



CHAPTER I

FOREST RESEARCH INSTITUTE DEHRADUN

Forest Research Institute (FRI), Dehradun has its roots in the erstwhile Imperial Forest Research Institute established in 1906 to organize and lead forestry research activities in the country. The Institute caters in particular, to the research needs of the Indo-Gangetic plains of Punjab, Haryana, Chandigarh, Uttar Pradesh and Uttaranchal. This Institute also has status Deemed University and at present offers three courses leading to M.Sc. degree and Post-Graduate Diploma courses, beside Ph. D. degree in forestry.

PROJECTS COMPLETED DURING THE YEAR 2003-2004

Project 1: Screening of new poplar clones developed by FRI based on wood quality parameters [FRI/190/BOT-29/2002-2004]
Principal Investigator - Dr Sangeeta Gupta

Findings: The result of this project indicated that wood quality of mature trees could be predicted at a very young age. The details of findings are being compiled in the form of project report.

Project 2: Computerization of Herbarium of Forest Research Institute, Dehradun [FRI-15/BOT-5 (SB)/1997-2004]
Principal Investigator - Dr Sas Biswas

Findings: Herbarium database on 900 specimens representing valuable type collections and species of economic importance was completed. A software based on operational taxonomic units, typification features and threat categories was developed with the help of Information Technology Division, ICFRE.

Project 3: Studies on isolation and characterization of polysaccharides of abundantly available seeds of trees/shrubs, leaves, bark and exudate gums [FRI-51/Chem-1]
Principal Investigator - Dr P.L. Soni

Sub-project (i) Study of *Cassia tora* seed gum (CTG) to find its uses [1997 - 2003]
Co-Investigator - Dr Vineet Kumar

Findings: Methylation of the oligosaccharides from cold water (CWS 1-4) and hot water soluble (HWS 1-4) polysaccharide was carried out by both Hakmori and Purdie method. Alditol acetate derivatives of the above oligosaccharides were prepared.

Project 4: Phytochemical examination for the utilisation of leaves, bark, fruits and roots of Indian Forest Plants [FRI-53/Chem-3].

Sub-project (v): Studies on vegetable dyes from *Parthenium hysterophorus*, *Ageratum conyzoides*, *Azadirachta indica* and *Eupatorium glandulosum* [2000-2003]
Principal Investigator - Dr Rameshwar Dayal

Findings: Methods were standardised to isolate the dye from the aerial parts of *Ageratum conyzoides*, *Parthenium hysterophorus*, *Eupatorium glandulosum* and *Azadirachta indica*. Optimum dyeing conditions using these dyes and mordants were determined.

Project 5: Impacts of pollutants on some tree species of Doon valley [FRI-116/Eco-3/1999-2004]
Principal Investigator- Dr (Ms) Laxmi Rawat



Findings: SPM level was found to be very high whereas SO₂ and NO₂ levels were within the CPCB standards at most of the experimental sites. The effects of pollutants on foliar pigments were upto 40-50 m distance from the highway.

Project 6 : Role of forests in soil and water conservation [FRI-117/Eco-4/ 1998-2003]

Principal Investigator -Dr Kalyan Singh

Findings: Studies on hydrology, soil and vegetation were conducted in Kulhal Forest watershed of Shiwaliks at Kalsi Forest Division, Dehradun (Uttaranchal) to find out the role of forests in soil and water conservation. The upper, mid and lower slope vegetation affected slope hydrology and stream flow in different ways.

Project 7: Management of sal heartwood borer in natural forests [FRI-63/FED-2/1993-2004]

Principal Investigator - Shri R.S. Bhandari

Sub-project (i): Management of sal heartwood borer in natural forests

Status: The incidence of sal heartwood borer, *Hoplocerambyx spinicornis* was drastically reduced to 1.25 percent in Dehradun Forest Division, 2.5 percent in Soil Conservation Division, Kalsi and 1.75 percent in Ramgarh Range of Rajaji National Park after successfully conducting the trap tree operation in the past year.

Sub-project (ii): Phytochemical examination of *Shorea robusta* to isolate and identify suitable compounds (kairomones etc.) for management of sal heartwood borer (*Hoplocerambyx spinicornis*)

Principal Investigator - Dr Rameshwar Dayal

Findings: Essential oils were isolated from different parts of *Shorea robusta* and characterized by GC-MS. The oils obtained from

leaves, heartwood, resin and bast showed the presence of 20, 24, 37 and 28 compounds, of which 8, 9, 17 and 9 compounds, were identified, respectively. α -caryophyllene was the chief constituent in the leaf oil while heartwood and resin oil contained germacrene-D as the major constituent and T-cadinol was the principal constituent of the bast oil. Behavioral study of the essential oils conducted against the sal heartwood borer showed bast oil to exhibit kairomonal activity.

Project 8: Evaluation of physical and mechanical properties of plantation grown *Paulownia fortunei* and two bamboo species, viz. *Bambusa balcooa* and *Bambusa nutans* [FRI-202/FPD (TM) - 42/2002-2003]

Principal Investigator - Shri Rajesh Bhandari

Findings: Effect of age on physical and mechanical properties of 3, 4 and 8 years old *Paulownia fortunei* were studied. The results indicated improvement in strength properties with age. In another study on bamboos, it was observed that bending strength of *Bambusa nutans* and *Bambusa balcooa* in split form is much higher than that in the round form both in dry and green condition. The compressive strength in dry condition both in split and round form is higher than that of green condition.

Project 9: To study the suitability of different combinations of plantation grown species for plywood manufacture [FRI-201/FPD(CW)-41/2002-2004]

Principal Investigator – Shri D.P. Khali

Findings: General purpose plywood using different combinations of Eucalyptus, Poplar and Paulownia were evaluated and it is observed that Eucalyptus with Paulownia performs better in comparison to other combinations.



Project 10: To study and develop the techniques of cultivation of *Uncaria gambier* to propagate it in the field and popularize the species in India [FRI-126/NWFP-6/1998-2003]

Principal Investigator - Dr P.P. Bhojvaid

Findings: The broad objectives of this project was to introduce an Indonesian species *Uncaria gambier* in India. This species yields tannin, which is used as a substitute for katha in India. Some germ plasm was collected from Padang Island. Seeds were grown in pure sand, sand+farm yard manure, and sand+soil+farm yard manure. There was profuse germination in all the growing media. However, pure sand showed the best results. Seed germination was observed between 10 to 15 days after sowing. Pricking of seedling was done in hyco trays, polybags and earthen pots. The germinated seedling/pricking started with onset of winter. Germplasm shifted to mist chamber and incubator survived for sometime in the mist chamber and eventually died. On the other hand the seedlings maintained in the incubator survived but did not show any growth at all. Subsequent to onset of spring these were again shifted to hardening chamber but seedlings did not show any promising growth and eventually died.

Project 11: Economic valuation of FRI estate [FRI-208/RS&M-11/2002-04]

Principal Investigator - Dr Mohit Gera

Findings: The project envisaged the valuation of tangible and intangible services provided by FRI estate. The various monetary valuation techniques employed included Contingent Valuation Method (CVM) Travel Cost Method (TCM), Hedonic Pricing Method (HPM) and benefit transfer method.

A large number of samples were drawn while employing these methods. A total of 812

questionnaires were filled up for CVM, 602 for TCM and 108 for HPM. Out of a total annual value of Rs. 6.11 crores estimated for the services of FRI estate, the maximum amount was contributed by CVM i.e. 55.32 percent whereas HPM contributed 30.93 percent and TCM accounted for only 2.67 percent of the total value. The tangible benefits and services on account of carbon sequestration contributed the remaining part.

Project 12: Poplar improvement in India [FRI-2/Silva-2/1997-2003]

Principal Investigator - Shri Dinesh Kumar

Findings: Recorded data of two year old field trials of clones of poplar (*Populus deltoides*) that have been produced under this project (i) from seeds collected from natural stands in the USA, (ii) through hybridisation among promising clones of previous introductions, and (iii) developed abroad. Maintained the germplasm bank of all (i.e. 400) clones produced under this project in a clone bank-cum-nursery at FRI campus.

Project 13: To standardize formation of compost from *Parthenium* under different variables with reference to quality [FRI-182/ Silva-16/ 2001-2003]

Principal Investigator - Shri M.S. Negi.

Findings: Compost has been prepared by Barkley and Indore processes. The samples of the compost were analysed for nutritional value.

PROJECTS CONTINUED DURING THE YEAR 2003-2004

Project 1: Computerisation of anatomical database of Indian hardwoods for the purpose of their identification [FRI-17/BOT-7/1997-2004]

Principal Investigator - Dr Sangeeta Gupta



Status : Wood Anatomy Information System has been developed for wood identification and wood anatomy research. Data are being collected for entering into the software. Wood images have been stored for all the three sections of woods viz. transverse, radial and tangential.

Project 2: Assessment of the performance of different clones of *Dalbergia sissoo* and *Eucalyptus* sp. on the basis of wood quality under different farm forestry programmes [FRI-192/BOT-31/2002-2005]

Principal Investigator - Dr P. K. Pande

Status: Intra-clonal and inter-clonal variations in specific gravity and anatomical properties of eight year old grown remets of six clones of *Dalbergia sissoo* Roxb. were investigated. Radial and location-wise intraclonal variations were non-significant for anatomical properties and specific gravity in all the three sites for all clones. However, inter clonal variations in wood properties and specific gravity were significantly different.

Project 3: Inventorisation of multipurpose trees and shrubs for domestication and introduction in agro forestry for socio-economic upliftment of rural sector of Dehradun [FRI-199/SF-5/2002-2005]

Principal Investigator – Dr Veena Chandra

Status: Questionnaire prepared and socio-economic data has been collected from families participating in agroforestry.

Project 4: Complete elimination of sulphur and chlorine compounds in pulping and bleaching by MILOX process [FRI-150/C&P-15/2001 – 2004]

Principal Investigator – Dr K. S. Bhandari

Status: In continuation to earlier experiments, to reduce the doses of formic acid and

peroxyformic acid *Eucalyptus tereticornis* wood chips were further pulped using lower doses of formic acid sandwiched between lower doses of peroxyformic acid treatment in two stages. Different catalysts were also tried for better formation of peroxyformic acid. Unbleached pulps were bleached in three stages alkaline peroxide under standard conditions.

Project 5: Studies on isolation and characterization of polysaccharides of abundantly available seeds of trees/shrubs, leaves, bark and exudate gums [FRI-51/Chem-1]

Principal Investigator - Dr P.L. Soni

Sub-project (vii): Chemical investigation of *Prosopis juliflora* seed polysaccharides [2000 - 2005]

Co-Investigator - Dr P.K. Gupta

Status: The Cold Water Soluble (CWS) polysaccharides isolated from the endosperm of seeds of *P. juliflora* was partially hydrolyzed with dil. H_2SO_4 (0.05 - 0.75N) and the product was subjected to paper chromatography. Results indicated the presence of 5 oligosaccharides.

Sub-project (ix): Chemical investigation of *Dalbergia sissoo* leaf polysaccharide [2002-2005]

Co-Investigator - Dr Vineet Kumar

Status: Three oligosaccharides (O-1, O-2, O-3) were eluted from partially hydrolyzed *Dalbergia sissoo* leaf polysaccharide by Dent's method.

Project 6: Phytochemical examination for the utilisation of leaves, barks, fruits and roots of Indian forest trees [FRI-53/Chem-3]

Principal Investigator - Dr Rameshwar Dayal

Sub-project (vi): Screening of medicinally important plants (i) *Achyranthes aspera*,



(ii) *Casearia tomentosa* and (iii) *Clematis roylei* [2002-2005].

Status: Extraction of *Achyranthes aspera* parts with petroleum ether, acetone and methanol was continued. Eight compounds were identified of which hydroquinone was found to be the chief constituent. Extractives of *Casearia tomentosa* bark and leaves using petroleum ether, acetone and methanol were prepared. The alcohol extract of the aerial part of *Clematis roylei* was prepared and is being screened for its anti-inflammatory, antipyretic, analgesic and antifungal activities.

Project 7: Chemical modification of cellulose and its industrial uses [FRI-194/Chem-8/2002-2006]

Principal Investigator - Dr V.K. Varshney

Status: Carboxymethylation of cellulosic material derived from bamboo was studied with reference to NaOH concentration. All the derivatives were soluble in cold water and maximum DS of 0.71 was found with 40 percent NaOH. Cyanoethylation of cotton linter cellulosic material was studied with reference to NaOH concentration.

