






INTRODUCTION

The Council is the premier forestry research organization of the country with the mandate to formulate, organize, direct, and manage forestry research, transfer the technologies developed for States and other user agencies; and impart forestry education.

The objectives of the Council are:

-  To undertake, aid, promote and coordinate forestry education, research and its application
-  To develop and maintain a National Library and Information Center for forestry and allied sciences
-  To act as a clearing-house for research and general information relating to forests and wildlife
-  To develop forestry extension programmes and propagate the same through mass media, audio-visual aids and extension machinery
-  To provide consultancy services in the field of forestry research, education and training and in allied sciences
-  To do other things considered necessary to attain these objectives.

The Council has 8 research Institutes and 3 advanced centers in various parts of the country to cater to the research needs of different bio-geographical regions of the nation. These are located at Dehra Dun, Shimla, Allahabad, Ranchi, Jorhat, Jabalpur, Chhindwara, Jodhpur, Hyderabad, Bangalore and Coimbatore. Activities of these centres are described in the following chapters.

FORESTRY RESEARCH

“To undertake, aid and coordinate Forestry Research” is one of the most important mandate for ICFRE. Directorate of Research Coordinates, assists and provides research activities within ICFRE Institutes and to various Universities, NGOs, Forest Departments and Industrial Research Organisations engaged in Forestry Research. The activities of this Directorate are being carried out by 3 Sub-Directorates viz. Planning, Programme and Monitoring & Evaluation.

The comprehensive document of **NFRP** printed in two volumes along with Executive Summary and Annexure was released on 17th May, 2000 by Thiru T.R. Baalu, H'ble Minister of Environment and Forests, Government of India. **ICFRE Technology Mission** was prepared for the expansion of country's Forest cover and increasing its productivity. RAG meetings for prioritisation of research projects were organised in all the ICFRE Institutes. Consolidated Institutes wise prioritised research projects were prepared for final approval by RPC. Second RPC meeting of ICFRE was held on 25th May, 2001 at Van Vigyan Bhawan, New Delhi, where all the research projects provisionally prioritised by RAGs 2000 were finally approved.

A database of donor agencies was created and a large number of potential donor agencies were contacted to explore the possibility of funding of research projects of ICFRE Institutes and several Nationally Coordinated Projects. A status report on submission of research projects to various donor agencies as indicated by ICFRE Institutes was prepared and is being updated from time to time. **95 Research Projects** have been submitted to various donor agencies. A **Project Formulation Cell** has been created for formulating new projects and for seeking financial support from donor agencies.

Planting Stock Improvement Programme (PSIP)

ICFRE has established 3373 ha Seed Production Areas (SPAs), 13 ha Clonal Seed Orchards (CSOs), 5.96 ha Seedling Seed Orchards (SSOs), 3.5 ha Vegetative Multiplication Gardens (VMGs) for important species and six Modern Nurseries were established in different States of the Country during the year 2000- 2001.

Research Grant Fund (RGF)

Research Grant Fund (RGF) is an important component of the World Bank FREEP; the programme has helped ICFRE to fulfill one of the important national mandate of aiding and coordinating forestry research in India to State Forest Department, Universities, NGO's and Private Sectors.

Projects sanctioned under RGF covers a very wide range of disciplines viz., Agroforestry and Silviculture, Biodiversity Conservation, Tree Improvement, Biotechnologies, Forest Produce, Seed Technology, Biofertilizer, Socio-Economic and JFM. Many of these projects are coordinated projects. Out of 200 projects sanctioned, 40 projects have been completed. The significant findings of the RGF projects are: -

- Conducted multi-locational trial, of Poplar under different Eco-climatic zone of the country.
- Developed agroforestry models in the Tarai region of Nainital.
- Completed Ethnobotanical studies in the wild plants of Jaunsar and Bhabar for the first time.
- Identified two new species of *Ochlandra* *Ochalonra spirostylis* and *O. sodastromiana*.
- Developed CD-ROM Package for the entire 125 years of Indian Forester.
- Protocol developed for *Chlorophytum borivilianum* by using tissue culture technologies.
- Developed seed handling techniques for various important forestry species.
- Identified No. of Candidate Plus Tree (CPTs) and conducted Tree Improvement trial of *Dalbergia sissoo*, *Populus*, *Acacia nilotica*, Teak, Eucalyptus, Neem and Pine.
- Completed Socio-economic and marketing studies in Teak, Eucalyptus, Casuarina and in NWFP species.



International provenance trail - *Eucalyptus grandis*

- Identified suitable Vesicular Arbuscular Mycorrhizal (VAM) fungi and phosphate solubilizing, microbes for improving the quality of nursery seedling of various forestry species.

Chief Technical Advisors (CTAs)

Twenty one CTAs appointed under the World Bank Project are coordinating research activities of all ICFRE Institutes as well as RGF Projects funded under FREEP.

Twenty one CTAs Workshops / Peer-review meetings were organized on rotation basis in the ICFRE Institutes, where progress of research projects of ICFRE / RGF were reviewed and recommendations made.

The application software for RIS & ME was developed for the Council and implemented at Forest Research Institute, Dehra Dun.

- Training on operating RIS to various scientists / technical staff of ICFRE Institutes and trained them for operating RIS & ME Module.
- Data entry of ongoing projects was organized for all divisions of Forest Research Institute.
- During the first phase Oct. 2000 only few project leaders attended the training. In second phase during February–March, 2001 remaining work was completed by inviting all PI's except very few projects in Silviculture & Extension Divisions.
- Format was developed for the physical monitoring in the field for different projects of respective Institutes of the Council.
- Meetings were organized with IT members for the solution of installation of RIS & ME Module in different Institutes.
- A comprehensive list for all the projects running in different Institute of this Council was arranged in a specific format and compiled.
- Screenings of the various projects as directed by MoEF to ICFRE were completed.

Sketch of demonstration center of forestry technology was developed to maintain uniformity in all the States. Line estimate for the construction of demonstration center was also prepared.

FORESTRY EDUCATION

The major function of the Directorate is to arrange :

- Educational and training programmes to generate trained human resource.
- Provide support to strengthen the infrastructure of Universities imparting forestry education in the country.
- Provide consultancies on education and training.
- Conduct professional skill development programme.
- Review and develop Forestry Education curricula in Schools and Universities.
- Provide Research Fellowships in different disciplines of forestry research.
- Human Resource Development Plan.

To strengthen the infrastructure for forestry faculties in the Universities imparting forestry training at Graduate / Post Graduate levels, financial assistance to the tune of Rs.104.94 lakhs was granted to various Universities, imparting Forestry Education & Research in the country.

M.Sc Forestry curriculum was prepared and circulated to all Indian Universities for implementation.

The Human Resource Development Plan, which was earlier prepared by IAMR, New Delhi through M/s Winrock International was not found satisfactory and as such taken up by an In-house-team consisting of representatives of Forest Managers, Scientists and ICFRE Employees. The finalization of the plan is in progress.

A total number of 116 fellowships (JRFs 82; SRFs 24; RAs 10) were provided to support forestry research being undertaken in various ICFRE Institutes for the year under report.

The Research Fellows and Research Associates handled research projects mainly under the World Bank FREE Project besides projects funded by CSMP, USDA and NPFDP.

FRI Deemed University

FRI Deemed University is actively engaged in running Post Graduate Diploma and Degree courses in following six disciplines:

1. Post Graduate Diploma in Plantation Technology.
2. Post Graduate Diploma in Pulp and Paper Technology.
3. Post Graduate Diploma in Biodiversity Conservation.
4. M.Sc. Forestry (Economics and Management).
5. M.Sc. Wood Science and Technology.
6. M.Sc. Environment and Management.



Students in the Laboratory

In addition the University has also undertaken Doctoral and Post Doctoral Research programmes in various disciplines of forestry at different Institutes of ICFRE. The Council has been funding these research programmes by providing research fellowships to research scholars and monthly stipends to student. 40 persons were provisionally awarded Ph.D. degree during the year 2000-2001.

