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PROGRAM REVIEW

PACIFIC FOREST
RESEARCH CENTRE

1984-85



Government
of Canada

Gouvernement
du Canada

Canadian
Forestry
Service

Service
canadien des
forêts

PROGRAM REVIEW

Pacific Forest Research Centre

1984-85

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1985

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The Canadian Forestry Service Government of Canada

The Canadian Forestry Service is the principal source of federal expertise in forestry. 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.

A number of federal agencies are involved in forestry programs and a Federal Forestry Sector Strategy Committee has been established to coordinate federal forestry activities. The Canadian Forestry Service has been designated the lead agency.

The Canadian Forestry Service is comprised of a headquarters unit, six forest research centres, and two national institutes. The forest research 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

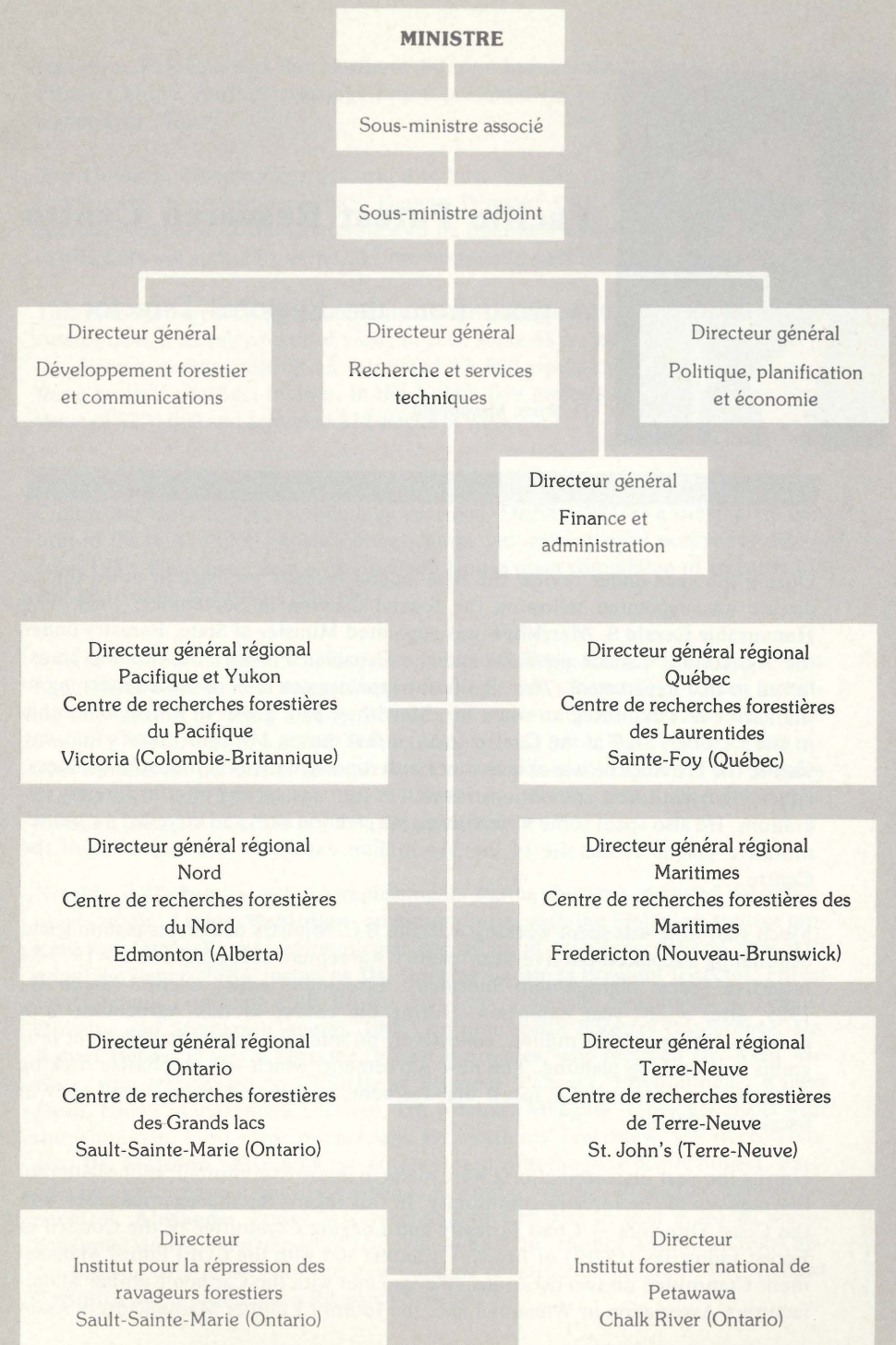
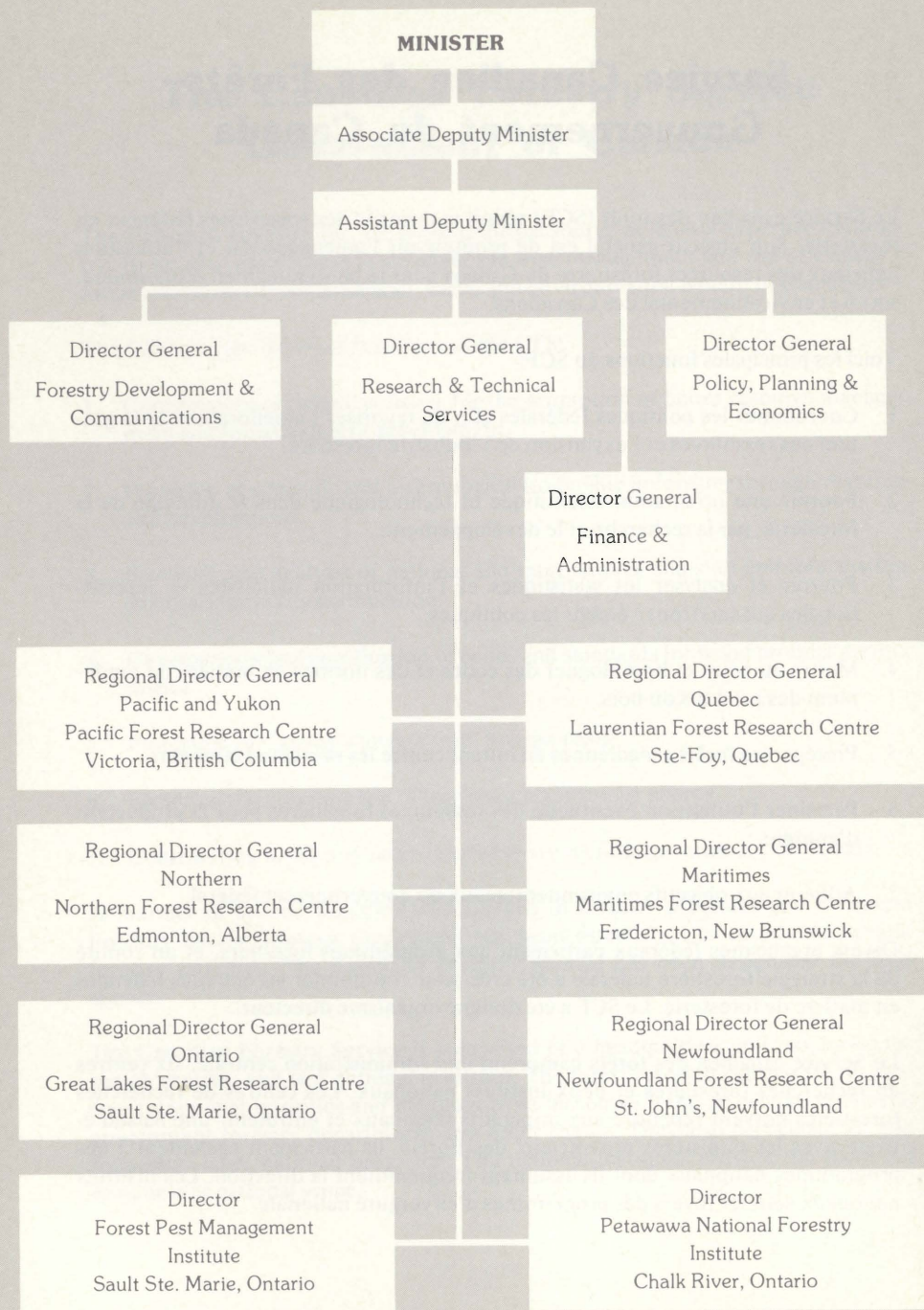
Le Service canadien des forêts (SCF) réunit la majorité des spécialistes fédéraux en foresterie. Son objectif général est de promouvoir l'aménagement et l'utilisation judicieuse des ressources forestières du Canada pour le plus grand bien économique, social et environnemental des Canadiens.

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 ravageurs étrangers.
6. Parrainer l'utilisation éventuelle des ressources forestières pour la production d'énergie.
7. Adhérer aux objectifs environnementaux du gouvernement fédéral.

Divers organismes fédéraux participent aux programmes forestiers, et un comité de la stratégie forestière fédérale a été créé pour coordonner les activités fédérales en matière de foresterie. Le SCF a été désigné organisme directeur.

Le Service canadien des forêts comprend une administration centrale, six centres de recherches forestières et deux instituts nationaux. Les centres de recherches forestières 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.





Pacific Forest Research Centre

A word from the Regional Director

D. Ross Macdonald

During the year under review the first federal forestry minister in more than a decade was appointed following the federal election in September, 1984. The **Honourable Gerald S. Merrithew** was appointed Minister of State, Forestry under the Agriculture Canada portfolio and the Canadian Forestry Service was transferred to that department. This significant appointment took on added meaning to the Pacific & Yukon Region when Mr. Merrithew paid a visit to British Columbia in late October. Staff at the Centre ensured that during Mr. Merrithew's four-day visit to the Province he was able to meet with representatives of industry, business, educational institutes, associations, as well as tour coastal and interior forestry operations. He also spent some time visiting job creation sites and unveiled a commemorative plaque at the site of the \$14 million expansion and upgrading of the Centre.

Much staff time was spent working with the B.C. Ministry of Forests planning and negotiating a replacement five-year forestry Agreement subsequent to the 1979-84 Intensive Forest Management Subsidiary Agreement, which expired March 31, 1985, after a one-year extension. During the course of this Agreement both governments spent \$61 million; collectively on intensive forest management programs and backlog planting. The new Agreement, which will emphasize backlog reforestation and intensive forest management, is expected to be signed early in fiscal year 1985-86.

During the year increased efforts were made to improve communications with representatives of the forestry community. In this regard the management met with the Coast Directors — Coast Forestry and Logging Committee of the Council of Forest Industries (COFI) of British Columbia and with the COFI Forest Management Committee on two occasions. We also met with the Cariboo Lumber Manufacturers Association in Williams Lake, the Interior Lumber Manufacturers Asso-

ciation in Kelowna and the Northern Interior Lumberman's Sector of COFI in Prince George. Further meetings with representatives of these client groups are planned for 1985-86.

The Canadian Government was asked to host the 12th Commonwealth Forestry Conference in September, 1985. Deputy Director **Cliff Brown** was appointed Secretary-General of the Conference to be held in Victoria. It is anticipated 300 participants will attend from the 50 Commonwealth countries.

