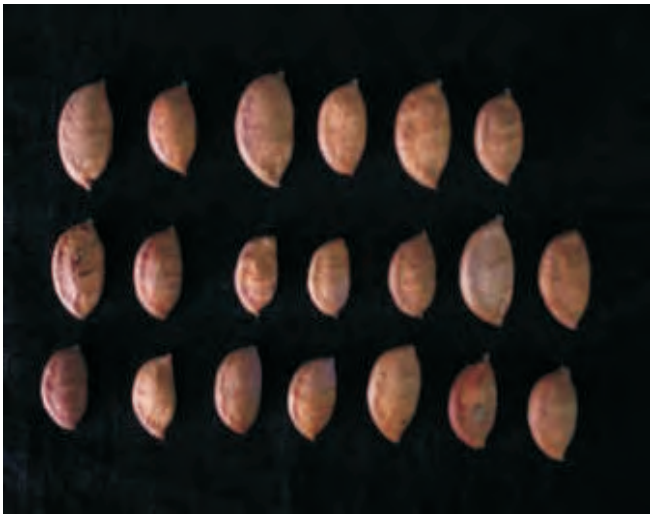
Pantnagar (Uttarakhand) for testing stability, adaptability and growth performance.

A total of 87 high fruit yielding candidate plus trees of *Pongamia pinnata* were selected from 24 districts in different agro-climatic zones of Tamil Nadu, Puducherry and are clonally multiplied. Flowering and fruit production in the selected trees were recorded. Generally, the trees at Krishnagiri, Dharmapuri, Theni, Erode and Nagapattinam exhibited higher yield as compared to the other locations. The pod and kernel showed significant variation among the clones, which will be used for genetic improvement of the species. A Vegetative multiplication garden (VMG) with 87 CPTs is being established for mass multiplication of CPTs.



Fruits and seeds of CPT 7 (*Pongamia pinnata*) from Erode

Seeds of CPT25 (*Pongamia pinnata*) from Theni



Fruits of CPT 54 (*Pongamia pinnata*) from Pudukkottai

Hardwickia binata

To study the variability in *Hardwickia binata*, core samples were collected from natural populations and known aged plantations and bark thickness, sapwood and heartwood content and specific gravity was estimated. Seeds were collected from different populations and seed and

Single tree seed collection from selected CPTs of Red Sanders

seedling parameters recorded. To estimate the genetic variability, molecular marker studies are being carried out.

Acacia mangium

For development of advanced generation seed orchard of *A. mangium*, the progeny trial was maintained through regular weeding and fireline tracing. Significant variation in growth parameters among 126 families was observed. Heavy undergrowth of mangium seedlings in the trial was also observed. The families have been ranked and after the second year evaluation, further ranking will be done for thinning.

Pterocarpus santalinus

The seeds from 32 CPTs selected from plantations as well as four bulk seed lots obtained from IFB Hyderabad (total 36) were prepared and treated and sown for germination. Germination varied from 0-40 per cent among seed lots. A total of 50 CPTs selected and seeds from eighteen trees were collected. Wood samples have been collected and analysed for heartwood content.

Calophyllum inophyllum

Through intensive survey, identified populations of *C.inophyllum* in Trivandrum, Allepey, Kollam, Kazargod, Nagercoil, Kanya Kumari, Courtrallam. Chidambaram, Aliyar, Chennai, Karur, Annur, Avinashi, Anaikatti, Nagapattinam, Tenkasi, Sengottai, Puducherry, Karaikkal, Havelock, Mayabunder, Diglipur, Wandoor, Chidiyatapu, Rangat and Betapur in the states of Tamil Nadu, Kerala and Andamans. A total of 159 CPTs were identified and their passport data collected. Standardized, vegetative multiplication technique, through stem cuttings and produced rooted clones of selected CPTs. Established, Clone bank and Half-sib Progeny trial at Panampally and maintained. Established, one multilocation trial of *Calophyllum inophyllum* in 1 ha. at Gudalur research station near Chennai. Shortlisted 40 high yielding clones having more than 55 per cent oil content.

Sapindus emarginatus

Identified 133 CPTs and established germplasm bank at Panampally. Progenies of the collected CPTs were raised and maintained. Average of 13 per cent saponin was identified as benchmark for shortlisting high saponin yielding CPTs.

Jatropha curcas

Performance of different accessions of *Jatropha curcas* in unreclaimed sodic soils was found to be unsatisfactory. At 6½ years of age, the plants exhibited poor survival and growth. None of the accessions could record growth rate comparable to plantation of this species on a good site. Seed yield has been negligible. Pruning at 30, 45 or 60 cm height resulted in production of more number of branches and greater canopy diameter. Superior germplasm of *Jatropha curcas* established in Uttarakhand as a part of multilocation trial, was evaluated. Seed production started at the age of four years. Significant differences in yield were found among accessions.

***Bauhinia* sp.**

Variability studies on seed quality parameters and seed mycoflora of *Bauhinia purpurea, Bauhinia semla* and *Bauhinia variegata* were conducted for their *ex-situ* conservation. Seeds stored at 5^0C and -20^0C maintained 100 per cent viability for 19 months storage, in comparison to seeds kept at room temperature. A rich mycoflora comprising a total of 10 fungal genera was detected on seeds of *B. purpurea* and *B. variegata* in fresh as well as in storage (6-month) condition. Among 10

genera, Aspergillus had highest number of colonies followed by Penicillium; while Rhizopus and Fusarium had minimum number of colonies.

Bombax ceiba

For evaluation of *Bombax ceiba* seed sources in northern India, growth and form of the species has been examined and criteria for selection of trees worked out. Experiment on rooting of branch cutting was established. Rooting has been found to be affected by age. Ten CPTs have been selected. Geremplasm from Assam was also collected and multiplied.

***Dipterocarpus retusus* (Hollong)**

The effect of storing Hollong fruits for different periods in different storage containers at different temperatures was studied by storing the fruits in a) paper bags at ambient condition, b) in polythene bags at 10°C, c) by treating the fruits in liquid paraffin wax and d) by storing the fruits in mud pots embedded in moist sand bed. The results indicated that seeds can be stored in mud pots for a longer period. The experiments on the effect of moisture content on storage showed that the germination percentage reduced below 25 per cent moisture content.

Aquilaria malaccensis

Germplasm banks of Agar were established at VVK, Chessa, Arunachal Pradesh and ARCBR, Aizawl, Mizoram. DNA finger printing was done using 22 RAPD primers to find out the variation existing among the accessions established in the germplasm bank.

***Shorea assamica* (Makai)**

Experiments were carried out for the effect of moisture content and storage conditions on seed germination. The fresh seeds showed 72 per cent germination. Among the various storage conditions, the seeds stored in mud pots, showed 40 per cent germination even after 25 days. Under various storage conditions with different moisture contents, the fruits showed poor germination with reduction in moisture content.

Seedlings of *Shorea assamica* in nursery bed

Germinating seeds of *Shorea assamica*

Neolamarckia cadamba

For improvement of *Neolamarckia cadamba*, selection in the natural population and existing plantation in different parts of Tamil Nadu, Kerala, A & N Islands and North Eastern State (Assam) was carried out. Standardization of vegetative propagation, mass multiplication of clones and to identify the best performing progeny/clones was also carried out. Selection of candidate plus trees has been done by scoring the selected trees in two

plantation of Tamil Nadu (Narasipuram and Devarayapuram) and in natural forest of Kerala, Andamans and Assam. Till date, about 114 Candidate Plus Trees have been identified. Coppice shoots were collected and tried for rooting with 1000, 2000 and 3000 ppm of IBA and NAA and out of three Cuttings treated with IBA/NAA 1000ppm gave good result. It was found that the cuttings treated with IBA/NAA at 500 ppm concentration have given better result as compared to all other treatment.

Thespesia

Selection and Screening of germplasm of *Thespesia populnea* was carried out for improving productivity. Under took extensive field surveys in Western Zone, North Western Zone, Cauvery Delta Zone, Southern Zone, North Eastern Zone and High Rainfall Zone of Tamil Nadu and selected 104 Candidate Plus Trees. Branch cuttings were collected from these CPTs and kept for rooting in vegetative propagation complex. Average rooting percentage obtained was 60. Established a Clonal Multiplication Area with 52 clones at Panampally Research Station, Kerala during the last week of October 2012.

Clonal multiplication area of *Thespesia* at Panampally

Vegetative propagation of *Thespesia*

Prosopis cineraria

Pods have been collected from selected CPTs, available and parameters from individual pods of these CPTs like length, width and weight recorded. The data from collected pods from individual trees were then subjected to statistical analysis.

CPTs of *Prosopis cineraria*

5.2.1 All India Coordinated Project (AICP) - *Melia composita*

An All India Coordinated Project for Genetic Improvement of *Melia composita* has now been approved by the ICFRE, whereby, all the ICFRE Institutes and other associated organizations will be carrying out the research work on defined lines. Survey was carried out in Nagaland, Meghalaya, Sikkim and in West Bengal (Cooch Behar) and Tripura to identify promising genotypes and provenances through selection and field evaluation. Fruits were collected to study their physical attributes. Seeds of 42 accessions were also procured from FRI, Dehradun and sown in nursery for rising stock to establish multi-locational trial.

The natural forests and the plantations of the species surveyed in different states to select plus trees. A total of 230 candidate plus trees (CPTs) were selected from different geographical regions and analyzed for index value based on height, diameter at breast height, straightness, clear bole height, crown diameter and knots. The field trials of different progenies at various locations were established to evaluate their performance.

Survey work was carried out to identify suitable plantations of different age as well as different spacing in southern part of Karnataka. Sample plots were laid out and preliminary growth observations were recorded.

In South, 50 plus trees were selected. Girth at breast height and clear bole length were the main criteria considered for the selection of trees. Single tree collections were made and maintained the identity of the fruits. The fruits and seeds were studied for their physical characteristics. Germination studies revealed that the source of seeds and medium of germination were the major influencing factors for establishment of the plants. Three provenance trials have been established, one each in the states of Tamil Nadu, Kerala and Karnataka.

5.2.2 All India Coordinated Project (AICP) - *Eucalyptus*

Interspecies hybridization between *E peliita* and *E. urophylla* was carried out at FRI Dehradun and F1 hybrids were produced. The hybrids so produced were transferred in the field in the form of field trials. Data have been recorded for the field trials.

Inter-specific hybrids were also developed at IFGTB, Coimbatore and efforts are made towards generation of genetic linkage and QTL maps for traits such as salt tolerance, adventitious rooting and wood pulping characteristics were sketched. The crosses developed were *Eucalyptus camaldulensis* x *E. tereticornis* and *Eucalyptus tereticornis* x *E. grandis*. These inter-specific hybrids were genotyped and hybrid purity index was calculated to confirm the interspecific parentage. Phenotyping of *Eucalyptus camaldulensis* x *E. tereticornis* mapping population was carried out for salinity tolerance traits and putative QTLs were identified.

Control pollination programmes to produce Inter-Specific hybrids in *Corymbia* and intra specific hybrids in Eucalyptus were developed in the projects supported by the industries. Messrs ITC Ltd. and Messrs TNPL Ltd. Using a fullsib diallel mating design, the clones namely IFGTB-1, IFGTB-2 and IFGTB-3 were combined and eleven seed lots were released to TNPL during June, 2012.

The first generation Eucalyptus provenance trials were assessed and trees for collection of seeds for establishment of second generation seed orchards shortlisted. Further, superior trees in the

Clonal seed orchard of Eucalyptus at Salem, TN

Progeny trial of Eucalyptus at Chennai, TN

first generation progeny trials were also shortlisted for making clones.

Progeny trials for selected eucalyptus clones were established during 2009 to 2011 at Chennai, Coimbatore, Puthukottai and Hyderabad. These trials were assessed for their growth. Annual maintenance works were also carried out in these trials.

IFGTB screened the clones of *Eucalyptus tereticornis and E. camaldulensis* in multilocation trials in south India. From the observatios recorded in Andhra Pradesh at Hyderabad, Tirupathi, Warangal, Rajamundhry and (PAJANCOA) Karaikal, few promising clones have been identified for their release.

For evaluation of wood properties and growth performance of *Eucalyptus* hybrids raised in multilocation trials, hybrids of *Eucalyptus* were evaluated for wood traits. Vertical variations were recorded for all the wood traits while horizontal radial variations were recorded for all the wood traits except for fibre diameter.

5.2.3 All India Coordinated Project (AICP) - *Casuarina*

Developing Genetic Improvement of Casuarina Species through Second Generation Orchards

This component aims at moving the ongoing breeding programme of *Casuarina equisetifolia* and *C. junghuhniana* from the first to second generation. The most outstanding entries of the first generation orchards were designated as mother trees for sourcing families to establish large breeding populations as second generation progeny trials. Over 16 ha of breeding populations established were continued to be assessed for growth, form and wood properties. Ranking of families and individual trees was completed for all trials aged 3 years and above. Culling of inferior trees has been started to convert the progeny tests

Outstanding growth of a *Casuarina junghuhniana* clone short listed for public release (age: 4 years; Erode, Tamil Nadu)

into second generation orchards for producing genetically improved seeds.

Improving the accessibility and affordability of improved seeds

Three Community Seed Orchards established during the previous years have been intensively managed by involving the farming and nursery operator communities. One of them (Valluvamedu, U.T. of Puducherry) started yielding seeds this year. The stakeholder community was trained in seed collection and modern nursery techniques for using the orchard-produced seeds in their nursery. A short film entitled Casuarina Improvement for Rural Livelihood Support was produced to document the socio-economic importance of Casuarina and its genetic improvement programme.

Screening for blister bark disease resistance in clones

C. equisetifolia often infected by a fungus called *Subramanianospora vesiculosa* (=*Tricho-sporium vesiculosum*) that causes blister bark or stem wilt disease. Identifying resistant phenotypes of *C. equisetifolia* is the long term solution for this disease. In this project, pathogenic cultures of *S. vesiculosa* was inoculated to *C. equisetifolia* clones and assessed for disease resistance through disease severity score and phenol contents in different clones. 250 clones (15 replicates each) were vegetatively propagated and inoculated with the pathogen *S. vesiculosa*. The inoculated clones were screened for disease resistance through disease severity score. The clones TNPP -4,TNKP -1, TNIPT -5, TNCS -3, TNIPT 12 showed severe infection. Totally, 36 clones are showing resistant and 55 clones showed moderately resistant. Rest of the other clones showed moderate symptoms. The resistant clones have been planted at Puducherry in RBD to test the resistance against blister bark disease under field conditions. Under field conditions, the clones TNIPT 1 and TNIPT 7 showed resistance against the blister bark or stem wilt disease.

Root nodules

Identification of superior growth promoting strains of *Frankia* in *Casuarina equisetifolia* and *C. jughuhniana*

Casuarina species were associated with a nitrogen fixing bacteria called *Frankia*. To achieve *Frankia* inoculation in seedlings, the root nodules from matured trees were collected and used conventionally for inoculation. Site specific strains of *Frankia* were collected, cultured and inoculated in seedlings and cuttings of Casuarinas spp. Simultaneously, in nursery conditions, the *Frankia* inoculated seedlings and cuttings were observed for the growth improvement in *C. equisetifolia* and *C. junghuhniana.* This method will give active *Frankia* for nitrogen fixation than the existing method which is directly uses root nodules for *Frankia* inoculation. Collected totally 10 strains of *Frankia* associated with *C. junghuhniana* and *C. equisetifolia* and cultured in P media and maintained in the laboratory. 93 clones of *C. equisetifolia* and seedlings of *C. junghuniana* were inoculated with Frankia strains and assessed the growth parameters. Increased shoot length, root length, collar diameter and biomass were found in *C.*

Nodulated trees

equisetifolia and *C. junghuhniana* due to inoculation of *Frankia.* The field performances of *Frankia* inoculated trees of Casuarinas showed three times higher growth and biomass than that of un inoculated controls. Profuse growth of root nodules was also observed in the planted Casuarinas due to inoculation of *Frankia.*

5.2.4 All India Coordinated Project of Teak

Realizing genetic gain from teak seed orchards

Assessment of flowering, fruiting and seed production from two clonal seed orchards (CSO) and a seed production area has been continued for the tenth consecutive year. Orchards and clones showed marked differences in these attributes across years and locations. Clone- and ramet-wise seed collection was from the orchards and subjected X-radiography and germination tests. Orchard seeds recorded lower filling and germination as compared to those from the seed production area. Estimation of outcrossing rate using DNA derived from seeds is in progress.

Developing breeding populations of Teak

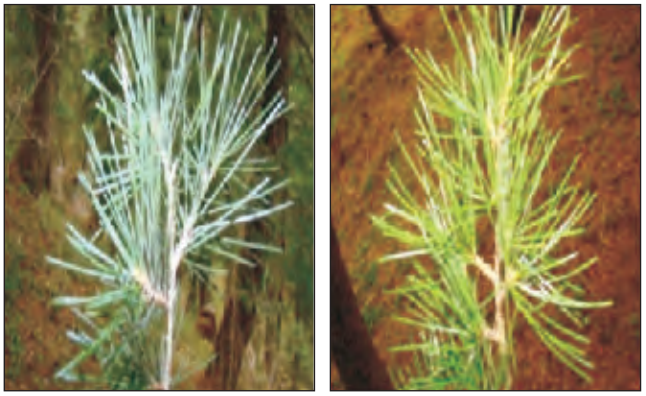
A survey was conducted in Seed Production Area of Teak at Topslip, Parambikulam, Walayar, Kulathu puzha, Konni, Ariyankavu and Nilambur. Identified and selected 200 CPTs of Teak based on superiority in growth, stem straightness, pest free nature and flowering. Collected open-pollinated seeds from selected CPTs, ready for sowing in nursery beds.

Evaluation of progeny trials

Progeny trials established with 18, 16, 28 and nine half-sib families of teak at Rajpipla Shivrajpur, Sajjangarh and Jodhpur respectively were evaluated. Analysis of variance of these trials revealed that variation due to families was significant for most of the traits, indicating scope for family selection except for basal area in Shivrajpur and height, girth in case of Sajjangarh materials. In all the trials, narrow sense heritability ranges from 2 to 97 per cent for various traits. Height and collar girth exhibited low to moderate estimates of narrow sense heritability, respectively at individual as well as family level. Family heritability values were considerately higher for both the traits suggesting effectiveness for family selection. Genetic advance estimates for these traits also followed similar trend and ranged from 6.41 to 24.32 per cent. General combining ability (gca) analysis revealed that in all, 26 parents exhibited positive gca values. These parents are expected to harbour desired combination of alleles. In addition to this, seven new phenotypically superior trees were selected from different locations.

5.2.5 Development of DUS descriptors

Three populations each of *Pinus roxburghii* and *Cedrus deodara* were surveyed for distinct traits. The observations with regard to needle length and colour were found to vary considerably. The distinctness in traits for bark pattern and crown form and cone size in both the species were studied to identify distinct genotypes. Variants of the species with distinctness for morphomteric traits have also been identified.



Needle Colour variations in *Cedrus deodara*

Extensive field surveys were carried out to ascertain the variability of *B. balcooa and D. hamiltonii* in different parts of North East India. The selected clumps were also raised in the nursery for plantation programme to evaluate the DUS characters. The raised propagules have been planted in the field for the evaluation of DUS characters.

Ligule variation in *D. hamiltonii*

Variation of Cilia (presence or absence) in *B. balcooa*

Groove and Bud variation in *D. hamiltonii*

5.2.6 Seed Technology

Seed handling technique is under progress for *Neolamarckia cadamba* and based on the germination studies, it is found that it has 60- 70 per cent germination.

Rooted nodal cutting of *Myrica esculenta*

As per the demand of Punjab SFD, quality seeds of more than 30 species have been supplied. The required quantity of seeds of *Anthocephalus chinensis, Cinnamomum camphora, Eucalyptus* hybrid, *Dendrocalamus strictus, Melia burmanica,* Cassias, *Terminalia bellerica, T. chebula*, etc. were supplied to Punjab SFD. The seeds were cleaned, tested for germinability, fumigated and treated with bavistin before packing to prevent any fungal/pest infestation. In addition to it, bamboos plants (*Bambusa bambos* and *Dendrocalamus strictus*) have also been supplied to the department, for planting and creation of a rhizome bank.

5.3 Vegetative Propagation

In *Myrica esculenta* 10 per cent nodal cuttings, treated with 400ppm IBA showed rooting response. Air layering along with IBA treatment (4000 ppm) was successful in root induction. The air layered rooted branches were planted in the polythene bags for field planting.

Effect of N fertilizer on growth, nodulation and N fixation activity in *M.esculenta* was studied and preliminary observations showed that N fertilizer @ 80kg/h showed better performance than other treatments. For N assimilation study, necessary

Air layered rooted branches of *Myrica esculenta*

buffer and substrate solution has been standardized. It was observed that buffer solution (0.2M KH_2PO_4) at pH 8.1 and substrate solution 0.15MKNO_3 is suitable for the N assimilation study in the leaves of *M. esculenta.*

Effect of growth hormones and their concentrations, size and type of cuttings and season on rooting for *Melia dubia, Ailanthus excelsa, Grevillea robusta,* and *Anthocephalus chinensis* was studied. In *M. dubia,* sprouting and rooting has been observed in experiments laid in February and March. Maximum rooting was observed in lignified cuttings, treated with 1500 ppm of IBA.

Rooting of *Acacia auriculiformis* CPTs under poly tunnels in root trainers

61 superior trees of *Acacia auriculiformis,* selected in various progeny trials based on stem form and growth, have been multiplied vegetatively and 7000 rooted cuttings being maintained in the Nursery. The cuttings were initially rooted in root trainers and, later, transferred to polythene bags. A Vegetative Multiplication Garden (VMG)/clone bank has been established at Panampally Research Station and is being maintained.

A grafting technique for raising clonal plants of male and female *Ailanthus excelsa* trees has been developed by AFRI Jodhpur. This technique can easily be adopted by farmers and field staff of Forest Departments. It is equally beneficial to the firms which are exploiting the tree for fodder, timber or biomass.

As per the demand of State Forest Department of Rajasthan, a package of simple and scientific vegetative propagation method was developed for Guggul so that field officials can follow these guidelines in their nurseries. Detailed guidelines in Hindi for vegetative propagation of Guggul plants in mist chamber are prepared and submitted to State Forest Department for implementation in their nurseries.

Vegetative propagation of *Dalbergia sissoo* and Eucalyptus clones carried out at FRI. In *D. sissoo,* 75 clones were multiplied and about 15000 plantlets produced. The propagated plants were established in clonal trials at different locations of Haryana, Punjab, U.P and Uttarakhand. Similarly, in Eucalyptus, about 500 plantlets were produced for experimental purpose.

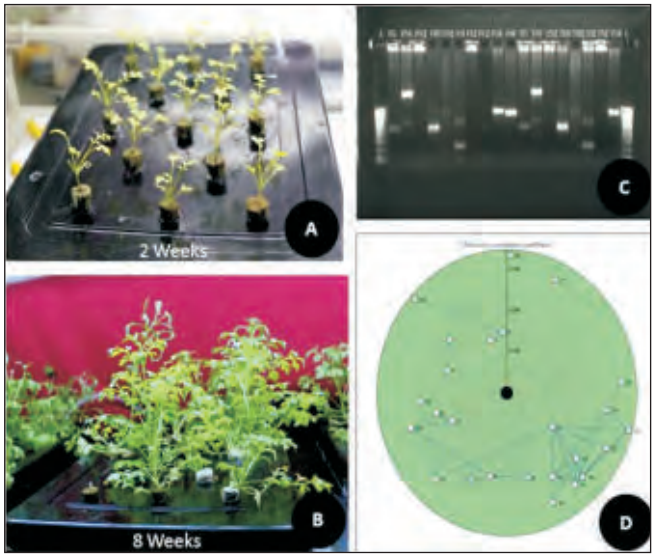
5.4 Biotechnology

Salt tolerant trees are an unexplored resource for genes conferring salt tolerance. The sodium-

hydrogen antiporter genes (*NHX*) from *Bruguiera gymnorhiza*, (355 bp), *B. cylindrica* (445 bp), *B. sexangula* (351 bp), *HKT1* gene from *Prosopis juliflora* (219 bp), *AKT1* genes from *Casuarina equisetifolia* (236 bp), *Eucalyptus camaldulensis* (309 bp), *Prosopis juliflora* (300 bp), *B. sexangula* (357 bp), *B. cylindrica* (409 bp), *K. candel* (273 bp), *P. juliflora* (291 bp) and *Acacia nilotica* (261 bp), and the Actin genes from *B. cylindrica* (203 bp), *B. gymnorhiza* (209 bp), *B. sexangula* (221 bp), *Kandelia candel* (204 bp), were sequenced and published with accession Numbers, JX679717, JX679718, JX679719, JX679724, JX840853, JX840854, JX840855, JX840856, JX840857, JX840858, JX840859, JX840860, JX679720, JX679721, JX679722, and JX679723 at the Gene Bank Database of the National Centre for Biotechnology Information (NCBI), National Library of Medicine, National Institute of Health, USA. These represent the first sequence information for the respective genes for these tree species.

Study of salt tolerance through gene expression: With the aim of analyzing salt-induced genes through a comparative genomics approach, establishment of fresh set of *Lepidium sativum* (selected halophyte) was done hydroponically. Electrophoresis of RT-PCR products was carried out to analyze the gene expression levels under different time intervals. Analysis of expression of gene product formation at different exposure intervals of salt solution was carried out. Nine putative genes were identified that have been found to be expressing under high salt conditions (100 and 140 mM NaCl). These genes have possible role in abiotic stress physiology.

Determination of sequence information of insect- genes is crucial for application of transgenic RNAi technology for control of the insects. In this direction, the partial gene sequence information for



Study of gene expression pattern in L. sativum: A. Lepidium sativum plants growing hydroponically at 2nd Week; B. plants growing hydroponically at 8th Week; C. A gel image showing bands generated from different genes under salt stress using gene specific primers D. Circular plot predicting closely correlated genes (including putative genes with unknown function) using Pearson's correlation coefficient for NHX1 (showing genes with correlation above 0.957).

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 Gen Bank Database of the National Centre for Biotechnology Information (NCBI), National Library of Medicine, National Institute of Health, USA.

Production of recombinant antifungal / antipest lectin from *Withania somnifera*

A mannose binding lectin was isolated from the leaves of *Withania somnifera* and designated as *WsMBP1*. The gene was expressed in bacteria and the recombinant lectin was purified and tested for antifungal/ antipest activity. The recombinant lectin showed limited antifungal activity but had a significant toxic effect on the food utilization, growth rate and metamorphosis of insect pest like

Hyblaea puera. In *Withania somnifera*, transcriptome analysis of leaf was conducted to identify genes involved in pathogenesis. A total of 71,062 transcript contigs were annotated and transcripts with metabolic and cellular function amounted to 70 per cent while transcripts with catalytic activity were 77 per cent.

Development of Tree DNA Fingerprint database: DNA Fingerprint information was collected from researchers, based on the experiments conducted at IFGTB in Eucalyptus, Casuarinas species using ISSR/FISSR, RAPD, and AFLP markers. ADNA fingerprint database has also been developed at IFGTB Coimbatore.

