

## CHAPTER VII

# 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 problems 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 and Kashmir. This Centre was redesignated as Himalayan Forest Research Institute, Shimla in 1998.

## PROJECTS COMPLETED DURING THE YEAR 2004-2005

**Project 1: Comparative studies on the ecology of degraded forests vis-a-vis relatively undisturbed forests in different eco-climatic zones of the region [HFRI-010/ 01(EBC-04)/ PLAN/2000-2005]**

**Findings:** A degraded site was selected in Mandhala Forests of Kuthar Forest Range falling under Kunihar Forest Division, Himachal Pradesh and initial ecological survey of the area was conducted. Dominant species of the site identified and diversity index also recorded.

Survey to assess the fuelwood need and fodder requirement of the villagers living around the degraded area was also carried out in the beginning following PRA techniques.

After analyzing the initial information, demonstration plantations of *Grewia optiva*, *Bauhinia variegata*, *Acacia catechu*, *Leucaena leucocephala*, *Dalbergia sissoo* and *Terminalia tomentosa* were established in the degraded sites.



Degraded Site

Floristic surveys both in and outside the plantation areas were carried out after three years of establishment of plantations so as to assess the changes in plant species diversity. Number of plant species as recorded in the plantation and outside the plantation area was  $70/m^2$  and  $38/m^2$ , respectively. On the basis of Importance Value Index (IVI), *Andropogon* sp. was found to be the dominant species both in plantation and out side the plantation area. Distribution of most of plant species was contiguous in both the areas. Index of dominance



for plants was lower (0.048) in the plantations while compared to the area outside the plantations (0.092). Index of diversity for plants was higher (5.237) in plantation in comparison to the area falling outside it (4.249).

Soil pH as recorded for the plantation area was 6.32 with electrical conductivity of 0.173 ms. Organic carbon of the planted area was 0.89 per cent, whereas available forms of nitrogen, phosphorus and potassium were 324.80 Kg/ ha, 26.11 Kg/ ha and 164.25 Kg/ ha, respectively. The soil of area falling outside the plantation was slightly alkaline with pH 7.46 and with electrical conductivity of 0.150 ms. Organic carbon in this site, however, was 0.47 per cent with 23.35 Kg/ ha of available phosphorus and 132.45 Kg/ ha of available potassium. The finding clearly shows that over a period of time the sites/ soils regain better fertility status in the planted areas compared to the soils which are allowed to degrade further without taking up any ameliorative activities.

#### **Project 2: Assessment of conservation status of hill Bamboos (Nirgals), collection of germplasm from various eco-climatic zones in Sutlej catchment area and establishment of germplasm bank [HFRI-011/02(EBC-05)/ PLAN/2000-2005]**

**Findings:** Survey of hill Bamboos i.e. *Arundinaria falcata* (*Sinarundinaria falcata*) – growing in the lower altitude and *Arundinaria spathiflora* (*Thamanoacalamus spathiflorus*) – a species of higher elevations – commonly known as Nirgals, was conducted in Sutlej catchment of district Shimla comprising forest areas of Taklech, Khunni and Khul in the lower zones and forests of Kashapath, Sungri-Bali, Nankhari, Hattu and Chichhar, etc. in the higher zones. It was found that above two species showed peculiar distribution in the areas of their natural occurrence and the studies have further

confirmed the earlier reports that hill Bamboo group in the state of Himachal Pradesh is represented by wild populations of the above two species only. It has also been found that this little studied group of plants is very significant from ecological point of view in addition to being of great local socio-economic values. Both the species flowered during the period under study and it was observed that the flowering of *A. falcata* varied from gregarious in some patches to few flowering in others, however, it was a case of complete mass flowering for *T. spathiflorus*.

Density of hill Bamboos per ha has been found to be dependent upon various factors affecting their distribution, the most prominent factor being the canopy cover and the optimum altitudinal range. As regards population structure, a ratio of 63: 37 between live and dead culms with 18 per cent of total culms being formed by current year culms has been observed in case of *A. falcata* whereas this ratio was 58: 42 between dead and live culms.

It was seen that the hill Bamboos play a significant role in the day-to-day life of local people. Basketry based on these species alone generates a wage equivalent of nearly Rupees One crore in the study area. Unrestricted access to right holders, high harvesting levels, inadequate research base and management prescriptions, changing land use and development pressures have, however, put this resource under great stress.

#### **Project 3: Comparative studies on the floristic composition of two diversely located alpine pastures [HFRI-023/ 03(EBC-09)/ PLAN/2003-2005]**

**Findings:** Field surveys conducted in the alpine and sub-alpine areas in Churdhar Wildlife Sanctuary, lead to the formation of different forest types viz., anthropogenic grasslands (2,150–2,450 m); Khasru oak – Rhododendron forests (2,400-2,700



m); conifer dominated forests (2,700–3,000 m); subalpine forests (3,100–3,250 m) and alpine pastures (3,200–3,450 m).

Interesting species of the area as recorded during the surveys included, *Thalictrum alpinum*, *Rhododendron arboreum*, *R. campanulatum*, *R. anthopogon*, *R. lapidoptum*, *Rheum webbianum*, *Viola biflora*, *Salix calycantha*, *Fritillaria royleii*, *Ranunculus* spp., *Potentela* spp., *Anemone obtusifolia*, *Allium humile*, *Swertia petiolata* and *Geum elatum*, etc. which were recorded from different altitudinal zonations. Besides this, interesting species like, *Ponerochis chusua*, *Goodayrea* sp., *Allium humile* and *Primula rheedii* were also collected from the site. The presence of all the four *Rhododendron* spp. in the sanctuary area and association of *Rhododendron arboreum* with *Quercus semecarpifolia* is quite unique to the sanctuary.

