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Pine Wood Nematodes—A Wormy Issue

by Mary Bracht

When pine wood nematodes (PWN) were discovered in wood chips shipped from the United States to Finland in 1984, a ban was put on all North American wood chips entering Finland. In 1985, Sweden followed suit. Today, the export of North American wood chips to all of Scandinavia is restricted.

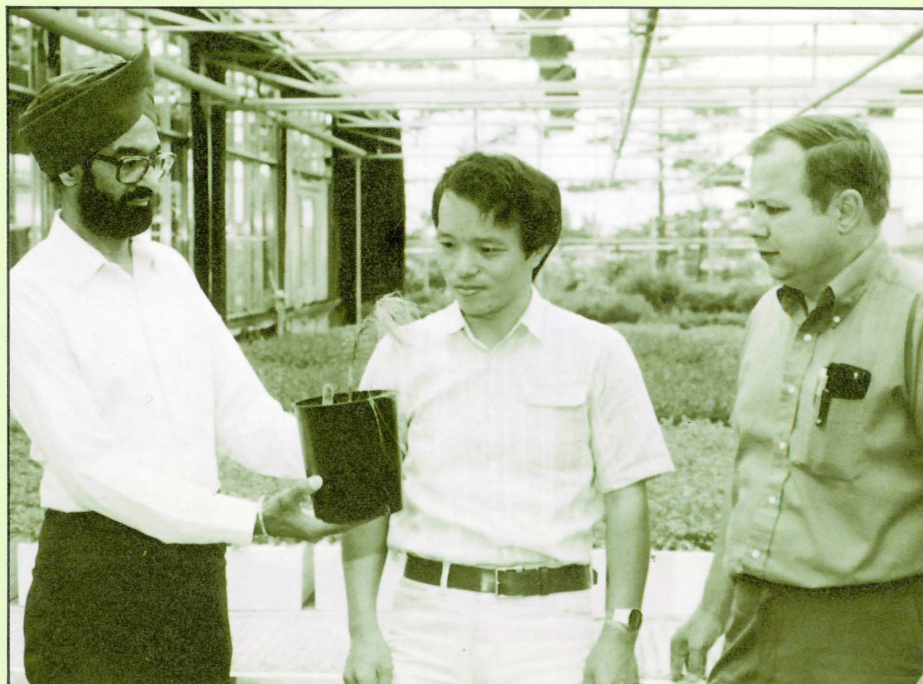
Canadian wood chips have been exported to Scandinavia since 1975, and raw lumber has been exported from Canada to Europe for hundreds of years. But pests know no boundaries, and the recent discovery of the pine wood nematode in North American wood chips has raised concerns amongst Scandinavians that the pathogen could enter and harm their Scots pine and lodgepole pine forests.

The creature causing all this trouble is *Bursaphelenchus xylophilus*—the pine wood nematode. A parasitic worm less than three quarters of a millimeter long, it has recently been found in Canadian forests but has never done much damage here. The PWN does some damage in the southern United States, however, where pine wilt disease—the disease caused by PWN, is more prevalent.

Aware of the nematode problem in the southern US, the Canadian Forestry Service's (CFS) Forest Insect and Disease Survey (FIDS) began surveying dead and dying pine trees for PWN as early as 1983. In 1985, Agriculture Canada (Plant Health division) and various provincial forest agencies began surveying chip piles across Canada for PWN.

From 1983 to 1986, more than 312 wood samples were tested by FIDS in B.C. About 15% contained some species of nematodes, but most of these were normal insect or bacterial associates. Only two dying trees contained *Bursaphelenchus xylophilus*.

Results from samples taken in 1987 are expected later this fall, but the evidence indicates a low frequency of the



Drs. Panesar, Futai and Sutherland (l-r) examine white pine seedling in PFC nursery.

nematode, and tree damage in the forest is extremely rare.

Never-the-less, the Scandinavians are concerned that the PWN might be capable of travelling from both wood chips and imported lumber to new host trees in Europe. No restrictions have been placed on the export of raw lumber, but Canada has already lost about \$140 million in wood chip exports.

Because of the impact further restrictions would have on the forest industry, and in order to have the current embargo lifted, a major study of the PWN was initiated at the request of **Gerald Merrithew**, Minister of State, Forestry and Mines. The CFS Pacific Forestry Centre (PFC), in Victoria, B.C., began intensive research on Canadian nematodes in July, 1986.