Post Graduate Diploma Course on Plantation Technology - I Semester, Post Graduate Diploma Course on Pulp and Paper Technology, and Post Graduate Diploma in Biodiversity Conservation were imparted.



Diploma students in the Class Room

FORESTRY EXTENSION

The Directorate of Extension has mandate to disseminate research findings and technologies developed by ICFRE, to provide Extension Support to State Forest Departments, Non-Government Organisations, etc. Also the Division collaborates with other Organisations to establish linkages with different user groups with the aim to motivate and educate the people on the role of forests through conservation, development, management of community land, public forest, the need for increasing the forest productivity and the scientific use of forest products. The following are the activities achieved by the ICFRE at its Institutes during 2000-2001.

Extension Support Fund (ESF)



Band Saw Machine

Twenty three extension proposals worth Rs. 17.2 million have been sanctioned by the Directorate of Extension to demonstrate different technologies in the field through well reputed and organized research Institutes like SIRDO, Bhimtal; BISRA Ranchi; SFRI A.P; KFRI-Kerala; Forest Departments of Tamil Nadu, Karnataka, Punjab, Tripura, Garhwal Mandal Vikas Nigam Ltd. Uttaranchal and a reputed NGO based at Yavatmal, which



Ammonia Fumigation Plant



Ammonia Plasticization Plant

are the permanent ICFRE satellite centers for demonstrating different wood technologies available as and when required. So far, funds worth Rs. 16.5 million have been released and twenty projects have been completed. The Extension Directorate of ICFRE is carrying out evaluation and impact assessment of the projects.



Extension support fund for women

Following fifteen films have so far been prepared by this Directorate and their VHS copies are available on sale at National Forest Library Information Centre, FRI, Dehra Dun.

1. Bamboo – A gift of Nature.
2. Bamboo – Promising gains – Part I.
3. Bamboo – Promising gains – Part II
4. Storage and Sawing of timber with special reference to Eucalyptus.
5. Seasoning of timber with special reference to Eucalyptus.
6. Preservative treatment of timber with special reference to Eucalyptus.
7. Treated Catamarans for traditional fisherman.
8. Non-Wood Forest Products (NWFP).
9. Economic Utilization of Casuarina.
10. Rain water harvesting in Arid zones.
11. Techniques for Afforestation of stress sites.
12. Agroforestry – A practice of progress and prosperity.
13. Neem – The green gold mine.
14. Rehabilitation of degraded mines.
15. Clonal Multiplication.

Extension Linkages

Contract entered with State Forest Department, NGOs, Industries and other organizations for transfer of technology and result thereof :

- **FRI, Dehra Dun** has established a collaborative project with Indian Paper Manufacturers Association (IPMA) New Delhi on “ High yield pulping and bleaching of plantation grown wood species and bagasse using Alkaline Peroxide Mechanical Pulping Process”. The project is funded by IPMA to the tune of Rs. 85 lacs.
- **FRI** has established collaboration with Gujarat Alkali and Chemicals Ltd, (GACL) Baroda for production of alpha cellulose from cotton linter, Bamboo, Eucalyptus and Bagasse. GACL has funded the project to the tune of Rs 5.0 lacs.

- **FRI** has established a collaboration with Indian Farm Forestry Development Cooperative (IFFDC), a Cooperative Sector Company for Five Extension Based, research projects on the farmers land.
- **FRI** has entered into a collaboration with Himalayan Institute (Hospital), Jollygrant, Dehra Dun for short term and long term testing of Catechu of *Uncaria gambier* and *Acacia catechu* for human consumption.
- **FRI** has established a Memorandum of Understanding for collaborative research work on pharmacological screening of pure compounds with Bergische University, Winppertal, Germany.
- **FRI** has formulated a project on 'Eco-restoration of iron mined area (3rd phase) for Steel Authority of India.
- **FRI** imparted Teaching support to Indira Gandhi National Forest Academy, State Forest Service College, etc.
- **IFGTB, Coimbatore** extended a consultancy to Kerala Forest Development Corporation and Kerala State Forest Department on clonal propagation of Teak.
- **IFGTB** extended consultancy to Shanthi Ashram for UNDP Funded Project on Agroforestry Models.
- **IFGTB** extended the technology to Kerala and Maharashtra Forest Development Corporations, Rangers trainees from Tamil Nadu Forest Department on Tree Improvement, Quality Seedling Production, Clonal Technique, Participatory Agroforestry for poverty alleviation and Nursery Management during April – September, 2000.
- **IFGTB** raised and supplied 35,650 seedlings of forestry, ornamental, horticulture plants to Shanthi Ashram.
- **RFRI, Jorhat** established an extension linkages and imparted a training on Seed Production Area, Clonal Seed Orchards and Seedling Seed Orchards to Forest Officials from five State Forest Departments of North-East region.
- **HFRI, Shimla** extended the technology to State Forest Departments of Himachal Pradesh and Jammu and Kashmir on Planting Stock Improvement Programme.
- **IFP, Ranchi** is maintaining a close liaison with all SFDs under jurisdiction of the Institute and Research Organizations like CCL, CMPDI Ltd., MECON, XISS, ILRI, Ranchi University, Birsa Agricultural University, Vidyasagar University Midnapore, Kalyani University, TRIFED, SEPC, BISCOLAMF, BIT Mesra, and NBPGR Ranchi on Lac activities.
- **FRC, Hyderabad** assisted IWST Bangalore in the study related to demand and supply position of wood and Bamboo as A.P. Forest Department consultancy project.



Demonstration of Bamboo Macroproliferation to Hon'ble Minister Thiru T.R. Baalu, MoEF

Transfer of Technology

Demonstration of technologies, organizing the Seminars and Workshops have been the main features of Industrial Technology Demonstration (ITD). Out of the 33 selected technologies, twelve are being disseminated through Extension Support Fund. Some of these tested technologies have been demonstrated to urban and rural industries, farmers, fishermen and other users. During the year 2000-2001 following demonstrations, Seminars, Conferences and Workshops were organised by the ICFRE and its Institutes.

Training

FRI, Dehra Dun organised short term training courses on various forestry related subjects to officials of the Govt. of India, the State Forest Departments, Public Sector Undertakings as well as representatives from various industries.

IFGTB, Coimbatore, has been identified by the Ministry of Environment and Forests to conduct Compulsory Training Course on Genetic Improvement and Propagation of forest trees to IFS Officers. The Institute conducted one week training course from 11th to 15th December, 2000. A total of 12 officers participated in the training programme.

IFGTB imparted training to staff of State Forest Departments on maintenance and management of SPA, SSO, CSO, VMGs, Model Nursery and Seed Centre from 13-11-2000 to 17-11-2000.

IFGTB organised one-month training programme on Clonal propagation of Teak to the official of Kerala Forest Development Corporation and Kerala State Forest Department from 28-07-2000 to 31-08-2000.

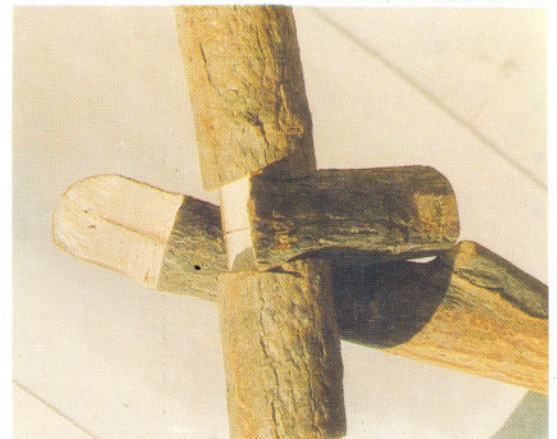
IFGTB imparted 3-days training on Tree Improvement, Vegetative Propagation and Nursery Techniques to the foresters from Kerala Forest School, Walayer from 31-10-2000 to 2-11-2000.

IFGTB conducted a summer training course to the Undergraduate students to various Universities from 20 May to 10 June, 2000.