Some of the unique flora collected during the

*Euphorbia stracheyii*



*Primula redii*



*Euphorbia pilosa*

*Galium aculium*



#### **Project 4: Standardization of methodology for collection of seed, its handling, storage, testing and certification of seeds of important tree species [HFRI-012/05(SFG-04)/PLAN/2000-2005]**

**Findings:** Storage trials using different types of containers/ storage environment were conducted with the seeds of *Cedrus deodara*. Results showed the declining trends in its seed germination with the passage of time including the environment used during storage. It was found that the seeds stored in refrigerator (<4.0° C) retained almost 50% viability after one year of its storage, which further reduced to 44 per cent after 18 months when stored in refrigerator under the same temperature. Storage of seeds in other types of containers, which were used as storage environments showed total loss of viability over a period of time.

Seeds of *Picea smithiana* retained more than 55 per cent viability even after one and a half years whereas in case of *Abies pindrow* around 70 per cent viability was lost over a period of one and a half years when stored under different storage environment/ containers.

Storage trials when conducted on different seed source of *Jatropha curcas* revealed that the seeds collected from Bilaspur source retained more than 64 per cent germination even after 6 months when stored at room temperature.

Studies on the optimum time of seed collection in *Prunus cornuta*, *Aesculus indica* and *Quercus dilatata* were carried out with respect to germination and subsequent growth performance of the seedlings raised in the nursery. It was found that in *Prunus cornuta*, optimum time of collection of seeds under temperate conditions of Shillaru - Narkanda region was third week of September with maximum 27.33 per cent germination in nursery whereas seeds collected

during fourth week of September gave only 4.00 per cent germination. No germination was recorded in the seeds of *Prunus cornuta* collected during the first week of August. In *Aesculus indica*, optimum time of collection of seeds under temperate conditions of the above region was found to be third week of October with maximum 46.00 per cent germination in the nursery conditions. Similarly, on the basis of seed germination and growth performance of Mohru oak (*Quercus dilatata*) seedlings raised from the seeds collected in the first week of August, showed better growth when compared to other collection dates.

#### **Project 5: Developing efficient methods for preparation of compost from different locally available raw materials in different eco-climatic zones [HFRI-015/ 05(SFG-05)/PLAN/ 2000-2005]**

**Findings:** Trials to assess the time for preparation of compost from locally available organic raw material was undertaken in temperate regions. It took around 4 months for production of compost from grasses, nursery weeds and leaves of broadleaved species like, Poplar, Salix and Alnus, etc. through aerobic composting technique as tried during March to December at Shillaru - Narkanda region (2500 m msl) of district Shimla. Aerobic composting of Kail and Deodar needles in the region, however, took 5-6 months (May – December) when around 20-25 per cent fresh cow dung fully soaked in urine was added to the total volume of material being used for composting.

In sub-tropical/lower regions of Himachal Pradesh time period of 50-60 days only was enough for production of compost through aerobic composting from nursery weeds, grasses



and leaves of shrubs and trees of broadleaved species with the addition of 15-20 per cent fresh cowdung.

#### **Project 6: Studies to evaluate impact of ban on green felling on regeneration of conifer species (Deodar) [HFRI-20/05 (SFG-07) PLAN/2002-2005]**

**Findings:** Stand evaluation was carried out at Cheyog forest, Chopal (Chopal forest), Kullu (Manali and Nagar forests), Chamba (Khani and Kalhail forests) and Dalhousie (Kalatop forests) covering 16 sites and data collected.

On the basis of the population curves, study sites/stands were classified into following three groups:

**Stands with good regeneration:** This condition was witnessed in stands where the canopy was sufficiently wide-open allowing sunlight to reach the ground surface. Such stands have shown profuse regeneration. The regeneration in Bajraundi was so profuse that it was difficult to pass through that area.

**Stands with moderate regeneration:** The regeneration of Deodar is fair in stands where gaps were created due to salvage removal. Such sites were observed in Chamba, Chopal and Nagarjhir of Kullu.

**Stands with poor regeneration:** High density leading to canopy closure lead to poor regeneration as observed in RF Khanni forest of Chamba, Kalatop and Phetaban of Kullu.

#### **Project 7: Planting stock improvement: improved technology for mass production of quality planting stock of *Dalbergia sissoo* [HFRI-21/05(SFG-08)/ PLAN/2002-2005]**

**Findings:** Trials to understand the effect of age of hedging on rooting, type of shoot on rooting and level of hedging on rooting and their

subsequent growth pattern were conducted with 100 clones in Vegetative Multiplication Garden (VMG) at Birplasi, Nalagarh. Apart from the above trials, supplementary studies to understand the effect of leaf area on rooting, effect of cutting length and diameter on rooting and effect of cutting angle on rooting and subsequent growth were also performed.

Results of the study revealed that the rejuvenation in Shisham is possible through planting of root pieces and maintaining them as hedges. Juvenile root suckers/ shoots extracted from them can be exploited for further multiplication. The best months for hedging are January-February whereas the best season for planting juvenile cuttings is April-May. The best time of shoot collection is morning hours when the cuttings are fully saturated.

### **PROJECTS CONTINUED DURING THE YEAR 2004-2005**

#### **Project 1: Introduction and performance trial of *Paulownia* spp. for agroforestry in different agro-climatic zones of Himachal Pradesh [HFRI-026/08 (AGF-02)PLAN/2003-2008]**

**Status:** Relevant growth data of the trials as laid out earlier to assess the performance of different species of Paulownia both in the field and in nursery conditions were recorded. Field introduction/ demonstration trials at village Johron in Poanta Sahib and at Dharja in district Solan, representing low and mid hill zones were maintained. Besides this, nursery trials at Model Nursery, Baragaon, Shimla and Johron nursery, Paonta Sahib were also conducted. Five thousand seedlings of *Paulownia* spp. were raised in polybags and root trainers. Vegetative multiplication of *Paulownia* spp. was also carried in the nursery beds. To study the performance



and suitability of different *Paulownia* spp. in the high hill zone, one field trial was established over an area of one hectare in the foothills of Dhauladhar ranges at Khaniyara (Dharamsala) of district Kangra.