The Task

Dr. Jack Sutherland, a plant pathologist with a nematology background at the Pacific Forestry Centre, was asked to act as scientific authority on the PWN research. Dr. Sutherland is now heading a project to determine:

- which species of Canadian trees are susceptible to PWN;
- which species of European trees are susceptible to PWN;
- the biology of organisms in wood chips and their effect on PWN; and
- the ability of the nematode to escape from wood chips, survive and multiply in soil and infect European forest trees.

Work on the project at PFC has included inoculation of the most economically

important species of Canadian conifers with three isolates of PWN. In early June, 1987, about 1100 seedlings were inoculated with nematodes from B.C., Ontario and New Brunswick; the results of these tests are expected soon. Inoculation of the minor Canadian tree species began in July.

Working with Dr. Sutherland are two visiting scientists and nematode experts, **Dr. Tochi Panesar** and **Dr. Kazuyoshi Futai**. Dr. Panesar, an NSERC post-doctoral fellow (Ph.D., McGill University), is concentrating his research on the survival and possible multiplication of PWN in soil and wood chips.

Dr. Futai, a professor from Kyoto University, has been sponsored by the Japanese Society for the Promotion of Science and the Technology Inflow Program (TIP) of External Affairs Canada. Dr. Futai's research focuses on the susceptibility and host response of trees to various Canadian forms of PWN. In Japan where the pine wilt disease has been affecting native pine stands for the last 50 years, the damage done is far more serious than anywhere else in the world.

Identifying the Pest

The two North American strains that have been positively identified so far can only be distinguished by the dif-

ference in tail shape. One isolate has a round tail and is a known pathogen, the other isolate has a pointed tail and may or may not be harmful. There are several gradations of PWN between the round and pointed tail isolates, but the physical distinctions are so slight they can be difficult to distinguish.

Researchers at Simon Fraser University are now working on a technique that would allow them to positively identify which gradations of the isolate are pathogenic and which are not. **Dr. John Webster** is heading the project and the technique he is using deals with recombinant DNA probes.

Using this technique, researchers extract ribosomal DNA from nematodes and examine the genetic complement. This, Dr. Webster feels, will enable scientists to classify nematodes with more concrete evidence than slight variations in tail shapes. Also, these DNA techniques are inexpensive and fast—they can be done overnight—and speed is definitely a factor in the effort to have the current embargo lifted.

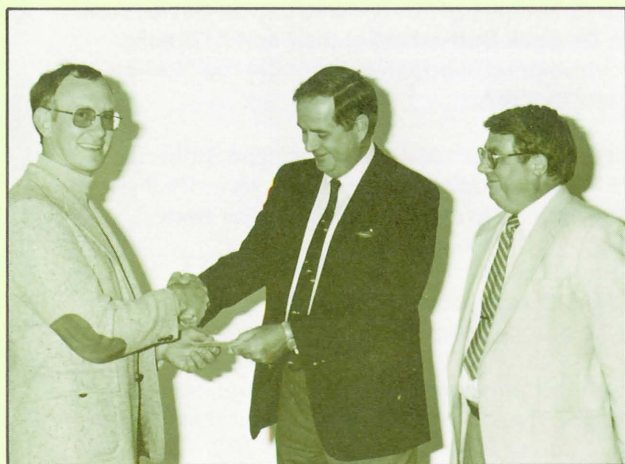
Scientists know the sawyer beetle is responsible for disseminating PWN, but what they don't know is which species of the sawyer beetle carry which

PWN isolates. Work on PWN insect vectors—the insects that carry the parasitic nematodes from tree to tree—is now underway at Memorial University in Newfoundland. The study is headed by **Dr. Jean Finney-Crawley**. Both the Simon Fraser and Memorial University projects are funded by Canadian Forestry Service Headquarters, with Dr. Sutherland as scientific authority.

Regional FIDS groups continue to determine the distribution, damage, hosts and vectors for the PWN across Canada. Material found locally will be cultured and used by Drs. Sutherland and Futai; cultures may also be sent to Dr. Finney-Crawley in Newfoundland. As well, **Dr. Al Funk**, a mycologist at PFC, identifies nematodes both from wood samples and from different species of sawyer beetles collected by FIDS rangers.