This year's job creation program, known as Environment 2000, was extremely successful from a forestry point of view. In B.C. some 68 projects were undertaken in the forestry sector creating an estimated 13 600 weeks of work. Total value of these projects was \$4.3 million. In the Yukon five projects were undertaken for a value of \$204 000 and provided 824 weeks of work.

Under the Special Recovery Capital Construction program expansion of the Centre was close to 75% complete by year-end. During 1984/85 a substantive portion of the \$14 million expansion was completed and expected occupancy date is July, 1985. Plans have begun for an Open House upon completion of construction and renovation of existing facilities.

A large number of scientists, foresters, and administrators from overseas visited PFC. There were several delegations from the People's Republic of China, including one headed by **Yang Zhong**, Minister of Forestry. Other visitors came from Sweden, Nepal, Japan, Iceland, Sudan, Mexico, and the U.S.A. Visiting scientists who worked for periods of several weeks to many months included; **Dr. Blanka Mankovska**, Czechoslovakia, **Dr. G. Aubertin**, Illinois; U.S.A. and **Dr. Leslie Mitchell** joined the Centre as a Post Doctoral Fellow.

Notable staff changes and accomplishments during the year included the retirements of **Dr. Lesley McMullan**, an entomologist with the biological control project, and **David Evans**, entomologist and Head of Insectary. Several new staff members joined PFC including **Dr. Douglas Lacate** as Program Director, Forest Environment, replacing Cliff Brown who took a Special Assignment as Deputy Director and Secretary-General, 12th Commonwealth Forestry Conference; **Dr. Robert Dobbs**, Program Director, Forest Resources, who replaced **Dr. Alan Auclair**, who transferred to CFS-HQ as Program Manager, Environment; **Robert Dean**, Chief, Management Services; **Dr. Michael Meagher**, forest geneticist with the white pine blister rust project; and **Dr. Anthony Trofymow**, soil microbiologist. **Dr. Malcolm Shrimpton**, an entomologist with the bark beetle project, started a two-year secondment to CFS-HQ as Scientific Advisor, Biotechnology and Biocontrol. **Alexander Fraser** was seconded to CFS-HQ to lead a special socio-economic study on the impact of acid rain. **John Ellis**, former Administration Officer became Coordinator for the new building construction program. **Dr. Richard C. Smith** was promoted to a Research Scientist 3.

In an on-going process, about one-third of the Centre's projects underwent intensive review by committees representing the management of PFRC, other scientists and members of the research community outside the Centre. Some projects were terminated with a view to placing more emphasis and resources on current priorities more in keeping with the changing mandate of the Canadian Forestry Service.

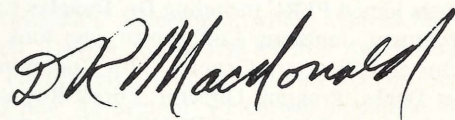
The 30 projects and over 150 studies conducted at the Pacific Forest Research Centre are divided into four major areas.

Forest Environment. Federal responsibilities in the Forest Insect and Disease Survey and plant quarantine are carried out in cooperation with other federal and provincial agencies. Research includes ways to improve the Canadian Forest Fire Danger Rating System as it relates to British Columbia and Yukon, as well as investigating meteorological and hydrological influences on forest ecosystems. Environmental impact assessments of major construction projects are carried out.

Forest Resources. Research and operations studies involve land classification, improving quality and production of seedlings, and developing improved regeneration methods and silvicultural practices to enhance the productivity of coastal and interior forests. Federal responsibilities in seed certification and testing are carried out.

Forest Protection. Research and operations include studies of insect and disease influences and forest depletion, as well as development of pest management strategies and guidelines, and the development of guidelines for the recognition, control and prediction of growth of stem diseases.

Forest Development and Relations. As well as negotiating and administering subsidiary agreements on intensive forest management, this group is active in planning activities for the Centre, technology transfer, managing forestry job creation programs, economic analysis and forestry relations and liaising with clients of PFC.



D.R. Macdonald
Regional Director
Pacific and Yukon Region

March 31, 1985



Forest Environment



Dr. D.S. Lacate, Program Director

Forest insect and disease survey

Project Leader: G.A. Van Sickle

Professionals: D. Evans, Dr. J.C. Hopkins, Dr. T.L. Shore

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, R. Turnquist, L.S. Unger, J. Vallentgoed, C.S. Wood, R.O. Wood

Objectives

To provide part of an annual national overview of important forest insect and disease conditions 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 measure pest-related tree mortality and growth losses, and 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 482 000 ha. Spruce beetle infestations declined to 46 000 ha.

Defoliation of Douglas-fir by western budworm decreased 15%, while defoliation of Douglas-fir stands by tussock moth virtually collapsed, as predicted due to virus and parasites. Parasitism reduced western hemlock looper in the Nelson regions but damage increased in the Kamloops and Cariboo regions. Western blackheaded budworm, larch casebearer and larch sawfly also increased. Major problems in



Survey ranger searches for signs of damage.

mature and immature forests continued to be root rots, dwarf mistletoes, rusts and canker diseases, with several needle diseases conspicuous on pines. Black army cutworm damage continued at fewer slash-burned sites in the northern interior. Several cone and seed pests were widespread and on average destroyed 35% of the cones. Quarantine related surveys for terminal crook disease, larch canker and pinewood nematode were negative. Gypsy moth occurred at three sites. Three plots were established as part of the national acid rain early warning system.

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 a booklet on "Pests of Second Growth" are in preparation. A computer assisted mapping and analysis system is being developed and evaluated.

Environmental effects of forestry operations

Project Leader: Dr. R.B. Smith

Professionals: P.R. Commandeur, Dr. E. Hetherington

Technician: E.F. Wass

Objectives

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

Achievements

With completion of the major portion of a study of natural revegetation and forest productivity on landslides in the Queen Charlotte Islands, attention has been directed to dissemination of results. A paper on the subject was presented at a IUFRO Symposium on Slope Stability and published in the Proceedings. Results were also discussed with resource agency personnel during a Fish/Forestry Interaction Workshop in Queen Charlotte City.



Runout zone of debris torrent showing piles of debarked trees deposited by torrent.

Soil surveys and sampling were conducted at a third stumping (root-disease control) site in preparation for establishment of soil disturbance plantations. Similar work was conducted on a downhill, ground-skidded clearcut. This area was also used to assess the relative merits of two soil disturbance survey systems. A tour of one of the plantations was arranged and conducted for the N.W. Forest Soils Council.

Submissions on "Forests and Water" were prepared for an inquiry into Federal Water Policy and for Inland Waters Directorate. Several lectures were delivered on environmental effects of forestry operations and advice on this subject tendered during field inspections and in respect to formulation of B.C. Ministry of Forests guidelines.

Projections

Reports on the Queen Charlotte Islands landslide study will be completed and a contribution made to a major Fish/Forestry Interaction Symposium. A poster presentation on the same topic will be made at the 1985 meeting of the Ecological Society of America. New plantations will be established with respect to soil disturbance impacts and monitoring of established ones continued.

Fire research

Project Leader: B.D. Lawson

Professionals: B.C. Hawkes

Technicians: G.N. Dalrymple, G.R. Lait

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

Contributed towards completion of and introduced to regional client agencies the 1984 Edition of Tables for the Canadian Forest Fire Weather Index (FWI) System and Interim User Guide to the Canadian Forest Fire Behavior Prediction (FBP) System. Both are major sub-systems of the Canadian Forest Fire Danger Rating System (CFFDRS), a nationally-coordinated research effort by the CFS fire danger group, aimed at improved fire occurrence and behavior prediction by wildland fire management agencies. The new FBP System contains fire rate of spread equations for 14 Canadian wildland fuel types and procedures for estimating fire size and perimeter growth.

A new two-year study of fire spread in lowland black spruce was started in north western Alberta, a cooperative venture between NoFRC, the CFS fire danger group and Alberta Forest Service. When completed, this work will be incorporated within the published version of the FBP System.

Prescribed fire research was highlighted by a proposal being accepted for a joint CFS/BCMF prescribed fire research steering committee at the provincial level. Work got under way on a strategic research plan, field methodology and a handbook for monitoring silvicultural prescribed fire behavior and effects to assist in predictive model development.

A number of workshop and seminar and course presentations on the CFFDRS and on burning to prescription were given throughout the year, including a national fire management workshop for Parks Canada senior staff at Jasper and a BCMF/ABCPF fire management course at Surrey.

Projections

Work on final publication of the FBP System is to continue, with development of fuel consumption and frontal fire intensity models to accompany the existing rate of spread models. The experimental fire phase of the lowland black spruce study will conclude in Alberta, weather permitting. Completion of a revised weather guide to the CFFDRS is planned.

New prescribed fire research will be initiated in key silvicultural problem areas being identified through the strategic planning process. A jointly funded (federal government and MacMillan Bloedel Ltd.) study is providing opportunities to test fire behavior and impact monitoring methodology and hypotheses about the sensitivity of some coastal sites to prescribed fire intensity at different seasons, with regard to productivity of the succeeding forest plantation. Findings of other just-concluded contracted research into short to medium-term (15-year) productivity effects of prescribed burn intensity on some other coastal sites and on interior white spruce sites will be examined as to their implications as regards site-specific silvicultural burning prescriptions.

Environmental assessments

Project Leader: Dr. W. Stanek

Objectives

To fulfill the Canadian Forestry Service's responsibilities in the Environmental Assessment and Review Process (EARP) in the Pacific and Yukon Region by ensuring that environmental effects are considered in federal projects. To acquire baseline data and conduct forest environmental research.

Achievements

The assignments dealing with the assessment of the impact of the gas pipeline on the environment along the Alaska and Dempster-Klondike highways (Studies P 90 and 136) were completed. Many pertinent documents were written, reviewed and commented on; three major reports, 28 maps at a scale of 1:50000, and four maps at a scale 1:250000 were published. Appropriate information is on file in case of reactivation of these major developments. In 1984, all studies at PFRC were subjected to departmental assessment and were found to present no detrimental



Wind-blown deposit (loess) exposed during highway construction near Teslin Lake, Yukon.

impact on the environment. Based on B.C. regulations and Federal Guidelines for Initial Environmental Screening, they were permitted to proceed.

Available vegetation data collected during the review of the Alaska Highway Gas Pipeline were utilized to produce a field guide to ecosystem classification. Additional soil and tree growth information was collected in known locations along the Alaska Highway. The guide is intended for the practicing forester but should provide multi-faceted information about the environment of the areas studied. The compilation of a monograph on Sitka spruce in B.C. and the Yukon has been initiated and will take approximately three years to complete. The study of the effect of spacing in lodgepole pine stands on the incidence of Atropellis canker was completed and submitted for publication. Input was made to the development of PFRC grounds and associated public awareness facilities. A terminology of virgin peat and peatlands was published in the proceedings of the Int. Symposium on Peat Utilization, and the Ecotour from Kamloops to Golden was completed.

Projections

Continue representing CFS, PFRC in the EARP. Continue literature review re Sitka spruce in B.C. and Yukon. Provide technology transfer, and function as scientific authority in contracts. Provide input into "Public awareness and grounds improvement" and "Mensurational input into pest damage assessment" studies. Complete the field guide for ecosystematic classification of forest in the Alaska Highway area, Yukon Territory. Complete revision of the PFRC plantation record and make adjustments arising from the construction of the PFRC addition.