Allelic diversity of Cinnamoyl CoA Reductase (CCR) Gene in *Casuarina equisetifolia:* Allelic diversity of Cinnamoyl CoA Reductase (CCR) Gene in *Casuarina equisetifolia* clones, assembled at IFGTB was studied, using the partial CCR gene sequence. The DNA sequence information was uploaded in NCBI. Efforts are being made to isolate the whole gene sequence.

5.4.1 Use of Molecular Markers in Breeding Programmes

For the assessment of variability and genetic fingerprinting in *Pongamia pinnata,* microsatellite markers were used for the genotyping of the collected accessions from West Bengal and Odisha. DNA extraction protocol was also standardized using different plant materials. More than 20 SSR primers have been designed, synthesized and being evaluated for molecular studies. SSR's from related forestry species also evaluated in *P. pinnata*.

For standardization of molecular based technique for timber tracing back to the forest area, screened 14 SSR primers, found working with DNA isolated from the woody tissues and three SSR loci were found showing allelic variations across the populations.

For the molecular based characterization of the twisted pines populations, DNA isolation and quantification of 144 twisted pine accessions and 20 normal pine accessions has been completed. The samples have been characterized using 10 ISSR primers.

Validation of chemical markers conferring Cylindrocladium leaf and seedling blight resistance in Eucalyptus was carried out at FRI Dehradun. A correlation of marker constituents with susceptibility / resistance was observed.

For assessment of genetic diversity and structure of *Boswellia serrata* populations, RAPD and ISSR molecular markers were used. The leaves and wood core samples of 20 individuals from the 12 different populations were collected along with the observation of leaf morphology, height and girth, crown shape. Genomic DNAs was extracted from the nine populations and used for fingerprinting.

In *Acacia auriculiformis*, efforts are made to develop microsatellite markers and genotype seed orchard population for the assessment of out-crossing rates.

In order to study variation in natural populations of *Pinus gerardiana,* isoenzyme markers were used. Six populations were assayed with stable enzyme systems.

Isozyme Variation Studies and Plus Tree of *Pinus gerardiana*

5.4.2 Development of Micropropagation techniques

For optimization for *in-vitro* propagation and conservation of *Embelia ribes,* a vulnerable medicinal plant, cultures have been established for both the species i.e., *Embelia ribes* and *E. tsjeriam-cottam*. Rooted plantlets were hardened and planted in field. Cultures have been put into conservation media and being tested periodically for its multiplication/ viability after storage.

Tissue culture technology was developed for *Podophyllum hexandrum* through leaf explants.

Multiplication of culture


In- vitro rooting

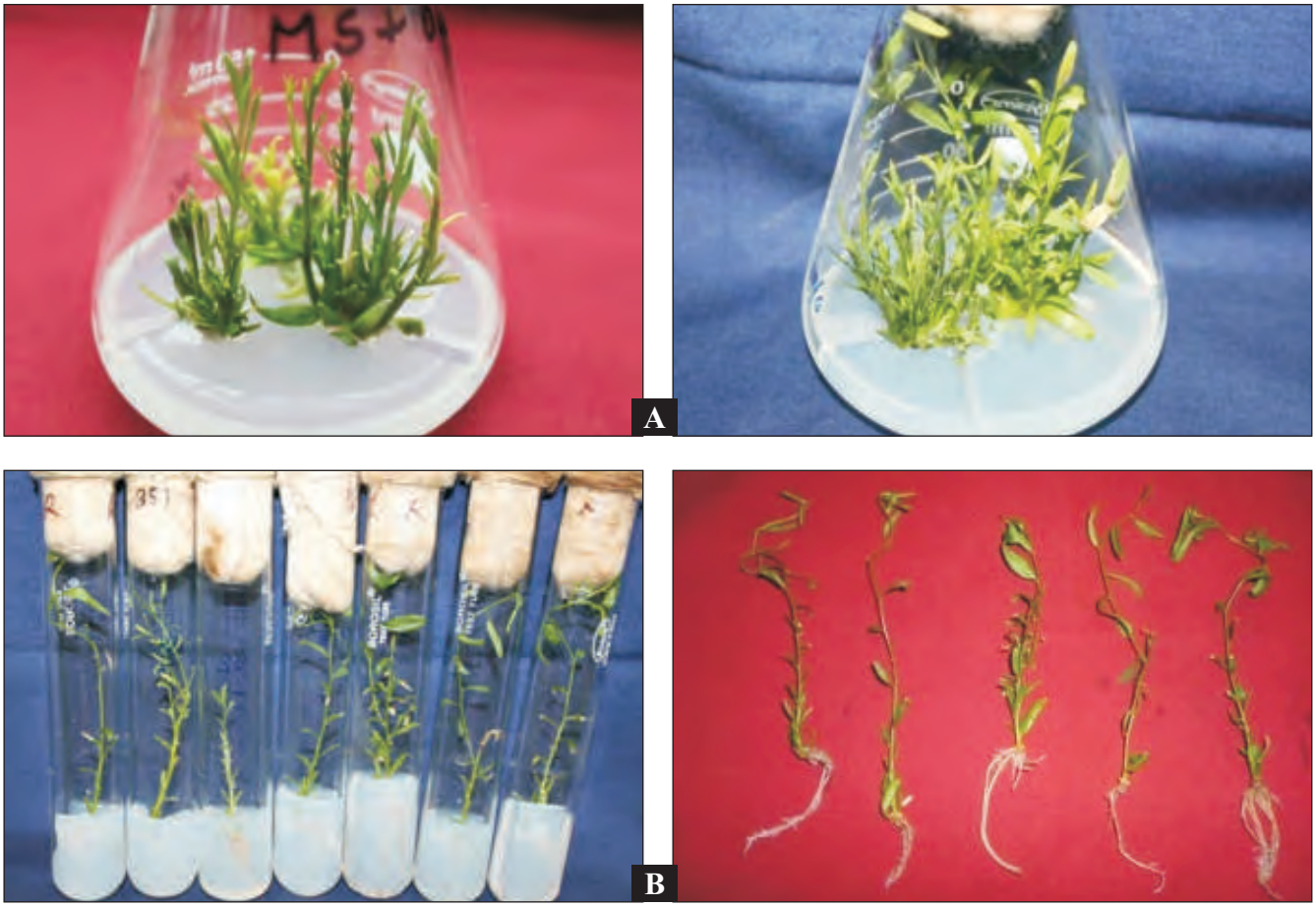
A micropropagation protocol for mature superior recombinants emanating from F2 generations of *Eucalyptus* hybrid (*E. citrodora* × *E. torelliana)* was developed.


Ex- vitro hardening of E1 in vermiculite


100 rooting % obtained in 2.85 µM and 1.42 µM of Indole Acetic Acid

For multiplication of economically important desert plant *Capparis deciduas*, experiments for rooting of stem cutting were conducted. Cutting harvested during the month of March-April and August-September-October were found to be suitable for rooting. Effect of various rooting medium was studied and Sand: Soil (2:1) was found good for rooting of stem cutting. For *in-vitro* propagation, amongst various auxins tried, IBA supplemented MS medium produced maximum number of roots as compared to NAA and IAA. It was observed that 1/4x MS medium found the best for *in-vitro* rooting. MS medium found to the best for *in- vitro* rooting experiment.

For *in- vitro* rooting of *Rauvolfia serpentina,* experiments were conducted to screen suitable basal media and their strength. Among different basal media and hormones, the maximum of 81.67 per cent rooting was obtained on ½ B5 medium. Among different hardening substratum, soilrite emerged as the best medium for hardening with 100 per cent survival. Varied response of organ formation was noticed in different genotypes



Micropropagation of *Capparis decidua:* (A) Shoot multiplication and (B) *in- vitro* rooted shoots

depending upon different concentration of growth hormones. In the interaction study, the maximum shoot formation was obtained in 5 mg/l BA and 4.5 mg/l NAA. Maximum rooting (66%) was obtained in 2.5mg/l BA and 8.5mg/l NAA. The ready hardened plantlets were transferred to the field.

For development of tissue culture technology for multiplication of economically important desert plant *Salvadora persica*, studies were conducted on the effect of media, growth hormones and incubation conditions (temperature, light, humidity) for high frequency multiple shoot induction and growth. MS medium supplemented with BAP (7.5 mg/l) proved best and favoured multiple shoot induction (2-3 shoots per explants) in four weeks at the 28^{0}C temperature with 2500 lux intensity of light.

For micropropagation of Sea Buckthorn (*Hippophae salicifolia*), healthy and mature seeds were surface sterilized with mercuric chloride and sodium hypochlorite and technique standardize. Surface sterilized seeds were transferred to MS solid medium for germination. Stem cuttings of *Hippophae salicifolia* were implanted after treating with different concentration of IBA, IAA and NAA at Khirsu for establishment of VMG.

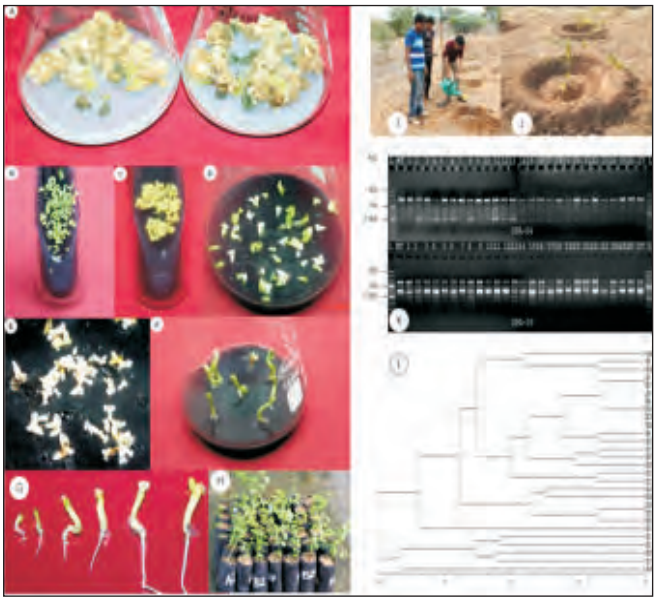
Complete micropropagation protocol, using axillary shoot derived and somatic embryo pathway have been developed for *Commiphora wightii* and plants successfully out planted in field condition with cent percent survival. Revival of

Plantlets raised through micro- propagation and seedlings are in the field condition

Maximum rooting (81.67%) of *R. serpentina* obtained on ½ B5 medium in GO-MN genotype

embryogenecity in long term maintained cultures was achieved enabling cyclic embryogenesis for over five year old cultures. Genetic fidelity test of *in- vitro* raised *C. wightii* plants, using DNA fingerprinting, involving RAPD markers has been done. The cost of single plant produced through somatic embryogenesis pathway, came out to be ₹ 19, while that produced through axillary shoot proliferation protocols ₹27.

In-vitro propagation protocols for two bamboo species of *Bambusa balcooa* and *Thyrsostachys oliveri* were refined. Among the various treatments tested with different PGRs and varying concentrations, MS liquid medium + NAA (0.25mg/l) + BAP (2.5mg/l) at pH 6.2 was found as best treatment for shoot multiplication of *Thyrostachys oliveri* with subculture period of 8-10 days. This treatment resulted in approximately 2 fold multiplication of shoots (15.08±0.78). In *Bambusa balcooa* MS liquid medium + NAA (0.25mg/l) + BAP (2.0mg/l) at pH 6.2 was best for multiplication. March and February were found the ideal time, for initiating cultures and for establishing cultures of both species.



In- vitro propagation and evaluation of *Commiphora wightii* and genetic fidelity plants: *A. Embryogenic* callus of *Commiphora wightii* (guggal); B. Somatic embryo (SE) development; C. SE multiplication; D. cotyledonary stage SE conversion; E. mature SEs.; F. Germination of SEs; G. various stages of germination of SEs; H. SE derived hardened plantlets; I & J. field trial of SE derived plants; K. DNA fingerprinting using RAPD markers and L. Dendrogram showing genetic fidelity of regenerated plants.

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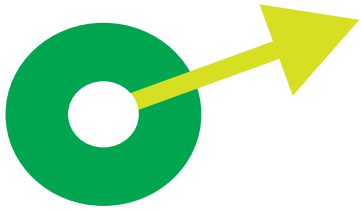


FORESTRY EDUCATION AND POLICY RESEARCH TO MEET EMERGING CHALLENGES

Forestry Education and Policy Research to Meet Emerging Challenges

Indian Council of Forestry Research and Education (ICFRE) provides financial support in the form of Grant-in-Aid to state agricultural universities at under-graduation and post-graduation level for strengthening the infrastructural facilities, enhancing teaching and research facilities.

6.1 Improving Formal Forestry Education

ICFRE provides grants to develop technical capabilities and strengthen infrastructure for forestry faculties in the universities imparting forestry education at the Graduation and Post-Graduation level. ICFRE is supporting the deficiency in basic infrastructure to a limited extent in these colleges and over the years, has tried to provide the facilities for promoting wider dissemination of education.

As on date, the ICFRE has provided the financial assistance to the tune of ₹ 5406.82 lakh to 27 Agricultural Universities for their infrastructure development since 1991 till 2011-12. In the year 2012-13, ICFRE has released Grant-in-aid to the tune of ₹ 115.00 lakh to 10 Universities for various educational programmes being undertaken by these universities.

6.1.1 FRI University

The FRI (Deemed) University has been offering the following academic courses on a regular basis:-

- Two years M.Sc. courses in Forestry, Environment Management, Wood Science and Technology and Cellulose and Paper Technology.
- One year course in Post Graduation Diploma in Aroma Technology. This course, first of its kind in India, is being conducted in collaboration with Fragrance & Flavour Development Centre, Kannauj.
- Ph.D. Degree was awarded to 46 Research Scholars on various topics including Forest Ecology & Environment, Silviculture, Forest Biotechnology, Forest Botany, Forest Genetics, Forest Management, Soil Science, Forest Pathology, Wildlife Science, Forest

Students during the visit to South India

Student of M.Sc. EM during the tour to Baddi

Sl. No.	Company	Selected students
1	Megha Plantation Agro Products Ltd, Yash Nagar	Salman Khan (Fr.), Neeta Lohani (C&PT) Ankur Dwivedi (C&PT)
2	Sonear Industries Ltd., New Delhi	Ashutosh Chaudhary, Shikhar Shukla, Prasad Pathak
3	Marque Impex (Moradabad)	Dnyaneshwar Hambarde
4	Basant, Jodhpur	Sourav Kumar, Nitin Dayma
5	Vedanta Polychem Pvt. Ltd.	Akhilesh Yadav, Anil Kumar Kewat Praveen Ukey, Sayan Roy Chaudhary
6	Rashtriya Ispat Nigam Limited-Visakhapatnam Steel Plant (RINL-VSP)	Subhash Kumar
7	M/s A.K. Lumbers Ltd.	Prabhav Sharma, Vibhor Agrawal Prashant Jadhav, Deepak Kumar Tailor Chirange Lal Chaudhary, Dnyaneshwar Hambarde
8	M/s CMF, Jaipur	Nikita Soni as a Project Associate
9	Aztec Shiva Handicrafts & Arts Pvt. Ltd., Jodhpur	Manjul Gupta as a Junior Merchandiser
10	Quetzel Total Environment Woodwork Pvt. Ltd.	Manjul Gupta as a Technical Assistant
11	M/s Bhandari Associates	Anuradha Ray

Entomology, Chemistry of Forest Products, Wood Science & Technology, Non Wood Forest Products.

- Campus interviews were conducted with different Organizations/Industries/ Companies/NGOs and placement of students for academic year 2012-13 carried out.

In addition to the above, 21 students were selected in different capacities in various Government and Private Banks.

6.2 Accreditation of Universities

To ensure delivery of quality forestry education in the universities, a system of accreditation on the pattern of AICTE/ICAR/NAC, has been put in place by ICFRE to establish a mechanism for maintenance of appropriate standards of teaching, research, examination and other academic activities with a view to imparting quality professional education in forestry. One of the main reasons behind accreditation is to encourage the forestry colleges/faculties to continuously strive towards the attainment of excellence. ICFRE has received proposal, as per the guidelines, from 18 Universities, and till date, all the 18 universities have been accredited. Efforts are being made to bring other Universities also in the accreditation fold.

6.3 Networking Forestry Education with Research and Extension

- The Non-Timber Forest Products (NTFPs) is one of the India's largest unorganized sector having a dependent population of

about 275 million and business turnover of more than ₹ 6000 crores per annum as per the Sub Group Report of the Planning Commission.

A networking project has been formulated involving universities/institutes of ICFRE, i.e., H.N.B. Garhwal, University, Srinagar Garhwal, Uttarakhand, S.K. University of Agricultural Sciences and Technology of Kashmir, Shalimar Srinagar, Sam Higginbottom Institute of Agriculture, Technology and Sciences, Naini, Allahabad, Aspee College of Horticulture and Forestry, Navsari Agricultural University, Navsari, Forest College and Research Institute Tamil Nadu, Agricultural University, Mettupalayam, College of Forestry, Kerala Agricultural University, Vellanikkara, Thrissur, Kerala, Tripura University, Mizoram University and Birsa Agricultural University, Ranchi, Forest Research Institute, Dehradun, Arid Forest Research Institute, Jodhpur, Himalayan Forest Research Institute, Shimla, Rain Forest Research Institute, Jorhat, Institute of Forest Genetics and Tree Breeding, Coimbatore, Institute of Forest Productivity, Ranchi.

Nine Status Reports on NTFPs of the States and Detailed Project Reports (DPRs) have been received.

- FRI, Dehradun has networked with national as well as international centers of research, i.e., National Institute of Hydrology, Roorkee, Central Soil Water Conservation Research and Training Institute, Dehradun, Indian Institute of Remote Sensing, Dehradun. International collaboration with York University, Canada in the field of forest hydrology and assessment of ecosystem services has been initiated. The institute conducted the following :
- A Workshop on "Livelihood opportunities in the Fringe Forests: Management and Research Perspectives" and interactive session with Sh. Shekhar Dutt, Governor of Chhattisgarh was organized on 9 and 10 August 2012.
- A Workshop on "Integrating Forest based Enterprises with Rural Development for livelihood Support and Economic Growth" in presence of Sh. T.K.A. Nair, Advisor to the Hon'ble Prime Minister of India was organized on 21 March 2013.

6.3.1 Participation in Seminars/Symposia/ Workshops/Trainings /Meetings

Over 250 scientists, officers and officials participated in different Seminars/Symposia/ Workshops/Trainings /Meetings organized by various organizations throughout the country on variety of subjects including, Climate Change-Evolution of REDD+ under UNFCCC, carbón trading, REDD Plus Architecture, India-ASEAN Network on Climate Change, Forest and Carbon Monitoring, Climate Change and Carbon Mitigation, Hydrological Modelling using RS/GIS, Green India Mission, Awareness Training Workshop on CITES, Plant Microbe Interactions for the Management of Soil-borne Plant, Validation of Descriptors of Casuarinas and Eucalypts, Genetic Engineering, Molecular Microbiology and Pathology, Protection of Wood from Weathering, Data Warehousing and Data Mining, Biodiversity Conservation and Sustainable Livelihoods, Bamboo Cultivation, Processing and Utilization, Agroforestry System, Nanotechnology Production, Estimation and characterization, Lac Cultivation, Processing and its Marketing, NWFP, Forest Insects and Biological Control etc. The details regarding same is mentioned below:

Sl. No.	Hqs./Institutes	No. of trainings	No. of Participants	Duration (in days)
1.	ICFRE, Dehradun	13	15	37
2.	FRI, Dehradun	9	Over 150	69
3.	IFGTB, Coimbatore	12	9	56
4.	IWST, Bangalore	16	10	159
5.	TFRI, Jabalpur	38	10	79
6.	AFRI, Jodhpur	9	8	34
7.	IFP, Ranchi	14	15	246
8.	IFB, Hyderabad	4	5	6
9.	HFRI, Shimla	29	20	101
10.	RFRI, Jorhat	10	10	46
		154	**Over 252**	**833**

6.3.2 Visits Abroad

Facilitated 75 cases of foreign visits, which were approved by the Government of India with funding from various sources for providing a much needed International Exposure to the scientific cadre.

- Dr. R.S. Rawat, Research Officer, ICFRE, Dehradun visited United States to attend USDA Forest Service International Training Programme on "Forest and Carbon Monitoring from 29 March to 13 April 2012.
- Dr. I.D. Arya, Scientist-F Dr. Sarita Arya, Scientist-F, AFRI, Jodhpur and Dr. O.K. Remadevi, Scientist-F, IWST, Bangalore visited Belgium to attend "9th World Bamboo Congress" from 9 to 20 April 2012.
- Dr. V.K. Bahuguna, DG, Sh. Omkar Singh, DDG(Edu), ICFRE, D.Dun visited Colorado University, US and Swedish University of Agricultural Sciences (SLU) in connection with Mid Career Training for IFS officers from 18 to 28 April 2012.
- Shri Rakesh Kumar Dogra, ADG(Edu), ICFRE, D.Dun visited Colorado University, US for internal monitoring of Mid Career Training for IFS officers and to coordinate the programme as International Coordinator from 14 to 28 April 2012.
- Shri Senthil Kumar, DCF (Admin), ICFRE, D.Dun visited Swedish University of Agricultural Sciences (SLU) for internal monitoring of Mid Career Training for IFS officers and to coordinate the programme as International Coordinator from 15 to 28 April 2012.
- Dr. B.N. Mohanty, GC(Res.), IWST, Bangalore and Sh. K.K. Uniyal, RA-I, FRI, D.Dun visited China to attend "Technology Training Course on Bamboo Cultivation, processing and utilization for Developing Countries" from 24 April to 18 June 2012.
- Dr. G.S. Ginwal, HoD, G&TP Division, Sh. Vasanthan B., IFS and Sh. J. Sriram, IFS, Student of FRI DU, D.Dun visited Malaysia for study tour for the Course in "Forest Genetics, Tree Improvement and Biotechnology" under Hari Singh Fellowship Programme from 29 April to 6 May 2012.
- Dr. (Mrs.) Sangeeta Gupta, Scientist-F, FRI,

Dehra Dun visited Portugal to participate in "IUFRO conferece-2012 Division 5 Forest Products" from 8 to 13 May 2012.

- Shri V.R.S. Rawat, Scientist 'E'/Addl Director, FCC Division, ICFRE participated in the 36th Session of SBSTA/SBI, 15th Session of AWG-LCA, 17th Session of AWG-KP and 1st Session of Ad-hoc Working Group on Durban Platform for Enhanced Actions (ADP) of UNFCCC from 14 to 25 May 2012 at Bonn, (Germany) as a member of official Indian Delegation.
- Dr. Ashok Kumar, Scientist-E; Ms. Parveen, Scientist-C, FRI, D.Dun and Sh. H.C. Sindhu Veerendra, Scientist-B, IFP, Ranchi visited Turkey to attend "Seed Orchard and Breeding Theory Conference" from 21 to 25 May 2012.
- Dr. N. Krishnakumar, Director, and Dr. A. Karthikeyan, Scientist-D, IFGTB, Coimbatore visited Malaysia to attend International Symposium on Reclamation, Restoration and Rehabilitation towards a Greener Asia" from 3 to 5 July 2012.
- Dr. T.P. Singh, ADG (Forests and Climate Change), ICFRE and Sh. V.R.S. Rawat, Add. Director, FCC Division, ICFRE participated in workshop on "Profiling for Regional Learning on REDD+ in South Asia" at ICIMOD, Kathmandu, Nepal from 24 to 27 July 2012.
- Sh. R.K. Meena, Scientist-B, RFRI, Jorhat, Sh. T.C. Bhuyan, R.O., and Ms. Amita Pandey, Scientist-B, IWST, Bangalore visited China to participate in the "Bamboo Technology Training Course from 20 June to 14 August 2012.
- Dr. Dinesh Kumar, Scientist-F, and Dr. Ombir Singh, Scientist-D, FRI, D.Dun visited Nepal to inspect field works of their Ph.D. scholars from 30 July to 3 August 2012.
- Dr. V.R.R. Singh, Director, HFRI, Shimla visited Nepal to make inspection of field work of Ph.D. Students of Institute of Forestry, Nepal from 30 July to 03 August 2012.
- Dr. V.K. Bahuguna, DG, ICFRE, D.Dun, Dr. P.P. Bhojvaid, Director, Sh. A.S. Rawat, Head, Silviculture Division, FRI, D.Dun, Dr. S.C. Joshi, Director, IWST, Bangalore and Sh. Sudhir Kumar, Scientist-F, Special Director, ICFRE, D.Dun visited China to attend 6th Assembly Meeting of APAFRI and International Symposium on "Sustainable Management of Tropical Forests (ISSMTF)" from 31 August to 03 September 2012.
- Dr. Sudhanshu Gupta, Secretary, ICFRE, D.Dun visited Bhutan to participate in the Sixth Governing Board Meeting of SAARC Forestry Centre on 3 and 4 September 2012.
- Dr. B. Nagarajan, Scientist-F, IFGTB, Coimbatore visited USA to attend International Conference on "Phonology-2012" from 10 to 13 September 2012.
- Dr. N. Krishnakumar, Director, IFGTB, Coimbatore visited Malaysia to attend "Regional Workshop on Forest Genetics Resources in Asia from 12 to14 September 2012.
- Dr. R.K. Kalita, Scientist-D, RFRI, Jorhat visited Thailand to attend workshop on "Mitigation of Climate Change through Precision Agriculture from 17 to19 September 2012.

- Dr. Ranjeet Kumar, Scientist-C, RFRI, Jorhat visited Japan to attend DST sponsored Training Programme under scheme "National Programme for Training of Scientists and Technologists working in Govt. Sector from 21 to 29 September 2012.
- Dr. V.K. Bahuguna, DG, Sh. Saibal Dasgupta, DDG(Extn.) and Sh. Pankaj Agrawal, ADG(EM), ICFRE, Dehra Dun visited Italy to attend panel discussion session of the World Forest Week 3 from 24 to 28 September 2012.
- Dr. P.P. Bhojvaid, Director, FRI, D.Dun visited Thailand to attend "Expert Group Meeting on National Forest Finance Strategy" on 28 and 29 September 2012.
- Dr. R. Sundararaj, Scientist-F, Dr. O.K. Remadevi, Scientist-G, and Sh. S.H. Jain, Scientist-C, IWST, Bangalore visited Hawaii, USA to attend International Sandalwood Symposium from 21 to 24 October 2012.
- Dr. N.S. Bisht, Director (IC), ICFRE, Dehradun visited Bhutan to participate in the meeting of Heads of Forestry Research Institutes /Centres of the SAARC Region on 10 and 11 October 2012.
- Dr. K.P. Singh, Scientist-C, FRI, Dehradun visited Sri Lanka to attend workshop on "Stakeholder Engagement to Enhance Development and Product of Tree Outside Forests (TOF) from 14 to 16 November 2012.
- Shri V.R.S. Rawat, Scientist 'E'/Addl Director, FCC Division, ICFRE, participated in the UNFCCC Climate Change Negotiations at COP 18/CMP 8, 37th Session of SBSTA/SBI, 15-2 Session of AWG-LCA, 17-2 Session of AWG-KP and 1-2 Session of *Ad-hoc* Working Group on Durban Platform for Enhanced Actions (ADP) (Qatar) from 26 November to 7 December 2012 at Doha (Qatar) as a member of official Indian Delegation.
- Dr. K. Palanisamy, Scientist-F, IFGTB, Coimbatore visited Republic of Korea to attend International Symposium on "Forest Biodiversity" on 24 and 25 January 2013. He also visited Thailand to attend "World Teak Conference" from 25 to 30 March 2013.
- Dr. Sangeeta Gupta, Scientist-F, FRI, D.Dun visited Japan to participate in the "219th RISH Symposium" from 17 to 23 February 2013. She also visited Tanzania to participate in the "World Wood Day Event" from 17 to 27 March 2013.
- Dr. P.P. Bhojvaid, Director and Sh. M.P. Singh, Head, Climate Change and Forest Influence Division FRI, Dehradun visited Indonesia to participate in the Third Training Workshop "Transitions to sustainable Forest Management and Rehabilitation in Asia-Pacific region" from 23 to 28 February 2013.
- Dr. V.K. Bahuguna, DG; Sh. Saibal Dasgupta, DDG(Extn.); Dr. Sudhanshu Gupta, Secretary; Sh. Pankaj Agrawal, ADG(EM); Sh. Sudhir Kumar, Spl. Director, ICFRE, Dehradun; Dr. N. Ramarao, Scientist-E, IFB, Hyderabad; Dr. H.B. Vashishtha, Scientist-E, FRI, D.Dun and Dr. V. Mohan, Scientist-E, IFGTB, Coimbatore visited Australia to visit "various mineral areas, industries and meeting with Govt. official" with regard above from 4 to 8 March 2013.
- Sh. Sandeep Tripathi, DDG(Res.), Smt. Neelu Gera, ADG(P&HD), ICFRE, D.Dun, Sh. S.P.

