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Renewal

The quarterly newsletter of the Canada-British Columbia Forest Resource Development Agreement (FRDA)

Growing Tomorrow's Forests

B.C. receiving top investment in forestry resource development

All across Canada, forest management is expanding dramatically as a result of federal/provincial agreements—and B.C. is benefitting from a FRDA commitment far greater per capita than in any other province.

The Canada-British Columbia Forest Resource Development Agreement has allotted $300 million to projects throughout the province between 1985-89.

The only province with an equal dollar commitment is Quebec. The Ontario agreement commits $150 million, with other provinces' forests getting the benefit of FRDA investments ranging from $91.5 million in Nova Scotia, to $24.1 million in Prince Edward Island.

In B.C., FRDA silviculture activities (surveying, rehabilitating sites, planting, brushing, juvenile spacing, releasing conifers and fertilizing) will be conducted on 1.2 million hectares of forest land. One hundred and seventy million seedlings will have been planted on backlog areas in the province. Also, an estimated 900,000 man-days of employment will have been created.

In neighbouring Alberta, a total $23 million in FRDA funding includes a pioneering project in the use of aspen. A woodworking shop in Spruce Grove, west of Edmonton, received financial backing to develop furniture products made of aspen.

The species exists in great abundance but was virtually unused in the forest industry until recently.

The Spruce Grove firm is now successfully manufacturing aspen cribs, children's furniture and cabinets. The products are finding markets as far away as Washington State and California.

Alberta is now seeing unparalleled investment in new aspen-using ventures, thanks to FRDA-sponsored research.

In Saskatchewan, FRDA helped the Montreal Lake Indian Band become the first of that province's native peoples to develop a comprehensive forest management plan for their land. It has created a plexus of continuous employment for band members, invaluable socially as well as economically.

The Canada-Ontario FRDA funded a project to modify a California lettuce transplanter for use in transplanting black spruce. The adapted transplanting system allows the black spruce seeds to be planted in pencil-thin tubes for short-term growing in the greenhouse, then outplanting in nursery beds.

This imaginative project is demonstrating improved growth and survival of black spruce seedlings. Naturally, the implications are positive for improving seedling production not only in Ontario but in other parts of Canada by similar technological adaptations.

The Canada-Quebec agreement funded the building of the Maniwaki Technology Transfer Centre to transfer advanced technologies like computer models which integrate fire hazards, weather data, topography and lightning. Developed jointly by the Petawawa National Forestry Institute, the Dept. of Energy and Resources and the conservation societies of Quebec, the technology will ultimately reduce the destruction caused in other provinces as well.

In total, the federal/provincial agreements have helped to triple forest management in Canada in just a few years. In the decade from 1977 to 1987, site preparation has increased from a total of 150,000 hectares in 1977 to 450,000 in 1987. Total planting during that time increased from slightly over 150,000 hectares to nearly 400,000. Tending has expanded from well below 100,000 hectares to well over 300,000. Money put into research and technology has increased from less than $40 million in 1977 to $90 million in 1986.

(See "Overview" on page 2.)

Overview of FRDA Commitments Across Canada

Canada—British Columbia

Forest Resource Development Agreement

1985-1990
$300 million ($150 million federal, $150 million provincial)

Objectives:

- manage part of non-satisfactorily restocked lands;
- intensively manage selected forest stands;
- support forestry research by government and non-government organizations;
- assist the forest industry through studies related to utilization, marketing and product development, technology transfer and training.

Canada—Alberta

Forest Resource Development Agreement

1984-1989
$23 million ($11.5 million federal, $11.5 million provincial)

Objectives:

- ensure economically accessible timber supplies, especially softwoods;
- ensure available timber supply, especially hardwoods, is efficiently utilized;
- promote economic development, diversification and employment.

Canada—Saskatchewan

Forest Resource Development Agreement

1984-1989
$28 million ($14 million federal, $14 million provincial)

Objectives:

- develop and maintain long-term timber supplies;
- assist in efficient utilization;
- contribute to economic development and employment.

