INTRODUCTION

FRDA research in the Southern Interior has focussed on backlog regeneration problems on cold, cool moist, and cool dry sites. The objectives of the program are to:

1) demonstrate the relative effectiveness of currently available reforestation practices
2) develop planting stock suited to the conditions on each broad site type
3) develop methods of measuring and predicting adverse growing conditions and of coping with them through altering practices and changing stock
4) improve guidelines for tree species selection for natural regeneration
5) improve the assessment, prediction and treatment of vegetative competition.

Much progress has been made. The remainder of this memo lists the individual research projects which have been funded in the last four years. Readers are encouraged to contact the project leaders (address and telephone numbers listed at the back) or consult the existing FRDA Memos and Reports if they want more information.

This program is more than a series of randomly connected projects. From the beginning we have set out to provide field staff with a package of relevant information on how to regenerate successfully backlog sites. The extension program is designed to do this, and by now, most people will have had some contact with the courses, workshops, and seminars that are taking place throughout the Southern Interior.

FRDA memos and reports are available from the Research Branch, 31 Bastion Square, Victoria, B.C. V8W 3E7. Unpublished draft reports are available from The SITAC Program Management Assistant (PMA), Ministry of Forests, 515 Columbia St., Kamloops, V2C 2T7.

COLD SITES

3.02 Site preparation and planting procedures to minimize seedling temperature and moisture stress in backlog areas of the Southern Interior

Project Leader: A. Black
BCFS Contact: B. Mitchell
Location: Kamloops Forest District

Objectives:
To investigate how various site preparation treatments: 1) modify microenvironments of planted Douglas-fir, interior spruce, and lodgepole pine seedlings, and 2) reduce seedling moisture stress, heat stress, and frost damage.

Progress to Date:
Sites are located near Savona along an elevational transect across the IDFb, MSc, and ESSFd subzones. Treatments tested at each site include ripping, scalping, herbicide application, shade cards, two types of trenching, and a control. Shortly after site preparation, all blocks were planted with lodgepole pine, Douglas-fir was planted in the IDFb blocks, and spruce was planted in the MSc and ESSFd blocks. Extensive monitoring of survival, damage and growth variables, seedling physiology, site and seedling microclimate, and general climatic conditions has occurred regularly since 1986. In general, site preparation was found to be beneficial in decreasing moisture stress and frost damage. Ripping and scalping were particularly beneficial in raising soil temperatures in the seedling root zone - resulting in decreased frost damage and increased seedling growth.

Expected Benefits:
Improved understanding of the processes causing seedling growth reduction and mortality, and more accurate prescriptions for site preparation method and intensity on similar sites. FRDA Memo 007 is available.

3.05 Perceptions of vegetation competition.
Evidence from growth of some Engelmann spruce and Douglas-fir plantations in the ICHb and ESSFb.

Project Leader: R. Scagel
BCFS Contact: E. Hamilton
Location: Revelstoke Forest District

Objectives:
1) to study individual trees in a plantation and examine three broad classes of factors surrounding growth: vegetation, environment, and silvics;
2) to apportion growth of individual trees into these three classes; and
3) to test a hypothesis that differences in planted seedling height growth is due to differing levels of competition from non-crop vegetation.

Progress to Date:
Project was completed in 1986. The height growth of 415 trees in 10 plantations was measured but no strong relationship emerged between the patterns of height growth in individual seedlings and the amount of non-crop vegetation. Initial height growth (nursery plus 2 years plantation growth) and site elevation seemed to have more influence on height growth than adjacent vegetation.

Expected Benefits:
Improved understanding of the influence of non-crop species on seedling height growth and development. Draft report (March 1986) available from SITAC PMA.

3.06 Determination of optimum climatic and edaphic conditions for Engelmann spruce fall planting in the Kamloops Forest Region.

Project Leader: R. Scagel
BCFS Contact: G. Krumlik
Location: Lillooet Forest District

Objectives:
1) to describe the soil and climate occurring throughout the year on high elevation sites;
2) to compare the success of spring planting with late summer or fall planting;
3) to relate the conditions at the time of planting to plantation performance; and
4) to relate seedling morphology and growth variables to seedling physiological condition.

Progress to Date:
3000 Engelmann spruce seedlings were hot planted at five different sites and six different times (five fall planting dates; one spring planting). Early results suggest that:
1) in addition to short growing seasons and cool temperatures, high elevation sites are subject to wide diurnal temperature swings (-2°C to >50°C);
2) spring plantations perform better than fall plantations;
3) first and second season root and shoot growth is greater with earlier planting times;
4) site factors have a stronger effect on seedling survival than planting time, and
5) persistence and depth of snowpack may have an important influence on survival.

Site-specific overwintering mortality, frost damage and dessication occurred on two sites. Damage was independent of planting time and can likely be attributed to early snow melt and the effect of dry winds on transpiration from seedlings anchored in frozen soil (ground was still frozen at 30 cm depth in late May).

Expected Benefits:
This information will lead to more accurate selection of planting times and stocktypes, which may increase regeneration success on high elevation sites. It will also aid in the identification of areas prone to frost and overwinter damage. FRDA Memo 008 is available.

3.19 Problem analysis on management options for dense Chilcotin pine (SBSa) stands.

Project Leader: R. Eremko
BCFS Contact: C. Sutherland
Location: Chilcotin Forest District

Objectives:
Problem analysis was to review:
1) the pine management problems in the western Cariboo Forest Region;
2) current operational practices; and
3) research information and operational experience to develop guidelines for improved pine management.

Progress to Date:
Project completed in 1987. A final draft report addressed the following:
1) a library search and literature review of information pertaining to lodgepole pine i) regeneration characteristics, ii) regeneration management, and iii) density management in juvenile stands
2) a summary of available operational and research information
3) correlation between i) site characteristics and stocking and ii) stocking status and density
4) recommendations for further research into cone serotiny, timing of site preparation following harvesting, and seed viability.

Expected Benefits:
This information improves our understanding of the problems in managing lodgepole pine stands. FRDA Memo 031 is available. Draft report available from SITAC PMA.

3.31 Rehabilitation of the Rhododendron- Vaccinium-Menzlesia brush community.

Project Leader: D. Coates
BCFS Contact: A. Vuye
Location: Clearwater Forest District

Objectives:
To study the effects of a range of manual and mechanical site preparation techniques and intensities on brush development, seedling microclimate and performance of planted lodgepole pine and Engelmann spruce seedlings in well-developed brush communities of the ESSF zone.

Progress to Date:
Treatment plots were established in 1987 and treated in 1988, employing various levels of mechanical site preparation (crawler tractor with brush blade) and manual slashing (brush and chainsaws) for vegetation control or removal. Lodgepole pine and Engelmann spruce seedlings were planted throughout the plots to assess survival and growth. Two-year results show that tree diameter was most responsive to reductions in competing vegetation. There is evidence that low soil and air temperatures and low light levels may be the most important
factors inhibiting seedling performance beneath the undisturbed brush community. Tentative thresholds where growth can be significantly improved, have been identified. Maintenance and monitoring of plots will continue.