Meteorology in forestry

Project Leader: Dr. R.H. Silversides

Technician: R. Benton

Objectives

To acquire and apply meteorological knowledge to assist in the solution of forestry and environmental problems in the Pacific Region. In the shorter term, to develop and test one or more models which simulate climatic influences.

Achievements

Further field data has been gathered for two cooperative studies, bark beetle dispersal and inland spruce cone rust.

Instrument systems using data loggers continue to be improved.

The AES climate data base is now being used on the PFRC VAX computer.

Latest developments in wind modelling include improved output display procedures.

Projections

During 1985-86 further data will be collected for the bark beetle dispersal study. Sufficient data has now been collected for the inland spruce cone rust study, so that no more field experiments are planned until the data are analyzed and results published.

Work on numerical wind models will continue.

The AES climate data base will be utilized in a number of small studies.

Measuring weather for the mountain pine beetle dispersal study.



Carnation Creek experimental watershed

Project Leader: Dr. R.B. Smith

Professionals: Dr. G.M. Aubertin, 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

In cooperation with Dr. Hetherington and visiting scientist Dr. G.M. Aubertin, continued data collection and prepared a termination report on a major subsurface, storm-flow study. Monitoring of scanner valley-bottom, groundwater levels, measurement of fog-drip precipitation and processing and analyses of valley-bottom and slope hydrology data were continued.

Annual revegetation assessments were completed for 87 plots in 6 units and for an additional 28 plots as a pre-herbicide spraying record. Soil disturbance transects were re-run in two cut-blocks and data summarized.

Dr. Hetherington has completed a substantial portion of a chapter on "The importance of forests in the hydrologic regime". This will be included in a major book on Canadian Aquatic Resources sponsored by the Rawson Academy of Aquatic Science.

Projections

Valley-bottom, groundwater levels will be monitored during the summer and further sub-surface flow measurements and experiments conducted. Soil disturbance and slope hydrology reports will be prepared. Sixty-three plots will be reexamined in accordance with the revegetation study plan. A chapter of a book on Aquatic Resources of Canada will be completed.

Pest damage appraisal

Project Leader: Dr. R.I. Alfaro

Technicians: R.G. Brown, E. Wegwitz

Objectives

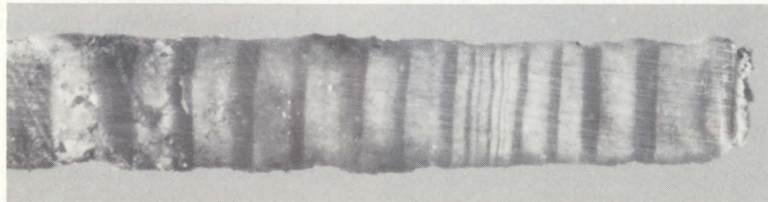
To determine the relationships between the level and duration of pest infestations and the loss of growth, form or mortality of trees and stands. To investigate, in cooperation with the National Forest Insect and Disease Survey, new techniques for the measurement of damage caused by forest pests in such a way that they become an integral part of national forestry statistics.

Achievements

Measurement of permanent plots to monitor pest levels and damage by tussock moth, budworm, western false hemlock loopers and spruce weevil, continued. Impact of the 1970's budworm infestation in the Fraser Canyon and Pemberton area was calculated; a report is in preparation. In a cooperative research effort, involving other PFRC scientists and industry, growth losses in western hemlock caused by hemlock dwarf mistletoe were quantified. Results were presented in a journal publication. Data analysis continued to calculate impact of the 1973-1975 tussock moth infestations in the North Thomson River area. Insecticide spray was again applied to individual trees near Kamloops in an experiment aiming at comparing growth between sprayed and unsprayed trees.

Projection

Existing damage appraisal permanent plots will again be measured, and data analysis on tussock moth impact to obtain per-hectare growth losses will continue. Field samples will be collected to measure growth losses in Douglas-fir caused by the western false hemlock looper in the Chase area. In cooperation with FIDS, permanent plots will be established to monitor impact of western spruce budworm defoliation on regeneration.



Increment core showing growth reduction in Douglas-fir by western spruce budworm.

Forest Resources

Dr. R.C. Dobbs, Program Director

Coastal Douglas-fir ecosystems and stand tending

Project Leader: Dr. H. Brix

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

Technicians: M. Clayton, C.R. Layton, K. McCullough

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.

Studies on nutrient cycling were continued including analyses of nutrients in foliage and litter and of factors affecting litter decomposition. Data on short- and long-term trends in utilization of soil water in relation to stand treatments were obtained. A study on wood density of Douglas-fir with different thinning and fertilization regimes, done in cooperation with FORINTEK, was completed.



Onsite technology transfer.

Reports were prepared on treatment effect on tree shape, absorption of gaseous ammonia by foliage, stem sapwood control of tree water stress, and cambial activity as affected by nitrogen fertilization; the report on 12-year growth response is being prepared for publication.

Projections

Studies on litter decomposition, nutrient losses and nutrient utilization will receive emphasis as inputs to the model of ecosystem changes in relation to stand treatments. A model of soil water budget will be developed to assist in growth projections at sites with different water regimes. Data on the 15-year treatment response and effects of refertilization after 6 years will be obtained.

Regeneration and silviculture systems

Project Leader: J.T. Arnott

Professionals: Dr. S. Eis, A.C. Gardner, D. Macey, Dr. R.G. McMinn

Technicians: D. Barwise, D. Beddows, D. Craigdallie, G.J. Goodmanson, M.A. Grismer

Objectives

To develop, test and demonstrate new nursery systems and improved methods of stand establishment and tending.

Achievements

High elevation species and stock type trials, run in cooperation with the B.C. Ministry of Forests, were appraised to determine fifth and seventh year survival and growth response of eight species planted in two series of experiments in mountain ecosystems of southwestern British Columbia. Field trials, to evaluate the suitability of introducing Engelmann spruce to the mountain hemlock forested zone of Vancouver Island, continue with third-year appraisals being completed in 1984.

An expanded series of inverted mounding trials were completed on four wide-range test sites in the B.C. Interior near Smithers, Fort St. Johns and Prince George. The objective is to determine if white spruce, planted on inverted mounds, with a range in depths of mineral soil cap, will improve the growth rate of

white spruce seedlings. Investigations of alternative white spruce stock types alone, and in combination with site preparation treatments, continue on spruce/subalpine fir sites in the Prince George Region.

Reporting continued on the earlier study of root, stem and crown development of five B.C. conifers. The relationship of tree biomass to changes in root weight proportions of western hemlock, western red cedar and Douglas-fir was analyzed and reported.

A trial to determine if auger planted improved the survival and early growth rate of lodgepole pine planted on forest landings in the Fort St. James region was evaluated five years after establishment.

In cooperation with the B.C. Ministry of Forests, field evaluations are being made on the influence that chemical root pruning has on early growth rates and root form of this species in the field. In addition, the influence of slow-release fertilizers on the early growth rate of this species is also being evaluated on these Vancouver Island test sites.

Projections

All comparative stock type and site preparation trials in coastal and interior B.C. and the southern Yukon will be maintained, measured and results reported. Problems associated with photoperiodism of high elevation and southern latitude species grown at coastal container nurseries will continue to be investigated.

Cone forecasting, seed quality improvement and certification

Project Leader: Dr. D.G.W. Edwards

Professionals: Dr. S. Eis

Technicians: D. Craigdallie, F.T. Portlock, D.W. Taylor

Objectives

To enhance the quality and quantity of forest tree seed supply in British Columbia and the Yukon by improving methods of cone forecasting, seed procurement, pro-

cessing and utilization. To develop and provide essential services for movement of seeds in international trade.

Achievements

Seed utilization research continued its focus on manipulating differences in moisture retention to separate viable and non-viable seeds. Some general procedures were developed. The method does not appear to discriminate as well as had been hoped in white spruce seeds although most seedlots tested showed significant improvement. In other species, notably lodgepole pine and Douglas-fir, seed qualities between 92%-96% were obtained. The separation step in the Incubation Drying Separation (IDS), process can be achieved in an air column, rather than in a water column, so the method can become a continuous-flow, rather than a batch, operation. The process is not yet applicable on a large scale.

A centrifuge method of detecting and separating mechanically damaged seeds produced good results, but needs more study of its useability on a practical scale. Procedures for heat-treating *Abies* seeds infested with insect larvae, without seriously harming germination were developed.

Four more species guides to interpreting reproductive strategies in conifers were prepared bringing, when published, the total to eighteen. Two others are to be prepared in 1985. As in previous years, the numbers of reproductive buds formed in winter were counted and the size of the subsequent cone crop in the following fall was evaluated. This added to the data base that will eventually lead to rating standards for cone crops.

The OECD and ISTA certification program for tree seeds moving in international trade, an integrated service unique in Canada, continued. A seed inspectors' training workshop was held to facilitate the initiation of seed certification activities in other regions of the country. The OECD Scheme expanded to include the registration of tree seed orchards to allow for certification of orchard (untested) seeds in 1985. Advice and services on seed quality assessment, cone maturation, seed and pollen supplies were maintained. Project Seed Regulations to accompany the Canada Seeds Act; a manual for testing tree seeds in this country, to become an appendix to the Regulations, has been drafted.

Projections

The feasibility of upgrading conifer seedlots, by manipulating the differences between viable and non-viable seeds to retain moisture, will remain the major thrust of the seed improvement work. Further tests of the centrifuge method, and the use of air separation as part of the IDS process will be included. Efforts will be made to develop the IDS process for use on a practical scale. Descriptions of the morphological characteristics of reproductive structures of white bark and lumber pines will be added to the "Reproduction of Conifer" series.

Forest land productivity

Project Leader: Dr. E.T. Oswald

Professionals: Dr. T.G. Honer, Dr. Y.J. Lee

Technicians: B.N. Brown, J.F. Dronzek

Objectives

To conduct field assessments and prepare reports on forest productivity, vegetation succession and classification of the forest resource in Ecoregions 1-14; to provide data to the national forest inventory of Canada; to monitor vegetation succession following recent burns; to develop functional computer based information storage and retrieval systems; and to test and utilize remote sensing technology for forest classification.

Achievements

Preliminary forest cover typing was completed on 27 1:250 000 map sheets and verified on 16 others in Ecoregions 1-14, using 100 ground samples in the verification. Field assessments for forest productivity and plant succession were conducted in Ecoregion 5 (Lake Laberge). Early seral vegetation was recorded on 44 permanent plots established in four recent burns, nine additional plots were established in a fifth burn, and five control plots were established. Computer data handling systems were developed or transferred to the new VAX computer for sample tree, field plot data, and forest productivity, plus part of the Yukon RRAMS systems. Two reports were published on Yukon forest resource and one on remote sensing. Project staff actively participated in national working groups on forest statistics, wetlands, and vegetation classification.

Projections

Evaluate and analyze new forest data sets and update computerized data handling systems and Yukon RRAMS; remeasure permanent plots for vegetation and tree growth, and establish additional plots as new sites become available; conduct field examinations to obtain data on forest cover, productivity, biomass, and vegetation succession; to establish permanent benchmark forest plots; evaluate new remote sensing technology; and participate in national working groups, symposia and conferences.

