# PROJECT 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

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

**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.

**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]**

**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, Populas 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* (28.69 mg/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), *Populas 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)**

**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 tentativly 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)**

**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 sphenograpta* using systemic insecticides (FRI-349/ FED-24 )

**Findings:** Experiment was laid out at Nahi Forest Block, Thano Forest Range for control of shisham leaf miner (*Leucoptera sphenograpta* ) as per statistical design. Three different concentrations of Monocrotophas 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 sphenograpta* 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]

**Findings :**Alpha cellulose isolated from stems of *Lantana camara* was subsequently modified to prepare industrially important cellulose derivatives as cyanoethyl cellulose (CEC), hydroxypropyl 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

**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 Number: FRI-376/FPD(WWF) – 62]

**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**

**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**

**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**

**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**

**Findings:** Samples of *P. radiata, A. excelsa, P. roxburghii* and *T. ciliata* were 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-36l).**

**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 ($-5^0$C) temperature proved to be fatal for the acorns. $5^0$C temperature was found to be suitable for the storage of seeds of banoak 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 D*albergia sissoo* for Seed Quality [Project No. FRI-355/Silva-32]

**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 % 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).

**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, 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]

**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]

**Findings:** Survey of selected sites in Uttarakhand has been made to know the status of Chir pine 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 chir pine forests in project area.