Canada—Manitoba

Forest Renewal Agreement

1984-1989
$27.2 million ($13.6 million federal, $13.6 million provincial)

Objectives:

- develop and maintain long-term timber supplies;
- promote efficient utilization;
- contribute to economic development and employment.

Canada—Ontario

Forest Resource Development Agreement

1984-1989
$150 million ($75 million federal, $75 million provincial)

Objectives:

- increase sustainable wood supply to ensure long-term viability and competitiveness;
- improve and increase utilization;
- contribute to economic development and employment.

Canada—Quebec

Forest Development Subsidiary Agreement

1985-1990
$300 million ($150 million federal, $150 million provincial)

Objectives:

- increase wood supply to improve viability and long-term competitiveness of the industry;
- put private and public lands back into production;
- encourage applied research and technology transfer.

Upper North Shore Special Subsidiary Agreement

1987-1992
$13 million ($6.5 million federal, $6.5 million provincial)

Objectives:

- increase the production of forests on Crown lands;
- increase the availability of wood to improve the viability and competitiveness of Quebec's forest industry.

Canada—New Brunswick

Forest Renewal Subsidiary Agreement

1984-1989
$77.4 million ($42.3 million federal, $35.1 million provincial)

Objectives:

- increase sustainable supply of softwoods;
- encourage effective and efficient intensive forest management on public and private lands;
- enhance private woodlot management.

Canada—Nova Scotia

Forest Resource Development Agreement

1982-1989
$91.5 million ($50.4 million federal, $41.1 million provincial)

Objectives:

- encourage and support forest management to increase sustainable softwood supplies to an average of 3.3 million cubic metres annually to ensure the viability and competitiveness of the wood based industry;
- improve and increase utilization of the forest to enhance future development opportunities.

Forest Renewal Agreement

1984-1987
$25.5 million ($17 million federal, $8.5 million provincial)

Objectives:

- expand forest renewal activity to ensure an economically accessible wood supply and a viable forest industry;
- support the formulation of further Group Management Ventures to enhance forest management on private woodlots;
- increase research and development and technology transfer;
- provide increased protection against forest fires;
- provide increased employment, nursery capacity, forest renewal and incentives for fuelwood use on Cape Breton Island.

Canada—Prince Edward Island

Forest Resource Development Agreement*

1988-1993
$24.1 million ($14.2 million federal, $9.9 million provincial)

Objectives:

- improve the forest resource;
- increase the harvest of fuelwood through better forest management;
- improve and intensify forest management thereby augmenting employment.

*First renewal of a Forest Resource Development Agreement, signed June 23, 1988.

Canada—Newfoundland

Forest Resource Development Agreement

1986-1990
$48 million ($33.6 million federal, $14.4 million provincial)

Objectives:

- reduce non-regenerated forest land and improve growth of existing immature forest;
- increase utilization;
- expand and improve the information base;
- undertake research and development;
- assess the potential to upgrade private woodlot management;
- improve the public perception of forestry;
- contribute to economic development and employment.

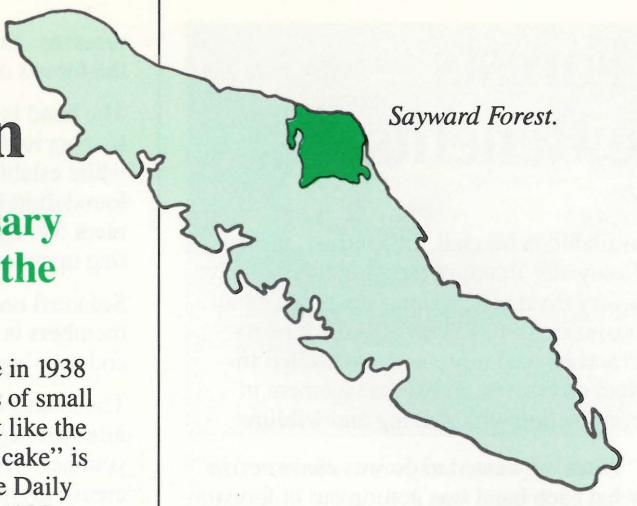
A Forest Lives Again

The 50th anniversary of the planting of the Sayward Forest.