Expected Benefits:
Understanding competitive interactions and growth responses on high elevation sites will help improve strategies for forest regeneration in these areas. FRDA Memo 011 is available.

3.32 Variation in the structure of weed communities in the ESSF and the relationship to impacts of interspecific competition on seedling performance.

Project Leaders: J.P. Kimmins and C.L. Caza
BCFS Contact: D. Lloyd
Location: Clearwater Forest District

Objectives:
To investigate vegetation competition and Engelmann spruce regeneration in the ESSF zone by studying patterns of plant community development and identifying the circumstances leading to vegetation competition problems.

Progress to Date:
Research to date indicates that within a backlog site in the ESSF zone there are major differences in the physical, chemical, and biological characteristics of herb-dominated and shrub-dominated environments. Over-winter mortality of Engelmann spruce seedlings was found to be greater in herbaceous areas. Leader growth of cold-stored stock was greater under dense shrubs than under dense herbs, although diameters did not differ. Hot-lifted stock had better leader growth than cold-stored stock, two seasons after planting. Seedling diameters were greater where vegetation had been removed at the time of planting, but there was no difference in leader growth. Partial removal of vegetation was ineffective for controlling herbs, and was less effective than total removal for controlling shrubs.

These preliminary observations suggest that seedlings grow differently in herb and shrub areas.

Expected Benefits:
This information will help foresters implement site-specific vegetation management and planting strategies to increase plantation success. FRDA Memo 010 is available.

3.34 Nutrition of ESSF cutovers: A literature review and foliar analysis of 49 plantations.

Project Leader: G. Weetman
BCFS Contact: A. Vyse
Project Location: Clearwater Forest District

Objectives:
To conduct an analysis of nutrient problems associated with backlog reforestation on high elevation (ESSF) areas of the Southern Interior.

Progress to Date:
Project was completed in 1987. An exploratory study determined if backlog high elevation cutovers have special nutrient supply problems requiring treatment. Conclusions of the study were:
1) spruce plantations in the ESSF have no deficiencies in N, P, K, Ca or Mg;
2) burning increased P, K and Ca foliar nutrition;
3) eradication of brush led to evidence of N and P nutrition enhancement; and
4) lodgepole pine may be considered an alternative to spruce for rehabilitation on burned, south facing slopes.

Expected Benefits:
The information identifies the need for planning site treatments at the pre-harvest stage. FRDA Memo 015 is available.

3.39 An analysis of site history information for NSR lands in the ESSFa subzone.

Project Leader: G. Butt
BCFS Contact: T. Braumandl
Location: Cranbrook and Invermere Forest Districts

Objectives:
1) to determine the reasons for the excessive NSR rate in the past; and
2) to identify ecological and silvicultural problems affecting regeneration success.

Progress to Date:
Project was completed in 1988. On-site inspection of 46 openings created either by logging or wildfire between 1970 and 1979 assessed relevant site factors, non-crop vegetation levels, natural regeneration patterns and regeneration performance (including height growth and stocking). Results indicated that appropriate site preparation, either prescribed fire or mechanical, immediately followed by planting is necessary for successful regeneration of mesic or wetter sites. “High impact” fires were most conducive to regeneration success but may compromise other non-merchantable values.

Expected Benefits:
The information identifies the need for planning site treatments at the pre-harvest stage. FRDA Memo 103 is available.

3.40 Mechanical and chemical site treatment effects on plantation performance in the ESSF Zone.

Project Leader: D. Lloyd
Location: Salmon Arm Forest District

Objectives:
1) to compare the effectiveness of mechanical scalping, patch scarification and glyphosate treatment to improve microsite conditions; and
2) to determine if a reduction in vegetation competition, an
increase in soil temperature, and an improved nutrient regime will enhance seedling performance.

Progress to Date:
The study area is located in the ESSF zone. Treatments were established in 1986. Lodgepole pine and Engelmann spruce were planted in each treatment and one-half of the seedlings were fertilized at the time of planting. First-year results show high survival in all treatments. Height measurements indicate no significant differences among treatments. Caliper measurements were significantly greater for fertilized than non-fertilized seedlings of both species. Soaked and fertilized spruce showed major increases in caliper and root response. These results are short-term. Monitoring will continue for 10 to 15 years.

Expected Benefits:
The research results will be used to develop guidelines for ESSF site rehabilitation. The site provides a site preparation demonstration area for the Salmon Arm and neighboring forest districts. FRDA Memo 021 is available.

3.42 Summer planting of Engelmann spruce in the Southern Interior of B.C.

Project Leader: A. Vyse

Objectives:
To identify suitable air and soil climate conditions for summer planting of hot-lifted Engelmann spruce on cold sites throughout the Southern Interior.

Progress to Date:
Eight plantations were established in 1988 in Kamloops, Penticton, and Golden to supplement the five sites established in 1987. Five of the new plantations are designed to study the effect of planting dates on performance, two are designed to study the effect of storage time on performance, and one will assess the effect of a chemical (paclobutrazol) which reportedly enhances cold hardiness. All new plantations were measured in the fall, 1988 and three plantations established in 1987 were assessed in spring and fall, 1988. On one 1987 site, cold-stored stock and summer stock (planted early July) were severely damaged by frost. Early results from the 1987 plantations suggest the 16-day field storage treatment used last year was too long. A uniform storage period will be used in 1989, and additional treatments will be added (i.e., fertilization, mounding, screening).

Expected Benefits:
The results of this project will be used to produce guidelines for summer planting of hot-lifted stock on backlog areas across the range of ESSF subzones in the Southern Interior. FRDA Memo 026 is available.

3.49 Competition between a Sitka alder dominated brush community and lodgepole pine seedlings in the Montane Spruce Zone: resource use, microenvironment and growth analysis.

Project Leader: S. Simard
BCFS Contact: A. Vyse
Location: Kamloops Forest District

Objectives:
To study lodgepole pine performance at various levels of competition with Sitka alder and associated shrubs and herbs, and to determine the critical level of vegetation competition at which pine growth and survival are significantly reduced.

Progress to Date:
The study was established in 1987. During 1988, herbicide treatments were performed to control the amount of vegetative regrowth. Seedling physiology, survival, and growth were monitored. In addition, soil moisture, soil and air temperature, solar radiation, and precipitation data were collected. Data from 63 plots installed in the untreated brush were also recorded. Initial results indicate Sitka alder and associated shrubs have a negative effect on both height and diameter of pine regeneration. This effect may impede stands from reaching free-growing status.

Expected Benefits:
This information will aid in the selection of appropriate strategies for regenerating lodgepole pine on alder-covered backlog NSR sites. FRDA Memos 030 and 072 are available.

