



## Chapter 3

# FOREST RESEARCH INSTITUTE DEHRADUN

Forest Research Institute (ISO 9001:2000), having history of over a century (established in 1906) of forestry research, is an ideal institution for learning forestry. Forest Research Institute (FRI) enjoys the reputation of leading Institute at global level in the field of Forestry Sciences. Under the umbrella of Indian Council of Forestry Research and Education, FRI is mainly focussing its activities in Uttarakhand, Uttar Pradesh, Haryana, Punjab, Chandigarh and Delhi. Researches on every aspect of forests like Silviculture, Ecology, Pathology, Entomology, Chemistry, Non-wood Forest Product, Genetics and Tree Breeding and Forest Soil and Land Reclamation is being conducted through projects of regional, national and international importance in the Institute. The Institute has excellent laboratory facilities and sophisticated and modern equipments to support its research. National Forest Library Information Centre of the Institute is the biggest forest library of the country having around two lakhs books and subscribes to 114 foreign and 110 Indian periodicals of forestry and related subjects. Forest Research Institute, Dehradun has also been conferred the status of 'University' by the Ministry of Human Resource Development, Government of India, New Delhi vide Notification No. F.9.25/89 U-3 dated 6<sup>th</sup> December 1991. Keeping in view the present scenario of advancement in the field of science, Institute has added two more Divisions i.e. Climate Change and Forest Influence Division and Bioinformatics Centre and GIS Cell.

An abstract of projects run by the Institute is as follows:

		No. of projects completed in 2008-09	No. of ongoing projects in 2008-09	No. of new projects initiated in 2008-09
FRI, Dehradun	Plan Projects	21	45	25
	Externally Aided Projects	18	27	01
CSFER, Allahabad	Plan Projects	Nil	05	Nil
	Externally Aided Projects	Nil	01	Nil
<b>Total</b>		<b>39</b>	<b>78</b>	<b>26</b>

## PROJECTS COMPLETED DURING THE YEAR 2008-2009

### PLAN PROJECTS

**Project 1: Evaluation of Australian seed sources and families of *Eucalyptus tereticornis* for productivity and genetic improvement PHASE II [FRI-203/G&TP-9/April 2006 - March 09]**

**Findings:** Provenance-cum-progeny trials evaluated on the basis of various morpho-metric traits after data recording and its analysis. North Queensland Provenances were identified as good performers (particularly Laura river and Petford provenance). Forty seven promising



phenotypes representing different sources and families of *Eucalyptus tereticornis* were identified and marked based on index selection, their coppicing and rooting ability was ascertained. Twenty four new clones developed and established in VMG at FRI. A clonal trial with 13 clones established at Manakpur (Haryana). Insect and disease incidence was recorded. Intra species hybridization was carried out between the best sources.

**Project 2: Impact of ban on green felling on the plant diversity of selected sites in Uttarakhand [FRI-357/Bot-52/2006-09]**

**Findings:** Vegetative analysis of unallotted seeding and final felling sites of Chirpine and Deodar forest of Chakrata and Nainital division were carried out. Regeneration was observed in seeding and final felling sites in both the species. Regeneration of Chirpine was observed in some compartments of northern aspect in Chakrata. However, in Nainital and Almora, regeneration was observed in both aspects. In case of deodar, regeneration was observed in some compartments of southern aspect. Check list of ground vegetation was made. No significant difference in plant diversity in unallotted seeding and final felling sites was observed.

**Project 3: Preparation of Weight and Volume Tables for Agroforestry Tree Species [FRI-389/RSM-17/April 2007-March 09]**

**Findings:** Weight and volume tables for *Melia composite*, Poplar and *Ailanthus excelsa* tree species have been prepared for use of tree growers based on the data from state of Punjab.

**Project 4: Development & multiplication of superior bioactive clones of *Stevia rebaudiana* [FRI-320/NWFP-19/2005-09]**

**Findings :** Fifty three accessions of *Stevia rebaudiana* have been collected from Uttarakhand, Delhi, Himachal Pradesh, Haryana, UP, and J&K States and introduced under field conditions for assessing their performance. Of these, 22 accessions have been analyzed for their biomass productivity and active constituent's viz., stevioside and rebaudioside percentage using HPLC technique. Breeding of accessions resulted in identification of eight high stevioside and 3 high rebaudioside rich selections which have been multiplied vegetatively.

**Project 5: Bio-ecology and nutritional behaviour of polyphagous insect pests with special reference to *Spilarctia obliqua* [FRI-304/FED-21/April 2005-July 08]**

**Findings :** Studies were conducted on the biology and nutritional preference of *S. obliqua* on Paulownia, Poplar, Teak, Toon and Brassica.

- Paulownia was found to be preferred host followed by *Brassica compestris*, *Populus deltoides*, *Tectona grandis* and *Toona ciliata*.
- Total sugar was found to be maximum (88.54 mg/gdw) in *P. fortunei* followed by 55.61mg/gdw in *Brassica compestris*, 33.00mg/gdw in *P. deltoides*, 31.87 mg/gdw in *Tectona grandis* and lowest 23.53mg/gdw in *Toona ciliata*.
- Starch contents were also found maximum i.e. 79.76mg/gdw in *Paulownia fortunei* followed by *B. compestris* (43.10mg/gdw), *P. deltoides* (29.27mg/gdw), *T. grandis* (28.69mg/gdw) and *T. ciliata* (21.12mg/gdw).
- Protein content was found to be maximum (18.10mg/gdw) in *Paulownia fortunei* followed by *Brassica compestris* (16.25mg/gdw), *Populus deltoides* (16.19mg/gdw), *Tectona grandis* (15.05mg/gdw) and *Toona ciliata* (14.12mg/gdw).

- Chlorophyll contents were found maximum, (1.14mg/gfw) in *P. deltoides*, (1.02mg/gfw) in *P. fortunei*, 0.73mg/gfw in *T. ciliata*, (0.71mg/gfw) in *B. compestris* and (0.36mg/gfw) in *T. grandis*.

**Project 6: Endangered and rare entomogenous fungus *Cordyceps sinensis*, identification of its insect hosts and food plants of insect hosts in the Bugyals of Uttarakhand [FRI-347/FED-22/April 2008-March 09]**

**Findings :** *Cordyceps sinensis* infested larvae were collected from Bedini Bugyal, Ghoralathani, Kuramtoli, Kewala Vinayak, Bhaguwabasa and Auli Bugyals, Badrinath Forest Division.

The life cycle of the insect is completed in two years. Larval period is prolonged and lasts for 18 to 21 months and the pupal period lasts for 2-3 months. The insect is tentatively identified as *Thitarodes nepalensis* (Lepidoptera: Hepialodae).

**Project 7: Studies on the Termite diversity of Northern India with special reference to species composition in relation to different tree species [FRI-275/FED-19/October 2004 - March 09]**

**Findings :** The project has been completed and altogether 73 species belonging to 24 genera and 5 families have been recorded from Northern India, which includes 7 new species and many new distributional records: Delhi - 11 species with 6 genera belonging 3 families; includes 7 new records, Haryana - 21 species with 11 genera belonging 3 families, which includes 9 new records; Himachal Pradesh - 20 species with 8 genera belonging 5 families, which includes 10 new records, Punjab - 28 species with 11 genera belonging 2 families, which includes 14 new records Uttar Pradesh - 17 species with 8 genera belonging 2 families; includes 13 new records and 1 new species, Uttarakhand - 52 species with 14 genera belonging 5 families; includes 31 new records and 3 new species and Uttar Pradesh - 17 species with 8 genera belonging to 2 families; includes 13 new records and 1 new species. Diagrams of all the 73 species were prepared with the help of the *Camera lucida*. Keys for the identification of families, genera and species have been provided. All the 7 new species have been described and illustrated with line diagrams.

**Project 8: Control of Shisham leaf miner *Leucoptera sphenograpt* using systemic insecticides [FRI-349/FED-24/April 2006-March 09]**

**Findings :** Experiment was laid out at Nahi Forest Block, Thano Forest Range for control of shisham leaf miner (*Leucoptera sphenograpt*) as per statistical design. Three different concentrations of Monocrotophos and Rogor were used for laying out the experiment. The concentrations used were 0.01%, 0.02% and 0.04% of both the insecticides having five replications. Post treatment observations on infestation of *Leucoptera sphenograpt* was taken and it was found that 0.04% of Monocrotophos has given maximum protection.

**Project 9: Production and value addition by chemical derivatization of alpha cellulose of *Lantana camara* for its useful applications [FRI-345/Chem-17/2006-09]**

**Findings :** Alpha cellulose isolated from stems of *Lantana camara* was subsequently modified to prepare industrially important cellulose derivatives as Cyano Ethyl Cellulose (CEC), Hydroxy Propyl Cellulose (HPC), Cellulose Sulphate (CS). Preparation of Methyl Cellulose (MS) by using methyl chloride (in gaseous phase) is in progress. All the variables for preparing the cellulose derivatives such as concentration of the reactants, solid liquor ration, time and temperature were optimized for maximum DS and solubility. The optimized product was evaluated with IR, SEM, TGA/DTA and WAXDs studies.

**Project 10: Analytic Studies in Woody Cell Wall Architecture [IWST/WSP/62/2006-09]**

**Findings:** Role of microtubules in orientation of microfibril was analyzed. Orientation of microfibril with the help of cyto-skeletal microtubules is not a universal phenomenon. Due to liquid crystalline nature of cellulose, self assembly of cellulosic microfibrils is possible which help in proper orientation of microfibrils. Role of geometrical constituent in cell wall was analyzed as a mechanism of cellulosic microfibril orientation in woody cell wall. It seems that no single model is capable of explaining the entire range of observations.

**Project 11: Studies on the effect of design parameters and different adhesives on the performance of finger joints in commercial timbers [Code:FRI-376/FPD(WWF)-62/2007-09]****Findings:**

**Mango:** Urea Formaldehyde adhesive always performs better than PVA in static bending and compression. The role of design parameters is not very explicit always. However, if one has to make a choice between the two cutters used, it is the cutter with design parameters L = 21 mm, P = 7 mm, T = 1.4 mm and S = 0.1 that gives better strength values.

**Eucalyptus:** Fingers profiled with first cutter and jointed using Urea Formaldehyde adhesive always perform better in static bending and compression. The role of the design parameters is quite clear unlike in the case of mango. The maximum crushing stress under compression parallel is lesser in jointed sections of Eucalyptus unlike in the case of mango.

**Project 12: Drying studies on timbers useful for Handicraft [Code: FRI-378/FPD(WS)-64/2007-09]**

**Findings:** The chemical seasoning study done on mango and kikar wood showed that bulking treatment was very effective in controlling the surface cracks in both the wood species. This technique will help wood handicraft artisans in value addition of their products.

**Project 13: Studies on shrinkage, swelling behavior of edge bonded solid wood boards [Code: FRI-379/FPD(WS)-65/2007-09]**

**Findings:** Studies were conducted on edge bonded boards of Shisham, Teak, Poplar and Pine. Fevicol and UF jointed boards showed similar trends of swelling irrespective of the thickness in the four species studied. Minimum swelling was observed with boards made from tangentially sawn material. Maximum swelling was observed with boards made from radially sawn material.

**Project 14: Eco-friendly preservative and fire retardants combinations for protection of structural bamboos for low cost houses [FRI-350/FPD(WP)-60/May 2006-March 09]**

**Finding:** Six combinations of fire retardant chemicals and preservatives at 15% conc. were tested for flame penetration, surface spread & rate of burning. Data of Flame Penetration Test was analyzed through SPSS: Species are arranged in the decreasing order of Performance: *Dendrocalamus strictus* > *Bambusa tulda* > *Bambusa arundinacea*.

Whereas, Composition performance on cumulative basis are as follows:

Arranged in decreasing order of performance: Comp.4 > Comp. 2 > Comp 1> Comp.5 > Comp.3> Comp.6

Composition	Ratio
1. Ammonium Sulphate: Ammonium Phosphate: ZiBOC	5:5:5
2. Ammonium Sulphate: ZiBOC	10:5
3. Ammonium Phosphate: ZiBOC	10:5
4. Magnesium Phosphate: Magnesium Pyrophosphate: ZiBOC	5:5:5
5. Magnesium Phosphate: ZiBOC	10:5
6. Magnesium Pyrophosphate: ZiBOC	10:5

A demonstration hut of Bamboo treated with Fire retardant compositions was constructed.

#### **Project 15: Studies on performance of plantation grown species in cooling towers [FRI/351/FPD(WP)-61/2006-09]**

**Findings:** Samples of *P. radiata*, *A. excelsa*, *P. roxburghii* and *T. ciliata* treated with 4% of CCA, CCB and ZiBOC were installed in cooling tower. Study shows that treated samples have shown upto 8 fold protection over the control samples.

#### **Project 16: Assessing biodiversity through maintenance of Preservation Plots of Uttarakhand [FRI-393/Silva-361/2007-09]**

**Findings:** Studies were carried out on forest composition, and enumeration in selected preservation plots situated in three forest types i.e. tropical, sub-tropical and temperate. Data was recorded on elite trees situated in the preservation plots of Uttarakhand. Thirty Preservation Plots of Uttarakhand were surveyed and data on their present status were also collected. The Project Completion report has been submitted.

#### **Project 17: Enhancing the longevity of acorns of *Quercus dilatata* and *Quercus leucotrichophora* [FRI-354/Silva-33/2006-09]**

**Findings:** The acorns of *Q. leucotrichophora* exhibited much better storability than the acorns of *Q. dilatata*. The acorns stored well in hydrated (non-desiccated) condition. Lowest Safe Moisture Content (LSMC) for acorns of banoak (*Q. leucotrichophora*) was 30% whereas acorns of moru oak (*Q. dilatata*) did not tolerate desiccation due to their maturity during rainy season.

Sub zero (-5°C) temperature proved to be fatal for the acorns. 5°C temperature was found to be suitable for the storage of seeds of Ban Oak as they retained above 60% viability even after 610 days in storage.

Polythene bag and steel box proved to be equally good containers for the storage of acorns as seeds stored in them retained viability for longest duration.

#### **Project 18: Evaluation of Seed Orchards of *Dalbergia sissoo* for Seed Quality [Project No. FRI-355/Silva-32/2006-09]**

**Findings:** Clonal Seed Orchard (CSO) and Seedling Seed Orchard (SSO) of *Dalbergia sissoo* Roxb. situated at Hissar, Yamunanagar and Hoshiarpur were evaluated for seed quality and genetic divergence at the age of about 10 years. The seeds of various clones/progenies exhibited significant variability in seed size, seed weight including pod parameters. The germination percent of fresh seeds from orchards is around 100% whereas it was 90% from general population. The storing capacity of seeds collected from orchards is more as compared to the seed collected from general plantations. The estimates of variability with regard to genetic parameters for seed traits in this study depicted wide range of variation. Moderate heritability and genetic gain was observed in seedling height and collar diameter at nursery level for about one year old seedlings raised from seeds of CSO and SSO's.

**Project 19: Multilocation trials of promising clones of *Gmelina arborea* [FRI-326/Silva-30/April 2005-July 08]**

**Findings :** Assemblage of 27 promising clones of *G. arborea* were collected from RFRI, Jorhat in March 2006, Total no. of cuttings sprouted in 2006 were recorded to be 63 % and total no. of cuttings rooted in the same year were 0.66%. Maximum value of sprouting were recorded 95% in RFRI 054 and minimum value were recorded in RFRI 053 i.e. 25%. Assemblage of 20 promising clones of *G. arborea* were collected from RFRI, Jorhat in March 2007. Total no. of cuttings sprouted in 2007 were recorded to be 73% and total no. of cutting rooted in the same year were 1.3%. Maximum value of sprouting were recorded 89% in RFRI 106 and minimum value were recorded in RFRI 004 i.e. 45%. Assemblage of 20 promising clones of *G. arborea* were collected from RFRI, Jorhat in March 2008. Total no. of cutting sprouted in 2008 were recorded to be 75.7% and total no. of cutting rooted in the same year were 1.1%. Maximum value of sprouting were recorded 95% in RFRI 037 and minimum value were recorded in RFRI 003 and 017 i.e 45%. It was observed that all three year sprouting was above 60 % but rooting was only around 1 %. After two months of planting of cuttings in polybags /field, no good rooting percentage could take place under best possible conditions also. This result of *Gmelina* rooting proves that *Gmelina* RFRI clones were hard to root under Dehradun conditions. Field trial of cuttings and seedlings of *Gmelina* at Majari compartment no 1 of Timli range (at Kalsi forest division) was laid, total 140 seedlings were planted along with 5 survived promising clones plants of RFRI (RFRI-079, RFRI-106, RFRI-004, RFRI-027 and RFRI-007) and F.R.I Tree 1,2,3,4 and also Tree 1,2,3,4 of Barkot range (Hardwar). Of each 5 plants were planted in field.

**Project 20: Studies on seasonal distribution of weeds in forest nursery and eco-friendly methods of their control [FRI-392/Silva-35/2007-09]**

**Findings:** Carried out experiments to study effect of leachates on vegetative propagules of weeds, on seeds of weed, on plants of test species vis-a-vis hand weeding and to study effect of dry leaves in combination with hand weeding on weed control.

**Project 21: Effect of Pine & Oak forests on agricultural crops [FRI-327/SF-10/October 2005-September 08]**

**Findings:** Survey of selected sites in Uttarakhand has been made to know the status of Chirpine and Oak. Soil profile of area falling under oak forest has been studied. Data on agriculture crops are being recorded and analyzed. Study on vegetation has been done in Oak and Chirpine forests in project area.

## EXTERNALLY AIDED PROJECTS

**Project 1: Collection and dissemination of market information on commercially important plants of Uttarakhand [FRI-282/RSM-16/External/2005 - March 09]**

**Findings:** The original project period expired on 31<sup>st</sup> March 2008. However, the funding agency i.e. National Medicinal Plants Board of Govt. of India granted extension upto 31<sup>st</sup> March 2009. The field project activities are, thus completed.

**Project 2: Preparation of working Plan of Dadra and Nagar Haveli Forest Division [FRI-328/RSM-20/External/2005-08]**

**Findings:** Draft Final Report submitted to Dadra and Nagar Haveli Forest Department for acceptance.



### **Project 3: Delhi Development Report, Forest, Tree Crop Management, Greening of Delhi**

**Findings:** Chapter on Forest, Tree Crop Management, and Greening of Delhi had been written and re-submitted to the funding agency after incorporating the necessary enhancement requested by funding agency.

