CHAPTER 3.7

Himalayan Forest Research Institute Shimla

Himalayan Forest Research Institute (HFRI), Shimla, Himachal Pradesh was established as Conifer Research Centre during May 1977 for carrying out Research on problem associated with natural regeneration of Silver fir and Spruce. The Centre developed the technology for the same and transferred it to the State Forest Departments. During reorganization of forestry research and coming up of Indian Council of Forestry Research and Education (ICFRE), Dehradun in 1987, the mandate of this Centre was enhanced from Regeneration of Silver fir and Spruce to Eco-Rehabilitation of Cold Deserts, Mined Areas Rehabilitation besides studies on Regeneration of Coniferous and Broadleaved Forests with the responsibility of addressing the problems of forestry Research in the Western Himalayan States of Himachal Pradesh and Jammu & Kashmir. This Centre was re-designated as Himalayan Forest Research Institute, Shimla in 1998.

PORJECTS COMPLETED DURING THE YEAR 2005 - 2006

Project 1: Development of Suitable Models for Afforestation of Mined Areas [HFRI-018/ 01(EBC-07)/ PLAN/ 2002-2006]

Findings: This research project was initiated with a view to develop suitable models for afforestation of mined out areas. To accomplish the objectives, floristic and ecological survey was undertaken to assess the vegetational and other related status of the mined out areas in the very beginning.

Nursery experiments were conducted to assess the effect of different combinations of Lime Mine Spoil and Forest Soils on the performance of five tree species viz. *Bauhinia variegata, Robinia pseudocacia, Eucalyptus* hybrid, *Grewia optiva* and *Toona ciliata* revealed that the combination of Lime Mine Spoil: Forest Soil in the ratio of 1:5 or 1:2 (v/ v) was found to be the most effective combination with regard to survival, growth and biomass parameters for all these five tree species. As far as species performance in the nursery conditions was concerned, *Eucalyptus* hybrid showed maximum value for height, collar diameter, shoot, root dry weight and total biomass whereas, survival was recorded maximum in *Grewia optiva*.

Field trial comprising of 600 ETPs of the species like, *Robinia pseudocacia, Leucaena leucocephala, Bauhinia variegata* and *Grewia optiva* as established during 2003 in JST Limestone Mine, Baldlwa (Paonta Sahib) was maintained. Another trial of about 1500 plants in the same location was established during 2004 where species like, *Alnus nitida, Quercus leucotrichophora, Robinia pseudocacia, Leucaena leucocephala, Bauhinia variegata* and *Grewia optiva* were used during planting.

It was concluded from the present study that plantations of *Robinia pseudoacacia, Bauhinia variegata, Leucaena leucocephala, Grewia optiva, Alnus nitida* and *Quercus leucotrichophora* can be taken up successfully for rehabilitation of lime stone mined out areas.

Project 2: Studies on Plant Diversity of Renuka and Simbalwara Wildlife Sanctuaries of Himachal Pradesh [HFRI-024/ 02(EBC-10)/ PLAN/ 2003 2006]

Findings: Floristic assessment around Renuka lake falling in Renuka Wildlife Sanctuary revealed that a total of 109 herbaceous plant species, 43 tree species and 24 shrub species including regeneration of 15 trees and shrub species

were recorded in this particular zone. Out of the total species, 73 species of medicinal value were also recorded from the area and 7 of them fall under the category of threatened plants.

Analysis of data as registered from the altitudinal gradient of 600-900 m above msl in the Renuka Wildlife Sanctuary, it was observed that the forest is composed of 61 species of trees, 64 species of shrubs and 157 species of herbs. The plant communities as identified at 500-750 m and 750-900 m elevation range were *Bauhinia variegata - Mallotus philippensis* and *Terminalia alata Bauhinia variegata* respectively. On the basis of importance value index (IVI), *Bauhinia variegata* and *Terminalia alata* were the dominant tree species at 600-750 m and 750-900 m elevation range respectively. The distribution pattern of plant species was random and contiguous in both the altitudes. The concentration of dominance was slightly lower and index of diversity was slightly higher for the plant species in 750-900 m elevations than 600-750 m elevation range. The population structure of tree species was found to be represented mainly by two patterns: one patterns represented by greater proportion of individuals in seedling stage indicating frequent reproduction whereas, another pattern showed more individuals in intermediate girth classes with absence of seedlings. It can therefore, be assessed that if such a trend continues for a longer period, these species may disappear from the area in the near future.

Becopa monnieri

Floristic assessment were also conducted in Simbalwara Wildlife Sanctuary area having altitudinal gradient 400-650 m above msl. On analysis of data, it was observed that the forest in the sanctuary area is composed of 53 species of trees, 32 species of shrubs and 175 species of herbs.

The plant communities identified at 400-525 m and 525-650 m elevation range were *Shorea robusta Mallotus philippensis* and *Shorea robusta- Terminalia alata* respectively. On the basis of Importance Value Index (IVI), *Shorea robusta* was the dominant tree species at both the elevational ranges. The distribution pattern of plant species was random and contiguous in both the altitudes.

Project 3: Screening and Selection of Insect pest and Disease Resistant Phenotypes/ Genotypes of Important Tree Species of *Pinus roxburghii, Dalbergia sissoo* and *Cedrus deodara* [HFRI-013/06(FPT-02)PLAN/2000-2006]

Findings: Provenances and clones of selected tree species were assessed for insect-pest and disease incidences. Seedlings of Deodar from 19 different seed sources as raised at Field Research Station, Shilly, Solan were examined regularly and systematically for Deodar defoliator attack, which revealed that the seeds collected from Sareen, Solan, Kalpa and Himgiri showed more resistance against *Ectropis deodarae* while compared to others.

