Forest Renewal Research Update

INTRODUCTION

The Forest Renewal subprogram within the FRDA II Forest Research Program has the following objectives:

1. to build upon technical advancements in tree improvement, nursery culture and site preparation and to develop high-yield plantation establishment and management strategies;
2. to maintain "benchmark" forest renewal FRDA research installations to the free-growing stage so that the biological and cost effectiveness of treatment options can be established; and
3. to develop a mixedwood/hardwood, silvicultural system and vegetation management research program providing direct support for improving forest renewal options.

This memo provides brief summaries and progress to September 30, 1991, of projects under the Forest Renewal initiative.

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FRDA memos and reports are available from the Research Branch, B.C. Ministry of Forests, 31 Bastion Square, Victoria, B.C. V8W 3E7, and from Forestry Canada, Pacific Forestry Centre, 506 West Burnside Road, Victoria, B.C. V8Z 1M5.

CONIFER PLANTATION ESTABLISHMENT

BC-FR01  Site stress X stock type stress resistance interactions on SBS NSR backlog sites

Project Leader: M. Kraaywijk
Project Location: Beaver Forest Road, Prince George Forest District

Objectives:
To evaluate the long-term biological and cost implications of various site preparation, stock type and brushing and weeding combinations on SBS NSR backlog sites; and to maintain a demonstration area of backlog reforestation options.

Progress to Date:
Site preparation by Ministry moulder, Sinkkilä moulder and Rome disc was followed by the spring planting in 1987 of two spruce stock types (1+0 PSB 313 and 2+0 PSB 313). Brushing of the site was completed in the summer of 1989.

An assessment of vegetation response to these treatments and fifth growing season measurements of the planted seedlings were completed in 1991. A report on the biological and cost effectiveness of different silvicultural regimes for white spruce in the SBS is being prepared.

Expected Benefits:
This study will lead to improved silvicultural prescriptions on the NSR sites of the SBS, and the demonstration area will contribute to long-term extension needs.

Mention of trade names or products does not constitute endorsement by the authors, the B.C. Ministry of Forests, or Forestry Canada.
BC-FR03  Assessment of treatment options and effects in rehabilitating dense, suppressed lodgepole pine stands

Project Location:  Between François and Ootsa Lake, Lakes Forest District (SBSmc)

Objectives:
To assess the economics of feasible site rehabilitation techniques for densely stocked lodgepole pine stands; and to quantify the effects of these treatments on the site and the subsequent plantation development.

Progress to Date:
Two densely stocked lodgepole pine stands of age class 3 were knocked down and two burning treatments (window and broadcast) were completed in 1986 and 1987. All plots were planted with PSB 211 PI plugs.
The 5-year soil and seedling measurements have been completed; results showing 5-year seedling performance were summarized in 1991.
A paper has been submitted to the Canadian Journal of Forest Research on biomass consumption during the burning treatments.

Expected Benefits:
This study will improve prescriptions for lodgepole pine rehabilitation treatments and will contribute to our understanding of ecological impacts of forestry practices.

BC-FR04  Treatment development for rehabilitation of ESSF backlog brushfields

Project Leader:  C. Sutherland
Project Location:  Quesnel Forest District

Objectives:
To evaluate site preparation, stock type, species and brushing options for reforesting backlog brushfields in the ESSF; and to establish a long-term ESSF demonstration site.

Progress to Date:
This benchmark trial, established under FRDA Project No. 1.17, examined the effect of five site preparation methods and four species-stock combinations on a rehabilitation area. FRDA Memo Nos. 053 and 054 provide detailed background information on trial establishment.
Yearly measurements of microclimatic conditions, seedling performance and non-crop vegetation will continue until 1992, when 5 years of data will be analyzed.

Expected Benefits:
Guidelines will be formulated for silvicultural options in the ESSF backlog brushfields, and a demonstration site for treatment options will be maintained.

BC-FR05  Post-planting injury on cold sites

Project Leaders:  M. Krasowski and N. Livingston
Project Location:  Red Rock Research Station

Objectives:
To assess how nursery treatments and stock characteristics relate to the type and severity of freeze desiccation injury; and to evaluate the extent of seedling dehydration.