*Paulownia* sp. in the nursery

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

**Status:** Surveys were carried out in the mid and high hill zones of Kullu district to select additional sites for undertaking agroforestry diagnostic survey and accordingly two villages each in the mid and high hill zones of Kullu district were selected through two stage random sampling. The existing agroforestry systems and practices prevalent in the region were studied.

During the preliminary agroforestry survey in high hill zone, scattered tree species of *Quercus dilatata* (Mohru), *Ulmus laevigata*, *Grewia optiva*, *Morus alba*, *Robinia pseudoacacia*, *Alnus nitida*, *Aesculus indica*, *Ficus palmata*, *Prunus armerinica*, *Pistacia integerrima*, *Populus ciliata*, *P. nigra*, *Pyrus pashia* and *Salix* spp., etc. were recorded.

In mid hill zone, *Grewia optiva*, *Alnus nitida*, *Quercus leucotrichophora*, *Q. dilata*, *Morus*

*alba* and *Robinia pseudoacacia* were found in the field boundaries of the agricultural and horticultural plantations. Data collected are being analysed.

### **Project 3: Development of suitable models for afforestation of mined areas [HFRI-018/01(EBC-07)/PLAN/2002-2006]**

**Status:** Nursery experiments 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 pseudoacacia*, *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 for the survival, growth and biomass parameters of the 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*. Performance of *Eucalyptus* hybrid was followed by *Bauhinia variegata*, whereas least values of growth and biomass parameters were recorded in *Toona ciliata*. Another nursery trial with different combinations of lime mine spoil, forest soil, farmyard manure, sand and compost showed that the combination of lime mine spoil: forest soil: farmyard manure in the ratio of 1:2:1 was the most effective combination for the growth and biomass production of the species like *Leucaena leucocephala*, *Eucalyptus* hybrid, *Bauhinia variegata* and *Acacia catechu*.

Survival percentage of the tree species planted out during 2003 was recorded, and found to be 84.04%, 60%, 53.33% and 85.7% for *Grewia optiva*, *Bauhinia variegata*, *Robinia pseudoacacia* and *Leucaena leucocephala*, respectively. Survival per cent of the plantation raised during the year 2004 was recorded maximum (78.66%) in *Alnus nitida* and minimum (46%) in *Grewia optiva*.



**Project 4: Standardization of nursery techniques of five dominant indigenous species (*Capparis spinosa*, *Collutea* spp., *Caragana* spp., *Ribes* spp. and *Crataegus* spp.) besides *Elaegnus angustifolia* and *Rosa webbiana* of cold deserts [HFRI-019/03(EBC-08)/PLAN/2002-2007]**

**Status:** To initiate trials on the standardization of nursery techniques, basic ecological details and relevant literature were scanned and nursery experiments were designed for initiating various experiments in the nursery and in field conditions.

Number of trials were laid out in the nursery to understand the effect of IBA on rooting in shoot cuttings of *Ribes* sp., *Collutea* sp., *Elaegnus angustifolia* and *Hippophae rhamnoides* and in root suckers of *Rosa webbiana* and *Capparis spinosa*. Effects of different pre-sowing treatments (hot-water and Gibberellic



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*Collutea*



*Rosa webbiana*

*Capparis spinosa*

Biomass studies on the species viz., *Collutea*, *Crataegus* and *Ribes* were also conducted. Maximum above ground ( $2.45 \text{ kg/ m}^2$ ) and below ground ( $1.27 \text{ kg/ m}^2$ ) biomass was recorded in *Crataegus* sp. followed by *Collutea* sp. having above ground and below ground biomass of  $2.16 \text{ kg/ m}^2$  and  $1.27 \text{ kg/ m}^2$ , respectively.

In *Ribes* sp., quite low rooting (20%) in the shoot cuttings was observed, whereas in *Elaegnus angustifolia*, as high as 85 per cent rooting was recorded. The shoot cuttings of



*Hippophae rhamnoides* showed rooting up to 75 per cent in poly-house condition whereas only 40% rooting was recorded outside the poly-house. Root suckers of *Rosa webbiana*, showed 80 per cent sprouting in the open condition whereas in case of *Capparis spinosa* 60 per cent sprouting in the root suckers was recorded.

Ecological studies related to biomass and distribution of *Capparis spinosa* and *Ribes alpestre* in Spiti Valley were undertaken and biomass as high as 400 g and 940 g for above ground component was recorded, respectively. In case of below ground parts, the biomass as high as 1750 g and 1200 g was recorded for these two species, respectively thereby showing the capacity of roots to store water and nutrients to tide over the adverse conditions in the cold deserts. The longest root as dug out for *Ribes alpestre* was 210 cm whereas in case of *Capparis spinosa*, the root measured 290 cm.