### **Project 4: Demand & Supply of medicinal plant and produce grown / found in Haryana [FRI-291/NWFP-18/External/2005-09]**

**Findings:** District wise data pertaining to cultivation, collection and demand and supply position of 11 selected medicinal plants in the state of Haryana revealed that currently there are 56 functional herbal units in the state and 66 active traders dealing in medicinal plants trade. The study estimated a demand of 690 MT/annum of these species by various herbal units, of which 379 MT is being met from within state by the local traders. Over 500 acres of land area is under cultivation of various medicinal plants.

### **Project 5: Researches on natural decay resistance of juvenile timbers like poplars (DST sponsored) [FRI-283/Path-18/External/2005-June 08]**

**Findings:** The information regarding the natural decay resistance of poplar clones has for the first time been brought out in India. It is a misconception that poplar wood is not durable. However, the present study reveals otherwise. There is definite variation among the clones/ source material for decay resistance; even within same clone of different locations. Poplar blocks are more susceptible to the attack of the white rot test fungus *Pycnoporus sanguineus* than the brown rot test fungus *Gloeophyllum striatum*. Brown rot fungi are more confined to higher altitude regions and from the findings of the present study, it can be suggested that poplar (*Populus deltooides*) wood can be safely used for construction and furniture making at high altitudes.

Unlike most traditional timber species, heartwood of poplar is more susceptible to decay fungi than sapwood. This quality can be used while peelings are made for plywood manufacture. Leaving a central core of inner-wood would give a decay resistant material.

Decay resistance varies within a tree from base to top, maximum resistance observed at 2.5 m height, above and below it decreased considerably. Resistance was more at the base than at the top of the tree. This quality can be used for selecting logs one metre above and below 2.5 m from the base for selecting material for manufacturing decay resistant plywood and panels.

Clone G-48 from Pind Khakli, Hoshiyarpur and S7C15 from WIMCO, Rudrapur are highly resistant clones against decay. These materials can be used selecting logs one metre above and below 2.5 metre from the base for making decay resistant plywood as well as for construction and furniture making.

### **Project 6: Income generation for women in rural areas of Uttarakhand through vermicomposting of organic solid waste into manure [FRI-281/Eco-16/External/2005-09]**

**Findings:** Four pit vermicomposting unit/ demonstration unit was constructed in FRI campus. On campus and off campus trainings were organized for the women folk of Shivpuri, Kotada, Aamwala, Kandoli, Phoolsani, Bhagwanpur, Rajawala and Telpura villages. Two vermimelas were organized. Total 775 women folk were given on campus and off-campus training and 23 vermicomposting units were constructed on the lands of the beneficiaries of phoolsani village. Earthworms were cultured in FRI and vermicompost distributed to the rural women.



**Project 7: Impact of tourism on Environment of Roopland and Pindari of Nanda Devi Biosphere Reserve of Uttarakhand [FRI-280/Eco-15/External/2004-December 08]**

**Findings:** Tourist trend of both the areas, vegetation survey / analysis along the trek routes, soil samples collection and analysis for their physico-chemical characteristics along the trek route and control sites, collection of information for socio-economic studies of both the areas like village wise human population, caste composition, literacy rate, livestock population, people's participation in tourism etc. have been done. For participation of stakeholders in tourism, environmental awareness among the local people, meetings were held at Khati, Vachham, Wan, Lohajung and Mundoli etc. villages of both the study sites.

**Project 8: Studies on population status and berberine content in different provenances of *Berberis aristata* DC in H.P. and standardization of its propagation techniques (Funded by DBT) [FRI-329/Chem-15/External/August 2005 - July 08]**

**Findings:** Chemical method for estimation of berberine in the roots of *Berberis aristata* was standardized. Forty three samples of roots of different provenances of Himachal Pradesh received from HFRI, Shimla were analyzed for berberine using the standardized method. Maximum berberine concentration was found to be in Kharapathar (1.25%), Kinnaur and Shimla (2.50% each) provenances.

**Project 9: Deployment of the promising F<sub>1</sub> hybrids of *Eucalyptus citriodora* and *Eucalyptus torelliana* for establishment of vegetative multiplication garden and their field trials [FRI-338/G&TP-17/External/2006-09]**

**Findings:** Natural (spontaneous) hybrids of *E. torelliana* and *E. citriodora* have been picked up based on established morphological genetic makers. To evaluate the growth performance, the hybrids along with the parents and proper control have been established in field trials at 10 locations in the state of Punjab, Haryana, Uttarakhand and Uttar Pradesh. Some of the hybrids between *E. citriodora* and *E. torelliana* displayed superior growth at the age of one and half year. Hybridization has released a new spectrum of variation for making useful selections from these two species. The resistance of hybrids to *Cylindrocladium quinqueseptatum* inherited from *E. torelliana* parent may be helpful for planting the hybrids on sites where *E. citriodora* is prone to the fungus. Some of the genotypes of F<sub>2</sub> generation of FRI- 4, *E. citriodora* and *E. torelliana* parents also showed good growth. Preliminary studies carried out on oil contents of F<sub>1</sub> hybrids of *E. citriodora* and *E. torelliana* have revealed variation in yield and odour. The vegetative multiplication garden of selected genotypes has been established at FRI to get rejuvenated shoots for conducting experiments on rooting of cuttings.

**Project 10: DNA fingerprinting of Shisham (*Dalbergia sissoo*) clones planted in Punjab [FRI-364/G&TP-21/External/April 2006 - July 08]**

**Findings:** Sixty seven clones of Shisham (*Dalbergia sissoo*) obtained from Punjab Forest Department were characterized and fingerprinted using RAPD-DNA markers. Twenty two most divergent and distant clones were identified and recommended to Punjab Forest Department for using those clones in their plantation and improvement programs. The level of genetic diversity existing between clones has been estimated and the closely related clones were listed. DNA fingerprints of 67 clones developed and provided to Punjab Forest Department.

**Project 11: Development of Live Red Data Book [FRI-277/Bot-42/External/2006-09]**

**Findings:** Rare and threatened species (*Buchanania lanceolata*, *G. travancorica*, *Calophyllum calaba*, *G. wightii*, *Coscinium fenestratum*, *Humboltia vahliana*, *Cyathea nilgirensis*, *Myristica*

*malabarica*, *Cyrtostachys renda*, *Poeciloneuron indica*, *Diospyros buxifolia*, *Syzygium mundagam*, *Garcinia*, *Diospyros buxifolia*, *Myristica malabarica*, *Calophyllum calaba*, *Garcinia wightii*, *Garcinia travancorica*, *Humboltia vahliana* and *Buchanania lanceolata*) collected from different parts of India and species were reintroduced in the Botanical Garden.

**Project 12: Expert system for Indian woods - their microstructure, identification, properties and uses [FRI-277/Bot-42/External/2005-08]**

**Findings:** Final Draft report' and "Users Manual" submitted. Suggestions received on the same are being incorporated.

**Project 13: Wood Anatomy of important commercial timbers of Assam with notes on their properties and uses [FRI-292/Bot-43/External/April 2006 - March 09]**

**Findings:** Described wood anatomy, properties and end uses of 52 timber species from Assam state. The important findings of the project are given below:

1. The card and dichotomous key will ensure the correct identity of the woods of selected tree species of Assam state for utilization point of view and for further researches. It was prepared on the basis of 178 wood anatomical and physical features.
2. Cluster analysis was also done to see the affinity of different species on the basis of the 178 wood anatomical and physical features plus 4 characters of form and commercial importance. Dendrogram showed that species belonged to same genera and genera to same family grouped together while genera of different families grouped separately. For example, members of Magnoliaceae and Dilliniaceae grouped together. In the same way species belongs to Elaeocarpaceae grouped in the same cluster. It showed that physical and wood anatomical features had also significance in taxonomy and phylogeny.
3. Dichotomous key was prepared for the genus *Elaeocarpus* and *Dillenia* at species level.

**Project 14: Development of micropropagation protocol for clonal multiplication and germplasm conservation of *Swertia chirata* Buch.-Ham. A medicinally important herb [FRI-333/Bot-47-External/2005-08]**

**Findings:** *In-vitro* shoots of *Swertia chirata* were multiplied on large scale. Ten to fifteen fold multiplication was obtained on MS medium supplemented with 1.0mg/l BAP + 0.5mg/l IAA + 50mg/l Ads. *In-vitro* rooting was standardized. Ninty two percent rooting was obtained on ½ strength MS medium supplemented with 1.0mg/l IBA.

Rooted plantlets were hardened and acclimatized under control conditions, thereafter, transferred to soil and pots. A complete tissue culture protocol has been developed.

**Project 15: Study on the impact of riverbed material collection on Silviculture, ecology and environment in Uttarakhand Himalayas (Funded by UFDC) [FRI-407/Silva-38/External/August 2006-08]**

**Findings:** Field studies were initiated in 7 rivers viz. Yamuna and Amlawa of Chakrata Forest Division, Gaula, Dabka, Nandaur and Nihal of Haldwani Forest Division and Kosi of Ramnagar Forest Division of Uttarakhand. Data were collected with respect to the impact of material extraction on ecological successions, accumulation of debris, change of river course, soils, volumes of ditches and gradient of catchments as well as lower courses. The following recommendations were made as per findings of study:

- Treatment of upper catchments to reduce debris transported downstream.
- The extraction of riverbed materials in the centre portion of the river is essential to control bank erosion during the influence of flood in rainy season. It is necessary to follow strict rules of extraction by leaving at least 25 m control wide strips on both the sides of the river. The soil on both the sides of the strips should be replenished and controlled by making spurs and dykes at suitable interval (50 m). It will not only bind the soil but also make favourable condition for regeneration and aggregation of species. The spurs will prevent debris accumulation in the adjoining forests.
- The monitoring of extraction area is necessary to prevent formation of deep ditches and removal of soil. Quantity of debris /annum should be calculated from extraction sites by random selection of ditches per hectare. Monitoring involves measurement of chemical, physical, and biological parameters to evaluate the magnitude of change that occurs following remedial and restoration activities and to estimate the rate of recovery of an ecosystem. The patch should be regulated where heavy extraction is done. This work is required to be done in Gaula and Yamuna rivers where extraction is not being regulated. This may cause damage to the ecology of the river and loss of property and life.
- The extraction of materials should not be started from the river mouth in case of perennial rivers. It may cut the river to other direction as in the case of Asan and Timli areas where river course has been changed and back flow is noticed at some places. It creates loss of water in the river and also loss to aquatic fauna.
- The extraction helps in deepening of central river channel, the water in rainy season flows in this channel without making bank erosion. The deepening of central channel enhances succession of the bank resulting regeneration of desired species. Nihal river is an example where debris have been accumulated in the centre of the river as a result the flood water enters in the nearby agricultural fields and also causes loss of property and lives. Regeneration and succession is badly affected due to heavy debris accumulation. The accumulation of debris is not only harm to forest regeneration.
- The extraction of riverbed materials should be incorporated in the Working Plans of respective divisions as the river mining work is carried out in forest areas of the divisions.



Debris accumulation in untrained rivers-damage to forest vegetation

**Project 16: Development of Silvicultural practices for promoting cultivation of *Taxus baccata*, *Rhododendron arboreum* and *Phyllanthus amarus* [FRI-294/Silva-25/External/2005-09]**

**Findings:** It was observed that germination of freshly harvested seeds in *Phyllanthus amarus* was slower than that of older seeds. Seeds from the first capsules to dehisce after harvest (dark green seeds) had higher percentage germination than those from capsules dehiscing later (light tan seeds). Experiment was carried out on the Effect of Nitrogen and Phosphorus doses on the Biomass production of *Phyllanthus amarus* plants in nursery stages. The results showed

that N30P50 had highest the plant height, number of branches, collar diameter, root length, fresh and dry weight of shoot. Further increase in level caused general decrease in plant growth rate. *Phyllanthus amarus* seeds were broadcasted for germination at three different degraded sites in Uttarakhand (Raipur, FRI and Premnagar). It was observed that 5 cm x 5 cm spacing gave highest biomass percentage in *P. amarus*. Experiment was conducted on rooting of branch cuttings of *Taxus baccata* and *Rhododendron arboretum* at Chakrata nursery. It was concluded that best results were recorded in 10,000 ppm IBA in both species (*Taxus baccata* and *R. arboretum*). Morphological observation of flower study of *Taxus baccata* was conducted. Grafting and air layering in *Rhododendron* were also performed.

**Project 17: Development of Technological package for the production and quality evaluation of seeds of important medicinal plant species under National Medicinal Plant Board [FRI-285/Silva-22/External/December 2004 - December 08]**

**Findings:** Seeds of 100 species of medicinal plants were collected from Ranikhet (Almora), Rishikesh, Mandal (Gopeshwar), Munsiyari (Pithoragarh) and Ramnagar in Uttarakhand. Seeds were extracted, cleaned and upgraded with the help of dodder sieve and gravity separator. The viability of seeds was evaluated by direct germination test and indirectly through TTZ test. Seed morpho-logical parameters such as seed length, width, shape, colour, 1000 seed weight, number of seeds in a single fruit and number of seeds in 1 kg were recorded. Seeds were pretreated with different growth promoters such as GA<sub>3</sub> 0.1%, KNO<sub>3</sub> 0.2%, H<sub>2</sub>O<sub>2</sub> 0.1% and subjected to germination test monthly.



Two Information Booklets on Medicinal Plants

Some of the important medicinal species on which studies were conducted are *Abroma augusta*, *Arus precatorius*, *Aegle marmelos*, *Andrographis paniculata*, *Artemisia vulgaris*, *Asparagus racemosus*, *Berberis asiatica*, *Bergenia ligulata*, *Catharanthus roseus*, *Celastrus paniculatus*, *Coleus barbatus*, *Costus speciosus*, *Cymbopogon martini*, *Gloriosa superba*, *Hippophae salicifolia*, *Lepidium sativum*, *Myrica nagi*, *Ocimum gratissimum*, *Peganum harmala*, *Plantago ovata*, *Potentilla fulgens*, *Saussurea lappa*, *Solanum nigrum* and *Woodfordia frutocosa* etc. The research findings has been compiled in the form of two booklets on medicinal plants seeds.

**Project 18: Raising of Demonstration Plantations for Augmenting Fuelwood and Fodder Resources and Promoting Income Generation in two villages of Uttarakhand (Funded by Uttarakhand Council of Science and Technology) [FRI-343/Silva-31/2006-08]**

**Status:** Under this project, model plantations of fuel, fodder and income generating species were established in two villages in Uttarakhand. Socio-economic survey showed greater requirement of fuel and fodder species in village Jadi, Chakrata whereas income generating species were in greater demand in village Hadam Dandasli, Dist. Tehri Garhwal. Mulbery, Walnut, Chullu, Kathal, Aonla and Carissa etc. were planted as cash generating species. In future, villagers will get fuel, fruits and fodder from this plantations and these sites will promote income generation in the villages. The plantations are now being maintained by the villagers.

## PLAN PROJECTS

**Project 1: Genetic Improvement of *Asparagus racemosus* to enhance root production and saponin content [FRI-340/G&TP-19/2006-09]**

**Status:** Total saponin was estimated in all the twenty sources deployed in the field. The flowering was observed in the month of October 2008 in the field trial. Certain seed sources have exhibited precocious flowering at the age of one year. The variation in seed size and shape has been studied in all seed sources of *A. racemosus* bearing fruits. Data recorded on seeds collected from monocarpellary, bi-carpellary and tri-carpellary ovaries. Leaves variation has been observed in same sources with regards to appearance of green leaves after dryness. Variation in saponin content was also recorded in plants of different phenological appearance of the same sources.

**Project 2: Establishment of breeding arboretum of *Eucalyptus* and production of interspecies hybrids [FRI-319/G&TP-15/2005-10]**

**Status:** Two species of *Eucalyptus* i.e. *E. pellita* and *E. urophylla* flowered synchronously and are inter-crossable as the reciprocal crosses attempted between two species have yielded fruits with seeds. The open pollinated seeds from *E. pellita* have been collected and progenies have been raised. Controlled hybridization attempted for production of tri-hybrids between *E. urograndis* (di-hybrid) and *E. pellita*. Phenological observation recorded regarding flowering and fruiting in all the species of *Eucalyptus* established in the trial.

**Project 3: Impact of biotic factors on forest biodiversity with particular reference to specific threatened sites and species of Uttar Pradesh, Uttarakhand and Delhi [FRI-359/Bot-54/2007-10]**

**Status:** Site selection and phytosociological analysis in north, central and south Delhi ridge forest has been completed. Candidate plus trees of important species were selected from Delhi ridge forest for germplasm collection and *ex-situ* conservation. Threat value assessment of species like *Sophora mollis*, *Dendrocalamus strictus* and *Leonotis nepetifolia* etc. has been completed. Inventorization of threatened sites of Bhagirathi valley, ecotone of Betula-Cedrus, threatened *Erythrina arborescens* and *Berberis asiatica* were studied. Threatened sites of Keshav Prayag, Laxmi Van and Auli were studied for threat value assessment.

**Project 4: Revision of Indian Woods – their identification, properties and uses, Vol. II [FRI-360/Bot-55/April 2007 - March 11]**

**Status:** Microstructure studies of the family Linaceae, Zygophyllaceae and Meliaceae completed as per the feature list given by International Association of Wood Anatomists, 1989.

**Project 5: Planting stock improvement: Inter and intraclonal variations in relation to shoot production, rooting and subsequent growth in Vegetative multiplication garden of *Dalbergia sissoo* [FRI-358/Bot-53/2007-10]**

**Status:** Marked interclonal and intraclonal variations in shoot no., days of shoot emergence and shoot length. Maximum shoot number (26) were produced in clone 66 and 6 while maximum shoot length of 68 cm observed in clone no. 49. Significant differences were observed in rooting percent which was maximum (90%) in 4 years old hedges in clone no. 41 while in aggregate, 73% rooting was observed in 4 years old hedges. There were inter and intraclonal

variations in sucker production which was maximum of 3 in clone no. 9. Five months growth data revealed maximum of 23.8 cm length in Cl. 41 and collar diameter of 5.65 mm in Cl. 88 in 4 years old hedges. Overall treatment effect of three different ages of VMG, the best response in shoot production was observed in 9 years old hedges while rooting and subsequent growth was best in 5 years old hedges while 14 years old depicted decline in rooting percent as well as subsequent growth of propagules.

