CHAPTER 3.1

Forest Research Institute Dehradun

Forest Research Institute (FRI), Dehradun has its roots in the erstwhile Imperial Forest Research Institute, established in 1906 to organize and lead forestry research activities in the country. The Institute caters, in particular, to the research needs of the Indo-Gangetic plains of Punjab, Haryana, Chandigarh, Uttar Pradesh and Uttaranchal. This Institute also has the 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 2005-2006

Project 1: 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 (ix): Chemical Investigation of *Dalbergia sissoo* leaf Polysaccharide [2002-2006]

Findings: *Dalbergia sissoo* leaf polysaccharide was isolated from its leaves by extraction with water. Complete hydrolysis of the polysaccharide followed by GLC and paper chromatography confirmed the presence of rhamnose, glucose, galactose and glucuronic acid. Partial hydrolysis indicated the presence of three oligosaccharides, which were isolated by preparative paper chromatography using Dent's method. Methylation of the oligosaccharides and polysaccharide was done using Hakomori and Purdie methods to study the linkages between oligosaccharides and polysaccharide. Periodate oxidation of the oligosaccharides and polysaccharide was carried out.

Sub-project (x): Chemical modification of Tamarind Kernel Powder (TKP) [2003-2006]

Findings: Reaction conditions were standardized for the preparation of carboxymethyl, cyanoethyl and quaternized products of Tamarind Kernel Powder (TKP). The modified products were characterized by FT-IR spectra and their rheological studies were carried out. Reaction conditions were optimized for grafting of TKP with vinyl monomers. The products were also characterized by FT-IR spectra.

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

Findings: Reaction conditions were standardized for the preparation products of *Cassia occidentalis* seed gum. The modified products were characterized by FT-IR spectra and their rheological studies were carried out. Grafted products of *Cassia occidentalis* seed gum were prepared using vinyl monomers viz. acrylonitrile, acrylamide and methylmethacrylate.

Project 2: Phytochemical examination for the utilization of leaves, barks, fruits and roots of India forest trees [FRI-53/Chem-3]

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

Findings: Phytochemical examination of *Achyranthes aspera, Clematis roylei* and *Casearia tomentosa* plants of immense medicinal value undertaken to isolate and identify their active principles.

Essential oil from *Achyranthes aspera* leaves was isolated by hydrodistillation method and characterized using Gas Chromatography-Mass Spectroscopy (GC-MS).

Different extracts of seeds, leaves, roots and stem of the plant were prepared using standard extraction protocol and their column chromatography over silica gel. Their structures were elucidated with the aid of different spectroscopic techniques. The methanol extract of roots was tested on the economic traits of silkworm *Bombyx mori* L. and gave favourable response in improving economic traits notably.

Leaves and roots of *Clematis roylei* were extracted with the solvents of increasing polarity to isolate their respective extracts. An essential oil was also isolated from the leaves and was examined for *in vitro* antibacterial activity by Agar cup plate method against 12 different bacterial strains. The oil showed antibacterial activity against five strains while maximum activity was found to be against *Salmonella typhii.*

Bark of the *Casearia tomentosa* was sequentially extracted with petroleum ether, acetone and methanol and their respective extracts were isolated. No compound could be isolated from other extracts. Their dyeing trials on different fabrics imparted very good shades with good color fastness properties.

Project 3: Chemical modification of cellulose and its industrial uses [FRI-194/Chem-8/ 2002-2006]

Findings: cellulose isolated from cotton linters, *Dendrocalamus strictus*, bamboo was studied for its chemical modification using different substitution reactions. All these derivatives were characterized by IR, and standard chemical methods for their DS and hydroxypropyl contents. These derivatives may possibly be used in food, pharmaceutical and textile industries.

Project 4: Study of plant responses to air pollution for air quality monitoring in Dehradun [FRI-231/Eco-11/2003-2006]

Findings: Identification and quantification of plant biochemical indicators of air pollution through active plant biomonitoring. Biochemical indicators were identified in the leaves of *Mangifera indica*, *Cassia fistula* and *Eucalyptus* hybrid and variation in their quantities were found to be pollution load dependent. These parameters can be used as indicators of air pollution for early diagnosis of stress or as a marker for physiological damage to trees prior to the onset of visible injury symptoms. Just by analyzing these biochemical indicators air quality can be assessed.

Passive plant biomonitoring: Effect of air pollution on the biochemical parameters of already existing plant species at different bioindicator stations was evaluated. Leaf samples of *Eucalyptus* hybrid, *Cassia fistula, Mangifera indica, Ailanthus excelsa* and *Populus deltoides* were collected from different polluted sites at Hardwar Road, Rajpur Road, Chakrata Road and Saharanpur Road in Dehradun and were evaluated for variations in biochemical indicators.

Project 5: Management of natural resources as affected by the socio-economics of rural people of Jhajra watershed in Dehradun district [FRI-251/SF-7/2003-2005]

Findings: As per the study, all the 12 Gram Panchayats of Jhajra rural community are heavily dependent on natural resources for their daily needs and they carry the fuelwood and fodder from 2 to 6 km spending 2 to 6 hours time for their collection and carriage. Poverty alleviation schemes shall be made based on the requirement of the local people.

Project 6: Evaluation of *Chrysoperla carnea* for predation potential against the key defoliators of *Dalbergia sissoo* and Populus [FRI-232/FED-15/2003-2006]

Findings: Eggs of *Chrysoperla carnea* (insect predator) were collected from *Dalbergia sissoo* and *Populus deltoides* plantations from different parts of Uttaranchal & Haryana and reared in the laboratory on the larvae of *Corcyra cephalonica.* Its biology was studied. Laboratory experiments revealed that the larvae of *C. carnea* are predacious over the eggs and larvae of Shisham defoliator, *Plecoptera reflexa* and Populus defoliator *Clostera cupreata* respectively. Based on the results of laboratory experiments this predator could be used for the management of Shisham and Populus defoliators.

Project 7: Evaluation of fertilizers effect on aromatic plants in watershed area for production and productivity [FRI-242 / FSLR-18 /2003-2005]

Findings: To evaluate the fertilizers effect on aromatic plants in watershed area for production and productivity, a field experiment was conducted in Kulhal watershed with two species (*Cymbopogaon citrates* and *Vertiveria zizanioides*) and four doses each of nitrogen and potassium to control the surface soil erosion. Experiment was conducted in randomized block design.

Observations recorded after two years of fertilizer treatments showed that application of fertilizers in tested plants boost up their height and oil production in shoot of *C. citrates* and root of *V. zizanioide.* Plantations of these species are beneficial for decreasing soil erosion and increasing soil productivity.

Project 8: Evaluation of Australian seed sources and families of *Eucalyptus tereticornis* for productivity and genetic improvement [FRI- 203 /G&TP-9/ 2002-2006]

Findings: Significant differences between the provenances and families were observed for growth parameters. Results indicate that significant genetic differences exist between the families and provenances of *E. tereticornis*. The growth traits were inter-correlated with each other. Geographic clonal variation pattern was observed in some of the growth traits. Identified 50 superior trees and marked for their clonal multiplication in a provenance-cum- progeny trial of FRI campus.

Project 9: Economics of cultivation of commercially important medicinal plants [FRI-246 / RSM-14/ 2003-2006]

Status: Data on cost of cultivation and economic returns for Kalmegh, Tulsi, Satavar, Ratti, Aswagandha, Kuth, Dolu, Kutki and Salampanja collected from the cultivators of Haryana and Uttaranchal, for working out the economics of cultivation.

Project 10: Contribution of forestry and human development index of forest dependent community of Jaunsar area [FRI-248/Stat-1/2003-2006]

Findings: Linkages between forest contributions has been explored.

PROJECTS CONTINUED DURING THE YEAR 2005-2006

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

Status: Monitoring of floral diversity of wetland sites in the vicinity of Doon valley was carried out. Taxonomic evaluation of 50 species typical of wetland sites was made for systematic accounting.

Project 2: To develop propogation technique i.e. micro-propagation of economically important bamboos - *Arundinaria falcata* and *Bambusa balcooa* [FRI-219/G&TP-10/2002-2006]

Status: Tissue culture protocol for economically important Hill Bamboo (*Arundinaria falcata*) was developed. *In vitro* shoot multiplication is standardised; 9-10 fold shoot multiplication was obtained. 90-95% rooting was obtained. Tissue culture raised plants were hardened and acclimatised.

Project 3: Development of protocol for clonal multiplication and germplasm conservation of some medicinal plants [FRI-243/G&TP-14/2003-2007]

Status: Developing protocol for micropropagation of medicinal plants *Oroxylum indicum* and *Gymnema sylvestre* are in process. *In vitro* shoot were multiplied and *in vitro* rooting was standardized in *Oroxylum indicum.*

Project 4: 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: Records of growth parameters such as height, diameter, etc. and crop yield have been taken.

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

Sub-project (vii): Chemical investigation of *Prosopis juliflora* seed polysaccharide [2000 2006]

Status: Methylation of the *Prosopis juliflora* seed endosperm polysaccharide by Hakomori and Purdie method was carried out and further methylated polysaccharide was derivatised to its alditol acetate derivatives for GLC analysis. Molecular weight determination of the *P. juliflora* seed endosperm polysaccharide was carried out. NMR spectral studies of polysaccharide and oligosaccharides has been done.

Project 6: Bioecology of insect pests of Paulownia and enumeration of their natural enemies [FRI-196/FED-11/2001-2008]

Status: Paulownia nursery and plantations at New Forest, Devipur, Sahaspur (Uttaranchal) and Saharanpur (UP) were surveyed to find out insect pests spectrum. Biological studies on an important defoliator of Paulownia, *Spodoptera litura* revealed 27% mortality of Ist instar larvae in the laboratory.

Experiments on nutritional behaviour of *Eupterote undata* were initiated on the foliage of *Paulownia fortunei*. Initial studies are indicative of its nutritional preferences towards Paulownia as the larva of *E. undata* in its last instar was recorded feeding 261 gms of Paulownia foliage over a period of 14 days whereas it fed only 34 gms of poplar, 1.45 gms of Teak and only 0.431 gms of Toon foliage when provided with multiple choice.

During insect survey at Sahaspur (Dehradun) second instars larvae of *Spilarctia oblique* were collected on *Paulownia fortunei. Brachymeria lasus* Walk. (Hymenoptera: Chalcididae). The parasitoid is recorded for the first time on *S. oblique.*

Laboratory culture of four species of egg parasitoid, Trichogramma on the eggs of *C. cephalonica* was maintained during the period.