Project 8: Improved utilization of raw materials for pulp and papermaking including juvenile tree utilization [FRI-129/C&P-14/1999-2005]

Principal Investigator - Dr Sanjay Naithani

Status: The pulps were evaluated for strength properties viz Burst factor 50, Tear factor 59, Breaking length 6800 meters and double fold 450. It was observed that unbleachable grade pulp can be obtained from populus roots.

Project 9: Plant growth strategy characterization, diversity and vegetational dynamics of rehabilitated and derelict mined

ecosystem in Western Himalaya [FRI-123/Eco-5/1999-2004]

Principal Investigator - Dr H.B. Vasistha

Status: Change in vegetation over the year has been monitored at different microhabitats selected in derelict and rehabilitated limestone mined area in Mussoorie hills of Garhwal Himalaya.

Project 10: Bio-ecological studies on the insect pests of bamboo and their management [FRI-144/FED-8/2000-2005]

Principal Investigator - Shri R.S. Bhandari

Status: Bamboo have versatile uses, particularly for rural poors. Insect pests cause heavy damage to green standing bamboos as well as felled bamboos in depots and in use. Borers of young sprouting culms causes direct loss. Hispine borer of bamboo may kill the culm or deshape it. Felled bamboos and bamboo in use is severely damaged by bamboo ghoon causing heavy loss of revenue. Management of the insect pests of bamboo will increase the productivity of bamboo.

Bioecological studies on hispine borer of bamboo *Estigmima chinensis* indicate that the beetle become active in the month of June. They feed on the tender leaves of bamboo. After mating female lays upto 15 eggs in the group of 2-5 on the surface of culm near node. Incubation period 11-15 days. Young larvae enter the culm and make an irregular, longitudinal larval gallery. Pupation takes place in the month of August and pupal period last for 20-25 days. The immature beetle remains in the larval gallery till next June. There is only one generation a year. Incidence of insect pests feeding on the bamboo was noted in Dehradun, Kalsi, Kaleshar



and Narendra Nagar Forest Divisions. The situation is as follows :

<i>Chrytotrachelus dux</i>	12 percent
<i>Estigmia chinensis</i>	11.25 percent
<i>Oregna bambusae</i>	3.5 percent
<i>Xylocapa</i> sp.	2.25 percent
Termite	3.15 percent

Project 11: Environmental conservation strategies for land use in the lower western Himalayas : Butterflies as indicators in monitoring environmental changes in urban gradients [FRI-145/FED-9/2000-2004]

Principal Investigator – Shri Arun Pratap Singh

Status: Environmental conservation strategies for land use in the lower western Himalayas with butterflies as indicators in monitoring environmental changes along an urban gradient.

Data collection on relative species richness and abundance of butterflies was carried out from 24 plots located at 6 sites under different land use patterns (sal forest habitats, agricultural land and tea gardens) during 45 days of monthly touring in Dehradun valley. Seven new species of butterflies collected taking the total checklist of the area to 218 species. Data compiled and analyzed for distribution, abundance, seasonality and diversity index under different sal forest habitats.

Project 12: Bioecology of insect pests of Paulownia and enumeration of their natural enemies [FRI 196/FED-11/2002-2007]

Principal Investigator - Dr M. Ahmad

Status : Regular survey conducted in Paulownia nurseries and plantations at New Forest, Devipur and Sahaspur (Dehradun), Burha khera (Saharanpur) and Hundewala Farm

(Yamunanagar) revealed moderate to heavy infestation of three lepidopterous defoliators, *Orgyia postica*, *Spilarctia obliqua* and *Hyposidra talaca*. Light infestation of *Spodoptera litura*, *Helicoverpa armigera*, *Autographa* sp., some pyralids and sphingids was recorded on the Paulownia foliage. *Nezara viridula*, *Dolycoris indicus* and *Tingis* sp. and some other phytophagous bugs and curculionid beetles were also found active on the foliage of Paulownia.

Parasitism was noticed in the larvae of *S. obliqua* and *O. postica*. Predatory bug, *Eocanthecona furcellata* and praying mantids were found active at all the sampling sites. Larvae of different instars of *O. postica* and *S. obliqua* were reared on the fresh leaves of Paulownia and also on alternate host, *Santalum album* and *Tectona grandis* respectively.

Studies on the bioecology of *O. postica* and nutritional preference of *S. obliqua* were conducted. Effect of different temperature conditions on the development of *O. postica* was studied. It takes 25 days to complete its life cycle from egg to moth at normal room temperature in April – May. During the months of January – February the larval period extended up to 41 days when reared at 15 °C in comparison to 17 days at normal room temperature in April. The pupal period was also prolonged to 28 days.

Project 13: Integrated pest management of major insect pests of mandate species in nurseries and plantations with special emphasis on biopesticides and microbial pesticides [FRI-198/FED-13/2002-2007]

Principal Investigator - Dr (Ms) Shamila Kalia

Status: During regular surveys in the selected sites. Fresh larvae of important pests viz.



Plecoptera reflexa, *Dichomeris eridantis*, *Cosmotriche laeta* and *Apodernus lolandus* and an unidentified arctiid larvae on *D. sissoo*, *C. cupreata*, *Parasa lepida*, *Bellipa lohor*, *Eupterote undulata* and *Neocerura wisei*, on Poplar along with many minor pests were collected. Seasonal life cycle also being worked out in the laboratory.

Dead and diseased larvae were also collected from the field. *Aspergillus flavus*, *Aspergillus niger* and two new fungi, *Nomuraea rileyi* and *Paecilomyces* sp., on *C. cupreata* and *Periconia* sp. and *Paecilomyces* sp. on *Parasa lepida* and *Aspergillus flavus* and *Pythium* sp. on *Plecoptera reflexa* have been identified and isolated for pure culture. Pathogenicity test conducted and pure cultures are being maintained for further experiments.

Regular collection of data on population fluctuation of *P. reflexa*, *D. eridantis*, *C. cupreata* and *P. lepida* is in progress. Experiments on the energy budget of *P. reflexa* continued. *Taniecus circumdatus* Wied, *Biston suppressoria* Guen and *Amsacta lactinea* reared as a new pest of *P. deltoids*.

Project 14: Green-dimensioning aspects of Bamboo and Eucalyptus processing [FRI-200/FPD (WWF)-40/2002-2004]

Principal Investigator – Shri S.P. Badoni

Status: The processing of the wood and bamboo products is initiated in green condition and inputs to improve durability, dimensional stability, strength and aspect of aesthetics are provided during the drying path. The slivers are not just stained by way of using ammonia fumigation, bark extracts, the component of durability and malleability have also been incorporated using a preservative, and a moisture retarding drying oil. These slivers are

quite soft to hands while making a product and offer a wide variety of shades ranging from light brown to dark golden brown for decorative basketry.

Project 15: To develop propagation technique i.e. micro propagation of economically important bamboos - *Arundinaria falcata* and *Bambusa balcooa* [FRI-219/G&TP-10/2002-2006]

Principal Investigator – Dr I.D. Arya

Status: Axillary bud cultures were established in *Arundinaria falcata* and *Bambusa balcooa*. *In vitro* shoot cultures were established and multiplied. Somatic embryogenesis was induced in *A. falcata*. *In vitro* rooting was induced in *in vitro* shoots.

Project 16: Evaluation of Australian seed sources and families of *Eucalyptus tereticornis* for productivity and genetic improvement [FRI-203/G&TP-9/2002-2006]

Principal Investigator - Dr H.S. Ginwal

Status: Observations with respect to various morphological traits were recorded on trials established at FRI Dehradun, Chiryanpur (Hardwar) and Midnapur (West Bengal).

Project 17: Development of cultivation methods of some commercially important medicinal plants (i) *Desmodium gangeticum* and (ii) *Oroxylum indicum* [FRI-204/NWFP-9/2002-2005]

Principal Investigator - Dr A.K. Sharma

Status: Extensive field surveys have been undertaken in the states of Haryana, Uttar Pradesh, Uttaranchal and parts of Himachal Pradesh. The population status of the project species was recorded. The germplasm of the species was collected and experimentally

tried under nursery conditions at Dehradun for studying the germination behaviour of the species.



Micropropagated plantlet of *Oroxyllum indicum*



Germinated Somatic embryos of *Swertia chirata*

Project 18: Introduction of commercially important medicinal plants in NWFP nursery, Dehradun [FRI-205/NWFP-10/2002-2005]

Principal Investigator - Dr A.K. Sharma

Status: Medicinal plants were collected from Dehradun and adjoining areas and introduced in NWFP nursery at FRI, Dehradun. The germplasm collected earlier was maintained and multiplied.

Project 19: Screening for disease resistance in genetic material raised under tree improvement programmes [FRI-207/Path-13/2002-2007]

Principal Investigator – Dr N.S.K. Harsh

Status: Screening for disease resistance done in CSOs and SSPAs of *Dalbergia sissoo* at Lacchiwala (Dehradun), Paonta Sahib (H.P), and Bhitmera (Hissar and Haryana), Hoshiyarpur (Punjab) and Chandigarh. Protocol for artificial inoculation of rust in *Dalbergia sissoo* seedlings has been successfully developed for the first time.



Artificial inoculation of rust in *Dalbergia sissoo* and symptoms development

Project 20: Biological control of *Lantana camara* and *Parthenium hysterophorus* by fungal pathogens [FRI-206/Path-12/2002-2007]

Principal Investigator – Shri Amit Pandey

Status: *Lantana camara* and *Parthenium hysterophorus* infested forests in and around Chhichharauli, Yamunanagar, Poanta Sahib, Saharanpur, Rani Chauri, Chakrata and Dehradun were surveyed for diseases on these weeds and diseased samples were collected. Study of sub-lethal doses of herbicides viz. glyphosate, paraquat, atrazine and 2,4-D and their combination with pathogens are being tested in glasshouse.

Project 21: Parasitic and symbiotic associations of tree species used for harsh sites afforestation [FRI-138/Path-08/2000-2005]

Principal Investigator – Dr Y.P. Singh



Status: Root and soil samples from sodic patch, grass and 6 commonly grown tree seedlings were collected and analyzed for mycorrhizal infection and types from nurseries raised in Kanaksinghpur and Ramshahpur PFFCs. Generally, root cortex of different plant species were colonized moderately high (67.2 percent) by the arbuscular mycorrhizal fungi. Varying spore numbers were quantified in the root zones of plant species ranging from 121.3 spores/50 ml of soil in sodic grass to 1188.0 spores/50 ml in *Eucalyptus* sp.

Shisham mortality and other diseases (leaf spots, twig blight, etc) were assessed in Harkumau, Kankupur, Urarmau, PFFCs, etc. Isolation and identification of root rot (*Ganoderma lucidium*), stem and twig blight (*Helminthosporium dalbergiae*) and leaf blight (*Colletotrichum gloeosporioides*) pathogens of shisham was done. Samples were collected including a root and soil sample of *Dalbergia sissoo* for *Pseudomonas* isolation. Besides, pioneering wood rotting fungi were also observed on the stem of dead shisham trees.

Project 22: Development of suitable silvicultural strategies under JFM [FRI- 180/ Silva -14/ 2001-2006]

Principal Investigator - Ms Neelu Gera

Status: Data with respect to socio-economic status of 8 villages of Garhwal and ecological conditions in protected and unprotected forests of JFM were compiled and analysed. Data with respect to the socio-economic conditions of the villagers through 120 questionnaires by random sampling were also collected from 6 villages of Uttaranchal.

Project 23: Evaluation of production and quality parameters of seeds from seed production area

vis-à-vis natural stands of chir [FRI-209/ Silva-18/ 2002-2005]

Principal Investigator – Ms Manisha Thapliyal

Status: The seedlings of individual families from Jarmola SPA raised in nursery were periodically observed for seedling survival, height, collar diameter, etc. Chirpine SPA site selection was done for collection of seeds. About 25-30 cones were collected from 6 trees.

Project 24: To develop Knap-sack manual root trainer carrier for carrying root trainer trays in different proportions and standardize model of knap-sack type manual root trainer [FRI-183/ Silva-17/2001-2004]

Principal Investigator – Shri M.S. Negi

Status: The proto-type root trainer carrier has been designed and developed by Forest Operation Unit and is under trial at Central Nursery of FRI.

NEW PROJECTS INITIATED DURING THE YEAR 2003-2004

Project 1: Inventorization and monitoring of biodiversity of threatened wetland sites of Doon valley and surroundings, Uttaranchal [FRI-250/ BOT-33/2003-2006]

Principal Investigator – Dr Sas Biswas

Status: Reassessment study of extent of flora of eight wetland sites of biological diversity significance and recharging potential was carried out for study on the successional development of biodiversity. Threatened habitat characterization and categorization criteria and indicators were finalized for the inventorization of wetland sites.