Singh, APCCF, (R&E), Madhya Pradesh, Sh. K.P. Singh, Scientist-C, FRI, Dehra Dun and Shri D.K. Sharma, DIG (RT), MoEF, GoI visited Edinburg to deliberate upon the formulation of DFID supported UKFC-ICFRE Forest Landscape Restoration Collaborative Umbrella Project from 9 to 15 March 2013.

6.4 Capacity Building of Scientific and Management Cadre

As part of the HRD initiatives for capacity building of scientific personnel, 11 training programmes were organized at ICFRE Institutes as well as in a number of training organizations of repute in which 142 participants were trained during the year as below:

Apart from the above, various trainings on subjects including Remote Sensing, GIS and GPS, Soil Quality Indicators, Bamboo Making Handicraft Items and Jewellery, Nursery and Clonal Propagation, Role of Forestry in Disaster

Participants and organizers of short-term training course on Development of Green Belts at FRI, Dehradun

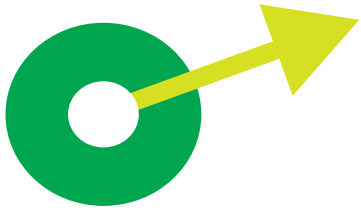
Training	Duration (in days)	Institutions	No. of Participants
Laboratory Management	5	TFRI, Jabalpur	25
Value addition of non wood forest product, Analytical methods, medicinal plants etc	5	AFRI, Jodhpur	25
Agro forestry and land management	5	PAU, Ludhiana (Punjab)	05
Analytical instrumentation for value addition	4	SICART, Anand (Gujarat)	03
Extension strategies in Forestry	5	IIFM, Bhopal (MP)	10
Nursery and clonal propagation techniques	5	FRI, Dehradun	10
Molecular microbiology & pathology	10	NBAIM, Mau Nath Bhanjan	10
Data warehouse and data mining	5	ICFRE, Dehradun	10
Genetic Engineering	12	IFGTB, Coimbatore	04
Nanotechnology, Production, estimation and characterization of Nanoparticles	5	IWST, Bangalore	15
Induction training of Scientists/ Research Officers	126	FRI Deemed University, Dehradun	25

Management, Development of Green Belts, Artificial cultivation of *Cordyceps sinensis* (Yarsha Gumba), Various aspects of CITES, NWFP value addition, processing and marketing, Bio-fertilizers and bio-pesticides, Diseases and their control measures in forest nurseries and plantations, vermi-compost, Reclamation and revegetation of mined overburden dumps, Scientific Methods of Lac Cultivation, Significance and Scope of REDD / REDD+ for India's Forests and Climate Change and Carbon Mitigation etc. were organized by ICFRE Hqs. and its institutes are as follows:

Participants and organizers of training-cum- demonstration programme on medicinal plants at HFRI, Shimla

Hqs./Institute	No. of trainings	Duration (in days)
ICFRE, Dehradun	6	27
FRI, Dehradun	32	267
IFGTB, Coimbatore	3	15
TFRI, Jabalpur	5	19
CFRHRD, Chhindwara	13	13
AFRI, Jodhpur	23	95
IFP, Ranchi	12	25
IFB, Hyderabad	2	2
HFRI, Shimla	11	11
Total	**107**	**474**

7



FORESTRY EXTENSION FOR TAKING RESEARCH TO PEOPLE

Forestry Extension for Taking Research to People

The Council has the mandate to evolve extension strategies, its periodic revision and issue guidelines for effective dissemination of technologies developed under the research projects to the stakeholders and the end users. It endeavors to transfer simple implementable technologies to the intended target groups especially the farmers. It also engages in development and dissemination of forestry extension programmes. It coordinates various extension activities of ICFRE institutes and centres. It also provides consultancy/ technical services in the field of forestry, environment and allied sciences and environment impact assessment and other related areas. The Council is committed to disseminate its research outputs to the stakeholders through various schemes such as Van Vigyan Kendras, Demo Villages, Direct to Consumer Scheme, through organizing and participating in various extension activities and by means of quality publications.

7.1 Collection, Compilation and Publication of Forestry Reports/Journals

7.1.1 Publications:

❖ Following books, newsletters etc. were published by ICFRE Hqs. during the year:

- A coffee table book on **'Forest Biodiversity in India'** was published for providing insight into the unique treasure of India's forest biodiversity. The book was released by Smt. Jayanti Natranjan, Hon'ble Minister of State (Independent Charge), Ministry of Environment and Forests, Government of India during COP-11 of CBD at Hyderabad on 17 October 2012.
- A book on **'Forest Sector Report'** was published with the aim to reflect the performance of forestry sector. The book was released by Smt. Jayanti Natranjan, Hon'ble Minister of State (Independent Charge), Ministry of Environment and Forests, Government of India during COP-11 of CBD at Hyderabad on 17 October 2012.
- ICFRE has brought out a booklet titled **'Forestry Research ICFRE Supporting Rural & Tribal Livelihoods'**. This booklet contains significant ICFRE research highlights viz. recent technologies, products, procedures and extension strategies. This would be of great use to the people especially those living in the rural, forest fringe as well as forest areas, besides other stakeholders such as forest departments and industries.
- Annual Reports of ICFRE, Annual Hindi Magazine *'Taruchintan'* and bi-annuals 'ICFRE Newsletter' and *'Vaniki Samachar'*.
- A book on 'Changing Frontiers of Research Programmes in ICFRE based on XIII Research Policy Committee (RPC) 2012 Meeting' was published which highlighted the new initiatives taken recently in the research planning and prioritization system of Council.
- A book on **'ICFRE Vision 2040'** was published which will give new direction to the forestry research system of Council. It also addresses the issue of food security, livelihood support, biodiversity conservation, ecological security,

forest genetic resource management for improving productivity and impacts of climate change and its adaptation/ mitigation strategies.

- **'Forestry Statistics India 2011'** was published by statistics division and released by Director General of ICFRE on 22 January 2013.
- 'Timber Bamboo Trade Bulletin' Volume 64 and 65 were published.
- 'Guidebook on Afforestation and Reforestation CDM Projects in India' was published.
- 'ICFRE Climate News' (4 Issues) covering the latest developments and upcoming events etc. in the field of forests and climate change were prepared and uploaded in ICFRE website.

❖ Following publications were brought out under the SLEM project:

- SLEM-CPP Newsletters-Vol.3 No.1 and Vol. 4 No.1
- Proceedings of the Seminar on 'Healthy Soil: Healthy Life' and interactive workshop on 'Findings of the Baseline Study and Monitoring and Evaluation Framework'.
- Flyers brought on 'Participatory model for water harvesting and development of community pastures in Thar Desert', 'Rehabilitation of degraded bamboo forests in Madhya Pradesh', 'Agarbatti preparation from degraded bamboo forests of Madhya Pradesh', 'Agro-biodiversity innovations for sustainable land and ecosystem management in Orissa' and 'Sustainable land and ecosystem management in shifting cultivation areas of Nagaland'.

❖ A total of 359 research articles were published by ICFRE institutes in scientific journal of national and international repute and in books during the year as per the following details:

Sl. No.	Name of the Institute	Number of research articles published in scientific journals and books		
		National Journal	Foreign Journal	Book Chapter
1	FRI, Dehradun	56	31	17
2	IWST, Bangalaru	45	16	21
3	IFGTB, Coimbatore	22	14	28
4	AFRI, Jodhpur	17	12	08
5	RFRI, Jorhat	16	10	03
6	TFRI, Jabalpur	16	01	01
7	HFRI, Shimla	07	04	01
8	IFP, Ranchi	07	01	02
9	IFB, Hyderabad	-	02	01
	Total	**186**	**91**	**82**

❖ A total of 72 research articles were presented in seminar/conferences/ workshops and 62 abstracts and 28 popular articles were also published by ICFRE institutes during the year as per the following details:

Sl. No.	Name of the Institute	Number of articles presented in seminar/conferences/ workshops and abstracts & popular articles published		
		Article presented	Abstract published	Popular article
1	FRI, Dehradun	29	11	06
2	IFGTB, Coimbatore	15	09	01
3	AFRI, Jodhpur	06	18	-
4	HFRI, Shimla	08	03	02
5	IWST, Bangalaru	12	-	-
6	RFRI, Jorhat	01	12	10
7	TFRI, Jabalpur	01	09	09
	Total	**72**	**62**	**28**

❖ A total of 16 books and 21 booklets, brochures/pamphlets were published by the ICFRE institutes during the year as per following details:

S. No.	Name of the Institute	Number of books and booklet, brochures/ pamphlets published	
		Books	Booklets/Brochures/ Pamphlets
1	IFGTB, Coimbatore	4	9
2	IWST, Bangalore	3	6
3	HFRI, Shimla	4	4
4	FRI, Dehradun	4	-
5	IFP, Ranchi	1	1
6	RFRI, Jorhat	-	1
	Total	**16**	**21**

7.1.2 National Forest Library and Information Centre

The National Forest Library and Information Centre (NFLIC) is the richest in document collection on forestry and allied sciences. It provides all types of library and information services to its users. During the year, 26,372 books were loaned to the users for outside reading and 55,448 documents were consulted inside the Library.

The document collection of NFLIC was enriched by the addition of 3,757 books and other documents. It subscribed 61 Indian and 100 foreign periodical titles and also received 485 periodical titles as *gratis*. It had also subscribed 47 most useful e-journals for all the institutes and centres of ICFRE. A bibliographical database on 'Forest Science Database' and SCOPUS were also subscribed for providing access to old as well as latest research articles and abstracts on forestry to the institutes and centres of ICFRE.

The NFLIC has sold ICFRE publications (435 books and 13 VCDs) through its Book Depot to the state forest departments, universities, etc.

7.1.3 Environmental Information System Centre

The Ministry of Environment and Forests, Government of India established Environmental

Information System (ENVIS) Centre on Forestry at National Forest Library and Information Centre. The ENVIS Centre, during the year, enriched the online accessible databases (Indian Forestry Abstracts, Participatory Forest Management, *Prosopis juliflora*, Poplars, Environment and Forest) by the addition of new references. It has also published two issues of 'ENVIS Forestry Bulletin' and compiled five issues of the 'Environment and Forests News Digest'.

7.2 Dissemination of Developed Technologies

7.2.1 Van Vigyan Kendras (VVKs) and Demo Villages (DVs)

- Model Nurseries were established by FRI, Dehradun in VVKs at Chandigarh and Pinjore (Haryana). Establishment of model nursery in other VVKs was also initiated.
- Developed a nursery with the facility of low cost mist chamber, propagation unit, irrigation facilities, mounted angle iron beds, shade house, seed drying platform, vermi-compost unit and root trainers at Demo Village, Shyampur (Dehradun).
- The interactive meet with Tree Growers of Cuddalore, Puducherry and Villupuram Districts were organized at KVK, Tindivanam under the networking of VVK and KVK on 10 December 2012.

Tree Growers Mela at IFGTB, Coimbatore

- Organised a field training programme to the frontline staff and the employees of the Andaman & Nicobar Forest Department on vegetation survey at VVK, Port Blair (Andaman &Nicobar Islands).
- IFGTB, Coimbatore organized 5th Tree Growers Mela on 21 and 22 February 2013. A workshop on "Sustainable Tree Farming: Wood Security, Food Security and Livelihood options" was also organized as part of the Tree Growers Mela. More than 1700 farmers from all districts of Tamil Nadu, Puducherry and Palakkad district in Kerala participated in the Tree Growers Mela.
- Regular budgetary support and literature on various technologies in Hindi, English and regional languages were provided by TFRI, Jabalpur to the VVKs for dissemination of the technologies through organizing training programmes.
- Hi-Tech Nursery was established at VVK, Bichhawal Nursery, Bikaner (Rajasthan) and about 3000 quality seedlings *of Prosopis cineraria* and *Dalbergia sissoo* were raised in Hi-Tech nursery for the demonstration and distribution to the farmers to promote agroforestry under VVK during 2012-13.
- Hi-Tech nursery was maintained at VVK, Chhipardi Beedi (Gujarat) and raised grafted plants of *Emblica officinalis* and *Ziziphus mauritiana* and high quality seedlings of *Casuarina equisetifolia*, *Eucalyptus* hybrid to promote agroforestry among the farmers.
- Nursery was maintained through different silvicultural practices at Demo Village, Salavas, (Jodhpur). Demonstrated technologies on soil and water conservation and silvipastoral model of *Cenchrus ciliaris* grass along with

Cordia gharaf and *Ziziphus nummularia* with intervention of *in situ* water conservation in Demo village.

- The herbal garden and medicinal plant propagation units were maintained at Demo Village, Gram Gaurav, Gumla (Jharkhand). Regular maintenance and demonstration of oil extraction unit, production of vermicompost and bamboo propagation techniques were carried out by IFP, Ranchi.
- Maintained the demonstration nursery, demonstration plantation and Vermi-compost unit at Demo Village, Lanabaka, Sirmour (HP). A camp workshopcum-villagers meeting at Demo village was organized by HFRI, Shimla on 28 January 2013. About 40 participants from local farmers and frontline field functionaries of Himachal Pradesh State Forest Department took active participation in the meeting. Technologies for cultivation of agroforestry species and medicinal plant species were transferred to the villagers of Lanabanka.
- Training programme on 'Non Timber Forest Products of Arunachal Pradesh, its Prospects in Rural Development' was organized by RFRI, Jorhat at Rono Auditorium, Doimukh under Doimukh Circle of Arunachal Pradesh on 20 March 2013 and 40 participants mainly farmers, entrepreneurs, and field functionaries of different Departments like Horticulture, Agriculture and Environment & Forests, Government of Arunachal Pradesh attended the training programme.
- Training on Bamboo, Rattan and Vermi-composting for Forest Department of Jorhat, Forest Development Agency, JFMC members of Jorhat District was organized at RFRI, Jorhat under Van Vigyan Kendra, Assam on 3 and 4 April 2012.

Field demonstration on Vermi-composting

- Training programme on 'Forests and Wildlife Management in Arunachal Pradesh' was organized by RFRI, Jorhat at Drupong Forest Range Office under Banderdewa Circle of Arunachal Pradesh on dated 21 March 2013. The training programme was attended by fifty Forest Officers/ Officials.
- RFRI established participatory rural appraisal programmes at Melang Grant, a hamlet of three villages in the fringe of Hollangapara Gibbon Wildlife Sanctuary under Demo Village programme. The permanent nursery was established and quality planting stocks of *Bambusa vulgaris* var. *wamin* and other bamboo species were raised. Seedlings of *Aquilaria malaccensis* and *Anthocephalus* were also raised on the demand of farmers and other agencies. Farmers generate extra income through production of *Capsicum chinense* (Bhoot Jolokia).

7.2.2 Direct to Consumer Scheme

ICFRE launched a new scheme called 'Direct to Consumer', wherein, the technology/research findings having maximum potential of public service are extended to the stakeholders (farmers, rural poor, forest departments and industry). Under

'Direct to Consumer Scheme', the project outcomes, those have been found to be of tremendous use for rural communities is being implemented jointly with rural institutions.

FRI, Dehradun had conducted the following activities under 'Direct to Consumer Scheme':

- Centre for Bamboo Processing and Training was established.
- A component entitled 'Awareness-cum-Extension' Activity of the Product 'SAMRIDDHI' developed under ICFRE funded project among silkworm farmers and sericulture industry, through organizing trainings and interactive meetings' was taken up under training programme on 'Quality Silk Production using Herbal Product Samriddhi' was organized for farmers at Sahapur and Balluwala villages under Dehradun District on 30 March 2013.
- Tested promising *Eucalyptus* clones of M/s Pragati Biotech for disease resistance against leaf and twig blight.

IFGTB, Coimbatore had conducted following activities under Direct to Consumer Scheme:

- *Melia dubia* is one of the most preferred species of the farmers today and finds a place in the 'Tree Cultivation in Private Lands (TCPL)' Scheme of the Government of Tamil Nadu. Institute provided quality planting stock of *Melia dubia* (to cover an area of 20 ha) and distributed publications/extension material in Tamil / English on *M. dubia* for wider publicity.
- Pest/disease tolerant clones of *Casuarina* were multiplied for supply to farmers and tree growers.
- Grafting and cleft grafting of superior accessions of Red and Sweet Tamarid was carried out and about 2000 quality planting materials have been produced and provided to the various stakeholders during Tree Growers Mela, 2013.

AFRI, Jodhpur had conducted following activities under Direct to Consumer Scheme:

- A training programme on "Management of Insect pests and diseases in Mehndi and Isabgol" at Krishi Vigyan Kendra, Pali was organized on 20 March 2013 and about 45 farmers from different villages of Pali District (Rajasthan) participated.

One day training programme on "Management of Insect pests and diseases in Mehndi and Isabgol" at KVK, Pali

- Following two brochures in Hindi were also published for distribution to the stakeholders.
  - Cure and Prevention of Diseases and Insects Attacking Mehndi Crop.
  - Cure and Prevention of Diseases and Insects Attacking Isabgol Crop.
- AFRI also organized training-cum-workshop on 'Rainwater Harvesting and Afforestation for the Rehabilitation of Degraded Hills' at Banswara (Rajasthan) on 13 March 2013. Following brochures in Hindi and English were published for distribution to the stakeholders:
  - Rainwater harvesting in restoration of degraded hills and people livelihood.
  - Carbon sequestration during rehabilitation of degraded hills.

IFP, Ranchi had conducted the following activities under Direct to Consumer Scheme:

A project on "Exploration of Lac cultivation on non-traditional host *Flemingia sp*. and its possibility in sustainable plantation forestry" was launched in August 2012 at Jiwri and Janum Pidi village of Khunti district of Jharkhand with the aim to improve the rural livelihood of forest fringe villagers. In first stage, a total 10297 *Flemingia* plants were distributed to the farmers and technical support was provided at field level. Additionally, 8000 *Flemingia* plants were also distributed to the farmers in the month of September, 2012. Harvesting of lac from 1600 plants was done in the month of February, 2013 and 245 kg of brood lac was obtained by the farmer. The farmer earned an amount of ₹ 2.45 Lakh after selling the brood lac ₹ 1000/- per kg. The earning of the farmers through lac cultivation on *Flemingia semialata* host plant is proving a successful model of Khunti district. This model can be replicated throughout the state or even in another part of the country.

HFRI, Shimla conducted the following activities under Direct to Consumer Scheme:

- A meeting with the members of local Panchayat and progressive farmers was organized at village Khatnol, Distt. Shimla, Himachal Pradesh on 8 September 2012. During the meeting, the relevance of the scheme to the participants with special reference to cultivation of medicinal plants especially Atish, Chora, Kutki etc. was highlighted.
- A one day training programme on 'Nursery Techniques of Atish and Chora - Important Temperate Medicinal Plants' was organized for skill development of farmers at village Khatnol of District Shimla, (H.P.) on 25 November 2012.
- One day 'Exposure Visit' of motivated farmers from Khatnol (Shimla) and Nichar (Kinnaur) villages of Himachal Pradesh was organised on 16 March 2013 for practical demonstration of various techniques for raising temperate medicinal plants at Shillaru, distt. Shimla (HP).
- IWST, Bangalore organised a one- day interactive cum information sharing extension programme at Bagalkot on 7 March 2013 under Direct to Consumer Scheme. Over 100 farmers, tree growers, NGO's and forest officials had participated in the programme.
- RFRI, Jorhat conducted various field demonstrations to the visitors of Demo Village from time to time and also trained youngsters from Demo Village at Bamboo Composite Centre for the training on Bamboo Handicrafts under Direct to Consumer scheme.
- IFB, Hyderabad organized a training programme on Agro-forestry of *Givotia rottleriformis* Griffith for providing livelihoods to artisans and farmers under Direct to Consumer Scheme at Nirmal on 9 March 2013.

Exposure Visit of farmers to Shillaru Nursery, HFRI, Shimla

7.2.3 Technologies Transferred

- The technique for reshaping of gums was transferred to M/s Anand Gond Udyog, Nagpur by charging licence fee of ₹ 1.4 Lakhs on 18

June 2012 by Forest Research Institute (FRI), Dehradun.

- Full sib seeds of *Eucalyptus* and *Corymbia* were released by IFGTB, Coimbatore to M/s TNPL Ltd. and M/s ITC Ltd.
- Isolated and cultured potassium mobilizing microorganism *Frateuria aurantia* and the culture was released as a product called K mobilizer during Tree Growers Mela on 21 February 2013 by IFGTB, Coimbatore.
- Seed Handling Technology of Shola species was transferred to the stakeholders by IFGTB, Coimbatore.
- Technology for 'Windbreak agroforestry systems with superior clones to minimize crop damage: A Protective support to plantain growers' was transferred to farmers by IFGTB, Coimbatore.
- Technology package for raising sandal plantations from Quality Planting Stock was transferred to the stakeholders by IWST, Bangalore.
- Macropropagation technique for raising *Dendrocalamus stocksii* was transferred to stakeholders by IWST, Bangalore.
- A seminar- cum -workshop programme was organized by the TFRI, Jabalpur for "Outreach of Research Findings" on 30 September 2012. This programme was organized to disseminate research findings of the technologies on, sustainable harvesting of *Arjuna* bark, integrated pest management of white grubs in forest nurseries, biological control of insect pest of teak in plantations, Teak-turmeric silvi-medicinal system, drought type drum dryer techniques of drying seeds of important non-wood forest species, tree species suitable for different stress sites in central India, VAM and *Azospirillum* production techniques for teak stump production, micro-propagation of *Rauwolfia serpentina* development of a *Metarhizium* based mycoinsecticide (peststat) for management of forest pests, biopesticide product - vilvekam - *Aegle marmelos* seed oil based bio-pesticide, micro-catchment for plantation establishment, apparatus for preservative treatment of bamboos, handmade paper from *Lantana camara,* and demonstration of forest fire fighting tools and management of forest fire.
- Technologies for PRA techniques and microplanning, bamboo treatment, vermicompost, apiculture, patchouli agrotechniques, *Trichoderma* production and field application, mycorrhizal technology, biopesticide production and field application, seed handling - grading and sowing techniques, technology on chili based agroforestry model, technology on air layering of various economic important tree species using *Sphagnum*, technology on low-cost vermicompost, and technology on raising of agar (*Aquilaria malaccensis*) plantations and Cultivation of Muskdana (*Abelmoschus moschatus*) were transferred to the end users by RFRI, Jorhat.

7.3 Evolving and Coordinating Comprehensive Extension Strategies in Forestry Research

7.3.1 Sustainable Land and Ecosystem Management (SLEM)

Following activities were carried out under the project during the year:

- A draft baseline study report at national and eight selected states namely: Madhya Pradesh, Uttar Pradesh, Andhra Pradesh, Rajasthan, Nagaland, Uttarakhand, Kerala and Orissa had been prepared for the SLEM components viz.

land degradation, biodiversity conservation and impact of climate change/variability on land use practices across the country.

- A seminar was organized on 17 June, 2012 to commemorate The World Day on Combat Desertification at ICFRE, Dehradun with the theme "Healthy Soil: Healthy Life". The seminar was attended by about 125 participants including senior officers and scientists of ICFRE & FRI. The deliberations during the seminar highlighted the role and importance of soil in securing water energy and building resilience to climate change.
- A two-day 'Interactive workshop on findings of the baseline study and monitoring and evaluation framework' under SLEM project was organised on 16 and 17 July 2012 at ICFRE, Dehradun. The two-day deliberations focused on findings of the baseline study on various thematic areas, viz. land management, climate change, biodiversity conservation, policy and institutional reform, monitoring and evaluation framework and communication strategy for SLEM-CPP.
- The fourth meeting of National Steering Committee (NSC) was held on 4 and 5 April 2013 at Hyderabad. The Meeting was attended by officials from Ministry of Environment and Forests, members of NSC, representatives from World Bank, UNDP and FAO, SLEM-TFO members, officials from project partners, SPACC, CARE, Soil and Land Use Survey, Ministry of Agriculture, Institute of Forest Biodiversity, and NGOs.

Releasing of flyers on SLEM activities

- A workshop on "Integrating forest based enterprise with rural development for livelihood support and economic growth" was organised on 21 March 2013 at ICFRE, Dehradun. The workshop highlighted the importance of Panchayat Raj Institutions (PRI) in the scheme of governance and the role of ICFRE in implementing the government policies and programmes with the involvement of rural institutions. Representatives from Gram Panchayat shared their experiences regarding use of natural resources to provide livelihood in rural areas.
- A training programme for frontline staff of Madhya Pradesh Forest Department was organised from 25 to 27 September, 2012 at Tropical Forest Research Institute (TFRI), Jabalpur. The training module covered various aspects of soil and water conservation, cultivation of lac for livelihood and rehabilitation of bamboo forests.
- A training programme on "Role of Biodiversity Conservation in Poverty Alleviation and Rural Livelihood" for officials from Revenue, Agriculture, Horticulture and Husbandry departments, NGOs and farmers was organized at IFGTB, Coimbatore from 29 to 31 October, 2012.
- A training programme on "Shifting cultivation practices vis-a-vis livelihood opportunities in North East India" was organized at RFRI, Jorhat from 25 to 27 February 2013. The training programme was attended by 25 participants from State Forest Department, Universities, Soil and Water Conservation Department, NGOs and progressive farmers.

- A training programme on "Climate change adaptability and impact on land degradation and biodiversity conservation" for various stakeholders was held at Institute of Forest Biodiversity (IFB), Hyderabad from 26 to 28 February 2013.