Roots of *Capparis spinosa*

#### **Project 5: Studies on plant diversity of Renuka and Simbalwara Wildlife Sanctuaries of Himachal Pradesh [HFRI-024/02(EBC-10)/ PLAN/ 2003-2006]**

**Status:** Plant diversity studies were conducted to assess the diversity of trees, shrubs and herbs by laying out quadrats of different sizes in Renuka and Simbalwara Wildlife Sanctuaries of Himachal Pradesh, which are located at altitude varying from 600 – 850 m above msl and 400 – 650 m above msl, respectively. Approximately 250 plant species from Renuka and 200 plant species from Simbalwara were recorded. Some plant samples for further identification and soil samples for assessing chemical properties of the soils were collected from these sanctuaries. On the basis of importance value index (IVI), *Xanthium indicum* was the dominant species followed by *Oplimonus* sp., *Neuimbo nucifera* and *Phylla nudiflora*. Distribution of most of the plant species was contiguous. The value of diversity index and dominance index was 5.976 and 0.021, respectively.

An overview of Renuka Wildlife Sanctuary



In Simbalwara Wildlife Sanctuary, a total of 206 species were present in the altitude ranging from 400-525 m msl, whereas 189 species were recorded at elevations varying from 525-650 m msl. *Shorea robusta* was the dominant tree species whereas *Mallotus philippensis* was the dominant shrub.

**Project 6: Development of ecologically viable and socio-economically acceptable integrated model for arresting Willow (*Salix* sp.) mortality in Lahaul Valley of Himachal Pradesh [HFRI-021/03(EBC-09)/PLAN/2003-2008]**

**Status:** Basic causes behind large-scale mortality of Willow were ascertained and accordingly, a detailed report was submitted to the State Forest Department and all other concerned authorities of the state of Himachal Pradesh. Dr. (Ms.) Ketrin Heinsoo from Estonian Agricultural University was contacted for the import of clonal material of Willow from her Institute. Eight different species of Salix were collected from 7 different provenances/ sources including Tabo – the cold deserts – and about 350 cuttings raised and are being maintained in the Model Nursery for establishing demonstration trials. Various provenances of Willow from Jammu & Kashmir were also introduced and multiplied. All the experiments are being maintained.



Willow Mortality in Lahaul Valley

**Project 7: Screening and selection of insect pest and disease resistant phenotypes provenances of important tree species [HFRI-13/06(FPT-02)/ PLAN/2000-2006]**

**Status:** Provenances and clones of selected tree species were surveyed for insect pest and disease incidences. Seedlings of Deodar from 19 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.

Six provenances of Chir pine in Himachal Pradesh were screened against stem borer complex. Data collected for 4 provenances was analyzed and it was found that Seer Kunar Khud provenance is comparatively more resistant to insect borer complex in comparison to provenances of Giri Gambhar, Kangra valley and Pabbar-Tons.

Nursery trial to assess seed source variation for resistance towards nursery diseases i.e. damping-off, root rot, etc. in Deodar was initiated for which seeds from six different sources were collected. Seed morphometric traits were observed and sown in nursery beds as well as polybags. Observations on germination, seedling mortality and reasons for mortality are being recorded. A pot culture trial had also been laid to assess the seed source variation for susceptibility to damping-off caused by *Fusarium oxysporum*. Experiment is being repeated and data is to be analysed statistically to arrive at conclusive results.

**Project 8: Development of model for integrated pest management with special reference to *Cedrus deodara* [HFRI-017/06(FPT-03)/PLAN/2000-2006]**



**Status:** Bio-ecology of *Ectropis deodarae*, a key insect-pest of *Cedrus deodara* was studied in detail. It was observed that the pest completed one generation in a year with its peak activity during May and June.

The pest was found on four coniferous trees only, among 37 tree species surveyed. Maximum infestation was observed on *Cedrus deodara*. Minor incidence of the pest was observed on *Pinus wallichiana*, *Picea smithiana* and *Abies pindrow*. The highest larval population was recorded on deodar ( $1.8 \pm 1.0$  per meter of branch) followed by *Pinus wallichiana* ( $0.3 \pm 0.02$ ), *Picea smithiana* ( $0.02 \pm 0.01$ ) and *Abies pindrow* ( $0.03 \pm 0.01$ ), respectively under field conditions. Under laboratory condition, *Cedrus deodara* was found to be the best host showing maximum larval survival, growth index (84.7%, 2.6) and minimum larval period (32.8 days). On *Pinus wallichiana*, *Picea smithiana* and *Abies pindrow* total larval period ranged from 37.2 – 39.5 days, but larval survival was below 40.0 per cent. In Deodar, 5<sup>th</sup> instar larvae consumed 185 mg needles in 72 hours.

The larvae were found to cause damage to the needles not only by consuming them but also by making the needle to fall by nibbling and cutting them above middle or at the base. Total needle loss due to cumulative action of various instars rendered the affected trees needleless. Regeneration and younger crop of deodar was found to be most susceptible to the attack of this pest.

#### **Project 9: Natural enemy complex of key and potential pest of five *Quercus* sp. in Himachal Pradesh [HFRI-027/06(FPD-5)/PLAN/2003-2006]**

**Status :** Natural forests and plantations of Oaks from almost all the altitudinal zones of Himachal Pradesh were surveyed, comprising

mainly of Jhungi Forest and Darer Forest (Sudernagar), Sargheen, Shiog, Shogi-Taradevi Forest (Shimla), Taradevi roadside plantation towards Shimla Airport Salni: Koti Forest (Chamba), Kalpa, Brelingi, Song Thong (Kinnaur), Khalti, Korgu (Rampur) and Narkanda, Hattu (Shimla), Karsog (Mandi), Gadachh, Khirki, Jabna (Chopal), Shilly (Solan), Tikkar, Charech, Bhajiana and Charavag (Sirmaur).