3.61 Natural regeneration on high elevation backlog cutblocks in the Southern Interior.

Project Leader: G. Butt
BCFS Contact: A. Vyse
Location: Kamloops, Merritt and Clearwater Forest Districts

Objectives:
To evaluate the assumption that planting is the only way to meet basic silvicultural standards on ESSF backlog sites in the Southern Interior.

Progress to Date:
Total and well-spaced stocking of Engelmann spruce and subalpine fir natural regeneration were recorded in four subzones of the ESSF to determine the amount and rate of colonization of cut-over lands by these species. The amount and rate of colonization was not sensitive to elevation or site moisture regime. However, southern aspects showed lower stocking and slower colonization rates than northern aspects. Rates of colonization were highest on mechanically-scarified sites with 30 to 50% mineral soil exposure. Height growth of new spruce and subalpine fir regeneration was slow (5 - 10 cm/year). Results indicate that reliance upon natural regeneration alone to restock cutovers would be an unsatisfactory alternative to artificial regeneration on most ESSF sites in these subzones.

Expected Benefits:
Information from this project will aid foresters in determining the degree to which artificial regeneration will be complemented by natural regeneration on high elevation cutblocks. Draft final report available.
3.65 Frost prone sites on the Interior Plateau: recognition and management.

Project Leader: O. Steen
Location: Chilcotin, Horseshy and Williams Lake Forest Districts

Objectives:
To prepare a field guide that will assist operational foresters to recognize sites that are prone to growing season frosts and to identify appropriate harvesting and reforestation options for these sites.

Progress to Date:
Approximately 20 temperature monitoring stations were established in each of three geographic areas of the Cariboo Forest Region. Minimum temperatures on a range of topographic features expected to influence cold air drainage were recorded. Minimum overnight temperatures were monitored at these 60 locations throughout the 1988 growing season. Aerial thermographic imagery has also been used to identify night-time cold air pockets. Data collection will be complete by fall, 1989. Preliminary data inspection indicates substantial variation in frost frequency and severity over the landscape.

Expected Benefits:
Information from this project will help foresters recognize and manage sites where regeneration attempts may be complicated by frost damage. FRDA Report 073 available.

BCFS Contact: B. Wikeem
Location: Kamloops Forest District

Objectives:
1) to re-evaluate and update grass/tree/cattle interaction research priorities emphasizing backlog reforestation; and
2) to prepare a five-year plan for grass/tree/cattle research in the Southern Interior.

Progress to Date:
This project was completed in 1987. A five-year plan for integrated Forest/Range Research was prepared containing recommendations for research in the following areas:
1) the relative competition of native and domestic forages to regenerating conifers;
2) the effects of basal scarring on tree growth and survival; and
3) research and demonstration of specific grazing management programs which minimize damage to regenerating trees.

Some of these concerns are being addressed in FRDA project 3.55.

Expected Benefits:
The results of the study made recommendations for further research into the interactions between forage grasses, cattle grazing and forest regeneration. FRDA Report 064 and FRDA Memo 068 are available.

3.02 Site preparation and planting procedures to minimize seedling temperature and moisture stress in backlog areas of the Southern Interior.

See Cold Sites for information.


Project Leader: M. Pitt

3.50 A study of the effects of mechanical site preparation on soil and foliar nutrient status of seedlings in the drier IDF, MS, and ESSF subzones.

Project Leader: B. Mitchell
Location: Kamloops Forest District

Objectives:
To study the effects of forest floor removal on soil and foliar nutrient concentrations of Douglas-fir (IDFdk subzone), lodgepole pine (IDFdk, MSxk subzones), and Engelmann spruce (MSxk, ESSFxc subzones).

COOL/DRY SITES

3.01 Competition between Douglas-fir seedlings and pinegrass on an Interior Douglas-fir Zone site in southern British Columbia: resource use, physiology and growth analysis.

Project Leader: A. Nicholson
Location: Williams Lake Forest District

3.03 Site preparation and planting procedures to minimize seedling temperature and moisture stress in backlog areas of the Southern Interior.

See Cold Sites for information.


Project Leader: M. Pitt
Progress to Date:
The project is located on growth and survival plots established under FRDA project 3.02. Soil samples were collected from two treatments - scalped and control - at all three sites. Preliminary analysis of these samples indicate that the scalping treatment caused significant losses of soil nitrogen, phosphorous, and sulfur. Losses of available cations appeared to be less significant. Foliar samples will be collected in the fall of 1989.

Expected Benefits:
Results from this project will help foresters make allowance for short- and long-term nutritional effects when considering mechanical site preparation.

3.55 The effects of cattle grazing, forage seeding rate, basal scarring, and shoot damage on forest regeneration.

Project Leader: B. Wikeem
Location: Merritt Forest District

Objectives:
1) to determine the effects of grass forage seeding rates and grazing intensity on suppression of native vegetation, conifer survival and growth, plant densities, forage production, and cattle weight gain;

2) to develop management prescriptions for seeding rates and cattle use on seeded plantations; and

3) to determine the effects of seeding girdling, shoot removal, and season of damage on seedlings of two different age classes.

Progress to Date:
Three cutblocks totaling 120 hectares in the MS zone were site prepared in 1987 and seeded to forages in 1988. Shortly after seeding, blocks were planted with lodgepole pine seedlings. Twenty-seven hundred trees were measured in fall 1988 for survival, seedling height, and basal diameter. Forage seeding rates had no effect on survival or growth in 1988. Beginning in 1989, cattle will graze each cutblock from mid-July to mid-August. Seedlings will be reassessed in the fall of 1989.

The second part of the project (Objective 3) is a small scale trial located on a site that was operationally planted with lodgepole pine in 1988. Four levels of stem girdling (0, 25, 50, and 75%) and three levels of shoot removal (control, apical bud removed, and 50% of terminal leader removed) were hand applied to trees in June and August respectively. Measurements taken in fall 1988 showed that the girdling and terminal leader treatments had no effect on survival or growth after the first year. Further measurements will be taken. The same treatments will be applied in 1989 to seedlings growing in their second year after planting.

Expected Benefits:
Information from these experiments will guide resource managers in choosing the preferred combinations of seeding and grazing that will benefit both trees and livestock, thus minimizing future resource conflicts on backlog sites where integrated forest/range management is prescribed. FRDA Memo 035 and 068 are available.

3.60 Controlling aspen regeneration in cutovers by girdling and chemical treatments before harvest.

Project Leader: B. Bancroft
BCFS Contact: A. Vyse
Location: Kamloops Forest District

Objectives:
1) to compare the biological effectiveness of chemical and mechanical treatments to control aspen regeneration in cutovers when applied to mature aspen before harvesting;

2) to determine the best time to apply treatments; and

3) to review the potential effects of the treatments on cavity-nesting bird species.

Progress to Date:
A working plan has been approved by the cooperating agencies. After pre-treatment baseline assessments, the first hack-and-squirt treatments were applied in fall, 1988.