7.3.2 Seminars/Symposia/Workshops Organized

- An Interactive workshop on REDD+ was organized by ICFRE, Dehradun in collaboration with Climate Change Department, Government of Gujarat at Gandhi Nagar, Gujarat on 27 and 28 September 2012.

- ICFRE and FRI, Dehradun organized 24th Session of International Poplar Commission and 46th meeting of its Executive Committee in October 2012 at Dehradun. It is for the first time that such a prestigious event of IPC was held in India. Various technical sessions were held simultaneously during the mega event. A total of 227 delegates from 23 countries participated in the sessions. Besides, the meeting of National Poplar Commission of India was also held and its scope was enhanced by introducing new species and re-designating it as "National Commission on Poplars, Willows and other Short- Rotation Crops" with its secretariat at FRI, Dehradun.

Inaugural Session of 24th Session of IPC

- FRI, Dehradun organized the following:
- Workshops- cum- Kissan Mela on 'Role of Kissan Mela in sustainable supply of wood for industries' to the farmers and other stakeholders at PAU, Ludhiana on 6 and 7 March, 2013 and at Yamuna Nagar on 23 March, 2013.
- Workshop on 'Sustainable management practices and livelihood at Dehradun on 3 and 4 October 2012.
- Side Event on 'Forest Insect Diversity in India: Facts and challenges' during CBD CoP-11 at Hyderabad on 11 October 2012.

- IFGTB, Coimbatore organized the following:
- Series of three awareness training workshops on 'The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)' for various enforcement agencies involved in CITES implementation in India.
- A stakeholder meeting on 'Validation of Descriptors of *Casuarina* and *Eucalyptus'* on 15 June 2012
- A stakeholder meeting with Tamil Nadu Forest Plantation Corporation Limited at Tiruchirappalli on 2 July 2012.
- Fourth Stakeholders Meet 2012 in Office of PCCF, Tamil Nadu Forest Department, Panagal Maaligai, Chennai on 8 August 2012.
- Fourth Stakeholders Meet of IFGTB with the Kerala Forest Department at Department of Forests and Wildlife Headquaters, Vazhuthacaud, Thiruvananthapuram on 13 August 2012.
- Interactive meet of Tree Growers and distribution of *Casuarina* seedlings developed by IFGTB for the Thane Cyclone affected farmers was organized by IFGTB, Coimbatore under Networking of VVK and KVK at Krishi Vigyan Kendra, Villupuram located at Tindivanam, Tamil Nadu on 10 December 2012.

- IWST, Bangalore organized the following:
- Training- cum- workshop on 'Cultivation and Nursery Practices of Sandalwood and *Melia dubia*' from 21 to 24 August 2012 to the officials of the Karnataka Forest Department.
- Brain storming session for finalization of Comprehensive Environmental Management Plan (CEMP) with active participation of various NGOs was organized by IWST, Bangalore on 23 October 2012.
- First Technology Marketing Meet on 5 December 2012 and Second Technology Marketing Meet on 14 December 2012. Around 30 business persons from various categories attended the events.
- An Interactive meet on 'Agarbathis' on 20 December 2012.
- Interactive meetings on 'Integrated Pest Management in Forestry' was organized by IWST, Bangalore on 29 January 2013 and 22 February 2013.
- An interactive meet on advanced wood working machines for KSFIC/entrepreneur/industrialist/ sawmill owners/ construction sector and carpenters on 8 February 2013.
- An interactive -cum -information sharing meeting on "Insect pest and disease problems of sandalwood under cultivation and their management" for sandalwood growers, farmers and forest officials was organized by IWST, Bangalore on 7 March 2013 at Krishi Vigyan Kendra, Bagalkot, Agriculatural University, Dharwad (Karnataka).

- TFRI, Jabalpur organized the following:
- Workshop on 'Strengthening Network for Outreach of Research Findings' on 30 November 2012.
- A workshop-cum-Training programme on 'Recent Advances in Forestry Research and Sustainable NTFPs Harvesting' from 4 to 7 March 2013 for the officials of Maharashtra State Forest Department.
- workshop-cum-training on 'Achanakmar-Amarkantak Biosphere Reserve' for the front line staff of Acahanakmar-Amarkantak Biosphere Reserve at Bilaspur, Chhattisgarh on 23 March 2013.

- AFRI, Jodhpur organized the following:
- Training- cum- workshop on 'Rainwater harvesting and afforestation for the rehabilitation of degraded hills' on 13 March 2013 at Banswara (Rajasthan).
- Workshop for the development of Coordinated Programme on Arid and Semi-Arid Regions (CP-ASAR) in collaboration with Department of Science and Technology, Government of India at Jodhpur from 16 to18 April, 2012.
- Stakeholders' meeting at Jaipur, Rajasthan for officials from SFD, Universities, research institute, leading farmers and NGOs on 22 August 2012.
- Stakeholders' meeting held at FTI, Gandhinagar, Gujarat, in which officials from SFD, Universities, research institute, leading farmers and NGOs on 10 September 2012 participated.
- Workshop on Biodiversity in collaboration with Rajasthan State Biodiversity Board at Jaipur on 13 December 2012.

- IFB, Hyderabad organized an interactive meeting on Research methods on forest biodiversity on 18 March 2013 at Hyderabad.

- HFRI, Shimla organized the following:
- 7th Network Project Partner's Workshop at Srinagar, Garhwal (Uttarakhand) in collaboration with High Altitude Plant Physiology Research Centre, Srinagar on 27 September 2012.

- A workshop- cum- review meeting on 'Cumulative Environmental Impact Assessment of Sutlej Basin (Himachal Pradesh)' at Shimla on 11 October 2012.
- Workshop-cum-Villager's Meeting at Rajgarh, Solan (H.P.) in collaboration with the State Forest Department of Himachal Pradesh on 31 January, 2013.

➢ RFRI Jorhat, organized the following:

- Training- cum- workshop on 'Application of Global Positioning System in Forestry' for 25 officers from Nagaland Forest Department at Jorhat from 30 July to 01 August 2012.
- Awareness generation programme on 'Livelihood development and creation of carbon pool through bamboo plantation in degraded jhum land' at Johner Sinar village (Silonijan) Karbi Anglong on 2 November 2012.
- 'Motivation and Training- cum- Workshop' on *Agarbatti* sticks making at Borholla, Jorhat on 19 March 2013 for 42 women from 12 self help groups and at Sipahikhola Block, Jorhat on 23 March, 2013 for 78 women from 30 self help groups.

7.3.3 Special Activities

Name of Occasion and date	Name of institutes	Activities performed
Himalayan Day 9 September 2012	FRI, Dehradun, HFRI, Shimla, RFRI, Jorhat	A Panel Discussion, a workshop - New Growth Measures for the Nation and Himalaya and a talk.
International Biodiversity Day 22 May 2012	AFRI, Jodhpur	seedlings of tree species were planted
National Technology Day 11 May 2012	FRI, Dehradun	A special exhibition
Sadbhawna Pakhwara 20 August 2012 to 3 September 2012	TFRI, Jabalpur	
Van Mahotsava	FRI, Dehradun (2 July); AFRI, Jodhpur (19 July)	Planting of seedlings
Vigilance Awareness Week 29 October to 3 November 2012	FRI, Dehradun; IFGTB, Coimbatore, IWST, Bangalore; TFRI, Jabalpur: AFRI, Jodhpur; RFRI, Jorhat	 2500 students and teachers attended World Forestry Day at RFRI, Jorhat
Wild Life Conservation Week 1 to 7 October 2012	TFRI, Jabalpur	
World Day to Combat Desertification 17 June 2012	ICFRE, Dehradun; TFRI, Jabalpur; AFRI, Jodhpur	
World Forestry Day 21 March 2013.	FRI, Dehradun; RFRI, Jorhat	
World Environment Day 5 June 2012	FRI, Dehradun (also observed FRI Day); AFRI, Jodhpur	campaign against use of polythene, painting competition for children on "our environment"

7.4 Consultancy Services

In order to put in place the scientific mining and rehabilitation of mined out areas, the Hon'ble Supreme Court of India through Central Empowered Committee and the Government of Karnataka had entrusted the task of preparation of Rehabilitation and Reclamation (R&R) Plans to ICFRE. During the year 2012-13, ICFRE had completed the preparation of 60 R&R plans which were subsequently approved by the Hon'ble Supreme Court of India and scientific mining has started in the state of Karnataka after its closure for about one and half years.

ICFRE has also prepared a draft Cumulative Impact Assessment and Implementation Plan for the districts of Bellary, Chtitradurga and Tumkur of Karnataka for ensuring biological, physical and social rehabilitation of erstwhile degraded areas. In addition, ICFRE is working on the preparation of R&R Plans for additional 106 mines of the districts which will be completed during the year 2013-14.

ICFRE is also carrying out two important projects on 'Cumulative Environmental Impact Assessment of Hydro-electric Projects on Sutlej River Basin in Himachal Pradesh' and 'Cumulative Impact Assessment of Hydro-electric Projects on River Yamuna and Tons and its Tributaries in the State of Uttarakhand'. Also, there are five separate hydro-power projects of Himachal Pradesh for which the impact assessment work is in the final stage. Similarly, for Bunakha and Sankosh Multi-purpose Hydro Electric Projects of Bhutan, the studies are in the advanced stage. Biodiversity study in the Coal Mines of Bina Extension and Krishnashila OCP of Northern Coalfield Limited, Singrauli district of Madhya Pradesh was also completed in 2012-13.

FRI, Dehradun conducted following consultancy services to the various stakeholders:

- Technical services were provided to 35 firms through the testing of wood and wood products.
- Wood identification services provided to various departments of Railways, Vigilance, Customs, Forest, Anti-corruption, Housing corporations, LIC, Indian Oil, NTPC, CPWD, BHEL, Central Warehousing Corporations, Ordnance Factories, Power Grid Corp., Municipal Corporation, Tourism and Transport Corporation, MES, Telecom, NBCC Ltd., and private timber merchants.
- Identification services provided for bio-piracy samples received from different Police Stations, Forest Departments etc.
- Paper samples received from Government organizations and private industries such as Employment News New Delhi, NCERT New Delhi , Indian Railways Varanasi, ISRO Ahmedabad, Radex Stationary New Delhi , Rama News Print Bijnor, Sri Krishna Paper New Delhi, Anand Triplex Board Ltd., Meerut, Army New Delhi, Chhatisgarh Pathyapustak Nigam, Raipur, State Printing Roorkee, Directorate of Education Dehradun etc. were tested for physical and optical properties.
- Provided technical services to three industries namely (i) M/S Suncare Pharmaceuticals Pvt. Ltd., Plot No. 8, Pharma City, Selaqui, Dehra Dun (ii) M/S Shnakhubaba International, Sidcul, Haridwar, and (iii) M/S Auro Sundaram Ply and Door (Pvt.) Ltd., Bhawanipur, Roorkee
- The wood sample of Southern Cooling Tower Pvt. Ltd., Kolkata was tested for essential oil contents.
- Advisory to APSARA Authority, Cambodia and ASI for conservation of trees at Ta Prohm temple, Cambodia.

- Advisory to Bodhgaya Temple Management Committee for maintenance and conservation of Bodhivriksha at Bodhgaya.
- Consultancy project: To inspect the health status of Mahabodhi Tree at Bodhgaya, Bihar.
- Advisory to Kurukshetra Development Board for the conservation of Vatvriksha at Jyotisar, Kurukshetra.

IFGTB, Coimbatore initiated a consultancy project on *Casuarina* seed orchards for BILT Tree Tech Limited.

IWST, Bangalore rendered the services, such as, wood identification, determination of moisture content, density and strength properties to various organizations.

TFRI, Jabalpur conducted studies on 'Assessment of green cover and its tangible and intangible benefits and tree cover management plan for STPP-Korba Project'.

AFRI, Jodhpur evaluated the plantation sites for 'Dry Land Agroforestry Project' at Salawas, Jodhpur and Data, Sikar funded by ONGC. Technical consultancy to grow *Jatropha curcas* in Rajasthan was also provided to State Biofuel Authority, Jaipur, Rajasthan.

7.5 Activities of Rajbhasha

ICFRE Hqs. and its Institutes are continuously working in the direction of implementation of Rajbhasha rules and regulations issued by the Government of India in its day to day functioning with a view to promoting the use of Rajbhasha to the maximum. ICFRE Hqs. organized a Hindi training workshop on "सरकारी काम–काज में हिन्दी को बढ़ावा" on 19 December 2012. ICFRE is regularly publishing a Hindi magazine *Taruchintan* and half yearly

Lighting the lamp at the closing ceremony of *Hindi Saptah* at ICFRE, Dehradun

Newsletter *Vaniki Samachar* with a view to promoting the implementation of Rajbhasha Hindi. AFRI, Jodhpur also published Hindi Magazine *AFRI Darpan* regularly.

Hindi Saptah was organized from 7 to 14 September 2012 at ICFRE Hqs. FRI, Dehradun organized Hindi Week from 11 to 17 September 2012. *Hindi Pakhwara* was observed at TFRI, Jabalpur from 1 to 15 September 2012 and from 14 to 28 September 2012 at AFRI, Jodhpur. Various competitions including Essay, Hindi Typing, Noting Drafting in Hindi and recitation of poems were organized during the *Hindi Saptah/Pakhwara*.

Dr.P. P. Bhojvaid, Director, FRI giving prizes during *Hindi Saptah*

Offical Language Implementation Meetings were conducted on regular interval basis at ICFRE and its institutes. Quarterly Progress Report was sent to the Official Language Department of the Ministry of Environment and Forests. ICFRE and its institutes also celebrated Hindi Diwas on 14 September 2012. ICFRE and its institutes regularly participated in the "TOLIC" Meetings.

Training programme on Hindi software 'Saransh' were organized at ICFRE and its institutes. IWST, Bangalore organized Rajbhasha Orientation Programmes for the officers and scientists of the institute on 29 June 2012 and 5 September 2012 and Hindi Workshops for clerical staff were organized on 18 December 2012 and 24 January 2013. During the year, two LDC's were deputed for 40 days full Hindi Typing Training to Central Hindi Training Sub-institute, Bangalore.

7.6 Awards and Honours

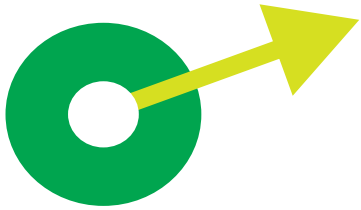
- Dr. V.K. Bahuguna, DG, ICFRE was elected as Member of the Executive Committee of International Poplar Commission for 2012-2016.
- Dr. Dinesh Kumar, Scientist F, Silviculture Division, FRI, Dehradun was elected as Member of the Executive Committee of International Poplar Commission for 2012-2016.
- Ms. Neetu Bhatt, Dr. P. K. Gupta and Dr. Sanjay Naithani of FRI, Dehradun were awarded second prize for the oral presentation on topic titled "*Lantana camara* a potential weed for preparing alpha cellulose and its cellulose sulphate derivatives" in the 7th Uttarakhand State Science and Technology Congress organized by Uttarakhand State Council for Science and Technology at Dehradun from 21 to23 November 2012.
- Dr. Rashmi and Sh. Panakj Tiwari were awarded with the *Innovator of the Year Award (2012)* for *Samriddhi:* A product of green technology for silkworm farmers *in* 7th Uttarakhand Science and Technology Congress, held on from 21 to 23 November 2012 at Dehradun.
- Dr. Modhumita Dasgupta, Scientist E, IFGTB, Coimbatore was nominated as member of International Climate-Resilient Crop Genomics Consortium towards preparation of white paper on *Eucalyptus* for drought and salinity tolerance traits. Dr. Dasgupta, was also nominated by Department of Biotechnology, Government of India as DBT representative on the IBSC constituted at Rubber Research Institute of India, Kottayam and Bharathidasan University, Trichy.
- Dr. K. K. Pandey, IWST, Bangalore was awarded "National Awards for Excellence in Forestry Research" by ICFRE for the year 2006-2008. He was also elected as a Fellow of the International Academy of Wood Science in 2013.
- Dr. N. Bala, Sh. Pramod Kumar,Dr. N.K. Bohra, Sh. N.K. Limba, Sh. S.R. Baloch and Dr. G. Singh of AFRI, Jodhpur were awarded the prestigious S.K. Seth Prize for the year 2010 by The Indian Forester for their research article on "Production and decomposition of litter in plantation forests of *Eucalyptus camaldulensis* along the canal command area in Indian desert".
- Dr. Bhimi Ram, SRF, IFB, Hyderabad awarded first prize in poster presentation on 'Molecular analysis of micropropagated *Melia dubia* plants using RAPD and ISSR markers for creating clonal fidelity' at CMR College, Bangalore on 6 March 2013.

Visit of Dignitaries

- Parliamentary Committee on Science and Technology, Environment & Forests headed by Dr. T. Subbarami Reddy visited FRI, Dehradun on 4 July 2012. Committee appreciated the efforts of ICFRE. Chairman of the committee has written letters to the Hon'ble Prime Minister, Hon'ble Forest Minister and Chairman Planning Commission regarding the recent initiatives by ICFRE and requesting for additional allotment of budget to take forestry research to higher levels.
- The Third Sub-Committee of Committee of Parliament on Official Language including Hon'ble Members of Parliament Prof. Alka Balram Kshatriya, Shri Hukumdev Narayan Yadav, Dr. Raghuvansh Prashad Singh and Dr. Ram Prashad visited FRI, Dehardun on 29 May 2012 and inspected the progress on implementation of Rajbhasha Hindi in FRI and ICFRE, Dehradun.
- His Excellency Shri Shekhar Dutt, Hon'ble Governor, Chhattisgarh visited FRI on 9 August 2012. The visiting dignitary interacted with the officers and scientists of ICFRE and FRI, Dehradun and launched the web portal http://ntfpmarketwatch.icfre.gov.in/ which is a price dissemination system to help farmers and tribal community to watch the market prices of non-timber forest products in India.

8

ADMINISTRATION AND INFORMATION TECHNOLOGY

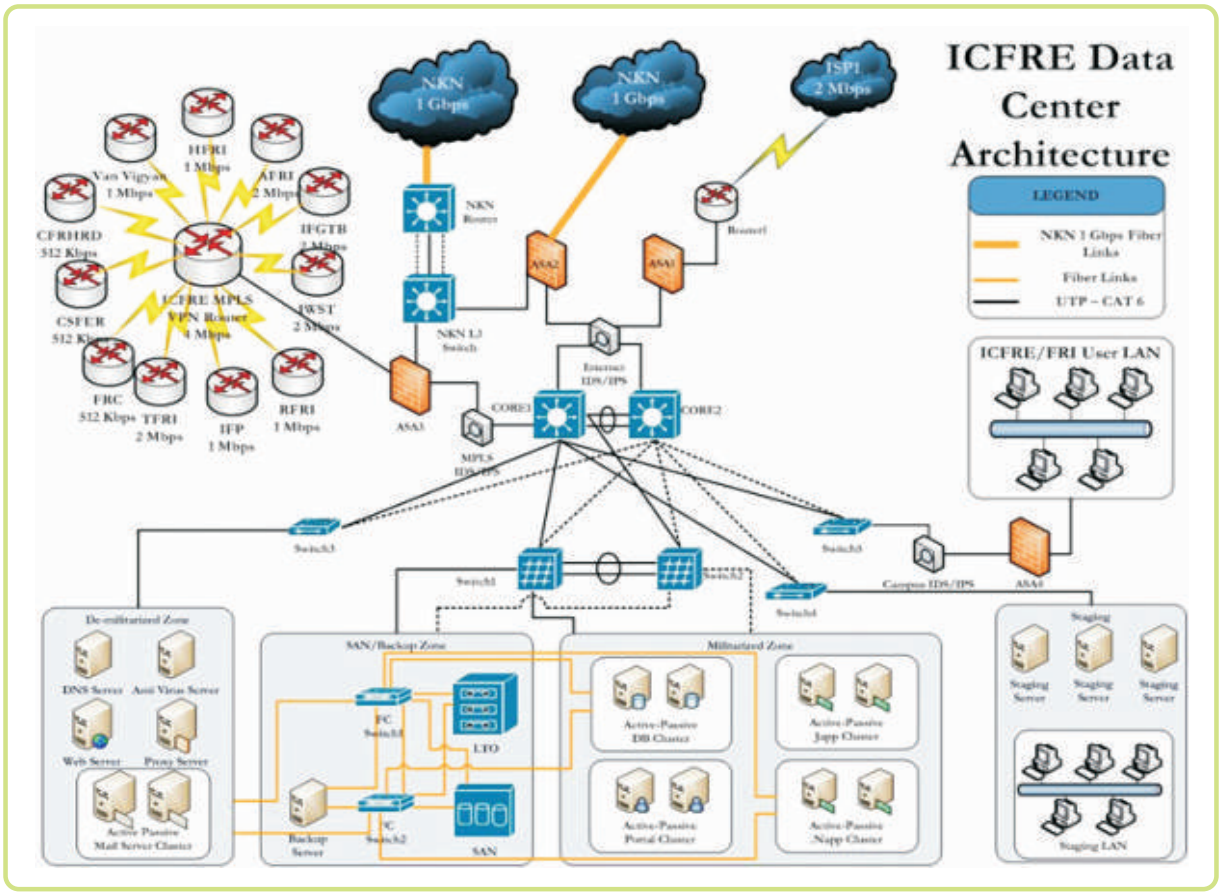


Administration and Information Technology

8.1 Information Technology

Information Technology is the key driver in carrying out research, administrative and other support activity. IT Division, ICFRE is using Information Communication Technology, progressively providing the users 24X7 services to the satisfaction of them. IT Division caters to the Information & Communication Technology needs of all institutes under ICFRE and ICFRE HQ.

ICFRE Data Centre: The ICFRE Server Farm is hosting the IFRIS Application and other allied key services like Messaging Service, Web Service, Database Service, Proxy Service, DNS Service, DHCP Service, FTP Service, Backup Service, Internet Service, MPLS-VPN service, Videoconferencing, Antivirus Service, Helpdesk Service, CA EMS ISS. Around 18 websites on different aspects of ICFRE and its Institutes have been hosted on ICFRE Web Server. ICFRE Data Centre 'Building Management System' (BMS) is implemented & configured for effective management, monitoring and Integration of various Non-IT equipments like Fire Alarm System, Very



Early Smoke Detection Appliance (VESDA) System, Rodent Controller, Water Leakage Detector, Access System, Surveillance System, Public Address (PA) System, Cooling System.

Indian Forestry Research & Information System (IFRIS): IFRIS was conceptualized with the aim to translate some of the present working manual systems into automated systems; increase/improve access, efficiency, transparency and accountability of services; enhance the responsiveness of ICFRE through workflow automation and knowledge management; enhance the ease of convenience of the users, stakeholders in accessing the information and services provided by the ICFRE. PIMS (Personal Information Management System), PMS (Payroll Mangaement System), FAS (Financial Accounting System), RIMS (Research Information System), EDMS (Electronic Documentation System) etc. are some of modules widely used across all the institutes. PIMS is having 2098 employees data. 16126 leave transactions took place between 1 April 2012 to 31 March 2013 through PIMS across all the institutes of ICFRE.

PMS is being used from more than two years across all the institutes. Pay slips and other reports related to salary is being generated through PMS. A total of 37482 numbers of vouchers were generated in FAS from 1 April 2012 to 31 March 2013. RIMS is having more than 350 projects data. EDMS contains more than 6000 documents.

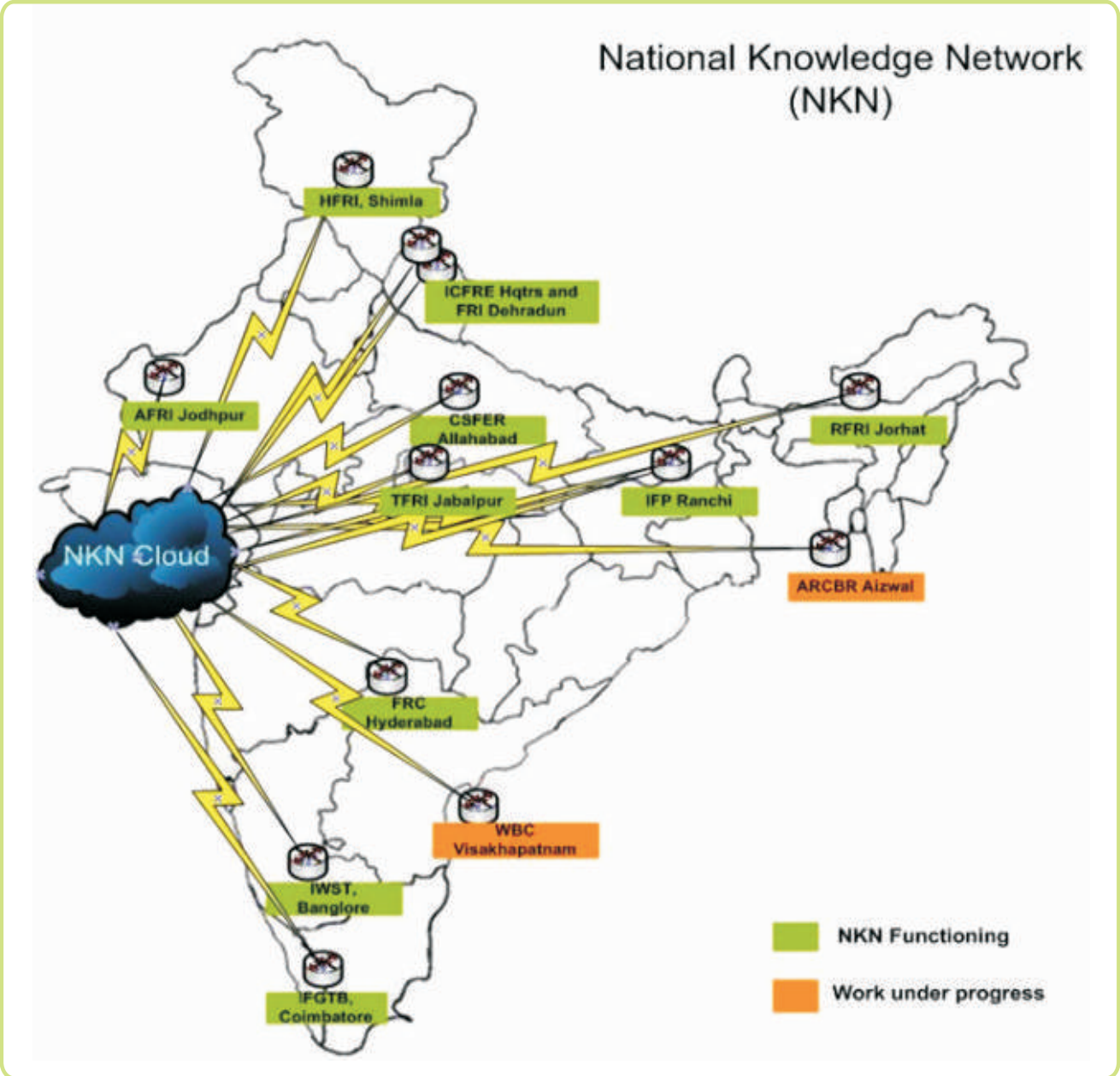
Video Conferencing Facilities: Video conferencing services at ICFRE has been started from **May 2008** and till date more than 900 videoconferencing sessions have been successfully completed allowing real-time conversation using state of art equipment.