Project 2: Studies on isolation and characterization of polysaccharides of



abundantly available seeds of trees/shrubs, leaves, bark and exudate gums [FRI-51/Chem-1]

Principal Investigator - Dr P.L. Soni

(a) Sub-project: Chemical modification of *Cassia occidentalis* seed gum [2003 - 2006].

Status: Carboxymethylation, carbomylethylation, and cyanoethylation of *C. occidentalis* seed gum were carried out with respect to amount of alkali, substituents (monochloroacetic acid, acrylamide, acrylonitrile), temperature, duration and gum-solvent ratio. Characterization, analysis and rheological studies of the modified products were carried out.

(b) Sub-project: Chemical modification of Tamarind Kernel Powder (TKP) for industrial uses [2003-2006]

Co-Investigator - Dr Vineet Kumar

Status: Carboxymethylation of TKP has been carried out. The reaction conditions were optimized with respect to concentration of NaOH, monochloroacetic acid (MCA), reaction time, temperature and mass-liquor ratio. Viscosity of 2 percent solution of the modified product was found to be 1137.5 cps as compared to native TKP, which has a viscosity 525 cps.

Project 3: Study of plant responses to air pollution for air quality monitoring in Dehradun [FRI-231/Eco-11/ 2003 - 2006]

Principal Investigator- Dr Ashutosh Kumar Tripathi

Status: Various sites at Haridwar road, Rajpur road, Chakrata road and Saharanpur road have been selected for monitoring purposes. Leaf samples of *Eucalyptus* hybrid, *Cassia fistula*, *Mangifera indica*, *Ailanthus excelsa* and *Populus deltoides* were collected.

Project 4: Evaluation of *Chrysoperla carnea* for predation potential against the key defoliator

of *Dalbergia sissoo* and *Populus* sp. [FRI-232/FED-15/2003-2006]

Principal Investigator - Shri Lalji Prasad

Status: Evaluation of *Chrysoperla carnea* for predation potential against the key defoliators of *Dalbergia sissoo* and *Populus* sp. (Approved by RPC in May 2003 and work started from the same month). Survey of *Dalbergia sissoo* nurseries and plantations was carried out at Kalsi, Dakpathar, Bahadarabad (Hardwar), Roorkee Forest Range, Barkot Forest Range (Dehradun) and Chhachharauli Forest Range (Haryana) for the collection of *Chrysoperla carnea* (Predator) and *Plecoptera reflexa* and *Clostera* sp., the key defoliators of Shisham and Poplar respectively. During course of survey light to moderate defoliation was observed by *P. reflexa* on *D. sissoo* at aforesaid sites. Some eggs of *Chrysoperla* were collected from shisham plantation, Barkot Range, Dehradun. These eggs were kept in the laboratory for hatching. Hatched larvae were reared by feeding eggs and larvae of various host insects. Adults thus obtained were processed in the laboratory and identified as *Chrysoperla carnea* Stephens. Preliminary rearing experiments revealed it as a potential insect predator. Further work is in progress.

Project 5: Upgradation and computerisation of National Insect Reference Collection (NIRC) [FRI-233/FED-16/2003-2006]

Principal Investigator - Dr Sudhir Singh

Status: Taxonomy of Parasitic Micro-Hymenoptera (Chalcidoidea) - Discovered and described following four new species of hymenoptera viz. *Metaphycus cassiae* sp. nov., *Astymachus felix* sp. nov., *Cheiloneurella indica* sp. nov. and *Caenohomalopoda longistylus* belonging to family Encyrtidae.



Discovered and described new genus *Indocampsis*, parasiting pine cone borer, *Chlorophorus strobilicola* (Col.: Cerambycidae). This species is the first record of subfamily Sigalphinae (Hymenoptera: Braconidae) from the Oriental region.

Upgradation of NIRC - Geometrid collection in NIRC was updated and upgraded with the help of Dr V. K. Walia, Department of Zoology, Punjab University, Chandigarh. Names of 267 species updated and 16 new additions (donated by him) are being incorporated and rearranged with the existing holdings of NIRC.

Bethylidae and Formicidae (Hymenoptera) collections in the NIRC have been updated with present nomenclature and former is completely incorporated into the database.

Accessions of the collection was increased by 292 new incorporations (from 20967 to 21258).

Computerisation of NIRC - A Database in Microsoft Access was developed where information regarding taxa, their hosts, locality, bionomics and location in the collection is recorded. Information is stored in 16 tables, which are linked to a main entry form. This main form has 33 fields for storing above-mentioned information of a species. Database can generate reports for accession register, index cards, specimen labels, cabinet labels, host-parasite list, Checklist of species, etc.

Presently data of 2000 species have been incorporated into the database. These data are mainly on the type specimens present in the Collection.

Project 6: Identification and updating of Braconid parasites (Hymenoptera) of major insect pests in National Insect Reference

Collection (NIRC) and Doon valley [FRI-234/FED-17/2003-2006]

Principal Investigator - Dr (Ms) Neena Chauhan

Status: Under the project, Identification and upgradation of NIRC, identification services have been provided to JRF of S.D. College, Muzaffar Nagar. Pyralid - *Scirpophaga excerptalis* Walker on Sugar cane has been identified. Freshly stretched, labeled and identified specimens belonging to 50 species were donated by Dr V.K. Walia of Punjab University, Chandigarh were incorporated in NIRC. Identification services have been provided to Central Nursery, Silviculture Division moth *Oxytrita bipars* Hmps (Lep : Noc) has been identified. Identification services have been provided to Officer-in-Charge, DRS Jodhpur, Rajasthan. Ten insects of different orders, Coleoptera, Hemiptera and Orthoptera were identified. Identification and upgradation of NIRC, identification services have been provided to HFRI, Shimla. *Polygraphus longifolia*, *Ips longifolia* (Scolytidae : Coleoptera) on *Pinus roxburghii* have been identified. Identification services have been provided to Dr K.C. Joshi, Head, Entomology Division, TFRI, Jabalpur.

Project 7: Women and NTFP based agro-forestry system in Uttaranchal and Western Uttar Pradesh [FRI-235/SF-6/2003-2005]

Principal Investigator - Dr Rajiv Kumar

Status: A questionnaire was developed for collection of information on various aspects. Survey was completed of NTFP based agro-forestry system in 3 villages of Chakrata Block, 8 villages of Doiwala Block, 3 villages of Kalsi Block, 4 villages of Vikasnagar, 5 villages of Raipur Block and 7 villages of Sahaspur of District Dehradun; 2 villages of Hapur block and



2 villages of Garhmukteshwar of District Ghazibad; and 2 villages of Dugadda, 2 villages of Khirsu and 2 villages of Pauri block of District Pauri Garhwal.

Project 8: Management of natural resources as affected by the socio-economics of rural people of Jhajra watershed in Dehradun district [FRI-251/SF-7/2003-2005]

Principal Investigator - Dr D.D. Haokip

Status: Literature survey, development of questionnaire, preliminary survey of the project area/villages and identification of families were completed. Survey and data collection is initiated.

Project 9: Development of computer database for management of strength properties of timber [FRI-237/ FPD (TM) – 44/2003-2004]

Principal Investigator – Shri Rajesh Bhandari

Status: Database architecture prepared and data entry form, data retrieval, various calculations, report generation and all possible data flow for strength properties and suitability indices and safe working stress of timber has been tested. Collection of data and entry of 200 species was carried out.

Project 10: Evaluation of physical and mechanical properties of *Acrocarpus fraxinifolius* and classification and grading of timber for different end uses [FRI-238/ FPD (TM) – 45/2003-2005]

Principal Investigator – Shri V.K. Jain

Status: Testing of *Acrocarpus fraxinifolius* in green and dry conditions for evaluation of its physical and mechanical properties has been completed as per IS : 2455.

Project 11: Effect of moisture content on (a) resonance frequency of timber and in turn

on dynamic MOE, (b) microwave absorption [FRI-239/ FPD (TM) – 46/2003-2004]

Principal Investigator – Dr Vimal Kothiyal

Status: Testing of *Albizia procera* samples by conventional and vibration method completed as a first component. Samples of *Albizia procera* were also studied by microwave absorptions as second component. The technique is non destructive in nature and subject to various factors as such the first run is a trial run and its data will be useful at subsequent stages to perfect this technique.

Project 12: Studies on enhancement of natural durability of bamboo and plantation grown species with conventional/eco-friendly preservatives [FRI-236/FPD (WP)-43/2003-2006]

Principal Investigator - Dr Sadhna Tripathi

Status: *Bambusa balcooa* and *Bambusa nutans* were treated with modified Boucherie and Modified Wick Processes using borax : boric acid. Chemical analysis revealed that retention in both processes was uniform at all points of investigation and newly developed modified Wick process was about five times faster than modified Boucherie process.

A new composition Copper; Zinc; Borate (CZB) complex at 1 percent concentration gave efficient fixation of each metal ion in Poplar and Chir wood and shown high efficacy against brown and white rot fungus in laboratory.

Project 13: Evaluation of fertilizer effects on medicinal plants in watershed areas for soil conservation and production [FRI-242/FSLR-18/2003-2005]

Principal Investigator - Dr S.B. Singh

Status: Degraded site in Kulhal watershed area, Dehradun was selected and soil profile



was studied. *Vetiveria zizanioides* and *Cymbopogon citratus* were transplanted in the area, treated with four doses of N (0, 25, 50 and 75 kg per ha) and four doses of potash (0, 25, 50 and 75 kg per ha) following randomized block design.

Project 14: Contribution of soil minerals for sustainable management of Uttarakhand forest [FRI-240 / FSLR-16 /2003-2005]

Principal Investigator - Dr A.K. Raina

Status: The rock and soil samples from the selected sites were collected. Physical and chemical analysis was carried out.

Project 15: Development of computer based forest soil information system for India [FRI-241 / FSLR-17 /2003-2005]

Principal Investigator - Dr M.K. Gupta

Status: Developed computer based soil information system programme to feed the soil information, consulting the literature and collecting the required information on the soil attributes under different forest, plantations, land uses in various parts of India.

Project 16: Exploration of copper lignin complexes for wood preservation and effect of post treatment processes on precipitation or fixation in wood [FRI-252/FPD (WP)-44/ 2003-2006]

Principal Investigator - Dr Sadhna Tripathi

Status: Evaluation of natural durability and evaluation of treatability are in progress comprising experiments in the lab. and field trials at Dehradun Chakrata and Jodhpur.

Further higher concentrations of complexes for efficacy in mango wood are under investigations. Scanning electron micrograph of wood revealed efficient penetration of preservative.

Project 17: Development of protocol for clonal multiplication and germplasm conservation of some medicinal plants [FRI-243/G&TP-14/ 2003-2004]

Principal Investigator - Ms Parveen

Status: Work on micropropagation of three species of medicinal importance namely, *Oroxylum indicum*, *Swertia chirata* and *Gymnema sylvestre* was carried out. To conduct this study modified formulations of nutrient medium (Ms) supplemented with different hormonal regime were tried. A protocol for micropropagation of *O. indicum* has been developed using different ex-plants from *in vitro* grown seedlings. Fifty shoot buds were produced from single ex-plant after passage of two sub-culturing. High frequency of somatic embryos have been produced in *S. chirata* using immature zygotic embryos. These embryos germinated into emblings when they were transferred into another.

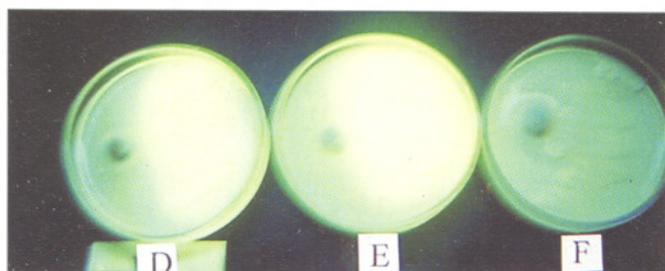
Project 18: Assessment of shisham die back (decline) in northern India and its remedial measures [FRI-245/Path-12, 2003-2008]

Principal Investigator - Dr A.N. Shukla

Status: *Fusarium solani* was isolated from the pitch and dead roots. Its morphological and cultural characters have been studied and it was subjected against 15 strains of *Pseudomonas*



Antagonistic interactions between *Pseudomonas fluorescence* and *Fusarium solani*



The plates as seen under UV light D,E,F depict the places from where *P. fluorescence* was collected (D-Kapurthala, E-Birshah ka jungle, F-Patyadi)

fluorescence isolated from healthy shisham trees, growing in diseased areas, for testing its antagonistic ability. Control experiments were also laid down at Haldwani in a pure shisham plantation in 1999 using seven treatments such as *Trichoderma viride*, *Pseudomonas fluorescence*, Chloropyrophos, Carbendazim and Propiconazole and their combinations

Project 19: Economics of cultivation of commercially important medicinal plants [FRI- 246/ RSM-14/ 2003-2006]

Principal Investigator - Dr Mohit Gera

Status: Collection of data on cost and benefit aspects of cultivation of medicinal plants was carried out for Kalmegh, Tulsi, Satavar, Ratti and Aswagandha from the cultivators at Karnal and Yamuna Nagar in Haryana.