The Campbell River forest fire in 1938 was no ordinary fire. "A series of small infernos where old snags burnt like the candles on the devil's birthday cake" is how Torchy Anderson from the Daily Province reported it on July 6, 1938.

Unemployed men from as far away as Vancouver signed on as firefighters for 25 cents an hour. The Canadian destroyers HMCS Fraser and HMCS St. Laurent anchored off Duncan Bay to assist in case of possible evacuations.

It took 1500 men one month to control the fire which in the end claimed no human lives but consumed 30,184 hectares (74,495 acres) of forest land. The Sayward Forest was totally devastated by the fire. Today it is a good example of forest being managed to provide timber, water, recreation opportunities and fish and wildlife habitat.



Sayward Forest.

This new forest began with the planting of seedlings, followed by protecting the young trees from fires, disease, insects and competing vegetation. Thinning, pruning and fertilizing is also underway on a continuous basis.

In the past three years, FRDA funding has helped with site rehabilitation of 700 hectares, fertilization, juvenile spacing and intensive brushing.

This year there is a celebration for the Sayward Forest entitled 50 years of forest management. A series of events and celebrations has been planned from the creation of forest trails to workshops, parades and media events.

On August 5, 1988, the Minister of Forests and Lands, Dave Parker, will officially unveil the new large outdoor displays.

The Sayward Forest is a good example of how federal and provincial governments can work together in forest management for British Columbia.

For more information on how you can participate in the Sayward Celebration contact the Ministry of Forests, 370 South Dogwood Street, Campbell River, B.C. V8W 6Y4.

Advanced Silviculture Education for Professionals

Currently, 115 "students"—all professional foresters—are taking advantage of courses offered by the Silviculture Institute of British Columbia, funded by FRDA.

The continuing education courses are designed to develop and refine the professional forester's capabilities in making sound silvicultural prescriptions.

The 115 students presently involved are divided into five groups of 20-25 persons studying five course modules. The modules each consist of a two-week course with a specific silvicultural emphasis.

Course modules are offered twice a year; once at a lower mainland location and once in the central interior.

In module one, participants examine six components that form the biological basis for understanding the effects of silvicultural management: forest environment, physiology, ecology, pathology, entomology and wildlife.

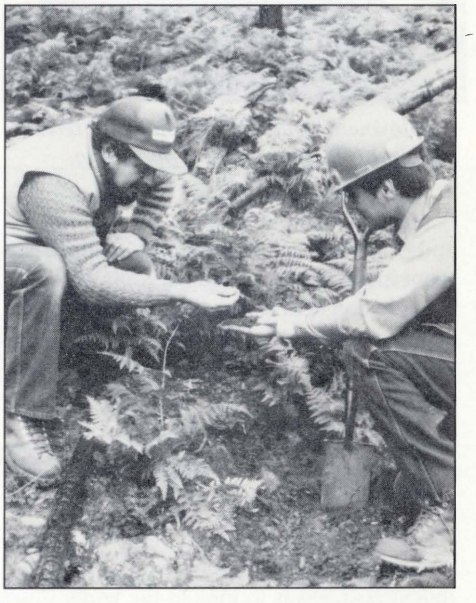
Module two deals with forest regeneration. Module three studies forest stand development using computer modelling. Module four covers silvicultural planning and practises used to improve the forest stand structure for timber and multiple use benefits. Module five involves case studies of silviculture problem solving.

Over 2000 pages of scientific papers, instructors' lecture notes and research publications are made available to students. In the third module, each student receives a forest management textbook. Free computer software for uneven-aged stand management, stand treatment financial analysis and forest harvesting methods are also made available to interested students.

To qualify for the course, you must be a registered professional forester with the ABCPF with a minimum of five years experience in silvicultural field operations; or, a graduate of a Bachelor of Science program in an allied field to forestry and have considerable silvicultural field experience.

The courses are paid for by both the CFS and MOF under FRDA, at a cost of $850 per student.

The faculty of the Institute, predominantly unpaid volunteers, now totals 50 people. They come from UBC, UVic, Oregon State and Simon Fraser, the Ministry of Forests - Research Branch, the CFS, and the ranks of private companies.