Network Support: The LAN / WAN services have been extended to around 350 users within FRI / ICFRE through a Gigabit Optical Fibre backbone with 100 Mbps connectivity at end points with state of art hardware. One more feather has been added by the ICFRE to the Network Support in this field through establishment of Layer 3 Multi Protocol Label Switching (MPLS), Virtual Private Networking (VPN) across the ICFRE Hqtrs. and its Regional Institutes. The MPLS-VPN connectivity uses for accessing IFRIS application, Videoconference service, FTP service and other intranet applications. All network hardwares across the ICFRE institutes are maintained by IT Division, ICFRE. Around 15 routers are installed at ICFRE and its institutes and are under AMC.

The above equipments maintenance is monitored and reported by the IT Divisions of respective institutes.

Maintenance of Hardware: At present all the officers / officials at ICFRE Hqtrs. up till the level of LDC have been equipped with a Desktop Computer and a printer. Apart from maintenance of the Network Hardware, this division also undertakes the maintenance of computer and peripheral, hardware installed at ICFRE Hqtrs through the third party vendors. At institutes level, hardware are maintained by IT Division of respective institutes.

NKN: The connectivity provisioned under this arrangement form the basis of knowledge sharing between the National & International Research Institutions. The ICFRE envisages to consolidate the NKN connectivity at all its regional locations for utilizing it as a substitute to its existing MPLS-VPN arrangement with very high availability of bandwidth and cost effectiveness.



Manage and Impart In-House Trainings to ICFRE Personnels: The Division is actively involved in the process of imparting in-house training to the ICFRE / FRI Officers and staff. The Division also conducts various trainings for PIMS module, FAS and EDMS module for ICFRE Head Qtrs/Institutes officials. A training on 'Data Warehousing and Data Mining' was imparted to the scientists of ICFRE and its institutes from 18 to 22 March 2013.

Development and maintenance of "Interactive Portal : Interface with stakeholders": In the changing scenario of IT revolution, traditional mode of addressing the problems/ queries of end-

users becomes obsolete and requires major changes in the strategies for projecting ICFRE as problem-solving organization/team of experts. This portal has been developed to facilitate our valued end-users to find quick and reliable solution of their problem by using internet environment.

Design and Development of ICFRE Website: ICFRE website is continuously being upgraded and maintained. New features are being added. Information on website is promptly updated.

IPC website: The International Poplar Commission (IPC) is a technical statutory body of the Food and Agriculture Organization of the United Nations and it aims to promote the cultivation, conservation and utilization of poplars and willows. It serves the members through National Poplar Commissions of respective countries, Working Parties and full Sessions.

The 24th Session of the IPC held at FRI Dehradun from 30 October to 2 November 2012. The website http://ipc2012.icfre.org for the same was developed with all the features, including online submission of papers, online payment, online review etc.

Databases: Many databases are available and maintained at ICFRE and its institutes like Indian Wood Insects Database, Anatomical Database of Indian Hardwoods, National Forest Insect Collection (NFIC), Forest Soil Information System for India, Database of FRI Herbarium, Database on Biodiversity, Database of IWST Xylarium, Expert System for Indian Woods, NWFP Information System, Research Projects Database etc. These are being updated time to time. A brief summary of databases available at ICFRE and its institutes is as below:

Sl.No.	Database	Institute	Detail
1	Wood Anatomy Information System(WAIS)	FRI, Dehradun	A specialized software entitled 'WOOD ANATOMY INFORMATION SYTEM (WAIS) has been developed and all scattered published data stored on it.
2	National Forest Insect Collection (NFIC)	FRI, Dehradun	Information of 17,000 species belonging to 48,000 localities were entered into the database.
3	Database in Tree Improvement on Mandatory Species	IFGTB, Coimbatore	Tree Improvement information collected from Tamilnadu State Forest Department, Kerala State Forest Department, Annual Reports of Forest departments, ICFRE Statistical Report, DANIDA Plus tree records, Scientists and other sources and entered in Database.
4	Database on Biodiversity	IFGTB, Coimbatore	It is database of 70 threatened plant species with different retrieval, addition, deletion and modification options by using information on botanical name, Family, description, distribution, phenology, uses etc.
5	Database of IWST Xylarium	IWST, Bangalore	Contains the information of IWST Xylarium.

Sl.No.	Database	Institute	Detail
6	Expert system for Indian woods - their microstructure, identification, properties and uses.	FRI, Dehradun	Database of microstructure, identification, physical properties and uses of Indian commercial woods has been generated for commercial woods of India and incorporated on electronic media (CD) for easy retrieval. The same was incorporated in 'WAIS', an expert system developed for storage and retrieval of wood database.
7	NWFP information system	TFRI, Jabalpur	An interactive database package for keeping records of NWFP species.
8	Indian Wood Insect Database	IWST, Bangalore	Contains the information of Wood and Insects.
9	ICFRE Research Database Projects since 1990	ICFRE, Dehradun	This database contains all projects of ICFRE since 1990. Lot of search option for the user are available to find the exact information related to projects. It contains detail of 1104 projects.

At ICFRE Institutes: The above mentioned services, Institute's website, databases, hardware/software is being looked after and maintained at Institute level by IT Division of respective institutes.

8.2 Sevottam: Activities Relating to the Citizens/Clients Charter

ICFRE is a research organization, which mainly deals with the forestry research activities extending the research support to the Forest Department, in general, and public, at large, in all the states falling under the jurisdiction of the Institutes. ICFRE, thus, is committed to excellence in the field of forestry and environment. The wide range of clientele including Wood based industries, Handicraft industries, Saw millers State Forest Departments, Police Department, Judiciary, Wildlife Crime Control Bureau, Customs Department, and other Govt Organizations, Non Government Organisations, Perfumeries and Farmers necessitate that we have a standard service delivery system that caters to the need of all based on transparency, accountability, reliability, responsiveness and empathy.

Sevottam symbolizes the Government's intent to move from 'administration' mindset to 'service orientation' in delivery of public services. It is a standardized Service Delivery Excellence Model whose main features are to identify the services provided by the organization, to set norms for each service, to ensure delivery as per norms, to assess quality of delivery on a continuous basis and to proactively redress public grievances.

In the modern times, it is the responsibility of every organization to implement a quality management system for public services.

8.2.1 Action Taken to Formulate the Charter:

Citizen's Charter is drafted and implemented by all the Institutes with provision for Annual Review of the Charter Services provided. The timely redress of public grievances is being monitored by

the Public Grievance Officer. Steps are undertaken to take remedial measures for quick disposal of complaints.

Procedures have been formulated for identifying the research problems in forestry, developing the projects based on the problems and dissemination of the research results and technologies to the users. In order to identify the research problem, stakeholders meeting are organized in the states falling under the jurisdiction of each institute. Officials from SFD's, progressive farmers, scientists and NGO's participate in the stakeholders meeting and express the problems on which the research is required. Based on the research problems given by the stakeholders, in -house discussions are made amongst the scientists of the Institute and the research projects are formulated by the scientists after the thorough review of scientific literature. To fulfill the Charter, research projects have been prepared in consultation with the stakeholders, vetted by outside experts, RAG members and finally by RPC for internal funding and implementation for continuous changes are made through monitoring and evaluation mechanism at various levels.

8.2.2. Action Taken to Implement the Charter:

To implement the charter, research projects have been prepared in consultation with the stakeholders, vetted by RAG members and finally approved by RPC for internal funding and implementation. Projects have also been submitted for various donor agencies for implementing the Charter. Stakeholders meet of AFRI, Jodhpur was organized at Jaipur on 22 August 2012 and at Forest Training Research Centre, Gandhi Nagar on 10 September 2012. RAG Meeting of AFRI was held on 8 November 2012. At HFRI, the Institute fixes its targets, includes research projects to be implemented during the year, information regarding trainings, exposure visits, workshops, seminars and awareness programme to the school children and is being implemented in its true spirit. At RFRI also, research projects have been prepared in consultation with the stakeholders of North Eastern states, vetted by outside experts, RAG members and finally by RPC for internal funding and implementation.

8.2.3 Trainings, Workshops held for Implementation of Charter:

Trainings and workshops are integral part of functioning of the Council. These are regularly being organized across the ICFRE institutes. The institutes also conducted RAG meetings, stakeholders interactive meets/ liaison meetings and compulsory training for IFS officers every year. The training component has been covered in detail under Chapter 6 and workshops are presented in detail in Chapter 7 of the Report.

8.2.4 Publicity Efforts Made on Charter for the Clients:

The Charter has been placed on the website. Publicity of the efforts for stakeholders through publications and various media tools, including print media is a regular feature in the ICFRE system. At IWST, the institute has produced many publications/technical Bulletins/Pamphlets in English, Kannada, Konkani and Telugu which are distributed free of cost in *Krishi Melas*, trainings and demonstration programmes, VVK etc. Only some of them are made available to the public on

payment basis. At TFRI, Publicity and Awareness campaigns on charter for the citizen/clients were made by putting up slogans on notice boards and other prominent areas to motivate citizens. General lectures on the awareness were also organized at the Institute. At HFRI, the staff was encouraged to implement the Client Charter in its true spirit for the benefit of the stakeholders. All other institutes under ICFRE were also engaged in publicity campaigns for the awareness of the public.

8.2.5 Evaluation of Implementation of Charter:

For evaluation of implementation of Charter in the Organization and assessment of the level of satisfaction among Citizen/Clients at IWST, the Internal Evaluation of the implementation of Charter is being done by the Director and in due course of time, mechanism for External evaluation of implementation of Charter in the organization will be developed. While at AFRI, all the new projects and progress of the ongoing research projects are being presented to the internal and external experts of the Research Advisory Group at HFRI, the Client Charter is being monitored at the end of financial year apprising the stakeholders about the extension activities proposed in Action Plan and the Client Charter and encouraging them to attend trainings for the ultimate benefit of forests and environment.

8.3 Welfare Measures for the Backward and Minority Communities:

At ICFRE interactive meeting of Grievances redressal Cell for SC/ST/OBC employees of ICFRE, Dehradun was organized on 25 March 2013. A training workshop on "Reservation Policy" was organized for the officers/officials of ICFRE (Hqr) and its institutes on 20 March 2013. Total 19 participants from ICFRE (Hqr) and its Institutes have attended the training workshop. At IFGTB, Dr. Ambedkar Birth Anniversy Celebration was observed in the Institute. On the occasion, Dr. S. Balaji, Director, TNFA delivered a talk on "Dr. Babasaheb Bhimarao Ambedkar and his contribution to "Democratization of Indian Society".

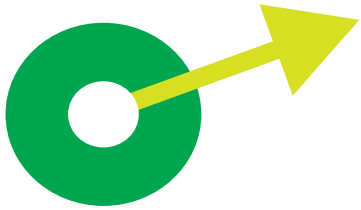
IWST has established Grievance and Redressal Cell to attend to the grievances of employees. The cell is also looking after several welfare measures of SC/ST/OBC employees of the Institute. The employees put their grievances to Grievance and Redressal Officer which are attended promptly. An association of SC/ST employees has also been formed which is looking after the overall development and welfare of the employees. At AFRI, to promote the general interest of SC/ST/OBC employees and to work for their collective betterment development and upliftment, AFRI SC/ST/OBC Employees Welfare Association was formed on 20 September 2012. The Association celebrated the 56th *Parinirvan Diwas* of the architect of Indian Constitution *Bharat Ratna* Dr. B. R. Ambedkar for the first time at Arid Forest Research Institute, Jodhpur on 6 December 2012. Dr. T. S. Rathore, Director, AFRI preceded over the programme to pay homage to Baba Saheb Ambedkar. Professsor Tara Ram, Director, *Bodh Adhyayan Anusandhan Kendra*, Jodhpur was invited as the chief guest to deliver lecture on "Constitution of Dr. B. R. Ambedkar and Conservation of Environment". Shri M.R.Baloch, GCR, A.F.R.I, Jodhpur also spoke on the ideals of Baba Saheb Ambedkar. For proper functioning of the Association, a separate room was also allotted in

Library building which is being utilized by the Association for meetings and discussions for the welfare of the SC/ST/OBC Employees. The Redressal of the complaints received during 2012-13 from the weaker section employees is under process.

At HFRI, the welfare of the communities SC/ ST/ Backward/ Minority Communities is being undertaken. These backward communities are accommodated in various training/ extension programmes organized by the Institute. At RFRI, an SC/ST/backward/minority communities welfare Committee under the chairpersonship of Ms. Imtientla Ao, CF has been constituted. The Committee looks after the welfare and the grievances of the employees of the SC/ST/backward/ minority communities. Commendably, no grievance was reported in the year 2012-2013 from the employees of these sections.

9

BALANCE SHEET



9. BALANCE SHEET

CONTENTS

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN

BALANCE SHEET AS AT 31ST MARCH, 2013

(Amount in Rs.)

CORPUS/CAPITAL FUND AND LIABILITIES	SCHEDULE	CURRENT YEAR AS ON 31.03.2013		PREVIOUS YEAR 31.03.2012
		RS.	RS.	RS.
CORPUS/CAPITAL FUND	1		1,431,476,721	1,513,614,733
RESERVES AND SURPLUS	2		-	-
EARMARKED/ENDOWMENT FUNDS :	3			
> One Time Special Grant		188,732,351		-
> Project Unspent Balance		264,819,104		424,842,565
> Corpus Fund Unspent Balance		14,211,144	467,762,599	
SECURED LOANS AND BORROWINGS	4		-	-
UNSECURED LOANS AND BORROWINGS	5		-	-
DEFFERRED CREDIT LIABILITIES	6		-	-
CURRENT LIABILITIES AND PROVISIONS				
(A) CURRENT LIABILITY:	7	79,453,203		
(B) PROVISIONS:		-	79,453,203	58,630,986
TOTAL			1,978,692,523	1,997,088,284

ASSETS		CURRENT YEAR AS ON 31.03.2013		PREVIOUS YEAR 31.03.2012
		RS.	RS.	RS.
FIXED ASSETS	8		1,241,132,550	1,286,514,176
INVESTMENTS-FROM EARMARKED/ENDOWMENT	9			
> F.D.R.(For One Time Special Grant)			80,000,000	80,000,000
> F.D.R.(With Institutes)				-
INVESTMENTS-OTHERS	10			-
> F.D.R.(With Institutes)			-	
CURRENT ASSETS, LOANS, ADVANCES ETC.	11		657,559,973	630,574,108
MISCELLANEOUS EXPENDITURE		-	-	-
> (to the extent not written off or adjusted)				
> (items under reconcilation)				
TOTAL			1,978,692,523	1,997,088,284
SIGNIFICANT ACOUNTING POLICIES	24			
CONTINGENT LIABILITIES AND NOTES ON ACOUNTS	25			

SH. KANTHARAJ JUDE SEKAR (Director General, ICFRE)

Dr. S.P. SINGH , (Dy. Director General, Admin., ICFRE)

SH. S.D.SHARMA, (Asstt. Director General, Admin., ICFRE)

SH. V.R.SRINIVASAN, (Fin. Adviser & Chief Accounts Officer, ICFRE)

"AS PER OUR SEPARATE REPORT OF EVEN DATE ANNEXED"
FOR P.K.SINGHAL & CO.,
CHARTERED ACCOUNTANTS

(P.K.SINGHAL)Partner
Chartered Accountant
Membership No. 73882
DATED: 11TH JULY, 2013
PLACE: DEHRADUN

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2013

INCOME	Schedule	Current Year 31.03.2013	Previous Year 31.03.2012
		RS	RS.
Income from sales/services	12	8,380,296	6,242,867
Grants/Subsidies	13	1,205,212,000	1,065,000,000
Fees/Subscriptions	14	9,000.00	23,500
Income from Investments (Income on Invest .from earmarked/endow.	15	-	-
Income from Royalty, Publications etc.	16	2,106,582.00	505,527
Interest Earned	17	17,956,451.67	12,275,386
Other Income	18	50,030,910.70	45,578,363
Increase/(decrease) in stock of finished goods and works-in-progress	19	-	-
		-	-
Total(A)		**1,283,695,240**	**1,129,625,642.77**

EXPENDITURE	Schedule	Current Year 31.03.2013	Previous Year 31.03.2012
		RS.	RS.
Establishment Expenses	20	969,239,966	835,614,554
Other Administrative Expenses etc.	21	349,752,764	292,216,297
Expenditure on Grants, Subsidies etc.	22	12,148,352	1,392,381
Interest	23	-	-
Depreciation(Net Total at the year end-corresponding to Schedule 8)		109,118,559	130,368,268
TOTAL(B)		**1,440,259,640**	**1,259,591,500**
Balance being excess of Income over Expenditure(A-B)		(156,564,400)	(129,965,857)
Transfers to Special Reserve(Specify each)		-	
Transfer to/from General Reserve		-	
BALANCE BEING DEFICIT CARRIED TO CORPLUS FUND		**(156,564,400)**	**(129,965,857)**
SIGNIFICANT ACCOUNTING POLICIES	24		
CONTINGENT LIABILITIES AND NOTES ON ACCOUNTS	25		

SH. KANTHARAJ JUDE SEKAR (Director General, ICFRE)

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SMT. VIJAY DHASMANA (Under Secretary, Budget, ICFRE)

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INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH, 2013

Amount-(Rs)

SCHEDULE 1-CORPUS/CAPITAL FUND:	CURRENT YEAR 31.03.2013		PREVIOUS YEAR 31.03.2012	
	RS.	RS.	RS.	RS.
Balance as at the beginning of the year	1,513,614,732.92		1,596,660,521.83	
Less: Provision for Salary Payable March 2012	-	1,513,614,732.92	(44,862,550.00)	1,551,797,971.83
Add: Revenue Received at DDO's		64,496,409.46		59,642,949.68
Add: Contributions towards Corpus/Capital Fund				
Plan Account	50,000,000.00			50,000,000.00
North East	22,500,000.00	72,500,000.00		30,000,000.00
Less: Balance of net income/expenditure transferred		(156,564,399.64)		(119,321,438.11)
LESS: Revenue Receipt paid to D.G. ICFRE by the DDO.s		(62,570,021.46)		(58,504,750.48)
BALANCE AS AT THE YEAR-END		1,431,476,721.28		1,513,614,732.92

SCHEDULE 2-RESERVES AND SURPLUS:	CURRENT YEAR 31.02.2013		PREVIOUS YEAR 31.03.2012	
	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	-	-	-	-

SH. KANTHARAJ JUDE SEKAR (Director General, ICFRE)

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(P.K.SINGHAL) Partner
Chartered Accountant
Membership No. 73882
DATED: 11TH JULY, 2013
PLACE: DEHRADUN

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31st, MARCH,2013

Amount-(Rs)

SCHEDULE 3-EARMARKED/ENDOWMENT FUNDS	FUND -WISE BREAK UP				TOTALS	
	ONE TIME SPECIAL GRANT	PROJECT ACCOUNTS	INTEREST CORPUS FUND	Fund	Current Year 31.03.2013	Previous Year 31.03.2012
a)Opening balance of the funds	205,358,441	211,213,548	8,270,576	-	424,842,565	285,368,742
Adjustment of Exp. From Plan (GC) A/c to OTSG A/c under Minor Works						
b)Additions to the Funds:						
i) Donations/grants						
One Time Special Grant (General)	33,700,000	-	-	-	33,700,000	138,000,000
One Time Special Grant (Cretion of Assetsl)	58,500,000				58,500,000	
ii) Income from investments made on account of funds	-	-	8,545,774	-	8,545,774	8,270,576
iii) Other additions (specify nature)	-	-	-	-	-	-
iv) Project Receipts	-	341,559,142	-	-	341,559,142	235,163,749
TOTAL(a+b)	297,558,441	552,772,690	16,816,350	-	867,147,481	666,803,067
C) Utilisation/Expenditure towards objectives of funds					-	-
i) Capital Expenditure					-	-
- Fixed Assets	45,353,019	-	-	-	45,353,019	14,986,986
- Others	-	-	-	-	-	-
Total.....	45,353,019	-			45,353,019	14,986,986
ii) Revenue Expenditure			-	-	-	-
- Salaries, Wages and allowances etc.	-	-	-	-	-	-
- Rent	-	-	-	-	-	-
- Other Administrative expenses	63,473,071	-	2,605,206	-	66,078,277	17,254,595
- Project Payments	-	287,953,587	-	-	287,953,587	209,718,921
Total	63,473,071	287,953,587	2,605,206		354,031,864	226,973,516
					-	
Total (c)	108,826,090	287,953,587	2,605,206	-	399,384,883	226,973,516
NET BALANCE AS AT THE YEAR END(a+b-c)	188,732,351	264,819,104	14,211,144	-	467,762,599	424,842,565

SH. KANTHARAJUDE SEKAR (Director General, ICFRE)

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FOR P.K.SINGHAL & CO.,
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P.K.SINGHAL, Partner
Chartered Accountant
Membership No.73882
DATED:
PLACE: DEHRADUN

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH, 2013

Amount-(Rs)

SCHEDULE 4-SECURED LOANS AND BORROWINGS:	CURRENT YEAR 31.03.2013		PREVIOUS YEAR 31.03.2012	
	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

P.K. SINGHAL & CO. DELHI Chartered Accountants

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH, 2013

Amount-(Rs)

Schedule 5-UNSECURED LOANS AND BORROWINGS	Current Year 31.03.2013 RS.	Previous Year 31.03.2012 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 31.03.2013 RS.	Previous Year 31.03.2012 RS.
a) Acceptances secured by hypothecation of capital equipment and other	-	-
b) Others	-	-
TOTAL	-	-
Note: Amounts due within one year		

P.K. SINGHAL & CO. DELHI Chartered Accountants

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH, 2013

Amount-(Rs)

SCHEDULE 7-CURRENT LIABILITIES AND PROVISIONS	CURRENT YEAR 31.03.2013		PREVIOUS YEAR 31.03.2012	
	RS.	RS.	RS.	RS.
A.CURRENT LIABILITIES				
1.Acceptances	-	-	-	-
2.Sundry Creditors:	-	-	-	-
a)For Goods	-	-	-	-
b)Others	-	-	-	-
3.Advances Received	-	-	-	-
4.Interest accrued but not due on:	-	-	-	-
a)Secured Loans/borrowings	-	-	-	-
b)Unsecured Loans/borrowings	-	-	-	-
5.Statutory Liabilities:	-	-	-	-
a)Overdue	-	-	-	-
b)Others	-	-	-	-
6.Other Current Liabilities				
Security & EMD Account	14,773,801.20	14,773,801.20	10,219,052.20	10,219,052.20
Amount Payable to Controller, Pension Cell, ICFRE				
GPF Subscription/ Refund	224,521.00		221,583.00	
GSLIS	(1,056.00)		346.00	
Pension Contribution	66,190.00		66,190.00	
New Pension Scheme	(24,365.00)	265,290.00	12,355.00	300,474.00
Amount Payable to PAO (F), NEW DELHI				
GPF Subscription/ Refund	358,692.00		358,692.00	
CGEGIS	11,980.00		11,980.00	
Any Other Recovery	128,451.00	499,123.00	128,451.00	499,123.00
Amount Payable to Other Units				
Saving Fund	64,071.00		64,071.00	
Death Claim	44,013.00		44,013.00	
Advance Recovery	511.00		511.00	
CGEIS	1,031.00	109,626.00	1,031.00	109,626.00
Amount Payable to Others				
L.I.C.	2,057.00		3,447.00	
T.D.S./Service Tax/ Professionala Tax	34,154.00		27,341.00	
Payable to Controller ICFRE	1,508,902.00		2,035,453.00	
Misc. Recoveries	332,396.00		(3,710,574.00)	
Inter Unit Account	-	1,877,509.00	-	(1,644,333.00)
Salary Payable Account		61,927,854.00		49,147,044.00
TOTAL(A)		79,453,203.20		58,630,986.20
B.PROVISIONS				
1.For Taxation		-	-	-
2.Gratuity		-	-	-
3.Superannuation/Pension		-	-	-
4.Accumulated Leave Encashment		-	-	-
5.Trade Warranties/Claims		-	-	-
6.Others(Specify)		-	-	-
TOTAL(B)		-	-	-
TOTAL(A+B)		79,453,203.20		58,630,986.20

P.K. SINGHAL & CO. DELHI Chartered Accountants

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH, 2013

Amount-(Rs)

SCHEDULE 8 -FIXED ASSETS	GROSS BLOCK					DEPRICIATION						NET BLOCK	
DESCRIPTION	Cost valuation As at beginning of the year	Addition during the year before 30.09.2012	Addition during the year after 30.09.2012	Deductions during the year	Cost/valuation at the year-end	Rate of depreciation	As at the beginning of the year	On Additions during the year before 30.09.2012	On Additions during the year after 30.09.2012	On deductions during the year	Total up to the Year-end	As at the Current year-end	As at the previous year-end
	RS.	RS.	RS.	RS.	RS.	RS.	RS.	RS.	RS.	RS.	RS.	RS.	RS.
A. Fixed Assets:													
1.LAND:													
a)Freehold	9,126,020.00	-	1,753,400.00	-	10,879,420.00	-	-	-	-	-	-	10,879,420.00	9,126,020.00
b)Leasehold	-	-	-	-	-	-	-	-	-	-	-	-	-
2.BUILDINGS:	-	-	-	-	-	-	-	-	-	-	-	-	-
a)On Freehold Land	949,960,728.84	3,447,742.00	5,504,587.00	-	958,913,057.84	0.05	47,498,036.44	172,387.10	137,614.68	-	47,808,038.22	911,105,019.62	949,960,728.84
b)On Leasehold Land	-	-	-	-	-	-	-	-	-	-	-	-	-
c)Ownership Flats/ Premises	-	-	-	-	-	-	-	-	-	-	-	-	-
d)Superstructures on land not belonging to the entity	-	-	-	-	-	-	-	-	-	-	-	-	-
3.PLANT MACHINERY & EQUIPMENT	-	-	-	-	-	-	-	-	-	-	-	-	-
a) Scientific Equipment	161,827,113.66	350,766.00	32,300,709.00	-	194,478,590.66	0.15	24,274,867.85	52,615.20	2,422,553.18	-	26,749,235.42	167,729,355.24	161,827,113.66
b) I.T.Equipment	15,073,134.84	2,715,709.00	3,152,419.00	-	20,941,262.84	0.60	9,043,880.90	1,629,425.40	945,725.70	-	11,619,032.00	9,322,230.84	15,073,134.84
4.VEHICLES	11,893,337.11	-	-	-	11,893,337.11	0.15	1,784,000.57	-	-	-	1,784,000.57	10,109,336.54	11,893,337.11
5.FURNITURE,FIXTURES	13,424,980.77	404,172.00	3,789,588.50	-	17,618,741.27	0.10	1,342,498.08	40,417.20	189,479.43	-	1,572,394.70	16,046,346.57	13,424,980.77
6.OFFICE EQUIPMENT	77,290,310.70	418,113.00	3,994,497.00	-	81,702,920.70	0.15	11,593,546.61	62,716.95	299,587.28	-	11,955,850.83	69,747,069.87	77,290,310.70
7.COMPUTER/PERIPHERALS	-	-	-	-	-	-	-	-	-	-	-	-	-
8.ELECTRIC INSTALLATIONS	2,181,699.95	-	-	-	2,181,699.95	0.15	327,254.99	-	-	-	327,254.99	1,854,444.96	2,181,699.95
9.LIBRARY BOOKS	42,349,465.63	-	5,914,128.00	8,900.00	48,254,693.63	0.15	6,352,419.84	-	443,599.60	1,335.00	6,794,644.44	41,460,049.19	42,349,465.63
10.TUBEWELLS & W.SUPPLY	-	-	-	-	-	-	-	-	-	-	-	-	-
11.OTHER FIXED ASSETS	-	-	-	-	-	-	-	-	-	-	-	-	-
12.TOOLS & EQUIPMENTS	3,387,384.45	-	-	-	3,387,384.45	0.15	508,107.67	-	-	-	508,107.67	2,879,276.78	3,387,384.45
TOTAL OF CURRENT YEAR	1,286,514,175.95	7,336,504.00	56,409,328.50	8,900.00	1,350,251,108.45		102,723,812.15	1,957,561.85	4,438,519.85	1,335.00	109,118,558.85	1,241,132,549.60	1,286,514,175.95
PREVIOUS YEAR	-	-		-	-		-	-		-	-	-	-
B.CAPITAL WORK-IN-PROGRESS	-	-		-	-		-			-	-	-	-
TOTAL	1,286,514,175.95	7,336,504.00	56,409,328.50	8,900.00	1,350,251,108.45		102,723,812.15	1,957,561.85	4,438,519.85	1,335.00	109,118,558.85	1,241,132,549.60	1,286,514,175.95
(Note to be given as to cost of assets on hire purchase basis included above)													

