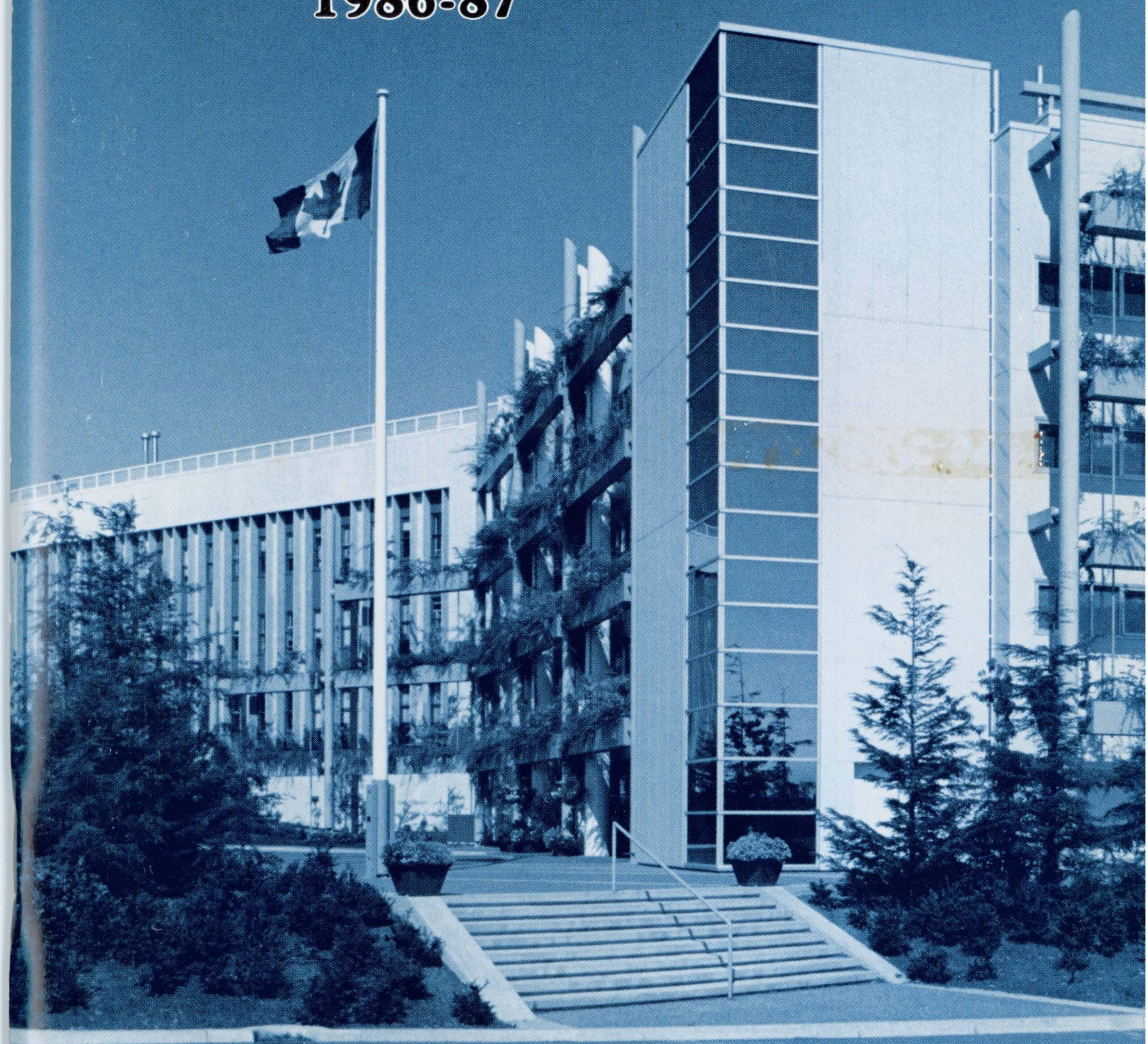
Program Review

Pacific Forestry Centre
1986-87



Government of Canada
Gouvernement du Canada

Canadian Forestry Service
Service canadien des forêts

Program Review

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1986-87

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1987

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The Canadian Forestry Service
Government of Canada

The Canadian Forestry Service is the principal source of federal expertise in forestry and has been designated as the government's lead agency for forestry matters. Its general objective is to promote the wise management and use of Canada's forest resources for the economic, social, and environmental benefit of Canadians.

The following are the main functions of the CFS:

1. Coordination of federal policies for the promotion of better resource management and forest industry development.

2. Provision of scientific and technological leadership in forestry through research and development.

3. Provision and analysis of national and international statistics and information as a basis for policy formulation.

4. Development and certification of codes and standards for wood product performance.

5. Protection of Canada's forests from foreign pests.

6. Fostering the potential use of the forest resource for energy.

7. Contributing to the environmental objectives of the Government of Canada.

Canadian Forestry Service programs are coordinated with those of other forestry agencies through a variety of mechanisms, including the Canadian Council of Forestry Ministers, the Forest Sector Strategy Committee, management committees for Federal-Provincial Forestry Development programs, national and regional Research Advisory Committees, and various technical committees for specific program areas.

The Canadian Forestry Service is comprised of a headquarters unit, six forestry centres, and two national institutes. The forestry centres are responsive to regional priorities and maintain close liaison with the respective provincial government forestry departments and other clients. They also participate in, and frequently lead, national programs. The national institutes provide the focus for programs of national scope.

Service Canadien des Forêts
Gouvernement du Canada

Le Service canadien des forêts (SCF) réunit la majorité des spécialistes fédéraux en foresterie; il a été désigné comme l'organisme officiel du gouvernement responsable du secteur forestier. Son objectif général est de promouvoir l'aménagement et l'utilisation judicieux des ressources forestières du Canada pour le plus grand bien économique, social et environnemental des Canadiens.

Voici les principales fonctions du SCF:

1. Coordonner les politiques fédérales afin de favoriser l'amélioration de la gestion des ressources et l'expansion de l'industrie forestière.

2. Fournir une orientation scientifique et technologique dans le domaine de la foresterie, par la recherche et le développement.

3. Fournir et analyser les statistiques et l'information nationales et internationales qui serviront à établir les politiques.

4. Mettre au point et homologuer des codes et des normes en matière de rendement des produits du bois.

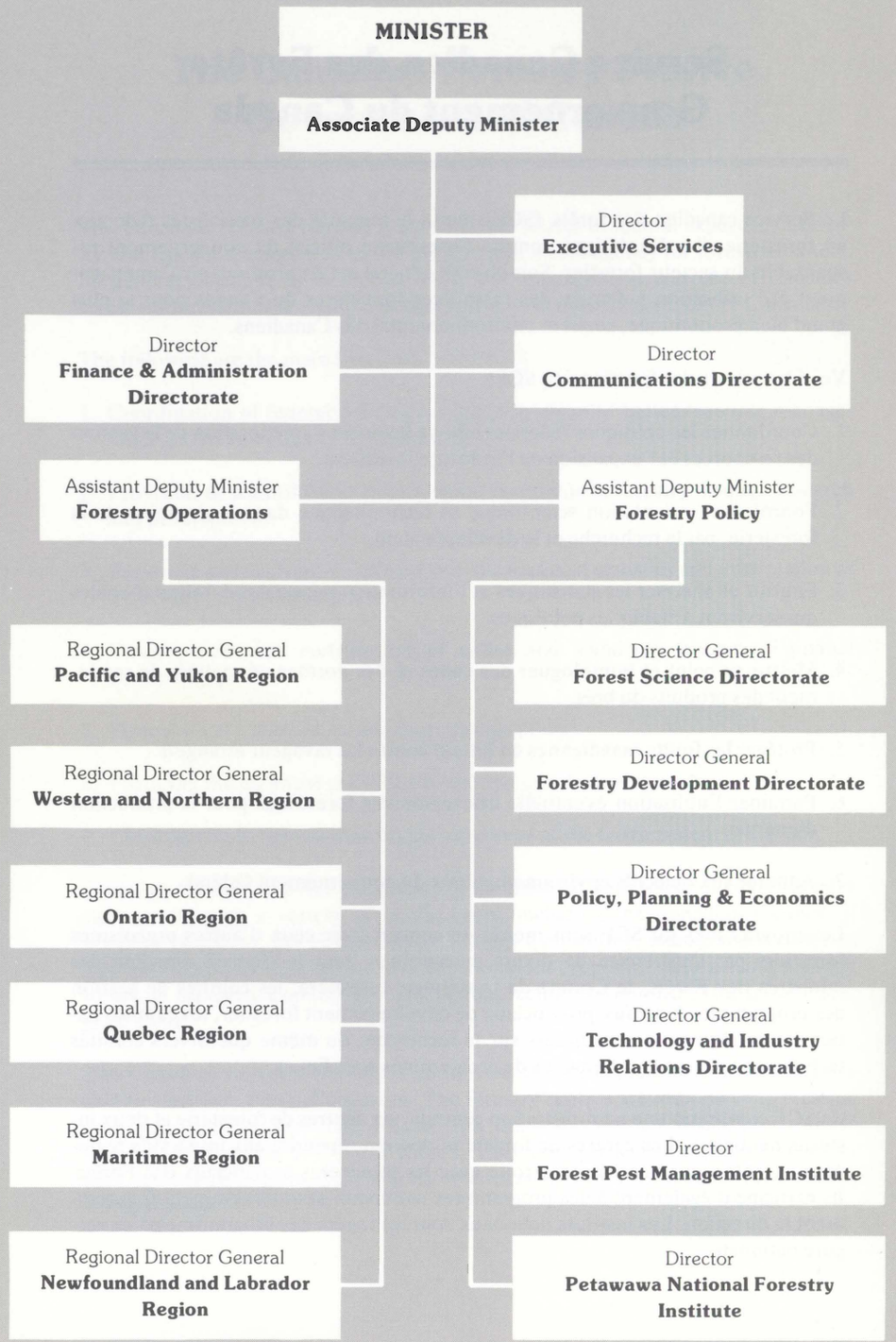
5. Protéger les forêts canadiennes en luttant contre les ravageur étrangers.