Foresters making an assessment of plantation performance.

The next course is offered for the Prince George area in February, 1989. Applications are due by November 4, 1988. For more information and an application form, write to: S.I.B.C., 9800 140th St., Surrey, B.C., V3T 4M5.

Managing Indian Forests for Comprehensive Benefits

Employment opportunities have increased due to the Tanizul forestry operation.

A recently completed analysis of social and economic returns to forest management investments on Indian lands will provide considerable guidance to achieve successful forestry programs for B.C. Indian bands.

The one-year study, conducted by Allen Hopwood Enterprises was funded by FRDA under the Canadian Forestry Service's Indian Forest Lands Program.

"The objective," says Dr. Glenn H. Manning, Chief of Economic Analysis of CFS in Victoria, "was to look at the wide spectrum of forestry goals of the Indian bands of B.C. and how the bands can most benefit from forestry management programs.

"To do that," says Manning, "the study characterizes two extreme cases in the spectrum. The Stuart Trembleur lake Band, near Fort St. James, depends to a large degree on forestry, which has resulted in the creation of B.C.'s only Indian controlled Tree Farm Licence (Tanizul Timber Ltd.) The comprehensive report of the study is presently being edited for release. It is expected to be available in late fall. In contrast, the Coldwater Band, of the Merritt area, have a very diverse economy: ranching, small business, some forestry. Their forestry practises deal more with traditional Indian objectives, forest management in conjunction with grazing and wildlife.

"What we wanted to do was characterize what each band was getting out of forest management. To do this, we had to look at the social/economic background of the bands, their overall economic status, then apply some very generalized analysis, as much from the social point of view as the economic. The study breaks down the benefits and costs to the bands themselves and to the provincial and federal governments."

Among the benefits the study defines for the Stuart Trembleur Lake Band's forestry program is the fact that band members are building financial equity (currently $1 million), which will help perpetuate the company's operations and likely lead to new business ventures.

The Tanizul forestry operation provides a focus and vehicle for economic development and employment training for the whole band.

Business opportunities have been created for and seized by some band members (for example, logging contractors).

Role models are being developed for the band's young people by band members working for Tanizul and its contractors.

The employment level for the band as a whole has been increased substantially as a result of jobs created by Tanizul's operations.

The training and employment of band members by Tanizul has created opportunities for gaining employment elsewhere with other companies in the forest industry.

Relying on Tanizul, the band administration has significantly reduced its efforts in economic development and employment training, even in non-forestry fields.

Benefits identified in the Coldwater Band's forestry program included the fact that the band and its members are using federal job creation and training programs to train silvicultural workers, enhance the range resources on the reserves, and improve the future yields of the forests on the reserves.

The band is currently managing and conserving its forest and range resources while establishing the infrastructural foundation for future economic development through education, training and setting up resources of venture capital.

Seasonal unemployment of band members is offset by forestry job creation and training projects.

The band's benefit/cost analysis of juvenile spacing and range enhancement of its younger forests indicates a 50 percent increase in tree growth rates and a substantial increase in grazing capacity.

The current enhancement of the band's forest and range lands through job creation/training programs will result in higher timber and forage yields and hence reduced unemployment and increased economic activity in the future.

As with the Stuart Trembleur Lake Band, the success of the Coldwater Band and the part that the federal government is playing in that success could be used as a demonstration and role model for other bands with similar opportunities.

The most significant finding of the report, says Manning, is "the striking degree to which band forestry management programs have benefits which accrue to the economy as a whole. The greatest beneficiary of these programs is not just the individual band, but the entire local economy, which receives a considerable input of money as a result of employment and economic activity." The success of Tanizul Timber Ltd. has helped to develop a higher degree of pride within the band itself and a greater measure of respect in the local region's business and social circles.

Opportunities are being created for secondary and indirect economic activity to accrue to the band (for example, public works projects such as roads and bridges are being done by Tanizul instead of outside contractors).

Local control of land-use and management of the environment is being done by people who are familiar with it and actually live on it.