All five species of Oaks viz. *Quercus glauca*, *Q. leucotrichophora*, *Q. dilatata*, *Q. semicarpifolia* and *Q. ilex* were screened. The most destructive pests are *Sitophilus glandium* and *Curculio sikkimensis* that attack acorns; *Lymantria obfuscata*, *L. mathura* and *Trabala vishnou*, that defoliate heavily; *Callirithites semicarpifolia*, *Andricus* sp. and *Neuroterous hassi*, that cause leaf and stem galls; adults of *Holotrichia longipennis* also causes defoliation and *Eriophyes* sp., a mite that damage the leaves.

*Lymantria obfuscata*, the Indian Gypsy moth and *Lymantria mathura*, the Rosy Gypsy moth (Lymantridae) cause heavy defoliation to Ban and Bani oak. Evaluation of the damage by Indian Gypsy moth and working out pest control measures are in progress.

#### **Project 10: Standardization of nursery technology for mass propagation of selected medicinal plant species [HFRI-009/07(NWFP-01)/PLAN/2000-2007]**

**Status:** Germplasm of 33 species of medicinal plants of temperate Himalayas in Field Research Station, Brundhar (Manali) and 30 species at Field Research Station, Shilly (Solan) and 10 species each at Field Research Station, Shillaru (Shimla) and Model Nursery (Shimla) raised and is being maintained. Trials are in progress for improving the agro-techniques of economically important medicinal plant species e.g. Karu,



Patish, Mushkbala, Salam-Misri and Chora, etc. Macro-proliferation technique developed in the project for the multiplication of *Picrorhiza kurooa* and *Valeriana jatamansi* has been successfully tested under National Medicinal Plants Board (NMPB) funded project on large-scale basis for the production of thousands of plants of these species.

#### **Project 11: Standardization of nursery techniques of raising containerized seedlings of conifers and their broadleaved associates [HFRI-016/05(SFG-06)/PLAN/2002-2007]**

**Status:** Nursery stock of Deodar, Fir and Spruce were maintained under various trials in root trainers at Model Nursery, Baragaon, Shimla and Field Research Station, Shillaru. Trials laid to find out the optimum size/ type of root trainer for seedling production of *Cedrus deodara*, *Picea smithiana* and *Alnus nitida* have revealed that the growth performance of all these three species was found to be the best in root trainers of the size 500 cc vis-à-vis, grown in the traditional system.

Trials on plug+3 seedling production system in *Abies pindrow* were carried out and it was found that suitable root-plug formation was achieved in 150 cc block type root-trainer after  $1\frac{1}{4}$  years, which when planted subsequently in the nursery beds resulted in better root biomass and root/ shoot ratio over control after 3 years of its out planting.

#### **Project 12: Planting Stock Improvement Programme in *Cedrus deodara* [HFRI- 028/05(SFG-08)/PLAN-03/2003-2008]**

**Status:** Surveys of Deodar forests to select best stands based on the ocular estimates of morphometric traits were carried out. As a result of these surveys, areas were marked in Theog, Chopal, Chamba and Kullu Forest Divisions of

Himachal Pradesh. Survey to mark more areas is in progress. Sample plot study, wherein each individual tree in the sample plot would be assessed for quantitative as well as qualitative traits using score method and the areas with maximum average for the stand will finally be selected for their conversion into Seed Production Area (SPA).

After finalizing the criteria for selection of phenotypically superior trees, 19 CPTs of Deodar have been marked in different forests. Further selection of plus trees is in progress.

### **NEW PROJECTS INITIATED DURING THE YEAR 2004-2005**

#### **Project 1: Studies on plant diversity in cold deserts of district Kinnaur, Himachal Pradesh [HFRI-029/ 02(EBC-11)/PLAN/2004-2007]**

**Status:** Floristic surveys were carried out at an altitude varying from 3000 m – 5000 m above msl in Labrang Valley of Pooh sub-division of district Kinnaur, Himachal Pradesh during 2004. Approximately 15 species of trees, 25 of shrubs and 175 species of herbs were recorded during the survey.



Tim Cho - A Lake at 5000 m in study area



Three species of Junipers viz., *Juniperus macropoda* (3000-4000 m), *J. communis* (3300-4000 m) and *J. indica* (3500-4400 m) were recorded as per their altitudinal zonations. *Orobanche* sp. (parasitic plant) collected during the survey may be one of the new records for the flora of Himachal Pradesh.

### **Project 2: Establishment of Amla and Khair demonstration plantations in lower hills of Himachal Pradesh**

**Status:** Two sites have been selected for the establishment of demonstration plantations of Amla and Khair in degraded grasslands of Hamirpur district of Himachal Pradesh. The sites namely Upper Darogan and Bhareta situated on Hamirpur – Sarkaghat National Highway near Toni Devi Town. The sites have been fenced and soil of planting pits replaced with loamy soil brought from outside sources along with addition of fully decomposed F.Y.M. The plantations of Amla and Khair have been carried out during July-August, 2004 on 2.5 ha of degraded grasslands. The plantations are being maintained intensively for the development of realistic model of Amla and Khair plantations.



Plantation of Amla and Khair

## **PROJECTS COMPLETED DURING THE YEAR 2004-2005**

**(Externally Aided)**

**NIL.**

## **PROJECTS CONTINUED DURING THE YEAR 2004-2005**

**(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]**

**Status:** Extensive surveys were carried out to select the farmers and experimental sites for undertaking trials on medicinal plants intercropping interventions with horticultural plantations in high hill temperate regions of Kullu and Shimla districts of Himachal Pradesh. Sites in the village Sajala of Kullu and in Shillaru of Shimla districts were selected and 7 and 4 farmers were identified in these two respective locations as an ultimate unit for the proposed study.

Planting stocks of selected medicinal plants viz. *Aconitum heterophyllum* (Atish), *Valeriana jatamansi* (Muskbala), *Picrorhiza kurrooa* (Kutki), *Polygonatum verticillatum* (Salam Misri) and *Angelica glauca* (Chora) in Field Research Stations located at Burndhar (Kullu) and Shillaru (Shimla) were raised and maintained.