Demonstration and Training to various target groups

- **IFGTB** conducted a Summer Training Course on Bio-chemistry of seeds to students of various colleges from 24th May to 10th June, 2000.
- **IFGTB** imparted a lecture on Seed Collection, handling and storage techniques to the Kerala Forest School from 31-10-2000 to 02-11-2000.
- **IFGTB** celebrated World Environment Day by conducting various competitive programmes to students.
- **IFGTB** organised a training on Neem seed collection, storage and nursery raising for tribal women, also practical training on SSOs, CSOs, Nursery techniques and Compost making were arranged to SFDs, SFDCs of Kerala, Tamil Nadu, Maharashtra and Goa during April – September, 2000.
- **IFGTB** organised a technical training on nursery management, biofertilizer, pest and disease management and seed handling techniques conducted for farmers.
- **IFGTB** imparted training on nursery establishment and management to the local villagers, unemployed youth and women.
- **IFGTB** organised exchange programme between farmers to exchange the practical knowledge on Agroforestry.
- **IWST, Bangalore**, demonstrated the technology developed to the fisherman of 6 villages in Krishnapatnam and Chennai during December 2000- January 2001.
- **IWST** demonstrated Forestry and Wood Science Technologies for the farmers of villages of Venkatagiri Kote on 28.3.2001.
- **IWST** imparted training to officials of Naval Dockyard, Visakhapatnam in the field of wood properties.
- **IWST** imparted training teaching support- A total of approximate 100 students visited the Institute. Lecture and visits were organized.



Demonstration of technology



Rin Pit - Rainwater storage technique for Arid zone

- **TFRI, Jabalpur** organised two days training programme on cultivation, rehabilitation of degraded sites and agroforestry practices from 15-16 March 2001.
- **TFRI** organised two days training on cultivation, processing and marketing of medicinal plants from 27-28 March 2001.
- **TFRI** imparted training to P.G. students on tissue culture.
- **TFRI** organised a training programme for farmers on 'Development of tree borne oil-seeds'.
- **TFRI** organised two days of training on cultivation, rehabilitation of degraded sites and agroforestry systems from 17- 19 July, 2000.
- **TFRI** organised two days training on cultivation, processing and marketing of medicinal plants from 16 to 18 August, 2000.
- **TFRI** has conducted three training on research communication for research staff and projects from 18 to 20 September, 2000.
- **RFRI, Jorhat** demonstrated mass plantation programme of multiple species at Naharoni Experimental site on 27 - 28th June, 2000.
- **RFRI** organised training programme under UNDP in collaboration with Kerala Forest Research Institute (KFRI) to Forest Officials during 18-19 April, 2000.
- **RFRI** trained Foresters of North-East India on Bio-diversity technique during the workshop on application of improved technology for afforestation in North-East India held on 24-26th April, 2001.
- **RFRI** imparted a training to farmers during 8-19 May 2000 at Deoban.
- **RFRI** imparted training to various forestry schools on forestry related subject.
- **HFRI, Shimla** conducted a self sustained / financed training programme on Bamboo from 19-21 March, 2001.
- **HFRI** imparted field demonstration of Seedling Seed Orchards (SSO and CSO) to the trainees of State Forest Officials.
- **HFRI** organised a training programme for State Forest Departments of Himachal Pradesh and Jammu & Kashmir.
- **HFRI** celebrated and created environmental conservation consciousness amongst general public and especially amongst students, on the occasion of the World Environment Day on 5th June, 2000
- **HFRI** imparted teaching support to 200 students from various schools on forestry related subjects.
- **IFP, Ranchi** organised a short duration training-cum-demonstration in Nucleus-Broodlac Farms on improved and scientific methods of lac cultivations as well as seasonal operation of lac crop viz. pruning, harvesting, inoculation & phunki removal for lac growers and villagers.
- **IFP** provided teaching support to the students of forestry faculty of Birsa Agricultural University, Ranchi and Birla Institute of Technology, Mesra, Ranchi.

- **IFP** demonstrated the techniques on propagation of bamboo and use of bio-fertilizers and VAM to the villagers.
- **IFP** imparted training to Officers / Technical Staffs of the Institute on clonal propagation of important tree spp.
- **IFP** imparted training to farmers, villagers, NGOs, forestry students and SFD personnel's on plantation, nursery techniques, seed processing, tissue culture, composting, and application of bio-fertilizers.
- **CFRHRD, Chhindwara** imparted training to farmers, NGOs, Institutes etc. - Fifth Junior Certificate Training Course has been concluded for improvement technical skills among grass root level workers.
- **CFRHRD** imparted teaching support reg. to various organization – Scientists were deputed to various organization as resource person to impart training / teaching.

Seminars / Workshops

- **ICFRE, Dehra Dun** organised an International Workshop on completion of Decade of Joint Forest Management Programme titled 'A Decade of JFM - Retrospection and Introspection' at Vigyan Bhawan, New Delhi on June 19th and 20th, 2000. Over 350 delegates attended it. A special First Day Cover was issued and Hon'ble Minister of Environment and Forests, Thiru T.R. Baalu inaugurated the event.
- **ICFRE, Dehra Dun** organised a "Regional Meeting of Coordinators of Man and Biosphere (MAB) Reserve from South and Central Asia" at Forest Research Institute, Dehra Dun from 22 - 25th February 2001.
- **FRI, Dehra Dun** conducted a seminar on "Environmental Perspectives and Management Strategies in the New Millennium" at Forest Research Institute, Dehra Dun from 14 - 15th April, 2000.
- **FRI** organised a sharing of National and Local experiences" with the Regional consultant during 20 - 22nd May, 2000.
- **FRI** organised a Seminar-cum-Workshop "Bamboo – The Eternal Reed" under the umbrella of Himalayan Forestry and Heritage Centre at Dehra Dun from 17 - 18th February 2001.
- **IFGTB, Coimbatore** organised a general seminar on sustainable concepts of agro-forestry developments conducted for NGOs.
- **IWST, Bangalore** organized Workshop on "Conservation of forest genetic resources-research and action plan" organized by A TREE, Bangalore in collaboration with Karnataka Forest Department and IWST Bangalore from 18.7.2000 to 19.7.2000.
- **IWST** organized Workshop on "Greening India through Agroforestry and JFM" on 12.9.2000 in collaboration with IPRITI, Bangalore Workshop was sponsored by Planning Commission, GOI & MOEF.
- **IWST** organized Peer review-cum-workshop (CTA) on Casuarina on 18.9.2000.



Regional Meeting of MAB at FRI - Inaugural Session

- **IWST** organized workshop on “use of wood in Andhra Pradesh: Present and Future perspective” organized by IWST, Bangalore and FRC, Hyderabad on 23rd September 2000.
- **IWST** organized CTA workshop on Sandal and Soil.
- **IWST** organized regional workshop on Bamboo on 21.3.2001 in collaboration with Bamboo society of India and Karnataka Forest Department.
- **AFRI, Jodhpur** organized and International Neem Network Workshop- Data-analysis from 21st-25th March, 2001.
- **AFRI** organized Peer review workshops on seed and nursery technology in the institute during the November, 2000.
- **HFRI, Shimla** conducted two workshops-cum-peer reviews on Chir Pine and Poplar on 27-28 July, 2000 and 20-21 December, 2000 respectively.
- **IFP, Ranchi** organised Institute level seminar on research priorities setting of RAG for N.F.R.P. on 11-12 October, 2000.
- **IFP** has conducted 4th CTA Workshops on *Dalbergia sissoo* on 13-14 October, 2000.



Exhibitions / Melas

- **FRI** demonstrated the technologies during “National Technology Day” at Mohan Khal, Chamoli Garhwal on 11th May, 2000.
- **FRI** organised exhibition on the occasion of “World Environment Day” on 5th June, 2000.
- **FRI** demonstrated technologies of FRI during the programme “Lokotsava” at Rangers College, Dehra Dun from 12th to 15th October, 2000.
- **FRI** participated in the “Uttanchal Mahotsava” at Rangers College, Dehra Dun from 1st to 7th November, 2000.
- **FRI** demonstrated the Technologies at District Industries Centre, Dehra Dun in collaboration with Indian Industries Association on 15th December, 2000.
- **FRI** participated in the exhibition organized on the occasion of “National Science Day” at Indian Institute of Remote Sensing, Kalidas Road, Dehra Dun on 28th February, 2001.



