

CHAPTER I

FOREST RESEARCH INSTITUTE DEHRADUN

Forest Research Institute (FRI), Dehradun was established in 1906 to organize and lead forestry research activities in the country. The Institute caters in particular to the research needs of the States of Punjab, Haryana, Chandigarh, Uttar Pradesh, Delhi and Uttarakhand. This Institute also has status of Deemed University and at present offers three courses leading to M.Sc. degree and two Post-Graduate Diploma Courses, besides awarding Ph.D. degree in Forestry.

PROJECTS COMPLETED DURING THE YEAR 2004-2005

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

Findings: An expert system entitled “Wood Anatomy Information System-WAIS” was developed in collaboration with National Informatics Centre, New Delhi. The database consists of all the structural details available so far of 1000 species. Photo-micrographs of 1000 species have also been incorporated under the database.

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]

Findings: Six clones were screened at multi location Clonal Seed Orchard (CSO) of *Dalbergia sissoo*. The impact of site quality was observed

for wood tracts. 15 clones of *Eucalyptus tereticornis* were also analyzed for wood tracts. The impact of juvenile and reaction wood was not found for wood tracts in both the species.

Project 3: Complete elimination of chlorine compounds in bleaching MILOX process [FRI-150/C&P-15/2001-2004]

Findings: Elimination of sulphur and chlorine/chlorinated compounds from pulping and bleaching of *Eucalyptus tereticornis* using different doses of formic acid sandwiched between different doses of peroxyformic acid treatment in two stages and bleaching adopting in three stages of H_2O_2 sequence under standard condition was achieved.

Project 4: Improved utilization of raw materials for pulp and papermaking including juvenile tree utilization [FRI-129/C&P-14/1999-2005]

Findings: Roots of *Eucalyptus tereticornis* were chipped and chemical conditions to obtain unbleached grade pulp were optimized. The progress of the project was not satisfactory and processing of roots for papermaking was found to be uneconomical. Thus the project was recommended for termination by Head, Chemistry Division during first six monthly review.

Project 5: Plant growth strategy characterization, diversity and vegetational dynamics of rehabilitated and derelict mined ecosystem in Western Himalaya [FRI 123/Eco-5/1999-2004]



Findings: Nutritionally poor sites of lime stone mined areas were found to be colonized by the species such as *Rumex hastatus*, *Wendlandia exserta*, *Eriophorum comosum* and *Cedrela toona* at lower elevation. In middle elevation, species such as *Coriaria nepalensis*, *Hypericum spp.*, *Eriophorum comosum*, *Rumex hastatus* and *Debregeasia hypoleuca* were found to be colonizing.

Project 6: Women and NTFP based agroforestry system in Uttarakhand and Western Uttar Pradesh [FRI-235/SF-6/2004-2005]

Findings: Survey of NTFP based agroforestry practices was completed in three Districts, viz. Dehradun, Pauri Garhwal and Pithoragarh in Uttarakhand state and two Districts, viz. Ghaziabad and Meerut in Western Uttar Pradesh. The villagers are collecting non-timber forest products from forest generally for their own use only. They are not cultivating NTFP based plants on significant scale due to lack of knowledge and marketing facilities. If the Government provides all facilities, the villages are ready and keen to cultivate NTFP based trees under agroforestry. The women are actively participating in all type of work related to agriculture/agroforestry.

Project 7: Environmental conservation strategies for land use in the lower western Himalayas : Butterflies as indicators in monitoring environmental changes in urban gradients [FRI-145/FED-9/2000-2005]

Findings: As many as 221 species of butterflies were sampled from the study area lying in the tropical moist deciduous sal forest zone (below 1000 m) of Dehradun valley. Butterflies found here represent 53% of the butterflies diversity found in the Western Himalayas, including 27 species sensitive to environmental changes in natural sal forest habitat. The study noticed a changed butterfly community in areas under different land use patterns (urbanized areas,

agriculture land, tea gardens and cantonments) in relation to the original native butterfly diversity existing under sal forest habitats which now occupy 50% of the land in the study area.

Project 8: Parasitic and symbiotic associations of tree species used for harsh sites afforestation [FRI-138/Path-8/2000-2005]

Findings: Disease status in different treatments of Shisham mortality management experiments was evaluated at two Primary Farm Forestry Cooperatives (PFFCs), namely Urarmau and Richaura in the month of September, 2004 and March, 2005. Testing of efficacy of different non-systemic (Captan, Copper-oxychloride, Mancozeb, Thiram and Sulphur, etc.) and systemic fungicides (Bavistin, Benomyl and Ridomil, etc.) was done against leaf spot pathogen, *Colletotrichum gloeosporioides* of Shisham. Root and soil samples from sodic patch, grass and six commonly grown tree seedlings (Azadirachta, Eucalyptus, Pongamia, Psidium, Shisham and Terminalia) were collected and analyzed for mycorrhizal infection and types from field/nurseries raised in Kanaksinghpur and Ramshahpur. The data of these very recently concluded experiments are being processed for final report.

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

Findings: Electronic database of available physical and mechanical properties of timber species tested so far since 1911 belonging to 510 records has been prepared. Various calculations of suitability indices and safe working stresses of timber species has been completed and tested.

Project 10: Effect of moisture content on (a) resonance frequency of timber and in turn on dynamic MOE and (b) microwave absorption [FRI-239/ FPD (TM) – 46/2003-2004]



Findings: Testing of wooden samples at 20 different moisture content levels (varying between 95% to 10%) by Vibration non-destructive testing method and conventional destructive method were completed for developing calibration for MOE. The MOE value increases with decrease in moisture content. Testing of samples by microwave absorption method at three different thicknesses (ranging from 0.5 to 1.5 cm) at 20 different moisture contents has also been completed. The data revealed that relationship between microwave absorption and moisture content is non-linear.

Project 11: 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]

Findings: All testing has been completed. Data analysis and final report preparation is in progress.

Project 12: Green-dimensioning aspects of Bamboo and Eucalyptus processing [FRI-200/FPD (WWF)-40/2002-2005]

Findings: The study indicates that the green Bamboo dries faster while working on it. The study also indicates the importance of water curbing – preservative applications while working with green Bamboo. An artisan friendly multipurpose and ecofriendly staining cluster treatments were developed which can be used for handicraft sector for making decorative products from Bamboo. The study also highlights the importance of working with green Eucalyptus at different cutting angles, which helps in rapid air-drying without any appreciable degrade. Further, different finishing treatments were developed on Eucalyptus for surface improvement and weathering trials for three months indicates the reduction in gloss for all the nine different treatments.

Project 13: Contribution of soil minerals for sustainable management of Uttarakhand forest [FRI-240/FSLR-16 /2003-2005]

Findings: The study was carried out in Dhanaulti and adjoining blocks of Jaunpur range, Mussoorie forest division (Uttarakhand). There is mutual relationship between vegetation and soil in the study area, which is governed by climate, aspect and other factors. It has been observed that *Cedrus deodara* forests occur in the soils of Mollisols order whereas *Pinus roxburghii* and *Quercus leucotrichophora* occur in the soils of Inceptisol order. The results of the study revealed that the impact of geology on vegetation is evident in some sites. Observations indicated that *Cedrus deodara* grows well on limestone, dolomite, quartzite and shale whereas *Pinus roxburghii* and *Quercus leucotrichophora* flourishes on phyllite, slate, sandstones, slate shales etc.

Project 14: Development of computer based forest soil information system for India [FRI - 241/ FSLR-17/ 2004-2005]

Findings: Computer based “Forest Soil Information System for India”, a programme (software) was developed to feed the forest and soil information. Data of 300 profiles were collected processed, tabulated and entered in the database of the software. Data on forests of different states and union territories were also fed in the database of the software.

Project 15: Introduction of commercially important medicinal plants in the NWFP Nursery, Dehradun [FRI-205/NWFP-10/2003-2005]

Findings: 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. Studies have been initiated to



propagate high altitude medicinal plants – *Microstylis wallichii*, *Berginia ciliata*, *Valeriana jatamansi* and *Swertia chirata* by following non-destructive methods at lower elevation (NWFP Nursery, Dehradun). Preliminary observations have revealed that these species can be cultivated at lower elevation.

Project 16: Development of cultivation methods of some commercially important medicinal plants *Desmodium gangeticum* and *Oroxylum indicum* [FRI-204/NWFP-9/2002-2005]

Findings: Cultivation trials of *Desmodium gangeticum* and *Oroxylum indicum* under *Eucalyptus* hybrid and *Prunus cerasoides* plantations as well as under open field conditions were finalized.

Project 17: 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]

Findings: Only minor differences in terms of germination percentage, mean germination time, seedling survival, growth period etc. were observed on comparison of seeds from cones, from Seed Production Areas (SPAs) and unculled stand outside SPA.

Project 18: 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 carrier [FRI-183/ Silva-17/2001-2004]

Findings: Proto-type root trainer carrier were designed and developed. Two such carriers fabricated were subjected to field trial but both the root trainer carriers were not found suitable during field trial. The design of the root trainer carrier was modified.

PROJECTS CONTINUED DURING THE YEAR 2004-2005

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

Status: Floristic surveys in wetland sites of Karwa Pani, Teen Pani, Asan Barrage, Mathronwala, Jaitigaon, Shahjahanpur, Shakumbari Range of Siwalik, Golattapur and Nakaraunda areas of the Doon Valley and surroundings were carried out. Loss of wetlands due to the conversion of the areas for urbanization, road construction, industrialization, and introduction of alien species exotics to the region was observed. Taxonomical evaluation and nomenclature update of 100 species typical of wetland sites were made for systematic accounting.

Project 2: Inventorization of multipurpose trees and shrubs for domestication and their implication in agroforestry for socio-economic upliftment of rural sector of Dehradun [FRI-199/SF-5/2002-2008]

Status: Growth parameters such as height and diameter were recorded for tree species planted in field along with crops. Crop yield was also recorded.

Project 3: To develop propagation technique i.e. micro-propagation of economically important Bamboos - *Arundinaria falcata* and *Bambusa balcooa* [FRI-219/G&TP-10/2002-2006]

Status: Axillary bud cultures were continued. Optimal medias were formulated for shoot proliferation from seed explants. *In vitro* shoot multiplication and maintenance carried out on a defined medium. Different types of plant



hormone were tested for the induction of *in vitro* rooting in shoots induced. Somatic embryo were germinated and experimented continued for their further development.

Project 4: Studies on isolation and characterization of polysaccharides of abundantly available seeds of trees/shrubs, leaves, bark and exudate gums [FRI-51/Chem-1]

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

Status: Partial hydrolysis of *Prosopis juliflora* seed polysaccharide was carried out. Five oligosaccharides have been identified by preparative paper chromatography and their isolation is in progress. Methylation studies of galactomannan polysaccharide was carried out followed by its hydrolysis.

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

Status: Methylation of polysaccharide was done by Hakamori's method. Alditol acetate of methylated polysaccharide was prepared after hydrolysis. G.L.C. analysis of methylated polysaccharide in the form of alditol acetate has been carried out. Methylation study of oligosaccharide O-1 is in progress.