On the "costs" side, the study indicates that traditional pursuits and lifestyles are changing. Band members who rely on trapping or guiding are adversely affected by large-scale timber cutting, while access via logging roads increases tourism and hunting pressure on the band's traditional wilderness lands.

Integrated Resource Management Studies

In keeping with FRDA's commitment to balanced forest management, many current projects focus on forestry practises as they affect other forest resources.

The best known example is Carnation Creek. The area is the site of 5 FRDA research projects—both Federal Component and Cost-Shared and is being used extensively as a demonstration, education and training facility related to the effects of herbicides and logging activities on the stream and its environment. Interim results were presented at the December 1987 workshop in Nanaimo.

In the Northern Interior, two projects focus on moose winter range forage. In the Prince George Forest Region one project looks at the autoecology of willow species in backlog NSR lands. This project will define the relationship between various willow species and site features; describe willow growth, phenology; and, based on the above information, recommend policies for willow management on backlog NSR areas.

The second project, in both the Prince George and Prince Rupert Forest Regions, examines the impact of glyphosate rates and timing of application on various willow species.

Through vegetation management workshops and training sessions for operations staff, the findings of these studies will aid the development of successful integrated management of the sub boreal spruce (SBS) zone.

A project in the Northwood TFL of the Prince George Forest Region is studying the impact of glyphosate on small mammal populations. The project measures population levels and species diversity of small mammals in wetter subzones of the SBS; determines the impact of the herbicide glyphosate on the habitat of small mammals in these subzones; and assesses the impact of glyphosate on small mammal population levels and species diversity. Live trapping of selected species is in its second year.

On the Coast, the final report of the project "Research needs concerning the impact on wildlife and wildlife habitat of treatments used for backlog reforestation" will be published by early fall.

*Calibrating the **microfoil** boom for spraying at the Carnation Creek project.*

The problem analysis provides background information on the extent of herbicide use in the province, and documents the concerns and information needs of professional wildlife and forest managers. It contains a review of existing technical literature and identifies several other potential research topics, ranked to reflect managers' needs.

A project in the Southern Interior examines the effects of cattle grazing, forage seeding rate, basal scarring and shoot damage on forest regeneration.

The first experiment will determine the effects of four seeding rates on supressing native vegetation and assess the subsequent benefits to conifer survival and growth; determine the effects of three levels of grazing intensity on supressing native vegetation and the survival and growth of conifers; and develop management prescriptions for both. In the second experiment, the objectives are to determine the effects of: different levels of seedling girdling on survival and growth; different levels of shoot removal on survival and growth; season of damage on survival and growth; and girdling and shoot removal on seedlings of two different classes.

The results of this experiment will provide resource managers with preliminary guidelines regarding how forage seeding and grazing affect competing native vegetation and subsequent conifer survival and growth, and how basal scarring and leader damage affects survival and growth of lodgepole pine. Additionally, cattle performance will be monitored to establish the best combination of seeding and grazing that will provide benefits to both trees and the livestock industry.

These are just a few of the projects currently funded by FRDA towards achieving forestry management practises that will enhance ecological balance.

The federal and provincial forest ministers hosted a tour of FRDA research sites on Vancouver Island for B.C. MPs and MLAs during National Forest Week. At one of the stops on the tour, Dave Parker (left), B.C. Minister of Forests, and Gerald Merrithew, federal Minister of State (Forestry and Mines), unveil a FRDA sign at the site of a stock quality improvement research project at the Cowichan Lake Research Centre.

Oyster River Provides Model for Interactive Resource Management

An outstanding example of forestry management in symbiotic relationship with other resource sectors is ongoing at the UBC Oyster River Research farm near Campbell River.

Says Forest Program Manager Harold E. Macy, "We're demonstrating positive interaction here between resource sectors which have historically been at odds with one another: forestry, fisheries and agriculture."

The UBC research farm forest management policy states: A forest is a complex resource capable of supplying a great variety of products and services. Timber production, watershed protection, recreation, nature reserves and education are some of the uses of a forest. Longer-term responsibilities are paramount in the management of forests, be they public and private. Thus our management programs will be aimed at integrating the use and maximizing the sustainable yield of all renewable resources. Concurrent with this is the protection and improvement of those non-renewable resources.