Clonal Seed Orchard (CSO) of Shisham at Gondpur, Paonta Valley having 35 clones was screened against *Odontotermis parvidens.* 29 clones and 25 provenance of *Dalbergia sissoo* were also screened against *Plecoptera reflexa* and it was observed that clones with code numbers 90, 203, 36, 260, 107, 66, 59 and 42 were susceptible with infestation level ranging from 97 to 100 per cent and least susceptible clones were 28, 101 and 103 having infestation varying from 21.91 to 25.98 per cent in field conditions. Among different provenances, provenances with code

number 53, 35, 61 and 2 were found susceptible thereby, showing infestation level ranging from 89.13 to 93.75 per cent and the provenance with code no. 46 and 94 had shown 21.02 to 24.11 per cent infestation.

Data collected for 7 provenances was analyzed for their pest resistance. Infestation level by the insect stem borers varied from 7.7 to 58.8 %. Collected data also revealed that the Seer Kunar Khud provenance under Hamirpur Forest Division comprising forest of P-38 AM Platu C-3b, P-38 AM Platu C-1d, P-38 AM Platu C-1c, Chalsai Forest C-4c were moderately resistance to the incidence of different insect borers complex (*Sphaenoptera aterrima*, *Cryptorhynchus rufescens*, *Platypus biformis* and *Polygraphus longifolia*). The Giri-Gambhar provenance under Solan and Rajgarh Forest Division comprising forest of RF Sakor C-I, RF Sakor C-III, R-136 E. Banethi C-4 were susceptible to attack of these insect borers complex.

Drying of Chir pine tree due to insect stem borer attack

Project 4: Development of model for integrated pest management with special reference to *Cedrus deodara* [HFRI-017/06(FPT-03)PLAN/2000-2006]

Findings: Bioecology of *Ectropis deodarae* in Deodar forests was studied and it was observed that the pest was able to complete only one generation in a year. Females were found to deposit eggs on the tender needles of deodar during the spring and the total incubation period ranged from 8.5 to 15.0 days. Light green colour larvae of *E. deodarae* were found to be hatching from the eggs during April and May. The larvae showed quite resemblance to the smaller twigs and arrested shoots of the infested trees.

Adult emergence began in mid February from over wintering pupae of previous year. Under field conditions, maximum emergence of moths took place when around 15 eggs were deposited in April. With the onset of spring, adults emerged to start the new generation. Thus, the pupal stage is the longest period in the life-cycle of this univoltine species.

All the instar stages of this defoliator move on the branches and also to other trees by means of silken threads secreted by the larvae themselves. During epidemic, the infested trees had a network of silken threads on the stem, branches and undergrowth.

A large number of natural enemies of this pest comprising of 11 parasitoids, 8 predators and 9 entomopathogens were identified. Three species of parasitoids viz. *Apanteles flavipes*, *Apanteles glomeratus* and *Apanteles ruficrus* emerged from the larvae of *E. deodarae*. The extent of parasitization by these species was 6.7, 12.2 and 16.0 per cent in April, May and June, respectively. Among the predators *Calosoma beesoni* was the most important and a single beetle of the same was found capable of consuming 5.6 ± 1.6 larvae of *Ectropis deodarae* daily.

Among entomopathogens, NPV, *Bacillus cereus* and *Beauvaria bassiana* are important causing infection to the extent of 12.6, 16.5 and 12.9 percent, respectively. In case of pupae, 22.4-36.5 per cent infection of *Beauvaria bassiana* was observed.

Campoplegidae deodarae - Pupal
Parasitoide of *E. deodarae*

PROJECTS CONTINUED DURING THE YEAR 2005-2006

Project 1: Introduction and Performance of *Paulownia* sp. for agroforestry in different agroclimatic zones of Himachal Pradesh [HFRI-026/08 (AGF-02) PLAN/2003-2008]

Status: Field trials of *Paulownia* sp. as established earlier in different agro climatic zones of Himachal Pradesh were maintained.

During the year, seedlings were raised mainly through root cuttings for laying out the new field trials. In the process, a trial in the forest land was established in Jammu region of J&K and a pure agroforestry trial was raised on the private land in Tea garden at Rakh Palampur, Himachal Pradesh. Besides this, beating up operations were also carried out. Data on different growth parameters in all the field and nursery trials were also recorded.

Field trial of Paulownia sp. at Dharamsala

Project 2: Diagnostic survey and appraisal of existing agroforestry systems in mid and high hills of Himachal Pradesh [HFRI-028/08 (AGF-03) PLAN/2003-2008]

Status: Villages have been identified for detailed survey and there after, stratification of selected areas and villages was done. Pilot survey conducted with questionnaires and village level meetings were also conducted. Data collected for various existing agroforestry systems in the identified zones is being analyzed.

A general landscape of mid hill region in Kullu Valley

Project 3: Standardization of nursery techniques of five dominant indigenous species (*Capparis spinosa, Colutea* spp., *Caragana* spp., *Ribes* spp. and *Cratagus* spp.) besides *Eleaegnus angustifolia* and *Rosa webbiana* of cold deserts [HFRI-019/03 (EBC-08)PLAN/ 2002-2007]

Status: Trials to understand the (i) Effect of different concentration of Indole-3 Butyric Acid on rooting in shoot cuttings of *Ribes* sp., *Colutea* sp., *Eleaegnus* sp., and *Hippophae rhamnoides* and in root suckers of *Rosa webbiana* and *Capparis spinosa,* (ii) Effect of pre-sowing (hot-water and Gibbrellic Acid) treatment on germination behaviour in the seeds of *Ribes* sp., *Collutea* sp., *Hippophae rhamnoides, Capparis spinosa* and *Rosa webbiana* and (iii) Effect of medium (various ratios of sand and soil) on germination behaviour in the seeds of *Ribes* sp., *Collutea* sp., *Hippophae rhamnoides, Capparis spinosa* and *Rosa webbiana* were repeated both in poly house and in nursery conditions. Besides this, experiments on the effect of mulching treatments on *Ribes* spp., *Hippophae rhamnoides, Rosa webbiana* and *Capparis spinosa* were also undertaken.