Sub-project (x): Chemical modification of Tamarind Kernel Powder (TKP)

Status: Quaternization and cyanoethylation of TKP completed which resulted in production of water soluble quaternized TKP of DS 0.61 and cyanoethylated TKP of DS 0.53 having apparent viscosity of 60 cps (2%) and 2112.5 cps (2%), respectively.

Sub-project (xi): Chemical modification of *Cassia occidentalis* seed gums

Status: Graft copolymerization of *Cassia occidentalis* seed gum with vinyl monomers (acrylamide, acrylonitrile and methylmethacrylate) was completed. Optimized grafted products were also characterized by FT-IR.

Project 5: Phytochemical examination for the utilization of leaves, barks, fruits and roots of Indian forest trees [FRI-53/Chem-3]

Sub-project: Screening of medicinally important plants (i) *Achyranthes aspera*, (ii) *Casearia tomentosa* and (iii) *Clematis roylei* [2002-2006]

Status: Extraction of *Achyranthes aspera* parts with petroleum ether, acetone and methanol to prepare the extracts of different polarity was carried out. Identification of sugars in three saponins isolated earlier was completed. Oleanolic acid was identified as aglycone. Permetylation and preparation of alditol acetates was also done for saponins. Petroleum ether extract of leaves, stem, and roots and methanol extract of seeds and root exhibited significant antioxidant activity. Different extracts of *Casearia tomentosa* bark were prepared. b-sitosterol and another pure compound were isolated from the petroleum ether extract of the bark. Conditions were optimized for the isolation of dye from the bark. Different extracts of *Clematis roylei* were prepared. The alcohol extract exhibited good anti-inflammatory, analgesic, antipyretic and antifungal activities. A pure compound was isolated from the alcohol extract.

Project 6: Chemical modification of cellulose and its industrial uses [FRI-194/Chem-8/2002-2006]

Status: Reaction conditions were optimized to produce a *non newtonian* pseudoplastic cold water soluble carboxymethyl cellulose of DS 0.98 having apparent viscosity of 75 cps (1% solution)



from cellulose obtained from *Dendrocalamus strictus* and organosoluble cyanoethyl celluloses of DS 2.2 and 2.5 from the cellulose obtained from *D. strictus* and cotton linters, respectively.

The carboxymethyl cellulose prepared from *Lantana camara* may find application particularly in oil well drilling operations, textile printing and in pharmaceutical preparations where carboxymethyl cellulose of low viscosity is needed. *Lantana camara* seems to be a potential feedstock for producing alpha cellulose and its derivatives for a variety of applications having thereby a way for management of this obnoxious weed by its utilization into products of commercial importance.

Project 7: Study of plant responses to air pollution for air quality monitoring in Dehradun [FRI-231/Eco-11/2003-2006]

Status: Active biomonitoring of air pollutants was performed. Total five bioindicator stations including urban and sub-urban sites, close to streets with heavy and light pollution load were identified and FRI was treated as control site. Anti Pollution Treatment Index (APTI) of five species (*Mangifera indica*, *Cassia fistula*, *Eucalyptus* hybrid, *Grevillea robusta* and *Dalbergia sissoo*) was calculated to find out sensitive, intermediate and tolerant species.

Project 8: Bio-ecological studies on the insect pests of Bamboo and their management [FRI-144/FED-8/2001-2006]

Status: Bio-ecological studies on hispine culm borer of Bamboo *Estigmene chinensis* have been completed. The beetle appear in May – June and after mating lay 14-20 eggs on the surface of internodes in groups of 2-5 eggs, incubation period of eggs lasts for 7-10 days, larval period 15-25 days and pupal period recorded was 8-9 days. The pharate beetle thus formed remains in the pupal chamber for rest of the year. Life cycle is annual. The incidence of various insect pests

feeding on Bamboo was recorded at four locations (one at New Forest, Two in Kalsi Soil conservation Division. Dharmawala and Shabhawala and one in Dehradun Forest Division, Karwapani).

Project 9: Bio-ecology of insect pests of Paulownia and enumeration of their natural enemies [FRI 196/FED-11/ 2002 – 2007]

Status: Moderate infestation of insect species including *Orgyia postica*, *Spilarctia obliqua*, *Helicoverpa armigera*, *Spodoptera litura*, *Hyposidra talaca*, *Euproctis* sp. and *Dasychira* sp. was observed on the foliage of *Paulownia* in nursery and plantations at New Forest, Sahaspur, Devipur (Uttaranchal), Saharanpur (U.P.) and Yamunanagar (Haryana). Larvae of *Acherontia* sp. were observed defoliating at Saharanpur and Devipur only. Chrysoemlid beetles, *Altica* spp., *Miochira gracilis* and *Mimastra cyanura* along with phytophagous pentatomid bugs *Dolycoris* sp., *Erthesina fullo* and *Nezara viridula* were observed feeding on *Paulownia* leaves. During field surveys in *Paulownia* nurseries some new lepidopterous larvae were found feeding on the foliage of *Paulownia*. Larvae fed *Paulownia* foliage gregariously and underwent seven moults before pupation. The fully grown larvae measured 8-9 cm in length and total life cycle was 85-122 days. Adult moth was identified as *Eupterote undata* (Lepidoptera : Eupterotidae). This was the first record of the pest on *Paulownia*.

Studies on the biology of *S. obliqua* was conducted. A mated female on an average laid 1200 eggs, which hatched in 3-4 days. Larva underwent five moults over a period of 32-34 days. Pupal period was of 8-10 days and life cycle was completed in 43-48 days.

Project 10: Integrated pest management of mandate species in nurseries and plantations with special reference to biopesticides and microbial pesticides [FRI-198/FED-13/2002 – 2007]



Status: Seasonal life cycle of many important pests viz. *Plecoptera reflexa*, *Dichomeris eridantis*, *Cosmotriche laeta*, *Apoderus blandis*, *Orgyia postica* and *Eupterote undata*, on *D. sissoo*, *Closteria cupreata*, *Parasa lepida*, *Bellipa lohor*, *Eupterote undata*, *Euproctis* sp., *Hyposidra talaca* and *Neocerura wisei* on Poplar is in progress in the laboratory.

Project 11: Evaluation of *Chrysoperla carnea* for predation potential against the key defoliator of *Dalbergia sissoo* and *Populus* [FRI-232/FED-15/2003–2006]



Mature and pre-pupation larvae of Shisham defoliator *Plecoptera reflexa*

Status: Survey of *Dalbergia sissoo* and *Populus* nurseries and plantations was carried out at Chhachrauli Forest Range Haryana, Bahadarabad (Roorkee Range), Kainchiwala, Jhajra Forest Range, Ghamandpur, Barkot Forest Range, Bhaniawala, Lacchiwala Forest Range for the collection of Shisham defoliator, *Plecoptera reflexa* and predator *Chrysoperla carnea*. During the course of survey light to moderate defoliation by *P. reflexa* was observed in the plantation from April to October-November. Eggs of *Chrysoperla carnea* were collected from the field, brought in the laboratory and reared at 27°C. The eggs hatched into alligator shaped larvae. All the

larval stages were predatory on eggs and larvae of *Plecoptera reflexa*. Laboratory experiments revealed it as an excellent predator.

Project 12: Upgradation and computerisation of National Insect Reference Collection (NIRC) [FRI-233/ FED-16/2003–2006]

Status: (a) Taxonomy of Parasitic Micro-Hymenoptera : Described five new species of parasitic Hymenoptera, four belonging to family Encyrtidae viz. *Caenohomalopoda longistylata*, *Metaphycus cassiae*, *Astymachus felix* and *Cheiloneurella indica* and one belonging to family Braconidae viz. *Spasskia indica*. *Clausenia purpurea* Ishii and *Ooencyrtus corbetti* Ferriere (Hym : Encyrtidae) were reported for the first time from India. *Ooencyrtus corbetti* was recorded from a new host – eggs of *Podontia affinis* (Coleoptera : Chrysomelidae).

Spasskia Belokobylskij was reported for the first time from India and the Oriental region. It is first species under the genus with known host record bred from larvae of *Chlorophorus strobilicola* (Coleoptera : Cerambycidae) infesting cones of *Pinus roxburghii*.

Work on the taxonomy of *Psyllaephagus* spp., which is parasitoids of gall making psyllids and kept unidentified in NIRC, was undertaken. Out of this collection ten have been identified as undescribed species. Taxonomy of encyrtid parasitoids of Diaspidid scales – two species of genus *Neococcidencyrtus*, *Adelencyrtus* and *Coccidencyrtus* was done. These are new species. A new species of *Euderus* parasitising *Alcidodes ludificator* (Curculionidae) a serious pest of *Gmelina arborea* nursery and young plants in the North-East India was described.

(b) Computerization of NIRC: Data of 1500 species was incorporated into the database belonging to families Curculionidae, Cucujidae,



Discomatidae, Dytiscidae, Derodontidae, Elateridae and Cicindelidae of order Coleoptera. Database now contains information of about 3800 species with 21,318 specimens belonging to 8769 localities.

Project 13: 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]

Status: Work of survey, collection and identification services were provided by NIRC.

Project 14: Management of natural resources as affected by the socio-economics of rural people of Jhajra watershed in Dehradun district [FRI-251/SF-7/2004-2005]

Status: Surveys, collection of data, data analysis and interpretation of data has been completed in all villages.

Project 15: Studies on enhancement of natural durability of Bamboo and plantation grown species with conventional/eco-friendly preservatives [FRI-236/FPD (WP)-43/ 2003-2006]

Status: *Bambusa balcooa* and *Bambusa nutans* were treated with VAC- FRI, Bouchrie diffusion and Wick process with Borax Boric Acid to compare the retentions and performance in field conditions.

A new complex ZiBOC revealed high efficacy against brown and white rot fungus in laboratory. Termite mound test of ZiBOC treated Pine and Poplar samples showed 1-3 % weight loss as compared to control where in Pine and Poplar 13% and 98% weight loss was observed respectively

Neem Oil exhibited high efficacy against brown and White rot fungus in Petri plate bioassays at 15% concentration of crude oil.

Methanol and ethanol Neem leaf extractives treated Poplar samples exhibited high efficacy against termites in bottles bioassays as compared to control samples.

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]

Status: Chir and Mango wood samples were treated with different concentrations of Lignin Copper complex A and B. Chir showed high protection at 0.2% concentration of A and B salt in accelerated field trials whereas Mango wood samples treated were affected mainly by soft rot fungus and slight to moderate infestation by termite and fungus could be seen.

Few formulations viz. calcium hydroxide, copper sulphate, reetha extract, cuprous oxide, sodium fluoride and copper complex A and B were tested at different concentrations against sap fungus in *Poplous deltoides* wood. Comparative study revealed high protection by reetha extract, copper lignin complex A and B and sodium fluoride. 100% of reetha extract 1,2 and 4% of Complex A and B and 4% of sodium flouride extract were found effective.

Black liquor and copper sulphate double spray on Poplar revealed good protection against sap stain fungus at 100% humidity.