Expected Benefits:
A better understanding of the control of aspen in cutovers leading to more successful regeneration through reduced competition. FRDA Memo 073 and Report 067 are available.

COOL/MOIST SITES

3.21 A comparison of site preparation options for reforesting backlog sites in the ICH subzones.

Project Leader: C.F. Thompson
Location: Arrow, Golden and Revelstoke Forest Districts

Objectives:
1) to assess both the detrimental and beneficial effects of four site preparation methods (broadcast burning, ground application of herbicide, mechanical scarification, and manual bush removal) on several ICH backlog sites in the Nelson Forest Region.

2) to examine the relative performance of different species and stocktypes planted in each of these treatments.

Progress to Date:
Study areas were located at Golden, Rossland, and Revelstoke in 1987. At each location plots were established using each of the four site preparation treatments plus a control. Treatments were planted, and seedlings measured immediately after planting in 1988. A post-site preparation evaluation of soil properties and post-burn assessment were completed. Another post-burn assessment was done in 1989. Vegetation was assessed before site treatment and after the first growing season. Vegetation assessments will continue on a yearly basis for the duration of the project. Climate stations to monitor soil and atmospheric microclimate were installed in all treatments at the Golden and Rossland locations, but only in the control at the Revelstoke location.
3.25 Ecophysiology study of selected species under three backlog reforestation treatments.

Project Leader: D. Crampton
BCFS Contact: C. Thompson
Location: Kootenay Lake Forest District

Objectives:
1) to measure the growth responses of four conifer species to alterations in the environment resulting from two levels of vegetation removal on a prescribed burn and a control site; and
2) to assess plant moisture stress and stomatal conductance of the four conifer species as an indicator of response to soil and air temperatures, soil moisture, relative humidity, and available light on the sites.

Progress to Date:
Project completed 1988. The study collected environmental data from two growing seasons. The vegetation on site was assessed for percent cover and presence. Stem moisture potential and stomatal conductance were measured on selected seedlings. All data were analysed to correlate seedling success to the levels of stress from the alteration of the sites.

Expected Benefits:
Results of the study will aid silviculturists in assessing seedling success in burned sites. FRDA Memo 119 is available.

3.26 A review of existing herbicide installations in vegetation complexes representative of backlog sites in the Nelson Region.

Project Leader: C. Thompson
Location: Nelson Forest Region

Objectives:
1) to assess the impact of herbicide treatment on target vegetation species in operational applications; and
2) to use these assessments to construct a first approximation efficacy table of chemical treatments for target non-crop species.

Progress to Date:
Project completed in 1987. The data from the study showed short-term herbicide effectiveness differs with the species and, in a few species, with the application rate. Efficacy also varies with the timing of application although information on this factor was restricted because of the limited range of treatment dates available. The recovery rate of each species varies, causing a shift in the species composition after herbicide treatment.

Expected Benefits:
This information will allow foresters to determine the pathological rotation of western hemlock and decide whether it should be considered an acceptable species for regeneration. Performance of residual hemlock can be forecast to determine whether they will form an acceptable new stand. FRDA Memo 104 is available.

3.47 A problem analysis on backlog NSR in the ICH zone.

Project Leaders: G. Butt, J. Mather, G. Utzig
BCFS Contact: A. Vyse
Location: Kamloops, Nelson and Cariboo Forest Regions

Objectives:
1) to identify silvicultural practices which led to regeneration success or failure in the ICH zone;
2) to provide a general summary of backlog conditions;
3) to produce brush hazard assessment guidelines; and
4) to recommend future research.

Progress to Date:
Project was completed in 1988. Three draft problem analyses, one for each region, addressed the objectives. Presentations were made to district staff in the Kamloops, Nelson and Cariboo Regions and to the ICH working group of the Southern Interior TAC.
3.48 Characterization of light microenvironments and competition in mixed shrub communities in the ICH.

**Project Leader:** P. Comeau  
**Location:** Arrow Forest District

**Objectives:**
1) to measure and describe light reduction in mixed shrub communities;  
2) to evaluate potential consequences of these light regimes on seedling survival and growth;  
3) to develop a model of competition for light; and  
4) to develop field techniques for assessing competition for light.

**Progress to Date:**
Five plots were established during 1988 at three locations in the Arrow Forest District. The sites were operationally planted during 1986 and 1987. Within each plot, 60 Engelmann spruce seedlings were tagged for annual remeasurement and vegetation assessment. In 1989, assessments of competing vegetation around each seedling were completed in four plots; and, seedling root collar diameter, height, 1988 height increment, and crown length were measured. Early results show that the rate of net photosynthesis and height increment of overtopped Engelmann spruce decline as vegetation cover increases and the amount of light reaching seedlings is reduced. Measurements and evaluations will continue in 1989.

**Expected Benefits:**
This project will provide greater understanding of how vegetative cover and light levels affect regeneration success. FRDA Memo 116 is available.

3.59 Comparison of biological controls to other vegetation control methods in the Nelson Forest Region.

**Project Leader:** R. Wall  
**BCFS Contact:** T. Braumandl  
**Location:** Arrow Forest District

**Objectives:**
1) to evaluate the effectiveness of available biological controls for thimbleberry and associated hardwoods;  
2) to measure the interactions among thimbleberry, overstory hardwoods and conifer regeneration;  
3) to evaluate the direct and indirect effects of selected biological control agents on conifers and other non-target vegetation; and  
4) to determine if these controls are a viable option alone or combined with other control methods.

**Progress to Date:**
Twelve fungal species with the potential for biological control were collected from forest weed species in the Southern Interior. Eight of these were tested in the greenhouse and field for their effect on thimbleberry, aspen, and Sitka alder. Two of the thimbleberry pathogens show promise: a leaf spot fungus which can cause premature defoliation and a root rot fungus which can cause mortality. A stem pathogen with potential usefulness in controlling most woody plants was also isolated. The thimbleberry pathogens may be suitable for formulation of a mycoherbicide provided other requirements such as non-target effects, and stability are met.

**Expected Benefits:**
This research may provide alternatives to traditional chemical and mechanical control measures, as well as new control options for weeds unresponsive to chemical or mechanical measures. FRDA Memo in progress.

3.62 Demonstration of site preparation options for reforesting backlog sites in the wet ICH subzones of the Southern Interior.

**Project Leader:** C.F. Thompson  
**Location:** Revelstoke Forest District

**Objectives:**
1) to create a demonstration area containing site preparation options for backlog sites in the wetter ICH subzone.

**Progress to Date:**
A site for this trial was selected in the Akalkolax River drainage south of Revelstoke. The site is a rich, productive river terrace in the ICHb subzone. Before treatment, the site was covered with two metre high bracken fern, fireweed, and thimbleberry. Vision (glyphosate) was applied in late August 1988 to part of the site. The other part was treated using a small bulldozer with a brush blade in September.