Project 7: Bioecological studies on the insect pests of bamboo and their management [FRI-144/FED-8/2001-2007]

Status: Regular observations were taken pertaining to the incidence of insect pests feeding on bamboo at New Forest, Kalsi and Dehradun Forest Divisions in the experimental plots. *Phloeobius crassicollis* (Coleoptera : Anthribidae) was recorded for the first time damaging green culms of *Bambusa bambos*. Eggs are laid at nodes and the larvae bore in the green culm feeding inside the culm. Pupation takes place just above the hollow at nodes by making oval pupal cocoons. Lifecycle is annual. Chemical control of *Oregama bambusae* was carried out by using systemic insecticide as internodal injections.

Project 8: Studies on the termite diversity of Northern India, with special reference to species composition in relation to different tree species [FRI-275/FED-19/2004-2007]

Status: Regular surveys were conducted in and around Dehradun, Saharanpur and Chhicharauli to collect termites and study the damage and extent of damage caused by termites to the nurseries and plantations. Two new species of the genus Angulitermes and Macrotermes *(*Family Kalotermitidae) have been identified.

Identified 34 species of termites (169 vials) belonging to 3 families *(*Kalotermitididae, Rhinotermitidae and Termitidae) and 9 genera, of which 11 are new to geographical distributional records. Four new species belonging to genera, Neotermes (*N. sen-saramai*), Glyptotrermes (*G. roonwali*), Angulitermes (*A. bhagsunagensis*) and Macrotermes (*M. punjabensis*) were recorded.

Psammotermes rajasthanicus Roonwal and Bose- a semiarid species has been found first time from Punjab. Twenty nine vials of termites from Delhi have also been identified which includes seven new record.

Project 9: Integrated pest management of mandate species in nurseries and plantations with special reference to biopesticides and microbial pesticides (*Dalbergia sissoo* and *Populus deltoides*) [FRI-198/FED-13/2002-2007]

Status: Identified 12 important insect pests on *Dalbergia sissoo* and 14 important insect pests on *Populus deltoides*. All the pests were studied for their biology, energy budget, damage potential and population fluctuation.

To achieve the management of important pests two strains of *Bacillus thuringiensis* was sprayed and proved highly effective with 100% mortality to the larvae of *Plecoptera reflexa, C. cupreata,, E. undata, D. eridantis* and *Phalantha phalantha* in the laboratory in 72 hours.

Eleven new fungi were identified as entomopathogenic on the above insect pests. Three fungi were mass-produced and tested for their efficiency in the laboratory.

Commercially available four neem products viz. Neemexel, Achook, Nimbicidin and Neemazal were tested for their efficacy against the major pests of shisham and poplar. The results showed 100% mortality with specific concentration in various pathogens.

Different parts of 50 plants/weeds were collected for identification of biopesticidal properties. Crude extract of 35 plants/weeds showed biopesticidal properties.

Different concentrations of the extracts *J. curcas* Eucalyptus leaves, Acorus rhizome and *Adhatoda vesica* leaves were formulated and tested against the major pests. Significant mortality rate of leaves was recorded in the laboratory.

Project 10: Upgradation and computerisation of National Insect Reference Collection (NIRC) [FRI-233/FED-16/2003-2008]

Status: Taxonomy of Parasitic Micro-Hymenoptera (Chalcidoidea) Parasitoides of Psyllids: Ten new species of genus Psyllaephagus parasitising different species of psyllids, have been identified. Description of all these species has been completed. Work on parasitoids of Diaspidid scales was carried out with the identification of five new species - two belonging to genus Neococcidencyrtus, and one each of Adelencyrtus, Epitetracnemus and Coccidencyrtus.

Eulophid Parasitoids (Aceratoneuromyia and Euderus): Described a new species of Euderus parasitising *Alcidodes ludificator* (Curculionidae) a serious pest of *Gmelina arborea* nursery and young plants in the north-east India. Data of 7,200 species, totalling 12,000, has been incorporated into the database.

Project 11: Identification and updating of Braconid parasites (Hymenoptera) of major insect pests in National Insect Reference Collection (NIRC) and Doon Valley [FRI-234/FED-17/2003-2007]

Status: Survey and collection of braconid parasites were done from different sites of Doon Valley. Two sps of genus *Apanteles*, 1 sp. of genus *Chelonus* and *Choerbus* sp. of subfamily Alysiinae were identified.

Project 12: Studies on enhancement of natural durability of bamboo and plantation grown species with conventional/ecofriendly preservatives [FRI-236/FPD (WP)-43/2003-2008]

Status: Chir and Poplar treated with ZiBOC 0.5 are in under periodical observation five Bamboo species treated with 4% Boric Borax solution got destroyed after 6 months. 5 bamboos species treated with 4% CCA samples are still normal. Treatability of *Bambusa nutans* culms by CCA (4%) after different times of green felling was carried out. Treatment of fresh green round *Bambusa nutans* without branches by modified boucherie process and by sealing their cut branches ends by fevicol and dobefil with hardner was carried out and it was found that freshly cut bamboos can be treated faster and cheaper without branches.

Project 13: 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: Different treatment methods to treat Mango wood with Copper Lignin complex A and B was tried. Periodic inspections show that the treated samples are performing well while the controls show very slight termite attack. Studied the efficacy of prophylactic treatments of black liquor with and without Copper sulphate, against sap stain fungus *Altenaria alternata* on *Populus deltoides* (Poplar). To complete protection of Poplar can be achieved for a longer duration by prophylactic treatment of black liquor and copper sulphate at various dilutions.

Project 14: Assessment of Shisham die-back (decline) in Northern India and its remedial measures [FRI-245/Path-12/2003-2008]

Status: Seedlings of shisham, which showed resistance in the initial pathogenecity trial, were stressed for seven days in water and inoculated with *F. solani* by root dip method for 24 hours.

Maximum survival was noticed in *Pseudomonas fluorescens* treated trees, followed by mixture of *Trichoderma viride*, *P. fluorescens* and Chloropyrophos. Lowest survival was recorded in control.

Project 15: Screening for disease resistance in genetic material raised under tree improvement programmes [FRI-207/Path-13/2002-2007]

Status: At Hissar clone of *Dalbergia sissoo* were assessed for disease and various clones 5,87,304 and 88 showed various of diseases.

Families of Eucalyptus (Australian germplasm) were screened against Cylindrocladium blight disease in nursery and plantation and families 20, 72 and 73 showed resistance. Root rot pathogen *Ganoderma lucidum* was found to be encouraged in presence of the root nodule forming bacterium Rhizobium, the latter encouraging the growth and spore germination of the former.

In a testing trial of F1 progeny hybrids of *Eucalyptus citriodora* and *E. torrelliana* in field, a new canker disease caused by *Phomposis* sp. along with its perfect stage in *Chrysoporthe* sp.

Project 16: Biological Control of *Lantana camara* and *Parthenium hysterophorus* by fungal pathogens [FRI-206/Path-12/2002-2007]

Status: *Lantana camara* and *Parthenium hysterophorus* infested sites around Allahabad, Varanasi and Kangra area of Himachal Pradesh especially areas near Palampur, Dharamshala and Una were surveyed and diseased samples were collected. Isolation of fungi was done from these samples. Pathogens of *Lantana camara* were screened for synergistic effect of different herbicides and adjuvants by poisoned food technique. Glasshouse experiments were conducted to find out sub-lethal doses of six herbicides on *Lantana camara*.

Project 17: Working Plan for Reserved Forest of Forest Research Institute Estate

Status: The removal of dead trees as per working plan prescriptions has been carried out. The up keep of reserve forest of FRI is in progress along with collection of data on various parameters consisting inputs and outputs. The production of seedlings in nursery is also in progress.

Project 18: Development of suitable Silvicultural practices for JFM [FRI- 180/ Silva - 14/2001-2006]

Findings: Data with respect to socio-economic structures, silvicultural strategies and ecological conditions of the protected as well as unprotected forests of 12 JFM villages from different altitudes of Uttaranchal have been collected, compiled and analysed. It was found from the studies that productivity of the JFM protected forests of the villages have been improved by increasing regeneration status of few species due to various silvicultural strategies adopted such as correct lopping, pruning, weeding, thinning, plantations and rotational grazing.

NEW PROJECTS INITIATED DURING THE YEAR 2005-2006

Project 1: Exploration, ethnobotanical evaluation and preservation of rare and endangered flora of Jaunsar-Bawar [FRI-298/Bot-43/2005-2008]

Status: Two collection trips have been made to different parts of the study area and 300 plant specimens were collected. Two hundred plants have been identified.

Project 2: Assessment of the wood quality parameters in seed raised plantations of different age series of *Dalbergia sissoo* Roxb. [FRI-299/Bot-44/2005-2008]

Status: Wood quality parameters are being collected.

Project 3: Evaluation of the principle chemical constituents of medicinal plants available with NWFP division [FRI300 / Chem-14/2005-2008]

Status: Analysis of *Andrographis panniculata* was carried out in respect of andrographoloide content, ash content, acid insoluble and water soluble ash, alcohol soluble and water soluble extractives.

Project 4: To study ecological succession in restored mined lands [FRI-302/Eco-19/2005-2008]

Status: Phytosociological studies have been carried out in restored mined areas and adjacent natural forests at Maldeota. Litter, plants and soil samples have been collected and their chemical analysis is in progress.

Project 5: To study the undergrowth ecology of natural and man made forests of Tarai belt of Uttaranchal [FRI-301/Eco-18/2005-2008]

Status: Six hundred fifty and 868 trees ha^{-1} were observed under moderately and partially disturbed teak plantation (1980) whereas it was 733 and 834 in case of natural forests. In case of moderately disturbed natural forest biomass was increased by 9% than partially disturbed natural forest. The preliminary observations indicate that disturbances to the forests are changing undergrowth ecology partially to man made forests.

Project 6: Evaluation of natural termite resistance in timber species [FRI-303/FED-20/2005-2008]

Status: Regular surveys were conducted to collect termite nests for laboratory testing of the timber species. Wooden blocks of *Grewelia robusta*, *Eucalyptus tereticornis* and *Populus deltoides* made and are being tested for their natural termite resistance against termite. Wood of six imported timber species were collected from the local market to study the Wood Anatomy Branch for their authentic identification.

Project 7: Bioecology and nutritional behaviour of polyphagus insect pests with special reference to *Spilarctia obliqua* [FRI-304/FED-21/2005-2008]

Status: Nurseries and plantations at Bahadrabad, Sahaspur, Herbartpur and Yamunagar were visited. The larvae of

Spilarctia obliqua collected from various sites were brought to the laboratory and reared on the leaves of Paulownia and Poplar. Experiments on the nutritional behaviour of *S. obliqua* were initiated.