Rosa webbiana

Colutea nepalensis

Detailed ecological studies for the identified species were carried out in the already selected sites at Mane, Ladang, Kurith, Hurling, Tabo and at Samdoh falling in Spiti Valley of Himachal Pradesh.

The data pertaining to different growth parameters in various experiments were recorded. Sites for carrying out ecological studies in case of *Cratagus songarica* were also selected in Trilokinath area of Lahaul Valley. All the ecological parameters of the species studied and the data is being analyzed. Field trials as raised earlier were also maintained during the period.

Facilities at Field Research Station, Tabo (Lahaul and Spiti) were further strengthened by erecting poly-tunnels, shade houses, digging out trenches and establishment of irrigation system for carrying out trials in the nursery conditions. Ecological details of the different species were scanned and new nursery experiments as laid were maintained.

A field trail of the different cold desert species

Project 4: Studies on plant diversity in cold deserts of district Kinnaur, Himachal Pradesh [HFRI-029/ 02(EBC-11)PLAN/2004-2007]

Status: Due to flash floods in river Satluj because of breeching of Parchhu lake in Tibet, the field studies could not be taken up during the year, however, data as collected during the earlier survey was analyzed. Major tree species - *Cedrus deodara, Pinus gerardiana, Juglens regia, Betula utilis* and *Salix alba,* whereas the shrubs of importance were *Capparis spinosa, Collutea nepalensis, Ribes* spp., *Rubus* spp. and *Lonicera* spp. etc. in the area. Herbs were also recorded and some of them are, *Thalictrum foliolosum, Hercacleum candicans, Epilobium* spp., *Persicaria* spp. and *Potentila* spp., etc. *Hyssopus officinalis, Bergenia strachyei, Viola biflora* and *Geranium wallichiana,* were the species of medicinal importance. *Orobache* sp. (parasitic plant) as collected during the survey may be one of the new record for the flora of Himachal Pradesh. The number of herb species analyzed were 83, 82, 38 and 25 at 3000-3500m, 3500-4000m, 4000-4500m and 4500-500 m elevational range respectively.

A view of Cold Desert (Pooh sub-division)

Project 5: Natural enemy complex of key and potential pests of five *Quercus* spp. of Himachal Pradesh [HFRI-027/06(FPT-05) PLAN-2003-2008]

Status: All the five species of oaks viz. *Quercus glauca, Q. leucotrichophora, Q. dilatata, Q. semicarpifolia* and *Q. ilex* were screened with major emphasis on ban oak. During this period Darer Forest, Jhungi (near Sudernagar Distt. Mandi), Narag and Rajgarh (near Nahan, Distt. Sirmour) areas were surveyed and impact of oak defoliators was also recorded. *Lymantria obfuscata*- the Indian Gypsy Moth was found to be the major defoliator and outbreak of the moth was observed in Sirmour district of Himachal Pradesh causing heavy defoliation to Ban oak. Evaluation of the damage by Indian Gypsy Moth in the term of leaf consumption was done using Leaf-Area Measurements. Life-cycle of *Lymantria obfuscata* feeding on ban oak was completed and a repeat study is in progress in the laboratory.

So far, three Hymenopteran parasitoids were discovered as a parasitoids of cynipid pests that cause leaf galls. These species are *Torymus himachalicus*, *T. stom*, and *T. absonus* and are new to entomological sciences. Virus infected larvae were collected from the field and also obtained from laboratory reared larvae of Indian Gypsy Moth. The larvae were homogenized, centrifuged, virus particles were purified using 1% SDS and were refrigerated. Identification was done under Transmission Electron Microscope in collaboration with Central Potato Research Institute (CPRI), Shimla. Further exploration of Nuclear Polyhedrosis Virus (NPV) is in progress.

5th Instar larva of *Lymantria obfuscata*

NPV infected larva of *Lymantria obfuscata*

Project 6: Standardization of nursery technology for mass propagation of selected medicinal plant species [HFRI-009/07(NWFP-01)/PLAN/2000-2007]

Status: Germplasm of 33 medicinal plants species growing in temperate Himalayas was maintained in Brundhar nursery (Manali), 30 species at Shilly nursery, Solan and 10 species each at Shillaru Nursery (Shimla) and Model Nursery (Shimla). Trials are in progress for improving the agro-techniques of economically important medicinal plant species e.g. *Picrorhiza kurrooa* (Karu), *Aconitum heterophyllum* (Patish), *Valeriana jatamansi* (Mushkbala) and *Angelica glauca* (Chora) etc. Work is in progress for obtaining vegetative propagation in these species.