SH. KANTHARAJ JUDE SEKAR (Director General, ICFRE)

Dr. S.P.SINGH , (D) Director General, Admin, ICFRE)

SH. S.D.SHARMA, (Asst. Director General, Admin., ICFRE)

SH. V.R.SRINIVASAN, (Fin. Advisor & Chief Accounts Officer, ICFRE)

SMT. VIJAY DHASMANA (Under Secretary, Budget, ICFRE)

"AS PER OUR SEPARATE REPORT OF EVEN DATE ANNEXED"
FOR P.K.SINGHAL & CO.,
CHARTERED ACCOUNTANTS

[illegible]/Partner
Chartered Accountant
Membership No. 73802
DATED:
PLACE: DEHRADUN

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH, 2013

Amount-(Rs)

SCHEDULE - 9 INVESTMENTS FROM EARMARKED/ENDOWMENT FUNDS	CURRENT YEAR 31.03.2013	PREVIOUS YEAR 31.03.2012
	RS.	RS.
1. In Government Securities		
> F.D.R.(For One Time Special Grant)	80,000,000.00	80,000,000.00
> 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	80,000,000.00	80,000,000.00

SCHEDULE 10- INVESTMENTS-OTHERS	CURRENT YEAR 31.03.2013	PREVIOUS YEAR 31.03.2012
	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	-	-

P.K. SINGHAL & CO. DELHI Chartered Accountants

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH, 2013

Amount-(Rs)

SCHEDULE - 11 CURRENT ASSETS,LOANS, ADVANCES ETC.	CURRENT YEAR 31.03.2013		PREVIOUS YEAR 31.03.2012	
	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 months	-	-		
> Others				
4.Cash balances in hand(including cheques/drafts and	416,996	416,996	577,479	577,479
5.Bank Balances:				
a)With Scheduled Banks:				
> On Current Accounts	415,703,759		385,549,647	
> On Deposit Accounts	23,392,646.00	439,096,405	35,000,000	420,549,647
> On Savings Accounts				
b)With non-Scheduled Banks:				
> On Current Accounts	-		-	
> On Deposit Accounts(includes margin money)	-			
> On Savings Accounts	-	-	-	-
6.Post Office-Savings Accounts	-	-	-	-
TOTAL (A)		**439,513,401**	-	**421,127,126**

P.K. SINGHAL & CO. DELHI Chartered Accountants

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH, 2013

Amount-(Rs)

SCHEDULE 11 – (A) CURRENT ASSETS,LOANS,ADVANCES ETC.(Cont.)	CURRENT YEAR 31.03.2013		PREVIOUS YEAR	31.03.2012
	RS.	RS.	RS.	RS.
B.LOANS,ADVANCES AND OTHER ASSETS				
1. Loans:				
a) Staff Advance				
Forest Advance	2,098,866		2,448,910	
Festival Advance	1,133,146		1,246,346	
Car advance	448,326		483,026	
Scooter Advance	108,583		628,858	
Cycle Advance	253,176		253,176	
House Building Advance (HBA)	3,878,395		5,123,203	
TA Advance	905,342		734,975	
LTC Advance	318,177		381,877	
TTA Advance	1,088,760		1,573,039	
Medical Advance	723,160		141,261	
Pay Advance	231,820		268,960	
Computer Advance	573,814		741,514	
Etc. (Please specify)	62,806	11,824,371	46,488	14,071,633
b) Other Entities engaged in activities/ objectives similar to that of the Entity				
c) Other(Specify)				
2. Advances and other amounts recoverable in cash or in kind or for value to be received:				
a) On Capital Account				
CPWD	5,513,185		480,281	
CCU -(North East)	76,917,000		70,752,000	
CCU -(Plan Account)	56,914,334		56,914,334	
CCU -(Plan OTSG A/c))	51,000,000		51,000,000	
KVS Account	8,270		8,270	
SCIENTIFIC EQUIPMENTS	151,747	190,504,536	285,755	179,440,640
b) Prepayments	-			
c) Others	-	-		
Amount Recoverable From Controller, Pension Cell, ICFRE				
GPF Advance	1,894,307		1,801,454	
DCRG	4,811,823		4,236,746	
Provisional Pension	239,600		188,130	
GPF Part/Final Payment	4,067,514	11,013,244	3,253,634	9,479,964
Amount Recoverable From PAO (F) NEW DELHI				
GPF Advance	510,522		2,591,225	
CGEGIS	965,296		965,296	
DCRG	526,855		526,855	
Provisional Pension	282,136		282,136	
GPF Part/Final Payment	322,508	2,607,317	(7,871)	4,357,641
Amount Recoverable From Other Units				
DDOs (Premium for the moth of March)	-		-	
Deputation & Others	-		-	
Service Tax	-		-	
GPF Subscription	13,514	13,514	13,514	13,514
3. Income Accrued:				
a) On Investments from Earmarked/Endowments Funds	-		-	
b) On Investments-Others	-		-	
c) On Loans and Advances	2,083,590		2,083,590	
d) Others (includes income due unrealized - Rs.....)	-	2,083,590	-	2,083,590
4. Claims Receivable				
TOTAL(B)		**218,046,572**		**209,446,982**
TOTAL(A+B)		**657,559,973**		**630,574,108**

P.K. SINGHAL & CO. DELHI Chartered Accountants

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN

SCHEDULES FORMING PART OF INCOME EXPENDITURE ACCOUNT

FOR THE YEAR ENDING 31ST MARCH, 2013

SCHEDULE 12 – INCOME FROM SALES/SERVICES	CURRENT YEAR 31.03.2013	PREVIOUS YEAR 31.03.2012
	RS.	RS.
1) Income from Sales		
a) Sale of Finished Goods	-	-
b) Sale of Raw Material	-	-
c) Sale of Scraps	-	-
2) Income from Services		
a) Labour and Processing Charges	-	-
b) Professional /Consultancy Services	-	
c) Agency Commission and Brokerage	-	-
d) Maintenance Services(Equipment/Property)	-	-
e) Others(Specify)	-	-
f) Shairing Cost received from Other Users of KV	8,380,296	6,242,867
TOTAL	**8,380,296**	**6,242,867**

SCHEDULE 13 –GRANTS/SUBSIDIES	CURRENT YEAR 31.03.2013	PREVIOUS YEAR 31.03.2012
	RS.	RS.
(Irrevocable Grants& Subsidies Received)		
1) Central Government		
- To Plan (GC-General)	940,000,000	800,000,000
- To Non Plan (GC-General-KV)	233,730,000	245,000,000
- To North East (GC-General)	31,482,000	20,000,000
2) State Government	-	-
3) Government Agencies	-	-
4) Institutions/Welfare Bodies	-	-
5) International Organisations	-	-
6) Others(Specify)	-	-
TOTAL	**1,205,212,000**	**1,065,000,000**

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN

SCHEDULES FORMING PART OF INCOME EXPENDITURE ACCOUNT FOR THE YEAR ENDING 31ST MARCH, 2013

Amount-(Rs)

SCHEDULE 14 -FEES/SUBSCRIPTION	CURRENT YEAR 31.03.2013	PREVIOUS YEAR 31.03.2012
	RS.	RS.
1) Entrance Fees	-	-
2) Annual Fees/Subscription	-	-
3) Seminar/Program Fees	-	-
4) Consultancy Fees	9,000.00	23,500
5) Others(specify)	-	-
TOTAL	9,000.00	23,500

Note - Accounting Policies towards each item are to be disclosed

SCHEDULE 15-INCOME FROM INVESTMENTS	Investment from Earmarked Fund		Investment -Others	
(Income on Invest .from Earmarked/Endowment funds transferred to Funds)	CURRENT YEAR 31.03.2013	PREVIOUS YEAR 31.03.2012	CURRENT YEAR 31.03.2013	PREVIOUS YEAR 31.03.2012
	RS.	RS.	RS.	RS.
1) Interest				
a) On Govt. Securities	-	-	-	-
b) Other Bonds/Debentures	-	-	-	-
2) Dividends:		-	-	-
a) On Shares	-	-	-	-
b) On Mutual Fund Securities	-	-	-	-
3) Rents	-	-	-	-
4) Others(Specify)	-	-	-	-
			-	-
		-		
TOTAL	-	-	-	-
TRANSFERRED TO EARMARKED/ENDOWMENT FUNDS				

P.K. SINGHAL & CO. DELHI Chartered Accountants

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN

SCHEDULES FORMING PART OF INCOME EXPENDITURE ACCOUNT FOR THE YEAR ENDING 31ST MARCH, 2013

(Amount – Rs.)

SCHEDULE 16 – INCOME FROM ROYALTY, PUBLICATION ETC.	CURRENT YEAR 31.03.2013	PREVIOUS YEAR 31.03.2012
	RS.	RS.
1) Income from Royalty	-	-
2) Income from Publications	2,106,582	505,527
3) Others (specify)		-
4) Revenue Received (House Licence Fees,Guest House,Mandap etc.		-
TOTAL	2,106,582	505,527

SCHEDULE 17 – INTEREST EARNED ETC.	CURRENT YEAR 31.03.2013	PREVIOUS YEAR 31.03.2012
	RS.	RS.
1) On Term Deposits:		
a) With Scheduled Banks	16,873,405	10,100,690
b) With Non-Scheduled Banks	-	-
c) With Institutions	-	-
d) Others	-	-
2) On Saving Accounts:		-
a) With Scheduled Banks	-	-
b) With Non – Scheduled Banks	-	-
c) Post Office Savings Accounts	-	-
d) Others	-	-
3) On Loans:		-
i) Interest accrued during the year		
a) Employees/Staff	-	325,343
ii) Interest earned during the year	-	
a) Employees/Staff	1,083,047	1,849,353
4) Interest on Debtors and Other Receivables	-	-
TOTAL	17,956,452	12,275,386

Note – Tax deducted at source to be indicated

P.K. SINGHAL & CO. DELHI Chartered Accountants

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN

SCHEDULES FORMING PART OF INCOME EXPENDITURE ACCOUNT FOR THE YEAR ENDING 31ST MARCH, 2013

(Amount – Rs.)

SCHEDULE 18 – OTHER INCOME/PRIOR PERIOD ITEMS:	CURRENT YEAR 31.03.2013		PREVIOUS YEAR 31.03.2012
	RS.	RS.	RS.
1) Profit on Sale/disposal of Assets:			
a) Owned assets		-	-
b) Assets acquired out of grants, or received free of cost		-	-
2) Export Incentives realized		-	-
3) Fees for Miscellaneous Services		-	-
4) Miscellaneous Income		50,030,910.70	45,578,362.77
5)Prior Period Income		-	
(i) Accrued interest income of earlier years		-	1,758,247.00
TOTAL		50,030,910.70	45,578,362.77

SCHEDULE 19 – INCREASE/(DECREASE) IN STOCK OF FINISHED GOODS & WORK IN PROGRESS	CURRENT YEAR 31.03.2013		PREVIOUS YEAR 31.03.2012
	RS.	RS.	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 31.03.2013		PREVIOUS YEAR 31.03.2012
	RS.	RS.	RS.
a) Salaries and Wages			
NON PLAN (General Component-General)			
By Salaries (Technical Staff)	100,093,471		124,964,131
By Salaries (Non Technical Staff)	96,140,305		91,287,368
By Grant to KV (Salaries)	45,948,000	242,181,776	33,031,000
Plan (General Components-General)			
By Salaries (Technical Staff)	426,950,249		364,033,499
By Salaries (Non Technical Staff)	199,971,514	626,921,763	191,643,811
b) Allowances and Bonus		-	-
c) Contribution to Provident Fund		-	-
d) Contribution to other Fund (specify)			
Revenue Paid to Pension Cell ICFRE out of Own Revenue		92,215,250	15,900,000
e) Staff Welfare Expenses		-	-
f) Expenses on Employees' Retirement and Terminal Benefits		-	-
g) Other (specify) Shairing cost		-	14,754,745
h) Salary paid in excess than provision of previous year		7,921,177	-
TOTAL		969,239,966	835,614,554

P.K. SINGHAL & CO. DELHI Chartered Accountants

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN

SCHEDULES FORMING PART OF INCOME EXPENDITURE ACCOUNT FOR THE YEAR ENDING 31ST MARCH, 2013

(Amount – Rs.)

SCHEDULE 21 – OTHER ADMINISTRATIVE EXPENSES ETC.	CURRENT YEAR 31.03.2013		PREVIOUS YEAR 31.03.2012
	RS.	RS.	RS.
a) Purchases			
b) Labour and processing expenses			
c) Cartage and Carriage Inwards			
d) Electricity and power		32,966,396.00	33,426,436.00
e) Water Charges		2,024,228.00	2,331,927.00
f) Insurance			
g) Repairs and maintenance			
> Minor Works/Maintenance	49,984,416.00		29,525,698.00
> M & S (Lab Contingencies)	8,834,440.00	58,818,856.00	7,829,088.00
h) Excise Duty		-	
i) Rent, Rates and Taxes			
> Rent building / Equipment	534,601.00		492,690.00
> Municipal Tax	2,342,443.00	2,877,044.00	1,342,443.00
j) Vehicles Running and maintenance			
> Fuel	6,648,781.75		6,215,979.00
> Repair	3,466,658.00		3,613,446.00
> Road Taxes / Insurance	1,288,415.00	11,403,854.75	975,117.00
k) Postage, Telephone & Communication Charges			
> Telephone charges	2,914,690.00		3,261,507.00
> Postal / Stamp Charges	959,247.00	3,873,937.00	817,709.00
l) Printing and Stationary			
> Printings & Publication	2,877,663.00		2,643,675.00
> Stationery	2,288,263.00	5,165,926.00	2,101,992.00
m) Traveling and Conveyance Expenses			
> T.E. (Technical Staff)	11,219,468.00		10,261,273.00
> T.E. (Non Technical Staff)	5,589,427.00		8,275,620.00
> O.E. (Technical)	-	16,808,895.00	
n) Expenses on Seminar/Workshops			
> Seminar / Conference / HRD	5,784,853.00		5,603,800.00
> Extension - Normal	3,015,222.00		1,144,953.00
> V.V.K. & Demo Villages	2,652,142.00		4,955,154.00
> Direct to Consumer Project	2,015,596.00		
> DOE	597,327.00		520,253.40
> Field Research Expenses	37,732,069.00	51,797,209.00	33,020,722.00
o) Subscription Expenses			
p) Expenses on fees			
> Fellowship/Scholarship/cash Awards		20,136,778.00	23,954,322.00
q) Auditors Remuneration		95,506.00	88,240.00
r) Hospitality Expenses		-	
s) Professional Charges		2,627,996.00	2,193,470.00
t) Provisions for Bad and Doubtful Debts/ Advances		-	
u) Irrecoverable Balances Written-off		-	
v) Packing Charges		-	
w) Freight and Forwarding Expenses		-	
x) Distribution Expenses		-	
y) Advertisement and Publicity		2,901,675.00	2,680,022.00
z) Maintenance of Equipments			
> Scientific	2,768,798.00		3,609,219.00
> Office	3,082,145.00		3,180,225.00
> I.T. Equipments / Services	19,144,009.52	24,994,952.52	16,399,528.00
za) Others (specify) Municipal Tax		-	
zb) Contingency Expenditure		76,411,664.80	55,173,918.39
zc) Medicines / X-ray		4,162,390.00	6,650,753.00
zd) Liveries		91,980.00	96,351.00
ze) Newspaper Bill		447,525.00	444,004.33
zf) North East Expenditure		32,145,950.50	19,386,762.00
TOTAL		**349,752,763.57**	**292,216,297.12**

P.K. SINGHAL & CO. DELHI Chartered Accountants

ANNEXURE OF PLAN NORTH EAST EXPENDITURE

FOR THE YEAR ENDING 31.03.2013

PARTICULARS	AMOUNT RS.
By Salaries (Technical Staff)	-
By Salaries (Non Technical Staff)	-
By Salaries (Research KVS)	-
	-
Plan (General Components)	-
By Salaries (Technical Staff)	11,985,066.00
By Salaries (Non Technical Staff)	-
By T.E. (Technical Staff)	1,052,888.00
By T.E. (Non Technical Staff)	925,539.00
By O.E. (Technical)	-
Maintenance of Vehicle	-
- Fuel	284,550.00
- Repair	333,014.00
- Road Taxes / Insurance	182,290.00
Electricity Charges	1,450,291.00
Telephone charges	319,234.00
Maintenance of Equipments	-
- Scientific	2,661.00
- Office	76,785.00
- I.T. Equipments / Services	47,882.00
Others	-
- Water Charges	31,668.00
- Stationery	204,495.00
- Contingency Expenditure	6,252,948.00
- Legal / Consultancy charges	6,400.00
- Municipal Tax	-
- Medicines / X-ray	-
- Liveries	-
- Postal / Stamp Charges	56,981.00
- Advertisement	104,302.00
- Seminar / Conference / HRD	16,000.00
- Newspaper Bill	51,837.00
- Extension -Normal	282,532.00
- V.V.K. & Demo Villages	498,761.00
- Direct to Cunsumers Project	1,768,083.00
- Rent building / Equipment	-
Plan (Research)	
By Fellowship/Scholarship/cash Awards	1,980,667.00
Printings & Publication	2,790.00
Field Research Expenses	1,159,380.00
By M & S (Lab Contingencies)	1,988,296.50
By Minor Works/Maintenance	1,080,610.00
Conveyance Advances	-
HBA	-
TOTAL:	32,145,950.50

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN

SCHEDULES FORMING PART OF INCOME EXPENDITURE ACCOUNT FOR THE YEAR ENDING 31ST MARCH, 2013

(Amount – Rs.)

SCHEDULE 22 – EXPENDITURE ON GRANTS, SUBSIDIES ETC..	CURRENT YEAR 31.03.2013	PREVIOUS YEAR 31.03.2012
	RS.	RS.
a) Grants given to Institutions/Organisations		
> Grants to Universities	12,148,352	1,392,381
b) Subsidies given to Institution/Organisations		
TOTAL	12,148,352	1,392,381

SCHEDULE 23 – INTEREST.	CURRENT YEAR 31.03.2013	PREVIOUS YEAR 31.03.2012
	RS.	RS.
a) On Fixed Loans	-	-
b) On Other Loans (including Bank Charges)	-	-
c) Other (specify)		
TOTAL	-	-

P.K. SINGHAL & CO. DELHI Chartered Accountants

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION
SCHEDULES FORMING PART OF ACCOUNTS
FOR THE YEAR ENDING 31ST MARCH 2013

SCHEDULE 24 : SIGNIFICANT ACCOUNTING AND MANAGEMENT POLICIES.

1. **Method of Accounting**:- The financial statements have been prepared as of going concern under historical cost convention. Only salary has been recognized on accrual basis of accounting. The remaining items of the financial statement have been recognized on receipt/cash basis.

2. **Fixed Assets**:-
   - (i) The fixed assets are carried at cost of acquisition or book value less accumulated depreciation.
   - (ii) Depreciation is being charged in written down value basis and depreciation is routed through Income and Expenditure Account. For assets acquired after 30.09.2012, depreciation has been charged for half year only.
   - (iii) The Fixed Assets purchased out of the Funds received for projects and One Time Special Grant is directly shown under Project Payment and not capitalizing in the Books of Account.

3. **Transaction in Foreign Exchange**:- Transaction in Foreign Currencies are recorded at exchange rates prevailing on the date of transaction.

4. **Employees Retirement Benefits**:- Pension, leave encashment etc. are being accounted on cash basis. Accordingly no provision for the same is being made in the books of Accounts.

5. **Others**
   - **i. The interest earned on Bank Account(s) at various units are being recognized to revenue on the basis of actual receipts at ICFRE Head Quarters.**
   - **ii. Interest on Deposit Accounts are being recognized to revenue on actual receipts basis.**

Shri KANTHARAJ JUDE SEKAR
(Director General, ICFRE)

Dr. S.P. SINGH,
(Dy. Director General [Admin], ICFRE)

Shri S.D. SHARMA
(Assistant Director General [Admin], ICFRE)

Shri V.R. SRINIVASAN
(FA&CAO, ICFRE)

Smt. VIJAY DHASMANA
(Under Secretary [Admin], ICFRE)

FOR P.K. SINGHAL & CO.
CHARTERED ACCOUNTANTS

(P. K. SINGHAL)
PARTNER
Membership No.:073882
Dated:11.07.2013
Place: Dehradun

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION
SCHEDULES FORMING PART OF ACCOUNTS
FOR THE YEAR ENDING 31ST MARCH 2013

SCHEDULE:25 CONTINGENT LIABILITY AND NOTES ON ACCOUNTS:-

1. **Contingent Liabilities**:- No provision for contingent liabilities has been made in the books of accounts.

2. **Taxation**:- ICFRE is registered u/s 12AA of Income Tax Act, 1961 and exempt from Income Tax as per the provision of the act.

3. **Project Balance**:- The opening balance of units, balance outstanding under various projects and inter unit balances are subject to confirmation and reconciliation.

4. **Pension Fund**:- The amount recoverable from controller has been arrived on the basis of data produced by the units after reconciliation of the same with the books of the controller Pension Cell.

5. The advances given to external agencies such as KV is treated as expenditure in the year of advance itself irrespective of non-receipt of utilization certificate. Generally UCs are received in the next financial year.
   (a) Corresponding figures for the previous year have been regrouped/rearranged suitably as far as practicable in the new format of Financial Statement for the Central Autonomous Bodies. Figures have been regrouped/rounded off/adjusted.

6. The entries on accrual basis for salary have been incorporated in the financial statements at Head Office Level during Consolidation of Account.

7. The grant is recognized in the books of receipt basis. The grant received by the organization has been accounted for in following manners during the year:
   (a) The grant under Plan (GC) "General", Non-Plan (GC) "General", "KV" and Plan (North-East) [GC] "General" amounting to total of **Rs.120.52 Crores** is routed through Income and Expenditure Accounts.
   (b) The grant received as contribution towards capital/corpus totaling **Rs.7.25 Crores** (Plan & North-East) is directly transferred to Corpus Account in Balance Sheet.
   (c) The grant received as One Time Special Grant during the year of **Rs.9.22 Crores** has been shown as One Time Special Grant under Earmarked/Endowment fund in the Balance Sheet.
   (d) Interest on Corpus Fund (OTSC) of **Rs.85,45,774/-** has been shown in Schedule 8 with Earmarked and Endowment Fund.

8. Schedule 1 to 25 are annexed to and from an integral part of the balance sheet as at 31.03.2012 and the Income and Expenditure Account for the year ended on that date.

9. A sum of Rs.4,80,281/- has been capitalized during the year out of Advance account CPWD (paid in previous year(s)) on the basis of Utilization Certificate.

10. A sum of Rs.29,04,461/- has been capitalized during the year (towards Compound Wall of IFGTB) out of adjustment of Minor works and maintenance head incurred in previous year(s) for rectifying purpose.