Project 8: Effect of *Populus deltoides* plantation on shade loving medicinal plants [FRI-305/SF-8/2005-2011]

Status: Site selected and plantation of poplar has been completed at Demo Co., Premnagar, Dehradun and are maintained plot at above. Two fields with 3 years old poplar of farmers has been selected at village Kuahedi (district Haridwar). Selected plot planted with shade loving medicinal plants. Regular monitoring and maintenance is in progress.

Project 9: Tree crop interactions: Effect of *Melia* species on crops [FRI-306/SF-9/2005-2011]

Status: Survey work on current agroforestry practices with special reference to Melia spp. in five districts viz. Hoshiarpur, Patiala, Roopnagar, Nawashahar and Jalandhar in Punjab State has been completed. A nursery of *Melia* sp. has been established at Central nursery, FRI.

Project 10: Effect of Pine and Oak Forests on agriculture crops [FRI-327/SF-10/2005-2008]

Status: Survey for site selection to conduct the study is in progress and different sites in Pauri, Uttarkashi and Chamoli districts of Uttaranchal have been visited for the purpose.

Project 11: Effect of Ammonia Fumigation on glue line strength of plywood from plantation species [FRI-312/FPD(CW)-57/2006-2008]

Status: The logs of Poplar and Eucalyptus were procured and converted them into veneers by rotary peeling. Preliminary experiments were carried out to assess the effect of Ammonia Fumigation on glue shear strength.

Project 12: Evolving kiln schedules under vacuum drying for selected plantation species [FRI-308/FPD (WS)-53/2005-2008]

Status: Work has been initiated on drying of Poplar through vacuum technique. A preliminary experiment was conducted to understand the drying behaviour of poplar planks under different combinations of pre-heat temperatures and vacuum levels.

Project 13: Velocity gradient induced single glass modified solar kiln for drying of timber and NWFPs [FRI-310/FPD(WS)-55/2005-2008]

Status: Fabrication of the modified kiln is in progress.

Project 14: Studies on effect of plank width on drying rates and seasoning degrades with special references to low girth plantation species [FRI-313/FPD(WS)-58/2005-2007]

Status: Preliminary experiments on drying pattern of planks of different width of poplar have been conducted.

Project 15: Development of ecofriendly water repellent preservative finishes for handicrafts items [FRI-307/FPD(WP)-52/2005-2008]

Status: Samples of mango wood were treated with 3% solution of Copperised Cashew Nut Shell Liquid (CR-CNSL) by dipping method. Treated samples were given five different polish treatments and their gloss was measured. Studies on the effect of Humidity and UV radiation on the performance of different treatments are being carried out.

Project 16: Bending and compression properties of small diameters round plantation timbers [FRI-311/ FPD(TM) 56/2005-2008]

Status: Small diameter plantation timber of *Eucalyptus* spp. (Eucalyptus), *Dalbergia sissoo* (Sissoo) and *Melia azaderach* (Persian lilac) will be tested in round form. Eucalyptus logs have been procured for testing.

Project 17: Evaluation of physical and mechanical properties of *Leucaena leucocephala* (Subabul) and classification and grading of timber for different end uses [FRI-309/ FPD(TM) 54/2005-2008]

Status: Fifteen logs were procured. Marking as per IS 2455 were made and the logs were converted into scantlings. The scantlings were segregated into two groups for testing in green and dry conditions. The scantlings meant for testing in dry condition were stacked for air-drying. Layout plan was drawn for testing in green condition and specimens were prepared. Testing in green condition has been completed.

Project 18: Prediction of plants for plantation on 'a soil' based on ionic properties of soil and plant roots [FRI-317/FSLR-22/ 2005 2008]

Status: Experimental pots were procured; two types of soil were collected from field and analyzed to know their initial properties. Soils were filled in pots and five species of plants were transplanted in pots. Experimental pots were maintained providing equal irrigation as per need. Six months after transplantation, growth attributes of plant were recorded, soil samples collected, prepared and their analysis started.

Project 19: Studies on soil geological and geomorphological linkages with different forest communities for sustainable management of Uttaranchal forests [FRI-314 / FSLR-19 /2005-2008]

Status: Five different sites consisting of *Pinus roxburghii, Quercus leucotrichophora* and *Dalbergia sissoo,* mixed and barren land (Control) on the basis of different vegetation, parent material and altitude for collection of samples were identified in Kempty range of Mussoorie forest. The soil and rock samples were collected, processed and prepared for analytical work. Physical and chemical analysis of soil and chemical analysis of rocks is in progress.

Project 20: Effect of different plantations on soil properties and carbon store [FRI-315/FSLR-20/2005-2008]

Status: Three sites, under Poplar and Eucalyptus plantation and one site under Shisham plantation were selected in Uttaranchal and Haryana. Three sampling points were selected at each site under Poplar, Eucalyptus and Shisham plantations in both the states. Soil samples were collected from these sampling points from predetermined depths. Soil samples collected from field, processed in laboratory and analysis are in progress.

Project 21: Soil and Vegetation Survey and preparation of Pedonarium in New Forest, Estate [FRI-316/FSLR-21/2005-2008]

Status: The New Forest Estate was reconnoitered for selection of site for soil sampling. Grid sampling design was adopted for soil investigation. The soil analysis is in progress. The vegetation map is under preparation.

Project 22: Genetic evaluation of selected genotypes for exploring clonal forestry potential in *Dalbergia sissoo* [FRI/319/G&TP-16/2005-2008]

Status: A number of plus trees were selected and harvested from a progeny trial consisting base materials from *Dalbergia sissoo* growing areas including Gonda, Lal Kuoan and other adjoining parts of Bihar and Uttar Pradesh. The seeds from seed bearing trees were collected and processed for raising the progeny trial. The seedlings have been raised and kept ready for progeny trial. The land has also been earmarked for this purpose in Chandiapur, Uttaranchal. The plus trees were coppiced and propagated clonally. They are being planted in the VMG. Clonal trial of *Dalbergia sissoo* has been raised at three locations of Punjab, in Completely Randomized Block Design with 9 plants per replication.

Project 23: Establishment of breeding arboretum of Eucalyptus and production of interspecies hybrids [FRI/318/G&TP-15/2005-2010]

Status: Open pollinated seeds and clonal material of different *Eucalyptus* sp. have been collected from different sources. Seeds were sown in pots and progenies were raised. Phenological observation has been recorded regarding flowering and fruiting in different *Eucalyptus* sp. growing at FRI campus. Cleaning operation in field was carried out for establishment of breeding arboretum.

Project 24: Development and multiplication of superior bioactive clones of *Stevia rebaudiana* [FRI 320/NWFP-19/2005-2008]

Status: Three accessions of *Stevia rebaudiana* have been collected from Uttaranchal and introduced under field conditions for assessing their performance.

Project 25: Evaluation of appropriate technology and its adoption as applicable in rural environment [FRI-321/PLO-3/2005-2008]

Status: Survey few villages on Dehradun- Shimla Road. Villagers were motivated to raise Bamboo seedlings in their area, Harbajwala village was selected, two-days Bamboo training programme was organised at the Rangers College, City Centre, Dehradun. General fields visit of the participants to the Central nursery was also undertaken. The seedlings were distributed.

Project 26: Regeneration study on *Quercus semicarpifolia* and *Carpinus viminea* [FRI- 324/ Silva-28/2005-2008]

Status: Identification, survey and selection of natural population of *Carpinus viminea* at different locations (Chopta, Gopeshwar, Mandal) in Kedarnath Forest Division were made, seeds collected from the same localities and seed morphology and biology were carried out in respect to seed length, width, colour, shape, 1000 seed weight, moisture content, number of seeds in 1 kg. Seeds were kept on different temperatures i.e. room temperature for storage study.

Project 27: Development of technology for cultivation of commercially important under exploited Lesser Known Tree Species (LKTS) [FRI-322/Silva-26/2005-2008]

Status: The experiments were laid down in nursery with different media. Seed parameters for Ficus seeds were studied as per standards of ISTA. Cuttings of (*Cordia dichotoma, Ficus auriculata, F. glomerata* and *F. palmata)* were planted in nursery with different concentrations of rooting hormones. *F. palmata* gave best rooting in identified concentration.

Project 28: Multilocation trials of promising clones of *Gmelina arborea* Roxb. [FRI-326/Silva-30/2005-2008]

Status: Vegetative propagation material from 27 promising clones of *G. arborea* was collected from Rain Forest Research Institute, Jorhat. The cuttings were given rooting hormone treatment and planted in the shade house at FRI for multiplication.

Project 29: Field Evaluation of New Clones of Poplar [FRI-323/Silva-27/2005-2008]

Status: Established the nursery of Poplar consisting of 200 clones. These clones have been developed by Forest Research Institute, Dehradun.

Project 30: Development of Forest Fire Control Tools [FRI-325/Silva-29/2005-2008]

Status: The drawing and designing of forest fire control tools have been completed. Ten sets of the forest fire tools have also been fabricated and the tools are under trial.

PROJECTS COMPLETED DURING THE YEAR 2005-2006
(Externally Aided)

Project 1: Developing bioclimatic indices for important species existing under agroforestry and departmental plantations for different agroclimatic zones of Punjab [FRI-217/Bot-32/External/2002-2005]

Findings: Suitable tree species for agroforestry and departmental plantations for different agroclimatic zones of Punjab has been identified. Optimum range of bioclimatic indices and soil characteristics for different species have been identified.

Project 2: Creation of Germplasm Bank of commercially important tree species of Punjab [FRI-178/Bot-28/External/2001-2005]

Findings: Established three germplasm banks of fifteen commercially important tree species of Punjab. Five outstanding clones of *Dalbergia sissoo* were released in honour of Shri A.S. Dogra, PCCF, Punjab for his long contribution in the field of forestry research and management.

Project 3: Identification, taxonomy, properties and uses of different species of Shoreas of the Malay Peninsula [FRI/191/Bot-30/External/2002-2005]

Findings: The study on intra- and inter-species variations in the dimensions of different wood elements and density of Balau, Meranti Pa'ang (White meranti), Meranti damar hitam (yellow meranti) and Red meranti group of Malay Shorea were completed. Dichotomous and card key was prepared for the each group for identification.