**Project 2: Production of quality planting material of *Picrorhiza kurooa* Royle ex Benth. and *Valeriana jatamansi* Jones and extension of their cultivation technology to local communities [GO/HP-2/2004-2007]**

**Status:** In the first year of this project, a total of 2.3 lacs seedlings of quality planting material were



raised and maintained comprising of *Picrorhiza kurooa* (70,000) and *Valeriana jatamansi* (1,60,000) at three nurseries of the Institute viz. Field Research Station, Brundhar (Manali), Field Research Station, Shilly (Solan) and Field Research Station, Shillaru (Shimla). Poly-house and Shade-house were designed, established and commissioned at Field Research Station, Brundhar besides strengthening irrigation facilities. Various nursery and camping equipments were procured. Two training programmes and demonstration programme on "Commercial Cultivation of Karu and Valeriana" on 19<sup>th</sup> and 20<sup>th</sup> October, 2004 at Jagatsukh (Manali) and on 4<sup>th</sup> and 5<sup>th</sup> March, 2005 at Shillaru and Baragaon Model Nursery (Shimla) were organised for selected farmers of Kullu and Shimla districts, respectively. Extension material on Karu and Mushakbala was published under the project.

**Project 3: 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]**

**Status:** Around 50 kg seeds were collected from four different sources located in Shimla and Kinnaur districts of Himachal Pradesh. Seeds were stratified for 50 days in sand layers before sowing in nursery during March, 2005. Plantations were carried out at two locations namely Baragaon (Shimla) and Alampur (Kufri - Chail road) by using the material raised from the above sources. One short-term training programme was organised on 'Wild Apricot-Nursery, Plantation, Oil Production and its uses' at HFRI-Shimla from 24<sup>th</sup> and 25<sup>th</sup> March, 2005 for selected farmers of Shimla district.

**Project 4: Suitability of *Jatropha curcas* L. seed sources in lower and mid Himalayan regions of Himachal Pradesh [BT/PR/5094/AGR-16/429/2004-2007]**

**Status:** Around 30 kg of seeds of *Jatropha curcas* were collected from 22 seed sources mostly from Himachal Pradesh. Sowing has been done in 15,000 polybags during March, 2005. Site selection for raising 10 ha plantations of *Jatropha curcas* in lower and mid hills of Himachal Pradesh is being done.

**Project 5: Ecological and management studies in certain dry temperate and alpine pastures of Lahaul and Spiti, Himachal Pradesh [BT/PR-4102/NDB- 51/027/2003/2004-2007]**

**Status:** Annual Action Plan for implementation of the projects was discussed with another PI (being a collaborative project) and modalities for smooth execution of the project were worked out.



*Valeriana jatamansi*



Major equipments pertaining to the project were procured and one Junior Research Fellow was appointed. Discussions were held with the Divisional Forest Officers of Lahaul and Spiti Forest Divisions to get the basic data regarding distribution of alpine pastures in the project area. Field activities will commence from May, 2005.

#### **Project 6: Ecological assessment under Kol Dam Hydroelectric Project [Ft. 48-88/86 (CFA) 2004-2007] – Conservator of Forest, Bilaspur under Catchment Area Treatment (CAT) Plan**

**Status:** In consultation with the Conservator of Forests, Bilaspur modalities for execution of the project were finalized. Divisional Forest Officers of six Forest Divisions namely, Suket, Bilaspur, Kunihar, Karsog, Shimla and Theog were contacted regarding execution of the project. Thereafter, field trips were undertaken and sites

for undertaking detailed studies selected in Theog, Kunihar and Bilaspur Forest Divisions.

Besides the above mentioned externally funded projects, following three research proposals were approved for funding by G.B. Pant Institute of Himalayan Environment and Development, Almora under their Integrated Eco-development Research Programme (IERP):

1. Development of Ecologically Viable and Socio-economically Acceptable Integrated Models for Arresting Willow (*Salix spp.*)
2. Studies on plant diversity in Rakchham, Chitkul Wildlife Sanctuary of district Kinnaur, Himachal Pradesh.
3. Inventorization, documentation of plant diversity and to evolve site-specific management strategies for conservation of various sacred groves in Kullu Valley of Himachal Pradesh.

## **RESEARCH ACHIEVEMENTS**

Name of State	No. of Projects completed in 2004-2005	No. of on-going Projects in 2004-2005	No. of Projects initiated in 2004-2005
Himachal Pradesh	7	14	8 (2-Plan; 6-Externally funded)
Jammu & Kashmir	-	-	-

## **EDUCATION AND TRAINING**

### **Training**

#### **Organized**

1. IFS trainees from Indira Gandhi National Forest Academy, Dehra Dun visited the Institute and held discussions with the

Officers and Scientists, where questions pertaining to modern trends in forestry in general and forestry research in Himalayas in particular were discussed.

2. Range Forest Officers from State Forest Service College, Dehra Dun; Eastern Forest Rangers' College, Kurseong and Forest



Rangers' College, Burnihat visited the Institute and interacted with the Officers and Scientists on issues pertaining to forestry research.

3. Students undergoing different B.Sc. and M.Sc. (Forestry) courses at Tamil Nadu Agriculture University, Mettupalayam and Forest Research Institute – Deemed University, Dehra Dun visited the Institute and interacted with the Officers and Scientists.

4. Forty teachers serving in different Senior Secondary Schools of Shimla district visited this Institute to have discussion on various aspects of forestry in general and environmental issues in particular enabling them to discuss the feedback with their students after return to their respective places.