Project 17: Evaluation of fertilizers effect on medicinal plants in watershed area for production and productivity [FRI-242/FSLR-18/2003-2005]

Status: Field experiment conducted in Kulhal watershed area of Dehradun Forest Division, Dehradun was maintained. Growth observations (height and tillers) of transplanted plants in fertilizer treated and untreated plots were



recorded. Soil profile study was conducted and samples collected. Representative plants from treated and untreated plots were uprooted, washed and root and shoot biomass recorded. Soil samples for important physico-chemical properties and plant samples for oil content were analyzed. Data were tabulated for statistical analysis.

Project 18: Evaluation of Australian seed sources and families of *Eucalyptus tereticornis* for productivity and genetic improvement [FRI-203/G&TP-9/2002-2006]

Status: Observations with respect to various morphological traits have been recorded of trials established at Midnapur (West Bengal) and FRI campus. The first year growth data of three sites viz. Midnapur, Chiryanpur and FRI campus was analyzed. A significant difference between the families and seed sources was found in respect of various traits. The growth data of all three sites was used to check the provenance x site interaction. A significant interaction was observed for height and number of branches. However, for collar diameter and survival it was non-significant. Linear relationships were also established between the growth traits of different sites and the geographical coordinates of the provenances. Inter provenance controlled crossing was attempted in 15 trees at FRI campus. The parents selected for this hybridization were chosen based on the initial outstanding growth performance from the same trial.

Project 19: Development of protocol for clonal multiplication and germplasm conservation of some medicinal plants [FRI-243/G&TP-14/2003-2007]

Status: Multiplication achieved after sub culturing of *Oroxylum indicum* on to MS medium with BAP. Rooting of *in vitro* grown shoots of *Oroxylum indicum* from epicotyls explants was achieved.

Project 20: Assessment of Shisham die back (decline) in Northern India and its remedial measures [FRI-245/Path-12/ 2003-2008]

Status: The mortality areas were identified on the basis of divisional surveys. Localities with more than 70% mortality were selected in H.P., Haryana, Punjab, Delhi, Uttarakhand, U.P. and Bihar. The pathogenicity trials were conducted taking spores of *Fusarium solani* in a suspension and inoculating one month old seedlings. Nearly 50% seedlings died within 15 days of inoculation whereas the majority died after one month. The pathogen was re-isolated from diseased roots. The seeds of Shisham were collected from healthy trees growing in heavily diseased localities from North Indian states. They were germinated on sterilized soil mixture and inoculated artificially by spore suspension of *Fusarium solani* by root dip method. On the basis of mortality of seedlings they were categorized into 4 groups viz. very resistant, resistant, susceptible and very susceptible. The resistant provenances identified were Rakh Bhuru, Sohagana and Kathu Nangal in Amritsar and Bir Shikargah in Kapurthala, whereas Kangra, Vikas Nagar, Jagadari and Ambala were identified as susceptible provenances. The resistant provenances identified in the pathogenicity trials were further stressed by dipping the roots for 10 days in water. They were extracted and inoculated with *Fusarium solani* spore suspension for 24 hours and then planted in soil in RBD model. Observations were taken regularly and it was observed that 90% of seedlings dried after 30 to 40 days of inoculation. In control plants the mortality was less than 10%. Thus, creating stress conditions could break resistance of seedlings. The experiments with use of *Pseudomonas fluorescens* showed no mortality in control, total mortality in *Fusarium solani* infected seedlings, no mortality in *Pseudomonas*



fluorescence treated seedlings, 80% survival in *Pseudomonas fluorescence* + *Fusarium solani* treated seedlings, 10% survival *Fusarium solani* + *Pseudomonas fluorescence* treated seedlings and 90% survival in a mixed treatment *P. fluorescence* + *Fusarium solani*. The results indicate a positive response of *Pseudomonas fluorescence* if seedlings were given a protective treatment of the bacterium before infection with *Fusarium solani*.

Project 21: Screening for disease resistance in genetic material raised under tree improvement programmes [FRI-207/Path-13/2002-2007]

Status: Screening for disease resistance done in CSOs and SSPAs of *Dalbergia sissoo* at Lacchiwala (Dehradun), Paonta Sahib (H.P) and Bhitmera (Hissar - Haryana) and for *Euclayptus tereticornis* at New Forest campus. Only two clones No. 194 (Hasanpur Beat, Tulsipur Range, Gonda Forest Division) and No. 255 (Lalpani Beat, Rishikesh Range, Dehradun Forest Division) continued to exhibit resistance against *Ganoderma lucidum* root rot in CSO of *D. sissoo* at Bhitmera, Hissar, whereas No. 80 (Hanumangarh Range, Sriganganagar Forest Division) was found to be the most susceptible clone. In Australian source material of *Eucalyptus camaldulensis* drying up of tips was noticed and a basidiomycetous fungus has been isolated and identified as *Schizophyllum commune*. Pathogenicity tests were confirmed. Die back of leader shoots in *D. sissoo* caused by *Colletotrichum gloeosporioides* was observed in genetic material raised in nursery. Leaf blight disease in *D. sissoo* due to *Colletotrichum gloeosporioides* causes severe necrosis of leaves during the active growing period. Therefore, screening tests were conducted with 20 clones of *D. sissoo* for disease resistance. The causal fungus, *Colletotrichum gloeosporioides*, was isolated and mass culture was prepared. Three clones No. 9, 41 and 66 were found resistant, whereas clone No. 57, 62, 84, 121, 203 and 266

were the most susceptible ones. Screening for diseases resistance was also conducted against *Rhizoctonia solani*, another leaf blight pathogen, which causes severe premature defoliation during the active growing period. All the ten clones exhibited susceptible reaction in the screening tests.

Project 22: Biological control of *Lantana camara* and *Parthenium hysterophorus* by fungal pathogens [FRI-206/Path-12/2002-2007]

Status: *Lantana camara* and *Parthenium hysterophorus* plant samples showing disease symptoms were collected and associated pathogens were isolated. To increase the efficacy of the propagules of *Sclerotium rolfsii* and *Alternaria alternata* on *Parthenium*, adjuvants viz. APSA 80, Agrowet 101, Indtron AE and shampoo were tested in laboratory conditions. For studying the synergistic effect of herbicides viz. Atrazine, 2,4 D Ethyl Ester, 2,4 D Sodium salt, Paraquat, Glyphosate, Mop up, Lasso and table salts were screened against germination of the fungal propagules of above species. In case of *Alternaria alternata*, the adjuvants were also tested in glass house along with the conidia in tank mix. Different pathogen species viz. *Colletotrichum gloeosporioides*, *Curvularia lunata*, *Fusarium solani* and *Fusarium* sp. and two unidentified species were tested on *Lantana camara* in glass house conditions. An unidentified fungal pathogen caused mortality when combined with sub lethal doses of glyphosate in glasshouse experiments.

Project 23: Economics of cultivation of commercially important medicinal plants [FRI- 246/ RSM-14/ 2003-2006]

Status: Relevant literature from various sources was consulted. Surveys were conducted for identifying farmers/growers of medicinal plants in the states of FRI jurisdiction. Data on cost and benefit aspects of cultivation of medicinal plants



were collected for Kalmegh, Tulsi, Satavar, Ratti and Aswagandha from the cultivators of Karnal and Yamuna Nagar districts in Haryana. Cultivators of medicinal plants were also selected in Pithoragarh district and data on cost and benefits of Kuth (*Saussurea costus*), Dolu (*Rheum australe*), Kutki (*Picrorhiza kurroa*) and Salampanja (*Dactylorhiza hatagirea*) were collected from them. Data is being analysed.

Project 24: Development of suitable silvicultural practices for JFM [FRI-180/Silva- 14/2001-2006]

Status: Data with respect to socio-economic structures and ecological conditions of the protected as well as unprotected forests from two JFM villages of Ramnagar Forest Division have been collected, compiled and analysed. The sampled data of the JFM villages from Uttarakhand are being analysed for preparation of the final report of the project.

Project 25: Working Plan for Reserved Forest of Forest Research Institute Estate [2001-2010]

Status: Data on various parameters constituting inputs and outputs has been collected and documented.

Project 26: Contribution of forestry and human development index of forest dependent community of Jaunsar area [FRI-248/Stat-1/2003-2006]

Status: Secondary and primary data have been collected. Primary data has been collected from 15 villages and preliminary analysis has been done.

NEW PROJECT INITIATED DURING THE YEAR 2004-2005

Project 1: Studies on the termite diversity of Northern India with special reference to species composition in relation to different tree species (Insecta: Isoptera) [2004 – 2007]

Status: Studies were carried out on the unidentified collection in the National Insect Reference Collection and identified 13 species belonging to the families Rhinotermitidae and Termitidae (Isoptera). A new species of the genus *Nasutitermes* has been identified and details are being worked out. Besides, 89 vials of termites from Goa have been identified and the manuscript with new species and new distributional records was prepared. A key to the identification of the genus *Microcerotermes* has been updated and revised.

PROJECTS COMPLETED DURING THE YEAR 2004-2005

(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]

Findings: A total of 73 genera, 179 species and more than two hundred sixty two NFPs i.e., herbs, shrubs, climbers and tree were surveyed and study areas of Garhwal Himalayan Region (GHR) at the various altitudes during the survey works were identified.

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

Findings: The three species namely *Grewia optiva*, *Celtis australis* and *Quercus leucotrichophora* were found the most important fodder tree species having overall acceptability and major demand for planting by the villagers at three studies sites. The villages situated at tropical and sub-temperate climate prefer *Ougeinia oojeinensis*, *Bauhinia* species, *Terminalia*



alata and *Ficus* sp. as fodder species. The most liked fuelwood species were *Morus alba*, *Melia azadirach*, *Dalbergia sissoo* and *Toona ciliata* at tropical and sub-tropical climate. However, *Quercus leucotrichophora* were found most valuable and important fuel wood species in temperate areas. The *Alnus nepalensis* was also utilized as a fuelwood by the villagers at temperate altitude. Among all species, the seeds of *Quercus leucotrichophora* showed maximum germination percent and survival at all three nurseries followed by *Bauhinia purpurea*, *Melia azedarach* and *Ougeinia oojeinensis*. In respect of growth parameters, the maximum height and collar diameter were recorded in *Grewia optiva*, *Leucaena leucocephala* and *Bauhinia variegata* at 640 m altitude. However, at Jarmola (1800 m), maximum height was observed in *Prunus armeniaca* and at Sandra (1200 m) in *Prunus persica*. Maximum number of leaves was found in *Ougeinia oojeinensis* at Dehradun. While, at Sandra and Jarmola, maximum numbers of leaves were recorded in *Prunus armeniaca*. However, at all the three altitudes, *Prunus armeniaca* exhibited maximum number of leaves. Total biomass was observed maximum in *Morus alba* followed by *Ficus glomerata*, *Leucaena leucocephala* and *Ficus racemosa* at Dehradun however at Sandra, *Terminalia alata* and *Aesculus indica* had the maximum biomass. At Jarmola, *Prunus persica* exhibited the highest biomass followed by *Morus serrata*, *Populus ciliata* and *Salix alba*. At all the three altitudes, *Quercus leucotrichophora* was found to be photosynthetically most efficient followed by *Bauhinia purpurea* and *Grewia optiva*. At all the three altitudes, the maximum Nitrogen content was found in *Prunus persica* at 1800 m and Potassium content in *Toona ciliata* at 640 m, while Calcium and Magnesium content was found maximum in *Celtis australis* and *Toona ciliata* at 640 m altitude. Maximum content of crude protein

on dry basis in the leaves of fodder species was found in *Grewia optiva* at 640 m altitude in *Bauhinia variegata* at 1200 m altitude and in *Quercus leucotrichophora* at 1800 m altitude. In all the fodder and fuelwood species, the maximum calorific value (KJ/g dry weight) and Fuelwood Value Index was found maximum in *Toona ciliata* and *Sapindus mukorossi* respectively.