6. Parrainer l'utilisation éventuelle des ressources forestières pour la production d'energie.

7. Adhérer aux objectifs environnementaux du gouvernement fédéral.

Les programmes du SCF sont menés de concert avec ceux d'autres organismes forestiers par l'entremise de divers mécanismes dont le Conseil canadien des ministres des Forêts, le Comité de la stratégie forestière, les comités de gestion des programmes fédéraux-provinciaux de développement forestier, les comités nationaux et régionaux consultatifs sur la recherche, de même que divers comités techniques axés sur des domaines de programmes spécifiques.

Le SCF comprend une administration centrale, six centres de foresterie et deux instituts nationaux. Les centres de foresterie doivent répondre aux impératifs régionaux et entretenir une liaison étroite avec les ministères provinciaux des Forêts. Ils participent également à des programmes nationaux dont ils assument fréquemment la direction. Les instituts nationaux sont les foyers des programmes d'envergure nationale.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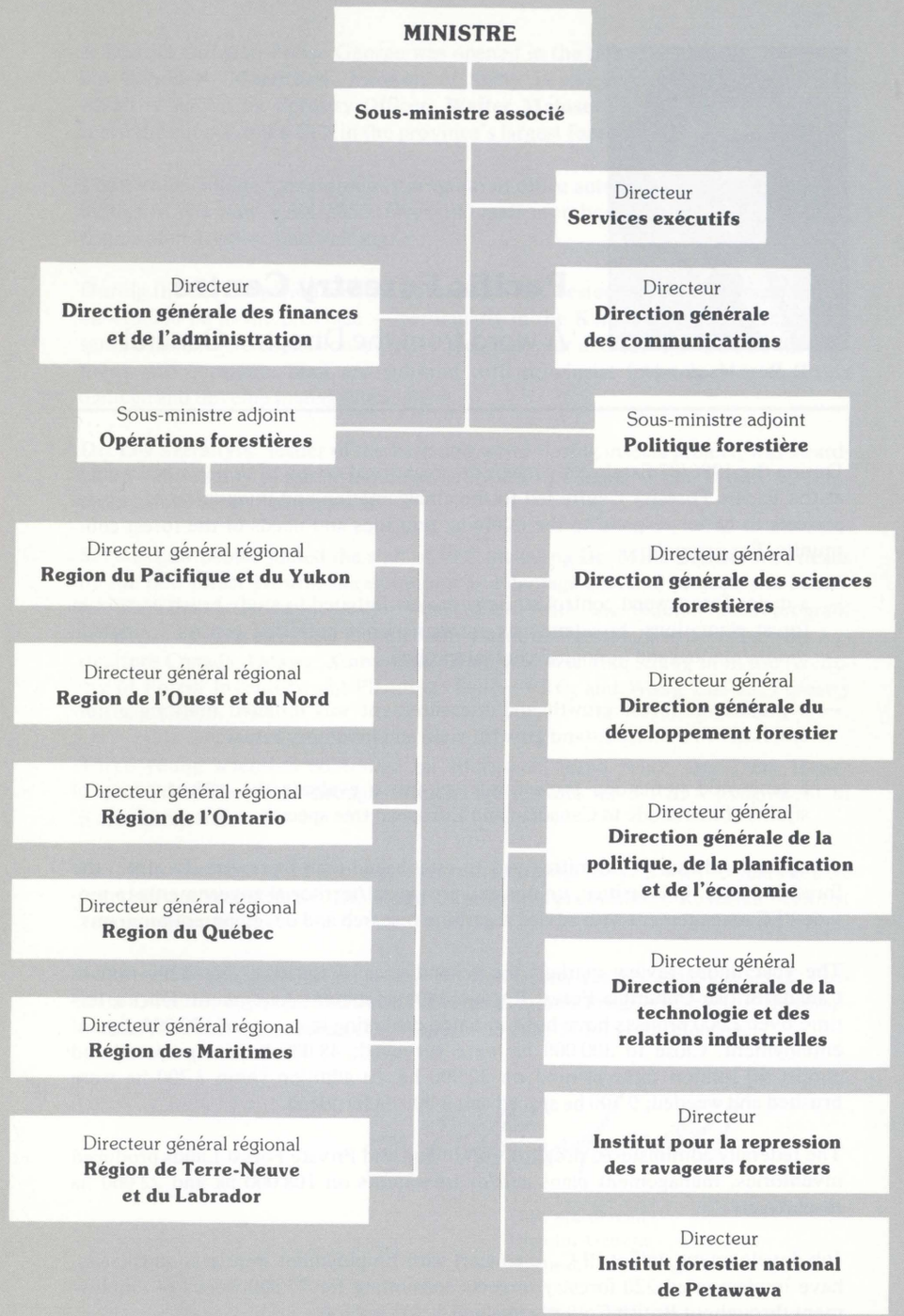
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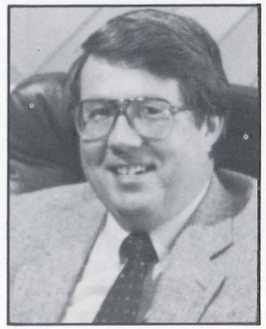


D. Ross Macdonald

Pacific Forestry Centre

A word from the Director-General

During the 1986/87 fiscal year a major organizational review of projects and studies at the Pacific Forestry Centre led to the amalgamation and integration of several projects to better respond to the evolving priorities and needs of the forest community. For example:

- a major forest weed control strategy project initiated to study brush control in forest plantations, broadened its emphasis from herbicide control to include motor/manual and biological control methods.

- a project on forest growth and measurement was initiated marking a new emphasis on managed stand growth, yield and inventory research.

- a pinewood nematode project was set up to evaluate the pathogenecity of strains of nematode to Canadian and European tree species.

A regional Advisory Committee was re-established with representation from the forest industry, universities, unions and provincial/territorial governments to provide PFC management with advice regarding research and development programs.

The year under review marked the second year of the five-year $300 million Canada/British Columbia Forest Resource Development Agreement. During this time over 2 000 projects have been initiated providing in excess of 150 000 days of employment. Close to 300 000 ha were surveyed; 48 000 ha site prepared and almost 40 million trees planted on 32 000 ha. In addition some 3 700 ha were brushed and weeded; 9 700 ha spaced and 8 000 ha fertilized.

The federally administered programs on Indian and Private Forest Lands produced inventories, management plans and/or treatments on 108 000 ha and 22 000 ha respectively.

Job development staff at PFC, in concert with Employment Immigration Canada, have implemented 320 forestry projects accounting for 77 300 weeks of employment throughout British Columbia valued at $33 million.

A District Office in Prince George was opened in the fall of 1986 by the Honourable **Gerald S. Merrithew**, Minister of State, Forestry and Mines. This office, which is staffed by Forestry Officer, **Walter Matosevic**, will allow us to better serve the clients of the CFS in the province's largest forest region.

The Centre initiated an ambitious program in office automation utilizing the capabilities of the new VAX 8650. Over 100 staff members completed a week long course of instruction and training.

During the review period a major outbreak of the western spruce budworm infested 413 000 ha in the province — particularly in the Kamloops region. This represents considerable expansion over the previous year and surveys indicate the outbreak will continue. Staff are working with provincial forest service to assess damage and develop management plans.

Dr. Les Safranyik, leader of the bark and wood-boring insects project, was awarded a "Fellowship" of the Entomological Society of Canada — one of only 12 entomologists to receive this honour.

Several new people joined the staff of PFC including **Dr. Mike Bonnor** who heads up the new forest growth, measurement and damage appraisal project; and **Jennifer Parkinson**, forestry development officer with the federal lands program (FRDA). Visiting scientists included **Dr. Caroline Preston**, Research Branch, Agriculture Canada, Ottawa; **Xiang Xiao-Qiang** and **Wei Jian Xiang** from the Academy of Forest Inventory and Planning, Beijing PRC; and **Wang Zhi-Li**, Forestry Bureau, Harbin, PRC.

Three young scientists continued on educatonal leave, while **Dr. Terry Honer** joined T.M. Thomson through Interchange Canada for a CIDA assignment in Kuala Lampoor.

Drs. Bob McMinn and **John Hopkins** retired during the year with 33 years and 31 years service respectively. **Dr. Hugh Barclay** was promoted to Research Scientist 3 during this period.

As a result of the organization review **Dr. Bob Dobbs** was designated as Senior Program Director, Research and **John Edwards** as Senior Program Director, Development. A revised organization chart appears on page 55 for your reference.

D.R. Macdonald
Director-General
Pacific & Yukon Region

March 31, 1987

Forest Growth and Biology Research

R.C. Dobbs
Program Director

A thinned and fertilized Douglas-fir stand.

Growth and biology: Douglas-fir ecosystems

Project Leader: Dr. H. Brix

Professionals: Dr. H. Barclay, E.R. Gardner, Dr. V.G. Marshall, A.K. Mitchell, Dr. P.C. Pang, Dr. C. Preston, Dr. T. Trofymow

Technicians: M. Clayton, C.R. Layton, K. McCullough, F.T. Portlock

Objectives

To investigate tree growth and biological processes of soil and trees in response to thinning and fertilization of a coastal Douglas-fir ecosystem and to use the resulting information to develop a biologically based model for growth prediction.

Achievements

Research continued on thinning and nitrogen fertilization effects on soil chemistry, soil water, soil microflora and fauna and their functional interrelationship in nutrient cycling and nutrient availability to trees. This, together with impacts on tree physiology, is the basis for development of a biological model of stand management effects on ecosystem response and stand growth.

Our analysis of foliar nutrient concentrations have indicated a possible induced deficiency of phosphorus and sulfur in trees after repeated nitrogen fertilization.

This will be investigated further in eight new plots treated with different combinations of nitrogen, phosphorus and sulfur.

Reports were published on the Shawn ecosystem model and on thinning and nitrogen fertilization effects on soil and tree water stress and above-ground nutrient distribution within trees and stands.

Projections

A synthesis of project results, which have been presented in part in over 60 reports, will be prepared. Results will be available on the 15-year growth response and on various aspects related to nutrient cycling. A water balance model as related to climate and thinning will be developed. Information obtained will be incorporated into the SHAWN model which will serve to predict stand tending effects under different site conditions.

Forest growth and measurement

Project Leader: Dr. G.M. Bonnor

Professionals: Dr. R. Alfaro, Dr. Y.J. Lee

Technicians: D. Beddows, B. Brown, J. Dronzek, E. Wegwitz

Objectives

In cooperation with other forest agencies, to develop, refine and apply methods of assessing effects of: silvicultural treatments on growth and yield; growth and yield of natural stands; catastrophic depletions due to pests and other causes; and static and dynamic inventories, for the purpose of improving intensive forest management practices.