Progress to Date:
To date, water losses from white spruce seedlings in the BWBS during winter (November – late March) have been shown to be minimal. Therefore, winter desiccation is not thought to be the primary cause of injury to overwintering stock in the BWBS.
Current investigations focus on the short-term effects of rapid thawing on water loss, a scenario more likely to happen in early spring than in winter. Changes in seedling capacity to lose water in the period following bud set have been studied so that a physiological test can be developed for quality assessment of summer-plant and fall-lift stock.

Expected Benefits:
Recommendations will be made on how nursery practices can be modified to produce seedlings best suited for frost problem areas.

BC-FR09  Site preparation and planting procedures to minimize seedling water and temperature stress in backlog areas in the southern Interior

Project Leader:  T.A. Black
BCFS Contact:  W.R. Mitchell
Project Location:  Fehr Mountain, Tsintsunko Lake and Paska Lake, Kamloops Forest District

Objectives:
To determine the effects of site preparation treatments on soil and aerial microclimate of planted seedlings, and to determine the effects on seedling growth and survival.

Progress to Date:
This project continues the work started in FRDA Project 3.02. Research summaries of preliminary results may be found in FRDA Memo Nos. 162, 166, 167, 177 and 181. The following are findings to date:
- Site preparation treatments that kill or remove grass significantly increase available soil water during the growing season.
- Although treatments which remove the surface organic layer increase seedling root zone temperature, there is no effect on seedling growth and survival.
- Even in the dry subzones of the southern Interior, there is no evidence of root collar injury due to high temperatures.
Conifer Plantation Establishment — Continued

- Overwinter damage occurs during periods when there is little or no snow cover and the soil is frozen. This occurs in all treatments except where snow is trapped.
- Frosts are common during the early summer when buds break and elongate and seedlings are most susceptible to freezing injury. Severe injury occurs in Douglas-fir and Engelmann spruce; lodgepole pine, however, is completely resistant. Treatments that remove the surface organic layer dramatically decrease frost injury.

Ongoing work for this site includes:
- continued microclimate monitoring at the sites;
- measuring of seedling growth and survival and the integration of these results with ongoing soil and foliar nutrient analyses and root form and biomass experiments; and
- determination of the effects of treatment size and trench cross-section on seedling microclimate. Mounds and mixed plots have been added at the Tsitsunko Lake and Paska Lake sites and seedlings have been planted in various positions. At Tsitsunko Lake, experiments have begun with a double-berm treatment, which has many of the benefits of trenching but is not susceptible to spring flooding.

Expected Benefits:

Information from this research will assist foresters in prescribing better site preparation treatments for cool dry sites in the southern Interior.

FC-FR02  Growth of naturally and artificially regenerated tree species in high elevation coastal forest ecosystems

Project Leader:  J.T. Arnott
Project Location:  Vancouver Forest Region

Objectives:

To measure the survival, growth, form and potential of eight tree species outplanted throughout the montane forests of the Vancouver Forest Region; and to develop benchmark growth specifications for judging the performance of montane regeneration.

Progress to Date:

Inconsistent stocking and growth of natural and planted trees in coastal montane clearcuts are not meeting current growth expectations. An assessment of growth in these areas is needed to establish standards for judging growth performance.

In 1991 and 1992, 13th-year remeasurements of 12 trial areas in the montane variants of the CWH and MH zones will be completed. Each trial area consists of a comparison of four to six tree species, three stock types and two planting seasons.

Surveys of natural regeneration in unplanted areas adjacent to each research installation will be carried out at the same time as these remeasurements.

Expected Benefits:

This study will provide ecologically based growth and yield data for all commercially important tree species in coastal montane forests. Recommendations for forest renewal options will follow.