Project 7: Standardization of nursery techniques of raising containerized seedlings of conifers and their broadleaved associates [HFRI-016/05(SFG-06)/PLAN/2000-2007]

Status: Maintained nursery stock of Deodar, Fir and Spruce and some broadleaved species as raised under various trials in root trainers at Model Nursery, Baragaon, Shimla and Research Nursery, Shillaru. Trials were conducted to find out the optimum size/ type of root trainer seedling production in *Cedrus deodara*, *Abies pindrow, Picea smithiana* and *Alnus nitida.* Trials have been initiated on potting media comprised of locally prepared compost under root trainer seedling production system. Field trials have been initiated to assess the survival and growth after out planting the nursery stock raised in root-trainers vis-à-vis traditional system in Deodar, Silver Fir and Spruce.

Root development in Silver fir nursery stock in root trainers

Project 8: Planting stock improvement programme in *Cedrus deodara* [HFRI-028/05(SFG-08) PLAN-03/2003-2008]

Status: Surveys in deodar forests to select best stands of deodar based on ocular estimates of morphometric traits were carried out. Ocular selection of seed stands was followed by sample plot study wherein each and every individual tree within the stand was assessed for quantitative as well as qualitative traits and the stands with maximum average were finally selected. Sample plot studies were carried out to supplement ocular selection of seed stands for their conversion into Seed Production Areas (SPAs). The Cheog Forest (20 ha) falling in Theog Forest Division and Nankhari Forest (15 ha) of Rampur Forest Division were finally selected for complete enumeration. Each individual tree in these selected forests was assessed and marked for retention and culling. In Cheyog Forest 1527 trees were assessed, of which 1230 have been retained and 297 marked for culling whereas in Nankhari Forest the total numbers of trees enumerated were 1137, of which 1011 have been retained and 126 marked for culling. Detailed marking lists of these stands are being prepared and will be submitted to authorities concerned to obtain culling permission. Deodar forests of Udhampur Forest Division falling in the state of Jammu & Kashmir have also been surveyed, however, more areas still to be surveyed for selecting 15 ha seed stands for their conversion into Seed Production Areas (SPAs). A total of 70 Plus Trees in different deodar areas both in the state of Himachal Pradesh and Jammu & Kashmir have been selected and seed will be collected this year to raise progeny trail.

Project 9: Establishment of Amla and Khair demonstration plantations in lower hills of Himachal Pradesh

Status: Carried out beating up of casualties and maintained about 2.5 ha demonstration plantations of Amla and Khair at two sites namely Upper Darogan and Bhareta situated on Hamirpur Sarkaghat National Highway near Tonidevi Town of Himachal Pradesh. The plantations are being maintained intensively for the development of realistic model of Amla and Khair plantation. Feed back received on the subject reveals that the farmers of nearby areas are also interested in such type of interventions in their underutilized grasslands.

NEW PROJECTS INITIATED DURING THE YEAR 2005-2006

Project 1: Mycorrhizal association in selected temperate medicinal plants of Himachal Pradesh and Jammu & Kashmir [HFRI-032/07(FPT-06)PLAN/2005-2008]

Status: Plants of *Angelica glauca* (Chora), *Aconitum heterophyllum* (Atish), *Valeriana jatamansi* (Mushkbala), *Picrorhiza kurrooa* (Karu), *Saussouria costus* (Kuth) and *Heracleum candicans* (Patrala) were collected along with roots and rhizosphere soil from Banshiru Dhar (Manali) and Hatu (Narkanda) areas. Root and soil samples of these species as collected during the survey were processed in the laboratory and later the root samples were fixed in F.A.A. (Formaldehyde, Acetic acid and Alcohol in the ratio of 5:5:9) for further studies. VAM colonization in roots confirmed the association of VAM species in all these species of medicinal importance. Spores were extracted from the soil by wet sieving and decanting methods. Chemical studies of rhizosphere soils have also been initiated.

Project 2: Survey, biology and control of insect pests of important medicinal plants in Himachal Pradesh and Jammu & Kashmir [HFRI-033/06(FPT-07)PLAN/2005-2010]

Status: Regular and systematic surveys were undertaken to record the incidence of various pests in research nurseries of the institute located at Shilly (Distt. Solan), Shillarru (Distt. Shimla), Brundhar (Distt. Kullu) and Baragaon (Distt. Shimla). Besides this, the nurseries/ experimental areas as maintained by Department of Ayurveda, Govt. of Himachal Pradesh at Neri (Distt. Hamirpur) and Joginder Nagar (Distt. Mandi) were also visited to record the above observations.

Project 3:Allozyme variation in natural populations of Deodar (*Cedrus deodara*) [HFRI-030/05(SFG-10) PLAN/03/2005-2008]

Status: Open pollinated seeds from at least 20 individuals from 11 different populations [Cheyog, Chopal, Manali, Chail, Dalhousie, Churah (RF Khani), Naldehra, Nankhadi, Karsog, Chajpur and Kalpa] in the state of Himachal Pradesh and 4 populations from Jammu & Kashmir are being used to study genetic diversity in populations of deodar. However, seed could not be collected from all these populations during the year as the same was found to be the lean seed year. However, the seed as collected form three populations of Karsog, Chopal and Manali were assayed for four enzyme systems.

Project 4: Diagnostic study of indigenous and institutionalized participatory forest management in Himachal Pradesh [HFRI-025/08(PFM-01) PLAN/2005-2008]

Status: The project aims at to carry out diagnostic survey of institutionalized and indigenous (traditional) participatory forest management approaches being tried in the state of Himachal Pradesh along with gender issues analysis**.** Conducted survey to select sites and also for carrying out diagnostic survey in different PFM areas of Kullu, Sirmour and Shimla districts of the state. Discussions with the Divisional Forest Officers in the field were held and secondary data regarding different VFC, VFDC were also collected. Village meetings during pilot surveys were conducted to probe the details of progress of PFM as per identified criterion. The survey of forest guards at forest training centre Sundernagar and forest school Chail was also conducted to analyze to attitudinal change and knowledge about PFM. Data from other forest circles is being collected.