Fertilizers applied on snow

Project Leader: Dr. V.G. Marshall

Professionals: Dr. E. Hetherington, Dr. P.C. Pang

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

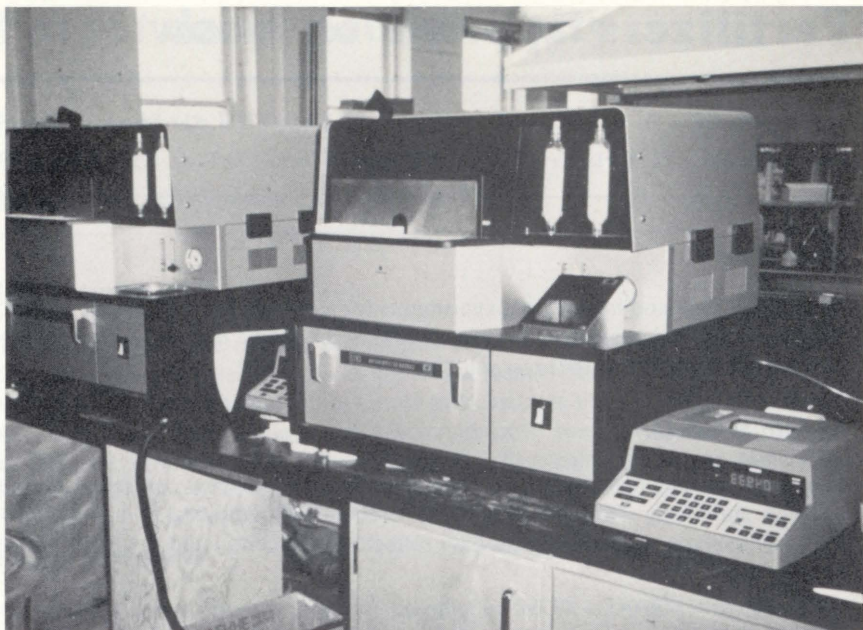
N-isotope analysis of already prepared plant and soil samples continued and remaining previously collected samples were chemically analysed as a prerequisite for 15-N analysis. Meteorological data collection was completed at Green Mountain.

Projections

To prepare the final report to the BCMF, write two scientific papers for journals, and consolidate the remaining field work of the project into a single study.



A variety of vehicles and equipment are required to collect data.



"Leco" carbon CR12 sulfur S132 analyzers.

Supporting services

Chemistry

Supervisor: A. Van Niekirk

Objectives

To provide inorganic chemical analysis of soil, plant material and water on a continuing basis to the research programs at PFRC.

Achievements

To reflect changing technology, an extensive upgrading and renewal of instrumentation and equipment has been completed.

Projections

To improve and increase routine analytical services required by the research staff.

Computing and statistics

Project Leader: J.S. Partridge

Professionals: S. Alers, S. Moncrieff, Dr. J. Pannekoek, D. Say, Dr. C. Simmons

Technicians: J. Foster, M. Simpson

Objectives

To provide computing equipment, software services, statistical services and computer operational support for the scientific and the administrative programs in the Pacific Forest Research Centre.

Achievements

Computer Services provided support for more than 70 research and technical staff. In 1984 a new VAX computer system was installed and the computer users were successfully moved onto it without any difficulty. Ten members of PFRC were extensively trained on the new system and another 32 members were given a brief training course. Eight new software packages were installed on the computer to improve user efficiency. As well, self-paced instruction courses were added to the library of programs available on the VAX computer. The Virtual Microcomputer for the VAX was leased for evaluation and was eventually purchased. The Computer Services Unit wrote many scientific programs and provided a consultation service for hardware, software and statistics.

Projections

The Computer Services Unit plans to continue to keep the computer hardware and software up to date and functioning satisfactorily. New equipment will be purchased and new software will be acquired or written to provide efficient and effective tools for science and administration. As well, the Computer Services Unit will continue to provide assistance and consultation to computer users and administration.



Forest Protection



Dr. T.E. Sterner, Program Director

Bark and wood-boring insects

Project Leader: Dr. L. Safranyik

Professionals: Dr. L.H. McMullen, Dr. H.A. Moeck, Dr. T.S. Sahota,
Dr. D.M. Shrimpton, Dr. H.S. Whitney

Technicians: R.E. Betts, A. Ibaraki, C.M. Lawko, D.A. Linton

Objectives

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

Achievements

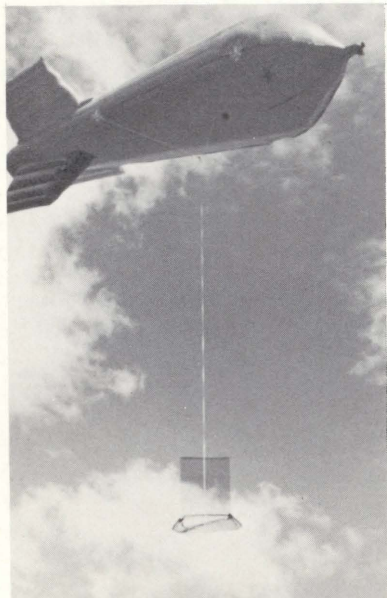
Eleven scientific and technical publications were prepared by project scientists on various aspects of bark beetle problems and control.

The incidence of spruce beetle infestations was evaluated in relation to elevation, site quality, stand age and spruce component of stands on a 2800 km² area that included 166 infestations. The effects of tree and stand diameter and total mortality on percentage of spruce trees killed in the various diameter classes of spruce were also evaluated in 29 infested stands from two outbreak periods. The infested stands were located in the Willow and Bowron River drainages southeast of Prince

George, B.C. In general, the incidence of spruce beetle infestations was directly related to site quality, stand age and the spruce component of stands, and inversely related to elevation. The results suggest that an effective stand hazard rating could be developed for the spruce beetle based on these factors.

Studies of bark beetle population quality are continuing. This work is aimed at discovering changes in bark beetle populations in relation population fluctuations and outbreaks. Digital images of cells are created and analyzed by using a special light measuring microscope and computers. Using these procedures, differences

Dispersal of mountain pine beetle studied by using traps suspended from balloons.



relating to reproductive capacity have been found in Douglas-fir beetle and spruce beetle before the insects are ready for reproduction.

In experiments on mountain pine beetle dispersal the use of balloons for supporting traps is being evaluated. So far, none of the few beetles trapped were from heights above tree tops. Excellent success was achieved by marking emerging mountain pine beetles on the bark of their brood trees by dusting the trees with fluorescent powder. In the field near Riske Creek, B.C., the lower 3m of 42 of 211 infested trees were dusted. Of 472 beetles collected in 32 barrier traps 37 (8%) were marked. Assuming that half the productive area of the treated trees were dusted, approximately 10% of the total productive bark area was dusted. Hence, marked beetles were trapped in proportion to their relative abundance suggesting that the powder did not have a significant effect on their dispersal behaviour.

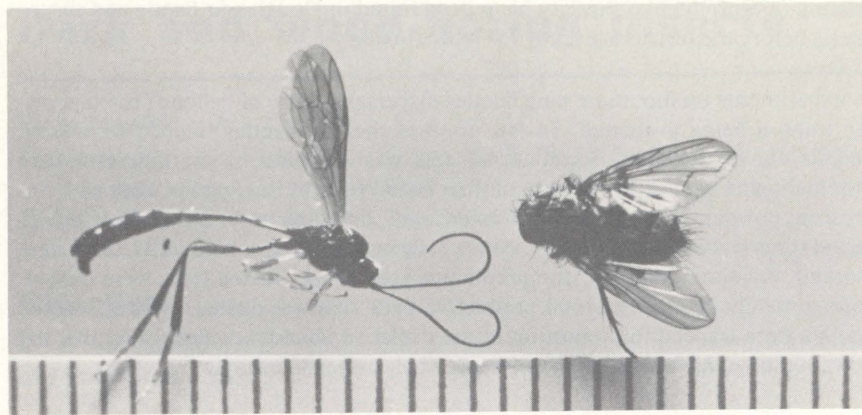
As part of the US/Canada agreement on mountain pine beetle, field plots are being established within the range of the bulk in B.C. to evaluate existing hazard routing systems. Plots were established in the Cariboo and Nelson districts this year in stands threatened or just coming under attack. Further plots will be measured in Prince Rupert and Kamloops districts next year. Plots will be re-evaluated after about three years and the accuracy of each hazard rating system assessed. Spin off from this study will be the detailed information on effects of mountain pine beetle on a variety of stand types and detailed loss figures.

Two pine oil formulations were applied with a garden pressure sprayer to the lower 3m of the bole of pheromone-baited lodgepole pine near Alexis Creek. Attack on trees treated with one of the formulations was significantly less than on check trees, and the proportion of galleries that were successful was significantly less than either the check or the other formulation.

The project leader conducted two workshops on the management of mountain pine beetle problems and served as chairman of "The Technical Committee on Mountain Pine Beetle" which included representatives from CFS, Parks Canada and protection personnel from the B.C. Ministry of Forests and the Alberta Forest Service. Dr. McMullen visited Drs. Amman and McGregor of the USDA Forest Service for discussions of dispersal studies and an overview of field sites demonstrating the effects of stand treatments on mountain pine beetle activity. Drs. Shrimpton and Safranyik supervised two contracts re reports on operational procedures in B.C. to combat mountain pine beetle and a literature review of recent advances in mountain pine beetle management.

Projections

Publish management guidelines for the spruce beetle; continue studies of mountain pine beetle dispersal, hazard rating systems and effects of pine oil in preventing attacks on individual trees.



The parasitic wasp (left) and parasitic fly introduced against winter moth.

Biological control of forest pests

Project Leader: Dr. M. 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, O.J. Spanier, 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

Most details of an integrated pest management system for Douglas-fir tussock moth have now been published. Our latest trials with the nuclear polyhedrosis virus of this pest clearly show that virus spraying can sufficiently reduce pest populations to prevent tree death.

A parasitic wasp and a parasitic fly were introduced around 1980 to control winter moth attack of oaks and fruit trees; they are parasitizing an increasing proportion of the pest population each year. Winter moth populations now appear to be declining, probably due to the increasing level of parasitism.

When powder containing *Beauveria bassiana* spores was dusted onto the bark of lodgepole pine trees and mountain pine beetle were then caged onto the trees, a small but significant number of beetles infected themselves and died within a short period.

Field surveys on the natural enemy complex of the Sitka spruce weevil and of the mountain pine beetle were continued. Some notably common natural enemies have been identified for further investigation.

Projections

Parasitoid or predator introductions to help control several forest insect pests will continue to be implemented and/or monitored. Particular attention will be given to larch casebearer and larch sawfly. Experiments designed to increase the numbers of mountain pine beetles infecting themselves with *Beauveria bassiana* will begin. Experiments will continue on possible ways to manipulate parasitoids and predators to help manage populations of mountain pine beetle and Sitka spruce weevil. A pheromone detection system is being developed for black army cutworm.



Virus application.