FC-FR05  Prescribed fire impact and smoke emission models

Project Leader:  S. Taylor

Objectives:

To develop a model of fuel consumption, energy release and smoke emissions from broadcast prescribed burns in British Columbia. Smoke emissions will be predicted by combining predictions of fuel consumption, in the flaming and smoldering stages of combustion, with emission factors for various smoke constituents in the respective combustion phases. This model will be coupled with models of smoke column development and smoke plume dispersion being developed by other co-operators in the inter-agency Smoke Plume Evaluation and Modelling (SPEM) Project.

Progress to Date:

Four prescribed burns were assessed in 1991 over a range of burning conditions. Fuel loads and fire temperature histories were determined on all four sites, and aerial infra-red imaging was carried out on three sites. These data will be used to determine fuel consumption and energy release rates.

Work in 1992 will involve analysis and interpretation of the fuel consumption and infra-red imaging data, and development of a prototype model. An emissions inventory from wildland fires in British Columbia will also be completed.

Expected Benefits:

The smoke emission models will permit land managers to design burning prescriptions that reduce smoke emissions or increase smoke dispersion.

FC-FR06  Northern interior seedling survival and growth evaluation

Project Leader:  K. McClain

Objectives:

To provide a common data set comparison of seedling survival and growth in cold, high elevation sites.

Progress to Date:

Forest industry personnel identified the need for seedling physiology research in cold, high elevation sites. To address this topic, existing research studies and operational data will be reviewed and the specific needs of industry clients will be evaluated.

A field study will be developed to address the outstanding issues. This study may involve the establishment of several semi-permanent seedling survival plots that cover a range of seedling stock types, species and soil conditions.

Expected Benefits:

Recommendations for future seedling regeneration and regeneration research needs are expected to result from this work.
SILVICULTURAL SYSTEMS

BC-FR06  The conversion of multi-storied brushfields to coniferous plantations: a benchmark evaluation of alternative silvicultural treatments

Project Leaders:  D. Coates and P. LePage

Project Location:  Kalum Forest District

Objectives:

To evaluate 10 stand conversion treatments and identify those treatments that favour establishment and growth of planted conifers; and to monitor the effects of the treatments on subsequent development of competing vegetation.

Progress to Date:

This study was established in 1987 under FRDA, on a 17-year-old multi-storied brushfield dominated by red alder in the overstory and thimbleberry, salmonberry, red elderberry, red-osier dogwood, stink currant and lady fern in the understory. The site, originally logged in the 1960's, developed a dense red alder and brush community after scarring in 1972.

Of the 10 treatments tested, burning and planting showed most promise for a single-intervention approach. Reseeded alder densities averaged 8000 saplings and shrub cover was initially reduced. Burn, spray and plant also successfully controlled the re-invasion of competing vegetation but required a second entry.

The blading treatments had extensive alder re-invasion, with an average of 212,000 saplings after 1 year. Blading and grass seeding had almost none of the pre-treatment shrub and herb species present and substantially less alder (96,000 saplings). The competition for moisture, nutrients and space, resulting from the grass layer, has slowed conifer growth.

While manual girdling killed the alder overstory with no sprouting, the resulting increase in available light and moisture allowed the understory shrub and herb cover to increase by 400 and 500%, respectively. This vegetation competition gives planted conifers little chance of success.

Hack-and-squirt effectively controlled alder and all pre-treatment shrub and herb species in the first year. By the second year, however, the herb layer had increased and the shrub layer was at pre-treatment levels. In addition, falling debris from the dead alder overstory caused extensive damage to planted conifers and would probably lead to plantation failure under operational conditions.

Results from the end of the fourth growing season are currently being analyzed. Interim results from years 2 and 3, including the relative costs of each treatment, are available in FRDA Memo Nos. 145 and 146.

Expected Benefits:

This evaluation of potentially feasible methods of stand conversion will provide options for the numerous coastal sites requiring backlog reforestation.

FC-FR01  Evaluation of silvicultural systems on montane regeneration and site productivity

Project Leader:  J.T. Arnott, W.J. Beece and N. Smith

Project Location:  Iron River, northern Vancouver Island

Objectives:

To develop and deliver to forest resource managers an understanding of coastal montane ecosystem function and recommendations for the "best practices" for sustainable development.