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

Project 1: Development of suitable model for intercropping of commercially important medicinal plants with horticultural plantations in temperate region of Himachal Pradesh [BT/PR4372/PBD/17/285/2003-2006: DBT Funded Project]

Status: Data recording in various intercropping trials of medicinal plants as laid in different sites of Kullu and Shimla district of Himachal Pradesh continued. Data for pre-harvest agronomic growth characters is being statistically analyzed. Porometer studies were also carried out for some of the trials. The trials were maintained by carrying out weeding, hoeing and watering and casuality replacement were also done. Quality planting stock of selected species to

Picrorhiza kurrooa

Valeriana jatamansi

be used for intercropping trials was maintained at Brundhar and Shillaru research nurseries by carrying out regular nursery operations. Samples of *Aconitum heterophyllum, Angelica glauca, Polygonatum verticilatum, Picrorhiza kurrooa* and *Valeriana jatamansi* were collected from natural habitat as well as from the local market for carrying out comparison as far as the active principles of these species of medicinal importance.

Soil sample were also collected from the natural zones of occurrence of these species and analyzed in the laboratory. Periodic recording of data including the growth parameters is being continued.

Project 2: Ecological and management studies in certain dry temperate and alpine pastures of Lahaul and Spiti, Himachal Pradesh [BT/PR4102/NBDB/ 51/027/2003]

Status: Sites supporting alpine pastures in each part of the district i.e. Miar Nallah, Trilokinath, Dalang and Kwaring in Lahaul valley and Gue, Tabo and Kunjam in Spiti valley were identified as the representative sites for recoding floral elements including assessment and distribution of rare and endemic plants.

Alpine pasture site for reconnaissance survey at [a] Trilokinath (Lahaul) and [B] Kunjam (Spiti)

Base line data of all the study sites were collected from the available sources.

Sites at Khoksar (Lahaul valley) and Kiyato and Gate (Spiti valley) were selected for detailed investigations on structural and functional aspects of the alpine pastures including the assessment of floral elements.

Studies on floristic composition, phenology, phyto-sociology of the constituent species including biomass estimation and productivity potential in the respective sites were carried out at monthly intervals by using quadrates. New floristics and their association were recorded in both the valleys. In all about 100 species were recorded from different altitudes and majority of them adding to the fragmented studies made earlier in the region. Number of species of medicinal importance and endemic to the area were also recorded from these pastures. Vegetation types were also identified from some of the sites. Data on productivity and other parameter is being analysed.

Project 3: Ecological assessment of forest areas falling under Koldam hydroelectric project in Bilaspur district of Himachal Pradesh [FT48-88/86(FCA) 2004-2007 KOL DAM: HPSFD Funded Project]

Status: Selected study sites in different catchment areas of Bilaspur, Kunihar, Theog and Karsog Forest Divisions and afterwards detailed reconnaissance survey and ecological studies in the identified locations were carried out. Plant diversity studies were accomplished. Soil samples were also collected to assess the chemical properties of the soil.

Koldam catchment (Theog Forest Div.)

Taxus wallichiana

Project 4: Production of quality planting material of *Picrorhiza kurrooa* Royle ex Benth and *Valeriana jatamansi* Jones and Extension of their cultivation technology to local communities [GO/HP-2/2004-2007: NMPB Funded Project]

Status: Activities under the project mainly centered around production and maintenance of quality planting material of *Picrorhiza kurrooa* and *Valeriana jatamansi* at three research stations/ nurseries of the Institute located at Bruhandhar (Manali), Shilly (Solan) and Shillaru (Shimla). The activities during the year mainly included preparation of land for nursery beds, macro-proliferation (multiplication) of 1-2 years old existing stock of *Picrorhiza kurrooa* and *Valeriana jatamansi* in the nursery and procurement of sand, FYM etc. Target for the production of 4 lacs Quality Planting Material (QPM) of *Picrorhiza kurrooa* (Kutki) and *Valeriana jatamansi* (Mushkbala) has been given

by National Medicinal Plants Board (NMPB) under this project during 2004 to 2007. The Institute accordingly, has fixed target to raise at least 3.20 to 3.30 lacs plants i. e. 80% of the target of these species during first two years of the project period, so that in last year of the project more emphasis be given on distribution of material and extension activities. Up to March 2006, the Institute had raised 3.3 lacs of quality planting material of Kutki and Mushkbala under this project in different nurseries. 15,750 numbers plants of these two species were distributed amongst local communities during the year 2005.

Project 5: Development of elite planting material, establishment of model plantations and extension of nursery and plantation techniques of Wild Apricot to local communities in Himachal Pradesh [27-79/NOVOD/2004/1188-89/ 2004-2007: NOVOD Funded Project]

Status: Seeds of Wild Apricot were collected from Kinnaur and Shimla districts of Himachal Pradesh. The seeds were then provided pre-seed stratification treatment in moist sand at low temperature and later sown in the nursery beds. Around 10,000 quality seedlings of wild apricot raised and maintained in the research nurseries.

A survey was conducted for the selection of suitable sites for carrying out plantations of the species over an area of 25 ha. Based upon soil depth and moisture regime, the sites for plantations were selected at Bhaba Nagar (Kinnaur), Shillaru (Shimla), Barog (Solan) and at Sambal (Mandi) district. The plantation activities later were carried out during the month of January-February 2006. 2,700 plants of wild apricot (6.75 ha) were planted at Bhaba Nagar (Kinnaur Forest Division), 2,500 plants (6.25ha) at Shillaru (Kotgarh Forest Division), 2,500 plants (6.25 ha) at Barog (Solan Forest Division) and 2,300 plants (5.75ha) at Bahlidhar, Sambal (Nachan Forest Division). Three training programmes were also organized under the project.