Project 3: Eradication of Lantana by underplanting with Bamboo [FRI/227/Bot-33 /External/2003-2004]

Findings: Studies were conducted to evaluate the physiological potential of Bamboo for suppression and ultimately eradication of lantana in Kandi Areas of Punjab, with a view to developing a silvicultural method for control and eradication of *Lantana camara*. Two species of Bamboo viz., *Dendrocalamus strictus* and *Bambusa bambos* were taken up and the trial was laid at 3 sites in Kandi area of Punjab. Since the project period was very short, no definite conclusion could be drawn.

Project 4: Production of alpha cellulose from *Lantana camara* and its chemical modification for industrial applications [FRI-226/Chem-11/ External/2003-2005]

Findings: Results show that *Lantana camara* can be considered a viable source of a- cellulose. The alpha cellulose yield from *Lantana camara* was 38.76%. It contained 94.8% alpha cellulose, 0.48% ash content, 0.8% lignin, 2.5% gamma cellulose, 1.42%beta cellulose (by difference), 81% brightness, 576 cm³ gm viscosity and 430 degree of polymerization.

Lantana camara, therefore, has a potential for producing alpha cellulose and its derivatives for a variety of applications paving way for management of this obnoxious weed by its



utilization into products of commercial importance.

Project 5: Impact of disturbances on biodiversity status, resource availability and their management for sustainable development in Kandi areas of Punjab [FRI-228/ Eco-10/External/2003-2005]

Findings: Ten plant species were identified as new records for the state of Punjab. Low content of nitrogen (0.024%) was recorded in highly disturbed sites which was slightly higher in moderately disturbed (0.034%) and high percentage in least disturbed site (0.04%). Carrying capacity of disturbed sites was recorded quite low (0.1 cow ha^{-1} to 3.3 cow ha^{-1}) than that of protected/natural forests (12.2 cow ha^{-1}).

Project 6: Study on soil/site for optimizing biomass productivity [FRI-229/ FSLR-115/ External/2003-2005]

Findings: Six field experiments were carried out in three types of variations occurring in the Kandi area of Punjab i.e., steep slopes, boulder tract and torrents (Cho beds). On the basis of survival, height and collar diameter of 15 species tested in boulder tract (Bhadiyar, Ballachaur Forest Division) *Melia composita*, *Dalbergia sissoo*, *Acacia catechu* and *Tectona grandis* were found more suitable whereas *Eucalyptus* and *Bauhinia variegata* were found least suitable. *Melia composita*, *Acacia catechu*, *Acacia nilotica*, *Albizia procera* and *Dalbergia sissoo* were found more suitable and *Bauhinia variegata* was found least suitable, out of the 15 species tested in Cho beds (Chaksadhu, Hoshiarpur Forest Division). In the sloppy area of Chakkhar (Pathankot Forest Division) *D. sissoo*, *M. composita*, *B. variegata* and *T. arjuna* were found most suitable while *Eucalyptus* was not found suitable. Vermicompost was found to be the superior source of organic

manure in comparison to farmyard manure and compost at all the experimental sites.

Project 7: Consultancy for operationalization of seedling production through clonal technology in Punjab [FRI-171/G&TP-8/ External/2001-2004]

Findings: Consultancy was taken up from Punjab forest department to render expert advise and guidance for the development of macro-propagation facilities, setting up multiplication garden of *Eucalyptus*, *Dalbergia sissoo* and *Poplars*. For achieving these objectives three training programmes were conducted. Training was imparted to 196 forest officials of the rank of Range Officers, Foresters and Forest guards on tree improvement, clonal propagation, management of multiplication garden, pathological and entomological aspects in nursery and plantations etc. Technical know how was imparted and two mist chambers were constructed at Hoshiarpur. Multiplication garden of *Eucalyptus*, *Dalbergia sissoo* and *Poplars* were established and handed over to the Punjab Forest Department.



Acacia nilotica proved suitable for Cho beds at Chaksadhu, Hoshiarpur



Project 8: Central scheme for development of Agro-techniques and cultivation of medicinal plants used in Ayurveda, Siddha, Unani and Homeopathy [FRI-173/ NWFP-8/ External/2003-2005]

Findings: Cultivation packages for *Elaeocarpus ganitrus*, *Prunus cerasoides*, *Habenaria intermedia* and *Microstylis wallichii* were developed. Demonstration plots of *Elaeocarpus ganitrus* and *Prunus cerasoides* were maintained. The flowering and fruiting has been recorded in both these species. The fruit production in *E. ganitrus* per tree basis is being recorded. It has been observed that early fruiting can be initiated through air layered propagated plants.

Project 9: Value assessment of plantations raised by Indian Farm Forestry Development Cooperatives Ltd. in Sultanpur, U.P. [FRI-220/RSM-13/External/ 2003-2004]

Findings: Field works and data analysis were completed and final report is being prepared. Results show that Shisham is the main species having (54.2 %) of the total number of trees followed by *Prosopis* (12.2%) and *Eucalyptus* (11.9%). The growth of Shisham is quite slow i.e., almost equal or comparable to the average site quality. The total value of the plantations of all the societies is Rs.10.89 crores. The future yield at 20, 25 and 30 years have also been predicted.

Project 10: Development of community based market information services for medicinal plants of Uttaranchal [FRI-215/RS&M-12/ 2002-2005]

Findings: Eleven issues of “Quarterly Newsletter on Market Information on Medicinal Plants” were published by the institute. It included prices of selected species at Delhi, Ramnagar, Saharanpur and Tanakpur market, price trend analysis of selected species, cultivation techniques of

important species and information about the markets as well as annual requirement of certain industries of Uttaranchal.

Project 11: Medicinal and aromatic plants technologies trade and commerce [FRI-284/ Silva-21/External/2004-2005]

Findings: The amount was provided by National Medicinal Plant Board to the Indian Forester for bringing out a special issue on Medicinal and Aromatic plant Technologies Trade and Commerce. The issue was brought out in the month of March, 2005.

PROJECTS CONTINUED DURING THE YEAR 2004-2005

(Externally Aided)

Project 1: Problem of forest regeneration of Sal (*Shorea robusta*) and associates in Dehradun Forest Division with special reference to fire, overgrazing and human interference [FRI-256/ Bot-35/External/2004-2006]

Status: Assessment of regeneration status of *Shorea robusta* (Sal) in three selected localities (Raipur, Lacchhiwala and Barkot Range) of Dehradun Forest Division of Uttaranchal was undertaken and the regeneration was quantified. Soil samples were also collected from all the three locations with special reference to burnt, unburnt, human interference, grazing and control areas for analysis of mineral components. Phosphorus and organic carbon were analyzed in soil samples.

Project 2: Developing bio-climatic indices for important species existing under agroforestry and departmental plantations for different agro-climatic zones of Punjab [FRI-217/Bot-32/External/2002-2005]

Status: Growth data for height and diameter of different aged plantations of *Acacia catechu*,



Poplulus deltoides, *Melia azedarach*, *Melia composita*, *Acacia nilotica*, *Albizia procera*, *Dalbergia sissoo*, *Eucalyptus* sp., *Morus alba* and *Terminalia arjuna* were collected from the departmental plantation of Ludhiana Forest Division. It comes under agro-ecological region no. 4 (Hot Semi-arid). Soil samples collected from study sites are being analyzed for chemical properties. Data collected in the field is tabulated and computed for further analysis. Climatological data for different ecological zones of Punjab was collected from the Punjab Agricultural University (PAU).

Project 3: Creation of Germplasm Bank of commercially important tree species of Punjab [FRI-178/Bot-28/External/2001-2005]

Status: Preparation of field map of fourteen selected project species for the proper establishment of Germplasm Bank. Seed collection of *Melia composita* from different regions of Punjab, Haryana, Himachal Pradesh and Uttarakhand was done. Seed sowing was done in the nursery of all the progenies of *Melia composita*.

Project 4: Development of suitable propagation technology of three *Terminalia* sp. [FRI-261/Bot-40/External/2003-2005]

Status: Field surveys in FRI Campus, Haldwani and Pant Nagar for distribution and availability of species in Uttarakhand region was carried. Vegetative propagation technology through mature cuttings as well as shoot cuttings in summer season was developed. Rooting in *Terminalia arjuna* has been done successful by using rooting hormones. Seeds of three *Terminalia* sp. were collected and sown. Collection of data on seed length, width, volume, vigour and its analysis are in progress.

Project 5: Micropropagation of Chir pine (*Pinus roxburghii*) and Shisham (*Dalbergia sissoo*) [FRI-222/Bot-13/External/2002-2005]

Status: Somatic embryogenesis was induced successfully from immature zygotic embryos. Somatic embryos were germinated and developed further on defined medium. Axillary bud differentiation was obtained from 20-25 days old seedlings, 10 years old hedges and from 20-25 years old trees. Seedling shoots were also cultured which gave best results. Adventitious bud differentiation was successfully induced on the surface of mature zygotic embryos of chirpine. Study of effect on phytohormones and sucrose was carried out. In *Dalbergia sissoo*, nodal segments were used as explant for *in vitro* multiplication of plants. Nodal segments were surface sterilized and cultured on medium supplemented with different plant hormones. A 90% ex-plant response was obtained.

Project 6: Network program for establishment of demonstrations of Bamboo plantations in Uttarakhand [FRI-257/Bot-36/External/2004-2007]

Status: Nodal segments (3-4 cm long with axillary buds) of *D. asper* were collected from young juvenile shoots of tissue culture raised 5 years old plant and the existing *in vitro* shoot cultures were used. The existing *in vitro* cultures were first multiplied and rooted *in vitro*. Later these tissue culture plants were hardened and acclimatized. Also T.C. plants available in the green house were macro proliferated and multiplied. Within a short period of 5 months 1200 plants were sent for plantation.

Project 7: Development of tissue culture technique for protocol development of *Bambusa balcooa* and *Melocanna bambusoides* [FRI-258/Bot-37/External/2004-2007]



Status: Selection for healthy clumps of *Bambusa balcooa* was done. Media preparation for inoculation of ex-plant and sterilization of ex-plant with different sterilizing agents were carried out and condition for sterilization was perfected. Inoculation of surface axillary buds were done in MS medium supplemented with cycloheximide.