The feeling amongst scientists involved in the project is that the climate in Canada simply does not favor the pine wood nematode. They must prove this, however, and must also satisfy the Scandinavians that the nematode could not escape from wood chips and thrive in their forests. To this end, work on the nematode projects—from Victoria to Newfoundland—is proceeding as quickly as possible. ■

Programmer Receives Award



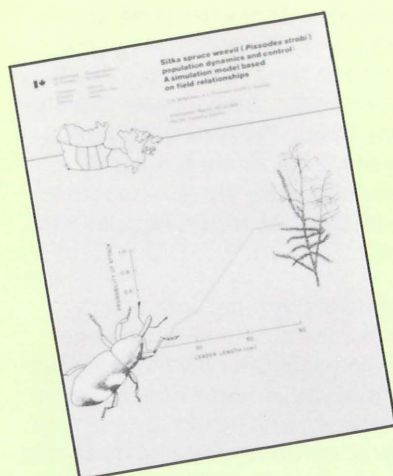
Dr. Jack Pannekoek (l) accepts a cheque from Esquimalt-Saanich M.P. Pat Crofton as part of a public service suggestion award. Ross Macdonald, (r) Regional Director General looks on.

Dr. Pannekoek, a computer programmer, and Jacques Cote, a finance officer, now working in Ottawa, were recognized for developing shortcuts to a computerized accounting system currently being used nation-wide by over a dozen federal government departments, resulting in substantial savings of federal government financial and person-year resources.

The project which began in Victoria as an answer to a local problem with the financial cost-control system, soon caught the attention of the federal Department of Supply and Services, who in turn further developed the program and offered it to other government departments.

The federal government incentive award program recognizes outstanding contributions by public servants to improving working conditions, simplifying procedures or producing savings. ■

Publications



Sitka spruce weevil (*Pissodes strobi*) population dynamics and control: A simulation model based on field relationships

L.H. McMullen, A.J. Thomson and R.V. Quenet

This report describes a simulation model of spruce weevil-host interaction based on previously published information and the results of a range of studies carried out over a number of years. This model provides the background necessary for understanding the interaction of the spruce weevil and its host, and for examining the relative merits of various control strategies.

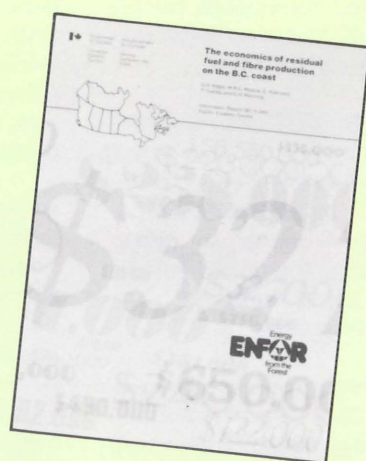
BC-X-288

The economics of residual fuel and fibre production on the B.C. coast

G.S. Nagle, R.C. Massie, G. Robinson, P. Oakley and G.H. Manning

This ENFOR publication describes the potential for a residual wood fibre industry on the B.C. coast using a simple model and the economic impact of such a new industry on the region is discussed.

BC-X-289

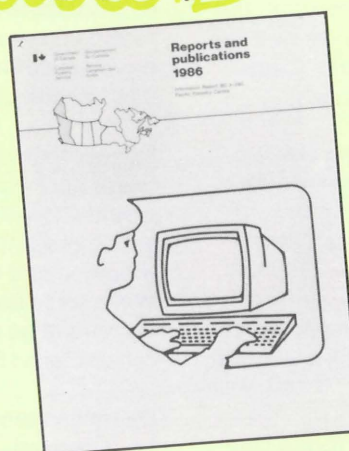


Reports and publications, 1986

E.L. Teske

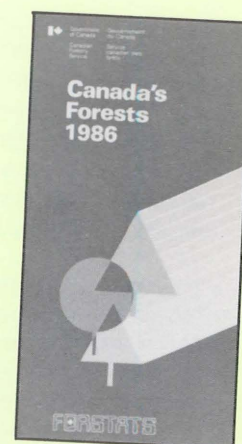
Listing of all reports and publications authored by Pacific Forestry Centre staff during the year 1986.

BC-X-290



Canada's Forests 1986

Statistical information on area classification, wood volume, primary forest production, forest industries and Canadian output of selected forest products from Statistics Canada, Canadian Forestry Service and Canadian Pulp and Paper Association sources.