Achievements

Continued the collection of sample plot data, assessment of data, and reporting of results related to damage and loss caused by tussock moth, spruce budworm and western false hemlock looper.

Developed loss factors for the BCFS to calculate potential losses caused by western spruce budworm in interior Douglas-fir, a model to calculate volume losses in sitka spruce plantations under sitka spruce weevil attack, and software for tree ring measurements.

Completed a draft report on root disease survey using remote sensing sources, and obtained satellite data from tussock moth infested areas in the Kamloops region. Analysed multispectral and radar remote sensing data for monitoring forest clearcut and regeneration sites on Vancouver Island.

Long term studies are necessary to study pest impacts on growth. In the picture a Douglas-fir tree before (left), during (centre) and after (right) a Douglas-fir tussock moth infestation.

Continued as a cooperator on the Levels-of-Growing Stock (LOGS) study.

Completed the major phases of a reconnaissance forest inventory for the Yukon Territory.

In consultation with other forest agencies, established goals, objectives and tasks of five new studies.

Published three reports on pest damage appraisal, two on the use of remote sensing, and three on growth and yield and inventories. Presented lectures and seminars, including some in China, and provided assistance to PFC staff and other forest agencies.

Projections

Develop detailed plans for five new studies and initiate work on the studies.

Continue work on pest damage appraisal and model development.

Prepare report on root disease study, and digitize remote sensing data related to the root disease study as well as to clearcut and regeneration evaluation.

Continue participation in the LOGS study; conduct fourth treatment thinning at Sayward Forest.

Complete the Yukon reconnaissance inventory.

Systems studies in forestry

Project leader: Dr. A.J. Thomson
Professionals: Dr. H.J. Barclay

Objectives

To evaluate effects of selected pests and forest management practices on tree and stand growth, and develop elements of models and management systems.

Achievements

Publications were prepared on a Sitka spruce weevil model, comparison of lodgepole pine yield tables, effects of tree aggregation on growth, and on various aspects of pest control. A new procedure for estimating effects of western spruce budworm on Douglas-fir stand volume was developed.

Projections

Models of mountain pine beetle population dynamics and impact will be developed, as well as a model of effects of *Trypodendron* on log decks and dryland sorts. Continued development of a white spruce reforestation model and a Douglas-fir growth analysis system will be carried out.

Fate of nitrogenous fertilizers

Project Leader: Dr. V.G. Marshall
Professionals: Dr. E. Hetherington, Dr. C. Preston

Objectives

To conduct field and laboratory experiments for assessing nutrient losses from application of urea and ammonium nitrate and to develop a decision-logic table for applying these fertilizers to forest soils.

Achievements

A review paper was published in the proceedings of the "Interior Forest Fertilization Workshop, 1986". Isotopic analysis on all 15N samples was completed; trees in the plots at Green Mountain, Sooke and Spillimacheen were measured and the data were statistically analysed. A final report on the project is in preparation.

Projections

Apart from technology transfer, this project is now terminated. A final report will be submitted to the BCMF&L and three papers — on urease activity, 15N distribution in two forest ecosystem, and tree-growth response from nitrogenous fertilizers applied on snow — are envisaged as articles in scientific journals.

Forest Renewal and Environment Research

D.A. Winston,
Program Director

Collaborative research and statistical services

Project Leader: Dr. J.F. Manville
Professionals: Drs. F. Peet, R.H. Silversides, C. Simmons
Technicians: R. Benton, T. Fraser

Objectives

To solve forestry problems through a series of collaborative studies, by enhancing and providing specialized skills in the areas of analytical organic chemistry, biological image processing, forest meteorology, and statistics.

Achievements

This was a year of change. The current team of researchers was assembled and given their new mandate. Major capital equipment (gas chromatograph — Fourier transform/infrared spectrometer, mass spectrometric detector, digitally controlled microscope stage, magnetic tape drive and plotter) was acquired, installed and made ready for research applications. An *in vivo* nuclear magnetic resonance study of *Barbara colfaxiana* was completed. The conversion of the monochromatic software from the 11/34 to the 11/23 microcomputer was completed. Most of the monochromatic, high resolution microscope system was converted from the old 11/34 minicomputer to the 11/23 microcomputer. Two manuscripts incorporating elements of biological image processing were published. Instruments for monitoring climate were installed at Stoney Lake near Prince George in preparation for a cooperative study which will examine methods for using prescribed burning to treat backlog NSR. Two papers were presented at the Forest Climate '86 Symposium at Orillia Ontario; one on seedling microclimate, and the other on data handling procedures. The statistical software package, SAS, was fully implemented. PFC's statistician attended a workshop in Petawawa to become more familiar with this newly acquired tool and instructed a large number of staff members who had pending applications.

Projections

This year will see the formalized application of the specialities of organic chemistry, biological image processing, forest meteorology, and statistics to cooperative studies at PFC.

Forest regeneration systems

Project Leader: J.T. Arnott
Professionals: Dr. D.G.W. Edwards, Dr. S. Eis, D. Macey
Technicians: D. Beddows, G.J. Goodmanson, F.T. Portlock and D.W. Taylor

Objectives

To develop, evaluate and enhance tree seedling production and establishment methods. To enhance the quality and quantity of forest tree seed supply in B.C. and the Yukon, by developing improved methods for forecasting, procurement, processing, utilization and certification of seeds. To administer international schemes for seed certification (OECD), seed sampling and testing (ISTA).

Achievements

Long-term study of tree growth in 15 to 20-year-old plantations of container seedling origin continue within this project. One of the objectives of this monitoring program is to determine any long-term effects of container seedling reforestation methods on plantation stability and growth.

High elevation species and stock type trials, run in cooperation with the B.C. Ministry of Forests and Lands, continue to be measured bi-annually. Noble fir continues to show promise as an exotic for introduction to the montane coastal western hemlock biogeoclimatic subzone.

Study of the interaction of stock type and fertilization with slow release Nutricote^{R} at the time of planting on western hemlock has been completed (cooperative research study with the B.C. Ministry of Forest and Lands). Fertilization at planting had a much greater positive influence on initial growth rates of these species than did the stock types.

The impact of drought stress versus short-days as a means of controlling the shoot growth of western hemlock in container seedling nurseries was studied in cooperation with others. Dr. J. Owens, through a federal FRDA contract, investigated the treatment response on gross seedling morphology. CFS and MacMillan Bloedel researchers evaluated the seedlings' physiological response to the treatments. The impact of these nursery cultural treatments on subsequent field performance of the seedlings is being investigated cooperatively by all three agencies.

Work on the so-called "IDS", or sink-float sorting method for separating germinable and non-germinable conifer seeds took a step towards making the process useable on a practical scale. Using a commercially built seed drier, part of the Hilleshog-designed seed equipment at the Pine Ridge (Alberta Forest Service) seed processing plant, tests were run on 2.5 kg quantities of lodgepole pine and white spruce seeds; these quantities are approximately 1000 times the amount of seeds used in laboratory experiments. These tests were highly successful, and proved that this equipment could be used for the drying (D) step in the IDS pro-

cess. Further tests, to determine how deep a layer of seeds can be dried, will be conducted when similar equipment has been installed at the B.C. Ministry of Forests and Lands new Seed Centre, Surrey. Further work on western white pine germination confirmed the previous year's results that compound stratification produces very good, if not optimum, germination. Other experiments found that two weeks of warmth (rather than four weeks) were satisfactory for some seedlots, particularly if the treatment temperature was raised to about 25°C; that a 2-day soak in water was preferable to a 1-day soak, but that this did not appear to be related to a change in seed moisture content; that a 2-day soak when air was bubbled through the water produced the best germination; that alternating cycles of one week warm stratification followed by one week cold stratification was not as effective as giving the warm treatment in one continuous period. These studies are continuing.

The official seed certification (OECD Scheme) and seed testing (ISTA-rules) services issued certificates representing more than 2000 kg of seeds destined for export. Regulations for Forest Tree Seeds (to accompany the Seeds Act of Canada), on which Project staff had worked for several years, were withdrawn in keeping with the federal government's policy of deregulating public and private enterprises. In lieu of regulations, guidelines for grading and labeling Canadian tree seeds were formulated. Preparation of the manual for testing tree seeds was completed with publication set for 1987.

Projections

Development of the IDS method for sorting seeds on a practical scale will continue as a prominent objective, but further efforts will be made to improve and refine methods for overcoming dormancy in western white pine and yellow cedar seeds.

To conduct more basic research on the impact of nursery cultural regimes on the morphological and physiological development of container-grown seedlings, and how these parameters affect the success of seedling establishment in the field.

To continue long-term monitoring of species and stock type trials already established.

Fire research

Project Leader: B.D. Lawson
Professionals: B.C. Hawkes, S.W. Taylor
Technicians: G.N. Dalrymple, M.A. Grismer

Objectives

To develop fire behavior prediction systems for major fuel types, incorporating this knowledge within the Canadian Forest Fire Danger Rating System, a national framework designed to assist fire management agencies with forest resource protection. To develop methods and models to incorporate fire effects knowledge into land management practice in order to improve the application of prescribed fire to a variety of silvicultural problems.

Achievements

Development of the Canadian Forest Fire Danger Rating System (CFFDRS) continued by the newly formalized CFS Fire Danger Working Group, for many years an informal cooperative group of fire researchers from three CFS regional establishments and the national forestry institute. During the past year, a national Users' Guide to the CFFDRS was developed, in the form of a modularly-designed three-ring binder, to house past, present and future national and regional publications and interpretive material defining and describing component systems of the CFFDRS.

Work on the newest of these component systems, the Canadian Forest Fire Behavior Prediction (FBP) System continued. New experimental fires and analysis of the existing fire behavior data base were conducted in order to develop FBP models of fuel consumption and frontal fire intensity for all 14 national fuel types presently included in the 1984 interim edition of the FBP System. Unfavorable burning weather in northern Alberta for much of the fire season resulted in only three additional experimental fires being conducted in the lowland black spruce fuel type currently under national study. However, these 1986 fires covered a range of low to high fire danger, with measured head fire rates of spread up to 30 m/min. A total of nine fires have now been conducted in this fuel type.