**Expected Benefits:**
This research will aid foresters in selecting site preparation for successful reforestation of backlog sites in the wet ICH subzones of the Southern Interior.

3.63 The effect of fireweed regeneration in wetter ecosystems of the ICH Zone.

**Project Leader:** A. Nicholson  
**Location:** Clearwater and Kamloops Forest District

**Objectives:**
This project will determine:
1) the ecosystems most susceptible to fireweed domination in the south-central ICH;  
2) the type of disturbance that enhances fireweed domination in the south-central ICH;  
3) the effects fireweed has on the seedling environment;  
4) the control level and timing needed to achieve acceptable conifer survival; and  
5) the amount of damage attributable to fireweed competition.
Progress to Date:
During 1988, planning was completed for the project. Study sites were selected and vegetation on a number of backlog fireweed-dominated sites was surveyed. In 1989, seedlings will be planted and the experimental treatments will begin.

Expected Benefits:
This project will help field foresters predict and assess fireweed competition and the effect it will have on successful regeneration of a site.

3.66 Silvicultural Implications of selective logging in the southern interior.

Project Leader: J. Pollack
Location: Nelson Forest Region

Objectives:
1) To examine the factors influencing the silvicultural success of present selective logging practices;
2) to inform managers and foresters who used partial cutting techniques, about the silvicultural implications of selective logging; and
3) to produce management recommendations for selective logging in larch/fir stand types.

Progress to Date:
Old selective logging research areas have been located. Data collection has been completed.

Expected Benefits:
Improved understanding of the silvicultural implications of partial cutting techniques used in the Nelson Forest Region.

3.67 Competition modeling along site gradients in Douglas-fir plantations dominated by paper birch in the ICH m subzone.

Project Leader: S. Simard
BCFS Contact: A. Vyse
Location: Kamloops Forest District

Objectives:
To quantify competitive interactions along site gradients dominated by Douglas-fir/paper birch communities in the advanced regeneration to sapling stage.

Progress to Date:
The following work will be completed during the 1989 field season:
1) collect field data on the performance of Douglas-fir and the amount, aggregation and distance to paper birch and other dominant competitors in Douglas-fir plantations;
2) characterize light availability and soil water potential of each plot;
3) quantify interspecific competition along site gradients; and
4) identify environmental factors and vegetation patterns that may be important to competitive interactions along site gradients.

Expected Benefits:
This information will aid in the selection of appropriate strategies for regenerating Douglas-fir on paper birch dominated backlog NSR sites.

3.68 Legume and grass seeding for brush control on mechanically prepared backlog brushfield sites in the southern interior ICH and ESSF zones.

Project Leader: O. Steen
Location: Cariboo Forest Region

Objectives:
To evaluate and demonstrate the effectiveness of the following treatments, individually and in combination, for reforestation of backlog brushfields or moist sites in the ICH and ESSF zones:
1) mechanical site preparation (brushblading);
2) seeding of low growing clover and grass species to control native vegetation redevelopment and to ameliorate site impacts of mechanical treatments;
3) broadcast fertilizer application to improve early growth of clovers and grasses; and
4) no treatment.

Progress to Date:
Operational monitoring plots were established in 1987 and 1988. The plots, prepared using a brushblade, were seeded with a clover/grass mix. Plots were measured for vegetation composition and/or soil chemical and physical properties. Crop trees were planted in 1988 and will be monitored for growth and survival.

Expected Benefits:
The establishment of demonstration sites and evaluation of grass/legume seeding for brushfield rehabilitation

ALL SITES - COLD, COOL/DRY, AND COOL/MOIST

3.35 Operational trials of site preparation, planting stock and post planting site maintenance on Southern Interior sites.

BCFS Contact: A. Vyse
Location: Kamloops, Nelson and Cariboo Forest Regions

Objectives:
To support FRDA research programs with demonstrations of effective backlight reforestation techniques.

Progress to Date:
The following operational trials and demonstration areas have been established:

Cool/Dry Sites
0.5 control of root rot through stumping and root raking, plus associated species trial - Kamloops Forest District (F.D.)

0.6 site preparation and associated species trial - Kamloops/Merritt F.D.

0.8 effect of mycorrhizal inoculation on field performance of nursery stock - Merritt F.D.

0.15 site preparation, species, stock type, and grazing exclusion trial - Williams Lake F.D.

0.16 site preparation and species trial - Invermere F.D.
Cool/Moist Sites

3.41 Screening trials to assess crop tree and vegetation response to chemical and non-chemical weeding treatments for major competition complexes in the Southern Interior.

BCFS Contact: D. Lloyd
Location: Kamloops, Nelson, Cariboo Forest Region

Objectives:
1) to conduct screening trials to evaluate chemical and non-chemical treatments on various backlog vegetation complexes in the Southern Interior;
2) to monitor the effectiveness of various treatments and document shifts in vegetation development;
3) to assess effects of treatments on crop trees and the crop tree environment;
4) to identify minimum effective concentrations of useful herbicides;
5) to determine the timing period when target species are most susceptible to treatment; and
6) to establish demonstration areas for local foresters.

Progress to Date:
Project 3.41 has twelve sub-projects as follows:

Kamloops F.D.

0.1 Glyphosate timing trial on Sitka alder.
0.2 Manual cutting timing trial for alder at seven different times during the growing season from pre-leafout to post-leaffall.
0.3 Assessment of the rate of regrowth of Sitka alder following a cut stump application of glyphosate applied at 0.10, 0.25, and 50% solutions.
0.4 Glyphosate rate and timing trial for pinegrass control.
0.5 Glyphosate rate and timing trial at three concentrations (0.7, 1.43, 2.14 kg a i/ha). The trial includes five growing season treatment dates. Target species are fireweed and thimbleberry.

Horsely F.D.

0.12 Glyphosate rate and timing trial using 3 concentrations applied five different times throughout the growing season to a backlog fireweed complex.

Two major documents have been completed:
Vegetation Management Strategy for the Southern Interior by Hamish Kimmins and Phil Comeau from U.B.C.
FRDA Report 093, Aucetology, biology, competitive status and response to treatment of seven Southern Interior weed species by P. Comeau and others, an ab-
3.07 The incidence of lodgepole pine stem diseases in the interior of British Columbia following juvenile spacing.

Project Leader: B. van der Kamp
Project Contact: J. Muir
Location: Kamloops Forest Region

Objectives:
To assess the incidence of stem diseases in young, juvenile spaced lodgepole pine stands.

Progress to Date:
The project was completed in 1986. The incidence of western soil rust, stalactiform and comandra blister rust, and Atropellas canker was measured in four permanent sample plots in young lodgepole pine stands. The first assessment was taken in 1980 shortly after operational juvenile spacing and again in 1985. Spaced areas showed higher incidence of all disease than unspaced controls in 1980. The 1985 assessment showed new infections of gold rust and comandra rusts to be of equal frequency in spaced and control areas. Stalactiform rust showed a higher occurrence in thinned stands.