5. To observe National Science Day, programmes in local governmental schools were organized, where the Scientists of this Institute delivered popular science lectures. Sensitization and generation of environmental awareness amongst the school children was the main aim behind the activities.

6. Dr. Ranjeet Singh, Dr. Charan Singh and Dr. Vijender P Panwar from this Institute were awarded Ph. D. Degrees in various fields of Forestry from FRI – Deemed University, Dehra Dun and Himachal Pradesh University, Shimla.

7. Trainings and Demonstration Programmes on Commercial Cultivation of Karu (*Picrorhiza kurrooa*) and Mushakbala (*Valeriana jatamansi*) for 23 farmers of Kullu district at Jagatsukh, Manali from 19<sup>th</sup> and 20<sup>th</sup> October, 2004.

8. Trainings and Demonstration Programmes on Commercial Cultivation of Karu and Mushakbala for 34 farmers of Shimla district at Shillaru and Model Nursery Baragaon, Shimla from 4<sup>th</sup> and 5<sup>th</sup> March, 2005.

9. Trainings and Demonstration Programmes on Commercial Cultivation of Medicinal and Aromatic Plants for 100 farmers of lower region of Himachal Pradesh at Majholi and Sai from 18<sup>th</sup> and 19<sup>th</sup> March, 2005.

10. Trainings and Demonstration Programmes on Wild Apricot – Nursery, Plantation, Oil Production and Its Uses for 29 farmers of Shimla district at HFRI – Shimla from 24<sup>th</sup> and 25<sup>th</sup> March, 2005.

#### Attended

1. Shri K.S. Thakur, IFS, DCF attended compulsory training on "Environmental Priorities and Sustainable Development" at the Indian Institute of Management, Bangalore from 20<sup>th</sup> to 24<sup>th</sup> September, 2004.
2. Shri Jagdish Singh, Scientist-C attended training programme on "Agroforestry" at FRI, Dehra Dun from 20<sup>th</sup> to 24<sup>th</sup> September, 2004.
3. Shri Sani Pradhan, Forest Range Officer and Shri Sanjeev Kumar, RA-I attended four days training on "Disaster Management" as organized by Central Potato Research Institute, Shimla and Institute of Integrated Himalayan Studies at Himachal Pradesh University, Shimla from 23<sup>rd</sup> to 26<sup>th</sup> October, 2004.
4. Dr. R.K. Verma, Scientist-D attended five days training programme on "Eco-restoration of Wastelands" at FRI, Dehra Dun from 25<sup>th</sup> to 29<sup>th</sup> October, 2004.
5. Shri Surinder Kumar, IFS, Director attended five days compulsory training on "Environmental Sustainable Development



and Forests vis-à-vis Globalization" at Gopabandhu Academy of Administration, Chandrashekhpur, Bhubhneswar from 1<sup>st</sup> to 5<sup>th</sup> November, 2004.

6. Dr. Sandeep Sharma and Dr. R.K. Verma, Scientists of this Institute attended five days training programme on ISO 14000: 1996 – Environmental Management Systems – Auditor's Training Course organized by ICFRE, Dehra Dun from 22<sup>nd</sup> to 27<sup>th</sup> November, 2004.
7. Dr. Sandeep Sharma, Scientist-D attended a five days training programme on "Management Development Programme" on 'Marketing of Forestry Products in the Changing Market Scenario' held at Indian Institute of Forest Management, Bhopal from 17<sup>th</sup> to 21<sup>st</sup> January, 2005.

## LINKAGES AND COLLABORATION

1. The Institute remained in constant touch with the State Forest Departments of Himachal Pradesh and Jammu & Kashmir, State Forest Research Institute, Jammu & Kashmir, National Bureau of Plant Genetic Resources, Shimla; Dr. Y.S. Parmar University of Horticulture and Forestry, Solan; CSK Himachal Pradesh Krishi Vishvavidayala, Palampur; Himachal Pradesh University, Shimla; Punjab University, Chandigarh and Punjab Agriculture University, Ludhiana and other research and non governmental organizations working in the field of forestry and forestry research in the state of Himachal Pradesh and Jammu & Kashmir.
2. Shri Surinder Kumar, IFS, Director visited Jammu as an expert in connection with evaluation of projects funded by Science and Society Division of Department

of Biotechnology, Government of India, New Delhi.

3. Shri Surinder Kumar, IFS, Director has also been nominated as an Expert – Member by the Ministry of Environment & Forests, Government of India for evaluation of the policy research proposal of the Ministry.
4. Besides this, efforts were initiated to link the Institute with the common people especially village farmers by establishing demonstration plantations of Amla and Khair in lower hills of Himachal Pradesh. For this activity farmers fields and village common lands were taken up for establishing such field plantations.

## PUBLICATIONS

### Brochures/ Technical Bulletins/ Booklets

1. Jagdish Singh, K.D. Sharma and Surinder Kumar (2005). Agroforestry Tree Species for Different Agro-climatic Zones of Himachal Pradesh: The Package and Practice. HFRI Publication BR. No. 014. (pp 51).
2. Sandeep, Sharma; P.S. Negi and K.S.Thakur (2005). Mushakbala Ki Kheti. Technical booklet in Hindi (10 pp).
3. Sandeep, Sharma; P.S. Negi and K.S.Thakur (2005). 'Karu Ki Kheti' Technical booklet in Hindi (10 pp).
4. Technical study material prepared for its distribution in the following trainings:
  - i. Commercial Cultivation of Medicinal and Aromatic plants for Lower Hill Zone of Himachal Pradesh.
  - ii. Commercial Cultivation of Medicinal Plants for farmers of High Hill Temperate Zone of Kullu district.