Project 6: Suitability of *Jatropha curcas* L. seed sources in lower and mid Himalayan regions of Himachal Pradesh [BT/PR/5094/AGR/16/429/2005-2008: DBT Funded Project]

Status: Approximately 26,000 numbers of quality planting stock of *Jatropha curcas* from 25 different seed sources was raised and maintained in the nursery during March to August 2005. The stock thus raised was later used for establishment of experimental-cum-demonstration plantations over an area of 10 ha at 6 different sites located in Solan, Bilaspur and Sirmour districts of Himachal Pradesh during July/ August 2005.

About 80 Kg of seeds of *Jatropha curcas* were also collected from 26 different locations during October/November 2005 covering 7 district of the state of Himachal Pradesh. Out of the collection, around 15 kg seeds were sent to FRI, Dehradun and 10 kg seeds were provided to Divisional Forests Officers of Solan and Nalagarh Forest Divisions for sowing purposes.

Bir Plassi Nursery, Nalagarh and Majholi Nursery, Solan were used for sowing the seeds in the month of March and April 2006. Besides this, around, 10,000 cuttings have also been planted for the overall production of 30,000 planting stock of Jatropha for carrying out beating up operations and fresh plantations over an area of 10 ha.

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

Project 1: Development of ecologically viable and socio-economically acceptable integrated model for Arresting Willow (*Salix* sp.) mortality in Lahaul Valley of Himachal Pradesh [GBPI/IERP/04-05/34/861]

Status: Nursery for raising the clones of willow was established at Sissoo (Lahaul valley) where both national and international clones, provenances and species were planted for their further screening. Besides, 8 international clones, 3 species as brought from the state of Jammu & Kashmir and 5 different provenances of Salix as identified in and around Karsog area of Himachal Pradesh were raised and maintained in this nursery. Besides this, material as collected from 14 different locations/ provenances within Spiti and Kinnaur valleys were also raised and maintained in the nursery at Tabo. A demonstration plantation in an area of 0.5 ha was established where 246 plants of Salix and 84 plants of *Populus ciliata* were raised.

Willow plantation in Lahaul Valley

While establishing this demonstration plantations at Sissoo, planting material of 5 different species of Salix from the state of Jammu & Kahsmir, 3 different provenances from Himachal Pradesh and 5 different international clones were used.

Nursery has been raised at Sissoo for assessment of Aphid attack on Willows including studies on their life cycle. Plantations of Willow as raised by villagers at Gompthang and at Keylong including plantations at Tandi and Satingri were visited. For recording populations of willow aphids, 9 twigs were marked and the required observations were recorded daily for 5 days.

The alatoid viviparous nymphs appeared when the colony became overcrowded. Alate aphids appeared and they were found taking shelter inside the crevices of rock. GWA was collected for the first time from Satingri in Lahaul valley.

Project 2: Studies on population status and Berberine content in different provenances of *Berberis aristata* DC in Himachal Pradesh and standardization of its propagation techniques [BT/PR 4695/PBD/17/300/2005-2008: DBT Funded Project]

Status: The Project aims to identify high berberine yielding *B. aristata* provenances in Himachal Pradesh and to develop nursery techniques for mass propagation of identified elite clones/ provenances of *B. aristata*. During the

initial phase of the project period, six provenances of *Berberis aristata* have been identified in Himachal Pradesh. Later 2 kg of root samples were collected after random selection of 2 to 3 mature plants from each of the provenance for further studies. The collected roots were cut into small pieces, dried in shade and sent to the Forest Research Institute, Dehradun for estimation of berberine content. To standardize nursery techniques for mass propagation of the species, one year old semi-hardwood cuttings collected from mature plants were treated with different concentrations of IBA, IAA and NAA and transplanted in mist chamber of the institute. Data on sprouting of stem cuttings are being collected from the nursery and mist chamber of the institute. For seed germination studies, seeds extracted from ripened fruits were subjected to 13 different pre-sowing treatments and the studies indicated that maximum germination was recorded in seeds with 24 hour hot water followed by 24 hour boiled water treatments.

Project 3: Invenorization, documentation of plant diversity and to evolve site specific management strategies for conservation of various sacred groves in Kullu Valley of Himachal Pradesh [GBPI/IERP/04-05/18/865/2005-2008: GBPIHED Funded Project]

Status: The present study aims at to inventorize and document the plant diversity, assess the regeneration status of trees in comparison to the adjacent forest area, create awareness amongst the local people and to develop site specific strategies for the rejuvenation and conservation of sacred groves through participation of local people.

A questionnaire was prepared to record data on the sacred groves and field visits were undertaken in the study area and meetings with the villagers were also held. Twenty two sacred groves were visited and information on plant diversity was recorded. Fifty five plant species belonging to 31 families have been recorded so far from the sacred groves. Traditional ethno-botanical information on 15 species have also been documented.

Project 4: Setting up 100 hectare demonstration plot in Himachal Pradesh and production of elite planting material of *Dendrocalamus hamiltonii* [BT/PR/5243/AGR/16/456/2005-2008/ DBT Funded Project]

Status: The site where demonstration plots of *Dendrocalamus hamiltonii* are being raised is situated about 28 km south-east of Solan. The area falls under Dhadiyarghat beat, Lugon Block, Parwanoo Range of Solan Forest Division.