**Project 6: Field evaluation of different clones of *Dalbergia sissoo* growing in Clonal Seed Orchard at Lachhiwala, Dehradun for their growth and physiological parameters [FRI-357/Bot-52/2007-10]**

**Status:** The best clone regarding height and clearbole was Cl. no. 123 belonging to Nepal followed by Cl. 202, 198 and 235 belonging to Gonda. Chlorophyll Fluorescence parameter FV/Fm was also maximum in clone no. 123 belonging to Nepal followed by clones 202, 196, 194 and 235, all belonging to Gonda. All the clones belonging to Rajasthan have poor growth but pod formation was observed in all the clones. Most of the clones of Rajasthan shed their leaves earlier. No pod formation in 66, 19, 80, 35, 123, 67, 194, 84 and 85.

**Project 7: Molecular analysis of high resin yielding genotypes of *Pinus roxburghii* [1.15/FRI/384/G&TP-20/2007-10]**

**Status:** RAPD analysis carried out for 93 high and low resin yielding genotypes of *P. roxburghii* from Uttarakhand and Himachal Pradesh. A total of fifty RAPD primers were initially used in the present study, of which 18 primers were selected based upon their reproducibility and polymorphic nature for screening of germplasm.

**Project 8: Recommendation of Land use model for degraded forests of Nainital of Uttarakhand [FRI-383/FSLR-25/2007-10]**

**Status:** Adoption of proper land use model for degraded sites may not only increase the productivity but also decrease the soil degradation. Therefore, need to identify existing constraints and suggest proper land use model for forest area of Uttarakhand is imperative. Surveyed the new area at Khurpatal, Naina, Rajgarh, Laldhunga, Herakhan, Lohakhan, Patloghat, Bhimtal, Bhowali and Neelghat etc. and soil profiles were exposed and their morphological properties were recorded. Soil samples from all genetic horizons were collected and brought to the laboratory. Soil samples so far collected are analysed for their physico-chemical properties.

**Project 9: Relative effect of geology, vegetation and climate on soil formation of Uttarakhand [FRI-381/FSLR-23/2007-12]**

**Status:** Uttarakhand forests of North-Western Himalaya is a confluence of all the rock formations resulting in different soil and vegetation types on different climatic zones. The importance of geology in forestry research is of great significance in evaluating the soil fertility status and in managing the soil for greater production. As such, the study regarding this project is being carried out in Uttarakhand State. The area was surveyed and the soil and rocks samples were collected from Dehradun, Nainital, Tehri Garhwal, Pauri Garhwal, Chamoli, Rudraprayag, Udham Singh Nagar, Pithoragarh and Champawat districts of Uttarakhand under different natural forests of *Quercus leucotrichophora*, *Pinus roxburghii*, *Cedrus deodara*, *Picea smithana*, *Abies pindrow* and *Shorea robusta* and miscellaneous forests with different geological formations. Geology of the area was studied. Soil and rock samples so far collected are being analysed for physical and chemical attributes.

### Project 10: Soil organic carbon inventory of Uttarakhand [FRI-382/FSLR-24/2007-12]

**Status:** In this project, Soil Organic Carbon pool is being estimated under different land uses viz. Forests (Silver fir and Spruce, Deodar, Chir, Oak, Sal, Kail and Miscellaneous), Plantations (Shisham, Teak, Chir, Poplar and Eucalyptus), Horticulture (Mango, Letchi, Guava, and Apple), Agroforestry (Poplar + Wheat) and Grasslands of Uttarakhand. Surveyed the various areas and selected the sites. This year, soil samples were collected from different land uses in Dehradun, Tehri Garhwal, Pauri Garhwal, Chamoli, Rudraprayag, Nainital, Udham Singh Nagar, Champawat and Pithoragarh districts of Uttarakhand. Total 1155 samples were collected from different land uses in the above mentioned districts and all the samples were analysed for soil organic carbon, bulk density and coarse fragment.

### Project 11: Econometric analysis of potential and constraints for farm forestry development in Eastern UP [FRI-356/Stat-2/April 2006 - March 10]

**Status:** Field data collection and its entry in the computer is completed.

### Project 12: Development of Organic Cultivation protocols for enhancing productivity of selected medicinal and aromatic plants in Uttarakhand [FRI-359/NWFP-23/2006-09]

**Status:** Organic cultivation protocol for 3 medicinal plants such as *Asparagus racemosus*, *Rauvolfia serpentina* and *Ocimum sanctum* is being finalized using different combinations of FYM, and vermicomposts. A hands on training on cultivation and value addition of medicinal plants was conducted. Optimization of farm input cost, effective soil moisture conservation, soil nutrient replenishment and weed control using mulch were suggested.



*Asparagus racemosus*



*Ocimum sanctum*



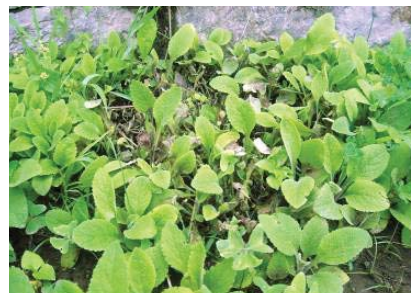
*Rauvolfia serpentina*

### Project 13: Studies on nursery diseases of important medicinal plants of Uttarakhand [FRI-352/NWFP-22/2006-09]

**Status:** Nursery diseases of Medicinal and Aromatic plants in the state of Uttarakhand have been studied. Diseases attacking over 70 medicinal and aromatic plants have been identified. Pictorial report with nursery management requirements are being suggested for reducing disease incidences and increasing productivity of medicinal and aromatic plants.



Disease on *Coleus barbatus*



Nursery Disease of *Digitalis purpurea*



Infection on *Gymnema sylvestris*

**Project 14: Extent and evaluation of die back of Shisham (*Dalbergia sissoo*) and identification of disease resistance sources [FRI-385/Path-22/2007-10]**

**Status:** Combined tours were undertaken in Rishikesh, Lacchiwala Range, Mejia, Durgapur (West Bengal) and Mattewala Range, Ludhiana. The disease severity and incidence were estimated and pathogen was collected. Soil samples and ecological parameters were also taken for future study. Molecular characterization of *Fusarium solani* by RAPD-PCR was done and resistant/susceptible germplasm of *Dalbergia sissoo* were DNA fingerprinted.

**Project 15: Mortality of Kikar (*Acacia nilotica*) in Punjab and Haryana and its management [FRI-386/Path-23/2007-10]**

**Status:** Areas in Punjab viz. Ludhiana, Amritsar, Firozpur, Bhatinda and Hoshiarpur were visited for disease incidence. Evaluation of mortality in Kikar with special reference to Ganoderma root rot and heart rot caused by *Phellinus badius* were estimated. Soil samples were collected.

**Project 16: Screening and hybridizing Indian isolates of *Cordyceps sinensis* for enhanced production of bioactive principles [FRI-387/Path-24/2007-10]**

**Status:** Thirty isolates of *Cordyceps sinensis* were brought into pure culture. Cultural characterization of these isolates was done. Growth of *Cordyceps sinensis* on different nutrient media was studied. The isolates were grown in Jhingora as per the protocol developed. Seven isolates were powdered in liquid nitrogen after a growth of 6 months and were analyzed for their bioactive principles by HPTLC. Some of the bioactive principles have been found to be in a higher quantity in the cultivated *Cordyceps sinensis* in comparison to the wild. Cordycepin was detected in these cultures, however, ergosterol was found in only one culture.



Vegetative growth of *C. sinensis* on Mandua (Left) and Jhingora (Right)

**Project 17: Molecular variability in *Cylindrocladium quinqueseptatum* causing leaf and seedling blight in Eucalyptus [FRI-388/Path-25/2007-10]**

**Status:** Seventy three isolates of *Cylindrocladium quinqueseptatum* from Uttarakhand, Punjab, Haryana and Uttar Pradesh were analyzed through RAPD-PCR and maximum polymorphism was obtained by the operon primers of 'E' series. The UPGMA cluster analysis of 284 loci led to the identification of 11 population lines and an outlier. The ITS region amplification with primer ITS 1 & 4 was done and 18 sequences were submitted to gene bank (NCBI). Three beta tubulin gene sequences were also submitted to the gene bank. All the above sequences were granted accession number and were published on web site of the gene bank (<http://www.ncbi.nlm.nih.gov>).

**Project 18: Identification and Evaluation of Disease Resistance in Different Genotypes of Poplar [FRI-353/Path-21/2006-11]**

**Status:** Growth and disease status of G-48, Udai, WSL-22 and WSL-39 at Jawahar Nagar (Udham Singh Nagar) and Maheshwari (Haridwar) nurseries were recorded monthly since July till October. Isolation of different pathogens (*Alternaria* (5), *Drechslera* (25), *Phoma* (2), *Sclerotium rolfsii* (1), etc) from the sample collected from the site and their detailed symptoms were captured. Two generations of crosses (2006 & 2007) of common poplar genotypes are



quantified for growth as well as diseases regularly. One hundred seventy genotypes were also scanned for growth and disease status. Pathogenic reactions of shoot juveniles of G-3 for 33 isolates of *Drechslera* were tested. Some of the isolates like D-2, D-4, D-19, D-31, D-32, and D-34 were more aggressive in comparison to others as they initiated blight symptoms earliest after 3h. Most of the aggressive isolates (D-2, D-19, D-31 and D-34) exhibited 100 percent foliage blight while two isolates i.e. D-4, D-32 also showed 86.7 and 96.7 percent blighted foliage, respectively within 48h. In another experiment, reactions of stem seedlings against 50 isolates were recorded for G-3 clone. Some of the isolates like D-12, D-18, D-31, D-32, D-40, D-44 and D-45 given wilting symptom within 3h. Blighted symptom was also expressed within the same observation period by isolates like D-9, D-10, D-43, D-48, D-49 and D-50.

### **Project 19: Creation of Photo Gallery for FRI at Shatabdi Van Vigyan Kendra, Dehradun [FRI-457/Path-31]3**

**Status:** In consultation with the designer hired for designing the gallery the project team has segregated the entire gallery into six sections – Genesis, Architecture, Personalities, Events, Visitors and Research. The civil and electrical works in the gallery are at the verge of completion. More than 200 photographs have been sent for digitization and framing to the firm hired for digitization and framing of the photographs and documents. Artifacts to be kept in the gallery have been identified and their collection has been initiated. Write-ups and titles of the photographs were prepared and stories created.

### **Project 20: Bioconversion of forest waste lignocellulosic biomass into ethanol [FRI-361/C&P-18/2007-10]**

**Status:** Detoxified hydroly sates of *Lantana camara* and Pine needle were subjected to fermentation with *Saccharomyces cerevisiae*. *Lantana* hydrolysate after fermentation yielded higher alcohol than pine needle after 54 hrs. of reaction time.

In order to decrease the toxicity, increase the fermentability efficiency of the hydrolysate and to make the process economical viable, *Lantana camara* and Pine needle were extracted with different solvents- Petroleum ether, Alcohol Benzene and Methanol. The extractives removal was more in Alcohol benzene in case of Pine needle whereas extractive solubilities were found maximum in Methanol in case of *Lantana camara*. The hydrolysis of extractive free biomass is under progress.



Growth of *Saccharomyces cerevisiae*

### **Project 21: Utilization of soda spent black liquor lignin for value added products [FRI-361/C&P-19/2007-10]**

**Status:** Soda spent black liquors collected from M/S Shreyans Papers Ltd, Ahmedgarh (Punjab) and M/S ABC Papers Ltd. Sailakhurd, Distt. Hoshiyarpur (Punjab) were analysed for their physico-chemical properties. Prototype for process development for carrying out modification reactions was set up. The soda spent black liquors were modified by the sulphonation at room temperature by passing SO<sub>2</sub> gas initially for 20 minutes. The modified products were concentrated for higher dry solid content. Further modification reactions to get optimum sulphonation are under process.

**Project 22: Role of Temple Forests in rejuvenating microclimate of some villages of Uttarakhand [FRI-369/Eco-24/April 2007-March 10]**

**Status:** Phyto-sociological studies of vegetation of Nagdev Forest Range have been done. The number varied according to the slope / aspect of the sites. Soil samples collected from both the study sites were analyzed for their physico-chemical properties, which didn't show much difference in both the sites. Daily compilation of Meteorological data from both the weather stations is done. Tabulation, conversion of meteorological data etc. is in progress.

**Project 23: Utilization of Fungi for Biofertilizer of Industrial Waste Water [FRI-346/Eco-20/April 2006-09]**

**Status:** Different fungi like *Aspergillus niger*, *Schizophyllum commune*, *Earliela scbrosa*, *Funalia leonine*, *Lenzylus vespacia*, *Polyporus gramocephalus*, *Trametes lactinea*, *Trametes versicolor* and *Trichoderma viride* were tested with tannery effluent and some of them showed good bioremediation potential. Other fungi were also tested against pulp & paper effluents for their adaptive nature and their capability to decolorize and bioabsorption of heavy metals from the effluents.

**Project 24: Development of air pollution biomonitoring station for Air Quality Assessment of Dehradun [FRI-368/Eco-23/2007-10]**

**Status:** Biomonitoring of air quality studies were performed for assessing the air quality by using plant biochemical indicators. Sensitivity index were developed for different species. Air quality index was also developed for Shatabdi Van Vigyan Kendra, Dehradun. Already established correlation between sensitivity index value and Air Quality index for different species were used for air quality estimation of that area.

**Project 25: Ecological Impact of urbanization on floral diversity in natural and man-made forests of Doon Valley [FRI-368/Eco-23/2007-10]**

**Status:** Diversity of trees was observed in increasing trend from highly disturbed to partially disturbed forest. Disturbances invite invasion of herbaceous species. Decrease in richness of trees from partially disturbed forest to highly disturbed forest was observed. Temperature decrease from open to partially disturbed forest was observed, whereas it was vice-versa in case of Relative Humidity (%) during sunny day observation. Socio-economic status of the village and towns located on forest fringe reveals dependency on forest.

**Project 26: Ecological Impact Assessment of invasion Lantana, its removal and subsequent Restoration of Habitats in Rajaji National Park of Tropical Moist Forests [FRI-367/Eco-22/2007-10]**

**Status:** Monitoring of vegetation was carried out in two years old Lantana removal sites under Sal (*Shorea robusta*) and mixed deciduous forest in Rajaji National Park. Soil samples from these sites were also collected to monitor the change in soil chemical attributes.

**Project 27: Biology and control of bamboo, *Phloeobius crassicollis* damaging green standing bamboo [FRI-374/FED-28/2007-10]**

**Status:** Studies on the biology of *Phloeobius crassicollis* was taken up in the laboratory. The beetle emerges during the month of May and June and feeds on the outer surface of the bamboo culms preferably near the nodes. It deposits eggs at the nodes conceded in this scale. Larvae feed on the woody tissues of node and internode and deposit frass inside the hollow. Larval period is prolonged from May-June to April-May. Pupation takes place in a pupal cell near the node in a crowded manner. Pupal period lasts for 20 days. Life cycle is completed in one year.

The incidence of attack was 3.5 to 18% on *Bambusa bambos* at Dehradun and 7.18 to 9.21% at Sahansara, Sakumbhari Range, Saharanpur Forest Division.

Chemical control experiments were carried out in the field using systemic and contact insecticide by internodal injections. Contact insecticide performed better than systemic insecticides.

**Project 28: Butterfly diversity in moist temperate forests of Garhwal: Evaluating species of conservation priority and indicator taxa of habitat disturbance in Ban Oak forest ecosystem [FRI-348/FED-23 /2006-09]**

**Status:** Oak forest sites in Garhwal namely, Kedarnath Musk Deer Sanctuary (Chamoli & Rudraprayag District), Govind Wildlife Sanctuary (Uttarkashi District), Benog Sanctuary-Mussoorie-Chakarata (Dehradun District); Kotikimoi RF- Dhanaulty RF- Nagtibba RF-Ghoraghati RF; Bhuddakedar RF -Pangarana RF (Tehri Garhwal District), were evaluated for butterfly diversity under different habitat conditions and altitudes. Data has been collected on the abundance, distribution, habitat preference, food plants and threatened status of over 225 species.

**Project 29: Bio-ecology and control of Oak stem borer, *Aphrodisium hardwickianum* (white) (Coleoptera: Cermbycidae) [FRI-348/FED-23/2007-10]**

**Status:** Bio-ecology of the borer was studied on standing dead trees in Dangan village in Govind Wildlife Sanctuary (Uttarkashi district) and Kanatal (Dhanaulty RF in Tehri Garhwal District) and also in the laboratory on Ban and *Moru oaks* along with data on base line parameters of stands. Natural enemies of this borer were also identified.

**Project 30: Upgradation and computerisation of National Insect Forest Collection (NIFC) [FRI-233/FED-16/2003-10]**

**Status:** In the year 2008-09 (up to September 2008) digital imaging work was taken up and about 4000 species were digitally imaged. In all, about 50,000 pictures have been taken. Copyright symbol, scale, name of collection, division and institute was also incorporated in each picture. About 20,000 pictures have been edited.

Database for proper management of National Forest Insect Collection (NFIC) is in the process of development. Seventeen thousand insect species, mainly of forestry importance, are represented in the collection. Forty four insect species not represented in the NFIC were also incorporated in the collection.

**Project 31: Studies on biodiversity of parasitic Chalcidoidea (Hymenoptera) of Uttarakhand [FRI-375/FED-29/2007-11]**

**Status:** Survey and collection of parasitic Chalcidoidea (Hymenoptera) was done in the Tehri District. Various places where collection was made were: Rani Chauri, Badshahithaul, Chamba, near Tehri dam site, Devali (near Ghansayali) and Kadukhal. Collections were also done in the doon valley to study the temporal distribution of the chalcid families. Various places where collection were done were: Barkot, Lachhiwala, Karvapani and Kalsi etc. Three different collection methods viz. sweeping, yellow pan trap and Malaise trap were used to collect the samples. From the preliminary observations, Family Eulophidae is the most abundant and species rich family in the area followed by Pteromalidae, Encyrtidae, Eucharitidae, Mymaridae, Eupelmidae, Aphelinidae and Trichogrammatidae.

A new record with the description of a new species of genus *Cynipencyrtus* (Chalcidoidea: Tanaostigmatidae) from India was also made. This new species was collected from Badshahithaul under the *Quercus leucotrichophora* trees.