Cooperative work in the Fire Danger Group continued in the "Accessory Fuel Moisture System" of the CFFDRS as well. In particular, a model of medium sized slash wood moisture was developed (by Van Wagner, PNFI), using an Ontario data set and tested against a B.C. data set. This model, after further development and testing, may be a useful addition to decision-aids for prescribed burning, an example of crossover applications between components of the CFFDRS, developed to assist fire managers in wildfire behavior prediction, and the growing need for improved tools to aid in prescribed fire behavior and impact prediction.

Prescribed fire research was strongly supported at PFC, particularly by FRDA cost-shared and federal direct delivery research sub-programs. Two FRDA cost-shared

research projects are being led by PFC fire researchers, to monitor operational burns and conduct experimental prescribed fires, in combination with chemical and mechanical site preparation treatments, to determine effective prescriptions for rehabilitating unsatisfactorily restocked (NSR) lands in the Prince George region of B.C. These five-year studies are now in their second year of field work, with experimental site treatments planned in the intensive study for the summer of 1987.

The 1986 field handbook for prescribed fire assessments was republished by FRDA in 1987, and is being widely used by fire managers to help create a data base of fire behavior and impact information for currently-logged and backlog sites across the province. This data will be used in the development of the second generation of predictive models for prescribed fire planning, currently under way at PFC, in cooperation with BCFS.

Other cooperative research was supported as well, with FRDA federal direct delivery studies continuing with MacMillan Bloedel Ltd. and with UBC Soil Science Department, both studying short and long-term effects of prescribed fire on tree growth and site productivity on some coastal B.C. sites.

National coordination of CFS prescribed fire research will be assisted through the 1986 formalization of a prescribed fire and effects national working group, chaired by PFC with members from other CFS regional establishments and national institutes.

A variety of technology transfer activities were conducted, including papers on prescribed fire research presented at a symposium in Prince George, at Northwest Forest Fire Council in Olympia, Wa., and at a fire management seminar at Qualicum, B.C. Training course presentations on the CFFDRS and prescribed fire decision-aids were given at Lorax Forestry fire courses, at U.B.C. and prescribed fire presentations were given at two session of the Silviculture Institute of B.C. and at a B.C. Forest Products workshop at Mackenzie, B.C.

Projections

The CFFDRS User's Guide will be distributed to fire management agencies. The Fire Behavior Prediction (FBP) System will add fuel consumption and fire intensity components to the existing rate of spread equations for 14 Canadian fuel types, in preparation for formal publication of the system as a national Forestry Technical Report (FTR). Computer programs will accompany all new developments in the CFFDRS to enhance the system's implementation within fire management agency initial attack and preparedness planning operations.

Prescribed fire research information will accelerate for both site rehabilitation and currently-logged site preparation burning. A framework will be developed for the second generation of prescribed fire decision-aid to assist the silviculturist and fire manager in achieving controllable and effective prescribed fire for pre-determined objectives on specific sites. Improved prescribed fire behavior and impact predictors for at least three key species-site groups should be developed by 1990 if the present level of research support and cooperation continues among governments, industry and university.

Carnation Creek fish/forest interaction

Project Leader: Dr. R.B. Smith
Professionals: Dr. E. Hetherington
Technicians: R.K. King, R.J. Rowswell

Objectives

To integrate and conduct forestry, hydrology, vegetation and soil studies at Carnation Creek for use in the development of appropriate forest harvesting practices for coastal salmonid-producing watersheds.

Achievements

Data collection at the steep slope, subsurface stormflow study site and monitoring of summer, valley bottom groundwater levels and fog-drip precipitation continued. Dr. G.M. Aubertin returned for six weeks to continue analyses of subsurface stormflow data.

Revegetation assessments were completed for 13 plots. A set of computer programs was recently developed through a contract with W. Hays for converting the revegetation data into a form amenable to multivariate analyses.

A major 3-day workshop "Applying 15 years of Carnation Creek Results" was held in January 1987. The following papers were presented: "Hydrology and logging in the Carnation Creek watershed-what have we learned?" by E. Hetherington and "Some implications of vegetative changes induced by forest management" by R.B. Smith, W. Hays and R.K. King.

Projections

Further subsurface flow measurements and experiments will be conducted and summer valley bottom groundwater levels and fog-drip precipitation monitored. Hydrology papers will be presented at an IAHS symposium in August 1987 and a Herbicide Workshop during the winter. Other hydrology reports will be prepared.

The 10th year assessments will be made on 89 revegetation plots. A second contract dealing with revegetation data analyses will be completed including a report on the influence of site treatment and environmental parameters on vegetation development. A final report on soil disturbance will be prepared.

Environmental impact of forestry practices

Project Leader: Dr. R.B. Smith
Professionals: Dr. E. Hetherington, J.P. Senyk, Dr. W. Stanek
Technician: E.F. Wass

Objectives

To identify, measure and explain the effects of harvesting, site preparation and stand tending practices on forest environments and productivity to support existing good practices and lead to the development of new practices where required.

Achievements

A paper describing natural regeneration and forest productivity on landslide scars on the Queen Charlotte Islands was published as B.C. Ministry of Forests and Land Management Report 41. These results were also presented at a workshop on the Charlottes attended by over 150 persons which covered major results from the 5-year Fish Forestry Interaction Program.

Marking the 5th year of measurement on two soil-disturbance plantations, additional measurements were made on selected trees including plant moisture stress,

Wide-tired skidder being tested for use during the winter season (Worthless Creek — Vancouver Island).

root and top biomass, needle weight, foliage nutrient content and an assessment of the abundance of ectomycorrhizae. A new plantation was established on a stumped site near Shawnigan Lake, Vancouver Island.

Two new studies were established. The first deals with impacts of forest fertilization on water quality in two small lakes near Victoria. Water sampling and hydrometeorological measurements were conducted prior to fertilization in March 1987. The second new study investigates the impacts of winter groundskidding in a coastal setting (western Vancouver Island) and effects of mechanical site preparation equipment on soil quality. Soil sampling, site description and transect sampling were completed prior to felling and yarding in the winter of 1986-87.

Projections

Analyses will be completed on the five years of data from the two oldest soil disturbance plantations (Vernon and Grand Forks) and a report prepared. Some of these data will be included in a paper to be presented at the XIV International Botanical Congress in Berlin.

Post-logging soil sampling and physical and chemical analyses will be completed. Effects of winter skidding on soil density and modification of nutrient capital will be evaluated and a report prepared. Site climate monitoring equipment will be established and seedling trials initiated. Soil sampling of four mechanically site treated areas at Golden will be completed.

Field sampling of lake water quality following forest fertilization will be concluded and a summary report prepared.

A guide to silvicultural ecosystems of the Yukon will be published and a bibliography of Sitka spruce completed.

Forest weed control strategies

Project Leader: G.W. Coombs, R.P.F.
Professionals: Dr. C.E. Dorworth, Dr. Y.J. Lee, Dr. J.F. Manville, Dr. E.T. Oswald, Dr. W. Stanek, Dr. R.E. Wall, R.J. Whitehead
Technicians: B.N. Brown, R.K. King, D. Chu

Objectives

To develop forest management strategies aimed at minimizing the effects of non-crop vegetation on crop species survival and growth. To develop an understanding of the dynamics of productive forest sites in the southern interior of B.C. and on the coast at various stages of development of plantation up to 20 years old by looking at the interrelationships of site characteristics and ecosystem components, and

Brush saw demonstration for forest weed control

their effects on vegetation succession and site productivity, following present harvesting methods and natural disturbances. To identify and develop forest weed control methods, including motor-manual, biological and chemical, both singularly and in combination, during the early stages of plantation development which will achieve an optimum balance between silvicultural efficacy and impacts on other resource values.

Achievements

The project's objectives were broadened to looking at the total vegetation community and the broad range of techniques which can be used to manipulate the non-crop vegetation to maximize crop species survival and growth.

During the summer, field plots were established for the Crop Response Study and the Ecology Study in the ICHA and ESSF biogeoclimatic zones in the Golden area. Working in collaboration with these two studies, aerial photography and satellite interpretation of crop and non-crop vegetation were conducted on these plots by the Remote Sensing Study. Under the Biocontrol Study, extensive collections were made of possible non-crop control pathogens from 15 non-crop species from Vancouver Island, and from the northern and southern interior of B.C. In addition, these non-crop species were potted and inoculated with the identified pathogens in the PFC greenhouse. Cooperative field assessments were again carried out in the summer between FPMI and PFC staff of the vegetation in the 1984 Aerial Roundup Trial in Carnation Creek.

1986 saw another shuffling of study leaders. Two study leaders (chemistry and pedology) were transferred to other projects while one new study leader (autecology) was added to the project.

Information exchange in the form of lectures, meetings and discussions were again made by project staff involving B.C. Ministry of Forests and Lands, B.C. Ministry of Environment and Parks, Industry, Universities, Silvicultural Committee (Coast, Northern and Southern Interior), Silvicultural Institute of B.C. and other groups. PFC's active involvement with the Expert Committee on Weeds continued with John Manville, Chairman of the Silviculture Section, and Roger Whitehead, the Section summarizer.

Projections

Studies under this new project will continue to expand in the 1987/88 fiscal year. The Biocontrol Study, with the transfer of Dr. R.E. Wall from the Maritime Forestry Centre, will continue to isolate, identify and carry out primary field evaluation of pathogens in controlling non-crop vegetation in plots on the coast and in the southern interior of B.C. The Ecology Study will remeasure plots established in the Golden area and new plots will be established in the Cranbrook area. The Crop Response Study will remeasure the Bush River plots near Golden, as well as set up motor-manual plots in the Nelson area. The Remote Sensing Study will continue analysis of the Landsat S-TM and 70 mm color aerial photos of the Bush River plots. Seventy millimeters photography will be used in conjunction with line transect plots to refine techniques of analyzing digital data of crop and non-crop competition in young conifer plantations on Vancouver Island. Autecology studies will be initiated on a selected number of non-crop species.

An effort will be made to provide information to others through technology transfer of the results of the work carried out in the various studies under this Project.

Forest Protection Research

G.E. Miller,
Program Director

Forest insect and disease survey

Project Leader: G.A. Van Sickle

Professionals: A. Funk, L. Humble

Technicians: R.J. Andrews, R. Duncan, R.D. Erickson, R. Ferris, R.W. Garbutt N. Humphreys, H.P. Koot, J. Loranger, D.P. Lowe, E. Pass, A. Stewart R. Turnquist, L.S. Unger, J. Vallentgoed, C.W. Wood.