Tissue Culture raised plants of Bamboo

Project 8: Enrichment, improvement and development of botanical garden and species specific arboreta of FRI [FRI-260/Bot-39/External/2003-2005]

Status: Misting unit has been set up in the garden. Irrigation facilities are in progress. A number of rare, spectacular and threatened species have been introduced and conserved as live reference materials.

Project 9: Identification, taxonomy, properties and uses of different species of Shoreas of the Malay Peninsula [FRI-191/Bot-30/External/2002-2005]

Status: Variations in physical, gross and microscopic anatomical features of different species of *Shorea* of Balau 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 fibre-diameter ($a=0.05$). Identification key in dichotomous pattern has been prepared on the basis of anatomical characters at species level for Balau group of Malay Peninsula. The dichotomy is based on a pair of contrasting characters e.g., presence vs absence of crystals, chambered vs non chambered crystals, presence vs absence of radial canal, maximum and minimum ray height, maximum and minimum ray width, maximum and minimum gum canal diameter, high frequency of vessels vs low frequency of vessels. Differences in quantitative characters are analysed using 't' test for the mean. Besides, features like density and types of gum canals are also used. The occurrence and location of prismatic crystals are found to be of diagnostic value on the species level.

Project 10: Bioconversion of lignocellulosics feed stock into ethanol as biofuel [FRI- 224/C&P-16/External/2003-2005]

Status: Proximate chemical analysis of *Lantana camara* and *Prosopis juliflora* was completed. Acid hydrolysis of *Lantana camara* and *Prosopis juliflora* with H_2SO_4 , HCl and H_3PO_4 was performed under different acid concentrations (0.5%, 1.0%, 3.0%, 4.5% and 5.5%). Lignin was separated out from the hydrolyzate. The hydrolyzate was neutralized, purified, decolorized and concentrated. The hydrolyzate was decolorized using activated charcoal. Total sugars were determined using Dinitrosalicylic acid (DNSA) method. The purified hydrolysis product was sent for its bioconversion into biofuel.

Project 11: Chemical screening of the oilseeds of some high oil yielding tree species in the Himalayan region [FRI-223/Chem-9/External/2003-2006]



Status: Seeds of 9 plant species were collected and their fatty oil content and physiochemical properties were determined. Fatty acids from each were isolated by hydrolysis and their methyl esters were prepared.

Project 12: Chemical screening of the oilseeds and development of seed handling practices and plantation trial of some high oil yielding tree species in the Himalayan region [FRI-223/Chem-9/External/2003-2006]

Status: Seed maturation study on *Sapindus mukorossi* was done and November was found to be the suitable time for collection of seeds. The seeds of *Sapindus mukorossi* for raising the nursery stock were collected. To develop the nursery techniques, seeds were also sown in five different media. Observations were taken on germination, height, survival %, etc. at regular intervals. Demonstration Plot of *Sapindus mukorossi* was raised at two sites- 0.69 ha (681 plants) at FRI campus and 2.0 ha (2220 plants) in Compartment 1, Jakhan Block, Barkot range, Dehradun Forest Division.

Seeds of *Prinsepia utilis* were collected from Naagthaath, Haathipaon and Sukhi (Uttaranchal). Seeds were extracted from fruits, dried and subjected to germination test (in different media and temperature) and vigour tests. Nursery stock of about 2500 seedlings of *P. utilis* was raised for plantation.

Putranjiva roxburghii seeds were collected from FRI campus, Pinjore, Chandigarh and Mohali. Seeds were tested for germinability and viability. Seeds from Mohali gave about 93% germination whereas it was only 30% in Pinjore seedlot. Nursery stock of about 4500 seedlings of *Putranjiva roxburghii* has been raised for plantation.

3.7 kg kernel of *Sapindus mukorossi* and 7 kg of seed of *Prinsepia utilis* were supplied to

Indian Institute of Petroleum for oil studies, fatty acid profile and machine test. The results show that its oil is suitable for use as a biofuel.

Project 13: Prospecting for botanical pesticides - an All India Coordinated Research Project [FRI-188/Chem-7/External/2002-2006]

Status: Eight extracts of three plants species were fractionated by Column Chromatography and 18 isolated fractions were sent for pesticidal screening. Eight fractions were found to be active.

Project 14: Identification, development and utilization of natural dyes from the forest plants of Uttarakhand [FRI-249/Chem-12/External/2003-2006]

Status: Procurement, installation and commissioning of natural dye pilot plant and four colour fastness determining equipments were completed. Isolation and fractionation of the *Eucalyptus* hybrid and *Populus deltoides* bark dyes were carried out to isolate some pure compounds. The dyes consist of a complex mixture of polyphenols.

Project 15: Utilization of economic potential of parthenium [FRI-262/Chem-13/ External/2003-2006]

Sub-project (i): Preparation of alpha cellulose and hand made paper

Status: Experiments were conducted to optimize the conditions (water and alkali hydrolysis, pulping, bleaching with respect to chemical concentration and time) for preparation of alpha cellulose. The product so obtained was studied for its chemical composition (hemicellulose alpha cellulose and ash content).

Sub-project (ii): Preparation of composites from Parthenium

Status: The parthenium lignocellulosic material was isolated and converted into fibres, which



were analysed for physical properties for development of Medium Density Fibre Board (MDFB).

Project 16: Novel chemo-enzymatic technology for the food fibre from Guar/ *Cassia tora* Gums [FRI-225/Chem-10/ External/2003-2006]

Status: Reaction conditions were developed for the depolymerization of *Cassia tora* galactomannan using *Cassia tora* seed enzyme. Enzymes were also isolated from the guar seeds, and depolymerization of Guar, *Cassia tora* and *Cassia occidentalis* endosperm was achieved using guar enzyme. Depolymerization of *Cassia occidentalis* endosperm was also done under acidic conditions.

Project 17: Development of ecorestoration model for iron ore mines of Bihar and Orissa [FRI -179/Eco-9/External/2001-2006]

Status: Plant, soil and rock samples from all the selected sites viz., overburden dumps mined out benches, degraded areas in vicinity of mines and planted overburden dumps were collected and vegetation survey and litter collection was done in the permanent samples plots.

Project 18: Garden of the Great Arc [FRI-263/ Eco-12/External/2004-2008]

Status: The Garden of the Great Arc is situated in main campus of the Survey of India in the Hathibarkala estate in district Dehradun. Project is part of the work undertaken by MECON with funding from Department of Science and Technology. FRI is undertaking plantation and afforestation works in the garden with same theme gardens.

Project 19: Long term impact of monoculture on site productivity and resource conservation [FRI-177/Eco-08/External/2001-2005]

Status: Harvesting of Eucalyptus, Sissoo and Khair was done for biomass estimation and productivity. About 1500 component samples from all these trees were weighed for their fresh weight and dry weight, then powdered for analyzing their nutrient status. About 1000 samples of different plant components have been analyzed for different nutrients. Data entry, tabulation, interpretation and report writing is in progress.

Project 20: Evaluation of Radiata pine from New Zealand [FRI-184/FPD-38 (CW) External/2002-2005]

The study is comprehensive in nature and has been conducted in the following sub-projects:

Sub-project (i): Evaluation of natural durability and treatability under Indian conditions

Status: Natural durability test indicates the *Pinus radiata* to be non-durable in Indian condition. Samples of *Pinus radiata* and *Pinus roxburghii* treated with CCA at different concentration have been installed for field evaluation at Jodhpur and Dehradun.

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

Status: BWR grade plywood, concrete shuttering plywood, marine grade plywood, exterior grade block board and interior grade block board at pressure level of 10.5 Kg/cm² and 14.0 Kg/cm² do not meet the IS standards. However, in all above categories at pressure level of 17.5 Kg/cm² meet the IS standards. MR grade plywood does not meet IS standards at all the three pressures.

Project 21: 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]



Status: Studies on different sawing methods have shown that the modified quarter sawing gives better recovery (about 65%) after seasoning. The finishing properties of Eucalyptus were found to be comparable to those of Teak including retention. A full sports court covering 1040 sq. ft. area was constructed with flooring strips using tongue and groove jointing as a demonstration of utilization of plantation grown Eucalyptus.

Project 22: Utilisation of Sisal fibre for making composites and handmade paper [FRI-268/FPD-49/External/2004-2006]

Status: Preliminary experiments were carried out to prepare particle boards. Testing of these boards is being carried out as per relevant IS specifications.

Project 23: Biotechnological approaches for improvement of plant species with special reference to pulp and paper [FRI-267/FPD-48/External/2004-2006]

Status: Specific gravity of 20 trees has been determined. Work on chemical analysis has been initiated.

Project 24: Inventory of forest Insects [FRI-218/FED-14/External/2002-2005]

Status: Inventory of forest insect was prepared comprising of 15908 insects species, which include morphological characters, distribution, biology and control belonging to 21 insect orders. Photographs of 4477 insects were also incorporated. HTML files of 1251 insects were prepared.

Project 25: Efficacy testing of the insecticide ACTARA-25WSG against termites [FRI-266/FED-18/External/2004-2007]

Status: M/s Syngenta India Ltd., Mumbai has sent the insecticide ACTARA-25 WSG for testing against termites both in the laboratory as well as

under field conditions. Preliminary laboratory studies were conducted alongwith two conventional insecticides Endosulfan 35EC and Chlorpyriphos 20EC for comparison. Endosulfan was found better whereas effectiveness of ACTARA - 25WSG and Chlorpyriphos 20EC was at par.

Project 26: An interdisciplinary approach to analyze the dynamics of forest and soil degradation and to develop sustainable agro-ecological strategies for fragile Himalayan watersheds [FRI-187/FSLR-13/External/2001- 2005]

Status: The data on hydrological measurements, recorded in the Arnigad Watershed, were sent to task leader, ALTERRA, Netherlands, for incorporation in LISEM model. The village and household level data on socio-economic status were processed and sent to task leader Norway for incorporation in the socio-economic model. Measurements of the tree density, vegetation characteristics, cohesion, soil moisture and random roughness in various micro and macro plots under forest, agriculture and degraded land was carried out and leaf samples from tree, shrub and herb were collected from each field and the Leaf Area Index was estimated. The soil samples were collected from each field and the aggregates were estimated.

Project 27: Micropagation of promising F1 interspecific hybrids of Eucalyptus and field plantations [FRI-220/G&TP-11/External/2002-2005]

Status: Field plantations of F1 hybrids of Eucalyptus (FRI-5 & FRI-14) were established at seven places. Different media combinations were tried to find out suitable media for establishment of *in vitro* shoot cultures and their multiplication in four hybrids. *In vitro* shoot cultures and multiplication were achieved



through axillary bud cultures of two hybrids FRI-10 & FRI-15. However, two other hybrid experiments are in progress. Fifteen thousand T.C. plants were developed and planted.