**Project 32: Taxonomic studies of parasitoids belonging to subfamily Microgastrinae (Hymenoptera: Braconidae) of Uttarakhand and Haryana [FRI-371/FED-25/2007-11]**

**Status:** Survey and collection of parasitic Microgastrinae (Hymenoptera: Braconidae) was done in the Tehri district. Various places where collection was made were Rani Chauri, Badshahithaul, Chamba, near Tehri dam site, Devali (near Ghansayali) and Kadukhal. Collections were also done at Barkot, Lachhiwala, Karvapani, Kalsi (Doon Valley) in the Uttarakhand. Chichroli Ambala and Yammuna Nagar of Haryana.

First record with the description of a new species of genus *Cotesia koebelei* (Riley 1889) on *Hyposidra talaca* Walker from India was also made. This new species was collected from Barkot Range.

Collection, identification and Updating of *Cotesia glomeratus* (Linnaeus 1758), on *Pieris brassicae* Linn. *Cotesia taprobanae* (Cameron 1887), on *Stauropus alternus* Walk. *Proapanteles* (*Proapanteles*) *oblique* (Wilkinson 1928) on *Diacrisia obliqua* Walk. *Dolochogenidea stantoni* (Ashmead 1904) on Pyralidae larvae. Two species of *Apanteles*, two species of *Microplitis* are also collected.

**Project 33: Studies on the development of biopesticides from *Eucalyptus* hybrid [FRI-344/Chem-16/2006- Sept. 09]**

**Status:** Different extracts and pure compounds were screened for their antifungal and insecticidal activities. Three samples namely EO, MET and AS exhibited antifungal activity against *Ganoderma lucidum* at 0.50%, 1.0% and 2.0% concentration respectively. The above samples did not exhibit insecticidal activity against larvae of *Dichomeris eridentis*. Formulations of MET and EO and ursolic acid were prepared for their antifungal screening. A process was developed for the isolation of ursolic acid from the leaves and patent application filed.

**Project 34: Studies on *Sapindus mukrossi* fruits for their utilization [FRI-362/Chem-18/2007-10]**

**Status:** Extraction of the seed kernel was done with methanol. Fractionation of the methanol extract was done in acetone, benzene and methanol fractions. Column chromatography of the acetone extract was done. Chloroform extract of *Sapindus* seeds collected from FRI and Gyarahdevi were tested against 8 forest fungi namely, *Alternaria* sp., *Colletotrichum gloesporioides*, *Phoma* sp., *Phomopsis dalbergiae*, *Fusarium oxysporum*, *Ganoderma lucidum*, *Rhizoctonia solani* and *Trichoderma pilluliferum* at different concentrations i.e. 0.5, 1.0, 1.5 and 2.0%. Chloroform extract (FRI) showed IC<sub>50</sub> against all fungi except *F. oxysporum* (47%) at the highest concentration of 2%. *P. dalbergiae* registered highest inhibition of 88% while *Alternaria* sp. showed lowest inhibition (57%). Chloroform extract of Gyarahdevi exhibited IC<sub>50</sub> against all the test fungi barring *Alternaria* sp. and *F. oxysporum* (47% each). Further, only *C. gloesporioides* showed less than 70% inhibition while *P. dalbergiae* had highest inhibition of 91%. Minimum Inhibitory Concentration (MIC) of Chloroform extract was also worked against *C. gloesporioides* (2.5%), *Phoma* sp. (3.0%), *P. dalbergiae* (3.0%), *G. lucidum* (1.5%), *R. solani* (4.0%) and *T. pilluliferum* (5.0%).

Chloroform extract of FRI was fungicidal against *C. gloesporioides*, *Phoma* sp., *P. dalbergiae* and *G. lucidum*. While, Methanol extract of FRI was fungicidal for *C. gloesporioides*, *Phoma* sp., *P. dalbergiae*, *G. lucidum* and *R. solani* and fungistatic for *T. pilluliferum*. Effect of Methanol

extract of FRI on spore germination of forest fungi was quantified and it was 94% and 89% inhibition for *C. gloesporioides* after 24 and 48 h, respectively (at very high concentration of 13%). Similarly, varied and high inhibition in the spore germination was recorded for *Phoma* sp. (2.5%; 87 and 83% after 24 and 48h, respectively), *P. dalbergiae* (3%; 89 and 86% after 24 and 48h, respectively), *G. lucidum* (6%; 89 and 86% after 24 and 48 h, respectively) and *T. pilluliferum* (6.5%; 88 and 82% after 24 and 48 h, respectively).

**Project 35: Chemical marker of *Eucalyptus* hybrids for wood durability and foliar dense: Characterization, heritability and genetic correlation [FRI 363/Chem-19/2007-10]**

**Status:** Citronellal (CNAL), citronellol (CNOL) and Ursolic Acid (UA) were characterized in the foliage of *Eucalyptus citriodora* (EC) and were found to exhibit bioactivity against *Cylindrocladium quinqueseptatum*. GC-FID method for quantification of monoterpenes in Eucalyptus foliage was developed. Foliage of different phases from EC, *E. torelliana* (ET) and their hybrid were collected monthly and their hexane extracts were prepared to study phenological variability of bioactive foliage monoterpenes. Extraction of the foliage with petroleum ether: acetone (4:1) for phenological variability of the UA was also initiated and continued. Quantification of CNAL and CNOL in EC foliage using GC-FID analysis of their hexane extracts was initiated and continued. Methanol extracts, EC3 and ET3, from heartwood of the EC and ET, respectively were found active against brown rot and white rot fungi. These extracts were further fractionated into ethyl acetate and n-butanol fractions. Gallic acid and protocatechuic acid were characterized in the EC3. Further work is in progress.

**Project 36: Isolation and characterization of phytoecdysteroids from *Achyranthes aspera* and *A. bidentata* and their effect on the economic traits of *Bombyx mori* L. [FRI-364/Chem-20/2007-10]**

**Status:** The leaves, stem, roots and seeds of *Achyranthes aspera* and *A. bidentata* were collected from the adjoining areas of Dehradun. The air dried and powdered parts were extracted with petroleum ether, acetone and methanol respectively and yield of the extracts was determined. Two pure compounds were isolated and characterized from the methanol extract of *A. aspera* seeds. Nine extracts and three pure compounds of *A. aspera* and six extracts of *A. bidentata* were tested on silk worm (*Bombyx mori*) for their uniform maturity. Six extracts and two pure compounds exhibited 80% or more maturity of silk worm in 18 hrs. In case of control 69% maturity was observed. The testing of extracts is in progress. The fatty oil content in the *A. bidentata* seeds was found to be 6.1%.

**Project 37: Studies on the utilization of seed polysaccharide from *Strychnos potatorum* [FRI-365/Chem-21/2007-10]**

**Status:** Carboxymethylation of *Strychnos potatorum* seed powder was carried out using sodium hydroxide and chloroacetic acid. Reaction conditions viz. effect of reaction time, concentration of monochloroacetic and sodium hydroxide and effect of solvent ratio were optimized. Rheological properties of the product with maximum DS (0.33) were studied. A pure compound was isolated from the methanol extract of the seeds.

**Project 38: Comparison of Hydrological regime of a micro watershed having dense Oak forest with a degraded micro watershed (in Mussoorie) [FRI-370/Eco-25/ April 2007 to March 12]**

**Status:** Data collection of the two micro watersheds is going on. Laboratory analysis of data samples of sediment yield and isotopic analysis has been completed. Analysis of data of the year 2008-09 has been completed.

**Project 39: Quality assessment of timbers by using ultrasound and microwave techniques [FRI-377/FPD/(TM)-63/2007-10]**

**Status:** Studied the effect of moisture content on ultrasonic velocity and microwaves attenuation at 9.89 GHz in timber. Ultrasonic velocity and strength properties (MOE and MOR) of *Cedrus deodara* and *Dalbergia sissoo* have been determined. Testing of *Tectona grandis* and defect detection in timber is under progress.

**Project 40: Extent and evaluation of dieback of Shisham (*Dalbergia sissoo*) and identification of disease resistance sources [FRI-385/Path-22/2007-10]**

**Status:**

- Physiological parameters viz., photosynthesis, transpiration, internal CO<sub>2</sub> and leaf temperature in field and laboratory conditions collected.
- Biochemical estimation of chlorophyll, carotenoids, sugars, protein, starch, amino acids, phenols also collected.

**Project 41: Clonal screening of *Dalbergia sissoo* in relation to nitrogen utilization and biomass production [FRI-114/Bot-62/2008-13]**

**Status:**

- Nine clones of *Dalbergia sissoo* viz., 9093 (1), 9058 (2); 9058 (1); 9065 (2); 9064 (2); 9063 (1); 9015 (2), 9049 (1) and 9065 (1) shoot was taken from the pot raised plants and prepared softwood cuttings for multiplication.
- After hormonal treatments cutting material was kept in mist chamber for rooting.
- Some hardwood cuttings were also prepared and kept in mist chamber for rooting.
- All material kept for rooting shows sprouting. After that it will be transferred for hardening.

**Project 42: Impact of major forest invasive plants on the biodiversity of Chakrata Forest Division [FRI-394/Silva-37/2007-10]**

**Status:** Selected three sites in different altitudinal zones i.e. tropical, sub-tropical and temperate in Chakrata for collection of field data. Field data were collected from the plots, which are affected by the Forest Invasive Species (FIS) as well as from un-affected plots by laying out of nested quadrats in similar ecological conditions. The forest areas included are Sal forest in tropical zone, banj and chir forests in sub-tropical zone and deodar and kail in temperate zone. The species composition and regeneration status of desired species have been found out. The forest areas are affected by the Forest Invasive Species (FIS) like *Eupatorium odoratum*, *Lantana camara*, *Aegrotum coinizoides*, *Artemisia vulgaris* and *Sarcococa saligna* etc.

**Project 43: Role of allelopathy on regeneration in Silver fir (*Abies pindrow*) and Spruce (*Picea smithiana*) forests – Effect of natural leachates on seed germination [FRI-391/Silva-34/2007-10]**

**Status:** Cones/seeds of Silver fir, Spruce, Deodar, Kail and understorey plants have been collected from Chakrata and Mussoorie. Identification of under story species of Silver fir and Spruce forests has been completed. Leachates/bioassay has also been prepared using specified techniques in laboratories for carrying out effect of leachates on germination of coniferous species.

**Project 44: Effect of *Populus deltoides* on shade loving medicinal plants crops [Project No. FRI-305/SF-8/2005-11]**

**Status:** Plants of *Asparagus recemosus* and Chitrak (*Plumbago zeylanica*) are being maintained under the shade of *Populus deltoides* in the Demo plot at Premnagar, Dehradun. Biomass of *Plumbago zeylanica* is taken under poplar shade. Growth of poplar has been recorded. Plantation of *Aloe vera* is done under poplar shade and in open area in Demo plot Premnagar.

**Project 45: Tree Crop interactions: Effect of *Melia* spp. on crops [FRI-306/SF-9/2006-11]**

**Status:** Demonstration plots of *Melia composita* are established in farmer's field at Chotla Kalan and Handsera in district Mohali and at Hukran in district Hoshiarpur in Punjab State. Monitoring and maintenance with pruning operation is being done whenever required. Soil studies of the same plots are in progress. Estimation of crop yield has been initiated. Maintenance of seedlings of *Melia composita* has been done. Plants are distributed to the interested farmers every year. Work on canopy management has been done through pruning of *Melia composita* plants.

## EXTERNALLY AIDED PROJECTS

**Project 1: Status of soils and organic carbon store in Giri Catchments of Himachal Pradesh [FRI-314/FSLR-19/External/December 2007 to December 09]**

**Status:** The new areas of the Giri Catchments were surveyed. Dug out the soil profiles were exposed in Kishankaur, Kirganu, Chakahan, Dhanrain, Shilaji and Chambidhar etc. under different land uses viz. miscellaneous and Chir forests and soil samples were collected from different genetic horizons. Geological studies of these areas were also studied. Soil samples for organic carbon estimation were also collected from different land uses from various locations. Bulk density samples were also collected from the same sites. Soil samples collected so far were analysed for various attributes.

**Project 2: Farm Forestry extension and its marketing and economic linkages [FRI-367/RSM-18/External/2005-09]**

**Status:** Draft Final Report submitted to the funding agency and also presented before review committee of Punjab Forest Department. The further suggestions and request of the funding agency is being incorporated in the report.

**Project 3: Strengthening of Monitoring, Assessment and Reporting on Sustainable Forest Management [MAR-SFM]**

**Status:** Meetings of National Steering Committee and National Network were convened on MAR-SFM under FAO project.

**Project 4: Development of Mechanism for Computation and Forecasting of Growing Stock in strip Forests of Haryana taking into account the yearwise plantation and survival of relevant species [FRI-289/RCS-2/External/2006-10]**

**Status:** Data of growth statistics from the selected three agro-climatic zones of Haryana for all the three types of strip forests have been collected and analyzed by entering in to excel sheets. Collection of data related to felling and volume calculation is in progress. Interim report has been submitted to funding agency indicating that there is wide spatial variability among the dia classes for plantations sites of road and canal side.

**Project 5: Development of Non-destructive harvesting methods for medicinal plants [No. GO/UA-07/2006-NMPB/2005-08]**

**Status:** Experimental trials related to non destructive harvesting methods in respect of project species viz. *Bergenia ligulata* and *Valeriana jatamansi* at NWFP Division Nursery and at Chakrata have been conducted. Seed germination of Picrorhiza and Rheum species were also carried out. A shade house at NWFP division Nursery, FRI campus and a poly house at Chakrata Nursery have been constructed. For demonstration of harvesting techniques to farmers and sharing of knowledge with forest officials, a field tour to Rewa district of Madhya Pradesh and in Chamoli district of Uttarakhand were organized.

**Project 6: Exploration, conservation & propagation of important medicinal climbers of Garhwal Himalayas [No. GO/UA-15/2006-NMPB/2006-09]**

**Status:** The work as per objective has been accomplished viz. explored 70 wild climber species in Garhwal Himalayas with their medicinal value. Conserved 25-30 species at the conservation site and propagation package has been developed for two species *Celastrus paniculatus* and *Ichnocarpus frutescence* suitable to the region. Extension materials (posters, brochures etc.) have been prepared. Few diseases have been identified in important medicinal climbers in wild and at conservation site.

**Project 7: Standardization of drying and storage protocol and quality assessment of selected commercially cultivated medicinal plants of Uttarakhand [GO/UA-08/2006-07-NMPB/2008-10]**

**Status:** Experimental drying and storage of *Asparagus racemosus*, *Rauwolfia serpentina* and *Aconitum heterophyllum* obtained from farmers cultivating these species in Uttarakhand, has been undertaken and quality profile of these species as per Ayurvedic Pharmacopoeia standards is being worked out.

**Project 8: Biological control of root diseases of some medicinal plants using selected antagonistic fungi (NMPB sponsored) [FRI-411/Path-26/External/March 2007-February 10]**

**Status:** Vascular wilt diseases in *Asparagus racemosus* caused by *Fusarium solani*, in *Stevia rebaudiana* by *Fusarium solani* and *Sclerotium rolfsii*, in *Wrightia tometosa* by *Fusarium solani*, by *Fusarium* sp. in *Rheum australis* and by *Macrophomina phaseolina* in *Valeriana wallichii* have been identified and their pathogenicity was established. Eight isolates of *Trichoderma* species have been screened against *Fusarium solani* and *Sclerotium rolfsii* for their antagonistic efficacy. *T. harzianum* (I), *T. piluliferum* and *T. viride* were found effective against *S. rolfsii* whereas *T. piluliferum* and *T. harzianum* (II), *T. viride* and *T. virens* were effective against *F. solani*.

Field experiments were conducted against *Sclerotium rolfsii* vascular wilt of *Stevia rebaudiana* and *Fusarium solani* vascular wilt of *Asparagus racemosus* using six *Trichoderma* species in bagasse formulation. *Trichoderma viride* formulation was found significantly superior to all the treatments and control in increasing the number and biomass of leaves of *Stevia rebaudiana*. In *Asparagus racemosus*, *Trichoderma piluliferum* and *T. viride* were significantly superior to other treatments and control in increasing the root biomass.

**Project 9: Management of fungal deterioration of medicinal plant produce in storage by the use of botanical fungitoxicants [UCOST funded]**

**Status:** Periodic isolations of fungi were made from the stored *Withania somnifera* (roots), *Stevia rebaudiana* (leaves), *Cinnamomum verum* (bark) and *Carum carvi* (seeds). *Alternaria alternata*,



*Aspergillus flavus*, *A. niger*, *A. terricola*, *Botrytis cinerea*, *Cladosporium cladosporioides*, *Fusarium solani*, *Gliocladium roseum*, *Penicillium implicatus*, *P. restrictum*, *Phymatotrichum* sp., *Rhizopus nigricans*, *Thielaviopsis bassicola* and *Trichoderma* sp. have been identified during periodic isolations. Volatile effect of lemon grass oil, tulsi oil, peppermint oil, garlic oil and citronella oil and petroleum extracts of leaves of eucalyptus, seeds of ajwain and fruits of camphor were tested for their antifungal activity against storage fungi. All the tested oils except tulsi oil have fungicidal effect on checking the growth of fungi, whereas, tulsi oil has a fungistatic effect for 15 days.

**Project 10: Molecular variability in *Cordyceps sinensis* isolates of Uttarakhand (UCOST Funded) [No. UCS&T/R&D/LS-74/07-08/2572/1, dated 01.01.2008]**

**Status:** DNA amplification of 30 isolates of *Cordyceps sinensis* were done with 10 operon primers. The polymorphism was recorded and the population lines were identified based on the cluster analysis.

**Project 11: Eco-restoration studies in Uranium Mines**

**Status:** The seven species found suitable for tailing pond revegetation have been further propagated on the tailing pond. Plant growth of these species viz., *Pogostemon benghalense*, *Colebrookea oppositifolia*, *Jatropha gossypifolia* and *Dodonaea viscosa*, *Imperata cylindrica*, *Furcraea foetida* and *Saccharum spontaneum* has been evaluated. Uptake of radionuclides (uranium, polonium and radium) has been evaluated in seedlings grown on tailing pond as well as raised in experimental containers at H.P.U. Jaduguda. Forest species of ethnobotanical relevance have been recorded on the basis of ethnobotanical survey undertaken in the surrounding villages. Total 81 species are being collected by local villagers for medicinal and other uses.

**Project 12: Development of RS base bioclimatic index (Funded by Department of Space, Space Application Centre, Ahmedabad ISR) [FRI-425/Eco-31/External/2008-10]**

**Status:** Selection of areas of change for ground verification (species composition) in Bedni Bugyal has been done. Identification of benchmark points for permanent sites to monitor species composition and validation of changes in timberline and other classes over the few decades in relation to the altitudinal gradient has been done.