Progress to Date:

Poor stocking and inconsistent growth of conifer regeneration in clearcuts above 700 m are common on eastern Vancouver Island. If this problem is not quantified and addressed, actual wood volume yields from these forests may fall below our current forecasts. An industry/FORCAN co-operative has been formed to address this issue.

Research will focus on a single experimental installation of several silvicultural systems in the 'CWHmm'. The initial work of ecosystems and soil mapping, microclimatic monitoring and experimental layout have already begun. A literature review and regeneration cruises of various aged clearcuts surrounding the demonstration area have also been started.

Expected Benefits:

A long-term, multidisciplinary silvicultural systems research demonstration area will be used to develop improved land use prescriptions for the coastal montane forests.

FC-FR03  Seedling physiological responses to microenvironmental gradients extending from an old-growth montane forest into a clearcut

Project Leader:  A. Mitchell

Project Location:  Iron River, northern Vancouver Island

Objectives:

To characterize the gradient in seedling microenvironments extending from an old-growth montane forest into an adjoining clearcut; to determine the range of seedling physiological and morphological responses to these microsites; and to determine seasonal fluctuations in physiological parameters affecting productivity over the range of microenvironments.

Progress to Date:

Candidate stands were identified through consultation with the Alternative Silvicultural Systems Coastal Montane Forest Cooperative, which includes representatives from MacMillan Bloedel and Forestry Canada.

A coastal montane forest study site was selected at Iron River in MacMillan Bloedel's Menzies Bay Division. Transects and plots were established and locations for environmental monitoring equipment were determined.

Samples were collected to characterize the demography of regenerating seedlings across the range of micro-environments, from old growth to clearcuts.
Expected Benefits:

Data on seedling physiological responses to microsite gradients will be used to evaluate the suitability of alternative silvicultural systems for regenerating coastal montane forests. Data on changes in microenvironments from the old growth to the clearcut will provide information on the impacts of alternative silvicultural systems on seedling microclimate.

**FC-FR04 Evaluation of alternative silvicultural systems in the ICH: Nelson Forest Region**

**Project Leader:** R.J. Whitehead and E.T. Oswald

**Project Location:** Nelson Forest Region

**Objectives:**

To develop a research co-operative to address silvicultural systems research in the Nelson Forest Region.

**Progress to Date:**

A research co-operative being formed in the Nelson Forest Region will include major licensees, Forestry Canada, FERIC, B.C. Ministry of Forests and B.C. Ministry of Environment, Lands and Parks.

In the 1991 field season, Forestry Canada staff identified several silvicultural systems research priorities and opportunities in the Nelson Forest Region:

1. site disturbance and productivity studies in the West Arm Demonstration Forest;
2. hydrology and sedimentation impact studies; and
3. stand structure modification assessments, aimed at reducing the risk of Mountain Pine Beetle attack.

**Expected Benefits:**

A co-ordinated and integrated silvicultural systems research co-operative will deliver operationally relevant information for the Nelson Forest Region.

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**HARDWOOD/MIXEDWOOD SILVICULTURE**

**BC-FR02 Assessment of treatment options for backlog hardwood stands in the BWBS**

**Project Leader:** M. Krasowski

**Project Location:** Stewart Lake and Bear Mountain, Dawson Creek Forest District

**Objectives:**

To identify the causes of white spruce seedling mortality in the BWBS during the first year after planting. Factors to be examined include climatic conditions, stock characteristics and site and microsite modifications that promote or prevent winter injury.

**Progress to Date:**

Results from FRDA Project 1.02 showed significant winter injury in planted white spruce on these sites.

Planting of the two sites near Dawson Creek was completed in 1990 and 1991. Seedlings were sampled and analyzed in the winter of 1990/91, and this will be repeated in 1991/92. Operationally planted sites in the Dawson Creek Forest District have been identified for monitoring of winter survival in the planted stock. Throughout the winter of 1991/92, the frost hardness of seedlings will be tested and climate monitoring on the test sites will be maintained.