- **FRI** participated in “Kisan Mela” at Punjab Agriculture University, Ludhiana from 15th to 16th March, 2001.
- **FRI** participated in an exhibition on the occasion of “Consumer Protection Day,” organized at District Supply Office, Dehra Dun on 15th March, 2001.
- **FRI** demonstrated the technologies in District Ropar of Punjab in collaboration with IWDP (Hills), Kandi Area, Punjab on 17th – 18th March, 2001.
- **FRI** demonstrated technologies on occasion of “World Forestry Day” during 21st March, 2001.
- **FRI** participated in “Basant Mela,” a programme organised at Indo-Tibet Border Police ground, Dehra Dun from 25th to 27th March, 2001.
- **FRI** established a demonstration of experimental plantations, SSPAs, CSOs and CMAs.
- **IFGTB, Coimbatore** has established demonstration plots for medicinal plants under UNDP.
- **IFGTB** has established trials of Eucalyptus, Casuarina, Teak and Neem established at Pannampally (Kerala), Karunya (Tamil Nadu) and Pudukottail (Tamil Nadu) to serve as demonstration plantations.
- **IFGTB** has established agroforestry models in various micro- water shed system.
- **IFGTB** displayed technical posters on Neem seed handling, determination of moisture content on wet weight and dry weight basis, estimation of seed requirement and other research activities during the seminar on sustainable concepts of agro-forestry development at Shanthi Ashram, Coimbatore on 30-04-2000.
- **IFGTB** displayed the various research activities during the National Conference of Forest Ministers from 20th-30th January, 2001.
- **IWST, Bangalore** celebrated Vana Mahotsava on 7.7. 2000.
- **IWST** organised a group meetings with the fishermen of 6 villages in Krishanpatnam and Chennai during December, 2000 – January, 2001.
- **IWST** organised a demonstration programme on forestry and wood science technologies on 21.3.2001.
- **TFRI, Jabalpur** demonstrated the technologies on NWFP and Agro-forestry to SFDs, NGOs and Farmers.
- **TFRI** technologies were demonstrated during Kisan Mela held at Jabalpur, M.P.
- **RFRI, Jorhat** organized an exhibition of various activities at Assam Agricultural University, Jorhat on 9-2-2001.
- **AFRI, Jodhpur** participated and demonstrated the technology developed to various user agencies during the Swadesi Mela 2000 and Hastshilp Utsava 2001. Film on rainwater harvesting has been shown in training & Public awareness program organized by Block Development Officer, Luni Block, Jodhpur.
- **AFRI** demonstrated the water harvesting technology and Agro-forestry systems in different sites to local farmers under different research projects.
- **HFRI, Shimla** organized exhibition on environment, forestry and activities undertaken on occasion of World Environment Day - 2000.



Publication and Extension literature

Publication of Books, Brochures, Bulletins, Pamphlets / Handouts and Newsletters, etc.

Books

1. Extension of ICFRE Technologies
2. Forestry Research Extension Programme
3. National Forestry Research Plan, ICFRE
4. Forestry Statistics 2000, ICFRE
5. Effect of Growing Eucalyptus, FRI
6. Annual Report Lac, IFP
7. Diseases and Insect Pests of Teak, TFRI
8. Recent Trends in Insect Pest Control to Enhance Forest Productivity, TFRI
9. Annual Reports 1998-99 English and Hindi, ICFRE
10. Annual Reports 1999-2000 English and Hindi, ICFRE.
11. Genetic Improvement and Propagation of Forest Trees, IFGTB
12. Seedling Seed Orchards for Breeding Tropical Trees, IFGTB
13. वन के हानिकारक कीट एवं उनका नियंत्रण, CFRHRD
14. Trends in Carbohydrate Chemistry, Vol. VI, FRI
15. Landmarks of Botany in India, FRI.

Brochures

1. Jatropha
2. Improved Planting Stock of *Eucalyptus tereticornis*, IFGTB.
3. Waterlogged sodic soil rearing trees (Success story), CSFER.
4. Agri-silviculture Model, IFGTB.
5. Achievements and Expertise- AFRI.
6. Brochures on Silviculture of species like Hollong, Gamar, Sal, Bamboo, Cane, Sam and Bokul- RFRI
7. Lemon grass, Kalihaldi, Kalmegh, Sarpgandha and Muskdana- CFRHRD,
8. Teak
9. Bamboo
10. Neem

Bulletins

1. Timber / Bamboo Trade Bulletin No. 20
2. Technical Bulletin on Simplified and Economical Method of Processing Pencil Slats (IFGTB)

Newsletters

1. Van Anusandhan Patrika (Vol. VI, No.2)
2. Van Anusandhan Patrika (Vol. VI, No.3)
3. Quarterly Newsletter "Biological Control"
4. Quarterly Newsletter "Forest Disease"
5. Quarterly Newsletter "Chir Pine"
6. Monthly Lac News Letter and Annual Lac Bulletins, IFP, Ranchi.

Pamphlets / Handouts

1. Fumed Furniture, Joinery and Handicrafts from Eucalyptus - FRI (Hindi).
2. Bamboo in Rural Housing -FRI (Hindi).
3. Structural Timber from Lops and Tops of Eucalyptus and Poplar - FRI (Hindi).
4. Jigat Substitute -FRI (Hindi).
5. Katha-FRI (Hindi).
6. Solar Heated Seasoning Kiln - IWST
7. Sawing and Seasoning Techniques of *Eucalyptus* hybrid –FRI.
8. Wood Plasticization and Bending through Vapour Phase Ammonia Treatment- FRI (Hindi).
9. Destructured Reconstituted Wood from Bamboo for Structural Purpose- FRI.
10. Preservation of Bamboo- FRI.
11. Natural Dyes from Forest Biomass – FRI.
12. Bamboo Boards - FRI (Hindi).
13. Booklet on “Mushroom Cultivation Technology”, -TFRI.
14. Pamphlet on “Seed Technology” -IFGTB.
15. Booklet on “Biofertilizer”, -TFRI.
16. Report on “Research Communication”, -TFRI.
17. Economics of *Gloriosa* in Tamil –IFGTB.
18. A booklet in Hindi - *Mushroom (Khumb) Kee Kheti*, -. TFRI.
19. A booklet in Hindi - *Jaiv Urvarak (Biofertilizer), Jaiv Urvarakon kaa vanaki main upyog*, TFRI.
20. Leaflet on the facilities (scientific equipment, library, hostals, conferencing etc.) available on payment basis.

Audio Visual Media

A few other methods of extension are being adopted which require no fund, such as broadcasting talks on local Radio (AIR, Najibabad), interviews of scientists of the Institute on popular topics (specially related to current problems in tree-farming etc.) on television, and through print media wherein the technologies developed at the Institute are covered in news items or in articles / reports. Another step adopted for extension is through short term training courses, being organized in about 14 disciplines, for which a fee is charged from participants. Besides serving foresters, people from industries, universities, and government as well as semi-government organizations are among the participants in these courses.

Curricula Consultants

Final reports for different classes of school curricula were prepared, and the completed assignment have been transferred to DDG (Education).

Extension Strategy of ICFRE and its Implementation

Indian Council of Forestry Research & Education under the World Bank FREEP (Forestry Research, Education and Extension Project) has prepared a Forestry Research Extension Programme - 2000, for dissemination of research findings, innovations and new technologies to the user groups.

Eight ICFRE Institutes at Bangalore, Coimbatore, Dehra Dun, Jabalpur, Jodhpur, Jorhat, Ranchi and Shimla have prepared their extension plans based on the guidelines provided in the document "Forestry Research Extension Programme- ICFRE". Implementation is in progress.