**Project 13: Utilization of economic potential of *Lantana camara* [FRI-401/Chem-22/External]**

**Status:** Carboxymethyl Cellulose (CMC) was prepared from  $\alpha$ -cellulose isolated from *Lantana camara*. Reaction conditions were optimized to prepare CMC by varying concentration of alkali, material to liquor ratio, alkalization time, reaction time, temperature etc. using cheap solvents. Detailed comparisons of carboxymethylation studies from  $\alpha$ -cellulose using monochloroacetic acid and its acetate were done to prepare CMC.

**Project 14: Prospecting for utilization of unexplored ethnobotanically important medicinal plants of Uttarakhand [FRI-402/Chem-23/External/2007-09]**

**Status:** Tubers from *Dicentra paucinervia* (DP) grown in FRI- NWFP nursery, *Pavetta indica* (PI) leaves and *Scindapsus officinalis* (SO) leaves and stems were collected and processed. Their respective extracts were prepared using different solvents. Presence of protopine and allocryptopine, the physiologically important alkaloids, in the tubers of DP was confirmed by comparison with the authentic compounds. Using the HPTLC method, the quantity of these alkaloids were determined in the tubers of the plant grown in the natural habitat, in Dehradun and were found to be comparable. Ursolic acid and  $\beta$ -sitosterol were characterized in the leaves of PI and SO respectively.

**Project 15: Phytochemical examination of bioactive agents from plants of therapeutic value [FRI-419/Chem-25/External/April 2007 to March 10]**

**Status:** Petroleum ether, Chloroform and methanol extracts of *Malaxis acuminata* pseudobulbs, *Drymaria cordata* (whole plant) and *Mussaenda glabra* (bark) were prepared. Fractionation of the methanol extract was done in ethyl acetate and butanol fractions. Column chromatography of the petroleum ether extract of *Malaxis acuminata* pseudobulbs was done. Three pure compounds MAP1, MAP2 and MAP3 were isolated from petroleum ether extract. Column chromatography of the petroleum ether extract of *Drymaria cordata* was done. Three pure compounds DRP1, DRP2 and DRP3 were

**Project 16: Creation of Bioinformatics facility under BTIS net Program for Biology Teaching [FRI-443/IT-01/External/2007-09]**

**Status:** The Bioinformatics facility has been created with hardware, software and civil infrastructure. The information system development is going on in domain of Biodiversity. One national workshop has been organized on Biodiversity Informatics

**Project 17: Screening and identification of the lower Asarone ( $\beta$ -Asarone) containing variety/populations of *Acorus calamus* L. and its multiplication to enhance its economical and medicinal value [FRI-434/G&TP-22/External/2007-10]**

**Status:** Germplasm of *Acorus calamus* collected from 20 different sources/populations from the natural range of its distribution covering the states of J&K, Uttarakhand and Himachal Pradesh. The collected material has been established at FRI campus in the form of germplasm bank. Morphological parameters of the collected sources were recorded. Root sample of 15 sources prepared for oil extraction and oil extracted of 20 sources. Estimated  $\beta$ -Asarone content from the samples of all 45 collected sources.

**Project 18: Study of Floristic Diversity of Shiwalik Hills of Haryana [FRI-399/Bot-56/External/April 2007 to June 09]**

**Status:** Vegetative analysis of different blocks of Haryana was carried out. In the study, new records have been reported for Haryana (such as *Ehretia acuminata* R. Br. *Pavetta indica* sensu Hk.f., *Olea glandulifera* Wall. ex G. Don., *Myrsine fricana* Linn., *Clematis natans* Royle, *Marsdenia roylei* W. & A., *Lepidagathis incurva* D. Don., *Swertia alata* (Royle ex D. Don (Cl) and *Tucurium quadrifarium* Buch.-Ham.).

**Project 19: Development of micropropagation protocol for the economically important bamboos: *Dendrocalamus hamiltonii* and *Gigantochloa atter* [August 2007 to December 09]**

**Status:** Axillary bud break was achieved on MS medium supplemented with BAP for both the bamboos. *In-vitro* shoot of *D. hamiltonii* was multiplied on MS medium supplemented with cytokinin. Experiments are going on for *in-vitro* multiplication of *G. atter*. Initial rooting response was obtained on MS medium supplemented with IBA in *D. hamiltonii*.

**Project 20: Planting stock improvement of some indigenous fuelwood and fodder tree species for higher biomass production in relevance to hilly region of Garhwal Himalaya [FRI-337/Bot-51/External/2006-09]**

**Status:** The seeds and cuttings of fuelwood and fodder tree species were collected from superior phenotypes from different altitudes (from 600 to 2000m a.s.l.) of Garhwal Himalaya. Study of seed characteristics (seed length, width, thickness, weight and germination percent) of collected seeds from different altitudes. Seeds of *Quercus leucotrichophora*, *Robinia pseud-acacia*, *Grewia optiva*, *Toona ciliata*, and *Ougeinia oojeinensis* were sown in polybags filled with soil, sand and

FYM in different three nurseries. Cuttings of *Populus ciliata*, *Salix alba*, *Morus serrata* and *Alnus nepalensis* were planted in nurseries. Data were collected from previous planting material growing at different nurseries. Training-cum-distribution of quality planting material was conducted at three nursery sites viz., Fatehgram, Herbartpur, Nagrasu, Rudraprayag and Jarmola, Tons Forest Division, Uttarkashi. Total 129 persons particularly women were trained for nursery technology. Total 340 persons including women were collected the planting material from different three nursery sites.

**Project 21: Bamboo improvement for rural and tribal Communities: integrating recent technologies (Funded by National Bamboo Mission) [FRI-416/Bot-61/External/2007-09]**

**Status:** Planting material of hill bamboo species viz., *Sinarundinaria falcata*, *Arundinaria jaunsarensis*, *Thamnocalamus falconerii* and *Thamnocalamus spathiflora* were collected from Garhwal region. The collected material of these species have been planted at Hill Bambusetum, Khirshu, Pauri Garhwal. Germplasm Bank of *Dendrocalamus strictus*. The collection of germplasm from different areas of Uttarakhand, Rajasthan, Chandigarh, Himachal Pradesh and Kanpur was done and the planting material was planted in gunny bags and maintained in Plant Physiology Glass house premises. The already collected planting material of *D. strictus* have been field planted at Pavilion Ground of FRI New Forest Campus, Dehradun. The bamboo clonal nursery was inaugurated by Dr. S.S. Negi, Director, FRI, Dehradun. The planting stock is prepared in Physiology glass house premises and transferred to nursery at City Campus, Dehradun. One week training was organised at Clonal Nursery, City Centre, Dehradun for the Forest Officers of Uttarakhand Forest Department.

**Project 22: Development of Genetically Superior Planting Material and cultivation technology for increasing productivity of *Jatropha curcas* [DBT Funded] [FRI-286/Silva-23/External/2005-09]**

**Status:** A demonstration plantation of 20 ha was established at Srinagar Garhwal using four accessions with more than 35% oil content. Germplasm bank was maintained. Plants of selected CPTs (produced from seeds and cuttings) were maintained in the nursery for establishing seed orchard, progeny trial, clonal trial and vegetative multiplication garden. Seeds were collected from 149 accessions throughout Uttarakhand and sent for oil analysis and germplasm conservation to agencies authorized by funding agency. About 60 kg seed with more than 33% oil content were collected and supplied to DBT for network trials and demonstration plantations.

Germination studies on effect of storage conditions (i.e. temperature, moisture content) and storage duration were completed.

**Project 23: Field Evaluation of Superior Germplasm of *Jatropha curcas* in Uttarakhand as a part of Multilocation Trial (DBT funded) [FRI-440/Silva-41/External/2007-09]**

**Status:** Multilocation trial located at Premnagar, Dehradun 30 20' 15"N latitude, 77 57' 40" longitude, 600 m altitude was taken up as per the guidelines issued by funding agency. Quarterly data of growth are being taken. Weekly weather data was collected. Another multilocation trial of ten more accessions was established at Raipur. Seeds of 19 accessions were received from DBT network and seedlings were raised in nursery for establishing half-sib progeny trial.

**Project 24: Genetic Improvement of *Jatropha curcas* for Adaptability and Oil Yield [CSIR funded] [FRI-293/Silva-24/External/2005-10]**

**Status:** Maintained the field trial of elite and native accessions of *Jatropha* at Etah, Uttar Pradesh. Collected field data and identified best accessions for height, collar diameter, no. of

branches and seed yield. Maintained the field trials at Dehradun to standardise spacing, irrigation, fertiliser and pollarding regimes and collected their data.

**Project 25: Eco-restoration and Conservation initiatives in the Garhwal Himalayas [428/Ext-01/External/2008-11]**

**Status:** People of rural community in Project area are interacted to know their views on species preference and they are motivated for plantation on community land. Site selection completed. Seedling of different species is procured from Silviculture Division to plant in project area. One thousand five hundred plants of different species have been planted in project area in monsoon season of year 2008 and winter plantation of 1100 Akhrot (*Juglens regia*) plants has been done.

**Project 26: Genetic improvement and conservation of different genetic resources of some economically more important bamboo species of North-eastern India (Project funded by MOEF to RFRI Jorhat and partly sent to FRI) [FRI-417/C&P-20/External/2008-10]**

**Status:** Two hundred forty nine clones of bamboo were received for studies on anatomical and chemical characteristics. One hundred clones were analysed for chemical composition and anatomical features.

**Project 27: Utilization of natural fibres of Uttarakhand region and natural dye waste for production of handmade paper KVIC Uttarakhand [Funded by Khadi Gramodyog Uttarakhand]**

**Status:** A meeting was arranged in FRI, Dehradun with Khadi & Village Industries Commission and Uttarakhand Khadi Village Board, Dehradun to explore the possibility of using natural grass of Uttarakhand for handmade paper. Natural grasses are yet to be supplied by Uttarakhand Khadi Village Board, Dehradun.

## NEW PROJECTS INITIATED DURING THE YEAR 2008-2009

### PLANPROJECTS

**Project 1: Population genetic analysis and characterization of *Cedrus deodara* germplasm through DNA based markers [FRI 465/G&TP-24/2008-11]**

**Status:** Methodology for the collection of samples and related parameters finalized in consultation with HFRI, Shimla. Available SSR markers on deodar were collected through available literature. Ten sets of SSR primers got synthesized and have been tested in deodar. Needle samples collected from twenty sources (1000 samples) representing Uttarakhand and Himachal Pradesh. DNA extraction protocol standardized. DNA extracted from 1400 samples of seven sources.

**Project 2: Genetic evaluation and characterization of different clones for higher productivity and hybridization in *Dalbergia sissoo* [FRI-464/G&TP-23/April 2008 - March 11]**

**Status:** Clonal trials of *D. sissoo* were taken up at two locations. Observations of clonal trials on various morphometric traits were recorded. Root suckers of second-generation selection from the clonal seed orchard of Hoshiarpur were collected for their multiplication. The

germplasm in vegetative multiplication garden coppiced and cuttings obtained from coppice shoots were kept for their propagation in the mist chamber for rooting.

**Project 3: Germplasm collection, evaluation and planting of *Jatropha* and *Karanj* for improved productivity and higher yield content [FRI-448/G&TP-24/November 2008 to October 11]**

**Status:** Plantations of *Pongamia pinnata* in the states of Uttarakhand and Uttar Pradesh were surveyed. A total of 84 candidate plus trees were marked. Nursery has been made ready for rooting of cuttings and raising of seedlings of desired genotypes.

**Project 4: Development of cost effective housing by using pole structures [FRI-454/ ENGG-01/2008-10]**

**Status:** To achieve a proper jointing system for joining round poles with side members as round pole, ply (shuttering grade) and wooden fish plate, a total of 158 structural joints were fabricated with metallic bolt & M.S. washers and got tested. Shutter grade ply found unsuitable to join with pole. A building plan for a moderate in expensive pole house was designed and developed.

**Project 5: Exploration of diversity in *Ganoderma lucidum* and its conservation with special emphasis on its medicinal uses [FRI-456/PATH-30–Plan/2008-11]**

**Status:** Specimens of 63 fruiting bodies of *G. lucidum* were collected from Delhi (NCR), Haryana, Punjab, Uttar Pradesh and Uttarakhand on 18 host tree species and 55 have been brought into pure culture. Morphological variations were studied for 40 specimens showing 11 sessile forms, 20 stipitate forms, 5 sub-stipitate forms, 2 imbricate forms and 2 immature forms. Anatomical variation in cuticle structure showed 31 forms with Characoderma and 9 forms with hymenioderma and context was hard in 28 forms and spongy in 12 forms. Variation in cultural characters has been studied in 14 isolates indicating three growth forms fast (7 cm in a week), moderate (6.0-6.2 cm per week) and slow (4.5 – 5.5 cm per week). Extraction of polysaccharides from the fruiting bodies of *G. lucidum* revealed glucose, galactose, arabinose and xylose sugars. DNA analysis of 10 isolates of *G. lucidum* was done using Rfu-18 and Rfu-23 primers. Rfu-23 primer gave maximum 38 bands comprising 25 polymorphic bands, 3 clusters and 4 outliers.

**Project 6: Studies on natural resistance of imported woods against insects and decay fungi in Indian environment FRI, component of IWST collaborated project**

**Status:** Seven imported wood samples were put to Accelerated Laboratory Tests for natural decay resistance namely. Teak (*Tectona grandis*) origin Tanzania, (II), Beech (*Fagus grandifolia*) origin France, Honnai Origin Indonesia, Teak (*Tectona grandis*) origin Australia, Ash (*Fraxinus americana*) origin France and Beech wood (*Fagus grandifolia*) origin Belgium using two white rot fungi *Pycnoporus sanguineus* and *Trametes versicolor* and two brown rot fungi *Gloeophyllum striatum* and *Oligoporus placentus*. The three samples of teak were highly resistant to all the test fungi, whereas samples of Honnai wood was not resistant to *P. sanguineus* and *G. striatum*, ash wood not resistant to *T. versicolor* and *O. placentus*, beech wood from France not resistant to *O. placentus* and beech wood sample from Belgium was not resistant to both the brown rot fungi.

**Project 7: To improve white rot fungus strains accessibility in Bamboo for better delignification through mechanical process [FRI-451/C&P-21/2008-11]**

**Status:** Raw material of Bamboo (*Dendrocalamus strictus*) was collected from Forest Research Institute, Dehradun. The bamboos were chipped and chips were air dried to the moisture

content (10-12%). Bamboo chips were processed through mechanical operation to increase surface area for better treatment. Bamboo and destructured chips were characterized for chemical composition, viz. ash content, hot water solubility, cold water solubility, 1% NaOH solubility, Alcohol-Benzene solubility, Klason lignin, Holocellulose,  $\alpha$ -Cellulose, pentosans by standard TAPPI method.



Mechanical processing of chips

Bamboo chips

Mechanically processed destructured chips

Pure Cultures of Fungi *Schizophyllum commune* and *Coriolus versicolor* were obtained from Pathology Lab (F.R.I), Dehradun. Sub-culturing of fungal culture was carried out on Agar Slants, time to time, to maintain cultures for future use. Fungi were allowed to grow on Potato Dextrose Agar media in a Petri dish for a different time periods at an optimum temperature and humidity. Culture was transferred from PDA Plate to Broth Medium in a flask to obtain loosely held Mycelium.

**Project 8: Studies on the Termites of Family Termitidae (Insecta: Isoptera), with special emphasis on their taxonomic status, identity and distribution [FRI-455/Fed-19/2008-10]**

**Status:** Taxonomic status of the twelve termite species has been discussed. A series of the collection of the twelve termite species was studied, morphometric measurements were taken and slides were prepared for morphological variations, original description of the species were consulted and wherever required 'type' specimens were also studied.

**Project No.9: Studies on natural dyes from *Tagetes minuta* and *Terminalia chebula* [FRI-452/Chem-27/2008-10]**

**Status:** *Tagetes minuta* (aerial parts) and *Terminalia chebula* (fruits, wood, bark and roots) were collected. Conditions w.r.t. time, material to liquor ratio and temperatures were optimized for the isolation of dye from the aerial parts of *Tagetes minuta* and fruit pericarp of *Terminalia chebula*. Dyeing trials on silk, wool and cotton using the isolated dyes were also done. The colour fastness properties & CIELAB values of the dyed fabrics were determined. Petroleum ether, acetone and methanol extracts of the plant material were also prepared for their chemical examination. The essential oil isolated from aerial parts was analyzed by GC-MS.

**Project No.10: Studies on the pectin substances from the fruits of *Diospyros peregrina* [FRI-453/Chem-28/2008-11]**

**Status:** Fruits of *Diospyros peregrina* were collected and deepfrozen at  $-20^{\circ}\text{C}$  to impede endogenous enzymes activity. Cell wall polysaccharides were isolated at  $-20^{\circ}\text{C}$  as acetone insoluble solids using homogenizer at  $\sim 50,000$  rpm. Pectin hydrolysing enzymes present in the cell sap degrade pectins in cell wall on extraction. For extraction and chemical characterization of pectins in cell wall preparations removal of endogenous activity is necessary.

Reactions were carried out to remove the activity of pectin hydrolysing enzymes viz. pectinesterase, polygalactouranase before separating cell wall polysaccharides. Pectin fraction was isolated using CDTA and sodium carbonate.

**Project 11: Wood quality assessment of selected candidates of *Eucalyptus tereticornis* of Australian origin [FRI-308/FPD(WS)-53/2008-11]**

**Status:** Mechanical testing of 16 superior phenotypes of *Eucalyptus tereticornis* has been completed and also FTNIR spectra of same specimens was generated. Chemical estimation of 16 phenotypes was also done.

**Project 12: Health assessment of logs and converted timbers by vibration techniques [FRI-458/FPD(TM)-70/2008-11]**

**Status:** Log of *Eucalyptus* spp. was converted into plank/sticks and testing of samples for the measurement of ultrasonic velocity and strength properties is under progress and visual observations of logs for defect detection is also in progress.

**Project 13: Development of Phenol- Urea-Formaldehyde (PUF) wood adhesives [FRI-461/FPD(CW)-73/April 2008-March 11]**

**Status:** Peeling of logs were carried out to get the veneers from Poplar and Sal. Preliminary experimental trials were carried out.

