

EXTERNALLY AIDED PROJECT

Project 1: Status of soils and organic carbon store in Giri Catchments of Himachal Pradesh.

Status: The new areas of the Giri catchments were surveyed. Dug out the soil profiles were exposed in Kishankaur, Kirganu, Chakahan, Dhanrain, Shilaji, 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. (2005- 2009)

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 year wise plantation and survival of relevant species

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*, *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 M.P. and in Chamoli district of U.K. 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 tc.) 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 - 2010)

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]

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 australe* 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*, *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 – File 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)

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*

Status: Carboxymethyl cellulose (CMC) was prepared from α -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 α -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

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 Dehra Dun and were found to be comparable. Ursolic acid and β -sitosterol were characterized in the leaves of PI and SO, respectively.

Project 15: Phytochemical examination of bioactive agents from plants of therapeutic value

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, 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 BTISnet Program for Biology Teaching

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 (β -Asarone) containing variety/populations of *Acorus calamus* L. and its multiplication to enhance its economical and medicinal value [FRI-434/G&TP-22/EXTERNAL]

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 Himanchal Pradesh. The collected material has been established at FRI campus in the form of germ plasm 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 β -Asarone content from the samples of all 45 collected sources.

Project 18: Study of Floristic Diversity of Shiwalik Hills of Haryana.

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)), *Tcucrium Quadrifarium* Buch. – Ham.).

Project 19: Development of micropropagation protocol for the economically important bamboos: *Dendrocalamus hamiltonii* and *Gigantochloa atter* [FRI-414/Bot.-59/External]

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]

Status: The seeds and cuttings of fuel wood 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

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 Dehra Dun. The bamboo clonal nursery was inaugurated by Dr. S.S. Negi, Director FRI, Dehra Dun. The planting stock is prepared in Physiology glass house premises and transferred to nursery at City Campus, Dehra Dun. One week training was organised at Clonal Nursery, City Centre, FRI, 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]

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 per cent 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]

Status: Multilocation trial located at Prem Nagar, 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]

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]

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. 1500 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 Northeastern India. [Project funded by MOEF to RFRI Jorhat and partly sent to FRI]

Status: 249 clones of bamboo were received for studies on anatomical and chemical characteristics. 100 clones were analysed for chemical composition and anatomical features.

Project 27: Utilization of natural fibers 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.