Project 20: Contribution of forestry and human development in forest dependent

community of Jaunsar area [FRI- 248/ Stat-1/ 2003-200]

Principal Investigator - Rajiv Pandey

Status: The sampling frame has been made and sample villages were identified. Questionnaire has been developed and tested. Data collection is under progress.

PROJECTS COMPLETED DURING THE YEAR 2003-2004

(Externally Aided)

Project 1: Evaluation of *Radiata pine* from New Zealand [FRI-184/FPD-38 (CW)-External/ 2002-2005]

Principal Investigator - Shri S.P. Badoni

Sub-project 1: Evaluation of physical and mechanical properties for doors and window shutters and frames and poles

Co-Investigator – Shri V.K. Jain

Findings: The sub-project has been completed and the report will be submitted to the sponsors in due course of time.

Sub-project 6: Evaluating the suitability of *Pinus radiata* as structural timber

Co-Investigator – Shri Mohan Lal

Findings: The sub-project has been completed and the report has been submitted.

Project 2: Qualitative and quantitative improvement of mulberry leaf production by application of chemical and biofertilizers in Doon valley of Uttranchal [FRI-189/Path-11/ External/2002-2004]

Principal Investigator – Dr Y.P. Singh

Findings: A survey of 15 mulberry varieties was conducted to evaluate their natural mycorrhizal



status at Sahaspur, Dehradun in January 2002 and October 2003. The varietal experiment was initiated in January 1999 and laid out in Randomized Block Design (RBD) with three blocks (replicates). During January 2002 sampling, in general, low root colonization was observed in all the mulberry varieties ranging from 35.8 (K-2) to 51.7 (TR-10) percent. In October 2003 sampling, in general, moderate root colonization was quantified ranging from 42.7 (S-799) to 64.0 (BC-259) percent. Contrary to root infection, the chlamydo spores in the rhizosphere of all the varieties were quite high (ranging from 14.5 in S-54 to 31.2 in S-1635). Varying numbers of chlamydo spores were extracted from the root zone of different varieties (ranging from 15.8 in BC- 259 to 34.0 in S-36).

PROJECTS CONTINUED DURING THE YEAR 2003-2004

(Externally Aided)

Project 1: Conservation of nitrogen fixing plants : A reliable approach for the rehabilitation of degraded sites in Himalayan ecosystem [FRI-161/BOT-22/External/2001-2004]

Principal Investigator - Dr S. Nautiyal

Status: The maximum number of genus and species were recorded in Papilionaceae followed by Mimosoaceae and minimum in Caesalpiniaceae. Among different species maximum number of plants recorded were herbs followed by shrubs, trees and minimum climbers between 350 to 2400 m in Garhwal Himalayan region.

Project 2: Screening and identification of fast growing fuelwood, fodder species for higher biomass projection in Garhwal Himalayas [FRI-162/Bot-23/External/2001-2004]

Principal Investigator - Dr S. Nautiyal

Status: Diurnal changes in chlorophyll fluorescence features in leaves of several indigenous fodder tree species grown under nursery conditions were recorded at three altitudes (640 m, 1200 m and 1800 m) in Garhwal Himalayas for comparative study as well as to adaptation potential of species along with altitudinal gradient. Chlorophyll fluorescence features occurrence of mid-day depression in Fv/Fm ratio is species specific and not common phenomenon to all species. Among the tested species *Grewia optiva*, *Bauhinia purpurea*, *Melia azedarach* and *Celtis australis* showed reduction in Fv/Fm ratio with increasing altitude. However, in *Quercus leucotricophora* Fv/Fm ratio increased with increasing altitude.

Project: 3 Creation of germplasm bank of commercially important tree species of Punjab [FRI-178/BOT-28/External/2001-2004]

Principal Investigator - Dr S. Nautiyal

Status: Germplasm bank of *Dalbergia sissoo* (53 Clones), *Acacia catechu* (95 progenies) *Populus deltoides* (116 Clones), and *Azadirachta indica* (43 progenies), at Pindori and Khakan in Punjab have been created. Bambusetum of *Bambusa balcooa*, *B. nutans*, *B. tulda*, *B. vulgaris*, *B. multiplex*, *Dendrocalamus membranaceus*, *D. asper*, *D. strictus* and *Melocanna baccifera* established at Kharkan, in Punjab. Planting stock of *Acacia nilotica* (55 progenies), *Albizia lebeck* (103 progenies), *Albizia procera* (53 progenies), *Holoptelia integrifolia* (56 progenies), *Terminalia arjuna* (85 progenies), *Melia azedarach* (87 progenies), *Toona ciliata* (24 progenies), *Morus alba* (39 clones), and *Eucalyptus tereticornis* have been raised and maintenance for transplanting.

Project 4: Developing bioclimatic indices for important species existing under agroforestry



and departmental plantations for different agro-climatic zones of Punjab [FRI-217/Bot-32/External/2002-2005]

Principal Investigator - Shri V.R.S. Rawat

Status: Growth data for selected species viz. *Acacia catechu*, *Acacia nilotica*, *Albizia procera*, *Dalbergia sissoo*, *Eucalyptus* sp. *Melia azedarach*, *Morus alba* and *Populus* sp. existing under Agroforestry/departmental plantations has been collected from Ropar, Hoshiyarpur and Ferozpur forest division along with soil samplings at four different horizons in each plantations.

Project 5: Identification, taxonomy, properties and uses of different species of Shorea of the Malay Peninsula [FRI/191/BOT-30/External/2002-2005]

Principal Investigator - Dr P.K. Pande

Status: Variations in physical, gross and microscopic anatomical features of different species of Shorea of red meranti group of Malay peninsula have been studied. Variance ratio (F) test indicated that differences among the wood element dimensions of studied species of Shorea were significant for fibre length, vessel length, wall thickness and fiber diameter ($\alpha = 0.05$).

Project 6: Prospecting for botanical pesticides/ an all India coordinated research project [FRI-188/Chem-7/External/2002-2005]

Principal Investigator - Dr Rameshwar Dayal

Status: Out of total 73 extracts, including those of the previous year (2002-2003) sent for screening, 13 extracts from different parts of 06 plant species were found to be active. 11 active extracts were re-prepared from the recollected plant material and sent for reconfirmation of their activity.

Project 7: Development of ecorestoration model for iron ore mines of Bihar and Orissa [FRI-179/Eco-9/2001-2006]

Principal Investigator - Dr (Ms) P. Soni

Status: Seeds of *Mangifera indica*, *Artocarpus heterophyllus*, *Spondias* sp., *Madhuca indica* and *Anacardium occidentale* were planted in the pits, whereas seeds of *Shorea robusta*, *Schleichera oleosa*, *Bauhinia* sp. and *Aegle marmelos* etc. were planted in the trenches. Ipomoea and Vitex cuttings were also planted at over burden dumps mined out benches and the degraded sites.

Project 8: Long term impact of monoculture of forest tree species on forest and non forest lands in Punjab [FRI-177/Eco-08/External/2001-2004]

Principal Investigator - Dr Laxmi Rawat

Status: Biomass and productivity were estimated for *Eucalyptus* sp. on regression equation basis. Shisham, Khair and Poplar species are being studied.

Project 9: Evaluation of Radiata pine from New Zealand [FRI-184/FPD-38(CW)-External/2002-2005]

Principal Investigator - Shri S.P. Badoni

Sub-project 2: Evaluation of natural durability and treatability under Indian conditions

Co-Investigator - Dr Indra Dev

Status: *Pinus radiata* blocks (19 x 19 x 19 mm) treated with different concentrations of CCA are being analysed for performance against white rot and brown rot fungi in the laboratory conditions. The wood, however, is showing differential penetration of preservative at various positions.

Sub-project 4: Evaluation of woodworking, carving and finishing properties under diverse operation

Co-Investigator - Shri S.P. Badoni.



Status: Analysis of data of all the six operations viz. planing, sanding, turning, moulding, mortising and boring has been completed as per IS: 8292:1992. The working quality index, ease factor and over all performance have been calculated.

The experiments on various combination of finishing treatments were completed and the gloss on the above treatments was measured. Photo oxidation studies are in progress on wood surface coatings.

Sub-project 5: Evaluating the suitability for general purpose, shuttering, marine plywood and block board

Co-Investigator – Shri D.P. Khali

Status: Radiata pine from New Zealand were evaluated for general purpose ply wood, marine grade plywood and concrete shuttering plywood.

Project 10: To establish manufacturing process and market utilization of Eucalyptus wood for value added products for domestic and export market [FRI-185/FPD-39(WS)/External/2001-2005]

Principal Investigator – Shri S.P. Badoni

Status: This project aims at making value added products from plantation grown Eucalyptus for export and domestic markets. Two lots of *Eucalyptus* hybrid logs were sawn by various methods with a view to obtain best recovery after seasoning. It has been observed that under steam heated kiln seasoning, planks sawn under modified quarter sawing method gave the maximum recovery after seasoning (64 percent) making it better than the balanced tangential sawing method. A few samples of flooring strips with tongue and groove jointing have been made using four side planar cum moulder. Final

touches are being given in this direction to perfect the technique.

Project 11: An interdisciplinary approach to analyse the dynamics of forest and soil degradation and to develop sustainable agro-ecological strategic fragile Himalayan watersheds [FRI-187/FSLR-13/2001-2005]

Principal Investigator - Dr M.N. Jha

Status: Hydrological instruments viz. rain-gauges were calibrated, standardized and installed at different places in Arnigad watershed to cover the variations of altitude, aspect and land use.

Project 12: Consultancy for operationalization of seedling production through clonal technology in Punjab [FRI-171/G&TP-8/External/2001-2004]

Principal Investigator - Dr A.K. Mandal

Status: Hedge gardens of three species viz; *Dalbergia sissoo*, *Eucalyptus tereticornis*, and *Populus deltoides* have been established. 140 personnel of the Punjab Forest Department have been trained on different aspects of clonal technology.

Project 13: Genetic improvement and mass production of nursery planting stock of khair, shisham and kikar [FRI-170/G&TP-7/External/2000-2005]

Principal Investigator – Dr S.K. Sharma

Status: Established progeny trials of *Acacia nilotica* and *Acacia catechu* using half-sib progenies of 40 CPTs each of both the species. Clonal seed orchard of *Dalbergia sissoo* has been established. Clonal materials of *A. nilotica* and *A. catechu* have been raised for establishment of CSO in April/May 2004. Assessment of progenies of *A. nilotica* and *A. catechu* is in progress.

Project 14: Analysis of population genetic structure and diversity in Himalayan Pines using molecular markers [FRI-221/G&TP-12/External/2002-2005]

Principal Investigator - Dr H.S. Ginwal

Status: Recruitment of staff has been completed. Laboratory has been equipped with fine equipments allotted under the project and the seed material of various species of pine was collected from different source of their natural zone.

Project 15: Micropropagation of promising interspecific F₁ hybrids of Eucalyptus and establishment of field trial [FRI-220/G&TP-11/External/2002-2005]

Principal Investigator - Dr I.D. Arya

Status: So far *in vitro* cultures were established through axillary bud culture in two hybrids, *in vitro* shoots were also multiplied. For scale up purposes cultures were provided to TERI, New Delhi for tissue culture plant production.

Project 16: Micropropagation of chirpine (*Pinus roxburghii*) and shisham (*Dalbergia sissoo*) [FRI-222/G&TP-13/External/2002-2005]

Principal Investigator - Dr Sarita Arya

Status: Immature green cones of all the developmental stages of chirpine were collected and evaluated in tissue culture system for the establishment of embryogenic cultures. In shisham superior clones were used to develop tissue culture through axillary bud culture. Different medium were formulated for the culture of axillary buds, *in vitro* shoot multiplication and for somatic embryogenesis.