- iii. Commercial Cultivation of Medicinal Plants for farmers of High Hill Temperate Zone of Shimla district.
- iv. Wild Chulli for the farmers of Baragoan and Chail, Shimla district.
- v. Commercial Cultivation of Karu and Mushakbala.
- vi. Cultivation of Medicinal and Aromatic Plants
- vii. Wild Apricot-Nursery, Plantation, Oil Production.

### Research Reports

- 1. Kumar, Ashok; Kumar, Shailendra and Kumar, Surinder. 2004. Pit Canker Disease of Siris (*Albizzia procera* Benth.) due to *Fusarium solani* (Mart.) at Forest Plantation, Badhlech (Dharja) in Solan Forest Division, (H.P.). Research Report No. HFRI/RP/026, September, 2004.
- 2. Kumar, Ashok; Kumar, Surinder; Singh, Ranjeet, and Kumar, Shailendra. 2004. Drying of Deodar trees in heritage zone, Shimla Research Report No. HFRI/RP/027, October, 2004.

### CONSULTANCIES

- 1. A detailed proposal for seeking consultancy, submitted to the authorities of Border Road Task Force, Kullu District Kullu, Himachal Pradesh.
- 2. A detailed report after investigations and a proposal for consultancy, submitted to the authorities of Sutlej Jal Vidyut Nigam, Nathpa-Jhakri, District Shimla, Himachal Pradesh.
- 3. A detailed report and a proposal for consultancy submitted to the authorities of M/S Gujrat Ambuja Cements Ltd., Darlaghat, District Solan, Himachal Pradesh.

### CONFERENCES/MEETINGS/ WORKSHOPS/SEMINARS/ SYMPOSIA/EXHIBITIONS

- 1. Shri Surinder Kumar, Director, HFRI attended two days workshop on “Need for Change – Vision Development Workshop” from 20<sup>th</sup> and 21<sup>st</sup> May, 2004 as organized by H.P. State Forest Department at Shimla.
- 2. Shri Surinder Kumar, Director, HFRI attended two days workshop on “Strategies for Conservation of Sacred Grooves” as organized by IFGTB, Coimbatore from 26<sup>th</sup> and 27<sup>th</sup> May, 2004.
- 3. Shri Surinder Kumar, IFS, Director and Dr. A. Rajasekaran, Scientist attended two days workshop on “Forest and Water Conservation – Myths and Realities” held at FRI, Dehra Dun from 8<sup>th</sup> to 10<sup>th</sup> June, 2004.
- 4. Dr. K.S. Kapoor, Scientist attended two days workshop on “Creation of Awareness amongst the Prospective PIs/Group/NGOs/, etc. of Himachal Region for Execution of Location Specific Action Oriented R&D Activities under IERP Programme” as organized by Institute of Himalayan Bio-resource Technology, Palampur and G.B. Pant Institute of Himalayan Environment and Development, Almora at IHBT, Palampur from 28<sup>th</sup> and 29<sup>th</sup> June, 2004.
- 5. Jagdish, Singh, Scientist-C, participated and presented a paper at ‘National Workshop on Agroforestry’, organised by Forest Department Haryana, at CII Complex, Chandigarh from 22<sup>nd</sup> to 24<sup>th</sup> November, 2004.
- 6. Dr. Ranjeet Singh, Scientist-D participated and presented a paper in International Conference on “Multipurpose trees in the Tropics: Assessment, Growth and



Management" organized by IUFRO at AFRI, Jodhpur from 22<sup>nd</sup> to 25<sup>th</sup> November, 2004.

7. Jagdish, Singh, Scientist-C, participated and presented paper at 'National Conference on Resource Conserving Technologies for Social Upliftment' organized by Indian Association of Soil and Water Conservationists, CSWCRI, Dehra Dun (Uttaranchal) from 7<sup>th</sup> and 8<sup>th</sup> December, 2004.
8. Dr. K.S. Kapoor and Dr. A. Rajasekaran, Scientists of this Institute attended two days interactive workshop on "Problems and Prospects of Afforestation and Tree Planting in Degraded Hill Slopes with special reference to NTFP Species" as organized by Regional Centre of National Afforestation and Eco-Development Board, Dr. Y.S. Parmar University of Horticulture and Forestry, Solan from 15<sup>th</sup> and 16<sup>th</sup> February, 2005 at Shimla.
9. Shri Surinder Kumar, IFS, Director along with Dr. K.S. Kapoor and Dr. Sandeep Sharma, Scientists attended two days workshop on "Mainstreaming Medicinal Plants for Development of Region – Himachal Pradesh:

A Case in Point" as organized by G.B. Pant Institute of Himalayan Environment and Development – Himachal Unit, Kullu from 12<sup>th</sup> and 13<sup>th</sup> March, 2005.

10. Dr. Ranjeet Singh, Scientist-D and Dr. Rajesh Sharma, Scientist-D participated and presented a paper in National Symposium on "Exotics in Indian Forestry" organized by Department of Forestry and Natural Resources and ICFRE, Dehradun at Punjab Agricultural University, Ludhiana from 15<sup>th</sup> to 18<sup>th</sup> March, 2005.
11. Shri Surinder Kumar, IFS, Director, Dr. Sandeep Sharma, Scientist-D and Shri Jagdish Singh, Scientist-C participated in a meeting on 'State Medicinal Plants Policy' held at Hotel Holiday Home on 22<sup>nd</sup> March, 2005.

## DISTINGUISHED VISITORS

1. Thakur Satya Prakash, Chairman, Himachal Pradesh Marketing Board, Shimla and ex Minister for Horticulture visited HFRI, Shimla on 1<sup>st</sup> July, 2004 and interacted with the Officers and Scientists of this Institute.