**Project 14: Development of quality wood composite from lops and tops of mixed plantation species [FRI-460/FPD(CW)-72/April 2008-March 11]**

**Status:** Particle preparation from lops and tops of *Eucalyptus* and Poplar were carried out. Preliminary experimental trials were carried out.

**Project 15: Fabrication and performance study of vacuum based wood dryer for fast and efficient drying of timbers [FRI-462/FPD(WS)-74/2008-12]**

**Status:** A vacuum based kiln was indigenously designed and fabricated. The kiln has been installed at the Wood Seasoning Discipline, FRI, Dehradun.

**Project 16: Development of treatment technology for commercially important difficult to treat species [FRI-463/FPD(WP)-75/2008-11]**

**Status:** *Eucalyptus* samples were pretreated with different pretreatments i.e. steaming, hot water, incising (5mm and 10mm) and then, treated with CCA, CCB, Borax-Boric and ZiBOC preservatives at 4% and 8% concentration by Diffusion and Pressure treatment methods. Hot water treatment followed by pressure treatment has shown encouraging results.

**Project 17: Studies on the natural resistance of imported woods against insects and decay fungi in Indian environment [IWST, ICFRE funded project]**

**Status:** Samples received from IWST, Bangaluru were installed at Timber test yard, Dehradun. First quarterly information shows very slight termite attack on few samples.

**Project 18 : Digitization of Herbarium (Dehradun Herbarium) of Forest Research Institute [FRI-450/Bot-60/2008-13]**

**Status:** One hundred seventy six genera, 1129 species and 4678 specimen details have been entered into the database. Seven thousand four hundred eighteen photographs of plant specimens have been taken and edited.



**Project 19: Taxonomic and Anatomical studies of Exotic Pinus species [FRI-445/Bot-63/2008-11]**

**Status:** Collection of Herbarium material and wood samples carried for eleven species of exotic pines. Their taxonomic and wood anatomical studies are well underway.

**Project 20: Fluorescent studies of Indian Woods [FRI-447/Bot-65/2008-11]**

**Status:** Three hundred fifty species were studied for their ultraviolet properties.

**Project 21: Inheritance pattern of wood anatomical traits in *Populus deltoides* Bartr. ex Marsh [FRI-446/Bot-64/2008-11]**

**Status:** The project was initiated in April 2008. In the project samples of the parents and offsprings of  $F_1$  generation of *Populus deltoides* were collected from the field. Quantitative data on the dimensions of wood elements viz. fibre and vessel dimensions were collected from the macerated wood samples. Moreover, specific gravity was also determined for the samples of parent trees.

**Project 22: Field evaluation of tissue culture plants of *Eucalyptus* hybrids at seven agro-climatic sites [FRI-448/Bot-66/2008-11]**

**Status:** The first year of this ongoing project is completed and observations are as follows. The tissue culture raised plants of *Eucalyptus* hybrids FRI-5 and 14 are in fifth year of age at Dehradun, Hissar, Hoshiarpur, Haldwani, Pantnagar, Meerut and Jodhpur. Field maintenance and collection of field data like plant height, Clear Bole Length (CBL), diameter at breast height (dbh), branch angle etc were completed. The results across the sites shows that the plants of FRI-5 and FRI-14 were tallest at Haldwani (18.6 m) and Hoshiarpur (14.1 m) respectively, while thickest dbh at Pantnagar (15.6 cm) and Hoshiarpur (15.0) respectively. Also plants of FRI-5 and FRI-14 had clear bole at Haldwani (7.4m) and Pantnagar (5.3m) respectively. The branch angle of FRI-5 and FRI-14 was in range of  $45^\circ - 60^\circ$  and  $60^\circ - 90^\circ$ . On Hoshiarpur and Dehradun site FRI-14 were taller and dbh was thicker than FRI-5 where as at Pantnagar site the result was in contrast. At all these sites where both FRI-5 and FRI-14 were present, FRI-14 had most clear bole.

**Project 23: Impact of ban on green felling in Deodar, Blue Pine, Fir and Spruce forests in Uttarakhand [FRI-/Silvi-390/RSM-18/2008-11]**

**Status:** The project area was surveyed and data recorded on the plots prescribed for felling in 1980s. The data was recorded from the compartments of Deodar, Spruce, Fir and Blue Pine forests, which were actually felled and unfelled coupes under Chakrata, Uttarkashi and Badrinath forest divisions. The field data were collected from Chakrata and Uttarkashi forest divisions.

**Project 24: Silviculture studies on *Hippophae salicifolia* -A wonder lesser known plant of Uttarakhand [FRI-322/Silvi-26/2008-11]**

**Status:** Survey was conducted on natural population of *Hippophae salicifolia* in Uttarkashi and Chamoli distt. The seeds of *Hippophae salicifolia* were collected in two different seasons (October and February). Germination studies of *H. salicifolia* was initiated in field and laboratory condition. Experiment was carried out to study the effect of light and temperature on seeds of *Hippophae salicifolia*. Introduction trial was initiated to see the performance of *H. salicifolia* at Chakrata nursery.



*H. salicifolia**H. tibetiana*

### Project 25: Enhancement of seed longevity of *Diploknema butyracea* [FRI-466/Silvi-42/2008-12]

**Status:** The literature of *Diploknema butyracea* on distribution of natural population and their phenology (flowering and fruiting), ripening/maturation, biology, longevity, viability, vigour, storability and nursery technique of species were consulted. Survey conducted in Pithoragarh Forest Division for locating the population of *D. butyracea*. Fruits of *D. butyracea* were collected from Harkante population, Gurna beat, Pithoragarh Forest Division. Fruits were extracted and processed in Laboratory. Moisture contents, purity and weight of seed were determined. Morphological traits of seed were recorded. Germination, viability and vigour of seed were assessed. Sowing of seeds in nursery was done and selected the sites for soil sampling from natural population. Observations of growth parameters of seedlings were recorded.

## EXTERNALLY AIDED PROJECT

### Project 1: Second National Communication to UNFCCC

**Status:** This project is a part of the Second National Communication (SNC) of India to UNFCCC for the estimation of soil carbon stock in forest soil under different species, and forest type over the period from 1995 to 2007 and for assessment of soil carbon dynamics due to land use change from forest to non-forest and vice versa in key forest types. Soil samples were collected from different forest subtypes located in Uttarakhand, U P, Punjab, Haryana, Delhi and Chandigarh. Soil samples for soil organic carbon, bulk density and coarse fragments from 28 forests subtypes (three samples from each forest subtypes as replicates) were collected and analysed for above mentioned attributes. Ten sites in non-forest area adjacent to forest subtypes were also collected for similar attributes and analysed.

## PROGRESS OF VAN VIGYAN KENDRAS AND DEMO VILLAGE (2008-2009)

### Establishment of Van Vigyan Kendras (VVK)

**Status:** Total 5 Van Vigyan Kendras (VVK) have been established and nodal officers appointed and ten trainings conducted for farmers/ foresters in the States/UT's under the jurisdiction of FRI.

- In Punjab, VVK at Hoshiarpur established on 4<sup>th</sup> August 2008. Nodal Officer, Shri R.K. Luna, appointed.
- In Haryana VVK at Pinjore established on 25<sup>th</sup> August 2008. Nodal Officer, Shri K.S.Chauhan, CCF (Res. & Trg.), appointed.

- In Uttarakhand at Haldwani on 22<sup>nd</sup> September 2008, Nodal Officer, Shri S.K. Dutta, CCF & Director, Forest Training Academy, Haldwani (Res. & Trg.), Haryana.
- In U.T. Chandigarh at the Botanical Garden and Nature Park on 20<sup>th</sup> October 2008, Nodal Officer, Shri Ishwar Singh, CF, Department of Forests, Chandigarh Administration.
- In NCT Delhi at Hauzrani City Forests near Saket in Delhi on 15<sup>th</sup> December 2008, Nodal Officer, Smt. Kamalpreet Kaur, DCF, Department of Forests & Wildlife, Govt. of NCT of Delhi.

MOU have also been signed between FRI and the SFDs for each Van Vigyan Kendra i.e. Punjab, Haryana, Uttarakhand, UT of Chandigarh and Delhi.

As for the establishment of model nursery under the VVK's, sites have been finalized and initial work on the establishment has been taken up at Pinjore and Chandigarh.

The exhibits of FRI innovations, important technologies developed are displayed in the VVKs in Hindi and English and extension material i.e. publications, pamphlets, reports etc. related to forestry are also placed in the VVKs for the visitors.

## DEMO VILLAGE

**Status:** One Demo Village has been established at Shyampur, P.O. Ambiwala, Dehradun and a memorandum of understanding has been signed between FRI and M/s Bhagwan Gram Udhog Samiti, Shyampur in January 2008.

Various divisions of FRI have been associated in the development of a Demo Village at Shyampur i.e. Silviculture, Non-Wood Forest Products, Chemistry, Pathology, Entomology and Extension Division. The following structures have been developed:

- Low cost mist chamber
- Green house
- Propagation unit
- Water tank with complete fittings
- Mounted angle iron stands
- Root trainers
- Preparation of nursery beds
- Covered seed drying platform
- Vermicompost under construction.

The following works have been undertaken in the Demo Village at Shyampur:

- Four thousand plant saplings have been raised
- One thousand five hundred seedlings were distributed amongst the villagers
- Two training programmes have been conducted for the farmers.

## NATIONAL FOREST LIBRARY AND INFORMATION CENTRE

The National Forest Library and Information Centre (NFLIC) is richest in document collection on forestry and allied sciences in South and South-east Asia. The NFLIC has been providing all types of library and information services viz. reference, referral, lending, reprography current awareness, inter-library loan, retrieval of information from machine

readable database, etc. to its users. During the year, a total 33,358 books were loaned to the users for outside reading. Besides, 70,284 documents were consulted inside the library.

The document collection of the NFLIC was enriched by the addition of 3,167 books and other documents. The NFLIC subscribed to 110 Indian and 114 foreign periodical titles at a cost of about Rs.78 lakh. It also received about 350 periodical titles gratis.

The NFLIC has been selling ICFRE publications through its Book Depot. During the year, 555 books and 38 VCDs were sold to the state forest departments, universities etc.

The Ministry of Environment and Forests, Govt. of India has established an ENVIS Centre on Forestry at the NFLIC. The Centre, during the year, enriched the following Forest database by the addition to new references: Indian Forestry Abstracts, Participatory Forest Management, *Prosopis juliflora*, Poplars, Forests and Environment in Press, Current Forestry Literature, which are accessible through the website of the centre having URL: [www.frienvis.nic.in](http://www.frienvis.nic.in). Besides, the contents pages of journals, forest cover of India, state wise and then district wise, announcements of forthcoming national and international conferences, seminars, symposia, training course were also put up on the website.

**Publications:** The ENVIS Centre on Forestry published the following publications during the year:

*ENVIS Forestry Bulletin:* Two special issues of the bulletin on Forest Seed Science and Technology, and Forestry Statistics were published.

*Environment and Forests News Digest:* Six issues of the Digest for 12 months were published.

## FOREST RESEARCH INSTITUTE UNIVERSITY

Forest Research Institute, Dehradun was conferred the status of 'University' by the Ministry of Human Resource Development, Government of India, New Delhi vide Notification No. F.9.25/89 U-3 dated 6<sup>th</sup> December 1991. In pursuance of the UGC Notification No. F.6-1 (II)/2006 (CPP-I) dated the 13.09.2006, the name of Forest Research Institute Deemed University is changed as Forest Research Institute University (Established under section 3 of the UGC act 1956 vide Notification No. F.9-25/89 U-3 dated 6<sup>th</sup> December 1991).

### Academic Courses and Admission

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

- (1) M.Sc. Forestry – 2 years duration
- (2) M.Sc. Environment Management – 2 years duration
- (3) M.Sc. Wood Science & Technology – 2 years duration
- (4) Post Masters Diploma in Natural Resource Management – 1 year duration
- (5) Post Masters Diploma in Non Wood Forest Products – 1 year duration
- (6) Post Graduate Diploma in Pulp & Paper Technology – 1 year duration

Admissions to the above courses are made on the basis of a candidate's performance in all India Competitive Entrance Test.

During the year 2008-09, 102 students were admitted in all the above six courses for the academic session 2008-10 and 2008-09 respectively.



## Industrial/Institutional Attachment and Dissertation work

All India based different industries and institutes were approached for the Industrial attachment in December and for Dissertation work/project work from 1<sup>st</sup> April to 31<sup>st</sup> May.

All the students of M.Sc. courses were sent to one month industrial attachment to different industries/organizations in December. M.Sc., PMD and PGD students completed their dissertation/project work on specific topic relevant to their subjects.

## TECHNOLOGY ASSESSED AND TRANSFERRED

Eighteen gene sequences of internal transcribed spacer of different isolates of fungus *Cylindrocladium quinqueseptatum* submitted to NCBI (<http://www.ncbi.nlm.nih.gov>) were incorporated in gene bank and accession numbers were allotted.

Three Beta tubulin gene sequences of different isolates of fungus *Cylindrocladium quinqueseptatum* submitted to NCBI (<http://www.ncbi.nlm.nih.gov>) were incorporated in gene bank and accession numbers were allotted.

1. "A black hair dye composition and a process for preparation thereof" transferred to M/s Mythili's Agro and Nature Care Private Limited, Chennai (License fee Rs.5.00 Lakhs) by Chemistry Division.
2. One Solar kilns was installed for M/s Haryana Forest Development Corporation at Pipli.
3. The dissemination of technology of clonal development has been made during various programmes of FRI from time to time.
4. Protocol developed for *Swertia chirata* – new technology.
5. The Institute demonstrated the methods for management of diseases and deterioration of bamboo and the preparation of fungicidal solution, spraying and seed treatment to officials of State Forest Departments, farmers and private growers of Chandigarh, Delhi, Haryana, Punjab and Uttarakhand in respective Van Vigyan Kendras.

## EDUCATION AND TRAINING

### Trainings

#### Conducted

1. A summer school on the topic "Recent trends on modern biology and biotechnology" for teachers and research scholars of Uttarakhand state from 18<sup>th</sup> to 29<sup>th</sup> August 2008.
2. A short-term training for the officials of Punjab Forest Department on the topic "Clonal forestry for higher economic returns" from 11<sup>th</sup> to 17<sup>th</sup> November 2008.
3. Training on hands-on training course on harvesting and value addition of medicinal plants for farmers from Shyampur Village from January 27<sup>th</sup> to 30<sup>th</sup> 2009.
4. Application of Geoinformatics and Bioinformatics in Forestry' was organized from 11<sup>th</sup> to 17<sup>th</sup> November 2008 at Uttarakhand Space Application Centre, Dehradun, for scientists of different disciplines.
5. Applications and Operation of Remote Sensing & GIS Software (ERDAS Imaging 9.3)' was organized from 16<sup>th</sup> to 20<sup>th</sup> February 2009 at Division of Bioinformatics and GIS, FRI for scientists of FRI.

6. Applications and Operation of Remote Sensing & GIS Software (ArcInfo 9.3)' was organized from 2<sup>nd</sup> to 6<sup>th</sup> March 2009 at Division of Bioinformatics and GIS, FRI for scientists of FRI.
7. Training on Improved Seed & Nursery Technology from 22<sup>nd</sup> to 26<sup>th</sup> September 2008.
8. Training on Capacity Building of Communities involved in Sustainable Forest Management under "DEFRA" Project from 17<sup>th</sup> to 23<sup>rd</sup> January 2009 at FRI Dehradun.
9. A training on Forest Fire Mitigation & Management from 16<sup>th</sup> to 20<sup>th</sup> February 2009.
10. Training on Bamboo Development for field staff of Himachal Pradesh Forest Department from 16<sup>th</sup> to 20<sup>th</sup> June 2008.
11. A training programme on Medicinal Plant Nursery Raising Technique was organized in Shatabdi Van Vigyan Kendra from 8<sup>th</sup> to 12<sup>th</sup> September 2008 for villagers.
12. The Forest Research Institute with the cooperation of Bagwan Gram Udhog Samiti organized training on Medicinal Plants at village, Shyampur from 8<sup>th</sup> to 12<sup>th</sup> December 2008.
13. A training programme in the Demo Village on "Nursery & Plantation Technology of Forestry & Medicinal Plants" at Ambiwala, Shyampur Prem Nagar from 18<sup>th</sup> to 21<sup>st</sup> February 2009.
14. A short term training course on "Classification, Grading and Inspection of Timber" from 3<sup>rd</sup> to 7<sup>th</sup> November 2008 which was attended by participants from Naval Dockyard Mumbai.
15. Short term training on "Plywood Manufacture" from 4<sup>th</sup> to 8<sup>th</sup> August 2008 and participants from different wood based industries participated.
16. A training was conducted on Development of Bamboo nurseries, propagation, and seasoning of bamboo at Shatabdi Van Vigyan Kendra, City Centre, FRI from 7<sup>th</sup> to 11<sup>th</sup> April 2008 for Farmers and SFDs field staff and Horticulture Department of Rajasthan, from 19<sup>th</sup> to 23<sup>rd</sup> May 2008 for farmers and SFDs field staff of Uttarakhand and from 23<sup>rd</sup> to 27<sup>th</sup> June 2008 for farmers and SFDs field staff and agriculture staff of J. & K.
17. A training on Medicinal Plants from 8<sup>th</sup> to 12<sup>th</sup> September 2008 was conducted at Shatabdi Van Vigyan Kendra, City Centre, FRI for farmers of Uttarakhand.
18. Five trainings each of five days, were conducted at VVK of Punjab, Haryana, Uttarakhand, NCT Delhi and UT Chandigarh in 2008 on "Awareness Programme on Forestry Research & its Utilization".
19. Five trainings each of five days, were conducted at VVK of Punjab, Haryana, Uttarakhand, NCT Delhi and UT Chandigarh in 2009 on "Propagation, Utilization and Protection of Bamboos".
20. Training on 'Methods for Preparation of Natural Dyes' to the farmers and NGO members was imparted by Shri Rakesh Kumar on 11<sup>th</sup> December 2008 and 19<sup>th</sup> February 2009 at Model Village, Shyampur.

### Attended

1. Applications of Geoinformatics and Bioinformatics in Forestry at Uttarakhand Space Application Centre, Department of Science and Technology (Govt. of Uttarakhand) from 11<sup>th</sup> to 17<sup>th</sup> November 2008.