Project 17: Studies on interrelationship between production levels and marketing of important forestry species in Punjab [FRI-174/RS&M-9/External/2000-2005]

Principal Investigator - Dr N.S. Bisht

Status: Growing stock of poplar has been worked out in different tehsils of district Ludhiana. It was observed that the estimated future harvest is decreasing continuously. The reason is, the decline in planting of poplar due to continuous price fall. Some of the reasons for the price fall of poplar were: bulk planting of poplar in late nineties; land consolidation in U.P; delay in payment of sugarcane prices in 2002; exploitation by commission agents; fear psychosis among farmers; incidence of insect attack on poplar; inappropriate planting material, and limited diverse uses of poplar wood.

The worse sufferer of price fall are the farmers. The net price received by farmers for good quality produce was Rs. 185/qt. in 2002. This has been further declined to Rs. 99/qt. for same quality produce in 2003.

Project 18: Development of community based market information services for medicinal plants of Uttaranchal [FRI-215/RS&M-12/2002-2005]

Principal Investigator - Dr N.S. Bisht

Status: Plant profile of rasaut / daruhaldi (*Berberis aristata*), chirayata (*Swertia chirayita*), kutki (*Picrorhiza kurroa*) and guggal (*Commiphora wightii*) and addresses of important traders of medicinal plants of Tanakpur, Ramnagar, Hardwar, Rishikesh and Saharanpur along with important news items pertaining to this sector in the Uttaranchal state have been published. A website on medicinal plants i.e. <http://marketinfoherbs.icfre.org> has also been launched.

Project 19: Value assessment of plantations raised by IFFDC Ltd. in Sultanpur [FRI-220/RSM-13/External/2003-2004]

Principal Investigator - Dr N.S. Bisht



Status: Training was imparted to IFFDC staff to collect field data. The enumeration was done by them, however, there were certain gaps in the field data as submitted by IFFDC. They have been requested to take fresh measurement incorporating the suggestions. A team shall also be sent shortly at Sultanpur to undertake final enumeration work.

Project 20: Studies on Himalayan pines [FRI-175/Silva-12/External]

Principal Investigator - Dr Rajeev Kumar Srivastava

Sub-project 1: Seed testing

Co-Investigator – Dr R.C. Thapliyal

Status: Significant amount of genetic variation has been observed in different characters of cone, seed and seedling. The chir pine seedlings belonging to 56 sources have been out planted in 4 ha area at FRI campus (600 m) and at Jarmola (1200 m) in a restricted randomized block design with 7 replications of 8 tree plots (in all 3380 plants) at each site.

Sub-project 2: Nursery and planting technology

Co-Investigator - Shri Dinesh Kumar

Status: Laid out three field trials of bareroot seedlings of *Pinus roxburghii* at Ringalgarh and Arakot in Distt. Tehri Garhwal and at FRI campus, Dehradun. Experiments showed that bareroot seedlings can be safely stored for 2-3 days in shade without use of any cold storage facility. The cost of transportation of bareroot seedlings was found to be considerably lower than containerised seedlings.

Sub-project 3: Screening and identification of drought resistant provenances of Himalayan pine species

Co-Investigator – Dr S. Nautiyal

Status: Four seed sources of *Pinus roxburghii* had been screened for their water stress tolerance behaviour. The variation in chlorophyll contents, photosynthetic potential/ behaviour was evaluated via chlorophyll fluorescence measurements and biomass studies had also been carried out. A sharp decrease was observed in chlorophyll content i.e., chlorophyll *a*, chlorophyll *b* and total chlorophyll as water stress increased. Jubbal Seed Source was found to be best drought tolerant and Mohand Seed Source was most drought sensitive.

Total leaf polyphenols, total sugars (reducing and non-reducing both) and total amino acids were also estimated of seven seed sources. Total polyphenols, sugars and amino acids were increased with increasing levels of water stress and had been observed maximum in monthly watering interval. Though in general these secondary metabolites were found maximum in Chopal Seed Source and minimum in Rajouri Seed Source.

SDS PAGE (Sodium Doecyl Sulphate Poly Acryl amide Gel Electrophoresis) of proteins of thirteen different seed sources of *Pinus roxburghii* and eleven different seed sources of *Pinus wallichiana* has been done to evaluate the genetic variability.

Genetic variability had been estimated out in twenty different seed sources of *Pinus wallichina* based on seed characteristics and germination parameters. Also correlation among these parameters was studied.

Sub-project 4: Studies on stem rust of chir pine

Co-Investigator - Dr A.N. Shukla

Status: The chir pine seedlings raised from the seeds of 32 provenances were inoculated with the sporidia of *Cronartium himalayense* and



incubated for 15 months at Nainital to get the symptoms. The following parameters were selected for the screening of resistant provenances.

Number of pycnia per seedling, size of canker, and other symptoms like oozing of resin etc. were selected for the screening of resistant provenances and it has been concluded that Nachan and Jamata (Nahan) provenances were highly resistant and Dharasu, Jarmola and Dambigarh provenances were highly susceptible. Microtomy was conducted to study the sequence and pattern of infection in the cells.

Sub-project 5: Investigation on Ectomycorrhizae of chirpine and bluepine

Co-Investigator – Dr P.S. Rawat

Status:

Chir pine

Mycorrhizal (Ectomycorrhizal) studies on one year old seedlings of 11 seed sources of chir pine have shown comparatively better growth and mycorrhizal occurrence in Birahi seed source. Brown smooth dichotomous mycorrhizae have shown their dominance in all the studied sources followed by black smooth types of mycorrhizae. Mycorrhizal isolates namely *Amanitopsis*, *Boletus* spp., *Coenococcum geophyllum* and two strains of *Russula* spp. were maintained on nutrient agar medium.

Blue pine

Qualitative and quantitative estimation of mycorrhizae collected from Uttaranchal (4) and Himachal Pradesh (4), identified for seed collection, have shown average number of short roots and mycorrhizal roots were maximum in Mashobra (47.20) Ghasta (H.P) and Sattal (Uttarkashi) have shown seven different types of mycorrhizae in each seed source. Black smooth and black bristled mycorrhizae in all

eight seed sources except black bristled form of mycorrhizae in Tapovan were isolated. The mycorrhiza fungi namely *Amanita hemibapha*, *Boletus edulis*, *Bovistella bovistoides*, *Rusulla delica* and *Suillus sibiricus* were collected and identified. *Suillus sibiricus* was found to be dominating in most of the locations surveyed during rains.

Sub-project 6: Investigation on diseases of bluepine (*Pinus wallichiana*)

Co-Investigator – Dr P.S. Rawat

Status: Seed collected from five seeds sources were examined for incidence of pathogenic mycoflora. A total of 11 fungal sp. namely *Aspergillus niger*, *A. flavus*, *Cladosporium herbarum*, *Penicillium* sp., *Trichoderma viride*, *Rhizoctonia solani*, *Chaetomium murorum*, *Fusarium oxysporum*, *Rhizopus stolonifer*, *Chaetomium globosum* and *Cladosporium epiphyllum* were recorded. *A. niger* was the most predominant one and was found in all seed sources except Pandaar which have shown least incidence of fungus. The incidence of heart rot caused by *Phellinus pini* was recorded to be maximum.

NEW PROJECTS INITIATED DURING THE YEAR 2003-2004

(Externally Aided)

Project 1: "Eradication of lantana by under planting with bamboo" Kandi project [FRI 227/ Bot 33/ External]

Principal Investigator – Dr Mohinder Pal

Status: *Dendrocalamus strictus* and *Bambusa bambos* were planted during August, 2003 at three different selected experimental sites (Kharkan, Bheet and Tibba Tappararian) in Punjab with five treatments and four replications. Collection of growth performance data and photosynthetic efficiency of planted bamboo along with soil sampling is in progress.



Project 2: Bioconversion of lignocellulosics feedstock into ethanol as biofuel [FRI-224/C&P-16/2003-2005]

Principal Investigator – Dr K. S. Bhandari

Status: Selection of lignocellulosic raw material, proximate chemical analysis of baggase was done in which alcohol – benzene solubility, holocellulose, lignin was determined. Acid hydrolysis of bagasse was performed under different conditions using different doses of H₂SO₄ (5 percent, 10 percent, 15 percent and 20 percent) and lignin was separated out from the hydrolyzate. The hydrolyzate was neutralized and concentrated. The hydrolyzate was decolorized using activated charcoal. Acid hydrolysis of lantana has been carried out under one set of conditions.

Project 3: Utilization of economic potential of parthenium [2003-2006]

Principal Investigator - Dr P.L. Soni

Status: Preliminary assessment of raw material in terms of hot water solubility, 1 percent NaOH solubility, alcohol-benzene solubility, holocellulose, alpha cellulose, petosans and klason lignin was carried out.

Project 4: Production of alpha cellulose from *Lantana camara* and its chemical modification for industrial applications [FRI-226/Chem-11/External/2003-2006]

Principal Investigator - Dr P.L. Soni

Status: The anatomical studies were undertaken in terms of fiber length, fiber diameter, lumen diameter, wall thickness, runkel ration, length/width ratio (L/D) and shape factor. Conditions for alkali hydrolysis were optimised. Alpha cellulose produced was isolated and derivatised to prepare carboxymethyl cellulose (CMC). Reactions conditions were optimized and derivatised product was analysed for degree of substitution, viscosity and turbidity.

Project 5: Novel chemo-enzymatic technology for the food fibre from Guar/*Cassia tora* gums [FRI-225/Chem-10/External/2003-2006]

Principal Investigator - Dr P.L. Soni

Status: Partial depolymerization of guar galactomannan was achieved using different concentrations of HCl (2N, 3N, 4N and 6N) for different durations from 30 to 180 minutes at varying liquor ratios (1:2 to 1:4) and further depolymerization was carried out with different concentrations of H₂O₂ (5 to 20 percent) for 30 minutes at 1:3 material to liquor ratio. The depolymerized products have viscosity 1 to 5 cps whereas the viscosity of native guar gum solution (1 percent) is 3650 cps. Thermal degradation of guar galactomannan was also done at ~130°C. Depolymerization of guar galactomannan was carried out using enzymes from *Cassia tora* seeds. The viscosity decreased from 3650 cps to 25 cps.

Project 6: Identification, development and utilization of natural dyes from the forest plants of Uttaranchal [FRI-249/Chemistry-12/External/2003-2006]

Principal Investigator - Dr Rameshwar Dayal

Status: Number of experiments were conducted to optimize the operational parameters to obtain quality product. Extraction and dyeing trials with dyes from lantana leaves, *Cassia tora* seeds and *Eucalyptus* hybrid leaves using different mordant were carried out.

Project 7: Chemical screening of the oilseeds of some high oil yielding tree species in the Himalayan region [FRI-233/Chem-9/External/DBT/2003 - 2006]

Principal Investigator - Dr Rameshwar Dayal

Status: Seeds of *Sapindus mukorosii*, *Prinsepia utilis*, *Heteropanax fragrans*, *Mallotus*

philippensis, *Putranjiva roxburghii*, *Cordia myxa*, *Bombax ceiba*, *Crateva nurvala*, *Holoptelea integrifolia*, *Michelia champaca*, *Perilla frutescens* and *Heynea trijuga* were procured from different locations. Fatty oil was extracted from these seeds. *Prinsepia utilis* seeds kernel were found to contain maximum yield of oil (37 percent).

Project 8: Chemical screening of the oil seeds and development of seed handling practices and plantation trial of some high oil yielding tree species in the Himalayan region [FRI-233/Chem-9/External/DBT/2003-2006]

Principal Investigator – Dr R. C. Thapliyal

Status: The objective of the project is to develop a package of seed handling techniques and proper collection time of seeds of the *Prinsepia utilis*, *Putranjiva roxburghii*, *Sapindus mukorosii* and *Schleichera oleosa* for raising vigorous and early transplantable seedling. Germination studies and various physico-chemical properties of oil like saponification value, acid value, and specific gravity were determined for different seed sources of *Sapindus mukorosii* and *Prinsepia utilis*.

Prinsepia utilis seeds collected from Hathipaon (Mussoorie Forest Division, Uttaranchal) showed (93 percent) initial germination declined to 0.00 percent after 3 months. August appears the most suitable seed collection time for *Schleichera oleosa*.

A fresh seed of two populations of *Putranjiva roxburghii* located at Rishikesh and FRI campus started germination after 8-10 days and was 100 percent. Oil content of seeds was 48 percent.