Shri KANTHARAJ JUDE SEKAR
(Director General, ICFRE)

Dr. S.P. SINGH,
(Dy. Director General [Admin], ICFRE)

Shri S.D. SHARMA
(Assistant Director General [Admin], ICFRE)

Shri V.R. SRINIVASAN
(FA&CAO, ICFRE)

Smt. VIJAY DHASMANA
(Under Secretary [Admin], ICFRE)

FOR P.K. SINGHAL & CO.
CHARTERED ACCOUNTANTS

(P. K. SINGHAL)
Chartered Accountant
Membership No.:073882
Dated: 11.07.2013
Place: Dehradun

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN
RECEIPT & PAYMENT ACCOUNT FOR THE YEAR ENDING 31st, MARCH 2013

RECEIPTS	AMOUNT RS.	T.AMOUNT RS.	PAYMENTS	AMOUNT RS.	T.AMOUNT RS.
I. Opening Balances			**I. Expenses**		
a) Cash in hand	577,479.00		a) Establishment Expenses	956,459,155.59	
b) Bank Balances			b) Administrative Expenses (Corresponding to Schedule 21)	349,752,763.57	
i) Incurrent accounts	385,549,646.96		c) Expenditure On Grant Subsidy Etc(Corresponding to Schedule 22	12,148,352.00	1,318,360,271.16
ii) In deposit accounts	115,000,000.00		**II. Payments made against funds for various projects**	287,953,586.72	
iii) Savings accounts		501,127,125.96	Expenditure incurred out of one time special grant	108,826,090.00	
II. Grants Received			Expenditure on Interest Corpus Fund	2,605,206.00	399,384,882.72
a) From Government of India					
Plan (G.C-General) Project /Revenue	940,000,000.00		**III. Investments and deposits made**		
Non Plan (GC-General)	233,730,000.00		a) Out of Earmarked/Endowment funds	-	-
North East (General Component)	31,482,000.00		b) Out of Own Funds (Investments-Others)		
One Time Special Grant	92,200,000.00	1,297,412,000.00	**IV. Expenditure on Fixed Assets & Capital Work-in-Progress**		
Plan (Research/Creation of Assets)	50,000,000.00		a) Purchase of Fixed Assets		
North East (Capital Assets)	22,500,000.00	72,500,000.00	Scientific Equipments	32,651,477.00	
b) From State Government		-	Office Equipments	4,412,610.00	
c) From other sources (Project Receipts)		341,339,142.44	I.T. Equipments/Services	3,868,128.00	
III. Income on Investments from		-	Tools & Equipment	-	
a) Earmarked/Endow Fund		-	Furniture & Fixture	4,193,760.50	
b) Own Funds (Oth. Investments)		8,545,774.00	Books & Journals	5,905,228.00	
IV. Interest Received			Vehicles	-	
Interest Received from Schedule Banks		17,956,452.00	Land	1,753,400.00	
Other Receipts			Road and Buildings	8,952,329.00	63,736,932.50
V. Other Income (Specify)		52,146,492.37	b) Expenditure on Capital Work-in-progress/		
VI. Amount Borrowed			**V. Refund of surplus money/Loans**		-
VII. Any other receipts (give details)			**VI. Finance Charges (Interests)**		-
Revenue Receipt Payable to own Revenue Account No	35,274,829.00		**VII. Other Payments (Specify)**		
Revenue Receipt From D.D.Os	64,496,409.46		Revenue Received paid to own Revenue Account No	35,803,380.00	
Securities / EMD (Plan (GC)	10,006,738.00		Revenue Receipt paid to D.G. ICFRE	62,570,021.46	
Sharing Cost Received fromOther users of KVS	8,380,296.00		EMD/Security Refunded	5,451,989.00	
Reimbursement from PAO (F) New Delhi	3,983,418.00		**Advance Paid**		
Reimbursement from Controller, ICFRE	50,728,765.00		> CCU/ CPWD	11,678,185.00	
Recoveries from Staff on behalf of PAO(F) New Delhi	1,791,833.00		> Scientific Equipments	(134,008.00)	
Receipt from Staff on behalf of other Office	10,999,270.00		Payments made on Behalf of PAO(F) New Delhi	2,233,094.00	
Recoveries from Staff on Behalf of Controller ICFRE	121,080,706.00		Payments made on Behalf of the Controller ICFRE	52,262,045.00	
Recoveries of Advances from Staff on behalf of ICFRE	116,036,023.00		Payment made to PAO (F) on behalf of Staff	1,791,833.00	
Recoveries from Staff on behalf of Others	111,938,574.82		Payments made to other offices on behalf of Staff	10,999,270.00	
Inter Unit Transactions	-		Payments to Controller, ICFRE on Behalf of the Staff	121,115,890.00	
Recovered from AO.FRI from Revenue	-	534,716,862.28	Advances paid to Staff on behalf of ICFRE	113,788,761.00	
Corpus Fund			Payments made to other Offices on behalf of staff	107,890,181.82	
Advance Account CPWD		480,281.00	Inter Unit Transactions	-	525,448,642.28
			VIII. Closing Balances		
			a) Cash in hand	416,996.00	
			c) Bank Balances (In Deposit Account)	103,392,646.00	519,513,401.39
TOTAL		2,826,644,130.05	TOTAL		2,826,644,130.05

SH. KANTHARAJ JUDE SEKAR (Director General, ICFRE)

Dr. S.P.SINGH, (Dy. Director General, Admin., ICFRE)

SH. S.D.SHARMA, (Asst. Director General, Admin., ICFRE)

SH. V.R.SRINIVASAN, (Fin. Adviser & Chief Accounts Officer, ICFRE)

SMT. VIJAY DHASMANA (Under Secretary, Budget, ICFRE)

AS PER OUR SEPARATE REPORT OF EVEN DATE ANNEXED

FOR P.K.SINGHAL & ASSOCIATES,
CHARTERED ACCOUNTANTS

(P.K.SINGHAL Partner)
Chartered Accountant
Membership No. 73882
DATED: 11TH JULY, 2013

P. K. Singhal & Co.
Chartered Accountants

Maa Ambica Complex
Selakui, Distt. Dehradun (U.K.)
Pin : 248011
Mob. : 09313088386, 9837354951,
09997631720, Fax: 011-22013772
E-mail : pksinghalca@gmail.com

AUDITOR'S REPORT

To,
The Members,
Indian Council of Forestry Research & Education.
Dehradun.

1. We have audited the attached Balance Sheet of Indian Council of Forestry Research & Educations at 31st March, 2013 and the Income & Expenditure Account with Receipts & Payment Account for the year ended on that date annexed thereto. The accounts of various units/projects of the council were consolidated while preparing the Financials Statements. These financial statements are the responsibility of the Council's management. Our responsibility is to express an opinion on these financial statements based on our Audit.

2. We have conducted our audit in accordance with the auditing standards generally accepted in India. The Standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material mis-statement. An audit includes examining, on a test basis, evidence supporting the accounting and disclosures in the financial statements. An audit also includes assessing the accounting principles used and significant estimates made by management, as well as evaluating the overall financial statement presentation. We believe that our audit provides a reasonable basis for our opinion.

3. We report that : -

   (i) We have obtained all the information and explanations, which to the best of our knowledge and belief were necessary for the purpose of our audit, *except* MOUS' for all the units for the Funding Agencies and Fixed Assets Register for the Capital Assets acquired out of Grant Received for the Projects, which were not produced before us for our verification.

   (ii) In our opinion proper books of accounts as required by the law have been kept by the Council so far as it appears from our examination of the books.

P.K. SINGHAL & CO. DEHRADUN Chartered Accountants

P. K. Singhal & Co.
Chartered Accountants

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Pin : 248011
Mob. : 09313088386, 9837354951,
09997631720, Fax: 011-22013772
E-mail : pksinghalca@gmail.com

(iii) The Balance Sheet & Income and Expenditure Account dealt with by this report are in agreement with the books of account.

(iv) In our opinion and to the best of our information and according to the explanations given to us, subject to our comments in sub para "a to q" as follows :-

a. The Council is reducing the amount of Cheques-in-transit, sent by the respective DDO's to the Council on account of revenue, from the Corpus/Capital Fund and adding back in the next year. During the year 2012-13 a total amount of Rs. 24,32,597/- (included in Rs. 6,25,70,021/- for Revenue Receipts paid to D. G. ICFRE) for cheques-in-hand as at 31st March, 2013 was reduced from Corpus/Capital Fund. A total amount of Rs. 43,58,995/- (included in Rs. 6,44,96,409/- for Revenue received at DDO's) for cheques-in-hand as at 31st March, 2012 was added back to the Corpus/Capital Fund. As a result the current assets and capital fund were understated by Rs. 24,32,597/- for cheques-in-transit as at 31st March, 2013.

b. As refer to point 2(iii) of Schedule 24 for Significant Accounting and Management Policies, the council is not capitalizing the Fixed Assets purchased from the Fund received for Projects and One Time Special Grant since its inception. During the year 2012-13, the council purchased a total fixed assets of Rs. 7,34,23,888/- out of the Grant received for projects/OTSG. In absence of Fixed Assets register, we are unable to quantify the actual amount of fixed assets purchased out of the Grant received for projects/OTSG since its inception. It is worthwhile to mention here that in absence of Fixed Assets Register the chance of mis-utilisation can't be ruled out. The details of fixed assets purchased during the year are as under :-

S.N.	NATURE OF GRANT	AMOUNT RS.
1	One Time Special Grant	6,34,73,071/-
2	Project Funds	99,50,817/-
TOTAL		7,34,23,888/-

P.K. SINGHAL & CO. DEHRADUN Chartered Accountants

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Mob. : 09313088386, 9837354951,
09997631720, Fax: 011-22013772
E-mail : pksinghalca@gmail.com

c. The purchase of fixed Assets at Plan of Rs. 2,12,51,477/- was charged to revenue. If it was to be capitalized, a total depreciation of Rs. 9,40,009/- would be charged. As a result the deficit for the year was overstated by Rs. 2,03,11,468/-.

d. The amount of Project Receipts and Project Payments are over stated by Rs. 1,98,08,190/- and Rs. 2,06,75,488/- respectively at Schedule – 3 of EARMARKED/ENDOWENT FUNDS. The details of which are given as under :-

S. N.	NATURE OF TRANSACTIONS	RECEIPTS RS.	PAYMENTS RS.
1	INTER UNIT TRANSFER OF FUND	1,86,97,004/-	1,86,97,004/-
2	TDS/PROFESSIONAL TAX	4,71,184/-	4,71,184/-
3	CASH DEPOSIT WITH THE BANK	3,86,148/-	3,86,148/-
4	FUND DEDUCTED FROM STAFF	2,32,354/-	2,32,354/-
5	SECURITY RECEIVED/PAID	21,500/-	888,798/-
TOTAL		1,98,08,190/-	2,06,75,488/-

e. During the year 2012 – 13 the council earned a total of Rs. 71,45,213/- for Intellectual Fee/Institutional charges for handling the various projects on which no Service Tax was paid.

f. In absence of respective MOU's with the funding agency we are unable to give any comments about liabilities of Service Tax on the fund received at the units other than Dehradun Units for the Projects.

g. During the year 2012-13 the Council refunded back a total amount of Rs. 10,69,440/- to the funding agency as an unspent money. In absence of respective MOU's with the funding agency we are unable to give any comments on the same.

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h. As at 31st March, 2013 a total amount of Rs. 2,08,06,701/- was lying in Bank Account(s) as unspent money of the projects expired during previous year(s). During the year a total amount of Rs. 7,29.976/- and Rs. 51,14,729/- were incurred for Capital Expenditure and Revenue Expenditure respectively without taking the extension from the Funding Agency.

i. As refer to point 5(i) of Schedule 24 for Significant Accounting and Management Policies, **the interest earned on Bank Account(s) at various units are being recognized to revenue on the basis of actual receipts at ICFRE Head Quarters.** During the year 2012 – 13 a total amount of Rs. 22,42,862/- was not recognized as revenue for interest earned on Bank Accounts of various projects. The net unrecognized amount of Rs. 15,08,902/- was lying at Current Liabilities under amount payble for controller ICFRE.

j. As refer to point 5(ii) of Schedule 24 for Significant Accounting and Management Policies, **Interest on Deposit Accounts are being recognized to revenue on actual receipts basis. During the year 2012 – 13 a total interest of Rs. 32,07,590/- on deposits was not recognized to revenue.**

k. During the year 2012 – 13, the Jodhpur Unit transferred a total amount of Rs. 16,49,805/- to revenue out of fund received of Rs. 26,90,717/- from Funding Agency i.e. 61.31% of fund received. In absence of respective MOU's we are unable to give any comment on it.

l. It was observed that the Council did not deduct Income Tax of Rs. 2,83,536/- on a total payment of Rs. 31,03,668/-.

m. A total cheques of Rs. 1,99,280/- which had become stale cheques were lying in Bank Reconciliation statement.

n. A total cheques of Rs. 3,54,245/- were lying in Bank Reconciliation Statement as cheques deposited but not cleared.

P.K. SINGHAL & CO. DEHRADUN Chartered Accountants

P. K. Singhal & Co.
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o. A total amount of Rs. 3,166/- was lying in B. R. statement, stated as Bank charges charged by bank and not recognized as expenditure in the Books of Account.

p. No MOUS' were produced before us except some of the MOU's of Dehradun Unit, due to which we are unable to verify whether :-

i. The fund utilized on the projects were according to terms & conditions of the Funding Agency.

ii. The amount of Rs.7,29,976/- and Rs. 51,14,729/- incurred on capital and revenue expenditure respectively on expired project were justified.

q. No Financial & stock records are maintained for capital assets acquired out of grants received.

The said accounts read together with the Significant Accounting & Management Policies and Contingent Liability and Notes on Accounts in Schedule 24 & 25 respectively give the information required by the Law in the manner so required and **give a true and fair view** in conformity with the accounting principles generally accepted in India:

i) In the case of the Balance sheet, of the state of affairs of the above name Council as at 31st March, 2013; and

ii) In the case of the Income and Expenditure Account, of the Deficit for the year ended on that date.

For P. K. SINGHAL &CO.
Chartered Accountants

CA P. K. Singhal
(Partner)
M. No. 073882
Firm Reg. No. 05051C

Place: Dehradun

Date: 11/07/2013

Reply to Auditor's Comments in Para 3 (iv) (Sub- Para a to q) as contained in the Auditors report on the Balance Sheet of ICFRE at 31.03.2013 and the Income & Expenditure Account with Receipt & Payment Accounts for 2012-13

Sub-Para	Audit Observations	Reply
a.	The Council is reducing the amount of Cheques in transit, sent by the respective DDO's to the Council on account of revenue, from the Corpus/Capital Fund and adding back in next year. During the year 2012-13 a total amount of Rs.24,32,597/- (included in Rs.6,25,70,021/- for Revenue receipts paid to D.G. ICFRE) for cheques in hand as at 31st March, 2013 was reduced from Corpus/Capital Fund. A total amount of Rs.43,58,995/- (included in Rs.6,44,96,409/- for Revenue received at DDO's) for cheques in hand as at 31st March, 2012 was added back to the Corpus/Capital Fund. As a result the current assets and capital fund were understated by RS.24,32,597/- for cheques in transit as at 31st March, 2013.	These are remittances between Units/Institutes and Hq. being revenue amounts in transit as on 31st March. These have been reconciled separately. They are not shown under 'current assets and loans and advances' since the amount remained in transit as on 31st March. Since this pertains to ICFRE and its constituent units only, it is being shown under Capital fund. Typically 'current assets and loan & advances' pertain to actual bank balances or receivables from outside agencies while Capital fund (Schedule – 1) is the equivalent to owners' equity. Hence, this item is correctly depicted in the Balance Sheet as per Accounting Procedure being followed.
b.	As refer to point 2(iii) of Schedule 24 for Significant Accounting and Management Policies, the council is not capitalizing the Fixed Assets purchased from the Fund received for Projects and One Time Special Grant since its inception. During the year 2012-13 the council purchased a total fixed assets of RS.7,34,23,888/- out of the Grant received for projects/OTSG. In absence of Fixed Assets register, we are unable to quantify the actual amount of fixed assets purchased out of the Grant received for project/OTSG since its inception. It is worthwhile to mention here that in absence of Fixed Assets Register the chance of mis-utilization can't be ruled out. The details of fixed assets purchased during the year is as under:- One Time Special Grant Rs.6,34,73,071/- Project Funds Rs. 99,50,817/- **TOTAL Rs. 7,34,23,888/-**	All fixed assets purchased from the funds received for projects/OTSG are entered in the Permanent Stock Register (PSR). However, action is also being taken for updating Fixed Asset Register. Capitalization is done only after the project/OTSG scheme is complete and ownership of the assets are specifically transferred to ICFRE in case of projects.
c.	The purchasing of fixed assets at Plan of Rs.2,12,51,477/- was charged to revenue. If it was to be capitalized, a total depreciation of Rs.9,40,009/- would be charged. As a result the deficit for the year was overstated by Rs.2,03,11,468/-	There was an unexpected cut in funding from MoEF. While additional ICFRE Plan RE for FY 2012-13 of Rs. 30 crore was approved by MoEF, based on which additional allocations were made to various Institutes/units, the actual additional amount released was only Rs. 12 crore. Due to this, many Institutes/units were forced to meet out the bills for the equipment etc delivered as per orders placed (based on expected additional funding) out of Plan GC-General. However, the correcting entry for capitalization of these assets would be made during the FY 2013-14, along with adjustment for depreciation w.e.f. date of purchase.
d.	The amount of Project Receipt and Project Payments are over stated by Rs.1,98,08,190/- and Rs.2,06,75,488/- respectively at Schedule – 3 of Earmarked/Endowent funds. The details are given as under:-	The project receipts and project payments are shown in schedule 3 (Earmarked funds) and only the closing balance travels to the balance sheet. The closing balance of projects in the Balance Sheet is not affected by such mutual transactions.

S.No.	Nature of Transactions	Receipts	Payments
1.	Inter unit transfer of fund	1,86,97,004/-	1,86,97,004/-
2.	TDS/professional tax	4,71,184/-	4,71,184/-
3.	Cash deposit with bank	3,86,148/-	3,86,148/-
4.	Fund deducted from staff	2,32,354/-	2,32,354/-
5.	Security received/paid	21,500/-	888,798/-
TOTAL		**1,98,08,190/-**	**2,06,75,488/-**

FA&CAO

ADG (Admin)

DDG (Admin)

e.	During the year 2012-13 the council earned a total of Rs.71,45,213/- for Intellectual Fee/Institutional charges for handling the various projects on which no Service Tax was paid.	Institutional charges are towards recovery of overhead administrative charges. Hence no service tax appears to be leviable on such recoveries. However, on the consultancy fee charged, service tax is paid as per rules applicable.
f.	In absence of respective MOU's with the funding agency we are unable to give any comments about liabilities of Service Tax on the fund received at the units other than Dehradun Units for the Projects.	Every project is governed by terms & conditions of funding agency and there may not be an MoU for every such project. As regards Service Tax, the same is being deposited strictly in accordance with Service Tax Rules, wherever applicable.
g.	During the year 2012-13 the Society refunded back a total amount of Rs.10,69,440/- to the funding agency as an unspent money. In absence of respective MOU's with the funding agency we are unable to give any comments on the same.	Every project is governed by terms & conditions of funding agency and there may not be an MoU for every such project. However, all the refunds are made only as per such terms & conditions and specific directions from the funding agency.
h.	As at 31st March, 2013 a total amount of Rs.2,08,06,701/- was lying in Bank Account(s) as unspent money of the projects expired during previous year (s). During the year a total amount of Rs.7,29,976/- and Rs.51,14,729/- were incurred for Capital Expenditure and Revenue Expenditure respectively without taking the extension from the Funding Agency.	Every project is governed by terms & conditions of funding agency and expenditure beyond closing date is normally incurred only after obtaining specific approvals, project requirements and directions from the funding agencies.
i.	As refer to point 5(i) of Schedule 24 for Significant Accounting and Management Policies, the interest earned on Bank Account(s) at various units are being recognized to revenue on the basis of actual receipts at ICFRE Head Quarters. During the year 2012-13 a total amount of Rs.22,42,862/- was not recognized as revenue for interest earned on Bank Accounts of various projects. The net unrecognized amount of Rs.15,08,902/- was lying at Current Liabilities under amount payable for controller ICFRE.	It has already been stated in the accounting policy point 5(i) of schedule 24, that the interest earned on Bank Account(s) at various units are being recognized to revenue on the basis of actual receipts at ICFRE Head Quarters. The interest on project bank accounts which are not transferred to ICFRE HQ are hence not taken to revenue. As regards current liabilities under amount payable to Controller, ICFRE, the amount has come down from Rs. 15,08,902/- to Rs. 2,65,920/- by relevant adjustments. This amount shall also be adjusted in due course.
j.	A refer to point 5(ii) of Schedule 24 for Significant Accounting and Management Policies, Interest on Deposit Accounts are being recognized to revenue on actual receipts basis. During the year 2012-13 a total interest of Rs. 32,07,590/- on deposits was not recognized to revenue.	It has already been stated in the accounting policy point 5(ii) of schedule 24, the interest earned on Deposit Account(s) are to be recognized to revenue on actual receipt basis. Hence, interest amount not actually received at ICFRE HQ are not taken to revenue as per accounting policy.
k.	During the year 2012-13, the Jodhpur Unit transferred a total amount of Rs. 16,49,805/- to revenue out of fund received of Rs. 26,90,717/- from Funding Agency i.e. 61.31% of fund received. In absence of respective MOU's we are unable to give any commen-t on it.	Funds under projects are often received in several installments from the funding agency spread over the duration of the project. Transfer of Institutional charges to revenue is usually made on completion of the project. However, details of fund received and revenue transferred in respect of AFRI (Jodhpur) projects will be shown to next audit.
l.	It was observed that the Council did not deduct Income Tax of Rs.2,83,536/- on a total payment of Rs.31,03,668/-.	TDS is effected on all payments **above the prescribed limit** as per Income Tax Act.
m.	A total cheques of Rs.1,99,280/- which had become stale cheques were lying in bank Reconciliation statement.	Necessary action to clear all the long outstanding items in the Bank Reconciliation Statement is being taken and will be shown to next auditors.
n.	A total cheques of Rs.3,54,245/- were lying in Bank Reconciliation Statement as cheques deposited but not clear.	
o.	A total amount of Rs.3,166/- was lying in B. R. statement, stated as Bank charges charged by bank and not recognized as expenditure in the Books of Account.	
p.	No MOU's were produced before us except some of the MOU's of Dehradun Unit, due to which we are unable to verify whether i. The fund utilized on the project were according to terms & conditions of the funding agency. ii. The amount of Rs. 729976/- and Rs.5114729/- incurred on capital and revenue expenditure respectively on expired projects were justified.	Every project is governed by terms & conditions of funding agency and there may not be an MoU for every such project. Utilization Certificates are provided for each project which encompass all these aspects. In fact, next installment of funds are released only after such utilization certificates duly signed by the PIs are made available to the funding agency and as such no specific MOU's on these aspects are entered into with funding agencies. Expenditure beyond closing date is normally incurred only after obtaining specific approvals, project requirements and directions from the funding agencies.
q.	No financial & Stock records are maintained for capital assets acquired out of grants received.	Institute-wise & Head-wise budget allocation & expenditure under Capital Assets is maintained and monitored regularly. Further, all Capital Assets acquired out of grants received are invariably entered in the Permanent Stock Register. However, Fixed Asset Register is also being updated at the respective Institutes/Units.

FA&CAO

ADG (Admin)

DDG (Admin)

P. K. Singhal & Co.
Chartered Accountants

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AUDITOR'S REPORT

To,
The Members,
Pension Cell
Indian Council of Forestry Research & Education.
Dehradun.

1. We have audited the attached Balance Sheet of Pension Cell of Indian Council of Forestry Research & Educations, Dehradun at 31st March, 2013 and the Income & Expenditure Account for the year ended on that date. These financial statements are the responsibility of the Pension Cell's management. Our responsibility is to express an opinion on these financial statements based on our Audit.

2. We have conducted our audit in accordance with the accounting, standards generally accepted in India. These Standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material mis-statement. An audit includes examining, on a test basis, evidence supporting the accounting and disclosures in the financial statements. An audit also includes assessing the accounting principles and significant estimates made by management, as well as evaluating the overall financial statement presentation. We believe that our audit provides a reasonable basis for our opinion.

3. In our opinion and to the best of our information's and according to the explanations given to us the said accounts give a true and fair view : -

   i) In the case of the Balance sheet, of the state of affairs of the above name Council as at 31st March, 2013; and

   ii) In the case of the Income and Expenditure Account, of the Surplus for the year ended on that date.

For P. K. SINGHAL &CO.
Chartered Accountants

CA P. K. Singhal
(Partner)
M. No. 073882
Firm Reg. No. 05051C

Place: Dehradun

Date: 11/07/2013

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, 2013

(Amount-Rs.)

CORPUS/CAPITAL FUND AND LIABILITIES	SCHE-DULE	CURRENT YEAR AS ON 31.03.2013		PREVIOUS YEAR AS ON 31.03.2012	
		RS.	RS.	RS.	RS.
PENSION CELL FUND ACCOUNT					
GENERAL PROV.FUND A/C	1	497,761,806.38		426,385,158.38	
GSLIS A/C	1	597,708.96		552,910.96	
PENSION A/C	1	1,147,390,258.64		1,048,943,904.05	
NEW PENSION FUND A/C	1	2,837,910.00	1,648,587,683.98	2,584,991.00	1,478,466,964.39
TOTAL			1,648,587,683.98	1,478,466,964.39	1,478,466,964.39
FIXED ASSETS			-		-
CURRENT ASSETS LOANS & ADV.					
INVESTMENTS-OTHERS			1,603,594,730.18		1,463,969,302.18
CASH & BANK BALANCES:			44,992,953.80		14,497,662.21
TOTAL			1,648,587,683.98	-	1,478,466,964.39
SIGNIFICANT ACCOUNTING POLICIES		2			
CONTINGENT LIABILITIES AND NOTES ON		2	-		-

SH. KANTHARAJ JUDE SEKAR (Director General, ICFRE)

Dr. S.P.SINGH , (Dy. Director General, Admin., ICFRE)

SH. S.D.SHARMA, (Asstt. Director General, Admin., ICFRE)

SH. V.R.SRINIVASAN, (Fin. Adviser & Chief Accounts Officer, ICFRE)

SMT. VIJAY DHASMANA (Under Secretary, Budget, ICFRE)

"AS PER OUR SEPARATE REPORT OF EVEN DATE ANNEXED"

FOR P.K.SINGHAL & CO.,
CHARTERED ACCOUNTANTS

(P.K.SINGHAL) Partner
Chartered Accountant
Membership No. 073882
DATED: 11TH JULY, 2013
PLACE: DEHRADUN

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN
DETAILS OF PENSION FUND AS ON 31ST MARCH 2013

SCHEDULE - I

(As Per Annexure 'B')	GPF	GSLIS	PENSION	NEW PENSION	TOTAL
	RS.	RS.	RS.	RS.	RS.
Opening	426,385,158.38	552,910.96	1,048,943,904.05	2,584,991.00	1,478,466,964.39
Add : Excess Of Income Over Expenditure	43,327,054.00	29,920.00	227,472,302.59	168,574.00	270,997,850.59
Add : Tfd.from General Fund	0.00	0.00	0.00	0.00	0.00
Saving Fund under GSLIS		1,129,850.00			1,129,850.00
Death Claim		698,327.00			698,327.00
Received from PAO	1,490,647.00		19,476,594.00		20,967,241.00
Subscription/contribution	111,015,363.00	1,677,897.00			112,693,260.00
New Pension Scheme/LSPC			267,731.00	8,651,373.00	8,919,104.00
Misc. receipts	0.00	0.00	0.00		0.00
TOTAL:	112,506,010.00	3,506,074.00	19,744,325.00	8,651,373.00	144,407,782.00
Less :					
Death Claim Paid		749,355.00			749,355.00
Saving Fund		1,089,861.00			1,089,861.00
Subscription to LIC		1,651,980.00			1,651,980.00
GPF Advance Reimbursement	30,117,238.00				30,117,238.00
GPF Part/Final Payment	41,852,213.00				41,852,213.00
GPF Final Payment	12,469,228.00				12,469,228.00
Pensionary Benefit paid			121,888,673.00		121,888,673.00
Paid to NSDL on A/c of NPS Contr.				8,567,028.00	8,567,028.00
DCRG			24,942,482.00		24,942,482.00
ISO Charges/Miscellenous Payments	17,737.00	0.00	1,939,118.00		1,956,855.00
TOTAL:	84,456,416.00	3,491,196.00	148,770,273.00	8,567,028.00	245,284,913.00
TOTAL:	497,761,806.38	597,708.96	1,147,390,258.64	2,837,910.00	1,648,587,683.98

SH. KANTHARAJ JUDE SEKAR (Director General, ICFRE)

Dr. S.P.SINGH, (Dy. Director General, Admin., ICFRE)

SH. S.D.SHARMA, (Asstt. Director General, Admin., ICFRE)

SH.V.R.SRINIVASAN, (Fin. Adviser & Chief Accounts Officer, ICFRE)

SMT. VIJAY DHASMANA (Under Secretary, Budget, ICFRE)

"AS PER OUR SEPARATE REPORT OF EVEN DATE ANNEXED"
FOR P.K.SINGHAL & CO.,
CHARTERED ACCOUNTANTS

(P.K.SINGHAL)Partner
Chartered Accountant
Membership No. 73882
DATED: 11TH JULY, 2013
PLACE: DEHRADUN

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN

PENSION-INCOME & EXPENDITURE ACCOUNT FOR THE YEAR ENDING 31ST MARCH 2013

INCOME	AMOUNT RS.
GRANT IN AID	
Received through DDG(ADMIN)	-
Received from Revenue ICFRE	92,215,249.59
Interest	135,257,053.00
TOTAL:.....	227,472,302.59
EXPENDITURE	**AMOUNT**
Expenditure	-
Excess Of Income Over Expentiture	227,472,302.59
TOTAL:.....	227,472,302.59