Expected Benefits:
The results from the study show that the incidence of new infections of stem diseases in young lodgepole pine stands can occur in spaced stands if infected stems are not removed during the thinning operation. FRDA Memo 037 is available.

3.08 Root disease of interior plantations: hazard assessment for planting sites and survey methodology for established plantations.

Project Leader: Pathoon Consulting
BCFS Contact: J. Muir
Location: Kamloops Forest District

Objectives:
1) to test, and if necessary, modify or develop root disease survey methods applicable to southern interior backlog areas; and
2) to develop site assessment procedures to determine root disease hazards and management options in backlog areas.

Progress to Date:
Project completed in 1987. Twenty-seven plantations were investigated for the presence of root disease. Eight were designated NSR at the time of study. Intensive study of 18 cutblocks included observations of root disease indicators in the cutblocks and in adjacent stands and incidence surveys within the cutbacks. The remaining 9 plantations were studied without incidence surveys. A hazard rating system is developed to assess the risk of root disease using root disease indicators. It appears that Armillaria is causing severe losses in plantations in the study area. Phelinus weirii was not found to contribute appreciably to understocking.

Expected Benefits:
The development of a hazard rating for the incidence of root disease in plantations will assist field silviculturists in improving site prescriptions. Draft report (March 1987) available from SITAC PMA.

3.33 Preliminary study on the effects of Black Army Cutworm on backlog reforestation efforts and plans in the North Thompson Valley.

Project Leader: T. Maher
BCFS Contact: A. Vyse
Location: Clearwater Forest District

Objectives:
To provide better management information for silviculturists on the direct effects of Black Army Cutworm damage in the North Thompson area. Outbreaks are persistent and have contributed in a small way to the existing backlog in that area.

Progress to Date:
Project was completed in 1987. Twenty-six infestations were analysed and four areas of seedling damage located. The interval between burning of cutblocks for site preparation and planting were the only common factors. All damage sites were located in the ICH zone and had been planted in the second season after burning. Established stocking surveys found only one plantation to be below minimum stocking. Natural ingress is considered to be responsible for satisfactory restocking of the other plantations.

Expected Benefits:
The potential of the cutworm to affect reforestation depends on the elements of risk and hazard involved. This study provides data necessary to identify potential problems with infestations and recommendations to eliminate, or at least alleviate, the impact of damage to planted seedlings. FRDA Report 022 and Memo 102 are available.

3.64 Assessment and prediction of damage caused by Douglas-fir canker in northern ICH plantations.

Project Leader: B. van der Kamp
BCFS Contact: J. Perry
Location: Williams Lake Forest District
Objectives:
1) to determine the cause(s) of Douglas-fir dieback in established and otherwise free-growing plantations in the ICH zone;
2) to identify high-risk areas in which dieback is likely to occur; and
3) to make recommendations that will lead to successful regeneration of commercial conifer species in high risk areas.

Progress to Date:
Field experiments were established in affected areas of the Prince George, Cariboo and Kamloops Forest Regions in 1987 and 1988. Results show that dieback is the result of spring and fall frost damage which has been followed by invasion by Cytospora and other weakly-parasitic canker fungi. Latent infections, often associated with giant conifer aphid damage, were activated following frost damage, resulting in girdling by the disease. Damage was restricted to flat valley bottoms and concave landforms. Clearcut designs that create frost pockets should be avoided, and high risk areas should be planted to alternate frost resistant species such as lodgepole pine.

Expected Benefits:
This project will help define areas where Douglas-fir dieback can be expected, so that alternate species may be planted and plantation failures avoided. FRDA Memo 071 is available.

3.24 Basic ecological classification training to assist in evaluating backlog reforestation options in the Nelson Region.

Project Leader: T. Braumandl
Location: Nelson Forest Region

Objectives:
To train district and industry staff in basic elements of site diagnosis.

Progress to Date:
Project was completed in 1987. Five training courses were given at district offices in the Nelson Region. A slide tape presentation and supporting script were produced.

Expected Benefits:
Improved training in basic ecological classification will assist field foresters in making accurate and thoughtful site prescriptions.

EXTENSION


Project Leader: T. Braumandl

Objectives:
To produce five 10-20 minute slide/tape modules and accompanying written materials on the BEC system and basic ecological principles. The primary target audience is operational field personnel making ecological site assessments for NSR site diagnosis, PHSP and regeneration surveys.

Project to Date:
Project was completed in 1988.

Expected Benefits:
Basic training in ecosystem classification, soil texturing, management interpretations, soil moisture and nutrient regimes and site diagnosis will assist field foresters in writing comprehensive site prescriptions and PHSP's. Slide/tape modules available from Nelson Regional Office.

3.51 Development of a training package summarizing ecological classification in the southern interior of British Columbia including field identification and application to backlog reforestation.

Project Leader: B. Bancroft
BCFS Contact: D. Lloyd
Location: Cariboo, Kamloops and Nelson Forest Regions

Objectives:
To develop and produce visual aids, instructor notes and handout materials for training in ecological site diagnosis and making backlog reforestation prescriptions.

Progress to Date:
Materials cover: the value and uses of the classification system; basic concepts and principles of the system; a review of the tools and aids that have been developed to classify sites in each Southern Interior forest region; mapping of site units, and general and site specific interpretations of site and biogeoclimatic units. These materials were used during field training sessions in ecosystem classification in the Southern Interior forest districts during 1989.

Expected Benefits:
Copies of the materials will be available in the Cariboo, Kamloops and Nelson Forest Regions for use in future training sessions.

3.52 An extension program for informing Southern Interior foresters of what is known about obtaining successful regeneration at high elevations.

Project Leader: C. Pearce
BCFS Contact: A. Vyse
Location: Cariboo, Kamloops and Nelson Forest Regions

Objectives:
To ensure that operational foresters receive existing information about establishing successful plantations on backlog areas at high elevation.

Progress to Date:
Assistance was provided for the 1988 SISCO summer workshop on high elevation reforestation in Golden. Visual aids, instructor notes and handout materials are being prepared to address three distinct topics relative to management of high elevation sites:
- the environment and vegetation;
- appropriate silviculture practices;
- management of sub-alpine fir.

These materials will be presented during 1989 in field training sessions in Southern Interior forest districts.
3.53 An extension program for grassy dry site reforestation operations.

Project Leader: P. Bunnell
BCFS Contact: A. Vyse
Location: Kamloops, Nelson, and Cariboo Forest Regions

Objectives:
1) to collect and integrate all available information on grassy dry site reforestation;
2) to create a one-day interactive field training program on this subject for operational foresters; and
3) to train regional foresters in delivering this program.