Survey for *Sapindus mukorosii* was conducted in Uttaranchal and Himachal Pradesh.

Seed maturation studies were done to determine the appropriate time of seed collection, which was seven months after anthesis. Mature seeds of *Sapindus mukorosii* were collected from 9 places. It is observed that germination at room temperature was slow (took 45 days) and low 10-12 percent on top of paper but in sand, it was faster (took one month) and 34 percent.

Project 9: Impact of disturbances on biodiversity status, resource availability and their management for sustainable development in Kandi area of Punjab [FRI- 228/Eco-10/External/2003-2005]

Principal Investigator - Dr H.B. Vasistha

Status: Various habitats influenced by fire, grazing lopping and infestation of exotic weeds have been selected in Kandi area of Punjab for ecological studies.

Project 10: Studies on soil site for optimizing biomass productivity [FRI-229/FSLR-115/External/2003-2006]

Principal Investigator - Dr M.N. Jha

Status: Six field experiments have been laid out, 2 each in steep slope, cho and bouldery gentle slope in Kandi Area of Punjab.

RESEARCH ACHIEVEMENTS

Name	No. of projects completed in 2003-2004	No. of ongoing projects in 2003-2004	No. of projects initiated in 2003-2004
Uttaranchal	2	8	12
Uttar Pradesh	—	1	2
Haryana	—	2	1
Punjab	—	6	4
Others	13	23	14



TECHNOLOGY ASSESSED AND TRANSFERRED

Tissue Culture Protocol for mass multiplication of two *Eucalyptus* hybrid (FRI-5 and FRI-14) has been transferred to TERI, New Delhi.

EDUCATION AND TRAINING

Trainings organised

The following Short Term Training Courses were organised for officials of Government of India, State Forest Departments, Public Sector Undertakings, NGOs and representatives from various Industries.

1. Basic training in field identification of timber
2. Wood technology
3. Development of green belts
4. Classification and grading of timber
5. Eco-restoration of waste lands, and
6. Management of forest harbarium and arboreta.
7. Training on Wooden Pallets for Packaging of Polyester Film Rolls.
8. Training on wood seasoning and ammonia bending technology to the participant of workshop of Indian Industries association held at FRI in February-March, 2004.
9. Nineteen villages were selected at three altitudes in Garhwal Himalayas and training cum demonstration camps were arranged for the farmers. They were educated about the pre and post planting techniques.
10. Four days training programme for ACFs and Range Officers Chandigarh from 12th to 15th January, 2004 regarding establishment and maintenance of field Germplasm Bank.
11. Farmers Training-cum Awareness Course on 'Cultivation of Medicinal plants under Agroforestry tree species'.

Training received

1. Ms Parveen attended training for two weeks on "Sample surveys and organization of large scale sample surveys" at Central Statistical Organization, New Delhi from 9th to 20th February, 2004.
2. Dr Mridula Negi, attended programme on 'Environmental Impact Assessment' at Wild Life Institute of India, Dehradun from 15th to 20th December, 2003.
3. Dr A.K. Tripathi attended a certificate course on "Management of Chemical/Hazardous Wastes" in Hyderabad organised by National Centre for Technical Development, Hyderabad from 6th to 9th February, 2004.

LINKAGES AND COLLABORATION

National

1. Memorandum of Understanding was signed between NRDC, New Delhi and ICFRE, Dehradun. NRDC will also assist in the patenting of technologies.
2. A multi-disciplinary and multi-institutional project "Biotechnological approaches for improvement of plant species with special reference to pulp and paper" was formulated project has been approved by New Millennium Indian Technology Leadership Initiative (NMITLI) cell of CSIR, New Delhi. In this project, eight Indian Research Institutes and four Industries are involved.
3. Collaboration with National Informatics Centre (NIC), New Delhi was sought for development of computer software for wood identification.

International

Dr (Ms) P. Soni is working as an activity leader in European Union Project to study the processes of degradation in Himalayas.

PUBLICATIONS

Books

Trends in Carbohydrate Chemistry, Vol. 8 (2002), ed. P.L. Soni.

Quarterly Newsletter

"Market Information on Medicinal Plants". Four issues of the Newsletter have been published by the RS & M Division and disseminated to various end users.

Bulletin

Singh, A.P. (2003). Evaluating natural resistance in *Populus deltoides* clones against its prime defoliator *Clostera cupreata* in northern India. *ICFRE Newsletter*, 3(2) : 4.

Research Papers

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CONSULTANCIES

- Preliminary consultancy report on utilization of effluent by Eucalyptus plantation at Patiala Distillery, Patiala for one day.
- Consultancy was given to five industrial units.
- M/s Polyplex Ltd., Khatima (Uttaranchal) on Wooden Pallets for packaging of Polyester film rolls.
- M/s Chambal Fertilizer and Chemicals Ltd., Kota (Rajasthan) on Cooling Towers Timbers.
- M/s Asahi India Glass Ltd., Mumbai (Maharashtra) on Wooden Crates for Packaging of Glass Sheets.
- Medicinal Plant Board of Haryana.

Testing

1. Large number of samples received from different industries and organization were tested. Total fees received Rs. 14,96,550=00.
2. About 625 wood samples were examined and identified and revenue of about Rs. 13 lakhs earned.

Patents Obtained / Filed

1. VAC-FRI Technology for treatment of green Bamboo Patent Filed No. PAT/4.19.14/03012/2003.

CONFERENCES/MEETINGS/WORKSHOPS/SEMINARS / SYMPOSIA / EXHIBITIONS

1. A National workshop on Wild Silks Culture and Forestry was organised at FRI from 21st and 22nd April, 2003. Official of Central Silk Board, ICFRE and FRI officers participated in the workshop.
2. A Parliamentary Standing Committee comprising Members from Lok Sabha and Rajya Sabha visited FRI on 28th June, 2003 to have on the spot assessment of the working of the FRI and interaction with the senior officers of the ICFRE and FRI. Sh. Manoj Bhattacharya, Honorable Member of Parliament chaired the meeting.
3. Agarwal, Manisha and Gupta, Sangeeta (2004). Microstructure of secondary xylem of ligneous species of Indian Sapindaceae (Subfamily: Dodonaeoideae) with special remarks on their systematic position and ecological variation. Presented at 91th *Indian Science Congress*, Chandigarh.
4. An entrepreneurship Development programme for the educated unemployed youths/ NGO's / Industrialists was organized with the help of SSI, Nainital and FRI, Dehradun.
5. An International Workshop on Forests for the Poverty reduction-changing role for research development and trainings institute. The international delegates from Bangladesh, Nepal, Bhutan, Myanmar, Thailand, Indonesia, Philippines and Cambodia participated besides officials from the state Forest Department and ICFRE and Institutes.



6. Arya, I.D.; Arya, Sarita; Gupta, Sangeeta and two research scholars attended *Indian Science Congress* from 3rd to 7th January, 2004.
7. Arya, I.D.; Chauhan, S.; Kumar, A.; Sharma, V.K. and Arya, Sarita (2004). Micropropagation of promising interspecific F1 hybrid of Eucalyptus. In: *Indian Science Congress*, Chandigarh.
8. Badoni, S.P. and Khali, D.P. (2004). Workshop on "Prospects of Lantana" on 10th and 11th February, 2004 at Dehradun organized by HESCO, Dehradun and DST, Govt of India.
9. Badoni, S.P. and Negi, Y.S. (2004). National Workshop on "Conservation and Sustainable Utilization of Lesser Known Tree Species" held at FRI, Dehradun from 8th to 10th March, 2004.
10. Badoni, S.P.; Inder Dev; Tripathi, Sadhna and Khali, D.P. (2003). National Workshop on "Wood Preservation in India: Challenges, opportunities and strategies" on 20th and 21st October, 2003 organized by Institute of Wood Science and Technology, Bangalore.
11. Badoni, S.P.; Khali, D.P.; Singh, S.P.; Singh, J.P.; Negi, Anil and Gupta, Sachin (2003). Patent awareness workshop on 13th August, 2003 at ICFRE, Dehradun.
12. Badoni, S.P.; Pandey, C.N.; Inder Dev; Kothiyal, Vimal; Khali, D.P.; Bhandari, Rajesh; Singh, S.P.; Singh, J.P. and Negi, Anil (2003). Panel-expo Seminar and Exhibition at Pragati Maidan, New Delhi on 5th September, 2003.
13. Badoni, S.P.; Singh, S.P. and Gupta, Sachin (2004). Training program for Entrepreneurship development on Forest Based Industries on 25th February, 2004 at FRI, Dehradun.
14. Badoni, S.P.; Tripathi, Sadhna; Kumar, Kishan and Khali, D.P. (2003). Workshop on "Natural Resourced based Technologies for Industries" on 27th December, 2003 at ICFRE, Dehradun organized by IIA, Uttaranchal Government and FRI.
15. Bhojvaid, P.P. (2004). Human Needs, Scientific Management and Economic Forces - Origin of Lesser-known Tree Species. Paper presented in the National Workshop on "Conservation and Sustainable Utilization of Lesser Known Tree Species" at Forest Research Institute, Dehradun from 8th to 10th March, 2004.
16. Bhojvaid, P.P. (2004). Subsistence needs, Scientific management and Economic forces : Issues for sustainable management of NTFP for livelihood generation in South Asia. Paper presented in the South Asian Workshop on "Accelerating Implementation of National Forest Program (NFP): Strategies and New Direction" at New Delhi from 10th to 12th March, 2004).
17. Bhojvaid, P.P. and Badoni, S.P. (2004). India Briefing Seminar of Pinus Radiata for select group of New Zealand forestry experts on 2nd February, 2004 held at New Delhi.
18. Biswas, Sas (2003). Eco- restoration of threatened habitats of biodiversity significance. In: International Conference on Eco-Restoration.
19. Biswas, Sas (2003). Forest biodiversity and environment management. In: IAEM



- National Conference on Innovative Approaches in the Management of Environment, Nagpur, 17th and 18th October, (2003). Proceedings IAEM Nagpur, Nagpur and Delhi College of Engineering, p. 49-50.
20. Biswas, Sas (2003). Forest biodiversity conservation initiative and poverty alleviation. In: Asia Pacific Regional Workshop on "Forests for Poverty Reduction: The Changing Role for Research, Development and Training Institution" 17th and 18th June, 2003 Proceedings at ICFRE, Dehradun p. 5.
21. Biswas, Sas (2003). Indigenous knowledge of Indian mountains, communities and biodiversity conservation: In International Seminar on mountain farming: High altitude harvest- A mosaic of perspectives on mountain development, 19th to 21st November, 2002, Mussoorie organized by CECI, CIDA, ICIMOD. 67 and 68.
22. Biswas, Sas; Jain, S.S. and Chandra, Sumer (2004). Lesser-Known Rare and Threatened Tree Diversity of Wetland Sites of Doon Valley and Surroundings, Uttarakhand : Need for Conservation: In National Workshop on "Conservation and Sustainable Utilization of Lesser Known Tree Species", Forest Research Institute, Dehradun.
23. Chandra, V. (2004). Ethnobotanical Approach to Eco-restoration. Proceeding of National Seminar on 'Rehabilitation of Lands under Anthropogenic Stress and Degradation.
24. Chandra, V. (2004). Traditional Knowledge and Wisdom in Conservation of Biodiversity with Special Reference to edible plants of India. Proceeding of National Conference in Traditional Knowledge Systems in India: Kharakpur.
25. Chandra, Veena and Sharma, Shruti. (2004). Ethnobotany of the Lesser Known Trees of Rajasthan : In Proceedings of National Workshop on "Conservation and Sustainable Utilization of Lesser Known Tree Species" Forest Research Institute, Dehradun from 8th to 10th March, 2004 : pp 38.
26. Dayal, Rameshwar (2004). Chemical constituents of some forest plants. Delivered an "Invited Lecture" in IUPAC International Conference on Biodiversity and Natural Products: Chemistry and Medical Applications (organised by University of Delhi and CSIR) held at Hotel Le Meridien, New Delhi from 26th to 31st January, 2004.
27. Entrepreneurship Development programme on Forest based Industries at F.R.I, Dehradun from 19th February to 3rd March, 2004.
28. F.R.I. Organised a "Seminar on Natural Resource Based Technologies for Industries" at F.R.I., Dehradun on 27th December, 2003.
29. Gupta, P.K. (2003). On the absolute molecular weight determination of cell wall polysaccharide through high performance gel permeation chromatography - Multi Angle Laser Light Scattering. Paper presented in XVIII Carbohydrate Conference held at IICB, Kolkata from 5th to 7th November, 2003.
30. Gupta, Sangeeta and Negi, Krishna (2004). Differentiating Chambered crystals in Wood