GPF-INCOME & EXPENDITURE ACCOUNT FOR THE YEAR ENDING 31ST MARCH 2013

INCOME	AMOUNT RS.
Interest & Dividend	43,327,054.00
TOTAL:.....	43,327,054.00
EXPENDITURE	
Excess Of Income Over Expentiture	43,327,054.00
TOTAL:.....	43,327,054.00

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN

SCHEDULE 1-"B"

GSLIS-INCOME & EXPENDITURE ACCOUNT FOR THE YEAR ENDING 31ST MARCH 2013

INCOME	AMOUNT RS.
Interest	29,920.00
TOTAL:.....	29,920.00
EXPENDITURE	**AMOUNT**
Excess Of Income Over Expentiture	29,920.00
TOTAL:.....	29,920.00

NEW PENSION ACCOUNT INCOME & EXPENDITURE A/C FOR THE YEAR ENDING 31ST MARCH, 2013

INCOME	AMOUNT RS.
Interest	168,574.00
TOTAL:.....	168,574.00
EXPENDITURE	**AMOUNT**
Excess Of Income Over Expentiture	- 168,574.00
TOTAL:.....	168,574.00

P.K. SINGH & CO. DELHI Chartered Accountants

CONTROLLER,PENSION CELL, (GPF, GSLIS, PENSION SCHEME AND NEW PENSION SCHEME,)
INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN
RECEIPTS & PAYMENTS ACCOUNT FOR THE YEAR ENDING 31st March 2013

RECEIPTS	AMOUNT	TOTAL AMOUNT	PAYMENTS	AMOUNT	TOTAL AMOUNT
Opening Balance as on 01.04.2012			GPF reimbursement to DDO's	30,117,238.00	
Cash in hand	-		GPF Part Final payment	41,852,213.00	
Cash at Bank	14,497,662.21		GPF Final payment	12,469,228.00	
F.D.R.ACCOUNT	1,463,969,302.18	1,478,466,964.39	Death Claims paid	749,355.00	
Amount recd. From DDG Admin(Revenue)		92,215,249.59	Saving fund paid	1,089,861.00	
Amount received from PAO (F) on			Amount of premium to LIC for GSLIS Subscripti	1,651,980.00	
account of GPF transfer	1,490,647.00	1,490,647.00	Pensionary benefit paid	121,888,673.00	
Amount received from Various DDO'S on			Reimbursement of DCRG, Pension to	-	
account of GPF Subscription	111,015,363.00	111,015,363.00	Various DDO's	24,942,482.00	
Amount received from Others on account of			ISO Charges	8,567,028.00	
refund of excess GPF Payments	-	-	Miscellenous Payments(GPF A/c)	1,956,855.00	245,284,913.00
Closer of New Pension Accounts	-	-	**Closing Balance as on 31.03.2013**		
Bank & FDR Interest	178,782,601.00	178,782,601.00	Cash-in-hand	-	
Amount received on account of Saving			Name of Component		
Funds under GSLIS	1,129,850.00	1,129,850.00	Cash at Bank with different institutes/units.		
Amount received on account of Death			Plan (GC) / Revenue / Project	44,992,953.80	
Claim under GSLIS	698,327.00	698,327.00	Name of Component		
Subscription from variuos DDOs	1,677,897.00	1,677,897.00	FDR's	1,603,594,730.18	1,648,587,683.98
Pro-rata Pensionary benefit received					
from PAO (F)	19,476,594.00	19,476,594.00			
Amount received from Various DDO's on					
account of Pension Contribution	8,651,373.00	8,651,373.00			
Amount received from other Departments					
on account of Pensionery benefits (LSPC)	267,731.00	267,731.00			
Misc. Receipts	-	-			
TOTAL:		**1,893,872,596.98**	**TOTAL:**	-	**1,893,872,596.98**

SH. KANTHARAJ JUDE SEKAR (Director General, ICFRE)

Dr. S.P.SINGH, (Dy. Director General, Admin., ICFRE)

SH. S.D.SHARMA, (Asstt. Director General, Admin., ICFRE)

SH.V.R.SRINIVASAN, (Fin. Adviser & Chief Accounts Officer, ICFRE)

SMT. VIJAY DHASMANA (Under Secretary, Budget, ICFRE)

"AS PER OUR SEPARATE REPORT OF EVEN DATE ANNEXED"

FOR P.K.SINGHAL & CO.,
CHARTERED ACCOUNTANTS

P.K.SINGHAL (Partner)
Chartered Accountant
Membership No. 73882
DATED:
PLACE: DEHRADUN

ANNEXURE

Annexure - I

Members of Board of Governors as on 31st March 2013

Chairman:
Dr. T. Chatterjee
Secretary to the Govt. of India and
Ministry of Environment and Forests,
Paryavaran Bhawan, CGO Complex,
Lodhi Road, New Delhi. 110 003.

Vice Chairman:
Dr. P.J. Dilip Kumar,
Director General of Forests and
Special Secretary to the Govt. of India,
Ministry of Environment and Forests,
Paryavaran Bhawan, CGO Complex,
Lodhi Road, New Delhi. 110 003.

Member Secretary:
The Director General,
Indian Council of Forestry Research and Education,
Dehra Dun

Members:
The Additional Secretary and Financial
Advisor,
Ministry of Environment and Forests,
Paryavaran Bhawan, CGO Complex,
Lodi Road, New Delhi. 110 003.

The Director General,
Indian Council of Agricultural Research,
Krishi Bhawan,
New Delhi

The Director General,
Council for Scientific and Industrial Research,
2, Rafi Marg, Anusandhan Bhawan,
New Delhi.

The Chairman,
University Grants Commission,
Bahadur Shah Zafar Marg,
New Delhi.

The Director,
Wildlife Institute of India,
Chandrabani, Clement Town,
Dehra Dun

The Director,
Indian Institute of Forest Management,
Nehru Nagar, Bhopal (M.P.) – 462 003

The Director,
Indira Gandhi National Forest Academy,
P.O. New Forest, Dehra Dun- 248 006

The Secretary to the Govt. of India,
Department of Science and Technology,
Technology Bhawan,
New Mehrouli Road, Delhi.

The Director General,
Forest Survey of India,
Kaulagarh Road, Dehra Dun

Dr. A.K. Pathak,
Vice Chancellor,
Navsari Agriculture University,
Navsari (Gujrat) - 396 450
Fax No. 02637- 282554

Dr. S.K. Sharma,
Vice Chancellor,
C.S.K. Himachal Pradesh Krishi Vishwavidhayalaya
Palampur, Kangara- 176 061.

The President,
Nothern Indian Plywood Manufactures Associations,
Venus Plywood Pvt. Ltd.
V. Raowalim Pathankot Road,
Jalandhar- 144 004.
Fax – 0181- 290391

The Principal Chief Conservator of Forests,
Tripura forest Department,
Aranya Bhawan, Nehru Complex,
Agartala (Tripura) – 797 001

The Principal Chief Conservator of Forests,
Karnataka State, 18th Cross,,
Aranya Bhawan, Malleswaram,Bangalore

The Director,
Institute of Forest Genetics and Tree Breeding,
Coimbatore

The Director,
Himalayan Forest Research Institute, Shimla

The Deputy Director General (Education),
ICFRE, Dehra Dun

Dr. Gurudev Singh, Scientist 'G',
IFGTB, Coimbatore.

Annexure - II

Right To Information

A Public Information Officer and Appellate Authority are functioning in the Public Authority, ICFRE under the RTI Act 2005. During the year 2012-13, RTI application (214) and RTI Appeals (08) are disposed off. Quarterly RTI returns are regularly uploaded by the ICFRE. A Transparency Officer under the RTI Act is functioning in ICFRE.

RTI Application Request	Opening Balance	No. of applications received as transfer from other P/As u/s 6(3)	Received during the period (including cases transferred to other Public Authority)	Number of cases transferred to other Public Authorities u/s 6(3)	Decisions where requests /Appeals rejected	Decisions where requests /Appeals accepted
1st Quarter	06	19	71	06	00	68
2nd Quarter	22	11	49	05	00	55
3rd Quarter	22	10	33	06	00	45
4th Quarter	14	06	42	04	00	46
Total	**64**	**46**	**195**	**21**	00	**214**
RTI First Appeals						
1st Quarter	03	N/A	00	N/A	00	03
2nd Quarter	00	N/A	01	N/A	00	01
3rd Quarter	00	N/A	02	N/A	00	02
4th Quarter	00	N/A	03	N/A	00	02
Total	**03**	–	**06**	–	–	**08**

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	Shri S.D. Sharma, Asstt. Director General (Stat.) Phone (O) : 0135-2224865, 0135-2752229 E-mail : sdsharma@icfre.org, adg_stat@icfre.org	Dr. Devendra Kumar, Scientist C, ICFRE Phone (O) :0135-2224835, 0135-2751270 E-mail : devendra@icfre.org	All matters related to ICFRE Hqrs., Dehradun
Forest Research Institute, P.O. New Forest, Dehradun-248 006	Dr. P.P. Bhojvaid, Director Forest Research Institute P.O. New Forest Dehradun- 248006 Phone: 0135-2224444, 2755277 Fax: 0135- 2756865 E-mail: dir_fri@icfre.org	Shri A.S. Rawat, Group Coordinator (Research), FRI P.O. New Forest Dehradun- 248 006 Phone : 0135-2224316, 0135-2752670, E-mail: groupco_fri@icfre.org	All Research & Account matters
		Dr. A.K. Tripathi, Registrar Deemed University, FRI Phone: 0135-2224439 (O) 0135-2751826 (O) Email: draktripathi@icfre.org	University matters
		Shri Deepak Mishra, Registrar, FRI Phone: 0135-2224316 (O) 0135-2752670 (O)	Establishment, Administrative & all other matters
Centre for Social Forestry and Eco-Rehabilitation (CSFER), 3/1, Lajpath Rai Road, New Katra, Allahabad-211 002	Dr. P.P. Bhojvaid, Director Phone: 0135-2224444, 2755277 Fax: 0135- 2756865 E-mail: dir_fri@icfre.org	Dr. Kumud Dubey Scientist and Director CSFER Phone:0532-2440795 Fax :0532-2440797 E-mail: head_csfer@icfre.org dir_csfer@icfre.org	All matters related to CSFER, Allahabad
Institute of Forest Genetics and Tree Breeding, Forest Campus, P.B.No 1061 R.S.Puram, Coimbatore - 641 002	Dr. N. Krishnakumar, Director, IFGTB, Coimbatore, Phone: 0422-2431942 (O) Fax. 0422-2430549 E-mail: dir_ifgtb@icfre.org	Shri T.P. Raghunath, Group Coordinator (Res.), IFGTB, Coimbatore Phone: 0422-2431540 (O)	All matters related to IFGTB, Coimbatore
Institute of Wood Science & Technology, PO Malleswarum, Bangalore -560003	Shri S.C. Joshi, Director, IWST Bangalore Phone : 080-23341731, E-mail: dir_iwst@icfre.org	Dr. K. Murugesan, Group Coordinator (Res.), IWST Bangalore, Phone: 080-22190106(O)	All matters related to IWST, Bangalore

Tropical Forest Research Institute, Jabalpur P.O. – R.F.R.C, Mandla Road, Jabalpur – 482 021	Dr. U. Prakasham, Director TFRI, Jabalpur RFRC Mandla Road, Jabalpur. Phone : 0761-5044003, E-mail: dir_tfri@icfre.org	Dr. Rupnarayan Sett, TFRI Jabalpur. Phone: 0761-5044003 (O)	All matters related to TFRI, Jabalpur
Centre for Forestry Research and Human Resources Development (CFRHRD), P.O. Kundalikala, Poama, Chhindwara - 480001	Dr. U. Prakasham, Director TFRI, Jabalpur RFRC Mandla Road, Jabalpur. Phone : 0761-5044003, E-mail: dir_tfri@icfre.org	Dr. P. Subramanyam, IFS, Director CFRHRD, Chhindwara Phone : 07162-254473 (O) Fax: 07162-254463 Email: head_cfrhrd@icfre.org	All matters related to CFRHRD, Chhindwara
Rain Forest Research Institute Post Box No. 136, Deovan, Sotai, A.T. Road, Jorhat- 785 001(Assam)	Dr. N.S. Bisht Director, RFRI Jorhat Phone: 0376-2350273(O) Fax. 0376-2350274 E-mail: dir_rfri@icfre.org	Shri Gautam Bannerjee, DCF, RFRI, Jorhat Phone: 0376-2350273 (O)	All matters related to RFRI, Jorhat
Advanced Research Centre for Bamboo and Rattans (ARCBR), P.O. Box 171, Kulikawn Aizwal-796001	Dr. N.S. Bisht Director, RFRI Jorhat Phone: 0376-2350273 (O) Fax: 0376-2350274 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 ARCBR, Aizwal
Centre for Forest Livelihood and Extension Sal Bagan Forest Campus PO – Gandhigram Agartala- 799 012 Tripura	Dr. N.S. Bisht Director, RFRI Jorhat Phone: 0376-2350273 (O) Fax: 0376-2350274 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 CFLE, Agartala
Arid Forest Research Institute, P.O. Krishi Upaz Mandi, New Pali Road, Jodhpur, 342005	Dr. T.S. Rathore, Director, AFRI Jodhpur Phone: 0291-2742549 (O) Fax. 0291-2722764 E-mail: dir_afri@icfre.org	Shri M.R. Baloch, Head Agroforestry & Extn. and Silviculture Div. AFRI Jodhpur. Phone: 0291-2721594	All matters related to AFRI, Jodhpur
Himalayan Forest Research Institute, Conifer Campus, Panthaghati, Shimla – 171 009	Dr. V.R.R. Singh, Director, HFRI, Shimla Phone : 0177-2626778 (O), Fax : 0177-2626779 E-mail: dir_hfri@icfre.org	Dr. K.S. Kapoor, Coordinator (Res.),HFRI Shimla -171 009 Phone: 0177-2626801(O) Fax. 0177-2626779	All matters related to HFRI, Shimla
Institute of Forest Productivity Aranvodaya, Gumla, N.H.-23, P.O. Lalgutwa Ranchi-835 303	Shri Rameshwar Das, Director, IFP Ranchi, Ph-0651-2548505(O) E-mail: dir_ifp@icfre.org	Group Coordinator (Res.) IFP Ranchi, Phone: 0651-3296974 (O), Fax- 0651 – 2546044 E-mail: dassr@icfre.org	All matters related to IFP, Ranchi
Institute of Forest Biodiversity P.O. Hakimpet, Dulapally, Hyderabad- 500014	Shri MRG Reddy Director, IFB, Hyderabad Phone: 040-66309501(O) Fax : 040-66309521 E-mail: dir_ifb@icfre.org	Dr. GRS Reddy Scientist -F, IFB, Hyderabad	All matters related to IFB, Hyderabad

Annexure - III

Email and Postal addresses of ICFRE and its Institutes

Director General
Indian Council of Forestry Research and Education
P.O. New Forest, Dehradun-248 006
E-mail : dg@icfre.org
Phone : 011-24361509; 2224333

Deputy Director General (Administration)
Indian Council of Forestry Research and Education
P.O. New Forest, Dehradun-248 006
E-mail : spsingh@icfre.org, ddg_admin@icfre.org
Phone : 0135- 2758295, 2224856

Deputy Director General (Research)
Indian Council of Forestry Research and Education
P.O. New Forest, Dehradun-248 006
E-mail : gorayags@icfre.org
ddg_res@icfre.org
Phone : 0135- 2757775, 2224836

Deputy Director General (Education)
Indian Council of Forestry Research and Education
P.O. New Forest, Dehradun-248 006
E-mail : ddg_edu@icfre.org
Phone : 0135- 2758571, 2224832

Deputy Director General (Extension)
Indian Council of Forestry Research and Education
P.O. New Forest, Dehradun-248 006
E-mail : ddg_extn@icfre.org
Phone : 0135- 2750693, 2224830

Director (International Cooperation)
Indian Council of Forestry Research and Education
P.O. New Forest, Dehradun-248 006
E-mail : nsbisht@icfre.org
dir_res@icfre.og
Phone : 0135- 2756497, 2224831

Assistant Director General (Information Technology and Forest Statistics)
Indian Council of Forestry Research and Education
P.O. New Forest, Dehradun-248 006
E-mail : pramodpant@icfre.org
adg_stat@icfre.org
Phone : 0135- 2755221, 2224865

Assistant Director General (Administration)
Indian Council of Forestry Research and Education
P.O. New Forest, Dehradun-248 006
E-mail : sdsharma@icfre.org
adg_admin@icfre.org
Phone : 0135- 2750297, 2224869

Assistant Director General (Education)
Indian Council of Forestry Research and Education
P.O. New Forest, Dehradun-248 006
E-mail : renusingh@icfre.org
adg_edu@icfre.org
Phone : 0135- 2758348, 2224850

Assistant Director General (Policy Research)
Indian Council of Forestry Research and Education
P.O. New Forest, Dehradun-248 006
E-mail : adg_pr@icfre.org
Phone : 0135- 2758348, 2224850

Assistant Director General (Panchayat and Human Dimensions)
Indian Council of Forestry Research and Education
P.O. New Forest, Dehradun-248 006
E-mail : neelugera@icfre.org
adg_pf@icfre.org
Phone : 0135- 2754882, 2224827

Assistant Director General (Environment Management)
Indian Council of Forestry Research and Education
P.O. New Forest, Dehradun-248 006
E-mail : pankaja@icfre.org
adg_eia@icfre.org
Phone : 0135- 2753882, 2224813

Secretary, ICFRE
Indian Council of Forestry Research and Education
P.O. New Forest, Dehradun-248 006
E-mail : sudhanshu@icfre.org
sec@icfre.org
Phone : 0135- 2758614, 2224867

Assistant Director General (Research and Planning)
Indian Council of Forestry Research and Education
P.O. New Forest, Dehradun-248 006
E-mail : kotiyalv@icfre.org
adg_rp@icfre.org
Phone : 0135- 2753290, 2224807

Assistant Director General (Monitoring and Evaluation)
Indian Council of Forestry Research and Education
P.O. New Forest, Dehradun-248 006
E-mail : adg_me@icfre.org
Phone : 0135- 2757485, 2224810

Assistant Director General (Media and Extension)
Indian Council of Forestry Research and Education
P.O. New Forest, Dehradun-248 006
E-mail : vykhandekar@icfre.org
adg_mp@icfre.org
Phone : 0135- 2755221, 2224814

Director Biodiversity Conservation (BC)
Indian Council of Forestry Research and Education
P.O. New Forest, Dehradun-248 006
E-mail : vykhandekar@icfre.org
Phone : 0135- 2755399, 2224839

PD (SLEM)
Indian Council of Forestry Research and Education
P.O. New Forest, Dehradun-248 006
E-mail : tpsingh@icfre.org
Phone : 0135- 2224823, 2750296

Assistant Director General (Forests & Climate Change)
Indian Council of Forestry Research and Education
P.O. New Forest, Dehradun-248 006
E-mail : tpsingh@icfre.org
Phone : 0135- 2755399, 2224823

Assistant Director General (Recruitment Board)
Indian Council of Forestry Research and Education
P.O. New Forest, Dehradun-248 006
E-mail : adg_rb@icfre.org
Phone : 0135- 2770820, 2224809

Director
Forest Research Institute, Dehradun
P.O.New Forest
Dehradun-248006
E-mail : dir_fri@icfre.org
Phone : 0135- 2224444, 2755277
Fax : 0135-2756865

Director
Institute of Forest Genetics and Tree Breeding, Coimbatore
Forest Campus, P.B.No 1061
R.S.Puram,
Coimbatore - 641 002.
E-mail : dir_ifgtb@icfre.org
Phone : 0422 –2431942, 2431540,
Fax : 0422 – 2430549

Director
Institute of Wood Science and Technology, Bangalore
P.O. Malleswaram, Bangalore-560 003
E-mail : dir_iwst@icfre.org
Phone : 080-23341731
Fax : 080- 23340529

Director
Tropical Forest Research Institute, Jabalpur
P.O. – R.F.R.C, Mandla Road,
Jabalpur – 482 021 (M.P)
E-mail : dir_tfri@icfre.org
Phone : 0761 – 4044002, 2840483 (O)
Fax : 0761 – 4044002, 2840484

Director
Rain Forest Research Institute, Jorhat
P. Box – 136, Deovan, Sotai, A. T. Road
Jorhat – 785001 (Assam)
E-mail : dir_rfri@icfre.org
Phone : 0376-2350273
Fax : 0376 2395360

Director
Arid Forest Research Institute, Jodhpur
P.O. Krishi Upaz Mandi
New Pali Road, Jodhpur 342005
E-mail : dir_afri@icfre.org
Phone : 0291-2742549
Fax : 0291-2722764

Director
Himalayan Forest Research Institute, Shimla
Conifer Campus, Panthaghati,
Shimla– 171 009 (HP)
E-mail : dir_hfri@icfre.org
Phone : 0177-2626778, 2626801
Fax : 0177-2626779

Director
Institute of Forest Productivity, Ranchi
Aranvodaya
AT & P.O. Lalgutwa (via Piska nagari) Ranchi-835303
E-mail : dir_ifp@icfre.org
Phone : 0651-2948505
Fax : 0651-2526006

Director
Institute of Forest Biodiversity
P.O. Hakimpet, Dulapally
Hyderabad- 500014
Email : dir_ifb@icfre.org
Phone : 040- 66309501
Fax : 040- 66309521

Director
Centre for Forestry Research and Human Resources Development (CFRHRD)
P.O. Kundalikala, Poama
Chhindwara (M.P.)-480001
Email : head_cfrhrd@icfre.org
Phone : 07162-254473
Fax : 07162- 254463

Director
Centre for Social Forestry and Eco Rehabilitation (CSFER)
3/1, Lajpath Rai Road, New Katra
Allahabad- 211 002
Email : head_csfer@icfre.org
Phone : 0532-2440795

Director
Centre for Forest Livelihood and Extension
Sal Bagan Forest Campus,
PO- Gandhigram
Agartala- 799 012

Director
Advanced Research Centre for Bamboo and Rattans (ARCBR)
P.O. Box 171,
Kulikawn Aizwal-796001
(Mizoram)
E-mail : imtienla@icfre.org
Phone : 0389- 2301159, 2301157
Fax : 0389-2301159

Annexure - IV

List of Abbreviations

ADG	-	Assistant Director General
AFRI	-	Arid Forest Research Institute
AICP	-	All India Co-ordinated Project
AM	-	Arbascular Mycorhiza
BAP	-	Benzlaminopurine
BR	-	Bioshpere Researve
CETP	-	Common Effluent Treatment Plant
CF	-	Conservator of Forests
CFRHRD	-	Centre for Forestry Research & Human Resource Development
CG	-	Chattisgarh
CITIES	-	Convention on International Trade in Endangered Species of Fauna and Flora
CPT(s)	-	Candidate Plus Trees(s)
DBT	-	Department of Biotechnology
DCF	-	Deputy Conservator of Forests
DFID	-	Department for International Development
DG	-	Director General
DNA	-	Deoxyribo Nucleic Acid
DST	-	Department of Science and Technology, New Delhi
EC	-	Electrical Conductivity
EIA	-	Environmental Impact Assessment
EMP	-	Environmental Management Plan
ENVIS	-	Environmental Information System
FAS	-	Financial Accounting System
FGRMN	-	Forest Genetics Resource Management Network
FRC	-	Forest Research Centre
FRI	-	Forest Research Institute
FYM	-	Farm Yard Manure
GBH	-	Girth at Breast Height
GIS	-	Geographic Information System
GLC	-	Gas liquid Chromatograph
GoI	-	Government of India
GPS	-	Global Positioning System
HRD	-	Human Resource Development
IAA	-	Indole Acetic Acid
IBA	-	Indole Butyric Acid

ICAR	-	Indian Council of Agriculture Research
IFGTB	-	Institute of Forest Genetics and Tree Breeding
IFP	-	Institute of Forest Productivity
IGNP	-	Indira Gandhi Nahar Pariyojana
IIRS	-	Indian Institute of Remote Sensing
IITJ	-	Indian Institute of Technology, Jodhpur
ISSR	-	Inter Simple Sequence Repeat
IT	-	Information Technology
IVI	-	Importance Value Index
IWST	-	Institute of Wood Science and Technology
JA	-	Jasmonic Acid
JFM	-	Joint Forest Management
KAU	-	Kerala Agriculture University
LAN	-	Local Area Network
MCA	-	Micronized Copper Azole
Mg	-	Mega Gram(10^6g)
mM	-	Millimolar
MoEF	-	Ministry of Environment & Forests
MOU	-	Memorandum of Understanding
MP	-	Madhya Pradesh
MS	-	Murashige and Skoog
NCBI	-	National Centre for Biotechnology Information
NFLIC	-	National Forest Library and Information Centre
NGO	-	Non Governmental Organization
NTFP	-	Non Timber Forest Product
NTPC	-	National Thermal Power Corporation
NWFP	-	Non Wood Forest Products
OBC	-	Other Backward Class
OR	-	Orrisa
PAL	-	Phenylalanine lysase
PCCF	-	Principal Chief Conservator of Forest
PCV	-	Phenotypic Coefficient of Variation
PDA	-	Potato Dextrose Agar
PGPR	-	Plant Growth Promoting Rhizo bacteria
PHA	-	Poly hydroxyl alkanoates
PIMS	-	Personnel Information Management System
PMS	-	Payroll Management System
PSB	-	Phosphate Solubilizing Bacteria

PVC	-	Poly Vinyl Chloride
QPM	-	Quality Planting Material
RADAR	-	Radio Detection and Ranging
RAPD	-	Random Amplified Polymorphic DNA
RBD	-	Randomized Block Design
RET	-	Rare Endangered and Threatened Species
RIMS	-	Research Management Information System
RPC	-	Research Policy Committee
RS	-	Remote Sensing
SA	-	Salysilic Acid
SC	-	Schedule Caste
SFD(s)	-	State Forest Department(s)
SLEM	-	Sustainable Landuse Ecosystem Management
SOC	-	Soil Organic Carbon
SPA(s)	-	Seed Protection Area(s)
ST	-	Scheduled Tribe
SVC	-	Steam Volatile Creosote
TBO	-	Tree Borne Oil seeds
TCPL	-	Tree Cultivation in Private Lands
TNAU	-	Tamil Nadu Agriculture University
TOF	-	Tree Outside Forest
TSO	-	Teak Seed Orchard
UGC	-	University Grants Commission
UNDP	-	United Nation Development Programme
UP	-	Uttar Pradesh
USDA	-	United States Department of Agriculture
VAM	-	Vesicular Arbuscular Mycorrhiza
VPC	-	Vegetative Propagation Centre
VPN	-	Virtual Private Network
VVK	-	Van Vigyan Kendra
WB	-	West Bengal
WNBR	-	World Network of Bioshpere Researve

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Sl. No.	Name of the Chapter	Chapter Editors
1.	Executive Summary and Introduction	• Shri Pankaj Aggarwal, ADG (EM) • Dr. V. Jeeva, Additional Director EM Division, ICFRE
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