Information Technology Division (Directorate of Extension)

ICFRE has created an IT Division at the Hqrs. and IT Cells in Institutes for promoting and aiding Forestry Research Education and Extension. During this year, Financial Accounting System (FAS) has been successfully implemented under Management Information System (MIS) in all the ICFRE Institutes including the headquarters.

IT has established a state of the art Local Area Network (LAN) at its headquarters, Dehra Dun. There are more than 150 clients spread all over the campus. The fiber is running for around 6 km. The services currently available are: Electronic mail; Access to CD-ROM bibliographic Database (Seven); Access to Library database OPAC (On-Line public access catalogue); Electronic access to Grey Literature Search, and Internet

ICFRE has its own web server accessible at <http://www.icfre.up.nic.in> and <http://www.icfre.org>. The server contains Annual Reports, Statistical Reports, Indian Forestry Research Plan, books available for sale, plans and programmes of different Institutes, technologies developed by ICFRE and ready for transfer to users, list of sophisticated and costly equipment available for corporate use in research, calendar of training on forestry and forestry research aspects, etc.

Action is initiated during 2000-2001 to increase the bandwidth from 64 kbps (VSAT) to 1 Mbps through a leased line. This shall enhance and facilitate speedy transaction and accessibility to ICFRE servers.

FORESTRY STATISTICS

Reliable Forestry Statistics are required at the national level by different agencies for planning, policy analysis, and making decision on forestry investment and development programmes. Statistics are also required to monitor and evaluate the impact of policies and programmes. To make this information available at one place, Statistics Division under Directorate of Education, Indian Council of Forestry Research & Education, Dehra Dun, has been created under FREEP.

The specific task to be carried out are as follows :

- Identify and agree with MoE&F, the primary and secondary forestry data to be collected.
- Liaison with agencies concerned with the collection of primary or secondary data.
- Collect, collate and process the agreed data.
- Check on data reliability.
- Provide required data to MoE&F or other authorised users, in a timely fashion.

Statistics Division has been collecting data on forest and pressure on forest from various agencies. For collection of data, two – way approach has been followed. The designed formats were sent to the various States / UT's and other agencies. Simultaneously, formats were sent to different Institute of Indian Council of Forestry Research & Education, working in the various States / UT's. In most of the cases, two sets of formats were received from States / UT's, which were used later for validation of data.

Keeping in view the quantum and different types of data, it was decided to use the electronic spreadsheet (MS EXCEL) for generation of Database Management System.

ICFRE has brought out following edition of "Forestry Statistics India":

- Forestry Statistics India - 1988-94**
- Forestry Statistics India - 1995**
- Forestry Statistics India - 1996**
- Forestry Statistics India - 2000**
- Forestry Statistics India - 2001**

ICFRE, has now taken a policy decision to publish Statistical Information bi-annually and the first bi-annual edition for the data period 1.4.1997 to 31.3.1998 and 1.4.1998 to 31.3.1999 was published.

Timber / Bamboo Trade Bulletin

The prices in the open market for the timber and other produce pertaining to the species harvested from forest are dependent on prices paid by the lessees for standing crops, logging cost, transportation and sawing cost, overheads, location of the market and other such factors. The pricing mechanism for timber, bamboo and firewood is also dependent on the exploitation of this produce from farm forestry operations. The prices vary from place to place depending on the demand and supply, location of small scale industries and the Government policy on marketing of forest produce. The classification followed in different markets all over the country vary a lot on account of the specific use of the forest produce. Under the World Bank FREE project, a quarterly Timber / Bamboo Trade Bulletin is published giving information on the prices of important forestry species in 19 market centres spread all over the country. So far 26 (Twenty six) Bulletins have been published by this Directorate starting from the first edition of December '94 to the latest issue of March' 2001.

Biometrical support has been provided to 97 (Ninety Seven) research Projects of different Institutes of ICFRE. In addition, several consultations have been provided to the Scientists of ICFRE Institutes and Centres viz.; Bangalore, Coimbatore, Dehra Dun, Jabalpur, Jodhpur, Jorhat, Ranchi, Shimla, Allahabad, Chhindwara and Hyderabad. Directorate of Statistics shall continue to provide such assistance as and when approached.

In addition to all the above, the experts of the Statistics Division are imparting Statistical Education to students in various streams of Deemed University - FRI.

EXTERNALLY AIDED PROJECTS

ICFRE-NABARD project for development of agro-forestry models for various agro-ecology region of India.

The 5 years research project implemented by ICFRE since September 1995 under the sponsorship of National Bank for Agriculture and Rural Development (NABARD) has been completed in September 2000. The original outlay of the project was Rs.126 lakhs, which was scaled down to about Rs. 50 lakhs. The objective of the project was to identify and develop different agroforestry models taking micro watershed

approach and ensure self-sustainability of eco-system under different ecological zones. The project has been implemented in the following four Institutes:-

- Institutes of Forest Genetics and Tree Breeding, Coimbatore: Hot semi and loamy soils.
- Tropical Forest Research Institute, Jabalpur: Hot sub-humid red black soils.
- Centre for Social Forestry & Eco-Rehabilitation, Allahabad: Hot sub humid-alluvial soil.
- Arid Forest Research Institute, Jodhpur: Hot arid-desert and saline soil.

Under this project an area of 6600 ha was selected in 12 micro-sheds in 16 villages. In all 2,84,836 seedlings of forestry species were raised in different nurseries. A part 50,253 fruit trees were also raised / procured from authentic sources. Recommendations of the different Institutes for the different Agro-forestry models in the area of their respective operation are as under:-

Institute of Forest Genetics & Tree Breeding, Coimbatore

The Institute has spent Rs.13,32,225 on the entire project and planted 89,495 forestry species and 8686 fruit species, and covered an area of 1000 ha in three villages in district Coimbatore of Tamil Nadu. Forty five demonstration plot representing different agroforestry models were developed and maintained. Periodical growth, Biometrics and yield observations were recorded. Though many models and combinations have been found to be economically viable as well as socially acceptable, the most promising tree species and combinations were agri-silviculture, agri-silvi-horti and silvi-pasture models. Among the identified combinations, the most productive models were *Casuarina-maize* (Agri-silvi), *Casuarina-Moringa-Maize* (Agri-silvi-horti) and *Acacia auriculiformis-Napier grass* (Silvi-pasture). Among the successful models, the economic production of few of the replicable models were worked out. The farmers in the micro-watershed were initially unaware of the economic benefits of agroforestry. Teak is another farmers favourite tree which is now accepted and grown by all the farmers in the watershed. Based on the data generated from sample plots, the economic productivity of the selected models was worked out.

Tropical Forestry Research Institute, Jabalpur

The Institute has spent Rs.14,24,389 on the entire project and planted 52,001 forestry species and 33,379 fruit species, and covered an area of 3560 ha in Chhindwara, Jabalpur and Bastar districts of Madhya Pradesh. Experiments conducted in Saliwara micro-watershed which was not suitable for agriculture, block plantation of *Tectona grandis* could be adopted. Since the area has high grazing pressure and stall feeding is not the practice, only those species which are not grazed like *Tectona grandis* can survive. In such areas soil and water conservation measures like staggered trenching and application of VAM proved to be very beneficial for the growth and checking soil and water losses. Silvi-horticulture models comprising of combinations of Teak, *D. sissoo*, *A. procera*, *G. arborea* with guava and *E. officinalis* was found to be successful. In Karaboh agri-silvi model both bund planting and within the field, Teak with arhar and vegetable crop has shown good results. Agri-horti model consisting of mango in combination with wheat crop has performed very well. In Gandagouri; agri-silvi, agri-horti and agri-silvi-horti (all bund planting) was found to be very successful. Paddy is the main crop in this area. Teak, *G. arborea*, *D. sissoo*, *A. procera* and *Eucalyptus camaldulensis* was found to be the most promising species among forestry crops, while guava, *Emblica officinalis*, mango and *Atrocarpus heterophyllus* among horticulture species are doing very well. Silvi-horti and silvicultural block planting were found to be slightly inferior in this locality. Bund planting comprising of a mixture of silviculture and horticulture species is widely accepted by the people.