Project 4: Problem of forest regeneration of Sal (S*horea robusta*) and its associates in Dehradun Forest Division with special reference to fire, overgrazing and human interference [FRI-256/Bot-35/External/2004-2006]

Findings: Assessment of regeneration status of Sal (*Shorea robusta*) in three selected localities (Raipur, Lachhiwala and Barkot Range) of Dehradun Forest Division of Uttaranchal was completed. Soil samples from different locations with special reference to burnt, unburnt, human interference, grazing and control areas were analysed for minerals components viz. phosphorus, potassium and organic carbon. Leaf litter was also collected and estimate for nutrients. Fuel load capacity vis-a-vis the effect of litter thickness on seed germination of the project area was estimated.

Project 5: Prospecting for botanical pesticides - An All India Coordinated Research Project [FRI-188/Chem-7/External /2002-2006]

Findings: Seventy nine extractives of different parts of the selected plant species were prepared using petroleum ether, chloroform and methanol which were screened against the selected pests of household and agriculture importance. Thirteen plant extracts of six plant species exhibited activity against the above insects.

Isolated fatty oils from seeds of 27 plant species. The fatty acid composition of the oils was determined by Gas Liquid Chromatography of the methyl esters.

Project 6: Chemical screening of the oil seeds and development of seed handling practices and plantation trial of some high oil yielding tree species in the Himalayan region [FRI-223/Chem-9/External/2003-2006]

Findings: Demonstration plots of *Sapindus mukorossi* have been raised over 2.0 ha and 0.7 ha at Barkot range, Dehradun Forest Division and FRI campus, respectively, and periodical grant data's were recorded.

Seedlings of *Putranjiva roxburghii* raised from 4 sources were transplanted over 2 ha area in Jakhan Block, Barkot range, Dehradun Forest Division at 3m X 3m spacing in randomized block design and survival and growth data of the same were recorded at six months interval. Demonstration plot of *Prinsepia utilis* was also established in Mussoorie Forest Division. Oil content in the seeds of the species was estimated.

Project 7: Novel chemo-enzymatic technology for the food fibre from Guar/*Cassia tora* Gums [FRI-225/Chem-10/External/2003-2006]

Findings: Depolymerization of guar gum was carried out by partial hydrolysis with acid and enzymes isolated from the germinating seeds of Guar (*Cymopsis tetragonolobus*) and Pawar (*Cassia tora*). Conditions of depolymerization were optimized with acid enzymes process. Five different stages of germination were selected for the enzyme isolation from Guar and Pawar seeds. The acid treated Guar gum was further depolymerized by above optimized condition of enzyme action and also quantity of enzyme used and time of reaction were optimized for both *Cymopsis tetragonolobus* and *Cassia tora* separately to obtain depolymerized Guar gum of very low viscosity.

Project 8: Long term impact of monoculture on site productivity and resource conservation [FRI-177/Eco-08/External/2001-2005]

Findings: Actual biomass calculated by harvesting trees of *Eucalyptus* hybrid, *Dalbergia sissoo*, *Acacia catechu* and *Populus* sp. at various Forest Divisions of Punjab. Productivity of all the sites calculated and prediction equations developed for each component of all the species.

Project 9: Inventory of forest insects [FRI-218/FED-14/External/2002-2005]

Findings: Inventory of forest insects was prepared comparising of 15,908 species of insects. This includes morphological characters, distribution, biology and control. Insects belong to 21 orders. Digital photographs of 4,477 insects were also incorporated. HTML files for 1,251 species of insect was also prepared.

Project 10: Evaluation of Radiata pine from New Zealand [FRI-184/FPD-38(CW)/External/2002-2005]

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

Findings: *Pinus radiata* of New Zealand origin is found to be non-durable in nature. The heartwood portion out side and adjacent to pith of this species falls in the "C" class, whereas heart wood juvenile portion falls in the "B" class as far as treatability is concerned according to Indian standards. Termites badly destroyed control and affected the CCA treated samples of *Pinus radiata* at 8 and 12 Kg/m^3 retentions, whereas no attack on higher retentions of treated samples were observed. Untreated *Pinus radiata* samples were badly damaged within 24 months of installation in the field trials at different centers. However treated samples with CCA and creosote fuel oil are performing well.

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

Findings: The sub-project completed and report accepted by the funding agency.

Project 11: 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]

Findings: The utility of *Eucalyptus* hybrid in making various products through different processes was studied, and the market potential of wooden floor tiles out of this species were emphasized.

Project 12: Genetic improvement and production of nursery planting stock of Khair, Shisham and Kikar [FRI-170/G&TP-7/External/2000-2005]

Findings: 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 Kikar (*Acacia nilotica*) and Khair (*Acacia catechu*) 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. Promising stands of Khair (5.0 ha) and Kikar (5.0 ha) have been finalized as seed stands.

Project 13: Analysis of population genetic structure and diversity in Himalayan Pines using molecular markers [FRI-221/G&TP-12/External/2002-2005]

Findings: RAPD (Random Amplified Polymorphic DNA) conditions with particular reference to the quantity of DNA, Mg concentration, annealing temperature and time, extension time and number of cycles in the PCR have been standardized for Himalayan pines. Polymorphic primers have been screened. The information obtained through the polymorphic gels in different species have been scored and recorded in binary form. Genetic diversity in *Pinus roxburghii, P. wallichiana, P. gerardiana* and *P. kesiya* has been studied showed a considerable differentiation among the populations of *P. roxburghii, P. wallichiana* and *P. kesiya*. However the differentiation was less in *P. gerardiana*. The molecular based phylogeny of the Indian pines was resolved with the help of RAPD markers. The UPGMA dendrogram revealed that the Chir Pine (*P. roxburghii*) is closely related with Blue Pine (*P. wallichiana*). These two species are further related with *P. kesiya.* The distantly related species with the other three pines was found to be *P. gerardiana*.

Project 14: Development of Agro-mediculture models for sustainable diversified farming in Uttaranchal and Haryana [FRI-214/NWFP-15/External/2002-2005]

Findings: The project resulted in development of four models for cultivation of medicinal plants under the shade of agroforestry species like Eucalyptus, Poplar and horticultural species like Prunus, and Mango. These models have been found to be biologically compatible, physically possible and economically viable. The medicinal plant species recommended for cultivation under the above mentioned tree crops are *Withania somnifera*, *Asparagus racemosus*, *Ocimum sanctum* and *Andrographis paniculata.*

Development of agro-mediculture models for sustainable diversified farming

Project 15: Demand and supply of medicinal plants and produce grown / found in Haryana [FRI-291/NWFP-18/External/2004-2005]

Findings: Surveys of 15 districts of Harayana for the demand and supply of some selected medicinal plants is under progress. The manufacturing units / traders are being contacted for collection of actual demand of medicinal plants in the state of Haryana.

Project 16: 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]

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

Technical data of various species was collected from published literature, electronic sources besides local communities.

Herbarium samples were prepared and handed over to the State Medicinal Plants Board. Final technical report is being compiled.

Project 17: Study and preventive measures of dying phenomenon of *Acacia nilotica* and *Dalbergia sissoo* in Haryana [FRI-286/Path-19/External/2005-2006]

Findings: The state was divided into three agroclimatic zones and surveys were made to assess the mortality of Kikar and Shisham. The diseased specimen were collected and the pathogens were identified. Maximum mortality in *Dalbergia sissoo* was observed in agroclimatic zone 1 due pathogen *Ganoderma lucidum*. In case of *Acacia nilotica* maximum mortality was found in agroclimatic zone III, caused due to *Ganoderma lucidum*.

Biotic stresses, old age of trees, landscape changes, variation in rainfall and temperature patterns, invasion by *Prosopis julifora* and *Capparis* spp. were found affect adversely Shisham and Kikar plantations and therefore morality was observed. Nitrogen concentration was higher in soil under dead trees. Chemical analysis of soil and plant samples has been completed.

Project 18: Evaluation of Microbial status of organic farming [FRI-271/Path-16/External/2004-2006]

Findings: The DST funded project under the *Women Scientist Scholarship Scheme* addressed the changes in conventional and organic farming soil in relation to beneficial microbes and physico-chemical properties. Different crops medicinal plants and trees were scanned for their microbial profile. General mycorrhizal status of different kinds of plants is quite low. In phosphate solublizers, fungi are predominating. Except organic carbon there is not much change between different parameters of soil properties.

Project 19: Studies on interrelationship between production level and marketing of important forestry species in Punjab [FRI-174/RS&M9/External/2000-2006]

Findings: Field work and data analysis completed.

PROJECT CONTINUED DURING THE YEAR 2005-2006
(Externally Aided)

Project 1: Development of suitable propagation technology of three *Terminalia* sp. [FRI-261/Bot-40/External/ 2003-2006]

Status: Developed vegetative propagation technology through mature cuttings as well as shoot cuttings in winter and summer seasons. Growth data of seedlings were recorded. Rooting response of cuttings of Terminalia has been carried out.

Project 2: 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: Microstructure, ultrastrucure studies of Indian species of Cinnamomum and photomicrographs taken for the diagnostic features of some species of Cinnamomum are under progress.

Project 3: Micropropagation of Chir Pine (*Pinus roxburghii*) and Shisham (*Dalbergia sissoo*) [FRI-222/Bot-13/External/2002-2006]

Status: In *Pinus roxburghii* embryogenic cultures were successfully established. Developed procedures for rapid multiplication of Chir Pine through forced axillary branching. Adventitious buds were successfully induced on the surface of cotyledons on cytokinin medium.

Superior clones of *Dalbergia sissoo* were established in tissue culture from the shoot hedges grown in the vegetative multiplication garden of FRI. Basal media formulation and culture conditions were standardized. Somatic embryogenesis from immature cotyledons obtained successfully.

Project 4: Micropropagation of promising F_1 Interspecific hybrids of Eucalyptus and field plantations [FRI-220/ G&TP-11/ External/ 2002-2006]

Status: Techniques were standardized for tissue culture plant production of FRI hybrids of Eucalyptus. Field trial of two of these hybrids at eight different Agroclimatic locations of the country has been completed.

Project 5: Network programme for establishment of demonstrations of Bamboo plantations in Uttaranchal [FRI-257/Bot-36/External/2004-2007]

Status: Tissue Culture plants of *Dendrocalamus asper* were produced on large scale and planted at different places of Uttaranchal State.

Project 6: Development of Tissue culture technique for protocol development of *Bambusa balcooa* and *Melocanna bambusoides* [FRI-258/Bot-37/External/2004-2007]

Status: Development of protocol for micropropagation of *Melocanna bambusoides* and *Bambusa balcooa* is under progress. *In vitro* shoots were multiplied.

Project 7: Enrichment, improvement and development of botanical garden and species specific arboreta of FRI [FRI-260/Bot-39/External/2003-2006]

Status: Financial assistance for the works to be carried out under 2nd installment is awaited from the MoEF, New Delhi.