The UBC research farm totals more than 700 hectares, of which 460 hectares are forested. The farm consists of two parcels: the 147-hectare Lower Farm, which has most of the agricultural activities as well as stands of mature timber. Four kilometers inland is the 556-hectare Top Farm. Approximately 30 per cent of it is forested in conifers, with alder, aspen and cottonwood occupying most of the rest.

The farm is managed on a "Best Use" policy.

A large dairy enterprise and areas of associated field crops are used for research, demonstration, extension and teaching.

Since 1985, the Oyster River Enhancement Society has constructed and operated a 300-meter salmonid spawning and rearing channel and a small hatchery on the farm. The facility demonstrates the compatability of the resources, allowing study of forestry, fisheries and agricultural interaction.

Silviculture trainee, Sharon Dalton, is shown spacing and thinning. Concentration is on removing the suppressed and less vigourous intermediate stems. Work is being done to reduce stand density from 12,000/hectare to 700/hectare.

In May 1986, with the assistance of FRDA under the Canadian Forestry Service's Private Forest Lands Program, a detailed inventory, operating and farm management plan was prepared.

Taking the farm's topographic variations into consideration, each area is being managed according to microsite classification with appropriate treatments and techniques.

The farm's forest lands are surrounded by homes and small agricultural enterprises. A good many streams cross the research land enroute to the Oyster River, a major watershed in the area. Treatment techniques used in the forest program take these into consideration.

Recreation opportunities for the public have been created by a trail from the Oyster River Nature Park, across the farm to Salmon Point. Access is controlled by permits and no horseback riding or hunting is allowed.

The goal of the farm's forest management plan is sustained production of quality timber. Harvesting of conifers and deciduous trees will continue as the stands mature.

To maximize growth and yield of existing conifer stands, juvenile spacing, pruning and commercial thinning are being carried out.

Conversion of non-commercial forest lands continues to occupy a major commitment of both capital and labour. Techniques are applied only after weighing the impact on the farm's other resources.

In achieving this balanced approach to resource management, the Oyster River farm has contributed much more than required under FRDA guidelines. Normally an $80,000 ceiling on FRDA's contribution is applied, with the recipient required to contribute a minimum 20 per cent of the project's costs. Funding to date has consisted of U.B.C. contributions amounting to $40,216, while the CFS has contributed $41,812. It is expected in the remaining two years of FRDA that U.B.C. will provide $62,424, while FRDA will contribute a further $26,818.

The work at the UBC research farm reflects progressive forestry practises in the province. The UBC project demonstrates the ability to fine-tune silvicultural operations to micro-sites. The research is especially applicable to small scale woodlot management.

"We are able to practise certain silvicultural treatments which are not yet mainstream," says Manager Macy. "For instance we are doing extensive propagation of fast-growing hardwoods, notably cottonwoods, for reclamation of hygric sites. The growth of these trees is amazing!"

Workshop Attacks Site Degradation

Site degradation affects the very roots of forest productivity. Forestry practises cause a loss in B.C. of an estimated 400,000 cubic meters in annual production of wood—and that is increasing by some 50,000 cubic meters per year.

This concern was the impetus for the Site Degradation Workshop held May 3-4, 1988, at UBC.

The workshop was organized by the B.C. Forest Site Degradation and Rehabilitation Committee. This committee was formed several years ago to: 1) increase awareness within the forest community in regard to site/soil degradation effects of forestry activities; 2) to promote the maintenance, improvement or rehabilitation of site productivity in forest and range management; and 3) to serve as the lead committee to coordinate related B.C. Forest Service activities.