Centre for Social Forestry & Eco-Rehabilitation, Allahabad

The centre has spent Rs.11,57,450 on the entire project and planted 71,821 plants of different silvicultural and horticultural species in different agroforestry models like silvi-agri, silvi-hort, silvi-block etc. and have covered an area of 900 ha in three micro watershed area of Bhagwatpur, Bamhrauli and Bharetha situated in Allahabad district. 22 sample plots comprising silvi-agri, silvi-horti, silvi-agri-horti and silvi-block were established in three micro watersheds in irrigated and unirrigated land. The project has been successful as it generated sufficient awareness among the villages and farmers regarding adoption of agroforestry models and use of biofertiliser in increasing crop productivity. Center has laid down different agroforestry models in the farmer's field during 1997 and 1998. Comparing the field data of field crop, it is seen that the growth is much better. Analysis of the data indicate no significance change in agricultural crop production after establishing agroforestry models. At this stage it is premature to draw any inference regarding the factors associated with agroforestry such as shade effects, competition for nutrients and water, effect of litter fall or best combination of species in agroforestry models and their rotation etc. The most favoured species in the area are Eucalyptus, Shisham and Teak. Rotation period of Teak and Shisham is very long hence 3 year growth data is not sufficient to predict gain to the farmers in terms of timber value.

Arid Forest Research Institute, Jodhpur

The Institute has spent an amount of Rs.9,74,673 on the entire project and planted 20,935 trees of different silvicultural and horticultural species, and have covered an area of 1120 ha in three micro watersheds of Jaleli, Kudi and Sangariya located in Jodhpur districts. Emphasis was given on integration of rain water harvesting and soil conservation measures for developing various agroforestry models. To assess the potential use of biofertilisers in agroforestry systems field trials were conducted to evaluate the effect of VAM on tree growth. In spite of several constraints being faced in raising agroforestry plantations, it remains the fact that the agroforestry or multi-story production system based on potential indigenous trees like *P. cineraria* and *Zizyphus* sp. forms the backbone of agricultural production system in arid zone. The main recommendations emerged from the various research activities of this project are detailed as under:-

- Most of the area is rainfed and soil being sandy remains prone to wind and water erosion, there exist good possibility and scope for establishing trees in agroforestry system with use of different rain water harvesting and soil moisture conservation techniques.
- Design and diagnostic survey revealed that most of the area is degraded in nature, rainfed, hence most suited for silvi-pastoral system.
- Analysis of existing agroforestry system revealed that mainly Khejri (*P. cineraria*) based agroforestry practice is followed. In Jaleli watershed *Prosopis-Zizyphus* based multi story system is more common. Other important tree bushes which farmers retain in fields are *A. nilotica*, *T. undulata* and *Capparis decidua*. *Prosopis juliflora* is grown on field boundaries for vegetative fence and cut every two or three year as fuel wood.
- Field trials have shown that use of VAM is having high potential in enhancing growth and productivity in agroforestry system.
- Different agroforestry research trials were conducted to find out suitability of tree crop combination, crop rotation, above and under ground interaction, stand density, planting geometry etc. It has been found that the highest crop yield was recorded with Khejri (*Prosopis cineraria*) having a density of 278 stem / ha. The growth of tree was directly related to its stand density. The Institute has also

suggested different agroforestry models for arid zone for getting maximum biomass, Stand crop production.

World Bank Aided “ Forestry Research, Education and Extension Project (FREEP)” (2000-2001).

Forestry Research, Education and Extension (FREE) project was launched on 30th September, 1994 with the assistance of the World Bank. It is being implemented by the Indian Council of Forestry Research & Education (ICFRE), the Ministry of Environment & Forests (MOEF), and the States of Himachal Pradesh and Tamil Nadu. The total estimated cost of the project is Rs. 2151.48 million equivalent to US\$ 56.48 million. IDA credit (Cr-2572 IN) is for US\$ 47.0 million equivalent. The details of project components, implementing agencies and outlays and expenditures are as follows-

**COMPONENT WISE OUTLAYS AND EXPENDITURE UNDER FREEP
(FOR ICFRE PART ONLY)**

Project Component	Implementing Agency	Outlay-including contingencies	Price Outlay	Expenditure till 31 st March, 2001
		In US \$ (Million)	Rs. in Crores	Rs. in Crores
A. Research Management	ICFRE	6.03	22.613	18.3288
B. Research Program Support	ICFRE	41.00	156.533	137.0772
C. Forestry Education & Training	ICFRE	1.87	7.082	4.6868
		48.9	186.228	
D. Forestry Policy & Preparation	MOEF	2.31	8.876	
E. Bio-diversity Conservation	T.N. & H.P.	5.28	20.07	
		7.59	28.946	
TOTAL PROJECT OUTLAY		56.49	215.174	160.0928

Initially the Project was to terminate on 31st December 1999 but project was extended for two years, upto 31.12.2001 as a two step process. The World Bank also agreed with the Action Plan with revised procurement plan for civil works, equipments, studies and consultancies, and various other activities for the year 2000 & 2001. The total project expenditure till March 2001 is Rs. 160.09 crores against an outlay of Rs. 168.360 crores. The revised EFC has been proposed for Rs. 198.36 crores. The progress of important project programmes implemented by ICFRE is as follows:

Development of ICFRE

Indian Forestry Research Information System (IFRIS) is operational from April 2000 at FRI, Dehra Dun and ICFRE Headquarters. Around 100 clients are provided trainings. Few modules like FAS, PIS, Payroll are also functional at TFRI, Jabalpur; IFP, Ranchi; and AFRI, Jodhpur. The Financial Accounting System (FAS) for the year 2000-2001 is being used by all regional Institutes. HFRI, Shimla; IFGTB, Coimbatore; RFRI, Jorhat; IFP, Ranchi; AFRI, Jodhpur; and FRI, Dehra Dun have successfully closed the financial year accounting and others are in progress of completion. The hardware and software is procured by the Institutes.

The comprehensive document of National Forestry Research Plan (NFRP) printed in two volumes was released on 17th May, 2000 by Hon’ble Minister of Environment and Forests, Government of India. NFRP document is also placed on website for users.

Essential scientific equipments to provide a startup aid to SFD's to the tune of Rs. 500.00 lakhs is proposed. Major Civil Works completed are being utilised. An expenditure of Rs. 313.29 lakhs was incurred during the year 2000-2001 on the civil works. Project related office and scientific equipments worth Rs. 346.83 lakhs were utilized during the year.

Thirty research programmes covering many forestry disciplines initiated during 1994 were continued during the year 2000-2001 also. The project on Cellulose and Paper, FRI, Dehra Dun was terminated on 30th Sept, 1999.

Under Planting Stock Improvement Programme an area of 337.3 ha was culled for Seed Productions Areas, 12.75 ha as CSO and 5.95 ha SSO and 4 ha as Vegetative Multiplication Garden during the year ending March 2001. The cumulative achievement is 1225.62 ha of SPA, 166.45 ha. of CSO, 344.40 ha. SSO and 56.60 ha. of VMG's. Twenty CTA's Workshops were held at different Institutes during the year. Under Research Grant Fund (RGF) out of 181 Research Projects 106 Projects were decentralised and transferred to different Institutes for supervision and monitoring. A total of 41 Projects were completed so far.

152 Research Fellows were engaged under Research Support System during the year. Thereafter 113 research fellows were engaged beyond December 2000. Expenditure of Rs. 44.87 lakhs were utilized during the year 2000-2001.

International Training was arranged through different Universities during the extended period of the Project. Under Study Tour out of 30 slots 27 slots were utilized and under three months training 39 slots were allotted during the year out of which 38 were utilized.

Review of progress of ongoing projects and various activities against Annual Action Plan 2000-2001 under FREEP was carried out by World Bank Supervision Mission from May 1 to May 26, 2000 and October 28 to November 6, 2000 by Visiting Institutes and field experiment sites and the mission had observed overall satisfactory progress.