Project 28: Analysis of population genetic structure and diversity in Himalayan Pines using molecular markers [FRI-221/G&TP-12/External/ 2002-2005]

Status: Protocols for genomic DNA isolation from needles of Chir pine (*Pinus roxburghii*), Blue pine (*Pinus wallichiana*), Chilgoza pine (*Pinus gerardiana*) and Khasi pine (*Pinus kesiya*) were standardized.

Project 29: Genetic improvement and production of nursery planting stock of Khair, Shisham and Kikar [FRI-170/G&TP-7/External/2000-2005]

Status: Clonal seed orchards of three species Khair, Shisham and Kikar (1.0 ha each) were established at Bir Sanur Patiala and Hoshiarpur (Punjab). Vegetative propagation strategies of *Acacia nilotica* (Kikar) and *Acacia catechu* (Khair) were developed and implemented for raising the plus tree ramets for the establishment of their CSOs. Progeny trials of Khair and Kikar comprising families of 40 plus trees of each species were established at Bir Sanur Patiala. Growth assessment of CSO and Progeny Trials are underway. Promising stands of Khair (5.0 ha) and Kikar (5.0 ha) have been finalized as seed stands. The process for the conversion of seed stands into Seed Production Areas is under progress.

Project 30: Development of agro-mediculture models for sustainable diversified farming in Uttarakhand and Haryana [FRI-214/NWFP-15/ External/2002-2005]

Status: Agroforestry based medicinal plant cultivation research plots were established in

Haryana and at Dehradun. The planting stock for all the experimental plots was raised at Karnal and Dehradun nurseries. The models were replicated during the second year so as to confirm the results of previous year trials. The cost economics of cultivation of different medicinal plants under different agroforestry and horticultural species have been achieved.

Project 31: Study on inventorisation, assessment of their demand and supply and potential of commercialisation of medicinal plants in South-West Haryana [FRI-269/NWFP-17/External/2004-2005]

Status: Extensive field surveys in the forest areas as well as non-forest areas of three districts of South-West Haryana viz., Gurgaon, Mahendragarh and Rewari were carried out and medicinal plants occurring in the area were recorded.

Project 32: Studies on interrelationship between production levels and marketing of important forestry species in Punjab [FRI-174/RS&M-9/2000-2005]

Status: Growing stock of Poplar has been worked out in all districts of Punjab. 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.

Project 33: Preparation of local volume tables of Khair, Sal, Shisham and Teak [FRI- 255/RS&M -15/External/2003-2005]



Status: Volume equation for Khair has been prepared and submitted to the U. P. Forest Development Corporation. Local volume tables for Sal, Teak and Shisham are being prepared.

Project 34: Studies on Himalayan Pines [FRI-175/Silva-13/External/1995-2005]

Sub-project 1: Seed testing

Status: Four seed sources of *Pinus roxburghii* had been screened for their water stress tolerance behaviour. Biochemical analysis in context of polyphenol, amino acids and carbohydrate of seven different seed sources of *Pinus roxburghii* have been done. Banding pattern has been achieved and analysis is being done. SDS- PAGE (Poly Acrylimide Gel Electrophoresis) of different seed sources of *Pinus roxburghii* and *Pinus wallichiana* had been evaluated. At present experiment under water stress of seven seed sources of Chir pine at Plant Physiology Glass House are in progress.

Sub-project 2: Seed technology

Status: The aim of the study is to explore the nature and extent of variation in wide range of population of Chir pine in some prominent characters and relate them to adaptability and growth. In order to achieve this object studies have been carried out to find out source variation in cone, seed and seedling characteristic of Chir pine. Different morphological traits, germination behaviour and nursery performances of the seed have been recorded and genetic variability estimated. Significant amount of genetic variation has been observed in different characters of cone, seed and seedling. A provenance trial of 56 seed sources has been established at FRI (600 m altitude) and Jarmola (1200 m altitude) in Uttarkashi Forest Division, Uttarakhand. Observations were taken on height, collar diameter, survival (%), bud length, bud breaking

etc. of the seedlings. Similar studies on Himalayan high level pine the *Pinus wallichiana* is also planned. Seeds of blue pine from 35 sources that were sown in nursery showed very poor emergence due to the inherent problem of emptiness in the seeds.

Sub-project 3: Nursery and planting technology

Status: The data on the seed and cone characteristics of the three provenances of *Pinus wallichiana* was recorded in 2004 and it was found that cone length is highly variable within a given tree; more than 99 per cent of the variation in this character is attributable to the tree factor. Technique for rapid extraction of seeds from cones of *Pinus roxburghii* was developed.

Sub-project 4: Investigation on diseases of Blue pine (*Pinus wallichiana*)

Status: Compilation of data for the preparation of a brochure was completed, which included the importance and utility of mycorrhizae in Blue pine, the seed mycoflora associated with it and the achievements obtained till now with scanned photographs. Preparation of MMN medium, subculturing of the mycorrhizal fungus associated with *Pinus wallichiana* as well as *Pinus roxburghii* from the fruiting bodies collected during the field tour to Dhanaulti, pure cultures were prepared and maintained by sub-culturing. Synthesis experiment was terminated in December. Three species namely *Gastrum*, *Coenococcum* and *Thelophora* showed efficient results. Seed mycoflora of three provenances namely Devrana, Nelong and Gangnani were studied. Erupting fungal colonies were pure cultured in test tubes for further experimental work. They were then identified using monographs and keys. Germination % age was observed. Collection of mycorrhizal soil samples of blue pine was conducted. Isolation of mycorrhizal roots from the collected samples is in progress.



NEW PROJECTS INITIATED DURING THE YEAR 2004-2005

(Externally Aided)

Project 1: Evaluation and standardization of the methods employed in identity of the medicinal plants employing woods of Himalayan and sub-Himalayan tract [FRI-276/Bot-41/External/2004-2007]

Status: Started in January, 2005.

Project 2: Impacts of tourism on environment of Roopkund and Pindari areas of Nanda Devi biosphere reserve of Uttarakhand [FRI-280/Eco-15/External/2004-2007]

Status: Project has been initiated in December, 2004. Relevant literature has been compiled.

Project 3: Ecorestoration studies in Uranium Mines [FRI-265/Eco-19/ External/2004-2008]

Status: Project was prepared to undertake ecorestoration studies in Uranium Mines of Jaduguda (Jharkhand). This project has been proposed to develop ecologically and economically viable restoration model for the restoration of environmentally sensitive Uranium mill tailings.

Project 4: Restoration of biodiversity in the hills of Kujapuri Siddhapeeth following Badrivan restoration approach [FRI-264/Eco-13/External/2004-2007]

Status: Monsoon and winter plantation of various native fodder and horticulture species was done in and around the Kujapuri temple and in village community and private lands. Monitoring of growth and survival of planted species was carried out. Vegetation and soil analysis was also done. Socio-economic survey in two villages located nearby Siddhapeeth was also concluded. Awareness campaigns about protection and

conservation of plant diversity were organized in the villages.

Project 5: Demand and supply of medicinal plants and produce grown/found in Haryana [FRI-291/NWFP-18/External/2004-2005]

Status: Project initiated in March, 2005 with the objective of assessing the demand and supply of medicinal plants in the state of Haryana.

Project 6: Study of pathogenic and molecular variability in *Fusarium solani* causing Shisham (*Dalbergia sissoo*) Wilt. [FRI-272/Path-17/External/2004-2007]

Status: The isolates of *Fusarium solani* were collected from Dehradun, Haldwani and Sultanpur. A total of 80 isolates were collected and purified.

Project 7: Researches on natural decay resistance of juvenile timbers like poplars – DST sponsored project [FRI-283/Path-18/External/2004-2007]

Status: Wimco Seedlings Ltd., Rudrapur was visited and modalities were worked out for procuring authentic material of poplar for testing. Four samples of different clones of poplar were procured and are being prepared for testing.

Project 8: Studies on fungal infestation, mycotoxin elaboration and induced biochemical changes associated with edible oilseeds of forest origin [FRI-270/Path-15/External/2004-2007]

Status: Seed samples of *Buchanania lanza*, *Juglans regia*, *Prunus armeniaca* and *Shorea robusta* were collected from different regions of Uttarakhand under field and storage conditions. The incidence of mycoflora was studied and an exhaustive list of mycoflora associated was prepared. The fungi isolated were screened for their mycotoxin producing potential. Natural



contamination of mycotoxins in fresh and stored samples was also carried out. Statistical analysis of the results was carried out to analyze the effect of season and source on incidence of mycoflora and natural occurrence of mycotoxin contamination.

Project 9: Evaluation of microbial status of organic farming [FRI-271/Path-16/External/2004-2006]

Status: Selection and collection of soil and root samples of different crop category like cereals, vegetables, medicinal plants and horticulture in different seasons (Kharif and Rabi) was carried out. Collection of soil and root sample in different growth phase of crops was done. Screening of different beneficial microbes from different crops and physico-chemical analysis of soils under different crops were carried out.

Project 10: Study and preventive measures of dying phenomenon of *Acacia nilotica* and *Dalbergia sissoo* in Haryana [FRI-286/Path-19/External/2005-2006]

Status: Project initiated in March, 2005.

Project 11: Networking forest plantations in a crowded world: Optimizing ecosystem services through improved planning and

management strategies funded by E.U. under ECCP [FRI-288/RCS-1/External/2005-2007]

Status: The principle objective of the project is to establish an expert network on forest plantation and management between leading universities and research institutes in densely populated countries. The initial kick-off workshop between participating institutes viz. FRI, Freiburg University, Germany and Alterra, Netherlands took place from 15th to 18th March, 2005 in Dehradun.

Project 12: Development of mechanism for computation and forecast of growing stock in strip forests of Haryana taking into account the year wise plantation and survival of relevant species [FRI-289/RCS-2/External/2005-2006]

Status: Project initiated in March, 2005.

Project 13: Development of Technological package for the production and quality evaluation of seeds of important medicinal plant [FRI-285/Silva-22/ External/2004-2007]

Status: After extensive literature survey, a calendar was prepared on the habit, habitat, distribution, flowering, fruiting and germination etc. of 100 medicinal species.

RESEARCH ACHIEVEMENTS

Name of state	No. of Projects completed in 2004-2005	No. of ongoing Projects in 2004-2005	No. of Projects initiated in 2004-2005
Uttaranchal	8	18	3
Uttar Pradesh	2	2	—
Haryana	—	1	4
Punjab	2	4	—
Others	16	35	8



EDUCATION AND TRAINING

Training organized

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

1. Wood Seasoning
2. Management of NWFP for Sustainable Development
3. Bamboo Silviculture and Utilisation
4. Inventory and Status Survey of the Herbal Wealth in the Cold Desert Region of the Indian Himalayas
5. Nursery and Plantation Technology
6. Plywood Manufacture
7. Development of Green Belts
8. Agroforestry
9. Classification and Grading of Timber
10. Seed Technology
11. Eco-restoration of Wastelands
12. Economics and Valuation of Forests and Forests Products
13. Training programme for ISS Probationers
14. Joint Forest Management
15. Recent Forestry Practices for Maximizing Agroforestry Returns
16. Commercial Utilisation and Value Addition of NWFP
17. Compulsory training of IFS Officers on Management of NWFP for Sustainable Development

Training received

1. Dr. V.K. Varshney attended laboratory training on "Aromatherapy creations and formulations" at Institute of Natural and

Modern Cosmetech, Faridabad from 27th and 28th October, 2004.