Keeping in view the activity schedule and target of raising 10 ha demonstration plot, complete socio-economic survey of adjoining village Dadhog was carried out besides other related activities required for preparation of sites. Plantation was raised in 5 ha area by using tissue culture raised experimental (2.63 ha), conventionally raised (0.27 ha) and demonstration plots of 2.10 ha. Randomized Block Design was followed to raise experimental plots. The experimental plots for tissue culture raised plants as per the guidelines have been laid out at two spacing of 5 m x 5 m and 6 m x 6 m with four treatments of the fertilizers and three replications. For conventionally raised plants demonstration plot the spacing have been kept at 5 m x 5 m.

Abstract: No. of Projects

	No. of projects completed in 2005-2006	No. of ongoing projects in 2005-2006	No. of projects initiated in 2005-2006
Plan Projects	4	9	4
External Projects	-	6	4
Total	4	15	8

EDUCATION AND TRAINING

Education

1. Probationers of Indian Forest Services from Indira Gandhi National Forest Academy, Dehradun, visited Himalayan Forest Research Institute (HFRI), Shimla on 17th May 2005.
2. Range Forest Officer Trainees of Uttranchal Forest Training Academy, Haldwani visited the institute on 19th May 2005.
3. Students from Sarswati Vidya Mandir School, Vikas Nagar, Shimla visited the institute on 22nd June 2005.
4. Forest Guard Trainees from Forest Training School, Chail, Himachal Pradesh visited the Institute on 22nd July, 2005. The trainees were made aware of the ongoing institutional research activities of the Institute through a presentation.
5. A team of farmers from Distt. Kinnaur alongwith officers from the Divisional Forest Office, Kinnaur was apprised of various activities being undertaken by the institutes and issues of common interest including ecology and suitable agroforestry models that can be practiced in the district were discussed on 21st March 2006.
6. Dr. Vaneet Jishtu from this institute was awarded Ph. D. Degree in forestry from FRI Deemed University, Dehradun.

Training Organized

1. Organized two days Farmers Training Programme on "Wild Apricot" on 2nd and 3rd September 2005 at Narag falling in Rajgarh Forest Division of District Sirmour, Himachal Pradesh. The Training was organized under the project funded by the NOVOD Board of Govt. of India. An open meeting under NOVOD funded project was also organized for the farmers of Baragaon village at Model Nursery, Baragaon on 17th March 2006, where farmers were made aware of importance of cultivation of Wild Apricot.
2. Organized two Farmer's Trainings Programmes on "Cultivation of Karu and Mushkbala" at village Sajla and Karjan of Kullu District on 10th March 2006 and at village Jhungi of Mandi

Training and demonstration programme on Wild Apricot

District on 12th and 13th March 2006 under the project funded by National Medicinal Plant Board, New Delhi.

3. One day Farmer's Training on "Commercial Cultivation of Medicinal and Aromatic Plants" at village Dhalwan on 14th March 2006, the funds for which were given by the State Forest Department, Himachal Pradesh


Training and demonstration programmes at Himachal Pradesh

Attended

1. Shri K.D. Sharma, IFS attended one week compulsory training course on "Wildlife Management: Issues, Concerns and Practices for Indian Forests Service Officers" from 20th to 24th June 2005 at Wildlife Institute, Dehradun (Uttaranchal).
2. Shri K.S. Thakur, DCF attended three days' training programme on Overview for Decision Makers at Indian Institute of Remote Sensing, Dehradun from 20th to 23rd September 2005.
3. Shri Surinder Kumar, Director, HFRI, Shimla attended two weeks Promotion Linked in-service Training for IFS Officer from 18th to 28th October 2005 at IGNFA, Dehradun.

LINKAGES AND COLLABORATION

The Institute remained in constant touch with the State Forest Departments of Himachal Pradesh and Jammu & Kashmir; State Forest Research Institute, National Bureau of Plant Genetic Resources, Shimla; Dr. Y.S. Parmar University of Horticulture and Forestry, Solan; CSK Himachal Pradesh Krishi Vishvavidayala, Palampur; Institute of Himalayan Bio-resource Technology, Palampur, Himachal Pradesh University, Shimla and Punjab Agriculture University, Ludhiana including other research and non governmental organizations working in the field of forestry and forestry research in the state of Himachal Pradesh and Jammu & Kashmir. Contacts were also established with Central Potato Research Institute, Shimla for Transmission Electron Microscopic (TEM) studies. Besides this, the institute is implementing two externally aided projects in close collaboration with CSK Himachal Pradesh Krishi Vishvavidayala, Palampur and Institute of Himalayan Bio-resource Technology, Palampur. This has enabled the institute to share the ideas and the research input with these organizations.

PUBLICATIONS

Brochures/ Technical Bulletins/ Booklets

1. Sharma, Sandeep; K.S. Thakur and Naina Joshi (2005). Jatropha: Bhavisya Ka Bio-diesel Paudha.
2. Thakur, K.S.; P.S. Negi and Sandeep Sharma (2005). Chuli: Paudhshala Avam Variksha Ropan Taknik.
3. Meena Bakshi, Surinder Kumar, Rajesh Sharma and K.S. Thakur (2006). Mass Vegetation Propagation of *Dalbergia sissoo* (Roxb).

Research Reports

Ranjeet Singh, Surinder Kumar, S. Chakrabarty and Ashok Kumar (2005). Resurgence of Indian Gypsy Moth, *Lymantria obfuscata* (Lepidoptera: Lymantriidae) on Ban Oak Forests of Rajgarh Forest Division, Himachal Pradesh. Research Report No. HFRI/RP/028, September 2005.