Progress to Date:
A two-hour presentation using overheads and accompanying script has been given to seven districts in the Southern Interior. Overheads are included in this presentation. In some districts, local staff organized a field trip to a cool, grassy site as an integral part of the presentation. Funding for 1989 will be used to update and revise the training program.

Expected Benefits:
This program summarizes current information concerning reforestation on pinegrass sites for effective transfer to operational foresters. Training materials are available from regional offices.

3.57 Development and implementation of an Extension and Demonstration Program for SiTAC.

Project Leader: C. Pearce
BCFS Contact: A. Vyse
Location: Kamloops, Nelson and Cariboo Forest Regions

Objectives:
1) to combine and integrate information from the Southern Interior research program with other research and operational information; and
2) to develop a relevant and informative extension and demonstration program to help Southern Interior silviculturists make better prescriptions for reforestation backlog sites.

Progress to Date:
Each project leader has been contacted to document past extension activities and identify future needs. Meetings were held with government, industry and consultants from each Southern Interior forest district in late 1988 to identify extension needs and preferred extension methods. A plan was developed based on this information and input from regional research and silviculture specialists. This plan includes the development and delivery of a number of training activities.

To date the following activities have been organized:
- seminars - an update on FRDA research in the ICH Zone;
- Quality Tree Seedlings - production, testing and handling; and presentations at the 1989 SISCO winter meeting;
- courses - A Framework for Effective Reforestation Recommendations; and
- field training sessions - Forest Vegetation Management; Reforesting Dry, Grassy Sites; The Challenge of Managing High Elevation Forests; a demonstration of site preparation equipment options; presentations at the 1989 SISCO summer field tour; and, Root Rot Management.

The following activities will be offered during 1989:
- courses - Identifying Silviculture Treatment Priorities
- workshops - Rehabilitating High Elevation Alpine-fr Stands; and Rehabilitating Cool, Moist Sites.

Selkirk College in Castlegar has been contracted to organize the delivery of these activities throughout the Southern Interior (Contact: April Anderson, 365-7292).
FRDA memos, operational summaries, and reports are also being written for specific projects.

Visits to certain project sites have been arranged.

Expected Benefits:
The effective transfer and integration of new information in backlog reforestation decision processes, and in management decisions for all sites.

PROVINCIAL PROJECTS

3.11 Biological monitoring system for backlog plantations.

Project Leader: I. Moss
BCFS Contact: A. Vyse

Objectives:
1) to review and make recommendations on monitoring of stands from seed to free growing; and
2) to compare programs in B.C. with other monitoring programs.

Progress to Date:
Project was completed in 1987. Recommendations were made to improve monitoring procedures at 5 levels of organization within the Ministry of Forests.

Expected Benefits:
The recommendations may help managers and planners develop a more comprehensive monitoring system within the ministry.

3.30 Effects of fertilization on early growth of planted seedlings - a problem analysis.

Project Leader: R. Brockley
Objectives:
1) to review and summarize available seedling fertilization information including: accumulated knowledge, research and silviculture trials, scientific literature; and
2) to recommend the direction and scope of future operational seedling fertilization projects and research trials.
3.54 Ergonomic/human performance evaluation of backlog reforestation planting work.

Project Leader: Dr. E.W. Bannister
BCFS Contact: A. Vyse

Objectives:
1) to conduct a detailed analysis of environmental, site-specific, and working condition factors which may affect efficiency, productivity, and quality of planting performance;
2) to evaluate alternative work practice strategies for enhancing planting productivity and reducing physical demands, cumulative trauma, and fatigue effects of planting; and
3) to develop work practice, health, safety, and hazard management criteria for planters and contractors which will lead to optimal planting productivity and quality.

Progress to Date:
Responses of tree planters to an extensive health questionnaire administered several times through the planting season, have been correlated with objective measures of their health status and fitness. The strenuous nature of tree-planting work has been confirmed through heart rate studies and serial measures of the elevation of serum enzyme activity (ESEA) throughout a planting project. Analysis of stress chemicals in the blood also indicated prolonged physical stress anxiety states with little recovery throughout the period of planting activity. It is believed that these stress factors may contribute to plant burnout, with the result of a shortened planting season for many. This may become a serious problem for the industry since large areas of backlog need planting. Evidence was also gathered on the susceptibility of some workers to the effects of pesticides contacted in handling seedlings. Sampling sites included Fort St. James, Clearwater, Golden, and Squamish.

Expected Benefits:
Improved planting productivity and quality, and safer, more manageable working conditions for tree planters. FRDA Memo is being produced.

3.09 Interpretation of stock quality monitoring data: root growth capacity standards for the Southern Interior - Kamloops, Cariboo, Nelson

Project Leader: D. Simpson
Location: Kalamalka Research Station

Objectives:
To determine the relationships between pre-planting root growth capacity and field performance for interior spruce, lodgepole pine, and interior Douglas-fir.

Progress to Date:
Between 1985 and 1987, 18 plantations were established on a range of forest sites in the Southern Interior. Before planting, seedlings were tested for RGC, in which the number of new roots 10 mm or longer after 7 days in a growth chamber was recorded. Results indicate that selecting stock for planting that have RGC levels greater than an average of 10 roots per plant, results in higher survival and less variation in performance for pine and spruce. There seemed to be no relationship between RGC and survival in Douglas-fir. Further measurements will be taken.

Expected Benefits:
This research will produce a set of minimum quality standards that will improve plantation survival and growth over a range of site conditions. FRDA Memo 009 is available.

3.14 Cold hardiness of conifer roots

Project Leader: D. Simpson
Location: Kalamalka Research Station

Objectives:
1) to evaluate several existing methods and/or develop new methods of measuring root mortality caused by low temperatures;

3.36 Development of guidelines for the assessment of soil temperature and moisture conditions at forest sites.

Project Leader: D. Spittlehouse

Objectives:
1) to explain, in a field guide, the physical principles behind the soil temperature and moisture regimes of forest soils; and
2) to describe the influence of site microclimate, particularly as altered by silvicultural practices.

Progress to Date:
Project completed in 1987. A draft soil temperature manual is currently under review for publication. A draft soil moisture manual is being written. Information from the draft manuals is used in Module 1 of the SIBC training courses.

Expected Benefits:
The manuals in a field handbook form will assist field foresters in identifying soil temperature and moisture regimes. This will aid in making better site prescriptions. FRDA Memo 019 is available.

FRDA Memo

FRDA REPORT

FRDA Memo

FRDA Memo
2) to examine the seasonal development and environmental control of root hardness; and

3) to investigate the effect of temperature on the repair of non-lethal damage caused by low temperatures.

Progress to Date:
The method of root freezing employed was found to be unsatisfactory for detailed examination of root physiology. New equipment that will permit refinement of freezing methods and assessment of damage, was ordered. The effects of day length and temperature on root hardness of seedlings of white spruce, lodgepole pine, and Douglas-fir have been examined.