2. "General Management programme for Senior scientists" from 28<sup>th</sup> July to 8<sup>th</sup> August 2008 at Administrative Staff College of India, Bella Vista, Hyderabad.
3. "Eco-tourism vis-à-vis Conservation of Forests" from 20<sup>th</sup> to 27<sup>th</sup> September 2008 at JL&R, Bangaluru.
4. 'Statistical Techniques for Research Methodology' 26<sup>th</sup> December to 7<sup>th</sup> January at IASRI, New Delhi.
5. Basic Forestry at SFS College Dehradun from 15<sup>th</sup> December 2008 to 23<sup>rd</sup> January 2009.
6. 'Geomatics in Disaster Management' on 2<sup>nd</sup> and 3<sup>rd</sup> February 2009, organised by Indian Society of Geomatics, Ahmedabad, at IIRS Campus, Dehradun.
7. Participatory Management of watershed project for sustainable livelihood. National Institute of Rural Development Rajendranagar, Hyderabad during 18<sup>th</sup> to 23<sup>rd</sup> August 2008.
8. "Standard Operating Procedures for Export Inspection and Phytosanitary Certification. Training organised by National Plant Quarantine Station (NPQS), Rangpuri, New Delhi from 22<sup>nd</sup> to 26<sup>th</sup> September 2008.
9. Research Management & Administration from 9<sup>th</sup> to 13<sup>th</sup> March at ASCI, Hyderabad.
10. Decision Support Tools & Techniques ( Sponsored by Department of Science & Technology, Govt. of India) at Administrative Staff College of India (Hyderabad) from 26<sup>th</sup> to 28<sup>th</sup> April 2008.
11. "Evaluation of Trainings" at Uttarakhand Administrative Academy, Nainital from 13<sup>th</sup> to 17<sup>th</sup> October 2008.
12. "Advances in Forestry Research and Development" at National Centre for Research on Agroforestry, Jhansi from 24<sup>th</sup> November to 5<sup>th</sup> December 2008.

## LINKAGES & COLLABORATION

The Institute established linkages and active collaboration with the following organizations:

1. Collaboration with NDMC, New Delhi, State Forest Departments, ICFRE Institutes, Universities, Farmers, NGOs, Bodhgaya Temple Management Committee, Archaeological Survey of India, private entrepreneurs and wood based industries.
2. Collaboration with Central Pulp and Paper Research Institutes, Saharanpur, Saurashtra University, Rajkot, Gujarat, Kurukshetra University, Kurukshetra, Haryana, E.P. Industries, Hyderabad.
3. Collaboration with Uttarakhand Space Application Centre, Indian Institute of Remote Sensing, Indian Space Research Organization and Forest Survey of India.
4. The New Forest meteorological data was used by Uttarakhand Irrigation Department, IMA, PWD, Forest Deptt., Researchers of Forest Research Institute and other Organisations/ Universities, State Forest Departments, G.B. Pant Institute of Himalayan Environment and Development, Almora, Department of Atomic Energy, Govt. of India, Mumbai, Space Application Centre (ISRO), Ahmedabad, M/s Faridabad Gurgaon Mineral, New Delhi, Indian Meteorological Department, Poona, DDA, New Delhi, Survey of India, Dehradun.



5. MoU for the use of natural dyes was signed between Forest Research Institute, Dehradun and Uttarakhand Khadi & Village Industries Board on 15<sup>th</sup> October 2007.
6. A joint project of SKVIB and FRI is being carried out on Project entitled "Identification, Development and Utilization of Natural Dyes from Forest Plants/ Weeds and Agricultural Waste".
7. Linkage and collaboration was developed with H.N.B. Garwal University, Pantnagar University and Allahabad University.
8. Linkage was developed with Managing Director, Uttarakhand Forest Development Corporation, Dehradun.
9. Linkage was developed with Managing Director, State Forest Development Corporation, J &K.
10. Linkages and collaboration was establishment with Uttarakhand, Delhi, Haryana, Punjab and Uttar Pradesh Forest Departments under various on going projects of the division. Under the project on *Jatropha* funded by DBT, work on multilocation trial of the species is being carried out in collaboration with High Altitude Plan Physiology Research Centre (HAPPRC), Garhwal University, Srinagar. Germplasm is being exchanged with the partner institutes i.e. M.S. Swaminathan Research Foundation, Chennai, NBRI Lucknow, Biotech Park Lucknow and PDKV Akola for establishing the multilocation trial of *Jatropha curcas* under the project. Collaboration was also made with Delhi Govt. for establishment of arboretum, bambusetum and raising of plants for commonwealth games.
11. Linkage and collaboration was also developed with :
  1. Max India, Roper.
  2. M/s Chambal Fertilizer and Chemicals Ltd., Kota, Rajasthan.
  3. M/s Southern Cooling Tower Pvt. Ltd., Kolkata.
  4. M/s Hindustan Petroleum Corporation Ltd., Mumbai.
  5. M/s Cunningham Lindsey International Pvt. Ltd., Mumbai.
  6. Housing Board Haryana, Dharuhera.
  7. Naval Dockyard, Mumbai: A short term training was given to their officials.
  8. Department of Fertilizers, Ministry of Chemical & Fertilizers, New Delhi.
  9. M/s Gujarat Narmada Valley Fertilizers Co. Ltd., Distt. Bhurach, Gujarat.
  10. M/s National Fertilizers Limited, Vijaipur, Guna, (M.P.).
  11. M/s IFFCO, Aonla Unit, Aonla, Bareilly, UP.
  12. M/s IFFCO, Phulpur Unit, P.O. Ghiya Nagar, Allahabad.
  13. M/s IFFCO, Kalol Unit, Distt. Gandhi Nagar, Gujarat.
  14. M/s Deepak Fertilizers & Petrochemicals Co. Ltd., Raigarh.
  15. M/s Indo Gulf Fertilizers, Distt. -Sultanpur, UP.
  16. M/s KRIBHCO, Kribhco Nagar, Surat.
  17. M/s KRIBHCO, Shyam Fertilizers, Shahjanpur, U.P.
  18. M/s Reliance Infra-structure Ltd., Zurinagar, Goa.
  19. Central Engineering Services, Jam Nagar, Gujarat.



20. M/s Reliance Industries Ltd., Patalganaga, Maharashtra.
21. M/s DCM Shriram Consolidated Ltd., Kota Rajasthan.
22. M/s Rashrtiya Chemicals & Fertilizers Ltd., Chembur, Mumbai.
23. M/s Creation Cooling Towers, Distt. Vadodra, Gujarat.
24. M/s Pharpur Cooling Towers Ltd., Kolkata.
25. M/s Paltech Cooling Tower & Equip. Ltd., Gurgaon, Haryana.
26. M/s Gamon Cooling tower Ltd., Mumbai.
27. M/s Koolaqa Tower Pvt. Ltd., Kolkata.
28. M/s Hamon Shri Ram Cottrell Pvt. Ltd., Mumbai.
29. M/s Chembond Drewtraet Ltd., New Delhi.
30. M/s Drew Australia Pvt. Ltd., New Australia.
31. M/s NOVACHEM, Ratanda, Jodhpur.
32. Tripura Forest Development, Agartala.
33. New Zealand High Commission, New Delhi.
34. M/s Madras Fertilizers Ltd., Chennai.
35. M/s National Fertilizers Ltd., Punjab.
36. M/s GE India Industrial Pvt. Ltd., Manglore.
37. M/s A& A Modular System, Mohali, Punjab.
38. Melfrank Engineers, Mumbai.
39. AE (Civil), AGE B/R Ranikhet, Ranikhet.
40. NIT Jalandher.
41. TIFAC, New Delhi.
42. IPIRTI, Bangaluru.

## PUBLICATIONS

### Books

1. Sangeeta Gupta, 2008. 'Atlas of Indian Hardwoods- their photomicrographs and Anatomical features', FRI publication, Dehradun. Reference Book.
2. Manisha Agrawal & Sangeeta Gupta, 2008. 'Wood Anatomy of Sapindales. Bishen Singh Mahendra Pal Singh, Dehradun. Reference Book.
3. Seed Manual Booklet.

### Brochure

Nautiyal, S. and Mishra, A. 2008. चारा पत्ती एवं जलाऊ लकड़ी के वृक्षों की उत्तम किस्म की पौध तैयार करने के लिए पौधशाला की स्थापना।

### Newsletters

Non-Wood Forest Product Division published two quarterly Newsletters one entitled "Market Information on Medicinal Plants" and another titled "Market Prices of Farm Grown/ Agroforestry Wood in Punjab".





## Bulletins

1. Kaushik, S.; Singh, Y.P.; Kumar, D. and M. Thapliyal (eds.), 2008. Forest Seed Science and Technology Special, 8(1). Dehradun, ENVIS Forestry Centre. 119p.
2. Kaushik, S.; Singh, Y.P.; Kumar, D. and M. Thapliyal (eds.), 2008. Forestry Statistics Special, 8(2). Dehradun, ENVIS Forestry Centre. 84p.

## Reports

1. A report on "Modified Conservation Plan for Flora, Fauna and Socio-economic Environment" of Rawghat Iron Ore Project funded by Steel Authority of India Limited (SAIL), Bhilai, Chhattisgarh was published.
2. A project completion report on "Effect of Pine and Oak Forest on Agriculture Crops" has been submitted to ICFRE.

## CONSULTANCIES

1. To MoEF on National and International issues of forestry assigned by MoEF e.g. National Committee on Forest Certification, Sustainable Forest Management (SFM), National Working Plan Code Revision, Price fixation of timber for DGS&D supply.
2. Advisory Services to Planning Commission for Greening of Delhi.
3. To Ministry of Defence (Army), New Delhi-1, M/s Multiwal Papers Ltd, Kashipur-01 and M/s J.K. Papers Ltd, New Delhi-3 for Paper Testing of Samples.
4. To M/s American Connexions, Dehradun-4 ,Osmania University, Hyderabad-10 for Wood Sample Testing for Lignin and Holocellulose Content (8 tests).
5. To M/s Star Paper Mill, Saharanpur-2 for Wood sample testing for Moisture Content (2 test).
6. Advisory services provided to Bodhgaya Temple Management Committee for management of heritage tree Bodhi Vriksha.
7. Advisory services provided to Archaeological Survey of India for the management and conservation of trees at Ta Prohm Temple, Siem Reap, Cambodia.
8. Provided advisory services to Forest Department of Uttarakhand for Biostabilization of Varunavat landslide.
9. Provided advisory services to Tehri Hydro Development Corporation Ltd., Tehri for stabilization of left and right bank slopes of Koteshwar Hydro Electric Project with the help of suitable vegetation.
10. Provided advisory services to M/s Sterlite Industries Ltd., Tamil Nadu.
11. A consultancy project on "Preparation and Modification of Conservation Plan for Flora, Fauna and Socio-economic Environment" of Rawghat Iron Ore funded by Steel Authority of India Limited (SAIL), Bhilai, Chhattisgarh has been completed.
12. Consultancy has been provided to Haryana Forest Development Corporation Limited for Installation of a Solar Kiln at Pipli, Haryana Organization. Training on its operation has been imparted to the staff of HFDC.
13. Gave consultancy to M/s HPCL, Mumbai, regarding timber utilization on 14<sup>th</sup> and 15<sup>th</sup> May 2008.



14. Provided Consultancy to M/s Kolkatta Port Trust on Sal Timber.
15. Consultancy provided to various organizations on Wood Identification. Identified over 111 wood samples and reported.
16. Consultancy was provided to the Ministry of Rural Development, Govt of India, New Delhi and UNDP for preparation of "Forestry Works Manual of Uttarakhand" under NREGS (National Rural Employment Guarantee Scheme) and NAP (National Afforestation Programme).
17. Consultancy was provided to Department of Environment, Forest and Rural Affairs of UK for preparation of training Module on "Capacity Building of Communities Involved in Sustainable Forest Management."
18. Consultancy was provided to Delhi Govt. for establishment of Arboretum and Bambusetum.
19. Consultancy project was executed for Baseline survey and Social impact assessment of Renuka Dam Project of Himachal Pradesh.

## PATENTS OBTAINED/FILED

1. "A process for the isolation of ursolic acid from *Eucalyptus* hybrid leaves" (Application No.361/Del/2009, dated 25/2/2009)
2. Patent on the new technology "Automized Boucherie method" filed.

## WORKSHOPS/SEMINARS/CONFERENCES/SYMPOSIA

### Attended

The representatives from FRI, Dehradun attended the Workshops/Seminars/Conferences/Symposia as given below during the period under report:

### International

1. "World Conference on Medicinal and Aromatic Plants (WOCMAP IV-2008) held at cape town, South Africa, 9<sup>th</sup> to 14<sup>th</sup> November 2008.
2. International Conference on current trends in Biotechnology and Implications in Agriculture held at Sardar Vallabh Bhai Patel University of Agriculture & Technology, Modipuram, Meerut from 19<sup>th</sup> to 21<sup>st</sup> February 2009.
3. International Biotechnology Seminar cum expedition/trade show 'Bangaluru Bio' from 24<sup>th</sup> to 26<sup>th</sup> April 2008 as part of delegation of Uttarakhand.
4. International Workshop on "Improvement of Bamboo Productivity and Marketing for Sustainable Livelihood" from 15<sup>th</sup> to 17<sup>th</sup> April at New Delhi.
5. International Conclave on Medicinal Plants for ASEAN and BIMSTEC Countries held from 11<sup>th</sup> to 13<sup>th</sup> December 2008 at Imphal.
6. XXXI All India Botanical Conference and International Symposium on Plant Biology and Environment: Changing Scenario from 17<sup>th</sup> to 19<sup>th</sup> December 2008, Allahabad University, Allahabad, India.
7. International Conference on Entomology on 22<sup>nd</sup> and 23<sup>rd</sup> February 2009 in Dept. of Zoology, Punjabi University, Patiala.



8. World Biodiversity Congress at Chiang Mai, Thailand from 10<sup>th</sup> to 13 March 2009.
9. Second International Conference on Polymer Blends, Composites, Membranes, Polyelectrolytes and Gels: Macro to Nano scales (ICBC-2008)' held at School of Chemical Sciences, Mahatama Gandhi University, Kottayam, Kerala, India, from 22<sup>nd</sup> to 24<sup>th</sup> September 2008.
10. Asian Symposium on Medicinal Plants, Spices and Other Natural Products (ASOMPS), XIII organized by Indian Institute of Chemical Technology, Hyderabad from 3<sup>rd</sup> to 6<sup>th</sup> November 2008.
11. International Conference on New Developments in Drug Discovery from Natural Products and Traditional Medicines held at NIPER, Chandigarh from 16<sup>th</sup> to 20<sup>th</sup> November 2008.
12. 'International Conference on Molecular Biology and Biotechnology, from 19<sup>th</sup> to 21<sup>st</sup> October 2008 at Banasthali University, Banasthali and Rajasthan.

### National

1. Symposium on "Phytochemistry and Ayurveda: Potential and Prospects" held at 1, Inder Road, Dehradun on 27<sup>th</sup> December 2008.
2. 'Biotech 2009: Present and future perspectives' at Punjabi University, Patiala on 19<sup>th</sup> and 20<sup>th</sup> March 2009.
3. National workshop on "Public Private Partnership in Forestry" on 23<sup>rd</sup> and 24<sup>th</sup> December 2008 at Vamnicone, Pune.
4. National workshop on "Sustainable Forestry Development and Forest Certification in India" from 22<sup>nd</sup> to 28<sup>th</sup> February 2009 at New Delhi.
5. Stakeholders' Workshop on Capacity Building of Communities involved in Sustainable Forest Management under DEFRA project on 28<sup>th</sup> July 2008 at FRI, Dehradun.
6. Third Science Congress of the UCOST at Roorkee on 10<sup>th</sup> and 11<sup>th</sup> November 2008.
7. National Seminar on Status of Biodiversity and conservation at Deptt. of Zoology & Environmental Sciences, Gurukula Kangri University, Haridwar on 27<sup>th</sup> and 28<sup>th</sup> February 2009.
8. National Symposium on Emerging Trends of Researches in Insect Pest Management and Environmental safety from 24<sup>th</sup> to 26<sup>th</sup> September 2008 at Haridwar.
9. National Conference 'Dhishana' 2008, Streamlining India's Traditional Knowledge towards formulating a Sui Generic Regime held from 23<sup>rd</sup> to 25<sup>th</sup> May 2008 at Trivandrum.
10. National Conference on Increasing Production and Productivity of Medicinal and Aromatic Plants through Traditional Practices from 18<sup>th</sup> to 20<sup>th</sup> September 2008, G.B. Pant Univ. Agri. and Tech., Pantnagar, Uttarakhand.
11. XXIII Carbohydrate Conference organized by Deptt. of Chemistry, Bhavnagar University, Bhavnagar (Gujarat) and Association of Carbohydrate Chemists & Technologists (India) from 22<sup>nd</sup> to 24<sup>th</sup> January 2009.
12. National Symposium on Biofuels potential and challenges, at TFRI Jabalapur (M.P.) from 22<sup>nd</sup> to 24<sup>th</sup> February 2009.
13. 'Second Edusat Workshop' Organized by IIRS, Dehradun on 20<sup>th</sup> March 2009.





Exhibits of Cellulose & Paper Division, FRI, Dehradun

14. Exhibition on Hand Made Paper from weeds at Buyer & Seller meet organized by KVIC at Hotel Indralok, Dehradun from 3<sup>rd</sup> to 7<sup>th</sup> November 2008.
15. 'XX BTIS net Coordinators Meeting' organized by DBT, New Delhi at NEHU, Shillong on 3<sup>rd</sup> and 4<sup>th</sup> February 2009.
16. National Conference on Bamboos: Management, Conservation, Value addition and Promotions to be held at Jabalpur from 12<sup>th</sup> to 24<sup>th</sup> March 2008.
17. National Seminar on "Reclamation of Mined Lands of Coalfields" on 5<sup>th</sup> and 6<sup>th</sup> August 2008 at State Forest Research Institute, Jabalpur.
18. Symposium on Knowledge systems for ecosystem for ecosystem management and sustainable development, New Delhi from 24<sup>th</sup> to 28<sup>th</sup> August 2008.
19. Homi Bhabha Centenary DAE-BRNS National Symposium on "Landscaping for Sustainable Environment" on 20<sup>th</sup> and 21<sup>st</sup> November 2008 at BARC, Mumbai.
20. National Seminar on Climate Change: Data requirement and availability at Institute for Social and Economic Change, Bangalore on 13<sup>th</sup> and 14<sup>th</sup> March 2009.
21. Workshop on "Avoided Deforestation Incentive Mechanism for States" at ICFRE, Dehradun on 23<sup>rd</sup> March 2009.
22. National Symposium on knowledge system for Ecosystem Management & Sustainable Development, NIE, New Delhi on 26<sup>th</sup> and 27<sup>th</sup> August 2008.
23. National Conference on Mass Instability and Earthquake Risk Management in Mountainous Regions. Challenger, Lessons learnt and Future Strategy. Disaster Mitigation and Management Centre, Uttarakhand on 27<sup>th</sup> and 28<sup>th</sup> June 2008.
24. Conference on "Emerging Trends of Research in Insect Pest Management and Environmental Safety" (organized by Uttar Pradesh Zoological Society, Muzaffarnagar) held at Haridwar from 24<sup>th</sup> to 26<sup>th</sup> September 2008.
25. Symposium on "Phytochemistry and Ayurveda: Potential and Prospects" Organized by Universities' Journal of Phytochemistry and Ayurvedic heights, Dehradun on 27<sup>th</sup> December 2008.
26. National Conference on Innovations in Drug Discovery and Research (NC-IDDR) Organized by Department of Pharmaceutical Sciences and Drug Research, Punjabi University, Patiala from 3<sup>rd</sup> to 5<sup>th</sup> March 2009.