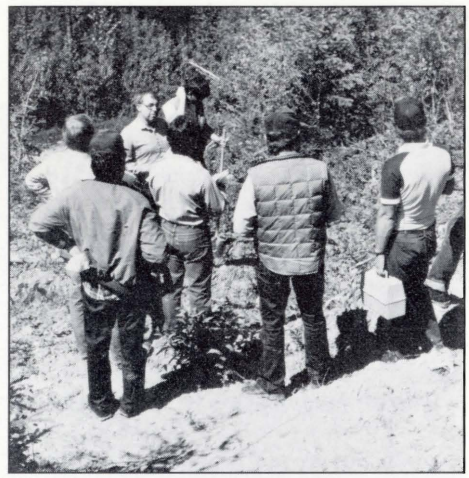
Committee members are pedologists, ecologists and hydrologists. Initially, all were from BCFS, but the committee's activities have expanded to include representatives from industry, the Forest Engineering Research Institute of Canada, CFS and the consulting field. Angus McLeod, BCFS Prince George, is the current chairman.

The May workshop in Vancouver was sponsored by the Site Degradation Working Group, Ministry of Forests, Dept. of Soil Science of UBC, Dept. of Forest Sciences of UBC, and the B.C. Chapter of the Soil and Water Conservation Society. Partial funding was provided by a FRDA Canadian Forest Service contract.

Though the workshop was designed primarily for those closely involved in research, several foresters from companies attended and participated actively throughout the session.

Wes Cheston, Assistant Deputy Minister, Forests, got the workshop off to a good start by underlining the importance of reducing losses in productivity due to soil degradation. He updated the participants on the organization of an Interior Forest Harvesting Council and Technical Advisory Committee and regional subcommittees structured to deal with the problem.

Two subsequent presentations further defined the problem. Bob Louie gave a summary of a contract report prepared by Gary Runka of Land Sense, which dealt with the nature and extent of soil degradation in agriculture and forestry in B.C. Greg Utzig and Marc Walmsley, Westland Resources, summarized their FRDA Canadian Forest Service contract, "Evaluation of Soil Degradation as a Factor Affecting Forest Productivity in B.C." (This report is available under FRDA #025.)



Foresters and soils specialists discussing acceptable limits of soil disturbance.

Current research in soil degradation was detailed by Bill Carr (constructed skidroads), Bill Watt and Jace Standish (random skidding and ripping), Angus McLeod (landings), Bill Beese (rehabilitation of landslides), Dick Smith and Ed Wass (stump extraction), and Rick Trowbridge, Mike Curran and Tim Ballard (prescribed burning).

Terry Rollerson described studies designed to determine the relationships among soil type, moisture content, number of tractor trips and soil bulk density (a measure of compaction).

Gordon Weetman showed how undisturbed soil with abundant cover of salal in coastal sites often results in poor growth of planted conifers relative to nearby sites previously subjected to windthrow.

Hamish Kimmins provided clues on how long-term consequences of site degradation could be modelled.

Terry Lewis explained how research results are being used to rate site sensitivity to soil degradation.

Following the presentations, participants were formed into small groups to discuss specific topics relating to site degradation and how to overcome it, such as, "When should rehabilitation be required?", "What are the most important research priorities?" and "Training needs—what are the highest priorities?"

An informal proceedings of the workshop is being prepared and distributed to participants and other interested persons.

New FRDA Releases

Reports

Comparison of Clearing-Saw Cutting Attachments for Weeding Young Conifer Plantations: by Sylvi D. Holmsen, R.P.F., Roger J. Whitehead, FRDA Report 028.

In a study funded under FRDA, FERIC and CFS established research plots for the silvicultural assessment of a vegetation-management trial in Nelson. FERIC conducted productivity assessments of three cutting attachments for Husqvarna clearing saws: the MAXI 200, MULTI 300 and MULTI 255-4. Pre-treatment vegetation and post-treatment seedling damage were examined by PFC researchers. This report summarizes the first-year results. Follow-up re-vegetation and crop growth response will be monitored and reported by PFC.

Requirements and Design Parameters for Lodgepole Pine Strip-Thinning Equipment in British Columbia: by I.B. Hedin, R.P.F., FRDA Report 032.

The characteristics of lodgepole-pine stands suitable for mechanical strip-thinning are defined within two stand types. Ranges of age, density, diameter, and height are given. For each stand type, treatable hectares (within reasonable accessibility) in British Columbia are estimated, and recommendations for equipment requirements are presented.