Ferbam 76 WDG Approved For Use Against Spruce Cone Rust

The fungicide Ferbam 76 WDG has been registered for use against spruce cone rust — a disease which severely damages spruce cone crops in forests throughout Canada. Ferbam has proven most effective in seed orchards, where the cone crops are accessible and where the high value of the crop warrants it.

Don Summers of the B.C. Ministry of Forests and Lands' Silviculture Branch, together with **Dr. Jack Sutherland** of the Pacific Forestry Centre (PFC), were instrumental in bringing about the registration of Ferbam 76 WDG early in 1987.

In studies done in 1982, 1983 and 1984, Summers and Sutherland found that Ferbam 76 WDG (wetable dry granules), was effective against cone rust when applied to spruce cones once or twice during pollination time.

Ferbam (Ferric dimethyldithiocarbamate) is marketed under various trade names and can be purchased at pesticide dealers.

For more information on the timing of ferbam application, refer to Summers, Sutherland and Woods in the Canadian Journal of Forest Research, Volume 16, Number 2, April 1986, p. 360-362. ■



Jack Sutherland (l), Rona Sturrock and John Dennis inspect seedlings in PFC greenhouse.

Help Available for Forest Nursery Pest Problems

One hundred and eighty-eight million tree seedlings were sown in B.C. forest nurseries in 1987 — more than double the 1974 program. With increased nursery production in recent years, there has been a corresponding increase in forest nursery diseases and pests, many of which are unique to nursery seedlings.

To assist B.C. forest nurserymen in producing healthy, vigorous seedlings, a team of federal and provincial specialists consisting of **Jack Sutherland**, **Rona Sturrock** and **John Dennis** of the Canadian Forestry Service (CFS), and **Glen Matthews**, **Wayne Gates**, **Gwen Shrimpton** and **John Maxwell** of the British Columbia Ministry of Forests and Lands (BCMoF&L), are all working on forest nursery pest problems. Together, these specialists help growers identify problems and offer solutions.

Both Rona Sturrock, a federal nursery pest specialist appointed under the Forest Resource Development Agreement (FRDA), and John Dennis, a technician in the Forest Protection program at the Pacific Forestry Centre, analyze disease problems. In addition to this, Sturrock and Dennis monitor such things as soil, soil mix, and water for

pathogens before growers sow their seeds.

Entomologist Gwen Shrimpton handles insect problems and gives advice based on guidelines prepared by the BCMoFL. Shrimpton also does fungicide, insecticide, and herbicide trials at various B.C. nurseries in order to get minor use registrations.

Also at the BCMoF&L are Glen Matthews, Wayne Gates and John Maxwell. Matthews and Gates offer advice on nutritional and cultural problems in container stock, and Maxwell gives recommendations on the nutrition and culturing of bare-root stock.

Eighteen tree species are represented in the 188 million seedlings sown this year, including lodgepole pine, interior spruce, interior and coastal Douglas-fir, western red cedar, and a variety of other trees including hemlock, larch and balsam species. Approximately 156 million of these are container grown; the rest are bare-root.

Nursery seedlings are affected by nutritional differences of the soils in which they are grown, the acidity of the

water with which they are watered, damage by insects, handling procedures, seed-borne pathogens, foliage and shoot pathogens, herbicide injury, stem cankers, shoot blights and much more. Of the many diseases to which they are susceptible, *Fusarium* and *Pythium* root rot, gray mould and Sirococcus blight are the most common.

The seedlings grown this year were sown in 24 commercial nurseries and six licensee nurseries in the private sector, and in 10 Forest Service nurseries. Commercial forest nurseries are run by private entrepreneurs, but the seedlings are grown for approved crown land projects. Forest Service nurseries operate in much the same way as commercial nurseries with the added responsibility of growing seedlings for research purposes and for seed orchards. Licensee nurseries are operated by forest companies for replanting on their licensed lands.

Free help from the nursery pest specialists is available to all B.C. forest nurseries: commercial, licensee and Forest Service. The specialists get best results when working with live samples so growers are asked to submit samples by courier; prepaid.

Samples should be clearly labeled with the name of the nursery, species, seed lot number, date the seeds were sown, date of collection, and date the symptoms were first observed. Seedlings and insects must be carefully handled; insects should be sent in snap-cap vials with enough seedling material to keep them alive during shipping, and seedlings should be sent in pin-perforated plastic bags with enough soil to keep the seedling from drying out.