A new trial using strip-cutting of aspen interplanted with spruce is being prepared. Aspen would provide shelter to young spruce and may lower the incidence of winter damage.

**Expected Benefits:**

Identifying the causes of first-year seedling losses will enable foresters to improve planting success and silviculture cost effectiveness in the BWBS.

**BC-FR14 Northern mixedwood forests, the carbon cycle, and sustainable production**

**Project Leaders:** P. Comeau and D. Spittlehouse

**Project Location:** Dawson Creek Forest District

**Objectives:**

To estimate the carbon budget of northern mixedwood forests; to examine the impact of harvesting and prescribed burning on the carbon budget; and to examine the impacts of different management strategies (hardwood, mixedwood and conifer) on the long-term productivity of boreal mixedwood forests.

**Progress to Date:**

To estimate carbon budgets, available published data pertaining to carbon cycling have been gathered. Also field data on carbon content and distribution from 12 aspen and mixedwood stands in the Dawson Creek Forest District have been collected and will be summarized.

**Expected Benefits:**

As the utilization and management of the northern mixedwood forests increases, this study will provide important information on their long-term productivity and role in the global carbon budget.
BC-FR15  Use of red alder in managing Phellinus weirii root disease

Project Leader:  R. Sturrock
BCFS Contact:  J. Beale
Project Location: Greater Vancouver Watershed

Objectives:
To investigate the effect of mixed alder/Douglas-fir cropping regimes on laminated root rot.

Progress to Date:
Two areas infected by laminated root rot were identified for trial establishment. In these areas, inoculum load was assessed and infected stumps were mapped and tagged and their characteristics recorded. Red alder seedlings were planted on an operational basis.

Hardwood survival, stump deterioration and Phellinus growth will be monitored annually for 5 years, then periodically until the alder reaches a commercial size (20–30 years) and the infected stumps are in their 21st year of assessment.

Expected Benefits:
This study will provide foresters with another option for managing laminated root rot.

BC-FR16  Analysis of quality and productivity of birch-dominated stands in the Prince George Forest Region

Project Leader:  C. Rose
BCFS Leader:  C. DeLong, Prince George Region
Project Location: Prince George Forest Region

Objectives:
To provide preliminary information on the extent, distribution, and growth and yield of paper birch in the Prince George Forest Region; to explore future management options for birch.

Progress to Date:
The analysis confirmed that birch makes up a significant portion of the total wood volume in the Prince George Forest Region. Since most of this volume is mature or overmature, its commercial utilization must be assessed before wood values continue to decline as a result of defect and decay.

Productivity in pure birch stands had a strong direct relationship to moisture regime, the best growth occurring on moist but well-drained sandy loam soils. Management recommendations for these sites include intermediate thinnings to reduce interspecific competition, and a rotation age of 50 years.

While the birch volume in mixed conifer stands was only 25% lower than in pure stands on mesic sites, these mixed stands also contained substantial conifer volumes. Additional study will determine the true merchantability and defect of mature birch in mixed conifer stands.

A final report describes the study results and summarizes information on birch autecology.

Expected Benefits:
This analysis will produce recommendations for management and for further research of birch stands in the Prince George Forest Region.

FC-FR07  Analysis of cottonwood management problems in British Columbia and related research needs

Project Leader:  R.J. Whitehead

Objectives:
To prepare a review of black cottonwood resources and management in British Columbia; to identify outstanding information gaps and management opportunities; and to develop a ranked list of potential research projects to address these concerns.

Progress to Date:
This report will assess the extent and value of the present cottonwood resource in British Columbia; provide a synopsis of management options and regimes, with their opportunities and limitations; and analyze the impact of cottonwood silviculture and management on non-timber forest resources.

Information on cottonwood will be assessed in three categories: 1) basic biology and silvics; 2) management options and impacts; and 3) economics and markets. A list of research requirements will be developed from these three categories. Research priorities will then be identified as short term (results available in less than 5 years) or long term (results available after 5 years).

The information will be published as a FRDA report in 1992.