Objectives

To provide part of an annual national overview of important forest insect and disease conditions, including acid rain, and their implications. To conduct quarantine-related surveys and activities. To support research through maintenance of historical records, monitoring and reporting and when possible, providing requested collections and observations. To develop methods to improve forest insect and disease sampling techniques.

Achievements

The annual monitoring and assessment of forest pest conditions in British Columbia and Yukon was conducted and results were published. The most damaging insect in western Canada continued to be mountain pine beetle with damage spread over 94 000 ha. Spruce beetle infestations declined to 3800 ha.

Defoliation of Douglas-fir by western budworm increased nearly two fold to 413 000 ha, while Douglas-fir tussock moth populations collapsed, as predicted due to virus and parasites. Western blackheaded budworm expanded to 55 000 ha mainly on the Queen Charlotte Islands. Larch casebearer declined and larch budmoth collapsed. Major problems in mature and immature forests continued to be root rots, dwarf mistletoes, rusts and canker diseases. Black army cutworm killed and severely defoliated seedlings in slash-burned sites in the northern interior. Several cone and seed pests were widespread and destroyed up to 78% of the cones. Quarantine related surveys found pinewood nematode for the first time in British Columbia; surveys for terminal crook disease and larch canker were negative. Gypsy moth occurred at eight sites. Six plots were established as part of the national acid rain early warning system bringing the total to 15 plots in the region.

Projections

A general survey in support of a national overview of important pest conditions will be conducted and reported. A compilation of 35 years of records of parasites of common insects of B.C. and map histories of major insect outbreaks are in preparation. A computer assisted mapping and analysis system is in use and will be linked to other data bases such as the national forest inventory. A national pest record retrieval system (INFOBASE) will be tested and further developed.

Bark and wood-boring insects

Project Leader: Dr. L. Safranyik

Professionals: E.R. Gardner, Dr. T.L. Shore, Dr. T.S. Sahota, Dr. H.S. Whitney

Technicians: R.E. Betts, A. Ibaraki, D.A. Linton

Objectives

To develop and promote management guidelines to reduce losses from major bark and wood-boring insects.

Achievements

Nine scientific and technical publications were prepared by project scientists on various aspects of bark beetle biology and management.

As part of the Canada/USA Agreement on mountain pine beetle, 42 field plots were established in lodgepole pine in the Prince Rupert, Kamloops and Nelson Regions to evaluate existing hazard rating systems. This completes sampling of all 150 stands planned for the study; all plots will be reexamined and assessed for beetle mortality following the decline of infestations in the sampled stands. In cooperation with the B.C. Ministry of Forests and Lands, five 5-ha plots were marked for diameter limit and spacing trials in mature lodgepole pine near Merritt as part of studies to reduce mortality from the mountain pine beetle. The various diameter limit and spacing treatments will be applied during the fall of 1987.

In studies of beetle population quality, disappearances occurred in the chromatin distribution in cell samples from two populations of Douglas-fir beetles that differed in reproductive potential, before the reproductive processes could be determined by alternative techniques. Cell samples of mountain pine beetle adults were studied to recognize possible differences between "pioneer" and other beetles.

Work has been completed on estimating mountain pine beetle attacks and broods in individual trees, distribution of attacks by spruce beetle in stumps and on the boles of individual spruce trees. Dr. Shore initiated a study of the effects of mountain pine beetle on lodgepole pine stand structure and dynamics.

Some of the highlights of advice and technology transfer work by project participants were as follows:

Drs. Whitney, Moeck and Safranyik and Mr. Linton and Stokes participated in performance evaluation of the prototype III design of the tree monkey. Generally, the machine did a good job at debarking but had difficulties climbing trees with boles having non-circular cross sections. Drs. Safranyik and Shore met with Crown Forest and B.C.F.S. research staff to discuss the history and locations of any thinning and/or fertilization trials on lodgepole pine, and located and examined lodgepole pine stands in Kelowna and Radium Hot Springs which were previously thinned and/or fertilized to determine if they could be useful to this study. Dr. T.S. Sahota advised Dr. R. Utkhede of Summerland Research Station on sample

preparation for chromatin distribution analysis of his samples. Dr. Shore gave a talk to Chinese delegation from Beijing Forestry University on the bark beetle project; gave a talk to Merritt TSA Steering committee on CFS protection research in the Merritt district; acted as Scientific Advisor on PILP contact to Phero Tech. Inc. on Ambrosia Beetles and acted on M.Sc. Thesis committee for Yongbiao Liv, Forestry U.B.C. Dr. Safranyik reviewed i) a BCFS report of mountain pine beetle winter mortality in the Cariboo Region, ii) a BCMF report on standardized probe and reporting procedures for bark beetles, iii) a BCFS report of bark and burn assessment for mpb control, iv) a FRDA Work Plan re white pine rust resistance demonstrations in B.C. plantations, v) thesis progress report by Mr. Stock (SFU) and Mr. Salom (UBC), vi) a report of the spruce beetle situation in the Cascade wilderness, and vii) a USDA, Forest Service, work plan on mountain pine beetle dispersal. Dr. Safranyik lectured at the Silvicultural Institute on insect population dynamics; at the Faculty of Forestry, UBC, on the techniques and effectiveness of direct control of the mountain pine beetle; at PFC on bark beetle management and biology to an academic delegation from the People Republic of China, a delegation from Swenka Cellulose, Sweden, and a delegation of central Interior Forest Industry representatives. Dr. Safranyik attended the Cariboo Region's fall pine beetle assessment meeting and made a field assessment in the Vanderhoof area of bark beetle hazard from lodgepole pines with fading crowns. He chaired the annual meeting of the Mountain Pine Beetle Technical Committee and was co-editor of the minutes. Dr. Shore also attended this meeting. Dr. Safranyik chaired the technical session of the IUFRO Working Party on bark beetle management at the World Congress in Yugoslavia.

Projections

Publish management guidelines for the spruce beetle, continue studies of mountain pine beetle biology and management.

Biological control of forest pests

Project Leader: Dr. M.A. Hulme

Professionals: Dr. J.W.E. Harris, Dr. H.A. Moeck, Dr. I.S. Otvos, Dr. R.F. Shepherd, Dr. H.S. Whitney

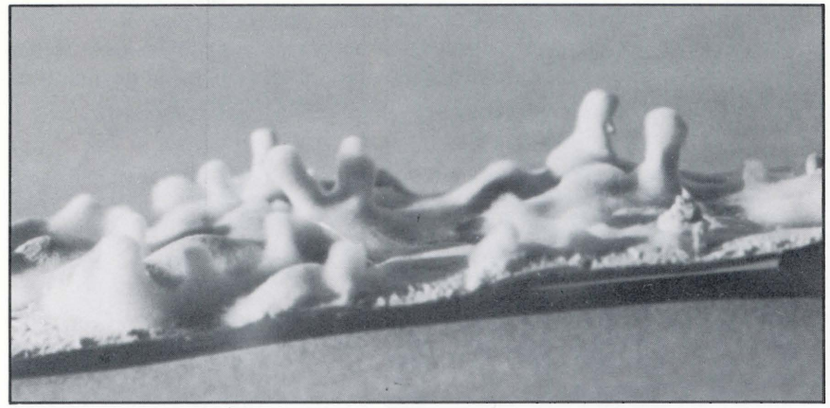
Technicians: T.G. Gray, C.M. Macdonald, M. Talmon de l'Armee

Objectives

To evaluate the use of natural enemies as control agents for forest pests and, where appropriate, incorporate natural enemy manipulations into forest pest management strategies.

Achievements

The periodic cycles of Douglas-fir tussock moth outbreaks over western North America have been analysed and found to be related to widespread virus-induced population collapse. The virus is the same one we include in our successful program of integrated pest management of Douglas-fir tussock moth. Winter moth populations and the subsequent defoliation continue to decline following introductions of a parasitic fly and a parasitic wasp. Monitoring of mortality in larch casebearer populations showed that about one third of the population disappeared during the winter, probably eaten by birds. Two parasitoids, *Agathis pumila* and *Chrysocharis larocinellae*, introduced to control larch casebearer populations, were the most common parasitoids found in recent field collections of the pest.



Pillars of mycelium (sterile synnematia, i.e. no spores) produced by an aggressive cultural biotype of *B. bassiana*.

Our selected isolates of *Beauveria bassiana* stopped producing spores in laboratory culture, and testing of their ability to destroy the mountain pine beetle was thus delayed. The mechanism of infection by this fungus was investigated by the study leader during development leave at the Boyce Thompson Institute's Insect Pathology Resource Centre, Cornell University, Ithaca, New York. Conidia of *B. bassiana* passed live through the alimentary tract of first instar larvae of the Colorado Potato Beetle; blastospores were produced if the spores germinated in the gut and were retained for 72 h.

Adult clerid beetles that prey on mountain pine beetles were live-trapped with Lindgren funnel traps baited with bark beetle pheromones. The captured clerid species are now being reared in the laboratory for further testing. Methods have also been devised for collecting the natural insect enemies of broods of spruce weevil. Spruce leaders containing the insects were clipped in late summer before new weevil emergence, and suitable freezing of the leaders killed the weevils. This allowed the natural enemies to emerge free of weevils when the leaders were warmed.

Projections

The introduction of natural enemies of several forest insect defoliators will continue to be monitored to measure their impact on pest damage. Methods will be tested to identify and avoid fast-growing non-sporulating biotypes of *B. bassiana*,

which have quickly dominated laboratory cultures. Further trapping of clerid beetles will be explored and further methods of obtaining natural enemies of spruce weevil for later release will be tested. The utility of kairomones in manipulating natural enemies of some of the above forest insect pests will be tested.