CONSULTANCY

To guide and to provide all necessary inputs, cooperation and technical assistance to M/s Gujarat Ambuja Cements Ltd. Darlaghat, District Solan (HP), Himalayan Forest Research Institute, Shimla signed a Memorandum of Understanding with the Company initially for a period of five years beginning from July 2005 for "Carrying out Eco-rehabilitation Activities in its Mined Out Areas at Kashlog". This consultancy is to be implemented by the Divisions of Ecology and Biodiversity Conservation and Silviculture and Tree Improvement of the institute. An amount of Rs. 3,97,347 has already been advanced to this institute for taking up the related works during 2005-2006.

CONFERENCE/MEETINGS/WORKSHOPS/SEMINARS/SYMPOSIA/ EXHIBITIONS

Organized

1. Shri Surinder Kumar, IFS, Director, HFRI and Dr. K.S. Kapoor, Coordinator, Research attended the meeting of Research Policy Committee of ICFRE from 30th April to 1st May 2005 at ICFRE, Dehradun.
2. Dr. Sandeep Sharma, Scientist-D attended a workshop on "Traditional System of Medicine" at YMCA. Complex, Shimla on 25th June 2005.
3. Dr. K.S. Kapoor, Scientist-E attended an International Workshop on "Conserving Hill and Mountain Ecology from 24th to 26th August 2005 organized by United States Educational Foundation in India at Shimla in collaboration with Institute of Integrated Himalayan Studies, Himachal Pradesh University, Summer Hill (Shimla) and Forest Survey of India (NZ), Shimla.
4. Shri Ashok Kumar, Scientist-B participated in the National Symposium on Changing Concepts of Forestry in 21st Century on 21st and 22nd October 2005 held at Dr. Y.S. Parmar University of Horticulture and Forestry

Nauni, Solan sponsored by ICFRE, Dehradun and H.P. State Forest Department.

5. Officers and Scientists of this institute attended one day's workshop on "Acts and Rules for Environmental Conservation" on 25th November 2005 as organized by State Director, World Wide Fund, Shimla in collaboration with HFRI, Shimla.
6. A Regional Workshop on Forestry Extension Strategy Review was organized by the Institute on 27th December 2005. Besides participation of officers and scientists from this institute, about 25 participants representing different Research Organizations, Universities, NGOs, Farmers and State Forest Departments like Forest, Horticulture and Animal Husbandry also attended the workshop.
7. Shri Surinder Kumar, IFS, Director, HFRI attended a workshop on Climatic Change Mitigation in Forestry Sector at New Delhi on 23rd and 24th January 2006.
8. Shri Surinder Kumar, IFS, Director; K.S. Kapoor, Coordinator research and Dr. Sandeep Sharma, Scientist-D attended Silviculture Conference as organized by FRI, Dehradun from 1st to 3rd February 2006.
9. Himalayan Forest Research Institute, Shimla in collaboration with State Forest Research Institute (SFRI), Jammu & Kashmir organized a one day Liaison Meeting on 7th February 2006 for the Senior Forest Officers of the Jammu & Kashmir, State Forest Department.
10. Dr. Rajesh Sharma, Scientist-D attended a national workshop on Tree Biotechnology Indian Scenario as organized by TFRI, Jabalpur on 9th and 10th February 2006.
11. Dr. Sandeep Sharma, Dr. R.K. Verma and Shri Jagdish Sharma attended a national workshop on Conservation and Cultivation of Medicinal Plants as organized by Haryana State Forest Department in close collaboration with State Medicinal Plant Board, Govt. of Haryana on 15th and 16th February 2006.
12. Shri Surinder Kumar, IFS, Director, HFRI attended workshop on Forestry Education in India: Issues and Opportunities at Deemed University, Dehradun on 20th and 21st March 2006.
13. Shri Surinder Kumar, IFS, Director, HFRI attended Research Policy Committee Meeting on 22nd and 23rd March 2006 at FRI, Dehradun.
14. Dr. K.S. Kapoor, Scientist-D and Dr. R.K. Verma, Scientist-D attended National Seminar on Wasteland Development in Shiwaliks with Particular Reference to Himachal Pradesh at Dr. Y.S. Parmar University, UHF, Nauni, Solan on 22nd and 23rd March 2006.
15. Sh. K.D. Sharma, IFS, DCF, HFRI attended one day Symposium on Disaster Management on 23rd March 2006 at Indus Hospital, Shimla.
16. Dr. Ranjeet Singh, Scientist-D attended a three days National Congress of Entomology from 15th to 17th March 2006 at Department of Zoology, Punjabi University, Patiala.
17. Shri P.S. Negi, Research Officer, HFRI, attended one day workshop on Nursery Propagation and Marketing of Medicinal Plant at Village Rakchham, Tehsil Sangla, Distt. Kinnaur, organized by Wildlife Division, Sarahan, Shimla.

DISTINGUISHED VISITORS

1. Shri R.P.S. Katwal, IFS, Ex. DG, ICFRE and now ADGF (Wildlife), Ministry of Environment and Forests, Government of India visited the Institute on 9th June 2005.
2. Dr. Dev Dutt, Scientist from the National Oilseeds and Vegetable Oils Development Board (NOVOD), Gurgaon visited the Institute from 24th to 26th August 2005 to assess and to review the ongoing research and demonstration activities under the project titled, "Development of Elite Planting Material, Establishment of Model Plantation Techniques of Wild Apricot to Local Communities in Himachal Pradesh" and funded by the Board.