Douglas-fir Fertilization Decision-Making for Industrial Use: An Establishment Report: by R. Carter and K. Klinka, FRDA Report 033.

Methodology and establishment of a research project, initiated in 1985, to study the effects of site-specific fertilization on immature coastal Douglas-fir ecosystems in southern British Columbia is described. Stand and site selection criteria, methods of ecosystem descrip-

tion, sampling, analysis and classification, selection of stands and treatments for fertilizer trials, and methods of evaluation of growth response are given in detail. By studying relationships between stand and site characteristics and growth response in 56 ecosystems, the project proposes to develop site-specific guidelines for coastal Douglas-fir fertilization decision-making for industrial use. This report provides a background reference for future publications reporting results of this project.

The Influence of Site Quality on Tree Resource Allocation to Fine Roots and Its Effect on Harvestable Productivity of Coastal Douglas-fir Stands: by Werner A. Kurz and J.P. Kimmins, FRDA Report 034.

The main objectives of the study presented in this report were to establish the seasonal pattern of live fine root biomass in second-growth coastal Douglas-fir stands of five different site qualities, and to quantify annual fine root production in these stands. Root samples for this study were collected on 6 sampling dates from May 1985 to May 1986 in 5 research sites on eastern Vancouver Island, which cover a range of site indices from 25 to 41 m at breast-height age 50 years.

All five stands displayed a similar pattern in live and dead fine root biomass. Live fine root biomass was highest in May 1985, decreased sharply in August and October, and increased again in the May 1986 samples. Dead fine root biomass displayed the opposite trend: low in May 1985, high in August and October, and decreasing again in May 1986. Annual fine root mortality was 60% to 100% of the live fine root biomass present in May 1985, and in some stands live fine root biomass in May 1986 had only recovered to 50% of the May 1985 value. This suggests large between-year variation in fine root biomass. Total fine root biomass, i.e. live plus dead, showed very little seasonal change. This emphasizes the need to differentiate root samples into live and dead categories if seasonal dynamics and fine root production are to be quantified.

The correlation between site index and both fine root production and mortality was always negative, but never significant. Fine root turnover, defined as the ratio of annual production to fine root biomass in May 1985, was always positively correlated with site index, and if the production estimate was based on significant changes in live fine root biomass, the correlation was significant ($p \leq 0.1$).

The effects of site quality on the proportion of total net primary production allocated belowground is currently being investigated in an ongoing research project.

Future research should attempt to identify factors which cause fine root mortality and factors which affect photosynthate allocation to belowground stand components. The effects of forest management activities, such as thinning and fertilization, on photosynthate partitioning and allocation to belowground biomass components must be understood if forest growth responses to such silvicultural activities are to be predicted.

Die-Back of Container-Grown Douglas-fir Seedlings: Associated Microclimate: by M.J. Peterson & S.E. Tuller, FRDA Report 035.

Microclimatic conditions associated with Douglas-fir needle-tip die-back were investigated in two container greenhouses operated by Canadian International Paper Inc. in Saanichton, B.C. Emphasis was on maximum soil temperature in different types of growing media. The effects on soil temperature of two kinds of grit cover were also examined. The lack of significant levels of needle-tip die-back prevented any direct associations to be made between microclimate and the disease. However, the soil temperature environment was described and a relationship between ambient and soil temperature was determined. Mean greenhouse (all treatment) soil temperatures, lagged 15 minutes behind ambient, could be described by the regression equation: Soil temperature = 1.4 x ambient temperature − 5.8°C.

The greatest significant differences between soil formulation temperatures occurred in mixes comprised of different peat types. The physical difference between these peats was mainly in the speed with which they absorb water. New Langley peat, with the lowest hydraulic conductivity, also had temperatures most significantly lower than the Manitoba peat. Soil temperatures were higher in a fibreglass-covered greenhouse than in a polyethylene-covered greenhouse. Different watering regimes may have contributed to this. Soil temperatures were higher than ambient for about 18-20 hours per day.

For copies of FRDA titles and/or further information about the Canada-British Columbia Forest Resource Development Agreement, contact:

Canadian Forestry Service
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