Forestry Statistics India 2000 has been published and distributed widely amongst the user agencies. Forestry Statistics India 2001 is under scrutiny and the data verification is in progress. Quarterly Timber / Bamboo Trade Bulletin is published regularly. Biometrical Assistance was provided to ICFRE Institutes as per guidelines laid down by World Bank.

Development of Neem in various Agro-Ecological Regions of India

Indian Council of Forestry Research & Education (ICFRE), Dehra Dun is executing the "NOVOD Board" sponsored Project on "**Integrated Development of Neem**" 1999-2002. The activities of Forest Research Institute, Dehra Dun are confined to the States of Punjab, Haryana, Uttaranchal and Western Uttar Pradesh. The other Institutes of Indian Council of Forestry Research and Education involved in the project are Arid Forest Research Institute, Jodhpur (for the State of Gujarat), Tropical Forest Research Institute, Jabalpur (for the States of Madhya Pradesh and Orissa), and Institute of Forest Genetics and Tree Breeding, Coimbatore (for the States of Tamil Nadu, Andhra Pradesh and Karnataka).

Based on survey results it was found that Neem trees are mostly growing in villages habitation, along the roadside but the number of trees on farmlands, wastelands, and forest areas are very few.

Based on data recorded in respect of tree measurement, trees have been divided into following girth classes: 50-70 cm; 70-90 cm; 90-110 cm; 110-140 cm and 140-280 cm. It was difficult to ascertain

the age of the trees but based on girth class some idea about their age has been worked out. The trees between 50-90 cm girth class have been grouped as young trees (10-15 years old), trees 90-110 cm girth class have been considered as middle age trees (15-25 years old) and 110 and above girth class have been considered as middle age old trees (25-35 years old). Lot of variation in tree form was observed which shows that no scientific methodology was followed in establishing trees and its management.

The number of CPTs during 2000-2001 identified in various States are given below : Punjab 142; Haryana 111 and Western U.P. 200.

The following provenances were delineated: Roorkee, Meerut, Khurza, Moradabad, Badaun, US Nagar, Agra, Ambala, Kurukshetra, Panipat, Patiala, Rohtak, Gurgaon, Hissar, Ropar, Muktsar, Amritsar and Hodal. Fruits were collected from 453 CPTs and 16 provenances.

Under Seed Exchange Programme, seeds of various provenances were exchanged between participating Institutes / Organizations. Germination percent recorded in respect of different provenances varies from 24 to 95%. The morphological parameters of seeds of various provenances recorded also varies.

Phenological studies conducted in Uttar Pradesh and Haryana reveals that leaves emergence commences is varied from place to place. The emergence of flowering commences from April to end of May. Fruiting takes place in end of May to end of June. The best time for collection of fruits is second week of July. The fruits will be collected within one week after ripening takes place.

Seeds of 453 and 50 provenances were sown in plastic trays filled with river sand. Total number of seedlings raised in root trainers was 59, 250.

Effect of nutrient application on growth performance of seedlings in the nursery was tested. Application of Nitrogen 500 ppm, Phosphorus 500 ppm and Potash 500 ppm has enhanced height and growth of Neem seedlings. Such combination has been standardized for raising nursery seedlings.

For mass multiplication of high oil yielding trees, vegetative propagation techniques have been standardized. Vegetative propagation techniques methods were tested. Soft wood cutting treated with I.B.A. (Indole Butyric Acid) 1000 ppm planted in vermiculite media, kept in Mist Chamber (35°C) gave about 50% rooting.

Conventional propagation through air layering, softwood cuttings and semi hardwood cuttings was chosen as a means for clonal propagation and advance clonal propagation through micropropagation was also undertaken for protocol development for commercial mass multiplication of clones.

Oil and azadirachtin content was determined and CPT's with 50% oil content and high Azadirachtin content were identified for future Neem Improvement Programme. The plantation of germplasm bank, provenance trial and spacing trial has been established at Gajrola, Uttar Pradesh.

Two farmers training were organized during February 2000 and March 2001 in Gajrola and Krishak Balaji Nursery and Balaji Nursery Bijnor.



MAJOR ACHIEVEMENTS OF THE COUNCIL

Forest Research Institute, Dehra Dun

- Developed cultivation package for *Sailanthes oleracea*.
- Evolved best clones of *Populus deltoides* for better growth and wood quality.
- Standardised method for extracting dyes from *Populus deltoides* and *Pinus roxburghii*.
- Evolved methods to compost the plant residue.
- Evolved natural resistance of Bamboo against termite.
- Effective conservation methods were evolved to control nursery disease and plantation.
- Borehole technique developed in Florida University were tested and is found to be significant to produce resin without much damage to the tree.
- An extra unit “dehumidifier” was evolved for saving drying time than the solar kiln drying.
- A new design of bentwood chair using vapour phase ammonia plasticization technique was evolved.
- Suitable species were evolved for mining area with appropriate soil and moisture conservation measure.
- List of tree species used for handicrafts products and alternative eco-friendly wood were surveyed and recommended to Kerala and Rajasthan to meet the wood demand for raw material.
- Methods were developed to modify Tamarind Kernel Powder (TKP) and *Cassia tora* gum to prepare products of commercial importance, texture and confectionery.
- Essential oil was isolated from the needles of *Cephalotaxus harringtonii* for the first time.
- Evolved screening of essential oils from *Vitex negundo* for its pesticidal activity against *Sitotroga cerealella*.
- Heartwood and resin oil of *Shorea robusta* were evolved for the first time.
- Evolved ameliorative role of tree plantation on soil properties in sodic areas.
- Complete tissue culture protocol has been developed for the *in-vitro* multiplication of Neem using explant for the multiplication of selected CPT for desired traits like high oil yield and high azadirachtin content.
- Efficient protocol has been developed for the regeneration of plants with leaf and internode as explant, which has potential use in future genetic transformation studies.
- Studies on natural durability and efficacy of preservative for Bamboo completed after 20 years of study and published.
- Working quality indices for few forestry species were evaluated to make meaningful comparisons and grouping for user agencies. Data on 85 species are available.
- A protocol has been developed for rejuvenation of mature clones, it is possible to obtain half-a-million clonal propagules from on hectare of hedge garden.
- Developed a new approach to study comprehensive parasitisation potential of egg parasitoid, *Trichogramma poliae*.
- Identified *Copidosoma varicorne* to be a promising larval parasitoid of the *D. sissoo*.
- Successfully evolved dewatering efficiency and brightness improvement from Poplar for paper manufacturing.
- Developed Research Database Management System package to provide timber price data on worldwide net.
- Methods were standardized to isolate dye from *Ageratum conyzoides*, *Parthenium hysterophorus*, *Populus deltoides* and Eucalyptus.

Institute of Forest Genetics and Tree Breeding, Coimbatore

- Standardized the micro-propagation protocols for *Eucalyptus* hybrid (*E. torelliana* x *E. citriodora*), *Acacia* hybrid (*A. mangium* x *A. auriculiformis*) and *Bambusa arundinacea*.
- A patent (No.PAT/418-16/99108) has been obtained for *in vitro* propagation of *Oxytenanthera stocksii* from National Research Development Council, New Delhi.
- Clonal propagation technology for Teak and Neem has been standardized for mass multiplication.
- The natural distribution of *Artocarpus hirsuta*, *A. integrifolia* and *A. lakoocha* has been studied in the States of Tamil Nadu, Andhra Pradesh and Karnataka.
- *E. camaldulensis* was found to be relatively tolerant to salt stress using the rate of photosynthesis as a physiological marker.
- Crude anti-fungal proteins obtained from *Rauwolfia tetraphylla*, *Andrographis paniculata* and *Piper longum* were found to totally inhibit the activity against 3 major forest pathogens, *Trichosporium vesiculosum*, *Macrophomina phaseolina* and *Aspergillus flavus*.
- The protocol for successful production of improved planting stock of Teak has been developed which has eliminated the problem of callus formation and increase the production of planting stock by 500 times compared to conventional method (seed route).
- Standardized the finger printing methods of *Casuarina* clones using Inter Simple Sequence Repeat with the assistance of Centre for DNA Finger printing and Diagnostics, Hyderabad.
- 51 CPTs of *Casuarina equisetifolia* have been planted at different places in S. India to study their performance and evolve suitable cultivar for environmental plantation.
- Suitable tree species for planting in the problem soils like mine dumps were identified and successfully raised in the quartz sand dumps after suitable bio-fertilizer inoculation.
- Standardised storage technique for *Vateria indica* seeds, which is a recalcitrant species, thus the viability of seeds could be increased from one week to about 2 months.
- Methanol and Hexane extracts obtained from the leaves and flowers of *Acacia nilotica* were found to be promising plant derived toxic chemical agents against the teak defoliators *Hyblaea puera* and *Eutectona machaeralis*.
- A database of 250 commercially exploitable medicinal plants was created. Cost benefit analysis of cultivating *Gloriosa superba* was worked out and network established for marketing *Gloriosa superba*, and *Mappia foetida* and other farm grown medicinal plants for farming community.