Expected Benefits:
The study is expected to improve understanding of root hardness and appropriate techniques for measuring root hardness. This will help develop nursery practices that minimize or avoid the severe overwintering damage experienced in the past. FRDA Memo 014 is available.

3.16 Hydrophylic polymers: their use with interior Douglas-fir and lodgepole pine.

Project Leader: D. Lavender
BCFS Contact: D. Simpson
Location: Kamloops Forest District, U.B.C. Research Nursery

Objectives:
1) To determine if the addition of a highly water absorbent material to the rooting medium of container-grown Douglas-fir or lodgepole pine seedlings will permit use of an irrigation regime which will be more effective in stimulating seedling dormancy than the regime employed with untreated seedlings; and

2) to determine if the addition of a highly water absorbent material to the roots of Douglas-fir or lodgepole pine seedlings at the time of planting will affect the survival and growth of the seedlings under mesic or xeric conditions.

Progress to Date:
Project was completed in 1988. Applications of any of the three hydrophylic gels failed to increase the survival or growth of seedlings of either species when planted in nursery or field conditions. Podest and over-winter damage greatly impacted survival of the seedlings planted in the field. The hydrophylic gels increased the water-holding capacity of the rooting medium but did not increase the time between irrigations.

Expected Benefits:
Results of the study will assist researchers in understanding the response of seedlings to increased water availability from the application of hydrophilic polymers.


Project Leader: D. Simpson
Location: Kalamalka Research Station

Objectives:
To determine the effects of espacement (seedlings/m²) and cell dimension (diameter/depth) on the growth of interior spruce seedlings growing in 80 to 100 ml volume containers.

Progress to Date:
Fourteen different container configurations were examined during an overwinter experiment. Spruce seedling spacing ranges from 441 to 936 seedling/m² in cavities of 62 to 133 ml volume. Early indications are that a spacing of 600-700 seedlings/m² for containers with a volume of 80 to 100 ml is the optimum for producing well-balanced and sturdy seedlings about 20 cm high and with a 4 mm root collar. The experiment will be repeated in the 1989 growing season and will include field testing.

Expected Benefits:
It is anticipated that the results of the study will enable nurserymen to manipulate seedling size without significantly affecting seedling physiological characteristics. FRDA Memo 014 is available.

3.18 Day length and drought effects on shoot and root growth of container-grown Interior Douglas-fir and larch.

Project Leader: D. Simpson
Location: Kalamalka Research Station

Objectives:
To determine the effects of day length reduction and drought on interior Douglas-fir seedling morphology and physiology.

Progress to Date:
A study began in 1986/87 to examine the effects on seedling growth of no drought, cyclic
drought, continuous drought, and long nights (short days) with no drought. Improvements in equipment were made during 1987/88. The effects of the treatment will be examined on shoot, root and resting bud development, bud dormancy, tissue nutrient content, cold hardiness, and root growth capacity. Data collection and analysis will be completed in 1989.

Expected Benefits:
The use of non-stress regimes to induce bud set and termination of shoot growth is expected to benefit root growth and seedling quality in general, thereby enhancing field performance. FRDA Memo 014 is available.

3.43 Use of fog misting to improve root quality in container-grown Douglas-fir and Engelmann spruce

Project Leader: G. Hunt
BCFS Contact: D. Simpson
Location: Kamloops Forest District

Objectives:
To determine if misting can be used to decrease the frequency of saturation watering, thereby improving growing medium aeration without adversely affecting seedling quality.

Progress to Date:
Project was completed in 1989. Short duration fine-droplet water mists were applied at intervals of 20 or 30 minutes to container-grown Engelmann spruce and interior Douglas-fir for 17 days when daily air temperatures exceeded 30°C. Water loss from styroblocks, seedling growth, and mycorrhizal colonization were assessed. A misting frequency of 20 minutes resulted in reduced water loss from containers of up to 36%. Misting may indirectly alter growth of spruce by affecting mycorrhizal colonization. Growth of Douglas-fir was not affected. When applied properly, misting does not increase the risk of foliar disease.

Expected Benefits:
Repeated, short duration misting can be used as a water management tool without increasing the risk of disease or harming growth. A draft final report is available from the SITAC PMA.

3.58 Survey of seedlots to which the IDS sorting method may apply

Project Leader: G. Edwards
BCFS Contact: C. Leadem
Location: Surrey Seed Centre

Objectives:
To conduct a survey of seedlots in storage at the Surrey Seed Centre to determine which can be beneficially re-processed using the IDS method.

Progress to Date:
Project completed in 1988/89. Sixty-live spruce (Sw, Se, and Sx) seedlots have been tested using the IDS (Incubation, Drying, Separation) method of seed sorting. The method is based on the difference in water loss between weak (or dead) and vigorous seeds following incubation and drying. The technique involves three steps: 1) incubation of hydrated seeds at 15°C for 72 hours, 2) drying at 25°C for 8 hours, and 3) separation using a water sorting method which produces viable sinker and dead floater seeds. Results showed germination in 55 of 65 seedlots to be significantly improved. Increases in germination ranged from greater than 50% to as low as 10% with an average increase of 17%. Germination tests are still in progress for an additional 32 seedlots.

Expected Benefits:
Reduced nursery costs through enhanced seed quality. FRDA Memo 115 is available.

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<td>Nicholson, Alison</td>
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<td>Wall, Ron Forestry Canada Pacific Forestry Centre 506 W. Burnside Rd. Victoria, B.C. V8Z 1M5</td>
<td></td>
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<tr>
<td>Research Branch 31 Bastion Square Victoria, B.C. V8W 3E7</td>
<td></td>
<td></td>
<td>388-0782</td>
</tr>
</tbody>
</table>
Southern Interior FRDA Project Locations

Cold sites
1. 3.02 + 3.35.6 + 3.42 + 3.50
2. 3.02 + 3.35.6 + 3.42 + 3.50
3. 3.06
4. 3.09
5. 3.31 + 3.41.7
6. 3.32 + 3.41.8-10 + 3.09
7. 3.35.2
8. 3.35.1 + 3.35.6 + 3.42
9. 3.35.7
10. 3.35.7 + 3.42

Cool, dry sites
11. 3.40 + 3.35.4 + 3.42 + 3.09
12. 3.41.1-3 + 3.49

Cool, moist sites
13. 3.42

3.01
14. 3.02 + 3.09 + 3.35.6 + 3.41.4 + 3.50 + 3.09
15. 3.35.5
16. 3.35.8
17. 3.35.11
18. 3.35.12
19. 3.35.13
20. 3.35.14
21. 3.35.15
22. 3.35.16
23. 3.35.19
24. 3.35.5
25. 3.41.5 + 3.63
26. 3.41.6
27. 3.41.7
28. 3.41.12
29. 3.42
30. 3.43
31. 3.44
32. 3.48
33. 3.25 + 3.42
34. 3.35.5
35. 3.59
36. 3.62
37. 3.35.9 + .20 +.21
38. 3.68