2. Dr. Ashok Kumar, Scientist-C attended a training programme on "ISO 14000 : 1996 Environmental Management System Lead Auditors Training Course" from 22nd to 27th November, 2004 conducted by the Division of Biodiversity and Climate Change of the Indian Council of Forestry Research and Education, Dehradun.
3. Dr. Ashok Kumar, Scientist-C of this division attended a training on bio-safety issues related to transgenic crops at the G. B. Pant University of Agriculture and Technology, Pantnagar, U.S. Nagar from December 27, 2004 to January 01, 2005 on different aspects including current scenario of development of transgenic plant, quarantine and controlled movement methods for ensuring biosafety, IPR for transgenic and the transfer of transgenics from lab to land.
4. Shri H. P. Singh, Scientist-B got training on "EMS Auditor training Course, ISO 14002" from 23rd to 27th November, 2004 at ICFRE, Dehradun.

LINKAGES AND COLLABORATION

Linkages were developed with following institutes/agencies:

National

1. Bureau of Indian Standards (BIS) during MSCD meeting at BIS, New Delhi attended by Sh. V.K. Jain, Head, Forest Products Division on 29th March, 2005.
2. CSIR during finalization of CSIR funded multi-disciplinary and multi-institutional project titled "Biotechnological approaches



- for improvement of plant species with special reference to pulp and paper".
3. TIFAC & DST were developed during participation in ASEAN-India Workshop on "Management of Technology Innovation" from 12th and 13th January, 2005, attended by Dr. Vimal Kothiyal, Scientist – E.
 4. Department of Forestry, HNB Garhwal University while collection of sample for CSIR funded project.
 5. Soil Conservation Research and Training Institute, Kaulagarh, Dehradun.
 6. NCL, Pune, Lucknow University, Osmania University, JK Paper Mills, ITC Bhadrachalam, NBRI Lucknow, CIMAP Lucknow, KFRI, Kerela.
 7. Wood and wood products manufacturer and user industries, important among them are NTPC Talcher, BIS New Delhi, Northern Coal Fields Ltd. Singrauli, Delhi Development Authority, Polyplex Ltd., Thailand.
 8. The farmers/trainees regarding Bamboo strength properties and Bamboo box manufacturing during the short term training courses titled "Bamboo Silviculture Practice and its Utilization" organized by PLO and Extension division.
 9. The State Forest Deptt of Uttarakhand for field planting of *Sapindus mukorossi* in 2.00 ha area in Jakhan Block, Barkot Range, Dehradun Forest Division and also for ongoing JFM project and for Monitoring and Evaluation of Panchayat land plantations made by Pauri Forest Division.
 10. Jhansi Forest Division for Monitoring and Evaluation of AOFP project of Jhansi Forest Division.
 11. Haryana Forest Department for making Micro-Plans under JFM project.
 12. National Informatic Centre, New Delhi for development of Computer software for wood identification.
 13. Bolani Ore Mines (Steel Authority of India), Keonjhar, and Orissa. Also working in collaboration with Department of Atomic Energy under the project "Ecorestoration Studies in Uranium Mines".
 14. Meteorological data used by Uttarakhand Irrigation Deptt., IMA and researchers.

International

1. European Union (EU) through a Research Project on "Interdisciplinary approach to analyze the dynamics of forest and soil degradation and to develop sustainability agro-ecological strategic fragile Himalayan watersheds" which is in progress.
2. Material transfer agreement was signed with Prof. Angel Concheiro, Department of Pharmacy and Pharmaceutical Technology, University of Santiago de Compostela, Spain for characterization of hydroxypropyl derivatives of cellulose.
3. Lund University, Sweden for M.Sc. Thesis.

PUBLICATIONS

Book

"Anatomy of Indian Bamboos" by Dr. Laxmi Chauhan and Dr. Mohinder Pal.

Quarterly Newsletter

"Market Information on Medicinal Plants". Four issues of the Newsletter were published by FRI, Dehradun during 2004-2005 and disseminated to various end users.



CONSULTANCIES

- Installation of steam-heated kiln at J & K Handicrafts Srinagar (J&K Handicrafts Corporation) funded by J&K Handicrafts (S&E) Corporation, Srinagar, Jammu and Kashmir for a period of 3 years. The consultancy amount is Rs. 16.5 Lakhs. The installation has been completed and staff of J&K Handicrafts has been trained in kiln operation.
- Installation of solar kiln at IMPCL factory premises, Mohan (IMPCL funded) by IMPCL, Mohan, Almora Dist., Uttarakhand for a period of 2 years. The consultancy amount is Rs. 3,37,200. This project is for installing a solar kiln for M/s IMPCL, Mohan and maintaining it for 1 year. The woodworking and procurements of materials are nearing completion and the kiln will be installed shortly.
- Greening of Delhi: Forest and Tree Crop Management. The work is in progress.
- Inspection and testing of timber for Cooling Tower at TPPS funded by NTPC, Talcher, Orrisa for period of 12 months. The consultancy amount is Rs. 12.0 Lakhs. The work is yet to start, as it is dependent on the requirements of time scheduling of NTPC.
- Consultancy/supply of strength properties of Teak to M/s Lcitiff Sons, Mumbai and revenue of Rs. 5, 000/- was earned.
- V.K. Jain visited factory of Polyplex Cor. Ltd, at Thailand from 16th to 21st September., 2004 to provide consultancy on wooden pallets and revenues of Rs. 46,000/- was earned.
- IRCON International Ltd., Gurgaon had requested Director, FRI to ascertain the

cause and extent of damage by termites to the IRCON building constructed two years back. The site of the building was visited, assessed the damage, collected the termites responsible for the damage. The technical report was submitted.

- Consultancy was given to M/s ABC Paper Mill, Hoshiarpur (Punjab) against a consultancy fee of Rs. 2000/-.
- Consultancy for operationalization of seedling production through clonal technology in Punjab by Punjab Forest Department.
- Large number of samples received from different industries and organization tested. Total fee received Rs. 27.29 Lakhs.
- About 400 wood samples has been examined and identified and revenue for about 19.50 Lakhs earned.

Patents Obtained/Filed

1. VAC-FRI Technology for treatment of green Bamboo Patent filed through NRDC No. 962/ DEL/2004 on 14.06.2004.

CONFERENCES/MEETINGS/ WORKSHOPS/SEMINARS/ SYMPOSIA/EXHIBITIONS

National

1. A paper entitled “ Impact of Protection on *Cryptomeria japonica* ecology in Wet temperate zone of Darjeeling Himalaya was presented by Dr. Nirmal Ram in National symposium on Exotics in Indian Forestry, organized by Department of Forestry, Punjab Agricultural University, Ludhiana.
2. A paper entitled “ Impacts of tourism on hydroecological parameters of sal plantation



in the forest hills of Darjeeling, Himalaya" was presented by Dr. Nirmal Ram in a National Seminar on tourism and Himalayan Biodiversity organized by Government P.G. College, Uttarkashi from 4th and 5th March, 2005.

3. Chandra, Veena Invited to deliver a special lecture on Threatened Biodiversity of Medicinal Plants IUCN RED LIST CATEGORIES Ver 3.1 in National symposium on Emerging Technologies and their Application in Assessment, Conservation and Management of Threatened Wild Medicinal Plants and their Habitats.
4. Dayal, R. Glycosides from some forest plants. Paper presented (invited) in XIX Carbohydrate Conference held at FRI, Dehradun from 1st to 3rd December, 2004.
5. Goyal, Puja, Kumar, Vineet and Sharma P. Carboxymethylation of Tamarind Kernel Powder. Paper presented in XIX Carbohydrate Conference held at FRI, Dehradun from 1st to 3rd December, 2004.
6. Gupta, Sangeeta attended 'National Workshop of ENVIS Centers and Nodes' held at Wildlife Institute of India, from 25th to 27th June, 2004.
7. Gupta, Sangeeta attended National Seminar on 'Bio-resources awareness and Management of solid waste' held at Jhansi.
8. Jha, M.N. attended Biodrainage Project Meeting at AFRI, Jodhpur from 19th to 22nd August, 2004 as special Invite. He also participated in international conference on "Multipurpose trees in the Tropics: Assessment, growth and management" held at Jodhpur in November, 2004; National Workshop on "Sacred grove a minibiosphere

helping in conservation of flora and fauna held at Coimbatore and EU NETFOP Project meeting with European collaborators held at Forest Research Institute, Dehradun from 14th to 18th March, 2005.

9. Jha, M.N. Attended National Workshop on "Forests and Water Conservation Myths and Realities" as a delegate at FRI, Dehradun from 8th to 10th June, 2004.
10. Jha, M.N. attended Workshop on "Methodologies in Forestry Mitigation Project" from 13th and 14th April, 2004- as delegate.
11. Kholiya, Deepak attended National Seminar on "Tourism Education and Contemporary Issues (26th and 27th March, 2005) organised by Kurukshetra Univ. at Kurukshetra from 26th and 27th March, 2005 and presented a paper "Dwarahat-Khajuraho of Kumaun Himalaya" by Deepak Kholiya, Laxmi Rawat and Preeti Joshi.
12. Khullar, Ritu; Gupta, P.K.; Varshney, V.K.; Naithani, S.; Bhatt, Amit and Soni, P.L. Carboxymethylation of cellulose isolated from *Lantana camara* and cotton linters, and their rheological behaviour. Paper presented in XIX Carbohydrate Conference held at FRI, Dehradun from 1st to 3rd December, 2004.
13. Kothiyal, Vimal Attended a ASEAN-India Workshop on "Management of Technology Innovation" organized by TIFAC & DST at New Delhi from 12th and 13th January, 2005.
14. Kumar, Vineet, Sharma, P. and Soni, P.L. MPTS management by sustainable utilization and value addition: A futuristic approach. Paper presented in Multipurpose Trees in the Tropics: Assessment, Growth and Management held at AFRI, Jodhpur from 22nd to 25th November, 2004.