Project 8: Identification, development and utilization of natural dyes from the forest plants of Uttaranchal [FRI-249/Chem-12/External/2003-2006]

Status: Several trials were conducted to develop the process for the isolation of natural dye from *Eucalyptus* hybrid (leaves and bark) and *Populus deltoides* (bark). *Lantana camara* (leaves) and *Pinus roxburghii* (needles) on a pilot

plant scale. Dyeing trials were performed using the isolated dye and color fastness properties of dyed fabrics were determined. Physicochemical properties of the dyes were determined. A number of shades with very good color fastness properties were obtained.

Project 9: Utilization of economic potential of Parthenium [FRI-262/Chem-13/External/2004-2007]

Sub-project (i): Preparation of composites

Status: Phenol formaldehyde resin was prepared and analysed using commercial grade phenol and formaldehyde. Particle boards were prepared. For reducing the water absorption of boards wax emulsion was also used for making particle boards. These boards were tested for various physical and mechanical properties as per relevant IS specification.

Sub-project (ii): Preparation of alpha cellulose and handmade paper

Status: Cellulose isolated under optimized conditions was analysed for alpha, beta and gamma cellulose, ash content, lignin and DP. Conditions for carboxymethyation of alpha cellulose to prepare caboxylmethyl cellulose were optimized with respect to NaOH concentrations, time, and temperature to achieve more than 1 DS.

Project 10: Impacts of tourism on environment of Roopkund and Pindari areas of Nanda Devi biosphere reserve of Uttaranchal [FRI-280/Eco-15/External/ 2004-2007]

Status: Vegetational studies socio-economic surveys along the trek route, collection of soil samples was carried out.

Project 11: Garden of the Great Arc [FRI-263/Eco-12/External/ 2004-2008]

Status: Plantation of all the forest types and avenue plantations have been completed. Tree Grooves, Nakshatra Vatica and Slope stabilized. Development of Picnic garden has also been completed. Besides these watercourse stabilization has been attempted. Nearly 80% of the area has been developed.

Project 12: Ecorestoration studies in Uranium Mines [FRI-265/Eco-19/External/ 2004-2008]

Status: Collection of plant specimens from mining belt and adjoining areas has been completed for chemical analysis. Collection of soil/tailings, soil from adjoining forest belt has been collected and analysed.

A rapid ecological appraisal of the impact of Uranium Mines and its tailings at Jaduguda were assessed.

Species have been selected for plantation on tailing pond area as well as for raising greenbelt on the periphery of tailings. Based on the root penetration studies following species have been identified for tailings. *Jatropha curcas, Albizzia lebbek* and *Acacia auriculiformis* have been selected for greenbelt.

Project 13: Development of ecorestoration model for Iron Ore Mines of Bihar and Orissa [FRI-179/Eco-9/External/2001-2006]

Status: Parent rocks and soils/mine spoil from all the selected sites have been collected and analyzed to study the mineralogical changes in rock fragments and soils as influenced by restoration and successional changes in floristic composition. Phytosociological studies in all the sites conducted and Important Value Index (IVI) has been calculated. Evaluation of survival and growth of plant species of different sites has been recorded. Ethnobotanical survey in all the 12 villages in the vicinity of mining area has been completed.

Project 14: Restoration of biodiversity in the hills of Kujapuri Siddhapeeth following Badrivan restoration approach [FRI-264/Eco-15/External/2004-2007]

Status: Planting of native forest/fodder, ornamental, horticulture and species of sericulture importance was done in forest and village private lands around Kujapuri temple. Meetings with villagers, Mandir Samiti were organized to create awareness about planting of trees and restoring bio-diversity in the Kujapuri hills.

Project 15: Utilisation of Sisal fibre for making composites and handmade paper [FRI-268/FPD-49/External/2004-2006]

Sub-project (i): Preperation particle boards

Status: Particle boards were prepared at various pressure, resin %, and wax emulsion % using different ratio of sisal and parthenium particles. These particle boards were then tested for various physical and mechanical properties as per relevant IS specification.

Sub-project (ii): Isolation of fibres

Status: 100% Sisal fibre Particle boards were prepared. For reducing the water absorption of boards, wax emulsion was used. Boards were tested for various physical and mechanical properties as per relevant IS specification. Pulp from Sisal fibre was prepared and sheets of different thickness were lifted.

Project 16: Biotechnological approaches for improvement of plant species with special reference to pulp and paper [FRI-267/FPD-48/External/2004-2006]

Sub-project (i): Chemical composition

Status: 145 samples of *Leucaena leucocephala* and one sample of *Leucaena diversifolia* collected. Lignin content, anatomical and physical parameters have been evaluated for more than 500 samples. About 100 individuals have been short listed for further selection from the 500 samples received from participating institutes.

Sub-project (ii): Studies on Pulp and Paper qualities

Status: Dust of 750 samples of *Leucaena* sp. were made for proximate analysis. Lignin, Holocellulose, Extractives and Ash percentage in case of subabul (*Leucaena* sp.) collected from different Geographical region showed wide variation.

Sub-project (iii): Anatomical studies

Status: Standardization was carried out for variation in radial direction, with height and between branch and main stem.

Project 17: Efficacy testing of the insecticide -ACTARA-25WSG against termites [FRI-266/FED-18/External/2004-2007]

Status: First phase of the laboratory testing and field trial of the insecticide Actara-25 WSG completed. For evaluation of comparative efficacy of Actara, two more insecticides- Endosulfan and Chlorpyriphos were tested against termites. Endosulfan has given better results in the laboratory.

Regular surveys were conducted in the Sal forests to collect termite nests of *Microcerotermes beesoni*.

Monthly observations were made on the mortality of Eucalyptus and Popular plants due to termites in the field trial being conducted in FRI campus. Three insecticides are being tested with four different dosages in three replications. The field trial was laid down as per a statistical design provided by the Statistical Branch, FRI.

Project 18: An interdisciplinary approach to analyze the dynamics of forest and soil degradation and to develop sustainable agroecological strategies for fragile Himalayan watersheds [FRI-187/FSLR-13/External/2002-2006]

Status: The field work and laboratory work were completed. The data was processed and interpreted in consultation with the action group leaders of Norway and Netherlands.

Project 19: Study of pathogenic and molecular variability in *Fusarium solani* causing Shisham (*Dalbergia sissoo*) Wilt [FRI-272/Path-17/External/2004-2007]

Status: A total of 129 isolates of *F. solani* were collected from all over the country. Out of this 53 isolates representative of high infection zone in north India were taken for further study. Thirty eight isolates were tested for morphological growth, sporulation, colour pattern on four different nutrient media. Other parameters studied. Pathogenicity trials against the known susceptible source was carried out with 16 isolates.

A new twing canker disease of *Terminalia arjuna* by *Fusarium solani* along rodside plantations

Project 20: Researches on natural decay resistance of juvenile timbers like poplars [FRI 283/Path-18/External/2004-2007]

Status: Samples of different clones of *Populus deltoides* were collected and subjected to accelerated laboratory tests. All tested clones showed resistance against brown rot fungus.

Project 21: 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: The mycotoxin producing fungi isolated from fruits/ seed kernels of *Buchanania lanzan*, *Juglans regia*, *Prunus armeniaca* and *Shorea robusta* collected from different locations of Uttaranchal were screened for their mycotoxin producing potential. Fungal infestation significantly reduced Protein, starch and oil content of the four oil seeds.

Project 22: Preparation of local volume tables of Khair, Sal, Shisham and Teak [FRI-255/RS&M-15/Extenal/2003-2005]

Status: Local volume table of Khair has been prepared. Field data of Sal and Shisham being analysed for preparation of volume tables.

Project 23: Preparation of Working Plan of Chandigarh Forest Division and Management Plan of Sukhna Wildlife Sanctuary [FRI-273/RS&M-15/External/ 2004-2006]

Status: Draft plan for Sukhna Wildlife Sanctuary was prepared. Field work for the preparation of Working Plan of Chandigarh completed.

Project 24: 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/2005-2006]

Status: Survey in villages is being undertaken for assessment of goods and services by local people. First year progress report has been accepted by the EU.

Project 25: 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/2005-2007]

Status: Data has been collected from various sites i.e. canal and road side from three districts and analysis is being done to develop the model.

Project 26: Development of Technological package for the production and quality evaluation of seeds of important medicinal plant species [FRI-285/Silva-22/External/2004-2007]

Status: The seeds of 70 species of medicinal plants were collected from Ranikhet, Tiuni, Muni Ki Reti Herbal Nursery, Mata Raj Rajeshwari Nursery and Munsiyari. Seed morphological parameters were recorded. Seedlings were transplanted in polybags for observing the survival percentage.

Project 27: Studies on Himalayan Pines [FRI-175/Silva-12/1995-2006]

Sub-project 1: Seed technology

Status: Morphological observations were recorded. A total of 17 seed sources of blue pine were collected from different localities of Uttaranchal and Himachal Pradesh. Seed biology in respect to cone were carried out. Seeds were kept in low temperature cabinet for storage study. Seeds of chilgoza pine were also collected from 5 different sources of Himachal Pradesh.

Sub-project 2: Nursery and planting technology

Status: Established nursery trial to study the effect of soil mixture in promoting root development of bareroot seedlings of *P. roxburghii*. The nursery experiment to determine optimum age for undercutting of Chir Pine seedlings is also in progress. The comparison of field performance of bareroot seedlings vis-à-vis containerised seedlings showed that the overall performance of bareroot seedlings is relatively poorer than plants raised in polythene bags.

Sub-project 3: Plant physiology

Status: Seven seed sources of *Pinus roxburghii* are being 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* are being done. Variability of 20 seed sources of *Pinus wallichiana* (Kail Pine) through isozyme studies has been done.

Sub-project 4: Investigation a diseases of Blue Pine (*Pinus wallichiana*)

Status: The status of diseases of Blue Pine (*Pinus wallichiana*) were assessed in Himachal Pradesh, Uttaranchal and Jammu & Kashmir.

NEW PROJECTS INITIATED DURING THE YEAR 2005-2006 (Externally Aided)

Project 1: Expert system for Indian woods, their microstructure, identification, properties and uses [FRI-277/Bot-42/External/2005-2008]

Status: The data on the physical properties and uses of wood is being collected and stored.

Project 2: Development of micropropagation protocol for clonal multiplication and germplsam conservation of *Swertia chirata* Buch.-Ham. A medicinally important herb [FRI-332/Bot-46/External/2005-2006]

Status: Development of protocol for clonal multiplication of *Swertia chirata* is under process. A series of experiments were conducted for sterilization of explant of *Swertia chirata* and the sterilization technique was standardized. Axillary bud break was achieved from a single bud.