Protection of second growth stands from root and stem diseases

Project Leader: Dr. W.J. Bloomberg
Professionals: K.E. Finck, Dr. G.D. Jensen, Dr. D. Morrison
Technicians: D. Chu, A. Hall, A.L.S. Johnson, G. Reynolds

Objectives

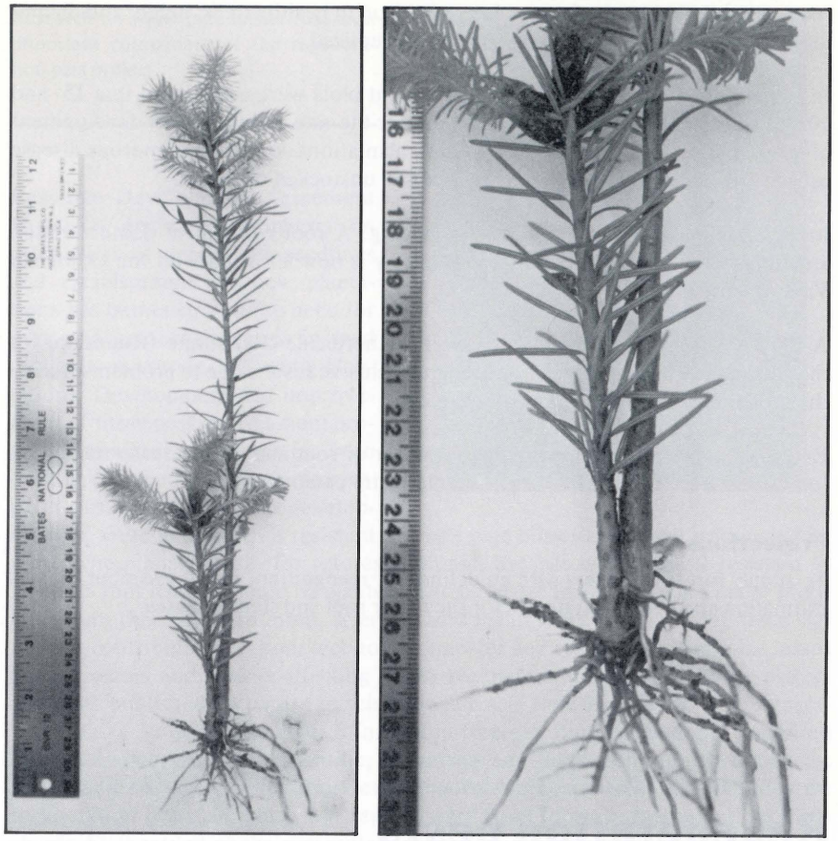
To define the epidemiology and impact of root and stem diseases in second-growth stands; to develop control strategies; to expedite application of research results, and to act as resource personnel and/or project leaders on Forest Resource Development Agreement (FRDA) projects related to root and stem diseases.

Achievements

In cooperation with B.C. Ministry of Forests and Lands scientists, the computer model of biologically realistic development of *Phellinus weirii* root rot in second-growth Douglas-fir stands (ROTSIM) was successfully incorporated as a submodel of the stand growth model (TASS). Trial runs with the composite model indicated that, as expected, the initial inoculum levels (infected stumps of the previous stand) would have a major effect on the merchantable volume of stands at age 100. Also, the disease would cause greater losses in densely stocked stands than in sparse stocking. The age at which stands were thinned and the degree of thinning would, according to the model, have major effects on yield. The validity of these conclusions from modeling will be checked against field situations.

A survey was completed of the residual root material remaining in the soil after stumps had been uprooted using three types of earth-moving machines. Uprooting is a method for reducing the residual inoculum of *Phellinus weirii* left after logging and thus decreasing infection of new crops of trees. A large (180 hp) backhoe was more effective than a small (115 hp) backhoe or a D8 Cat, both in removing most (over 90%) of the roots, and in having least damage effects on the soil. A report contains recommendations for treating infected sites.

A study of the relative susceptibility of commercial coniferous tree species to Phellinus root rot was evaluated in its 13th year after seedlings of seven species had



Paired cutting of potentially resistant mature Douglas-fir with juvenile material enhances rooting of the mature stock.

been planted around infectious stumps. Douglas-fir and grand fir have been the most susceptible to date, followed by western hemlock and spruce with lodgepole pine the least susceptible. Western red cedar and western white pine appear to be immune to the disease. The study will continue.

A pilot study was initiated to establish rooted clones for a planned histological investigation of host-pathogen interactions, following controlled inoculation, under defined conditions. Cuttings were taken from Douglas-fir trees potentially resistant to, or capable of recovery from, *Phellinus weirii* infection. Additional clones will be established in the coming year. This is a component of a larger study of host-pathogen relations that includes field inoculations and injury responses.

The effect of *Armillaria obscura* on growth of 80 — 100 year old Douglas-fir was measured at four locations in the Nelson and Kamloops regions. Trees were assigned to five classes based on their condition, presence of basal resinosis and amount of basal resinosis. The latter was closely related to the proportion of the

root system killed by the fungus. In comparison to healthy trees, height and diameter growth of diseased trees was significantly reduced.

In the southern interior, two 2-ha permanent plots were established in a 15- and 20-year old Douglas-fir plantation to monitor the rate and pattern of development of *Armillaria obscura* disease centers. Both plantations contained numerous disease centers. Mortality in some centers had caused unstocked openings.

Involvement with FRDA projects is ongoing. A root rot control demonstration area located on the Lake Cowichan Highway is now affiliated with the Cowichan Valley Demonstration Forest.

A FRDA project to test effectiveness of the herbicide Glyphosate (Roundup) for the control of *Phellinus weirii* produced inconclusive results due to problems tracing the movement of the herbicide to tree roots.

Extension work included technology transfer of root and stem disease-related information to schools, forest service and industry personnel.

Projections

To supply forest managers with guidelines for recognition, risk assessment, impact estimation and control strategies for the major root and stem diseases.

Regeneration pests

Project Leader: Dr. J.R. Sutherland

Professionals: Dr. A. Funk, Dr. R.S. Hunt, Dr. M. Meagher, Dr. G.E. Miller, Dr. L.A. Mitchell, Dr. T.S. Sahota, R.N. Sturrock, Dr. E.E. White

Technicians: H. Craig, D. Craigdallie, J. Dennis, G.R. Lait, D.S. Ruth, T.A.D. Woods

Objectives

To identify the major insect and disease pests including white pine blister rust of forest nurseries, seed orchards and reforested areas. To develop pest management strategies to keep the incidence of these pests below economic thresholds. To develop techniques that allow early detection and meaningful predictions regarding the pests. To assist in transferring new technology developed as a result of this research.

Achievements

Reforestation efforts in the province have continued to increase in recent years, especially as the result of the signing of the Canada/British Columbia Forest

Research on white pine blister rust is an important component of the regeneration pest project.

Resource Development Agreement (FRDA). Increased emphasis on production of seeds and seedlings and establishment of new plantations has demonstrated the need for pest management programs in seed orchards, nurseries and young plantations. Development and improvement of these pest management programs requires research in both basic and applied aspects of regeneration pests, including the development of white pine which is resistant to white pine blister rust. Such trees could be used, where appropriate, for reforestation and because white pine is resistant to *Phellinus* root rot they could be planted in areas where this root rot is a major problem. With these goals in mind, scientists and technicians in the project made significant contributions in both technology transfer and research to minimize losses from diseases and insects affecting forest regeneration. During the year project scientists published 14 papers in scientific journals (and had 19 more in preparation), plus one book, and eight Information Reports. Project personnel presented 19 lectures/workshops to scientific, university and forest community audiences. Two hundred and seventy-four letter/reports were prepared for enquiries on regeneration pests, of which 241 reports were from forest nurseries and seed orchards. Staff served on the committees of four graduate students. Excellent liaison was maintained with local, national and international colleagues in the forestry community. Dr. G.E. Miller moved to the program directorship of the Forest Protection Program and late in 1986/87, Dr. L.A. Mitchell resigned to accept employment elsewhere. Project researchers served as scientific authorities for nine contracts (over $700,000) for research funded through FRDA and Supply and Services Canada.

Some of the year's major accomplishments included: (i) publication of a book on Cone and Seed Diseases of North American Conifers (J. Sutherland), (ii) in collaboration with the B.C. Forest Service (BCFS), techniques were developed for estimating Douglas-fir seed orchard efficiencies and an insecticide trial was completed against seed bug (G. Miller), (iii) NMR work with Douglas-fir cone moth (*Barbara colfaxiana*) showed inhomogenities in the haemolymph, a first for any insect (T. Sahota), (iv) progress was made in the etiology of several canker diseases of Douglas-fir (A. Funk), (v) 20 white pine families were inoculated with white pine blister rust (WPBR) to determine resistance to the disease (R. Hunt), (vi) 132 additional white pine parent trees were selected (support provided by BCFS) and seeds of 88 trees were sown for inoculation with WPBR (M. Meagher), (vii) cloned chloroplast DNA of white pine in the bacterium *Escherichia coli* (E. White), (viii) completed development of a sensitive dot immunoassay employing

monoclonal antibodies for detecting the seed-borne pathogen *Sirococcus strobilinus* on spruce seeds (L. Mitchell) and (ix) completed a nursery trial on using hot water treatment of spruce seeds for eliminating *S. strobilinus* (R. Sturrock).

Projections

Diagnosis and pest management recommendations will continue for diseases and insects in seed orchards, nurseries and young plantations. A postdoctoral fellow will join the project to work on cone and seed-insects (to replace Dr. G. Miller). Also, in cone and seed insects the effects of temperature on development of pharate adults of the Douglas-fir cone moth will be investigated. Regarding canker diseases, Dr. Funk will determine the pathogenicity of several suspected fungi. In container nurseries gray mould epidemiology and management will be studied. The WPBR research will focus on several areas such as planting six white pine families in *Phellinus* root disease sites, continuation of WPBR inoculations and studying white pine geographic variability, locating photosystem genes on white pine DNA map, and host-pathogen interaction (biochemical) studies will begin using tissue cultures. FRDA related activities such as monitoring contract research will also continue.

Forest Development

J.A. Edwards,
Program Director

Program implementation

Project Leader: V.G. Ulrich
Professionals: W. Stokes

Objectives

To represent CFS interest in the implementation, administration and evaluation of the development initiatives. To provide coordination and administration guidance for the subvention programs dealing in external research and university support which includes programs to strengthen the forest research capability within the universities.

Achievements

Program guidelines and procedures were completed to support and direct the federal expenditure in British Columbia of some $39 million per year on reforestation, intensive forest management, and forestry development programs during the three year period April 1, 1987 to March 31, 1990, under the Canada/B.C. Forest Resource Development Agreement (1985-1990). Cost-shared programs account for $31.2 million each year.

Under the federal component of the Agreement, to date over 60 forest inventory and management plans have been completed through the Indian Forest Lands Program. These cover some 32% of Indian Reserve Lands in B.C. and will guide a program of silvicultural treatments and intensive forest management during the balance of the FRDA Agreement and beyond. The Private Forest Lands Program received over 500 inquiries during the year with 57 projects worth $1.4 either underway or completed. Federal component Research has committed $2.2 million through 37 research and demonstration projects.