27. National Symposium on Emerging Trends in Biomedical Sciences 2009, Organized by SBS (PG) Institute of Biomedical Sciences and Research, Dehradun on 27<sup>th</sup> and 28<sup>th</sup> February 2009.
28. "Sensitization program for committee members on prevention of sexual harassment at work place from 6<sup>th</sup> to 10<sup>th</sup> January 2009.
29. "Workshop on National Vegetation Carbon Pool Assessment Project (NCP-IGBP)" on 7<sup>th</sup> and 8<sup>th</sup> November 2008 at IIRS, Dehradun.
30. Summit on "Sustainable Development, Climate Change and Natural Resources Management: Status, Issues and Way Forward" (Uttarakhand Sustainable Development Summit) on 19<sup>th</sup> and 20<sup>th</sup> June 2008 at Dehradun.
31. 'Sensitization workshop on Resource Conserving Technologies' on 27<sup>th</sup> March 2009 at Central Soil and Water Conservation Research and Training Institute, Dehradun (Uttarakhand).
32. National Seminar on "Bamboo Plantation, Management and its Utilization" from 17<sup>th</sup> to 19<sup>th</sup> March 2009 at AFRI Jodhpur, Rajasthan.
33. "Celebration of Vaniki Mela" held at village Handesra, Mohali on 7<sup>th</sup> March 2009.
34. Twenty third Session of International Poplar Commission at Beijing, China from 26<sup>th</sup> to 29<sup>th</sup> October 2008.

### Organized

1. A training-cum-workshop on "Farm forestry Extension and its Marketing" for Punjab Forest Department Officials and progressive farmers on 11<sup>th</sup> September 2008 at Punjab Agricultural University Campus, Ludhiana.
2. A meeting of National Steering Committee (NSC) on MAR-SFM, 7<sup>th</sup> April 2008 in New Delhi.
3. National Seminar (Geomatics 2009) on "Geomatics and Impact of Climate Change with Specific Reference to Mountain Ecosystems" from 4<sup>th</sup> to 6<sup>th</sup> February 2009 at FRI, Dehradun in collaboration with Uttarakhand Space Application Centre (USAC) Dehradun.
4. A meeting was organized by Uttarakhand Khadi & Village Industries Board, Dehradun to discuss the potential of natural fibre of Uttarakhand for hand made paper manufacturing on 26<sup>th</sup> February 2009 at FRI.



Meeting with Uttarakhand Khadi & Village Industries Board at FRI Board Room, Dehradun

5. One day "IPR Sensitization Workshop" in collaboration with Patent Information Centre, G.B. Pant University of Agriculture & Technology, Pantnagar under the aegis of PFC-TIFAC, Department of Science & Technology (Govt. of India) was organized at FRI on 14<sup>th</sup> July 2008.
6. National Workshop-cum-Training on "Application of Biodiversity Informatics in Forestry" on 24<sup>th</sup> and 25<sup>th</sup> February 2009 at FRI, Dehradun (Sponsored by Department of Biotechnology (DBT), Govt. of India).
7. Two days National Seminar on "Premature Failure of Timber in Cooling Towers – Causes, Challenges and Future Strategies" on 10<sup>th</sup> and 11<sup>th</sup> November 2008.
8. A sensitization camp/workshop for wood based sports goods industry of Jalandhar sponsored by TIFAC, New Delhi on 15<sup>th</sup> October 2008.
9. An International Seminar on "Role of Plant Taxonomy in Biodiversity Management and Human Welfare" from 1<sup>st</sup> to 3<sup>rd</sup> December 2008.
10. Celebrated the National Technology Day on 11<sup>th</sup> May 2008.
11. Celebrated International Biodiversity Day on 22<sup>nd</sup> May 2008.
12. Celebrated the World Environment Day at FRI on 5<sup>th</sup> June 2008.
13. Meeting of "Sansadiya Rajbhasha Samiti" on 16<sup>th</sup> June 2008 was organized in Hotel Pacific, Rajpur Road, Dehradun.
14. Celebrated the 59<sup>th</sup> Van Mahotsava in the Kendriya Vidyalaya, FRI on 18<sup>th</sup> July 2008.
15. Asia Regional Workshop on "Role of youth in Mitigating the Impact of Climate Change for Sustainable Livelihood" from 13<sup>th</sup> to 18<sup>th</sup> October 2008 at FRI, Dehradun.
16. Vigilance Week was observed at FRI, Dehradun from 3<sup>rd</sup> to 7<sup>th</sup> November 2008.
17. A two-day conference on Gender Issues in Natural Resources Management- Perception and experiences in different parts of the world was organised from 16<sup>th</sup> to 19<sup>th</sup> November 2008.
18. A Workshop on "Forestry for Common People" was organized on 25<sup>th</sup> and 26<sup>th</sup> November 2008.
19. An International Seminar on "Role of Plant Taxonomy in Biodiversity Management and Human Welfare" was organized in collaboration with Association for Plant Taxonomy (APT) from 1<sup>st</sup> to 3<sup>rd</sup> December 2008 to mark the 100 years of the establishment of the world famous Herbarium of the FRI, Dehradun.
20. Forest Research Institute participated in the "Kissan Mela" organized by Gobind Ballabh Pant University, Dhakrani, Herbartpur on 15<sup>th</sup> December 2008.
21. Organized a Vaniki Mela on 7<sup>th</sup> March 2009 at village Handesra, Distt. Mohali, Punjab.
22. Celebrated the World Forestry Day on 21<sup>st</sup> March 2009.

## AWARD

- Dr. Ashok Kumar, Scientist D, G&TP Division, was awarded Brandis Award (2008) for the paper titled "Planting Stock Improvement in *Gmelina arborea* (Roxb.)". Indian Forester, 132 (6): 691-699.



## DISTINGUISHED VISITORS

1. Director, SAARC Forestry Centre, Thimpu, Bhutan visited Timber Mechanics Discipline on 27<sup>th</sup> June 2008.
2. Shri Paul Vaughan, Trade Commissioner – South Asia and Shri Siddhartha Bhargava, Business Development Manager, C/- New Zealand, High Commission, visited FRI, Dehradun on 14<sup>th</sup> August 2008 regarding future collaboration on Radiata Pine.
3. Shri Evan D. Shield, Consultor Forestal, Entre Rios 717. Piso 9 Dpto.B 3200 Concordia – Pcia.de Entre Rios, Argentina and Diana E. Diaz, EEA Concordia, C.C.34 3200 Concordia, Entre Rios Argentina visited FRI, Dehradun on 19<sup>th</sup> March 2009 regarding discussion on *Eucalyptus* utilization.
4. Shri K. Sankara Narayanan, Governor of Nagaland visited FRI, Dehradun on 25<sup>th</sup> May 2008.
5. Dr. Ratan Lat Jat (State Minister), Chairman, Rajasthan State Seeds Corporation Ltd., Jaipur, visited FRI, Dehradun on 8<sup>th</sup> July 2008.
6. Shri J.K. Dadoo, IAS, Secretary, Environment & Forest, National Capital, New Delhi visited FRI, Dehradun on 17<sup>th</sup> October 2008.

## EXHIBITION

Displayed the exhibits on natural dyes before the Honorable Chief Minister of Uttarakhand during Khadi Exhibition at Parade Ground, Dehradun on 6<sup>th</sup> November 2008.

## MISCELLANEOUS

1. The Bioinformatics Centre and Geomatics Centre were inaugurated on 24<sup>th</sup> February 2009 in the Bioinformatics Centre and GIS Division. The Centres are fully operational and being used for training, education and extension purposes. The separate internet leased line connectivity is available in the Bioinformatics Centre.
2. The Institute has been connected to Distant Learning Program of Consortium of Education Communication through EDUSAT Satellite Interactive Terminal. The facility has been established in Conference Hall of FRI University.
3. Evaluation of Fragrance and Flavour Development Centre (FFDC) was carried out, by a team of Dr. Rameshwar Dayal and Dr. V.K. Varshney, for the work conducted by the Centre in the proceeding plan as per the TOR given by the Ministry of Micro, Small and Medium Enterprises (MSME), Govt. of India.

## CENTRE FOR SOCIAL FORESTRY AND ECO-REHABILITATION, ALLAHABAD

Centre for Social Forestry & Eco-Rehabilitation (CSFER), Allahabad was established in October 1992 as an advanced Centre under the umbrella of ICFRE, Dehradun. Presently, it is a Centre of Forest Research Institute (FRI), Dehradun. The Centre aims to nurture and cultivate professional excellence in the field of Social Forestry and Eco-Rehabilitation in the state of Uttar Pradesh.

The important research activities of this Centre are in the field of Planting Stock Improvement Programme (PSIP), Wasteland reclamation, Development of Agroforestry



Models, Reclamation of mined areas through Afforestation, Productivity of Ecosystem, medicinal plants etc. A number of research projects, funded by different agencies viz. UNDP, NABARD, World Bank, etc., have been carried out at this Centre. This Centre has also taken up a project on Research and Development of *Jatropha* sponsored by NOVOD Board.

## PROJECTS ONGOING DURING THE YEAR 2008-2009

### PLAN PROJECTS

#### Project 1: Assessment of suitable age of seedlings for plantation in Uttar Pradesh [FRI-396/CSFER-2007]

##### Status:

- Nursery raising of selected species viz. *Holoptelia integrifolia*, *Albizia* sp., *Terminalia arjuna*, *Gmelina arborea*, *Bombax ceiba*, *Madhuca indica*, *Aegle marmelos*, *Pongamia pinnata*, *Acacia catechu*, *Tamarindus indica*, *Azadirachta indica*, *Artocarpus heterophyllus*, *Prosopis juliflora*, *Acacia nilotica*, *Syzigium cumunii*, *Pithecellobium dulce*, *Haterophragma adenophyllum*, *Dalbergia sissoo* and *Tectona grandis*.
- Field trial of 14 species (one year and two years old seedlings) viz. *Terminalia arjuna*, *Bombax ceiba*, *Pongamia pinnata*, *Tamarindus indica*, *Azadirachta indica*, *Artocarpus heterophyllus*, *Syzigium cumunii*, *Pithecellobium dulce*, *Haplophragma adenophyllum*, *Dalbergia sissoo*, *Tectona grandis*, *Albizia procera*, *Ficus glomerata* and *Acacia auriculiformis* has been done.
- Two sites in RBD design, two years old seedlings have been procured from the Forest Department, Allahabad.
- Maintenance and management of field trial is being done regularly.
- Growth data is being recorded regularly.

#### Project 2: Development of Agroforestry models for Eastern Uttar Pradesh [FRI-396/CSFER-2008]

##### Status:

- Field survey and selection of study sites was done in Jaunpur and Barabanki districts to identify farmers practicing agroforestry in their fields.
- In Barabanki district, agroforestry plots of different age groups of Eucalyptus and Teak were identified.
- In Jaunpur district, agroforestry plots of different age groups of Teak and Poplar were identified.
- In Allahabad district, agroforestry plots of different age groups of Aonla and Teak were identified and selected for studies.
- In Gorkhpur district, agroforestry plots of different age groups of Teak and Poplar were identified.
- Data of forestry species viz. age, height, girth etc. were recorded of these selected agroforestry plots.
- Collection of soil samples from the selected sites. Soil samples collected from selected sites of farmers fields are being analyzed for moisture content, electrical conductivity, pH, organic carbon, nitrogen and phosphorus.
- Farmers of selected agroforestry plots are being pursued regularly for crop (wheat) production data.



### Project 3: Demand Supply Gap Analysis of Important Tree Species of Selected Districts of U.P. for Extension and Afforestation Projects [FRI-396/CSFER-2009]

#### Status:

- Random selection of Tahsil wise villages (2% intensity) has been done for Gorakhpur and Deoria district to start survey of villages.
- Survey for demand-supply position of selected species has been completed in selected sixty six villages of Gorakhpur district under different Tehsils.
- Survey for demand-supply position of selected species in forty three villages of Deoria district has been completed.
- Market survey of Demand supply position has been done in the Gorakhpur and Deoria districts.

### Project 4: Bio-remediation of Bauxite residue (Red Mud) generated from Aluminum industry by using blue green algae/bio-inoculants [FRI-470/CSFER-2011]

#### Status:

- Collection of Red Mud samples from Hindalco factory.
- Chemical analysis of Red Mud.
- Procurement of Blue Green Algae species.
- Culture propagation of different species of Blue Green Algae.
- Different species of Blue Green Algae are being cultured with different amendments of Red Mud to observe the effect of Red Mud on growth performance and other characteristics of Red Mud.
- Propagation of Blue Green Algae in Tank is in propagation.

### Project 5: To standardize the Nursery techniques of Selected *Ficus* species by using Different Biotreatments [FRI-469/CSFER-2010]

#### Status:

- Collection and processing of seeds of selected *Ficus* species as Peepal, Bargad, Goolar and Pakad has been done.
- Lay out of experimental design for germination trial has been done.
- The germination trial has been completed.
- To study the effect of different biofertilizers on *F. religiosa*, a nursery pot experiment has been carried out.

## EXTERNALLY AIDED PROJECT

### Project 1: National Network Programme on Integrated Development of *Jatropha curcas* (Sponsoring Agency: NOVOD Board)

#### Status:

- National Networking trial I, has been established at Shankargarh in the year 2004-05.
- Progeny trial of marked CPTs and Zonal trial have been established at Central Padilla Nursery in the year 2005-06.



- Block plantation has been established at Shankargarh in the year 2004-05 and Defence land, Jhansi in the year 2005-06 in 10 hectare area each.
- Five Farmers Training and Two Trainers Training have been organized.
- Field Trial Under National Networking, III<sup>rd</sup> trial of 19 promising provenances from all over India, has been established at Central Padilla Nursery in RBD in the year 2008-09.
- Growth data in the nursery and Initial growth data in the field trial have been recorded.
- Fruit collection of the previous networking trial and progeny trial is in progress.

## EDUCATION AND TRAINING

Shri A.K. Pandey, IFS, Head, CSFER, Allahabad attended a training on Financial Management at Himachal Institute of Public Administration, Shimla (H.P.) from 9<sup>th</sup> to 13<sup>th</sup> June 2008.

## PUBLICATION

- A Brochure on Jatropha cultivation and its importance has been prepared.

## CONFERENCE/MEETINGS/WORKSHOPS/SYMPOSIA/EXHIBITIONS

### Attended

The representative from the centre attended the following Conference/Meetings/ Workshop/Symposium/Exhibition:

### International

1. International Seminar on Taxonomy in Botany Division of Forest Research Institute, Dehradun on 2<sup>nd</sup> and 3<sup>rd</sup> December 2008.
2. International Symposium on Afforestation of Medicinal Trees in the 3<sup>rd</sup> World Ayurvedic Congress held at Jaipur on 20<sup>th</sup> December 2008.

### National

1. National Seminar on "Harnessing Natural Resources towards Socio-economic Development" of North-east India at N.N. Saikia College, Titabor, Jorhat, Assam on 26<sup>th</sup> and 27<sup>th</sup> September 2008.
2. National Seminar on "Forestry for Common People" at FRI, Dehradun on 26<sup>th</sup> and 27<sup>th</sup> November 2008.
3. National Workshop on "Technological Intervention in Herbal and Medicinal Industry", IMS Varanasi on 21<sup>st</sup> December 2008.
4. National Conference on Bio-fuel at TFRI, Jabalpur on 25<sup>th</sup> and 26<sup>th</sup> February 2009.
5. National Seminar in the Botany Department at Gauhati University on 27<sup>th</sup> to 28<sup>th</sup> February 2009.
6. National Seminar on "Bamboo Plantation Management and its Utilization" at AFRI, Jodhpur on 17<sup>th</sup> and 18<sup>th</sup> March 2009.



## 2. Organised

1. A training programme on Bamboo species Cultivation, Harvesting and Sale was organized on 21<sup>st</sup> May 2008.
2. A training programme on Nursery and Plantation Technology of Important Forestry Species was organized on 26<sup>th</sup> August 2008.
3. A training programme for farmers on Rehabilitation of Degraded Soils in Uttar Pradesh was organized on 3<sup>rd</sup> September 2008.
4. A training programme for Farmers was organised at CSFER, Allahabad under the National Bamboo Mission from 13<sup>th</sup> to 17<sup>th</sup> October 2008.
5. Farmers Training on Cultivation and Management of Bamboos was organized at Sarnath (Varanasi), U.P. from 2<sup>nd</sup> to 4<sup>th</sup> November 2008.
6. Hindi Karyashala organized on 15<sup>th</sup> December 2008 at CSFER, Allahabad.
7. Demonstration-cum-training programme for Farmers on Commercial Cultivation of Medicinal Plants was organised on 17<sup>th</sup> December 2008.
8. A training Programme for Farmers was organized on the problem of Felling and Sale of Trees in Agroforestry on 27<sup>th</sup> March 2008.
9. A training programme was organised for farmers on Role of Biofuels in Agroforestry on 27<sup>th</sup> March 2008.

## MISCELLANEOUS

- The Extension calendar has been prepared for the year 2009-10.
- The land has been purchased at Village Silna, Nasirpur and its registry as well as mutation has been done. Proposal of land use change and construction by CCU has been submitted.
- A bamboosetum of different species was established at Padilla Nursery.
- Hindi Rajbhasa Samiti has been formed at CSFER, Allahabad to promote the use of Hindi in official use.