Project 3: *Ex-situ* Conservation of some critically endangered and rare plants of Uttaranachal [FRI-277/Bot-42/External/2005-2008]

Status: A list of rare and endangered plants of Garhwal has been prepared. Palm *Trachycarpus takil* has been introduced in the FRI Botanical Garden.

Trachycarpus takil-an endangered endemic palm grown in poly bags for planting in its origin habitat

Project 4: Development of Live Red data Book [FRI-277/Bot-42/ External/ 2006-2009]

Status: A list of rare and endangered plants of Kumaon has been prepared.

Project 5: Creation of germplasm bank of medicinally important tree species of Punjab [FRI-336/Bot-50/2006- 2009]

Status: The seeds of 40 trees of *Emblica officinalis*, 80 *Terminalia bellirica*, 50 *Terminalia chebula* were collected and the seed characteristics study was carried out. The seeds were sown in plastic trays for growing seedlings.

Project 6: Studies on population status and berberine content in different provenances of *Berberis aristata* DC in H.P. and standardization of its propagation techniques [FRI-329/Chem-15/External/2005-2008]

Status: Five root samples were received from Himalayan Forest Research Institute, Shimla, processed for the standardization of conditions for the estimation of berberine.

Project 7: Alkaline Peroxide Mechanical Pulping (APMP) bleaching [FRI-331/C&P-17/External/2005-2007]

Status: Conditions to produce APMP pulp from sarkanda was optimized. The pulp possessed all physical and optical properties. Dewatering experiments were carried out.

Project 8: Forest fire monitoring and management [FRI-295/Eco-External/17/ 2005-2006]

Status: Pre-fire vegetation survey for fuel load determination, and fuel moisture have been carried out under pine and Sal forests in Nainital Forest Division, Nainital. Other field data such as soil temperature, soil moisture, and vegetation were also collected and analysed. Vegetation data were collected for ground, understorey and tree components.

Project 9: Income generation for women in rural areas of Uttaranchal through vermicomposting of organic solid waste into manure [FRI-/Eco-16/External/ 2005-2008]

Status: Eight villages (Shivpuri, Kotada, Aamwala, Kandoli, Phoolsaini, Bhagwanpur, Rajawala, and Telpura) have been selected to create awareness among the rural women to adopt vermicomposting technique for additional income generation. On-campus training in F.R.I. campus was organized to train the women from different villages on vermiculturing, waste segregation, mixing with cowdung and finally composting using earthworms. Vermicompost and earthworms were distributed to some of them. Household kitchen wastes/organic solid wastes have been collected from FRI campus and subjected to vermicomposting for biofertilizer preparation.

Project 10: Deployment of the promising F1 hybrids of *Eucalyptus citriodora* and *Eucalyptus torelliana* for establishment of vegetative multiplication garden and their field trials [FRI/338/G&TP-17/External/2005-2008]

Status: The natural hybrids have been collected from the arboretum. Mature hybrids have been grafted for the establishment of VMG.

Project 11: Follow up project on advance genetic improvement in seed production areas, seed orchards and progeny trials of different forest tree species in Punjab [FRI/339/G&TP-18/External/2006-2009]

Status: Survey of all the improved stock and the measurements of SSO, Patiala, to be converted to advance generation SSO was completed. Field data collected for creation of SPA of Khair and about 5 ha area has been finalized for establishment of advance generation CSO of Eucalyptus.

Project 12: Genetic improvement of *Asperagus racemous* (Wilf) to enhance root production and saponin content [FRI/340/G&TP-19/External/2006-2009]

Status: The plants and seeds from different regions were collected, germinated and kept ready for planting. The root stock for saponin content has also been collected.

Project 13: Technology transfer and development of a model village by skill up gradation and capacity building of rural communities for socio-economic upliftment [FRI-287/PLO-1/External/2005-2008]

Subtitle: Development of Model Village Nursery

Status: Villages Sherpur, Harbajwala and Badonwala on Dehradun- Shimla road were selected for the development of medicinal plant nursery. Local villagers were contacted and created awareness regarding the importance of medicinal plants and other important forestry tree species by organizing group meetings. Through a questionnaire the data pertaining to the requirement of the plant species, field problems, their present socio economic status is being collected. With the help of a NGO individuals from Harbajwala and Badonwala villages were selected and accordingly a training programme for 5 days regarding the techniques for developing a medicinal plants nursery was organized. For the establishment of Modern Nursery, City Ranger College has been selected as a demonstration-cum-information centre for the local villagers.

Project 14: Technology transfer and development of a model village by skill upgradation and capacity building of rural communities for socio-economic upliftment [FRI-297/PLO-2/External/2005-2008]

Subtitle: Integrated Utilisation of Lantana

Status: A campaign to create awareness related to 'Integrated Utilisation of Lantana' amongst the villagers of Bishanpur Kandoli, Sahaspur Block, Dehradun was organised. Training programme on the utilization of Lantana was organised at the Ranger's College Campus. During the training period participants prepared small articles such as pen stand, waste paper basket, small baskets and paper tray etc. Demonstration of the use of stalk puller prepared by the institute was given to the trainees. Process of obtaining the natural dye from the leaves of Lantana was also explained to the trainees. Various stages involved for the preparation of board from Lantana were demonstrated to the trainees in the Forest Product Division. A visit to Tehri Garhwal was undertaken as per the request made from Mount Valley Development Association. Live demonstration of natural dye from the leaves of Lantana and article was shown to villagers. A survey of the villages was conducted to know their socio-economic status.

Project 15: Collection and dissemination of market information on commercially important medicinal plants of Uttaranchal [FRI-282/RSM-16/2005-2008]

Status: Market prices of commercially important medicinal plants collected from Ramnagar, Tanakpur, Saharanpur and Delhi markets published and disseminated throughout the country. Four issues of quarterly newsletter have been published.


Introduction of commercially important medicinal plants in NWEP nursery

Project 16: Preparation of Working Plan / Management Plan for Dadra & Nagar Haveli Forest Division [FRI-328/NWFP-15/External/2005-2008]

Status: Field tours for enumeration and collection of data undertook and data compiled. Previous Working Plans were reviewed. The preliminary Working Plan Report has been submitted to the sponsoring agency.

Project 17: Development of genetically superior planting material and cultivation technology for increasing productivity of *Jatropha curcas* [FRI-286/Silva-23/External/2005-2008]

Status: The natural stands of Jatropha in different forest divisions of Uttaranchal were surveyed for the selection of Candidate Plus Trees (CPTs). A total of 149 CPTs were selected in 16 stands. Seed samples from different stands/provenances in Uttaranchal, Haryana, Punjab, Himachal Pradesh, Rajasthan and Assam were collected for provenance trial of the species. Seed samples of accessions have been sent for oil estimation to TERI, Jabalpur. Experiments on effect of different type of containers and storage environment on oil content; and germination studies in different storage conditions are in progress. A provenance trial of 32 provenances was established in Prem Nagar Dehradun. Three sites have been selected for laying out experiments on spacing, fertilizer, irrigation and pruning regimes of the species. About 30,000 seedlings have been raised in nursery at these sites. Cuttings from CPTs had been collected and planted for rooting in the nursery. Passport Data have also been collected for each CPT.

Sub-project (I): Seed technology

Status: Seeds of *Jatropha curcas* were collected from 13 different places of Uttaranchal and processed to estimates the fatty oil content in them.

Project 18: Genetic improvement of *Jatropha curcas* for adaptability and oil yield [FRI-293/Silva-24/External/2005-2010]

Status: Survey was conducted for the availability of *Jatropha curcas* germplasm in the states of Uttar Pradesh, Punjab, Himachal Pradesh and Haryana. Plantations/stands were identified and Candidate Plus Trees (CPTs) were selected, marked and germplasm (cuttings, seeds) was collected along with passport data. Cuttings from a total of 48 CPTs have been collected and planted for rooting. Seed samples of some accessions have been sent to NBRI for oil content estimation. Germplasm of *Jatropha glandulifera* of Uttar Pradesh and *J gossypifolia* (cutting) from Haryana and UP has also been collected. Cuttings of elite/unique accession of Jatropha have been exchanged among different collaborating centres. Cuttings have been collected and planted for rooting. Site has been identified in Agra for laying out the experiments with the species.

Project 19: Development of silvicultural practices for promoting cultivation of *Taxus baccata*, *Rhododendron arboreum* and *Phyllanthus amarus* [FRI-294/Silva-25/External/2005-2008]

Status: Survey for natural distribution of *Taxus baccata*, *Rhododendron arboreum* and *Phyllanthus amarus* was conducted in Uttaranchal state. Areas were marked for further studies and cuttings of *T. baccata*, *R. arboreum* and wildlings of *P. amamrus* and *R. arboreum* were collected and planted for rooting in nursery. The experiments to

standardize seed and nursery technology of *P. amarus* are also in progress. Cuttings of *R. arboreum* were collected and planted in nursery for rooting after treating. Cuttings of *T. baccata* were treated and planted in poly-house for rooting. The experiments have also been designed for developing a protocol for early rooting of stem cuttings in low cost propagation chambers with these species.

Project 20: Raising of demonstration plantations for augmenting fuelwood and fodder resources and promoting income generation in two villages of Uttaranchal [FRI-343/Silva-31/External/2006-2007]

Status: Reconnaissance survey has been done and two villages, selected in consultation with key persons of the villages in Uttaranchal.

Project 21: Sample surey to update rates and ratios of Minor Forest Products and Timber in India [FRI-294/Stat-2 /External/2005-2006]

Status: Data has been collected and submitted to ICFRE for further analysis.

Abstract: No. of Projects

	No. of projects completed in 2005-2006	No. of ongoing projects in 2005-2006	No. of projects initiated in 2005-2006
Plan Projects	10	18	30
External Projects	19	27	19
Total	29	45	49

TECHNOLOGY ASSESSED AND TRANSFERRED

Technology for the manufacture of "Modified boucherie equipment for the treatment of green Bamboo" was transferred to M/s Garnet Tools, 2D, Industrial Area, Ujjain Road, Dewas.

EDUCATION AND TRAINING

Training organized

1. Training on Nursery techniques for raising medicinal plants at FRI City Centre, Dehradun from 22nd to 25th June 2005.
2. Training programme on the integrated utilization of Lantana at FRI City Centre, Dehradun from 26th to 30th September 2005.
3. A training programme on the integrated utilization of Lantana was organised in the ranger's college campus.
4. Free training on vermicompost to ladies of rural area of Uttaranchal at FRI, Dehradun from 25th to 28th October 2005.