- fibres and Wood Parenchyma: A Case study of Indian Meliaceae. Presented at 91th Indian Science Congress, Chandigarh.
31. Gupta, Sarika; Sharma, Pradeep and Soni, P.L. (2003). Carbamoylethylation of *Cassia occidentalis* seed gum. Paper presented in XVIII Carbohydrate Conference held at IICB, Kolkata from 5th to 7th November, 2003.
32. Gusain, M.S. and Bhojvaid, P.P. (2004). *Prunus cerasoides* D. Don. : A multipurpose tree for the hills. Paper presented in the National Workshop on "Conservation and Sustainable Utilization of Lesser Known Tree Species" at Forest Research Institute, Dehradun from 8th to 10th March, 2004.
33. His Excellency Governor of Uttaranchal, Shri Sudershan Agarwal, inaugurated the workshop. The main objective of this workshop was inventorisation of species diversity and genetic resources, role in eco-restoration and afforestation programme, involving indigenous groups in management and conservation, intellectual property rights and transferring benefits to indigenous communities, participatory forest management with emphasis of lesser known tree species (LKTS), sustainable use of forest products- food, fodder, oils, gums and resins and medicine, wood products, valuation and market strategies, high nutrition fodder from LKTS, capacity building and employment generation, demonstration sustainable management through technology transfer and training. The workshop was attended by the Forest Officers from various states, Scientists, University Professors and Non-Government Officers etc.
34. Husain, H.J.; Sharma, A. K.; Pirasteh, S. and Tomar, A. (2004). *Socio-economic and Agro-Ecological Analysis of Village Ecosystem in Garhwal Himalaya*. Proceedings: National Seminar on state of the art on Conservation of Biodiversity in India with particular reference to Himalaya at Centre of Research for Development, University of Kashmir, Srinagar (India) from 22nd to 24th March, 2004.
35. International Conference on Eco-Restoration was sponsored by Planning Commission of India and organized by National Institute of Ecology, New Delhi and ICFRE, Dehradun. The Chief Guest for the occasion was Prof. C.P. Thakur, Union Minister of Small Scale Industries. Maj. Gen. (retd.) B.C. Khandwari, Union Minister of Road Transport and Highway and Dr. D.N. Tiwari, Member Planning Commission have also addressed the delegates. About 70 delegates from National and International Institutions attended the conference and deliberated on issues related to restoration and conservation of forest lands.
36. International Conference on Eco-Restoration at FRI, Dehradun from 14th to 19th October, 2003.
37. International Trade Fair, Pragati Maidan, New Delhi from 14th to 27th November, 2003. (Dr S.P. Singh, R.O. and Sachin Gupta, R.A. I).



38. International Workshop on "Forests for Poverty Reduction: Changing Role for Research Development and Training Institutions" at F.R.I. Dehradun from 17th and 18th June, 2003.
39. Jain, S.S. and Biswas, Sas (2004). Some Rare and Threatened Lesser Known Tree Diversity and Strategies for their Conservation: In National Workshop on "*Conservation and Sustainable Utilization of Lesser Known Tree Species*" (Abstracts) Sponsored by Ministry of Environment and Forests, Govt. of India, New Delhi and organized by Forest Research Institute, Dehradun, 8th to 10th March, 2004: pp 81.
40. Jain, V.K. (2004). 7th "World Bamboo Congress" held in New Delhi from 27th February to 4th March, 2004.
41. Khullar, Ritu; Varshney, V.K.; Naithani, Sanjay and Soni, P.L. (2003). Carboxymethylation of a cellulose derived from cotton linters. Paper presented in XVIIIth Carbohydrate Conference held at IICB, Kolkata from 5th to 7th November, 2003.
42. Kishwan, J. and Kumar D. (2003). Future of Poplar in India. Presented in 'International Conference on the Future of Poplar Culture'. Italian National Poplar Commission, Rome, Italy. 7 p.
43. Kumar, D and Rana, A.K. (2003). Early deployment of new clones through multi-step selection and concurrent multiplication. Proc. of 'IUFRO International Conference on World Perspective on Short Rotation Forestry for Industrial and Rural Development' at Solan, Himachal Pradesh from 7th to 13th September, 2003. pp. 32-33.
44. Kumar, V. and Soni, P.L. (2004). Utilization and value addition of gums from lesser known tree species. Paper presented in the National Workshop on Conservation and sustainable utilization of Lesser Known Tree Species held at FRI, Dehradun from 8th to 10th March, 2004.
45. Kumar, Vineet; Sharma, B.R. and Soni, P.L. (2004). Chemical modification of seed gums for value additions. Paper presented in IUPAC International Conference on Biodiversity and Natural Products: Chemistry and Medical Applications (organised by University of Delhi and CSIR) held at Hotel Le Meridien, New Delhi from 26th to 31st January, 2004.
46. Mandal, A.K (2003). International Conference on "Quality Timber Products of Teak from Sustainable Forest Management" held at Kerala Forest Research Institute, Peechi, from 2nd to 5th December and presented a paper.
47. Mandal, A.K. (2004). National Workshop on " Conservation and Sustainable Utilization of Lesser Known Tree Species" held at FRI, Dehradun from 8th to 10th March.
48. Mandal, A.K. (2004). National Workshop on "Regional Strategy for Plant Conservation" held on 26th and 27th February, 2004 at TFRI, Jabalpur and presented two research papers.
49. Naithani, H.B. (2004). Lesser Known Tree Species of National Capital Territory Delhi: In Proceedings of National Workshop on "*Conservation and Sustainable Utilization*



- of Lesser Known Tree Species" Forest Research Institute, Dehradun, 8th to 10th March, 2004: pp12.
50. Naithani, S. and Soni, P.L. (2003). Bamboo for pulp and paper industry. Paper presented in VII World Bamboo Conference held at Ashoka Hotel, New Delhi from 27th Feb. to 4th March, 2004.
51. National Workshop on "Conservation and Sustainable Utilization of Lesser Known Tree Species" from 8th to 10th March, 2004.
52. National Workshop on "Wild Silks Culture and Forestry at Forest Research Institute, Dehradun from 21st and 22nd April, 2003.
53. Nautiyal, S.; Tyagi, Monica and Rawat, Kirti (2004). Presented a research paper titled "Variation in seed traits and germination characteristics in twenty seed sources of *Pinus wallichiana*" in National seminar on "Conservation and sustainable utilization of lesser known species" at Forest Research Institute from 8th to 10th March, 2004.
54. One day workshop was organized on 16th January, 2004 for forest officers ranking DFOs and above at Mahatma Gandhi Institute of Administration, Chandigarh on Creation of germplasm bank.
55. Pal, Mohinder and Arya, I.D. World Bamboo Congress at New Delhi from 27th February to 3rd March, 2004.
56. Pandey, C.N. (2003). Seventh meeting of the timber and timber stores sectional committee held at BIS, Bangalore from 23rd to 27th July, 2003.
57. Pandey, C.N. (2003). IUFRO International conference on world perspective on short rotation forestry for Industrial and rural development held at YS Parmar University of Horticulture and Forestry at Solan in September, 2003.
58. Pandey, C.N. and Kumar, Kishan (2003). Patent awareness workshop by Patent Office Branch, New Delhi and National Research Development Corporation, New Delhi in August, 2003.
59. Parliamentary Standing Committee on Science and Tehcnology, Environment and Forests visited ICFRE, F.R.I., Dehradun on 28th June, 2003.
60. Patent Awareness Workshop at F.R.I., Dehradun on 13th August, 2003.
61. Patent Awareness Workshop was conducted to generate awareness among the scientists of the Institute with regard to patenting of technologies, methodology to be adopted for patenting them and laws related to patents.
62. Pokhriyal, A.; Badoni, A. K.; Sharma, A.K. (2004). *Hippophae rhamnoides* L – a potential Socio-economic Tree Species For Garhwal Himalayas. Proceedings: National Workshop on Conservation and sustainable Utilization of Lesser Known Trees species at Forest Research Institute, Dehradun. (India) from 8th to 10th March, 2004.
63. Saxsena, Vishakha and Gupta, Sangeeta (2004). Occurrence of Perforated Ray Cells in the secondary xylem of Azima and Salvadora-A New Record for the Family Salvadoraceae. Presented at 91th ISC, Chandigarh.
64. Sharma, A.K. and Husain, H.J. (2004). *Oroxylum indicum* Vent, A Lesser Known



- Medicinal Tree*. Proceedings: National Workshop on Conservation and sustainable Utilization of Lesser Known Trees species at Forest Research Institute, Dehradun. (India) from 8th to 10th March, 2004.
65. Sharma, Brij Raj; Kumar, Vineet and Soni, P.L. (2003). Modification of *Cassia tora* gum with quaternary ammonium groups. Paper presented in XVIII Carbohydrate Conference held at IICB, Kolkata from 5th to 7th November, 2003.
66. Singh, A.P. (2003). Participated and presented a paper in IUFRO International Conference on "World Perspective in Short Rotation Forestry for Industrial and Rural Development" held at Solan, Himachal Pradesh, India from 7th to 13th September, 2003 entitled "Insect pests of *Populus deltoides* raised under short rotation forestry and their management in northern India".
67. Singh, S.P.; Gupta, Sachin and Sharma, C.M. (2003). International Trade Fair, Uttaranchal at Parade Ground, Dehradun from 23rd to 30th September, 2003.
68. Soni, P. (2003). Regional workshop of ITTO on "Guidelines for Restoration Management and Rehabilitation of Degraded and Secondary Tropical Forests" at Chaing Mai: Thailand from 30th March to 4th April, 2003. The country presentations was appreciated, adjudged best presentation and received prize.
69. Soni, P. (2003). Presented two papers entitled "Ecologically Sustainable Approach for mined lands in India and Vegetation Spectrum in Saranda Bonai forest ranges and its application in mine" in International conference of Eco-restoration, held at ICFRE, Dehradun from 14th to 21st October, 2003.
70. Soni, P. (2004). Delivered lectures on the topic "Scientific practices of restoration of mine sites for long term conservation prospects of biodiversity. "Impact of mining projects on biodiversity organized by Central Mine Planning and Design Institute Ltd., (CMPDI), Ranchi (15th to 17th March).
71. Soni, P. 2nd project meeting of European Union Project on Himalayan Degradation Processes at Netherlands.
72. Soni, P. and Chandra, Veena (2004). Lesser Known Tree Species of Restorative Value in the Mining Belt of Orissa and Jharkhand. Proceedings of National Workshop on "Conservation and Sustainable Utilization of Lesser Known Tree Species" (Abstracts) Sponsored by Ministry of Environment and Forests, Govt. of India, New Delhi and organized by Forest Research Institute, Dehradun, 8th to 10th March, 2004. : pp14.
73. Soni, P. LISEM Model workshop at Wageningen, The Netherlands.
74. Soni, P.L., Varshney, V.K. and Dayal, R. (2004). Prospecting for NTWFPs and their value addition for sustainable livelihood in rural sector. Paper presented in the workshop on Participatory Research for Natural Resource Management and Augmentation of Rural Livelihoods held at Himalayan Forest Research Institute, Shimla from 24th and 25th March, 2004.
75. Soni, P.L.; Dayal, Rameshwar and Varshney, V.K. (2003). JFM compatible technologies for



- value addition of NWFP's: *In National Workshop on Technological Innovations and Research Advancements for Application of Joint Forest Management*, ICFRE, Publication No. 102 ICFRE BL-8, 20-22.
76. Naithani, HB and Sumer Chandra (2004). Lesser Known Tree Species from Andaman and Nicobar Islands : *In Proceedings of National Workshop on "Conservation and Sustainable Utilization of Lesser Known Tree Forest Research Institute, Dehradun: 15.*
77. Srivastava, Rajeev Kumar Participated in the meeting of the Expert Group as an expert on matters pertaining to Convention on Biological Diversity (CBD) held at Paryavaran Bhawan, New Delhi on 16th March, 2004.
78. The National Forestry Commission under the chairmanship of Justice B.N. Kirpal visited ICFRE to apprise it of the activities of the ICFRE and its Institutes and the problem faced by them.
79. The Vth meeting of "Research Policy Committee (RPC) at ICFRE, Dehradun from 16th and 17th March.
80. Uniyal, D.P; Sharma, V.K and Ginwal, H.S (2003). IUFRO International Conference on "World Perspective on Short rotation Forestry for Industrial and Rural Development" held on 7th to 13th September, 2003 at Y.S.P University of Horticultural and Forestry. Nauni, Solan and presented a paper.
81. Varshney, V.K.; Soni, P.L.; Dayal, R. and Chandra, Sumer (2004). Prospects for conservation and sustainable utilization of some lesser known and threatened medicinal and aromatic trees in the National Workshop on Conservation and sustainable utilization of Lesser Known Tree Species held at FRI, Dehradun from 8th to 10th March, 2004.
82. Vasistha, H.B. (2003). National workshop on : Forestry Miligation Project at Indian Institute of Science, Bangalore from 9th to 13th July, 2003.
83. Vasistha, H.B. Presented a paper entitled "Plant species colonization as abandoned Limestone mined areas in Western Himalayas in International conference on Ecoestroation organized at ICFRE, Dehradun 14th to 21st October, 2003.
84. Visit of the National Forestry Commission to FRI, Dehradun on January, 2004.