Continued technical advice and monitoring was provided to over 200 projects under the Job Development and UIC Section 38 CEIC Programs.

Projection

To provide advice and assistance on the implementation of a technology transfer and forestry relations program. To provide assistance and data as required to the planning progress and to CEIC on forestry-related programs.

Forestry relations and technology transfer

Project Leader: J.P.G. de Lestard

Objectives

To establish and maintain contact with the forestry community in an advisory and consultative capacity and to promote and strengthen CFS research and development initiatives and programs in the Pacific and Yukon Region. To provide selected technology transfer services to PFC staff and clients. To provide professional support during the development and implementation of forestry agreements.

Achievements

Interactions with the public sector and government and forest industry officials are strengthening relationships resulting in opportunities for technology transfer and new CFS program initiatives. Highlights include: promoting CFS/PFC specialists and programs through visitations; participation in regional forestry exhibitions; public speaking opportunities; correspondence with domestic and foreign visitors; representing the CFS at key public and forestry advisory meetings; serving as the national Working Groups Co-ordinator and organizing technical sessions for the Canadian Institute of Forestry's 1986 annual meeting; providing CFS liaison to the Greater Vancouver Regional District's Seymour Demonstration Forest project; serving as course evaluation facilitator for the Silviculture Institute of British Columbia; preparing key ministerial briefing notes; and organizing professional forestry tours for the Minister of State (Forestry and Mines), community leaders and international visitors from the U.S.A., Sweden, China, Japan, West Germany, and the Netherlands.

Technology transfer is achieved through effective liaison.

Technology transfer activities include: organizing and implementing the pre-burn portion of a prescribed fire assessment workshop for provincial and industry representatives; participating in a workshop in Prince George describing the application of a new Prescribed Fire Assessment Handbook; assessing FRDA Federal Component proposals for technology transfer provisions; contributing to the development of PFC permanent and portable displays; participating in the Boy Scouts "Trees for Canada" program, participating in an Aerial Pesticide Application Technology Workshop in Campbell River; assisting scientists with patent applications; participating in Technology Transfer Steering Committee meetings; finalizing and distributing a report entitled "Herbicide Applications Technology in Forestry: An Analysis for British Columbia"; and providing consultative services on technology transfer activities.

Projections

Liaison activities will continue to be expanded throughout the forestry community and public sector in the Pacific and Yukon Region. Ongoing communications and visitations are expected to encourage clients and potential clients to capitalize on CFS regional and national research and development activities. Emphasis will be placed on stimulating increased awareness of the economic, social and environmental benefits being derived from the Canada-British Columbia Forest Resource Development Agreement.

Development of economic guidelines

Project Leader: G.H. Manning
Professionals: W.A. White
Technicians: C. Macklin

Objectives

To provide economic and policy advice to the department, its cooperators and the management and staff of PFC, to improve the information base in forest economics, and manage PFC's participation in the ENFOR (Energy from the Forest), program.

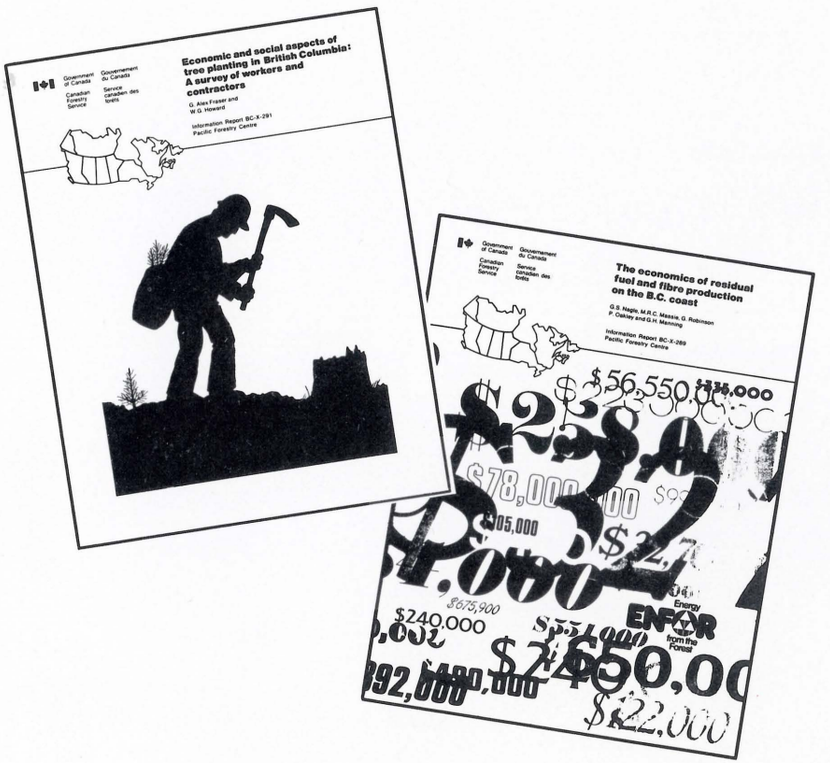
Achievements

The major thrust of the project continued to be in support of the Canada-B.C. Forest Resource Development Agreement. Economic studies underway included further investigations of forest dependent communities, completion of the study of labor content in silvicultural programs, the requirements for site preparation machinery in B.C., costs of logging second-growth coastal timber, specific machinery requirements for logging second growth timber, terrain conditions found in second growth lodgepole pine stands, and a study of the estimated economic benefits for FRDA-related forestry practices. In addition, a major study of O.R. techniques for forestry investment optimization continued.

With regards to ENFOR, in 1986-87, three contracts were in progress: development of a model to evaluate ENFOR projects, development of a technique to remove rocky debris from material intended as hog fuel, and an inventory of hog fuel on the southwest B.C. coast.

Projections

The project will continue to provide planning, economic and policy advice and liaisons as required by CFS/PFC staff and other client agencies. Specifically, studies related to evaluating the FRDA will be initiated, as will studies related to marketing and utilization opportunities for B.C. forest industries. Other research studies will continue, as will management of the ENFOR program.



Administration

R.M. Dean,
Management Services Officer

Administration

Management Services Officer: R.M. Dean

Finance Officer: W.D. Evans

Physical Plant: E.K. Hopps

Photographer: E. Chatelle

Materiel Management: H. Gray

Administrative Support: J. Andersen, D. Barwise, P. Chambers, S. Flarrow, B. Gee, D. Greenway, R. Hagel, H. Hendriksen, J. Horsland, E. Hosie, A. Inness, M. Johnson, L. Johnson, G. Kazmiruk, H. Matson, R. McPhee, M. Mosley, W. Pearce, S. Reid, R. Richardson, S. Fitch, J. Strobbe, B. Vander Heiden.

Casuals: D. Brady, J. Lum

Objectives

To provide a system of financial control and accountability in accordance with statutory and regulatory requirements. To provide general administrative support services including materiel management, financial services, records management, word processing, secretarial services, fleet management, and reception switchboard services. To provide physical facilities support for the Centre and 11 field stations.

Achievements

Financial management and accountability was conducted in accordance with existing statutory and regulatory requirements. All secretarial staff were trained in office automation and a comprehensive typesetting study was implemented. The financial unit expanded the Management Financial Reports to include a detailed breakdown of FRDA expenditures. New office accommodation was obtained in Prince George on our behalf, by Public Works Canada, for the FRDA program. Two FIDS field stations, constructed in the mid 50's in the Prince George area were replaced at a cost of $100 000, and a large number of small contracts were initiated by Public Works Canada. Approximately 2300 requisitions were processed by the Materiel Management unit and a fleet of 54 vehicles provided transportation for 174 employees.

Projections

Administrative and support services will continue to be provided to the research and development programs on a timely basis and increased analysis of financial expenditures will be undertaken. The FIDS field station at Summerland will be replaced and a new Fire Research station will be established at Hixon the Centre will upgrade the growing environment in the Greenhouse and Shadehouses and continue to improve the quality of plant material locally grown.

Information and Editorial Services

E.L. Teske,
Head

Information and editorial services

Project Leader: E.L. Teske
Professional: S. Glover
Support: L. Donk, B. Page, J. Wiens

Ojectives

To provide the Centre with editorial and graphic services; to act as the channel through which contact is developed and maintained with the public, the forest community, national, regional and local news media, editors and printers; to produce booklets, news releases and to handle telephone and written enquiries.

Achievements

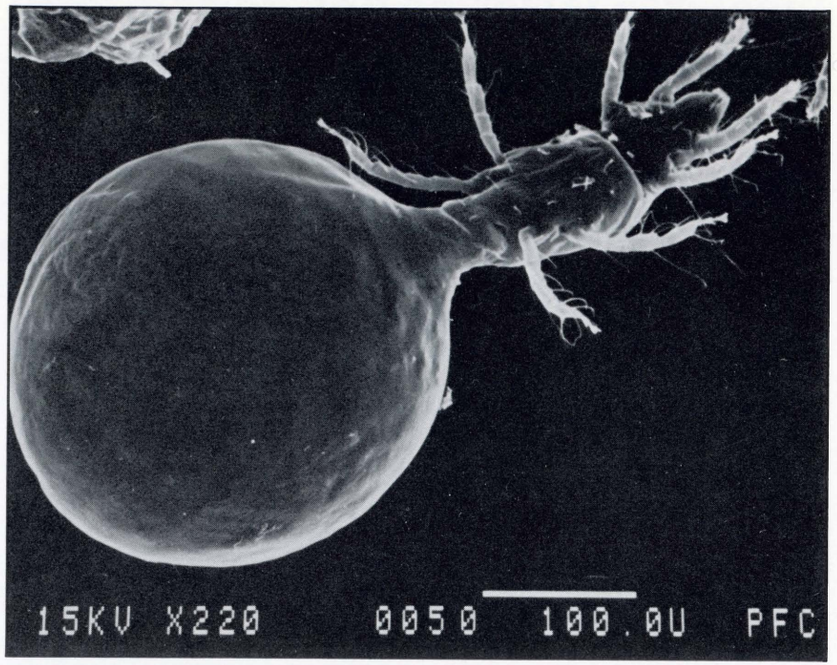
Conducted, under contract, a forestry awareness/opinion poll on forestry issues in B.C. to be used as a benchmark for communications programming. Cooperated in the development and delivery of Phase I and Phase II of the national forestry awareness campaign "Green Gold" sponsored by the Canadian Council of Forest Ministers. Published the proceedings from the 12th Commonwealth Forestry Conference, hosted by Canada in 1985. Edited and published a tri-government publication entitled "Cone and Seed Diseases of North American Conifers". Provided substantive support to the Canadian Forestry Association for 1986 National Forest Week activities in British Columbia. In support of ongoing programs at the Centre, staff provided editorial and graphic services; answered enquiries from clients; published "Information Forestry" magazine; issued news releases, backgrounders and speeches; maintained contact with the media; organized seminars and workshops and published 19 Information Reports, 51 journal articles, 7 contributions to symposium proceedings and 16 miscellaneous reports.