5. Training programme on the integrated utilization of Lantana at Kharawa in village, Rajpur, Dehradun from 15th to 19th February 2006.
6. A training programme on the integrated utilisation of Lantana was organised at the Gram Panchayat Bhawan of village Khrawain, Post Office Kulhan, Nangal Hatnala, Dehradun.
7. Training programme on utilization of Bamboo at FRI City Centre, Dehradun on 23rd and 24th March 2006.
8. A two days Bamboo training programme was organised at the Rangers College, City Centre, Dehradun for the selected farmers of the Harbajwala village under the project "Evaluation of Appropriate Technology and its Adoption as Applicable in Rural Environment."
9. Short Term Training Courses were organized for officials of Government of India, State Forest Departments, Public Sector Undertakings, NGOs and representatives from various Industries on Exposure to Field Identification of Timbers; Nursery and Plantation Technology; Plywood Manufacture; Management of NWFP for Sustainable; Development of Green Belts; Hi-Tech Nursery and Plantation Technology; Urban Forestry and Landscaping; and Environmental Problems & Bioremediation Techniques.

Attended

1. Dr. H.S. Ginwal, Scientist D and Dr. Ashok Kumar, Scientist C has attended the "Third Country Training Programme on Tree Improvement of Fast Growing Species" at Yogyakarta, Indonesia from 5th to 18th March 2006 with the financial support from Japan International Cooperation Agency (JICA).
2. Dr. Vineet Kumar visited Polytechnic University, New York and worked as a Post Doctoral visiting scientist on chemoenzymatic modification of halouronic acid and chemical modification of oligopeptides using reverse equilibrium protease catalysis.
3. Rakesh Kumar, Scientist B, Praveen Onial, RA I and Raj Dev Rawat, RA visited Northern India Textile Research Association, Ghaziabad to study Reference Bench top Spectrophotometer and other instrumention techniques related to quality control of natural dyes on 9th February 2006.
4. Dr. V.K. Varshney attended a training on Value added products covering aromatic chemicals, fragrance and flavor creation methodology from 19th to 27th September 2005 at Fragrance and Flavor Development, Centre, Kannauj (U.P.), India.

LINKAGES AND COLLABORATION

National

1. Linkages were developed with National Institute of Technology, Jalandhar during the project formulation for Technology Improvement of Sports Goods manufacturing.
2. Linkages were developed with Sport forum, Jalandhar when their 12 members visited Forest Products Division on 1st March 2006 and team of Jalandhar visited various factories at Jalandhar associated with Sports Forum.
3. Linkages were developed with Department of Forestry, HNB Garhwal University during collection of sample for CSIR funded project.
4. Linkages were developed with Forest Department Jaipur, Forest Department Bundi, Forest Department

Hanumangarh, Forest Department Haldwani, Forest Department Roorkee, Forest Department Hardwar, Forest Department Ranikhet and Forest Department Narendranagar Division.

5. Linkages were developed with various wood & wood products manufacturer and user industries, important among them are: NTPC, Talchar; NTPC, Barnyhat, Meghalaya; BIS, New Delhi; Northern Coal Fields Ltd. Singrauli; Delhi Development Authority; Asahi India Glass Ltd., Taloja; Reliance Industries Ltd., Jamnagar; Garnet Tools, Dewas; PPDC, Meerut; IMPCL, Mohan; Star Paper Mills, Saharanpur; Sports Forum, Jallandhar and National Mission on Bamboo Applications(NMBA)
6. Linkages with the state forest Department of Uttaranchal for field planting of *Putranjiva roxburghii* in 2.00 ha area in Jakhan Block, Barkot Range, Dehradun Forest Division and *Prinsepia utilis* in Mussoorie Forest Division and also for *Jatropha curcas* plantations.

International

1. An EU Research Project on "Interdisciplinary approach to analyse the dynamics of forest and soil degradation and to develop sustainability agroecological strategic fragile Himalayan watersheds" is in progress. The Netherlands, U.K., Norway, Pakistan, Nepal and India are working in this project.
2. Undergraduate student from USA (Rice Uni.) for information about tourism in Nanda Devi Biosphere Reserve, Uttaranchal.

PUBLICATIONS

Book

Soni, P, Veena Chandra and S.D. Sharma (2005). Mining Scenario and Ecorestoration Strategies (eds.). Jyoti Publishers & Distributors, Dehradun.

Brochure

A Brochure on "Studies on Himalayan Pines".

Quarterly Newsletter

Four issues of the Quarterly Newsletter " Market Information on Medicinal Plants".

Proceeding

Srivastava, R. K Hooda, A. K, Singh, Y. P, Thapliyal, M. and Ombir Singh (2006). XII Silviculture Conference. Forest Research Institute, Dehradun, February 1-3, 2006.71 p.

Technical Bulletin

Kaushik S, Singh Y.P, Gupta S. and Dinesh Kumar (eds.). (2005). Envis Forestry Bulletin (Forest Products Special, Vol. 5). 76p.

CONSULTANCIES

Long term consultancies

1. 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. This consultancy is for installing a steam heated kiln for M/s J&K Handicrafts (S&E) Corporation, Srinagar and maintaining it for 2 years. The installation has been completed and staff of J&K Handicrafts has been trained in kiln operation. The maintenance contract is on and will be over in November 2006.
2. Installation of solar kiln at IMPCL factory premises, Mohan (IMPCL) funded by IMPCL, Mohan, Almora Dist., Uttaranchal for a period of 2 years. The consultancy amount is Rs. 3,37,200. This consultancy is for installing a solar kiln for M/s IMPCL, Mohan and maintaining it for 1 year. The kiln has been installed and handed over to the client after successful trial and training of their staff. Maintenance contract is on and will be over in July 2006.

Short term consultancies

1. To Star Paper Mills, Saharanpur for prevention of decomposition in stored poplar wood.
2. To M/s Hukkeri Brothers, Kohlapur for preparation of katha from *Acacia catechu* against a consultancy fee of Rs. 10,000/-.
3. Development of Green Belts to Greater Noida Development Authority for two days. An amount of Rs. 20,000/ was charged.
4. On-site consultancy to SRF Ltd., Indore (M.P.) during 9th and 10th September 2005.
5. On-site consultancy to Asahi India Glass Ltd., Taloja (Maharashtra) during 29th to 31st August 2005. Gave a training consultancy to the same firm on "Wood Utilisation Aspects" during 9th to 12th January 2006.
6. On-site preliminary consultancy to the Sports Forum, Jallandhar to identify and tackle the problems faced by the wooden sports industry on short and long term bases.
7. About 485 wood samples examined and identified and revenue of about Rs. 23,45,000/- earned.
8. Revenue earned through various consultancies, testing and other services above Rs. 26 Lakhs.

CONFERENCES/MEETINGS/WORKSHOPS/SEMIMARS/SYMPOSIA/ EXHIBITIONS

Organized

1. National Technology Day was celebrated on 11th May 2005.
2. Forest Research Institute Dehradun celebrated the World Environment Day on 5th June 2005 with the start of running for the Environment in which the forest officials, Scientists, Scholars, staffs and children participated.
3. A training programme on Eco-sensitization was organised by Extension Division at Kandoli (Bishanpur) village and a lecture on Rural Development Technologies on Socio economic upliftment of Rural people. The technologies developed by FRI such as Natural Dyes, Compost preparation, Lantana articles including Board preparation from Lantana etc. were highlighted.
4. Hindi Saptaha at FRI, Dehradun from 19th to 23rd September 2005.
5. Vigilance awareness week at FRI, Dehradun from 07th to 11th November 2005
6. Forest Research Institute, Dehradun participated in Uttaranchal International Trade Fair (UITF-2005) from 5th to 12th November, 2005 and was sponsored by NABARD.
7. Regional Workshop on Challenges and Opportunities of Forestry Extension on 17th and 18th November 2005
8. XII Silviculture conference at FRI, Dehradun from 1st to 3rd February 2006.
9. National Conference on Ecology and Environment at FRI, Dehradun on 27th and 28th February 2006.
10. A two days National Workshop on Forestry Education in India: Issues and Opportunities was organised in the Convocation room of the FRI by Deemed University on dated 20th March 2006. Around 200 eminent scholars and experts from various universities, government and non-government organizations and research institutes participated in the workshop. The main theme of the workshop was status of forestry education, linking forestry education with research and extension and with other disciplines and job opportunities in forestry sector.
11. World forestry day was celebrated in the Forest Research Institute on 21st March 2006. Besides this some of the technologies developed by the institute such as Macro proliferation technique of Bamboos, Natural Dyes

from forest biomass, preparation of Herbal Gulaal, Kathaa from Gambier and herbal agarbattis etc were shown to the public. Integrated utilization of the Eucalyptus, Poplar and Lantana for the formation of furniture etc. was also demonstrated.

Attended

1. Dr. A. N. Shukla participated in National symposium on 'Changing Concepts of Forestry in 21st Century' at Dr. Y.S. Parmar Univ. of Horticulture and Forestry, Nauni, Solan (H.P.) and XII Silviculture Conference, at Forest Research Institute, Dehradun.
2. Dr. N.S.K. Harsh participated in National Conference on 'Biopesticides: Emerging Trends (BET-2005') at Institute of Himalayan Bioresource Technology (CSIR), Palampur and 'Tree Biotechnology: Indian Scenario' held at Tropical Forest Research Institute, Jabalpur.
3. Dr. Y.P. Singh participated National Conference on 'Forest Ecology and Environmental Priorities in 21st Century", held at Forest Research Institute, Dehradun and 'Plant Science Research in India: Challenges and Proapects' held at Botanical Survey of India, Dehradun.
4. Shri V.K. Jain, Dr. Vimal Kothiyal and Shri Sachin Gupta have attended a workshop on 'Uttaranchal Wooden Souvenir Workshop' at Srikot, Srinagar, Garhwal organized by Uttaranchal Handicraft and Handloom Council.
5. Dr. Vimal Kothiyal, Head, Forest Products Division made a presentation on 'Technologies in Forest Products Involving stake holders' in the ICFRE society meeting at Ministry of Environment and Forests, New Delhi.
6. Shri Rajesh Bhandari, Shri Ajmal Samani and Dr. Anil Negi participated in national seminar-cum-exhibition 'Bam Fest2006' at Bhubaneswar, Orissa.
7. Dr. Vineet Kumar participated in a symposium on 'Innovations at the interface of polymers and biology' held at Polytechnic University, New York.
8. Dr. K. Vishwanathan, Vineet Kumar and Gross, R. presented paper on Oligopeptides from protease catalysis: sources of macromers and functional polymers in National Science Foundation Industry/University Cooperative Research Meet at Centre for Biocatalysis and Bioprocessing of Macromolecules, Polytechnic Unviersity New York.