Root diseases

Project Leader: Dr. W.J. Bloomberg

Professionals: Dr. D. Morrison, Dr. Y.J. Lee, G.D. Jensen (educational leave 1984-85)

Technicians: D. Chu, A. Hall, A.L.S. Johnson, G. Reynolds

Objectives

To define the epidemiology and impacts of root diseases in second-growth stands, to develop control strategies and to expedite application of research results.

Achievements

Stump sampling in spaced stands to determine the effects of tree species, stump diameter, season of spacing and ecological zone on stump colonization by *Fomes annosus* was completed for coastal B.C. Permanent plots were established in a 20-year-old Douglas-fir stand near Vernon to determine rate of spread of *Armillaria ostoyae* in young stands. Rate of spread of the fungus along roots of 60-year-old trees is measured periodically at two interior locations. This data will be used in a model of *Armillaria* spread and impact. Damage surveys for Black stain root disease in 12 interior lodgepole pine stands were completed. The disease appears about age 45 and the number of centers and area occupied gradually increases. Excavation of stumps of diseased pines one and two years after falling revealed that the fungus was viable to a limited extent after one year and could not be isolated after two years. Management recommendations for diseased stands are to harvest before losses become significant and to restock immediately.

Increased research emphasis has been placed on providing forest managers with a choice of control options for *Phellinus* root rot of coastal Douglas-fir stands including mechanical, chemical, biological and silvicultural treatments. Field trials of modified spacing in root rot-infected stands were established. Plans are being made to establish demonstration areas for stump removal treatments and species resistance trials. Results of fumigant treatment of infected trees and stumps were analysed.

Advantage was taken of three federal job-creation contracts to collect badly needed information on ecological type relationships with *Phellinus* root rot and on impact of the disease in near-mature stands. Preliminary analyses indicate that probability of the disease is significantly higher in some ecotypes than in others. In some stands, growth loss due to the disease has been detected over periods up to 30 years.

Successful use of color infrared aerial photography to detect *Phellinus* root rot in coastal Douglas-fir stands has been demonstrated. Scales of 1:6000 for young stands and 1:15000 for old stands gave adequately accurate results.

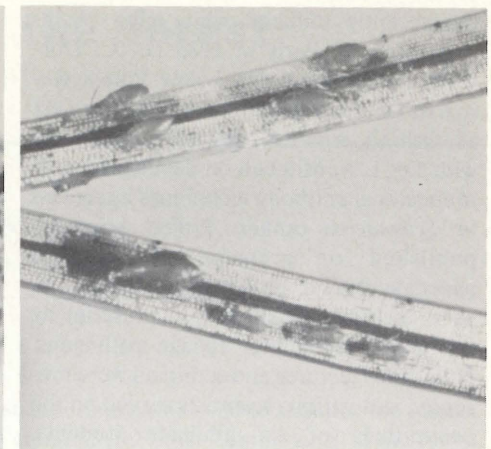
Technology transfer was undertaken primarily in relation to training field crews in recognition and surveying for root rots on the coast and in the Interior.

Projections

Projections for this project are to supply forest managers with guidelines for recognition, risk assessment, impact estimation and control strategies for the major root diseases in British Columbia.



Insect damage to white spruce cone.



Green spruce aphid — an important seed orchard pest.

Regeneration pests

Project Leader: Dr. J.R. Sutherland

Professionals: Dr. A. Funk, Dr. R.S. Hunt, Dr. M. Meagher, Dr. G.E. Miller, Dr. T.S. Sahota, Dr. E.E. White, Dr. C. Dorworth, Visiting Scientist, Dr. L.A. Mitchell, NSERC, P.D.F.

Technicians: H. Craig, J. Dennis, A. Ibaraki, F. Portlock, U. Rink, D.S. Ruth, T.A.D. Woods

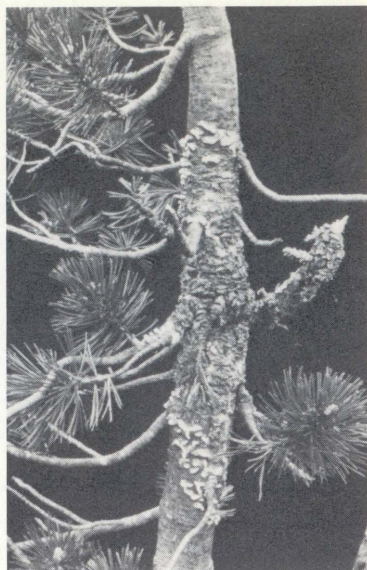
Objectives

To identify the major insect and disease pests 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

In mid-1984, the project was re-organized and became Regeneration Pests. Four additional scientists joined the project, i.e. Dr. A. Funk (mycologist) who will concentrate on foliage and canker diseases in seed orchards, provenance trials and young plantations; Drs. M. Meagher (geneticist/tree improvement), R.S. Hunt (pathologist) and E.E. White (geneticist/biochemist), all of whom will work on

the recently initiated white pine blister rust research. Early in 1985 Dr. C. Dorworth from the Great Lakes Forest Research Centre in Ontario joined the project as visiting scientist. He will collaborate with Dr. L.A. Mitchell on development of monoclonal antibody techniques as applied to *Scleroderris* canker. Project scientists published or prepared 27 scientific papers/symposia proceedings during the year, including a 200 page manuscript by Dr. Funk on conifer foliage pathogens. Numerous lectures and seminars were presented and various scientists served on the committees of six graduate students. Cooperation was especially good between project members and client agencies such as the B.C. Ministry of Forests and forest companies. Technology transfer continues as a particularly strong component of the project with over 300 (a 50% increase over last year) requests, being received for pest diagnosis and management recommendations in nurseries and seed orchards. Some research highlights included development of sampling procedures for Douglas-fir cone gall midge eggs (Dr. Miller); discovery that *Meria laracis* can defoliate Douglas-fir (a new host) seed orchard trees (Dr. Funk); completion of spruce cone rust epidemiology and fungicide control experiments (Dr. Sutherland); use of haemolymph proteins for distinguishing 1 and 2 year diapause in Douglas-fir cone moth (Dr. Sahota); and development of 30 cloned hybridoma cell lines that produced monoclonal antibodies directed to unique antigens of the seed-borne pathogen *Sirococcus* (Dr. Mitchell). Some accomplishments in the white pine blister rust research were completion of a literature review and a comprehensive proposal for genetic improvement of white pine (Dr. Meagher), a *Ribes* garden was established in cooperation with CIP Forest Products (Dr. Hunt) and techniques were tested for cytoplasmic DNA analysis (Dr. White).



Canker of white pine blister rust.

Projections

Identification and management of pests in nurseries, seed orchards and newly reforested areas, especially research on white pine blister rust will be emphasized. Pheromone testing and insect biology, specifically of cone and seed insects of Douglas-fir and spruce will be conducted. Investigations will be conducted on needle diseases in seed orchards, nurseries and a canker disease in the North Thomson. Plans are to develop a sensitive immunoassay for detecting *Sirococcus* in seed extracts using monoclonal antibodies.

Chemicals and the forest ecosystem

Project Leader: Dr. J.E. Manville

Professional: A.C. Gardner, J.P. Senyk

Technicians: D.R. Barwise, T.L. Fraser, R.K. King

Objectives

To assess the role of chemicals in host-pest interactions and to monitor the impact of specific herbicides on commercial conifers and other components of the forest ecosystem. To show, by extensive analytical chemistry, that external stimuli cause chemical changes to occur within plant cells and to determine their extent and duration. To determine the biological and physical characteristics of not-satisfactorily restocked sites in B.C. To observe and measure growth, form and morphological condition of conifers and competing vegetation following the implementation of weed control strategies.

Achievements

The analytical organic chemical laboratory was automated and a micro-computer added to provide efficient data storage, retrieval and manipulation. Studies in cooperation with other PFRC researchers have led to the development of new chemical lures, an understanding of host-pest interactions, and conifer responses to external stimuli. A major effort was expended in cooperation with the BCFS and the forest industry in preparing a problem analysis entitled "FOREST VEGETATION MANAGEMENT IN B.C.: THE HERBICIDE COMPONENT." A cooperative herbicide trial at Carnation Creek, Vancouver Island was conducted. A similar study was initiated at Skeena River, Terrace. The major cooperators were Forest Pest Management Institute (FPMI), BCFS and Fisheries and Oceans (at Carnation Creek).

Projections

Research efforts will continue to obtain chemical data on conifer species to demonstrate that the use of herbicides induces chemical changes within plant cells. Studies will be conducted to measure and evaluate growth, yield and morphological condition of conifers following semi-operational aerial herbicide applications. Herbicide trials are planned for Skeena River and suitable sites in the southern interior will be selected. Major co-operators will be the Forest Pest Management Institute and the British Columbia Ministry of Forests.

Ecological land relationships will be studied in order to predict vegetation succession patterns leading to management prescriptions that favour crop regeneration, hinder vegetation competition and soil degradation.

Digital imaging for forestry

Project Leader: Dr. F.G. Peet

Objectives

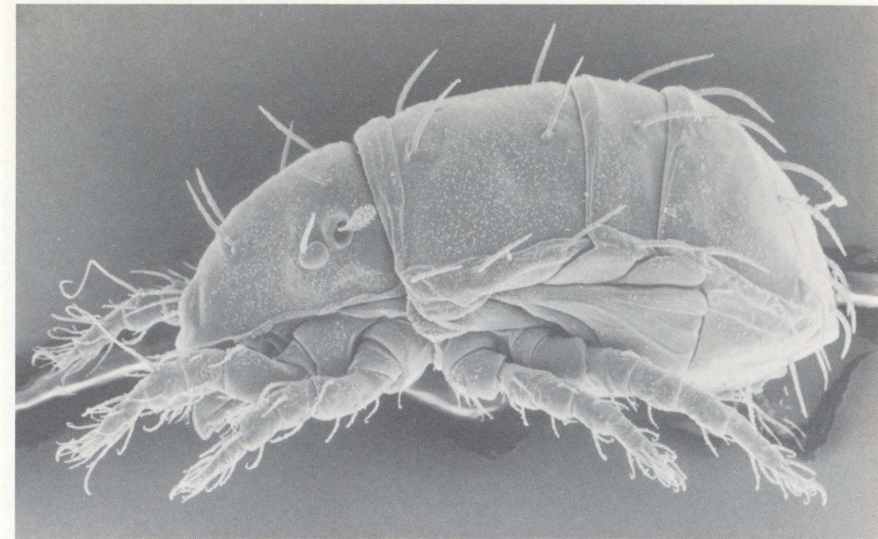
To research, develop, and apply digital image processing techniques to problems in forestry in the areas of optical microscopy, electrophoresis, and tree reproduction.

Achievements

Prior to 1984/85 a digital imaging system for optical microscopy had been developed and a prototype system for electrophoresis gels had been evaluated. During the past year, analysis methods for optical microscopy were generalized to handle more than two populations and these methods were implemented; a high resolution multispectral scanning system for optical microscopy was acquired and tested; and, a television data acquisition and editing technique for electrophoresis gels was devised and implemented. Data for approximately two hundred gels was acquired and edited.

Projections

During the coming year work will proceed on the conversion of the existing digital image processing system to a new computer.



Soil mite that contributes to litter decomposition in forests. Brachychthoniidae.