Projections

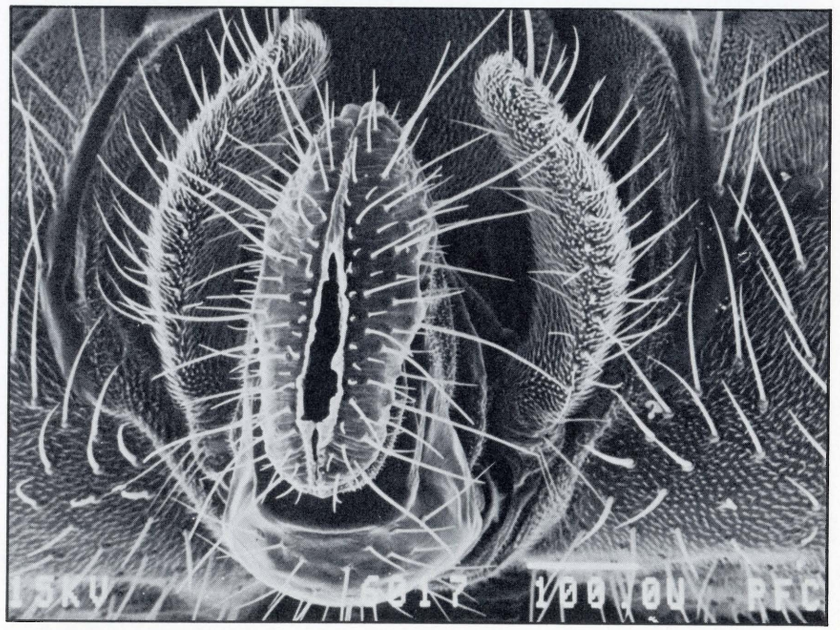
To continue to promote activities and programs of the Canadian Forestry Service in the region by providing graphic, editorial, public and media relations services. To cooperate with the provincial forest service to implement and deliver the regional component of the "Green Gold" campaign. To continue to support the federal component programs under FRDA by publishing brochures and leaflets, and by providing public and media relations services as required.

Planning and Technical Support Services

J.G. Skinner,
Manager



Female mite, *Pyemotes barbara* moser.



Predaceous dipteran, *Lonchaea corticis* (mouth parts)

Planning and technical support services

Prject Leader: J.G. Skinner
Professionals: L. Manning, A. Solyma
Support: M. Mitchell, A. Van Niekerk

Objectives

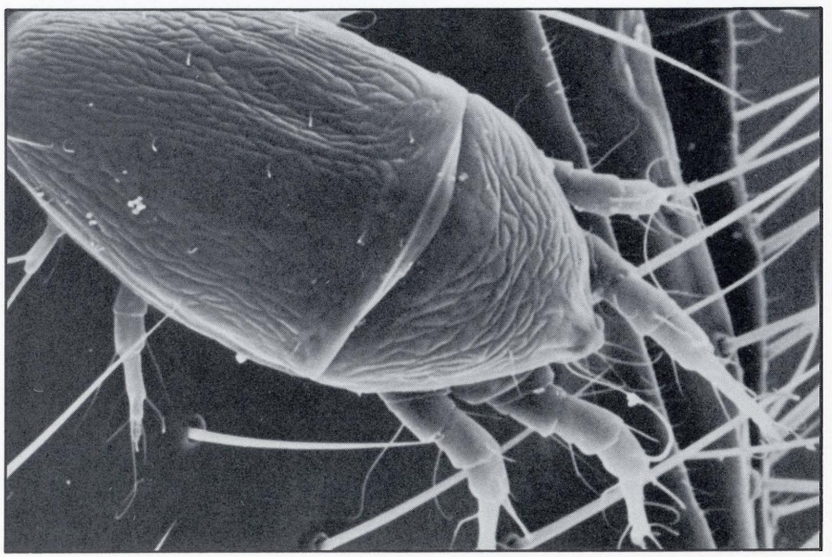
To provide planning services to PFC management; to provide library services, micro-electron services and inorganic chemical services to PFC staff and, to provide technical support services for FRDA.

Achievements

Staff in this project provided micro-electron services for 15 studies; analyze 1910 samples and reported 11 500 chemical parameters to 14 studies and one FRD agency; provide library services to all staff; acquired and installed a new VAX 8650 CPU and ancillary equipment; planned, developed and implemented a PFC-wide office automation system; and, completed coordination of the 1986/87 work plan.

Projections

To continue to provide planning and technical support services as required to staff of PFC.



Mite on the abdomen of fly

Computing Services

Project Leader: J. Partridge
Professionals: S. Alers, S. Moncrieff, Dr. J. Pannekoek, D. Say
Support: J. Foster, M. Henderson

Objectives

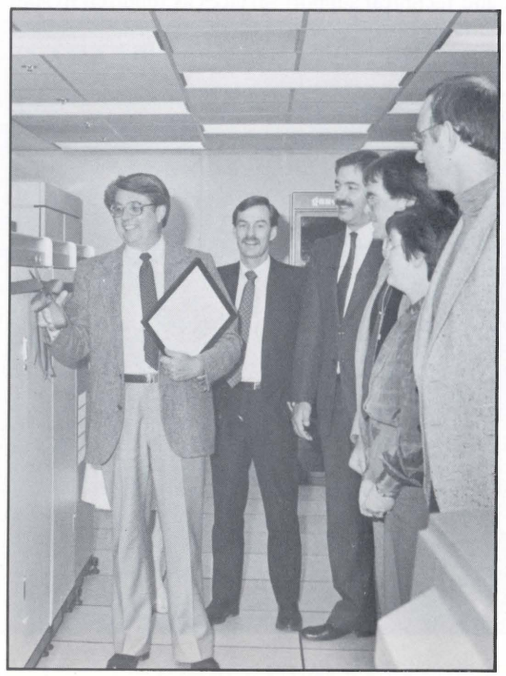
To provide computing facilities and general computing support for PFC staff and to meet program requirements support program requirements.

Achievements

Supervised the acquisition and installation of a new VAX 8650 CPU. Upgraded site software and licenses and provided maintenance for new CPU. Assisted in the development of a new Development Management Information System (DEVMIS) and implemented a Centre-wide office automation system. Staff also provide assistance with the development of some new scientific programs.

Projections

To continue to provide computing support services to staff.



Ross Macdonald (l) Regional Director-General cuts ribbon on new VAX 8650 as computing services staff and Digital representatives look on.

Appendixes

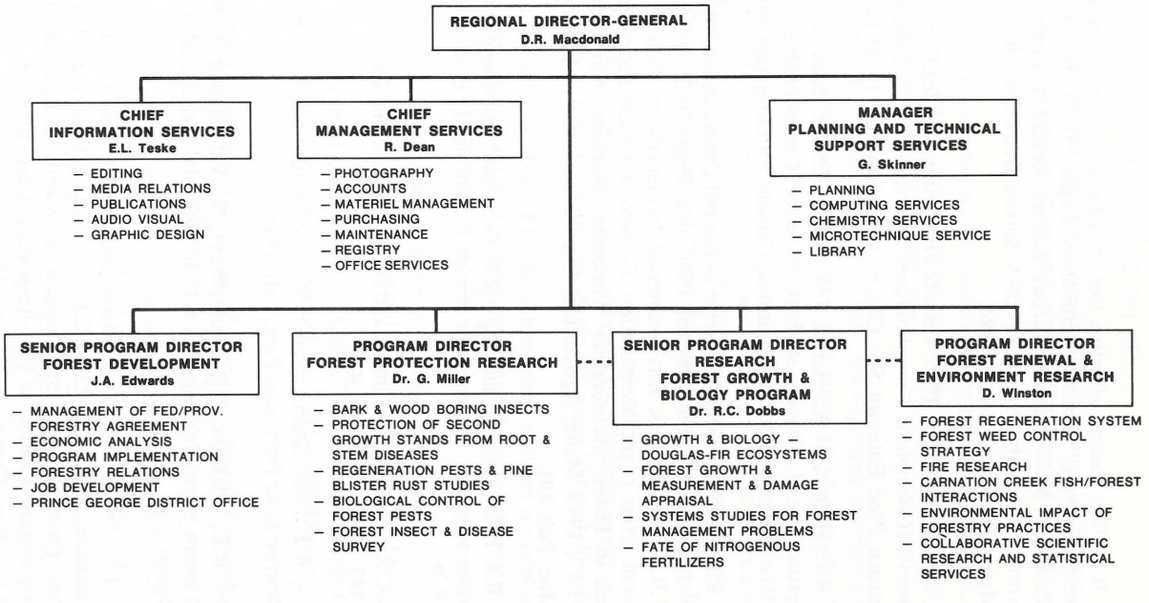
Pacific Forestry Centre

1986/87 Expenditures

Program	Person Years	Salaries	O&M	Capital	Contributions	Total
Director (includes Information Services)	6.3	$261.8	$307.6	$11.2	$0.0	$580.6
Management Services	35.1	$1041.9	$978.4	$296.1	$0.0	$2316.4
Growth & Biology	40.5	$1932.9	$357.0	$1170.4	$0.0	$3460.3
Protection	40.3	$2002.0	$286.0	$264.9	$0.0	$2552.9
Environment	34.2	$1526.8	$283.3	$98.5	$0.0	$1908.6
Development	18.9	$898.6	$880.5	$190.0	$16 762.0	$18 731.1
Total	175.3	$7664.0	$3092.8	$2031.1	$16 762.0	$29 549.9

Planning and Technical Support included within other program budgets for 1986/87.

Pacific Forestry Centre



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