9. Rashmi presented paper on *Jatropha curcas*: A potential source of Biodiesel in New horizons in lipids and specially oleo chemicals and lipids Expo 2005 held at IICT, Hyderabad and a paper on two new saponins from medicinally important seeds of *Achyranthes asper* in IUPAC sponsored second International Symposium on Green/Sustainable Chemistry held at Chemistry Department, Delhi University, Delhi.
10. Dr. V.K. Varshney attended the workshop on Intellectual Property Rights (IPR) on Herbs and Herbal Products held at India International Centre, New Delhi.
11. Dr. (Mrs) P. Soni participated in several workshops and meetings such as the MODIS data utilization workshop, Space Application Centre ISRO, Ahmedabad, Facilitating Forestry Mitigation Projects in India: Promoting Stakeholder Dialogue and Capacity Building at ICFRE, Seminar on International Law Issues and Multilateral Environment Agreements, Third International Seminar on Plants and Environmental Pollution and TPDM Meeting on Uranium Project at Atomic Energy Commission, Mumbai.
12. Dr. (Mrs) Laxmi Rawat attended several workshops and meetings such as National Symposium on Changing Concepts of Forestry in 21st Century at Y.S. Parmar University Horticulture and Forestry, Solan, Integrated Management of Natural Resources of Mountains at GB Pant University, Pantnagar, Ecosystem Services and Ecological Economics: Himalayan Mountain Context.
13. Shri A.K. Tripathi participated in the workshop on MODIS Data utilization at SAC-ISRO, Ahmedabad, Management of Municipal solid wastes and plastic wastes at Dehradun, Strategic Planning, Silviculture Conference, Strategising Hill Tourism, and Biomass Briquetts Workshop.
14. Shri H.B. Vasistha and Dr. Mridula Negi attended National Symposium on changing concepts of Forestry in 21st Century. Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan.
15. Scientist has attended the National Congress of Entomology held at Punjabi University, Patiala.
16. Dr. Veena Chandra was invited to deliver a lecture on Herbarium Techniques and its role in taxonomy in the National Seminar on Recent Trends in Plant Taxonomy held at Sarojini Naidu Govt. Girls PG (Autonomous) College Bhopal and Silver Jubilee Symosium on Ethnobotany in the new millennium at NBRI, Lucknow.
17. Dr. Sangeeta Gupta, Scientist D, Wood Anatomay attended 6th Pacific Regional Wood Anatomy Conference Kyoto, Japan.
18. Scientists of Botany Division participated in XXIII All India Botanical Conference and National Symposium on Plant science Research in India: Challenges and Prospects.

AWARDS

1. Dr. Mridula Negi received S.K. Seth Prize for best paper in Ecology and Environment entitled "Evidences of Climate change and its impact on structure and function of forest ecosystem".
2. Ms. Himani Bhatia received a Best Paper Award for her research paper entitled "The family leguminosae rich source of galactomannans" in Recent advances in science : a prospective presented in a "National Symposium on Recent Advances in Science: A perspective" held at Dolphin (PG) Institute of Bio-Medical and Natural Sciences, Dehradun from 3rd to 5th June 2005.
3. Dr. Veena Chandra received the Prof. Bashir Ahmad Razi Medal from the Association of Plant Taxonomists, India for her contribution to Plant Taxonomy and Ethnobotany at NBRI, Lucknow on 29th March 2006.

DISTINGUISHED VISITORS

1. David Daniel, Ambassador of Israel in India visited on 4th April 2005.
2. Dr. Mohammad Zakir Hussein, Director, Constituency, IDCN, Asia Region, Bangkok, Thailand visited on 12th May 2005.
3. Nikhat Sattar, Head, Regional Emerging Programmes, IUCN, Asia Region, Bangkok and Karachi visited on 12th May 2005.
4. Justice Cyraiac Joseph, Chief Justice, Uttaranchal High Court visited on 25th May 2005.
5. Pradyut Bardoloi, Minister of Forests, Govt. of Assam visited on 4th July 2005.
6. Lucie Edwards, High Commissioner for Canada visited on 21st July 2005.
7. Shri Maheshwar Murmu, State Forest Minister, West Bengal visited on 25th October 2005.
8. Dr. R. Lalthangliana, Honable Minister of Environment and Forests, Mizoram vistited on 11th February 2005.
9. Shri Namo Narain Meena, Minister of State for Environment and Forests, Govt. of India visited the Forest Products Division and familiarized with the technologies developed and research activities going on in the Division on 1st February 2006.

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 meaningfull and productive way. Besides turning out students having formal academic and practical education of University standard in specialized areas of study such as, Forest Economics and Management, Wood Science and Technology, Environment Management, Plantation Technology, Biodiversity Conservation to man responsible position in forestry research, wood based industries and plantation activities, the Deemed University has been fostering pioneering research in specialized areas under Ph.D. Programs.

Academic Courses and Admission

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

1. M.Sc. Forestry (Economics and Management)
2. M.Sc. Wood Science and Technology
3. M.Sc. Environment Management
4. Post Graduate Diploma in Biodiversity Conservation
5. Post Graduation Diploma in Management of Non Wood Forest Products
6. Six month Certificate Course in Pulp and Paper Technology.

The M.Sc. courses are of two years duration whereas post graduation diploma courses are of one year duration and the certificate course in Pulp and Paper Technology is only of six months duration The intake capacity of each course is 25 in M.Sc; 15 in PG. Diploma courses of Natural Resource Management, 22 in PG. Diploma courses of Management of Non Wood Forest Products and 15 in six month certificate course in Pulp and Paper Technology.

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

During the year 2005-2006 ninetynine students were admitted in all the above six courses. At present the total strength of the students in all courses is 98.

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

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

During the year 2005-07 ninety five students were admitted. The strength is as follows.

1	M.Sc. Forestry (Economics and Management)	- 20
2	M.Sc. Wood Science and Technology	- 25
3.	M.Sc. Environment Management	- 21
4.	P.G. Diploma in Biodiversity conservation	- 6
5.	P.G. Diploma in Management of Non Wood Forests Product	- 14
6.	Certificate courses in Pulp and Paper Technology	- 9
	TOTAL	**95**

Extra Curricular Activities

1. Students of FRI-DU attended and participated in the workshop "Forestry Education in India" held by FRI-Deemed University.
2. The annual convocation of S.F.S College on 12th April 2006 was attend by the students of FRI- DU. Annual sport meet held from 28th to 30th September 2005 for FRI, Dehradun were also attended by students.
3. A Cultural program "Ankur-the Beginning of Growth" was held on 24th February 2006 by the students and research scholars of the Deemed University.

Students welfare Activities

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

Other Activities

1. Prof. S.P Singh, Vice Chancellor, Garhwal University visited F R I on 12th December 2005 for taking viva-voice of Ph.D. Scholar.
2. Students of FRI (Deemed University) attended Silvicultural meet from 1st to 2nd February 2006 held in FRI, Dehradun
3. Opening Ceremony of National workshop on Forestry Education in India on 20th March 2006.
4. Campus interviews were conducted for M.Sc and PGD courses. Six students from M.Sc. (WST) courses and six students from M.Sc. Forestry and M.Sc. Environment Management courses have been selected in different industries/organization.

Ph.D. Programme

Research is an essential function of a National Institute like the Forest Research Institute (Deemed University) and increasing emphasis is being given to this important aspect of academic pursuit. Highly qualified

Foresters/ Scientists and talented Research Scholars have continued to be active in the frontier areas of research and their efforts have been generally supported by sponsoring agencies like the ICFRE, UGC and CSIR, etc. With the support of these organizations coupled with the guidance of talented researchers, which the Institutes and established Research Centers have, the research activities under Ph.D. Program have increased manifolds. At present 436 Research Scholars have been registered including registration of 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	Placement/Permanent appointment in agency
2004-06	M.Sc. Wood Science and Technology	2	C. L. Gupta, Moradabad.
		4	Evergreen Industries, Gurgaon.
		2	Ria Enterprises, Rajdhani Pasic Nangloi, Delhi
		3	Punjab Ply, Yamunanagar,
		4	Rama Woodcraft, Rudrapur
2004-06	M.Sc. Forestry	5	Foundation of Ecological Securities, Anand, Gujrat.
		1	Permanent job in BILT
2004-06	M.Sc. Environment Management	1	Foundation of Ecological Securities, Anand, Gujrat
2004-06	Management of N.W.F.P.	1	Permanent job in Vaidyanath Pharmaceutical, Jhansi.

NATIONAL FOREST LIBRARY AND INFORMATION CENTRE

The National Forest Library and Information Centre (NFLIC) is richest in document collection in 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 27,339 books were loaned to the users for outside reading. Besides, 58,343 documents were consulted inside the library.

The document collection was enriched by the addition of 1424 documents out of which 110 books were purchased at a cost of Rs. 3.53 lakhs and 1,314 books were received as gratis.

The NFLIC subscribed to Indian and foreign periodical titles at a cost of about Rs. 44.12 lakhs. It also received about 300 periodical titles as gratis. Besides, back issues of 39 periodical titles were also acquired at a cost of Rs. 9.21 lakhs.

The binding of loose issues of periodicals and old books is an essential library activity. During the year, 400 sets of periodicals and 150 sets of reports, etc. were got bound at a cost of Rs.32,500/-

The NFLIC has been selling ICFRE publications through its Book Depot. During the year 566 books, 30 VCDs and 2 VHF cassettes were sold which earned revenue of Rs. 1,53,317/-.

The Ministry of Environment and Forests, Govt. of India established an ENVIS Centre on Forestry at NFLIC. The Centre, during the year enriched the following databases by the addition to new references, which have internet accessibility through the website of the Centre having URL:www.frienvis.nic.in: Indian Forestry Abstracts, Joint Forest Mangement, *Prosopis juliflora*. Forests and Environment are in Press, Current Forestry Literature. A new database on Poplars was compiled. Besides, the contents pages of Indian and foreign journals, forest cover of India, state wise and then district wis, announcements of forthcoming national and international conferences, seminars, symposiums, training courses were also put up on the website. The ENVIS Centre on Forestry published 12 issues of ENVIS News Digest, and a thematic issue of ENVIS Forestry Bulletin on Forest Products, during the year.