Microtechnique and electron microscopy

Project Leader: L.E. Manning

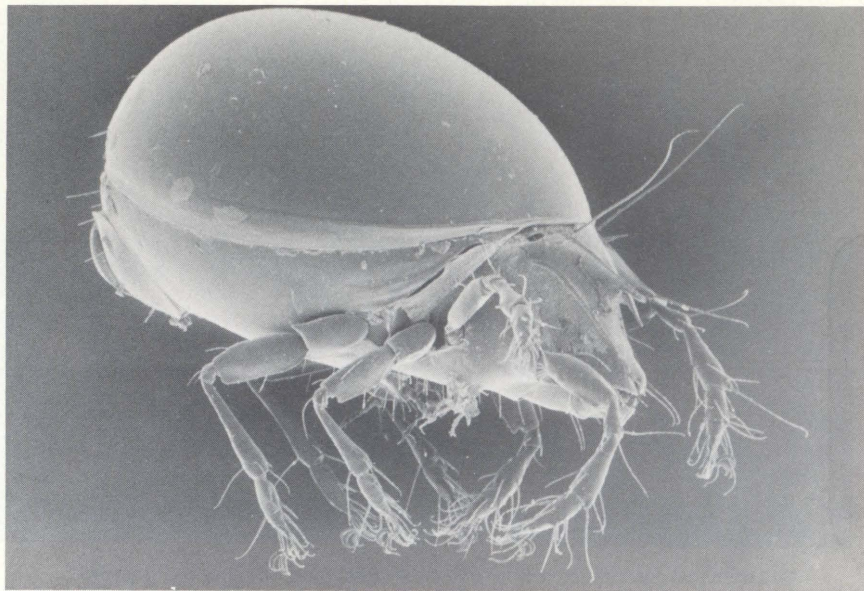
Objectives

To maintain an optical and electron microtechnique facility capable of providing the required assistance to the various research studies at PFRC. To develop and refine skills and methodology needed in specialized research including ultramicrotomy, sample preparation and photographic interpretation.

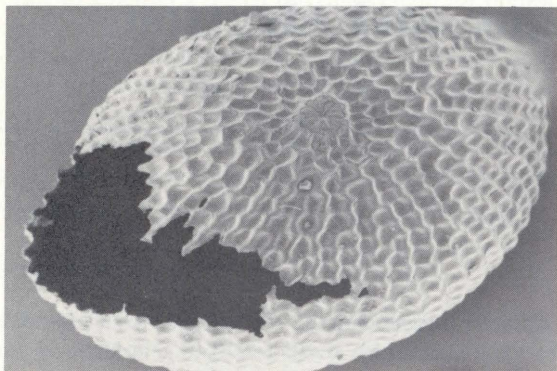
Achievements

A wide variety of research studies benefit from the optical and electron microtechnique facility at PFRC.

An ongoing study of White pine blister rust involved the Scanning Electron Microscopy (SEM), examination of Ribes leaves inoculated with *C. ribicola* uredospores, the fluorescence scope and SEM examination of white pine needles for basidiospores; then, light microscope study of serial sections of needles to study



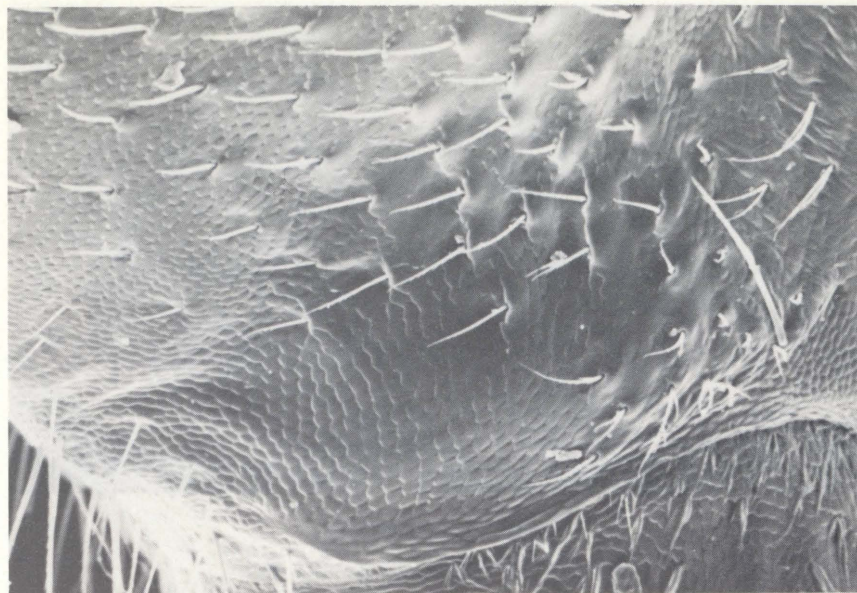
Soil mite Liacaridae.



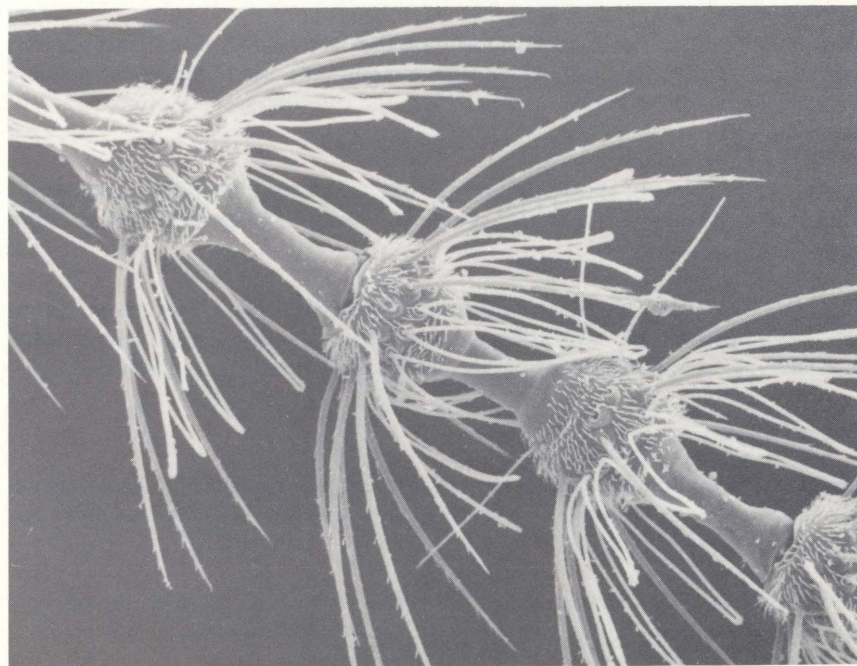
Black army cutworm egg.



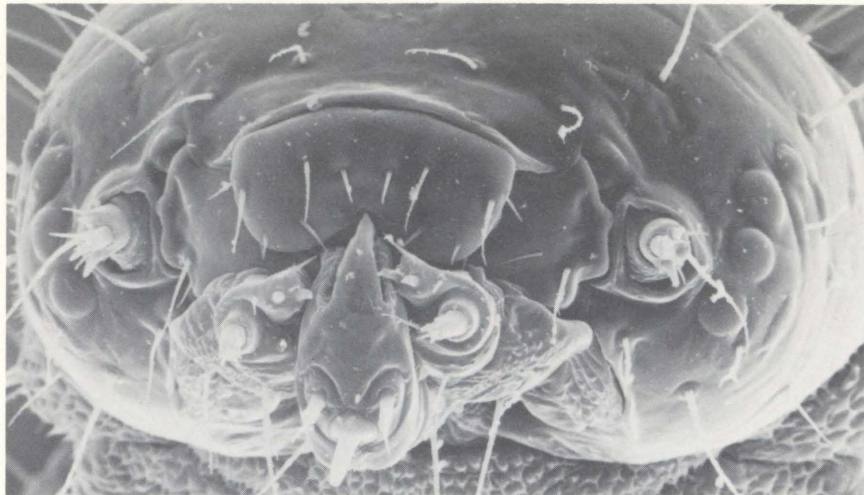
Microconidia of Fusarium.



Morphology of *Dendroctonus* in B.C. *Dendroctonus ponderosa* episternal area.



Antennal segments of Douglas-fir gall midge — the major D. fir pest of the coast.



2nd instar spruce budworm.

spore germination. Ultra-thin sections were also prepared for Transmission Electron Microscopy (TEM).

Three other studies that involved TEM were the examination of conifer broom for rickettsia-like bacteria, examination of mountain pine beetle larvae for possible viral pathogens and examination of DNA in the chloroplasts and mitochondria of pine needles.

A study of Engelmann and White spruce shoot apices combined light microscope examination of serial sections through an apex with SEM examination of entire samples.

Further SEM studies included investigations of fusarium and Sirococcus; soil inhabiting mites; tracheid walls from defoliated trees; Douglas-fir gall midge; *Dendroctonus* spp. morphology; sensing structures on parasites; and fungal cultures.

Projections

Research will continue to further develop and adapt techniques for Transmission and Scanning electron microscopy while maintaining the classical histological services to all research studies at PFRC.

Several studies have benefited greatly by examination of the same samples by SEM, TEM and light microscopy due to the specialized information available from each method. Combining two or more techniques shows great potential for future studies.

Forestry Relations and Development

J.A. Edwards, Program Director

Forestry relations and technology transfer

Project Leader: J.P.G. de Lestard

Professional: J.C. Edwards

Objectives

To offer consultative and advisory services as well as ensure the transfer of forest technology to clients in a timely and effective manner. To aid scientists to develop practical applications for research discoveries and assist clients to incorporate the results into management and operational systems. To assess forest resource development issues and initiatives and provide professional support during the development and implementation of forestry agreements.

Achievements

Major accomplishments included the initiation and organization of policy and operational meetings between PFRC Management and forest industry executives, Chief Foresters and industrial associations. Meetings were held with the COFI Coast Directors — Coast Forestry and Logging Committee, COFI Forest Management Committee (also field trip), Interior Lumber Manufacturers' Association, Cariboo Lumber Manufacturers' Association and the Northern Interior Lumber Sector (COFI). Industrial opinions assist with the development of CFS policy and research and development activities.

Liaison with the forest industry, UBC, the Yukon Forest Service and B.C. Ministry of Forests facilitated plans proposed by Svenska Cellulose (SCA Skog AB) of Sweden to conduct cooperative outplanting trials of genetically improved seedlings at northern latitudes in B.C. and Yukon.

Forestry relations activities included: participation in the Association of B.C. Professional Foresters interagency Advanced Silviculture Task Force; preparation of training module II (Quantitative Skills and the Management Context) and assisting with a report recommending the establishment of a Silviculture Institute of British Columbia (S.I.B.C.); formalizing a master agreement between UBC and PFRC to maximize forestry-oriented teaching, cooperative research and student development opportunities; organizing and/or participating in tours for the Minister of State (Forestry), international visitors and CFS establishment directors; preparation and revision of ministerial briefing notes including Meares Island and South Moresby Islands; planning activities for the 1986 PFRC Open House by participating on the Steering Committee (Chairman) and subcommittees.