Expected Benefits:
This review will identify and rank the direction of cottonwood research in British Columbia.
VEGETATION MANAGEMENT

BC-FR07  Development of vegetation management techniques for sites prone to salal domination

Project Leaders:  R.N. Green and B.N. D’Anjou
Project Locations: Cameron Lake, Northwest Bay (Port Alberni Forest District), Lens Lake (Campbell River Forest District)

Objectives:
To evaluate the effect of various vegetation management techniques and subsequent Douglas-fir performance.

Progress to Date:
Salal-dominated sites represent a large portion of the mid- to low elevation sites in the Vancouver Forest Region. FRDA Memo Nos. 155, 158 and 194 summarized preliminary results of mechanical and chemical site preparation treatments on Douglas-fir regeneration on these sites.

Ongoing work in 1991 included fifth-year remeasurements of regeneration vegetation and foliar nutrition at Cameron and Lens lakes, and an assessment of herbicide efficacy on salal and conifers at the Northwest Bay and Cameron Lake sites. A field workshop for operational foresters was conducted.

Expected Benefits:
This project will contribute not only valuable information about the management of salal-dominated sites and subsequent Douglas-fir performance, but also a long-term demonstration area.

BC-FR10  Effects of competing vegetation on growth and survival of Engelmann spruce seedlings

Project Leader:  P. Comeau and T. Braumandl
Project Location:  Arrow and Revelstoke Forest Districts

Objectives:
To develop and test methods for assessing vegetation competition in young Engelmann spruce plantations in the ICHmw1.

Progress to Date:
Study areas were established in 1988 and 1989 in mixed-shrub and fireweed communities in the ICHmw1. Initial results, summarized in FRDA Memo No. 159, indicate that the best competition index uses percent cover and height of all neighbouring species, as well as seedling height.

Information on growth, survival and response to competing vegetation for Engelmann spruce was collected in 1991.

Analysis of the 1991 data and a journal article summarizing results through 1991 are planned for 1992.

Expected Benefits:
This study will provide competition indices and models for assessing vegetation management treatments and ranking sites for treatment.

BC-FR11  Assessing the effects of fireweed and associated vegetation on planted conifer survival and growth in the southern Interior

Project Leader:  S. Lindieburg
BCFS Contact:  A. Nicholson
Project Location: South-central ICH

Objectives:
To identify ecosystems most susceptible to fireweed domination, and the type of disturbance that enhances this domination in the south-central ICH; to determine the degree of damage and overall environmental influence of fireweed on seedling survival; and to determine the control level and timing required for acceptable conifer survival.

Progress to Date:
This study, initiated in 1988 under FRDA Project 3.63, consists of three components:
1. a descriptive survey completed in 1988;
2. a factorial experiment established in 1989; and
3. a neighbourhood experiment established in 1989.

Measurements of seedling vigour and growth and vegetative competition will be used to prepare a third-year progress report.

Expected Benefits:
Information from this study will improve prediction and assessment of fireweed competition in the ICH.

BC-FR13  Maintenance and updating of the COMB computerized bibliography on the ecology and management of several trees, shrubs and herbs

Project Leader:  P. Comeau

Objectives:
To maintain and update the existing COMB database entries; and to revise COMB software and utilities.

Progress to Date:
The COMB computerized bibliography includes citations and abstracts of available published literature about 23 species of trees, shrubs and herbs found in British Columbia. The COMB database permits rapid searching and location of this literature with a personal computer.

In 1990/91, the database was expanded to include general information on the effectiveness and impacts of vegetation management treatments available in British Columbia.

To ensure the bibliography remains a useful resource tool, the database files are updated and edited periodically.

Expected Benefits:
A computerized bibliography of hardwood and vegetation management literature will simplify the support for extension, research and operational activities.
Vegetation Management — Continued

BC-FR17 Development of a database system for entry and retrieval of vegetation management trial information

Project Leader: P. Comeau

Objectives:
To develop and maintain a database for vegetation management trial information as part of a national Expert Committee on Weeds (ECW) database system; and to develop and test revised ECW/EDI software and enter information from past ECW Silviculture Abstracts into the system.