Exhibitions

1. F.R.I. Dehradun has participated in "Sindhu Mela" at Leh (Ladhakh) from 1st to 3rd June, 2003 organised by ITBP. During the Exhibition technologies developed by the F.R.I.; such as Pencil making from Hand Tools, Wood Seasoning and Wood Bending Technique, Bamboo mass propagation Technique etc. were displayed for the general public awareness.
2. World Environment Day at F.R.I, Dehradun on 5th June, 2003. World Environment day was celebrated at FRI. During the day long celebrations the technologies developed by the institute were demonstrated to the general public. A film show for the children was also organised.
3. Van Mahotsava at F.R.I., Dehradun on 22nd July, 2003.



4. Hindi Saptaha" at F.R.I, Dehradun on 22nd to 26th September, 2003. During the above-mentioned subject the following activities were carried out in Hindi :
 - (i) Typing
 - (ii) Noting and Drafting
 - (iii) Essay Competitions
 - (iv) Poem Competition.
5. "Vigilance Week" at F.R.I, Dehradun from 3rd to 7th November, 2003.
6. Pledge was taken by the staff of FRI. Essay competition, Workshop and film show, recital of poems was organized and prizes were distributed.
7. F.R.I., Dehradun participated in the "International Trade Fair" at Pragati Maidan, New Delhi from 14th to 27th November, 2003.
8. Technologies pertaining to FRI such as Bent Wood Furniture, Ammonia Fumigation, Solar Seasoning and Natural Dyes etc. were displayed along with posters and articles.
9. F.R.I., Dehradun, participated in the 30th Jawahar Lal Nehru National Children's Science Exhibition at Ordinance Factory, Raipur Road, Dehradun from 17th to 22nd November, 2003.
10. FRI participated in the above function and displayed the posters regarding Eco-Restoration, Natural Dyes, Bamboo Products etc. to create awareness among children on various environmental issues.
11. F.R.I., Dehradun, participated in the "Indian Science Congress" at Punjab University Campus, Chandigarh from 3rd to 7th January, 2004".
12. Forest Research Institute displayed the poverty alleviation technologies such as Bent wood furniture, Bamboo preservative technique, Compost preparation, Tissue culture technique, Agro-medicinal models, Solar seasoning and Natural Dye etc.
13. F.R.I., Dehradun participated in the "Basant Mela" at ITBP, Seema Dwar, Dehradun from 1st to 3rd February, 2004.
14. F.R.I. Dehradun, participated in the exhibition on Lantana organized by IIT, Delhi and HESCO at Aketa Hotel, Rajpur Road, Dehradun on 10th and 11th February, 2004. F.R.I. displayed the technologies of the institute such as Natural dye from lantana, compost from lantana, reconstituted wood from lantana.

AWARDS

- Ms Sarika Gupta awarded "Lucid Research Award" of Rs.5000/- along with the Certificate for her research paper on ' Cyanoethylation of *Cassia occidentalis* seed gum', in the XVIII Carbohydrate Conference held at IICB, Kolkata from 5th to 7th November, 2003.
- Dr N.S. Bist, ICFRE Award 2001-2002 for Excellence in the field of Forestry Research.
- Dr Mohit Gera, Brandis Award 2000 for Best article in the field of Silvicultural research published in Indian Forester.
- ICFRE Award for Excellence in Forest utilization awarded to Dr C.N. Pandey, Scientist-F for the year 2001-2002.
- Dr (Ms) P. Soni. The country presentations made at the ITTO workshop was awarded prize for best presentation.



- Dr M. Ahmad, Scientist- E and Head, Entomology Division was awarded ICFRE Award for Excellence for the year 2001-2002 in the field of Forest Protection.

DISTINGUISHED VISITORS

1. His Excellency Shri V.S. Kokje, Governor of Himachal Pradesh.
2. Shri C.P. Thakur, Hon'ble Minister for Small Scale Industries, Govt. of India.
3. His Excellency Justice Shri Ramajois, Governor Jharkhand.
4. Shri U.V. Krishnan Raju, Hon'ble Minister of State for Rural Development, Govt. of India.
5. Prof. Chander Kumar, Hon'ble Minister Forests, Himachal Pradesh.
6. Parliamentary Standing Committee on Science & Technology and Environment & Forests.
7. Shri Sompal, Member Planning Commission, Govt. of India.
8. Hon'ble Justice B.N. Kripal, Chairman and other members of National Forestry Commission.
9. German Ambassador Mr. Hymo Rister.
10. Dr Rudi Hessel and Dr Alex Hooijir from ALTERRA Netherland.
11. Dr Adrian Luckman and Dr Robert Davies from University of Swansea, U.K.
12. Dr Prem Sankhayan and Dr Bishal Sitaula of Agricultural University, Norway.
13. His Excellency, Mr. Michael Swain, Deputy High Commissioner, New Zealand High Commission, New Delhi.
14. Brig. K.P. Singh, Deo (Retd.) M.P, Orissa.
15. Dr Jagannath Mishra Ex Chief Minister, Bihar.

FOREST RESEARCH INSTITUTE (DEEMED UNIVERSITY)

Forest Research Institute, Dehradun was conferred the status of 'Deemed University' by the Ministry of a Human Resource Development, Government of India, New Delhi vide notification No. F-9-25/89 U-3 dated 6.12.1991. After the conferment of Deemed University status academic activities of the Institute have increased tremendously and it has been fostering research and education in forestry, environment and other allied disciplines in a more meaningful and productive way. Besides turning out students having formal academic and practical education of University standard in specialized areas of study newly introduced in

the country, such as, Forestry Economics and Management, Wood Science and Technology, Environment Management, Plantation Technology, Biodiversity Conservation to man responsible positions in forestry research, wood based industries and plantation activities, the Deemed University has been fostering pioneering research in specialized areas under Ph.D. Programme.

Academic Courses and Admissions

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

1. M.Sc. Forestry (Economics and Management)
2. M.Sc. Wood Science and Technology
3. M.Sc. Environment Management



4. Post Graduate Diploma in Plantation Technology
5. Post Graduate Diploma in Biodiversity Conservation.

The M.Sc. courses are of two years duration whereas Post-graduate Diploma Courses are of one year duration. The intake capacity of each course is 15.

Admission to these courses is made on the basis of a candidate's performance in All India competitive Entrance Test.

During the year 90 students were admitted in all to the above five courses. At present the total strength of the students in all courses is 89.

Lectures on above mentioned courses were delivered by internal faculty. Visiting faculty were also invited from IIRS, WII, IGNFA, DAV (PG) College, as well as by the retired scientists from these institutions to deliver lectures on specific topics.

Besides regular lecture programme and dissertation/project work on specific topic relevant to their course, students were sent to one month industrial attachment to different industries/organizations. Local excursion, short and long study tours and training were also organized during the academic session.

Extra Curricular Activities

Students of FRI Deemed University participated in the following events:

- Annual Sports Meet held from 15th to 20th December, 2003 at FRI, Dehradun.
- Students of FRI Deemed University participated in Wildlife week from 8th to 12th

October, 2003 organized by Government of Uttaranchal.

- Poster Competition on World Environment Day (5th June, 2003) on theme "Water Two Billion people are dying for it," organized by Kalpatru – SPCD an NGO.
- Presented a colourful cultural programme 'CHEERS-2003' on 30th December, 2003.

Students Welfare Activities

- F.R.I (Deemed University) provide medical facilities to its students.
- Hostel accommodation is available in F.R.I. Campus.
- The facilities for indoor games and common room are provided to the hostlers.
- Library and Computer facilities are available to the students.

Special Lectures

Dr G. Kumaravelu, CCF (R&T), Tamil Nadu Forest Department, Chennai delivered a special lecture to the students of FRI Deemed University on the topic "Recent Trends In Indian Forestry" on 26th 6 June, 2003.

Placement

The students passing out of the FRI Deemed University also have the facility of placements through placement coordinator. The campus interviews are arranged every year for students of all the disciplines. Following is the placement detail of our students for last two academic years.



Year	Courses	No. of Students	No. of Campus interview organized	No. of Student selected
2000-02	M. Sc. Wood Science Technology	18	6	10
2000-02	M. Sc. Forestry	17, Foreign Students- 5	3	7
2000-02	M. Sc. Environment Management	15	3	5
2001-02	PGD in Biodiversity Conservation	12	3	7
2001-02	PGD in Plantation Techechnology	13	3	3
2001-02	PGD in Pulp and Paper Techchnology	6	-	-
	TOTAL	81		32
2001-03	M. Sc. Wood Science Technology	20	10	18
2001-03	M. Sc. Forestry	17, Foreign Students- 5	3	6
2001-03	M. Sc. Environment Management	17	3	8
2002-03	PGD in Biodiversity Conservation	8	3	2
2002-03	PGD in Plantation Techchnology	7	3	
	TOTAL	69		34

Ph.D. Programme

Research is an essential function of a National Institute like the Forest Research Institute (Deemed University) and increasing emphasis is being given to this important aspect of academic pursuit. Highly qualified Foresters/Scientists and talented Research Scholars have continued to be active in the frontier areas of research and their efforts have been generally supported by sponsoring agencies like the

ICFRE, UGC and CSIR, etc. With the support of these organizations coupled with the guidance of talented researchers, which the Institutes and established Research Centres have, the research activities under Ph.D. Programmes have increased manifolds. At present 410 Research Scholars have been registered including registration of 80 Research Scholars in the current year. During the year 18 Research Scholars have been awarded Ph.D. Degree.

NATIONAL FOREST LIBRARY AND INFORMATION CENTRE

Upon creation of the Indian Council of Forestry Research and Education (ICFRE) in 1986 and subsequently its acquiring of autonomy in 1991, the then Central Library of Forest Research Institute and Colleges was rightly renamed National Forest Library and Information Centre (NFLIC).

The NFLIC is richest document collection in South and South-east Asia and has been providing all types of library and information services to the users viz. reference, referral, lending, reprography, current awareness, inter-library loan, retrieval of information from machine readable databases, etc.

During the year a total of 27,917 books were loaned to the users for outside reading. Besides,



57,273 books and journals were consulted inside the library.

The document collection of the NFLIC was enriched by the addition of 811 books, out of which 122 were purchased at a total cost of Rs.2.64 lakhs and 689 books were received gratis.

The NFLIC subscribed to almost all journals on forestry. During the year, it subscribed 160 foreign and 105 Indian periodical titles at a cost of about Rs.66.29 lakhs. An additional 350 periodical titles were received gratis.

For providing efficient and effective retrospective search and current awareness, the NFLIC subscribed CAB CD, and Tree CD bibliographical databases on CD ROM format. These databases were accessible on ICFRE intranet.

The binding of books and periodicals is an essential library activity. For increasing their

shelf life, during the year, 1,093 sets of books and periodicals were got bound at a total cost of Rs. 52,562/-.

For reading outside the premises of the NFLIC, a total of 22,346 documents were issued to the users during the year. The NFLIC has been selling ICFRE publications through its Book Depot. During 2003-2004, it sold 1,181 books and 29 VHS cassettes and earned revenue of Rs. 1,34,445/-.

The Ministry of Environment and Forests, Govt. of India established an ENVIS Centre on Forestry at NFLIC. This centre, during the year, started compilation of a new database on Joint Forest Management. Besides, it enriched databases on Indian Forestry Abstracts, *Prosopis juliflora* and Grey Literature on Forestry by the addition of new references with abstracts. The Centre also published ENVIS Forestry Bulletin and Forestry New Digest regularly.