Institute of Wood Science and Technology, Bangalore

- Codification using card key features required for the creation of database for computer assisted timber identification have been completed for 52 genera belonging to six families.
- Utilization of lignocellulosic material (wood waste) was studied.
- A mechanism was evolved to control extractive leaching in *Pterocarpus marsupium*.
- Yield and composition of oil of new cultivars of *Pogostemon patchouli* were evaluated.
- Wood quality parameter studies for *Tectona grandis* and *Eucalyptus tereticornis* have been completed
- Sixteen catamarans made of *Bombax ceiba* and treated with Copper - Chrome - Arsenic (CCA) were distributed to fishermen in AP and Tamil Nadu for field cum demonstration trials.

Tropical Forest Research Institute, Jabalpur

- A bulletin on 'Self employment through cultivating of Bach' is available.
- A bulletin on 'Cultivation of Safed Musli (*C. borivillianum*) on agricultural lands, an ideal intercrop for idle space in Teak plantation' is available.
- About 250 plant species are documented in ethnobotanical studies that are used by the tribes for various medicinal and other purposes in Central India.
- Standardised vegetative propagation method for Neem.
- Right doses of insecticides have been calculated for foliar spray to minimise infestation of seed borer of *Albizia procera*.
- Different quantities of egg parasitoid, *Trichogramma brasiliensis* were introduced in Teak forests to suppress the infestation of Teak leaf skeletonizer. 1.5 lakhs parasitoids / ha is effective to minimise the infestation.
- *Trichogramma pretiosum* was found to be highly effective to suppress the pest population irrespective to their period of release.
- Sterilization techniques for the explants i.e. seed and axillary bud in *Gmelina arborea* has been standardised.
- Higher multiplication rate of the shoots of *G. arborea* has been obtained by using graded doses of cytokinins and other hormones.
- Standardised root trainer seedling production protocol for *Albizia procera*, *Dalbergia sissoo* and *Acacia nilotica*.

Rain Forest Research Institute, Jorhat

- Documentation of pests associated with forest trees in nurseries, plantations and natural forests of North - East has been completed. It contains various informations on the distinguishing characters, distribution, host plants, nature of damage, damage potential, life-cycle and control measures of the insect pests.
- Work on the control of *Calopepla leayana* using pathogens, parasites and predators has been completed.
- Studies on the Microfaunal component of litter ecosystem and their changes in relation to Shifting Cultivation has been completed.
- A total of 60 phyto-pathogenic fungi have been recorded in different forest nurseries, plantations and natural forests of North - East India.
- Vegetative propagation of *Gmelina arborea* through grafting has been standardized through rooting of single nodal cuttings.
- A vegetative multiplication garden of *Gmelina arborea* and *Tectona grandis* with 78 and 58 clones respectively was established along with Clonal Seed Orchards of 70 clones of *Gmelina arborea* and 50 clones of *Tectona grandis*.
- Individual accession numbers were assigned to *Gmelina arborea*, *Tectona grandis* and *Dipterocarpus retusus* for the purpose to protect the intellectual property rights of the breeders and the Institute for future breeding programmes.
- An Integrated management practice for sustainable development of Shifting Cultivation has been developed to conserve natural resources and upliftment of jhumias.
- Standardization of nursery techniques for 6 Bamboo species of North - East India has been completed and ready for transfer to the users.

Arid Forest Research Institute, Jodhpur

- Water stress level of -0.1 to -0.5 Mpa is the best treatment for better growth, biomass production and physiological function of the seedlings of *E. camaldulensis*, *A. nilotica* and *D. sissoo* considering water availability in arid zone.
- Application of sewage effluent significantly enhanced the nutrient concentration, uptake and growth and biomass production of *E. camaldulensis*, *A. nilotica* and *D. sissoo* seedlings.
- Standardised combination of *Calligonum polygonoides* and *Cenchrus ciliaris* best for fuelwood and fodder production whereas *C. polygonoides* with *Cassia angustifolia* was controlling sand drift and fuel wood production.
- *Calligonum polygonoides* provides better conditions for regeneration of *C. angustifolia* compared to *A. tortilis* and *P. juliflora* for habitat restoration.
- Exotic shrubs of genus *Atriplex* popularly known as salt bushes performed best on degraded arid salt affected soils.
- Survival of planted seedling is the biggest problem in water logged salt affected areas. Two site specific models namely **Double ridge mound technique circular dished mound** were evolved to prevent Water logging.
- Top height model / site index equation developed for *E. camaldulensis* and *D. sissoo* under irrigated conditions, area which may be used for assessing the productive capacity.
- Selective strain of VAM fungi (consortium inoculum) for Neem has been prepared for nursery inoculation and field trials.
- Concept of Nursery Ecosystem Analysis with emphasis on cultural and quarantine control was evolved for better pest management in forest.
- Effective concentrations showed a positive response of *Balanites aegypticea* against *Patialus tecomella*.
- 200 ha of Seed Production Areas, 55 ha of SSO, 5 ha of VMG and 29 ha of CSO of different tree species have been established in Rajasthan and Gujarat.

Himalayan Forest Research Institute, Shimla

- Four types of insect borers viz. *Sphaenoptera aterrima*, *Cryptorhynchus rufescens*, *Platypus biformis* and *Polygraphus longifolia*, were identified, which badly damages the bark and bast and formed a girdle around the affected trees which ultimately lead to their death.
- Bio-ecology of *Ectropis deodarae* – a destructive insect pest of Deodar has been studied in the field and laboratory conditions.

Institute of Forest Productivity, Ranchi

- 5.5 ha of Eucalyptus Clonal Seed Orchards has been raised at Netaipur under the FSVS, Midnapore.
- 15.5 ha of Vegetative Multiplication Garden of Bamboo (11.5 ha) and *Paulownia fortunei* (4 ha) have been established.
- 60 ha of Seedling Seed Orchards have been created for *Eucalyptus* species, *D. sissoo*, *G. arborea* and *Acacia* species.

Centre for Forestry Research and Human Resource Development, Chhindwara

- Fifth Junior Certificate Course on Nursery and Plantation Technology has been concluded and nine trainees have been trained under human resource development.
- Comparative quantitative vegetation analysis and regeneration behaviour of tree species at three sites in tropical dry deciduous Teak forests of South Chhindwara Forest Division has been completed as per the disturbance magnitude.

Centre for Social Forestry and Eco-Rehabilitation, Allahabad

- Established effective afforestation model on water logged sodic wasteland.
- Socio-economic studies and vegetation types at selected sites for degraded, Silica Mined Area, Salt affected and moisture stress studies for the selected village completed.
- Under PSIP, 69 ha SPA of *Dalbergia sissoo*, 30 ha SSPA of *Dalbergia sissoo* (20 ha) and *Acacia nilotica* (10 ha) and 3 ha CSO of *D. sissoo* have been established.