Technology transfer activities included: serving on the Canada/British Columbia Herbicide R&D Subcommittee, contributing to a vegetation management problem analysis and preparing a report on aerial application equipment and systems for use in B.C.; assessing and preparing status reports on equipment developments including the BCMF Ripper Spot Moulder, Brücke Moulder and Tree Monkey; assisting with the field testing, production of a promotional video tape, the applications for patents and PILP funding to manufacture a pre-production model of the Tree Monkey; investigating robotics systems and an electrostatic dry chemical pesticide applicator; identifying potential demonstration areas on DND lands and participation in meetings to discuss technology transfer opportunities with industry and government staff.

Projections

Liaison will be expanded between PFRC and the forestry community in the Pacific and Yukon Region to impart an awareness of ongoing research and development activities and assess regional concerns which could be addressed by technology transfer action.

Activities will be directed to preparing for the official opening of the renovated and extended PFRC building and to an Open House in 1986.

Technology transfer services will concentrate on preparing all-inclusive audiovisual training modules to replace root disease seminars as well as displays for Open House 1986; organizing and participating in a Prescribed Burning Workshop; organizing a joint Forest Fertilization Symposium; writing an article relating sub-surface water flow rates to logging in the Carnation Creek Experimental Watershed; developing demonstration areas and silvicultural management programs suggested to be effective to reduce mountain pine beetle damage and preparing materials for a national seminar of the Canadian Forest Fire Danger Rating System.



Liaising with executive of Cariboo Lumber Manufacturers' Association while visiting PFRC.

Development of economic guidelines

Project Leader: Dr. G.H. Manning

Professionals: G.A. Fraser, Dr. E.A.F. Wetton, W.A. White (on education leave)

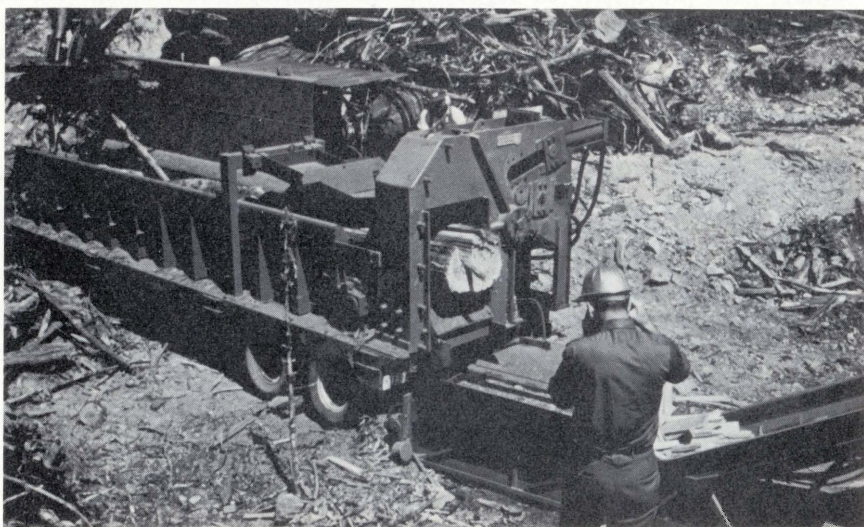
Technicians: C. Macklin, J. Rudd

Objectives

To provide economics and policy advice to the department, its cooperators, and the management and staff of PFRC, to improve the information base in forest economics, and manage PFRC's participation in the ENFOR program.

Achievements

In 1984-85, the major thrust of the project was the support of negotiations for a new Canada-B.C. Forest Resource Development Agreement, through the provision of policy and economics advice, preparation of Agreement documentation, and research in pertinent areas. Studies underway during the year included those in forest-dependent communities, silvicultural costs and labor content, and techniques for assessing benefits and costs of forestry programs. Work also continued on analyses to provide basic forest management tools for the Yukon.



Reducing logging residues to bioenergy fuel.

During 1984/85, W.A. White was on educational leave at Simon Fraser University, and G.A. Fraser was seconded to CFS Headquarters to lead a study of the economic impact of acid rain on the forestry sector. Dr. E.A.F. Wetton was hired on a term appointment to replace him.

With regards to ENFOR, in 1984/85 five contracts were in process. These contracts included the testing of biomass transportation systems, local economic impacts of biomass harvesting, and the role of biomass in the pulp industry's investment plans.

Projections

During 1985-86 this project will continue to provide planning, economic and policy advice and liaison as required by CFS/PFRC staff and other client agencies. Where required, this will be supported by research studies. Management of the ENFOR program will continue.

Planning

Project Leader: J.G. Skinner

Objectives

To lead, develop and coordinate the planning activities of the Pacific Forestry Centre; to provide management with the information necessary to effectively decide where research, technical and development program resources should be allocated in future years; and to integrate the Pacific Forestry Centre planning requirements with those of the Canadian Forestry Service.

Achievements

The 1985/86 Work Plan for the Pacific Forestry Centre was completed and the necessary input to the planning cycle provided.

Projections

During 1985-86, this project will plan, develop, coordinate and prepare work plans and management information systems in keeping with the requirements of the Ser-

vice; plan, develop and coordinate the preparation of necessary input to the Strategic Plan of the Service; and coordinate the Work Plan for 1985-86 for the approval of Management.



Environment 2000 program provided work for unemployed youth between ages of 16-24.

Job creation

Project Leader: D. Mills

Professionals: M. Atherton, J. Burch, C. Laird

Objectives

To represent CFS in the implementation, administration and evaluation of federal forestry job creation projects.

Achievements

The Environment 2000 program was completed on March 31, 1985. Over its one year duration, 68 projects were undertaken in the forestry sector creating an estimated 13 660 weeks of work for those unemployed but not necessarily on unemployment insurance. In addition, 5 projects were undertaken in the Yukon providing 824 weeks of work. The program was designed to extend and accelerate activities which contributed to the conservation, preservation and restoration of the natural environment. These objectives were fulfilled through the development of forest and ecological demonstration areas, juvenile spacing, brushing and weeding in young plantations, and a number of pest control projects.



Environment 2000 provided over 14 000 weeks of work for unemployed youth in B.C. and Yukon.

The major benefactors were the youth, 16-24 years, participating in the program. The sponsorship of projects included approximately 17% Community groups, 6% nonprofit organizations, 6% educational institutions and 9% native organizations. The balance of projects were distributed between municipalities, 8%, integrated business, 20%, forestry contractors, 34%, and individuals, 1%. The relatively good quality of work and the adaptability of the program to a wide range of worthwhile projects which would not normally be undertaken enabled the Environment 2000 forestry program to provide a positive contribution to employment and the forest resource.

Projections

During the early part of the 1985/86 year, projects will be finalized and an internal evaluation done on the Environment 2000 program.

New job creation programs involving the CFS have not been announced.

Development agreements — New initiatives

Project Leader: J.G. Skinner

Objectives

To plan and negotiate by March 31, 1985 a replacement five year agreement with British Columbia for forest renewal and management.

Achievements

In 1984-85 an extension of the current Intensive Forest Management Subsidiary Agreement was concluded. Documents for the new Agreement were prepared including Cabinet Memorandum, Discussion Paper, Treasury Board Submission, Privy Council Order, Press Release, letters etc.

Projections

To plan and develop and coordinate the management information systems for the implementation of the new agreement. The documentation for the new forest resource development agreement was completed including Cabinet Memorandum, Discussion Paper, Treasury Board Submission, Background information etc. The Agreement was signed by Ministers in May 25, 1985.

Development agreement — Implementation

Project Leader: V.G. Ulrich

Professionals: M. Atherton, J. Burch, C. Laird, D. Mills

Objectives

To represent CFS interest in the implementation, administration and evaluation of federal forestry development initiatives; to provide advice related to management and utilization of forest resources on Indian reserves; and to provide coordination and administration guidance for the subvention programs dealing with external research and university support which includes programs to strengthen the forest research capability within the universities.

Achievements

The Canada British Columbia Subsidiary Agreement on Intensive Forest Management (IFMSA) dated May 17, 1979 was extended for one year and terminated March 31, 1985. The total federal program budget and expenditure was \$30 500 000 for the six years with an additional contribution of \$30 500 000 being made by the Province. It is estimated that 354 225 hectares have been treated under this program through backlog reforestation, juvenile spacing, fertilization and research.

A three-year "Program of Research by Universities in Forestry" (PRUF) successfully completed its second year. For 1984/85 five projects were implemented in the Pacific Region with a total expenditure of \$127 000.

Projections

In 1985/86 three new P.R.U.F. projects have been approved for the Pacific Region with an estimated cost of \$28 470. During 1985-86, the accounting of the IFMSA program will be finalized with an evaluation and a final audit. It is anticipated that a new five year Canada-British Columbia Forest, Resource Development Agreement will be signed in 1985-86. Advice and assistance will be given on the development of project proposals for other government programs such as the Program for Industry/Laboratory Projects (PILP), Industrial Research Assistance Program (IRAP), Unsolicited Proposals and programs by the National Services and Engineering Research Council of Canada. Assistance will also be given on specific projects involving Technology Transfer and the Forestry Relations program. Assis-

tance and data will be provided as required to the Economic Analysis program and to the Planning program. Finally this project will be providing coordination and administrative advice for the Subventions program.



Administration



R.M. Dean, Management Services Officer

Administration

Management Services Officer: R.M. Dean

Librarian: A. Solyma

Finance Officer: W.D. Evans

Physical Plant: E.K. Hopps

Photographer: E. Chatelle

Administrative Support: J. Andersen, B. Baker, P. Chambers, L. Donk, A. Eng, H. Gray, D.A. Greenway, H. Henriksen, J. Horsland, E. Hosie, R. Hughes, A. Inness, M. Johnson, G. Kazmiruk, H. Matson, R. McPhee, M. Mitchell, M.D. Mosley, L. Palmer, W.A. Pearce, R.H. Reid, S. Reid, R.M. Richardson, S. Schaub, J. Strobbe, B.J. Vander Heiden

Objectives

To provide a system of financial control and accountability in accordance with statutory and regulatory requirements; to provide general administrative support services including material management, records management, secretarial services, vehicle fleet management and reception-switchboard services; to provide physical facilities for the total Centre and eleven field locations.

Achievements

Financial management and accountability was conducted in accordance with the objectives of the Centre and within the statutory and regulatory requirements. Physical Plant operations and preventative maintenance programs have been continued at a high level with major repairs to the heating system completed in October. Vehicle operations were maintained at 50 units supplemented by short term rentals. Negotiations continued with CFS-HQ re funding for the furnishings for the new laboratory and administrative wing but this remains unresolved at the end of the fiscal year.

The Librarian completed a contract with a subscription agent to handle all journal renewals at the Centre. Planning continues for the relocation of all support services to the new wing schedules for June 85.

Projections

It is planned to meet all the existing administrative needs of the research and development programs and to address new requirements subject to available resources. Plant operation costs will be monitored closely to determine the impact of the new Laboratory Wing and other facilities on the administration budget. The photography studio will be upgraded during the Phase III renovation contract and the obsolete graphic arts camera will be replaced.



Information Services



E.L. Teske, Head, Information & Editorial Services

Information services

Project Leader: E.L. Teske

Professional: D. Barkhouse, S. Glover

Support: B. Page, J. Wiens

Objectives

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

Achievements

Provided the Centre with editorial and graphic services; answered enquiries from clients; published "Information Forestry" newsletter, issued news releases and maintained media contacts; organized seminars and workshops; published PFRC Program Review; provided tours of PFRC for university, community college and high school students as well as some more specialized tours; participated in several major exhibits; edited over 100 articles for journals or research papers; and conducted public relations programs for the employment stimulation and forestry development and relations programs; produced a new exhibit as well as posters and other handouts in support of the 1985 National Forest Week.