Progress to Date:
This database is being developed in conjunction with the ECW Silviculture Subgroup and Agriculture Canada as a national database for results from vegetation management trials.

In 1991, a new user's manual has been prepared and software has been circulated for review. Planned activities include demonstration and revision of software and entry of information from past ECW Silviculture abstracts.

Expected Benefits:
This database will be a useful tool for preparing summaries of vegetation management trial results, and for identifying critical research gaps.

BC-FR18 Comparison of four brushing treatments for release of young, shrub-dominated spruce plantations in the ICH

Project Leader: R.J. Whitehead
BCFS Contact: J.C. Pollock
Project Location: Golden Forest District

Objectives:
To compare the effectiveness of four brushing options for releasing young, shrub-dominated spruce plantations in the ICH.

Progress to Date:
This project, established in a 3-year-old Engelmann spruce plantation in 1986, examined brush and crop tree responses to four vegetation management options: no treatment, manual cutting, and glyphosate and 2,4-D amine applications.

Growth responses of the crop trees and three major weed species were taken pre-treatment, and 1, 2 and 3 years after treatment.

The fifth-year post-treatment results and interpretation will be published as a FRDA Report.

Expected Benefits:
This project will produce recommendations on the efficacy of brushing options for shrub-dominated spruce plantations in the ICH.

PROPAGATION

BC-FR08 Establishing germination temperature optima for nursery seedling production of white spruce (Picea glauca)

Project Leader: C.L. Leadem
Project Location: BCFS Glyn Road Research Laboratory, Victoria

Objectives:
To gather baseline data on the response of white spruce seeds to a range of germination temperatures and to establish a generalized temperature response curve for British Columbia white spruce; to examine the interactions of temperature with stratification and seed source and their effects on total germination and germination speed; to establish the degree of biodiversity of the temperature response by testing white spruce seed sources from a broad geographic distribution within British Columbia; and to formulate nursery practice guidelines for the germination temperature regimes most favourable for seedling production.

Progress to date:
A prototype computer-controlled thermal gradient system was designed and tested, and control software was developed. Expansion to four test modules (total 64 cells) and additional of a high-capacity water bath have greatly extended the testing capability and flexibility of the system. Public presentations have been given, and the system has been demonstrated at several technical meetings.

The biological variation of white spruce seed germination is now being tested under a range of temperatures. Since the physiological readiness of seeds is essential to the germination process, research is also focusing on interactions between temperature, stratification and seed source.

Expected Benefits:
Two useful tools for seedling production will be generated: a user's manual for the controlled temperature gradient system, and germination guidelines for nursery production of white spruce. Results may be used to predict the potential success of direct seeding or natural regeneration of harvested sites.

BC-FR20 Application of DNA probes to the analysis of spruce introgression

Project Leader: B. Sutton
BCFS Contact: A. Yanchuk

Objectives:
To develop and characterize DNA probes for intra- and inter-specific genotype comparisons; and to use DNA probes to survey trees from the Smithers–Bulkley and Nass–Skeena transition areas to refine the estimation of the hybrid composition of the spruce complex.
Propagation—Continued

Progress to Date:

DNA probes are special enzymes used to break up genetic material so that specific genes can be compared. DNA probes that distinguish between type trees have been identified and tested against known Sitka, white and Engelmann spruce species types. Matching the species patterns against samples in the Nass–Skeena will help define the extent of introgression between these species.

Needle sampling in the Nass–Skeena transition was completed in 1991; seed collection from this area has been scheduled for 1992.

Results from these tests will be compiled to determine the genotype compositions of wild stands and seed orchard trees.

Expected Benefits:

By refining the zone of introgression between coastal and interior spruce, this study will reduce the use of off-site spruce seedlings from wild stand seedlots or seed orchards, and increase plantation survival.

PLOT LOCATIONS

Legend

* FC-FR01 (Iron River Div., MB)
  FC-FR03

▲ FC-FR02 8 sites Vancouver Island
  1 site Minkford

□ FC-FR05/RM06

FC-FR05

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