15. Naithani, S. Paper and Paper Chemical Additives. Paper presented (invited) in XIX Carbohydrate Conference held at FRI, Dehradun from 1st to 3rd December, 2004.
16. Nautiyal, S. Attended National Symposium on Exotics in Indian forestry, held at PAU Ludhiana (Punjab) from 15th to 18th March, 2005.
17. Nautiyal, S. Attended International conference on Multipurpose tree in the Tropics: Assessment, Growth and Management from 22nd to 25th November, 2004, held at Arid Forest Research Institute, Jodhpur.
18. Pande, P.K. attended IUFRO workshop at AFRI, Jodhpur.
19. Poster presentation on "Biomass estimation of Eucalyptus hybrid at different localities of Punjab" by Laxmi Rawat, R.K. Luna, S.K. Kamboj and JDS Negi in National Seminar on "Exotics in Indian Forestry" held at PAU Ludhiana from 13th to 18th March, 2005.
20. Rana, Vikas; Bhatia, Himani; Gupta, P.K. and Soni, P.L. Medicinal plant polysaccharides: structure and function relationship". Paper presented in XIX Carbohydrate Conference held at FRI, Dehradun from 1st to 3rd December, 2004
21. Rashmi and Dayal, R. Antioxidant activity of *Achyranthes aspera*. Paper presented in XIX Carbohydrate Conference held at FRI, Dehradun from 1st to 3rd December, 2004.
22. Rawat, Laxmi and Kholiya, Deepak attended National seminar on "Tourism and Himalayan Biodiversity from 4th and 5th March, 2005 at PG College Uttarkashi and presented a paper on "Impacts of tourism on floral diversity (roadside plants) of Mussoorie hills" by Sapna Madan and Laxmi Rawat.
23. Rawat, Laxmi attended International seminar on "Ecotourism-Global Issues and Challenge" organised by Kurukshetra Univ. at Kurukshetra from 28th to 30th March, 2005 and presented a paper "Consequences of tourist activities on floral diversity of Dwarahat, Kumaun Himalaya" by Deepak Kholiya, Laxmi Rawat and Preeti Joshi.
24. Rawat, Laxmi attended International Workshop on "Ecotourism Planning and Management in Protected Areas" from 28th February, 2004 to 3rd March, 2005 at Mussoorie organised by Centre for Mountain Tourism and Hospitality Studies, HNBGU Srinagar and presented a paper on "Impacts of tourist activities on Environment of Mussoorie" by Laxmi Rawat and Sapna Madan.
25. Rawat, Laxmi attended National workshop on "Forests and Water Conservation-Myths and Realities" from 8th to 10th June, 2004 and presented a paper 'Effects of pollution on water quality of some streams of Doon valley" by Laxmi Rawat, P. K. Pandey, P. S. Chauhan and Kanchan Pangtey.
26. Rawat, Laxmi attended National workshop on 'Resource dynamics in watershed management -Emerging Challenges and Options" from 23rd to 25th June, 2004 organised by GBPIHE&D Almora and presented a paper 'Impacts of forests on environment".
27. Soni, P. participated in National seminar on "Anthropogenic Stress on Environmental And Sustainable Development" from 17th and 18th December, 2004 at and Nagar Nigam Mahila Mahavidyalaya, Kanpur.



28. Soni, P. participated in a National seminar on “Forests and People” from 29th and 30th July, 2004 at Belgaum, Karnataka.
29. Soni, P.; Rawat, Laxmi and Vasistha H.B. got training in ISO 14001 Lead Environmental Auditors from 23rd to 27th November, 2004 provided by BIS.
30. Soni, P.L. Novel chemo-enzymatic approach to prepare dietary fibre from galactomannan. Paper presented (invited) in XIX Carbohydrate Conference held at FRI, Dehradun from 1st to 3rd December, 2004.
31. Srivastava, Rajeev K. was invited by MOEF as an expert member to attend a meeting on Conservation of Biological Diversity.
32. Srivastava, Rajeev K. was invited by MOEF for attending a core group meeting on NBSAP held in New Delhi.
33. Tripathi, A.K. attended an “Interactive workshop on water conservation” organized by National Institute of Hydrology, Roorkee from 13th and 14th April, 2004.
34. Varshney, V.K. and Sharma, Pradeep attended a one day seminar on Texture analysis organised by M/s Scientific and Digital Systems, New Delhi on 19th January, 2005.
35. Varshney, V.K. Chemical modification of cellulosic material isolated from Bamboo, lantana and cotton linters. Paper presented (invited) in XIX Carbohydrate Conference held at FRI, Dehradun from 1st to 3rd December, 2004
36. Vasistha, H.B. presented a paper on “Landslides: Strategy for their sustainable management in the Himalayan region” Acharya Narendra Dev Nagar Nigam Mahila Mhavidyalaya, Harsh Nagar, Kandpur from 17th and 18th December, 2004.

AWARDS

National

- Dr. Rajeev K. Srivastava, Head, Silviculture Division was awarded “Brandis Award” for best paper on Silviculture.
- Dr. Mohit Gera, IFS from RS&M Division received the ICFRE Award of Excellence in Forestry Research.
- Dr. P.L. Soni awarded Life Time Achievement award for his notable contributions in the field of Carbohydrate Chemistry by ACCTI in XIX Carbohydrate Conference held at FRI, Dehradun from 1st to 3rd December, 2004.
- Dr. (Mrs.) P. Soni, Dr. Laxmi Rawat and Dr. H.B. Vasistha successfully completed Lead Auditors Course and received certificate from Marsden International, UK.
- Dr. Salim Ali, National Wildlife Fellowship Award 2001 was given to Shri Arun P. Singh, Scientist-D, Entomology Division, FRI, ICFRE, Dehradun by the Ministry of Environment and Forests Government of India for carrying out the study entitled, “Ecology of woodpeckers in borer infested sal forest of Dehradun valley, the lower western Himalayas”.

Workshops and Exhibitions

National Technology Day at FRI Dehradun on 11th May, 2004

During the day long celebrations the technologies developed by the institute were demonstrated to the general public. Besides this there was free entry to all six Museums for visitors.

World Environment Day at FRI and Ranger’s College, Dehradun on 5th June, 2004.

Workshop on “Forest and Water Conservation – Myths and Reality” at FRI, Dehradun from 8th to 10th June, 2004.



Hon'ble Minister of Environment and Forests,
Govt. of India planting a sapling on
3rd August, 2004 on Van Mahotsava

Celebration of Van Mahotsava at FRI,
Dehradun on 3rd August, 2004.

Celebration of Hindi Saptaha at FRI,
Dehradun from 13th to 17th September, 2004.

Vigilance Week at FRI, Dehradun from 1st
to 6th November, 2004.

Platinum Jubilee Celebration of FRI
building, Dehradun from 7th and 8th November,
2004.

XIX Carbohydrate Conference at FRI,
Dehradun from 1st December to 3rd December,
2004.

**Celebration of National Science Day at FRI,
Dehradun on 28th February, 2005.**

National Science Day was celebrated on
28th February, 2005. A film show was also
organized for the school children and general
public in the Convocation hall. Forest Research
Institute also participated in the National Science
Day at Anthropological Survey of India,
Kaulagarh Road, Dehradun.

**World Consumer Rights Day at DAV College,
Dehradun on 15th March, 2005.**

World Forestry Day at FRI, Dehradun on 21st March, 2005.

World Forestry Day was celebrated on 21st
March, 2005. On this occasion the institute
organized an exhibition in the Information centre.
Beside this the research activities carried out by
the institute were also shown to the general public
including villagers and school children. The
exhibition was inaugurated by Shri B.S. Sajwan,
IFS, Deputy Director General (Extension).

DISTINGUISHED VISITORS

6.4.2004	Mr. Ulrich Podewils, Director, Daad, India.
2.4.2004	Yusuf Noristani, Minister of Irrigation, Water Resources and Environment of Afghanistan.
27.7.2004	Shri Sharad Pawar, Union Agriculture Minister, Govt. of India.
28.7.2004	Shri G.R. Mussafir, Speaker, Himachal Pradesh Assembly.
3.8.2004	Thiru A. Raja, Hon'ble Minister of Environment and Forests Govt. of India.
23.8.2004	Shri Hans Raj Josan, Forest Minister Punjab, Chandigarh.
28.8. 2004	Shri Sangay Ngedup, Minister of Agriculture, Bhutan.
13.9.2004	Thakur Ram Lal, Forest Minister (H.P.).
11.10.2004	Shri Namo Narayan Meena, MoS (E & F), Govt. of India.
11.10.2004	Shri Bhairon Singh Shekhawat, Vice President of India.
6.11.2004	Mr. Grene Watos, New Zealand High Commissioner.



- 16.2.2005 Visit of Honorable guests from New Zealand to review the work progress of Radiata Pine by FRI.
- 22.2.2005 IUFRO Team members visited the museums and held meeting at FRI.
- 22.3.2005 Lt. Gen. K.K. Khanna, AVSM, Commandant IMA, Dehradun

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

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: -

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 in Post Graduate Diploma Courses and 24 in M.Sc. Admission to these courses is made on the basis of 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 total strength of the students in all courses in 89.

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

Besides regular lectures 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

1. Students of FRI DU participated in the workshop on Intellectual Property Rights Awareness held on 19th and 20th April 2004, FRI DU.
2. Students of M.Sc. Environment Management course II semester attended a seminar on



“Woman’s Role in Disaster Management” organized by Rotary Club Dehradun on 19th June, 2004.

3. Annual Sport meet was held from 4th to 7th December, 2004 at FRI, Dehradun.

Students Welfare Activities

- FRI Deemed University provides 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. E.M. Wil from the World Cultural Council, Mexico addressed the student of FRI Deemed University on 23rd April, 2004.

Ph.D. Programme

Research is an essential function of a national institute like 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 Centers have, the research activities under Ph.D. Programmes have increased manifolds. At present 436 Research Scholars have been registered including registration 62 Research Scholars in the current year. During the year, 42 Research Scholars have been awarded Ph.D. Degree.

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	Course	No. of students	No. of campus interview organized	No. of students selected
2002-04	M.Sc. Wood Science & Technology	19	7	12
2002-04	M.Sc. Forestry	24	4	8
2002-04	M.Sc. Environment Management	22	4	4
2002-04	PGD in Biodiversity Conservation	9	1	1
2002-04	PGD in Plantation Technology	11	1	2
Total		85	17	27
2003-05	M.Sc. Wood Science & Technology	25		
2003-05	M.Sc. Forestry	23		
2003-05	M.Sc. Environment Management	23	1	
2003-05	PGD in Biodiversity Conservation	9		
2003-05	PGD in Plantation Technology	9		
Total		89	1	6



NATIONAL FOREST LIBRARY AND INFORMATION CENTRE

The National Forest Library and Information Centre (NFLIC) is richest in document collection South and South-East Asia and has been providing all types of library and information services to its 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 27,580 books were loaned to the users for outside reading. Besides, 56, 118 books and journals were consulted inside the library.

The NFLIC subscribed to 93 foreign and 113 Indian periodical titles at a cost of about Rs. 35.49 lakh. It also received 400 periodical titles gratis.

The NFLIC has been selling ICFRE publications through its Book Depot. During 2004-2005, it sold 796 books and 22 cassettes/VCDs and earned a revenue of Rs.1, 10,1019/-.

The Ministry of Environment and Forests, Govt. of India established an ENVIS Centre on Forestry at NFLIC. The Centre, during the year launched its website containing plethora of information on forestry viz. bibliographical databases entitled: Indian Forestry Abstracts, Joint Forest Management, *Prosopis juliflora* and Grey Literature on Forestry; content pages of Indian as well as foreign journals; forest cover in the country state wise and then district wise; detailed information of different forest species; details of forthcoming conferences, seminars, etc. Besides, the Centre also published ENVIS *Forestry Bulletin*'s special issue on Mangroves; and *Forestry News Digest* regularly.