Projections

Plans for 1985-86 include developing media and public relations support for the 12th Commonwealth Forestry Conference to be held in Victoria in September, 1985; working with the the B.C. Forest Museum to develop a new CFS display for the Museum; refurbishing the mobile trailer with exhibit material which will then be used as an orientation centre for the on-site forest/nature trail; publishing a self-guiding brochure for the trail; carrying out the Communications plan in support of the Canada/British Columbia Forest Resource Management Agreement; planning and executing opening ceremonies associated with the expansion of PFRC; planning and organizing a Centre-wide Open House early in 1986, and conducting other related public relations and editorial activities.



Appendixes



Contracts Let or Supervised by PFRC in Fiscal Year 1984-85

Energy From the Forest (ENFOR)

- A) MINISTRY OF FORESTS
31 Bastion Square
Victoria, B.C. V8W 1J1

Development of a comprehensive weight-based inventory of woody forest biomass for British Columbia.

- August 23, 1983 to April 30, 1984
- Contract = \$250,000.00
- Expenditure (84-85) = \$75,000.00

- B) J. BLAKENEY
1401 Laburnam Street
Vancouver, B.C. V6J 3W4

Presentation of paper for ENFOR program entitled "Development and Testing of Systems for Utilizing Forest Biomass for Energy in Canada".

- February 21, 1984 to April 9, 1984
- Contract = \$2,500.00
- Expenditure (84-85) = \$1,000.00

- C) TALISMAN LAND RESOURCE CONSULTANTS
300 - 842 Thurlow Street
Vancouver, B.C. V6E 1W2

Development of a review and problem analysis of the soil physical and biological properties resulting from biomass harvest.

- February 18, 1985 to March 31, 1985
- Contract = \$9,125.00
- Expenditure (84-85) = \$9,125.00

- D) ROBINSON CONSULTING AND ASSOCIATES LTD.
2526 Government Street
Victoria, B.C. V8T 4P7

Study of role of biomass in the British Columbia pulp and paper industry's energy strategy.

- February 13, 1985 to March 31, 1985
- Contract = \$15,000.00
- Expenditure (84-85) = \$15,000.00

- E) TRANSAMERICA ENVIRONMENTAL SCIENCE CONSULTANTS
P.O. Box 69
Duncan, B.C. V9L 3X1

Study to determine the effects of special biomass removal situations of forest wildlife

in British Columbia.

- May 1, 1984 to March 31, 1985
- Contract = \$44,987.50
- Expenditure (84-85) = \$44,966.17

- F) McDANIELS RESEARCH LTD.
910 - 475 Howe Street
Vancouver, B.C. V6C 2B3

Development of a planning and evaluation model for improved decision-making under the ENFOR program (Phase 1).

- January 8, 1984 to July 30, 1985
- Contract = \$50,000.00
- Expenditure (84-85) = \$35,000.00

- G) NAWITKA RENEWABLE RESOURCE CONSULTANTS LTD.
836 - 840 Cormorant Street
Victoria, B.C. V8W 1R1

Determination of the regional socio-economic impact of an integrated fuel and fibre production and merchandising system for the British Columbia coast.

- April 25, 1983 to March 31, 1985
- Contract = \$59,205.00
- Expenditure (84-85) = \$28,126.87

- H) FOREST ENGINEERING RESEARCH INSTITUTE OF CANADA (FERIC)
201 - 2112 West Broadway
Vancouver, B.C. V6K 2C8

Development and testing of special equipment for EHT recovery of roadside biomass in mountainous terrain.

- May 14, 1984 to March 31, 1985
- Contract = \$150,000.00
- Expenditure (84-85) = \$144,000.00

Program of Research by Universities in Forestry (PRUF)

A) UNIVERSITY OF BRITISH COLUMBIA Vancouver, B.C.

- 1) Collection and analysis of lodgepole pine wood, bark, foliage and stump-root systems for species characterization.
 - June 12, 1983 to March 31, 1985
 - Contract = 97,700.00
 - Expenditure (84-85) = \$57,238.00
- 2) Study to improve salmon spawning area using gabions in land slide-damaged streams.
 - June 6, 1983 to March 31, 1984
 - Contract = \$16,500.00
 - Expenditure (84-85) = \$1,971.27
- 3) Study of the patterns of nitrogen mobilization on interior British Columbia cutovers.
 - June 6, 1983 to March 31, 1985
 - Contract = \$35,370.00
 - Expenditure (84-85) = \$17,439.65
- 4) Study the effects of burning and mechanical site preparation on nutrition of planted white spruce.
 - June 6, 1983 to March 31, 1985
 - Contract = \$50,000.00
 - Expenditure (84-85) = \$25,000.00
- 5) Brush competition in coastal British Columbia plantations.
 - June 6, 1983 to June 5, 1984
 - Contract = \$31,051.00
 - Expenditure (84-85) = \$9,970.34
- 6) Evaluation of x-ray energy dispersive spectrometry as a tool in seed certification.
 - September 14, 1983 to March 31, 1984
 - Contract = \$22,022.00
 - Expenditure (84-85) = \$5,956.73

B) UNIVERSITY OF VICTORIA Victoria, B.C.

- 1) Study of the relationship of groundwater and subsurface water flow rates to logging activities on steep mountain slopes of the carnation creek experimental watershed.
 - July 1, 1983 to June 30, 1984
 - Contract = \$32,000.00
 - Expenditure (84-85) = \$9,500.00

Others

A) PEDOLOGY CONSULTANTS 1009 Langley Street Victoria, B.C. V8W 1V7

- Assessment of acid rain and pertinent resource oriented research and monitoring studies in British Columbia and the U.S. Pacific Northwest.
- December 7, 1984 to February 28, 1985
 - Contract = \$2,488.00
 - Expenditure (84-85) = \$2,474.23

B) UNIVERSITY OF BRITISH COLUMBIA Vancouver, B.C.

- Study of existing precipitation, throughfall, stemflow, mineral soil leachate pertinent to the arnews plot.
- January 2, 1985 to March 15, 1985
 - Contract = \$3,495.00
 - Expenditure (84-85) = \$2,987.96

PACIFIC FOREST RESEARCH CENTRE

1984 — 85 Expenditures

(\$000's)

Expenditures

Program Area	Person Years (a)	Salaries (a)	O & M	Capital	Grants & Contributions (c)	Total
Directorate (includes Information Services)	8.79	291.8	309.6	13.6	—	615.0
Administration	33.23	816.8	830.1	124.3	—	1771.2
Resources	45.22	1711.5	178.6	165.9	—	2056.0
Protection	44.59	1661.2	202.1	128.8	—	1992.1
Environment	37.67	1412.8	173.9	59.5	—	1646.2
Development/Economics	15.57	658.9	490.1	1.9	9963.4	11 114.3
Total	185.07	6553.0	2184.4	494.0	9963.4	19 194.8

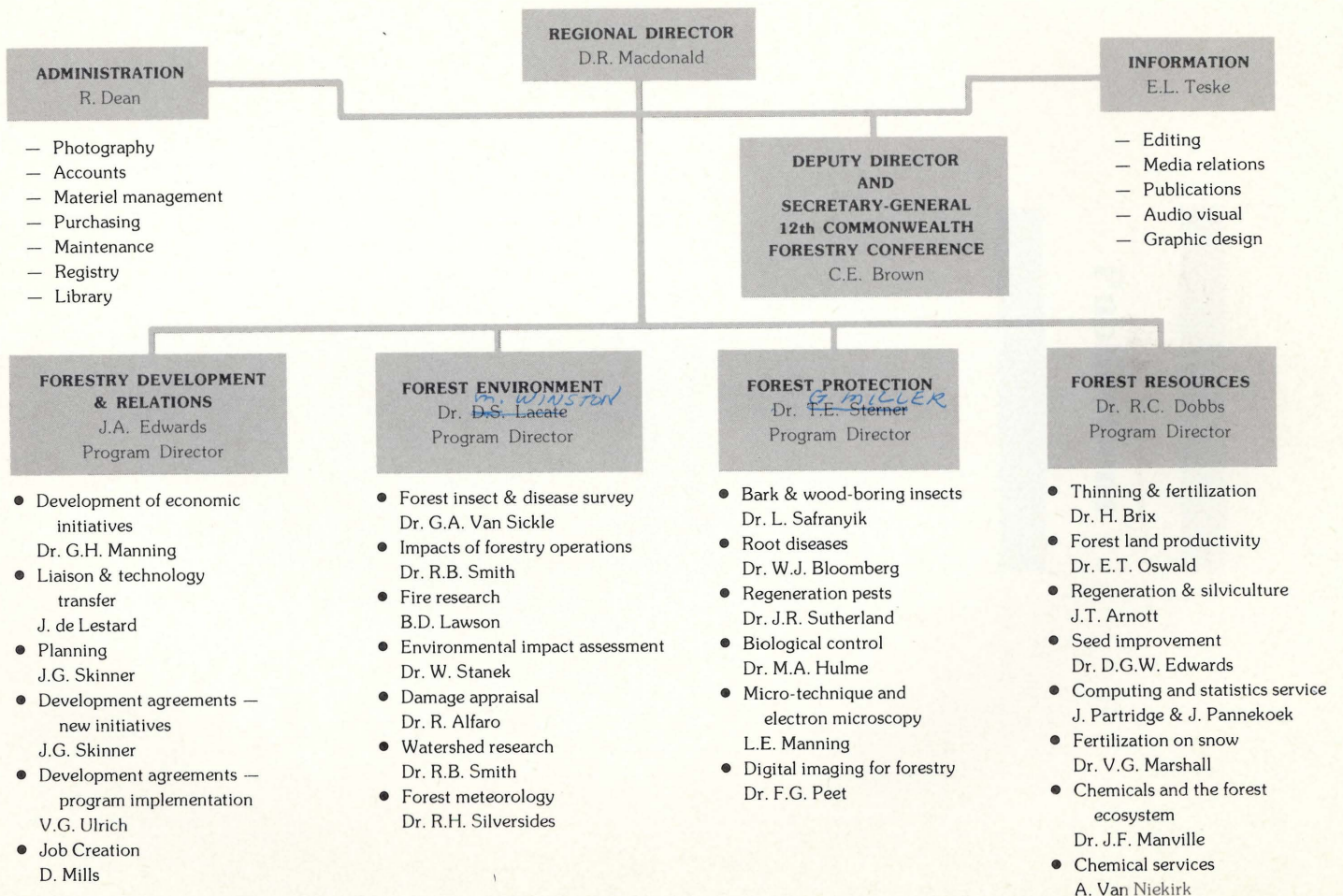
(a) Includes — Career Oriented Summer Employment Program
— Environment 2000

(b) Includes — ENFOR, PRUF & Environment 2000

(c) Includes — Environment 2000 (\$4,463,400.00)
— I.F.M.S.A. (\$5.5 million)

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PACIFIC FOREST RESEARCH CENTRE





Publications



Reports & Publications

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