Forest nurserymen can get more information on conifer seedling pest problems by contacting John Dennis or Rona Sturrock at the Pacific Forestry Centre, (604) 388-0600, or Gwen Shrimpton of the British Columbia Ministry of Forests and Lands Surrey Nursery, (604) 576-9161.

A free, joint report called *Diseases and Insect Pests in British Columbia Forest Nurseries* can be obtained by writing to The Canadian Forestry Service, Pacific Forestry Centre, 506 W. Burnside Road, Victoria, B.C. V8Z 1M5.

Long Service Awards



Ross Macdonald (left), Regional Director-General, Canadian Forestry Service, Pacific & Yukon Region, received a 35-year service medallion from Minister Merrithew during a recent visit to Vancouver. Mr. Macdonald, who began his career with the Canadian Forestry Service as a high school student in 1947, holds the record at the Pacific Forestry Centre of having the longest service time with the CFS.



Dr. Roy Shepherd (r) an entomologist with the biological control project, accepts 35-year long service award from Esquimalt-Saanich M.P. Pat Crofton. Dr. Shepherd joined the Canadian Forestry Service in Calgary in 1952 and transferred to the Pacific & Yukon Region in 1970.

Dr. Alvin Funk Honored by Canadian Phytopathological Society

Dr. Alvin Funk, a staff mycologist, was recently elected an Honorary Member of the Canadian Phytopathological Society (CPS) in recognition of the impact of his research and publications in the field of plant pathology. The award was officially announced June 24 at Carleton University, during the Annual Meetings of the Canadian Phytopathological Society and of the Mycological Society of America.

Dr. Funk has been with the PFC for 30 years, and in that time has written over 75 journal articles dealing almost entirely with the microfungi that produce disease in forest trees. Two of his more recent works are "Parasitic Microfungi of Western Trees" and "Foliar Fungi of Western Trees." In these CFS publications, Dr. Funk discusses almost all known stem and needle microfungi.

Taxonomy—the identification and classification of plants and animals—has been the most important part of Dr. Funk's work. Over the past 30 years, he has identified and described about 85 new species of fungi. For the last 15 years, Dr. Funk and nursery disease technician **John Dennis** have been chief mushroom identifiers for hospitals, for the City of Victoria, and for many individuals. This year, Dr. Funk also became Chief Diagnostician for the Forest Insect and Disease Survey (FIDS), examining about 1000 disease samples per summer.

Dr. R.I. Hamilton, past president of the CPS, presented the award to Dr. Funk at the 35th Western International Forest Disease Work Conference on August 18, in Nanaimo, B.C. ■

New Appointments



Gary M. Townsend has been appointed forest economist with the Economic Analysis group in Forest Development. He will undertake new studies pertaining to various aspects of the economics of forest management in British Columbia and Canada ranging from the impact of silviculture systems on logging costs and log values to wood supply forecasting. He will also provide advisory services on forest management related issues to PFC and CFS management. Prior to this appointment Mr. Townsend was a forest economist with the Forest Economics and Policy Analysis Research Unit at the University of British Columbia.



Ronald E. Wall has joined the PFC Weed management group to work on biological control of weeds. He works mainly with diseases of wild *Rubus* spp. affecting forest regeneration in the B.C. Interior. Prior to joining PFC he was engaged in research on diseases of forest trees and weed species in the Maritimes region.



Dr. Y. Jim Lee Honored in China

Dr. Y. Jim Lee a remote sensing specialist recently returned to Victoria from a five week lecture tour of China, where he was both conferred as Concurrent Professor at the Nanjing Forestry University, and appointed Honorary Professor at the Southwest Forestry College at Kunming.

Dr. Lee was officially invited to lecture on the *Applications of Remote Sensing and Geographic Information Systems for Forestry* at the Nanjing Forestry University, Nanjing, in June and July, 1987. While in China, Dr. Lee also lectured at the Southwest Forestry College in Kunming, and at the South China Agriculture University in Guangzhou.

Coming Events

The Canadian Forestry Service (CFS) is hosting the Fourteenth Session of the North American Forestry Commission from October 13-17, 1987, at the Great Lakes Forestry Centre in Sault Ste. Marie, Ontario.

The delegates will present reports on forestry activities, with emphasis on biotechnology, remote sensing and non-wood forest products. Special events, including a one-day excursion to forested areas north of Sault Ste. Marie, have also been planned.

Contact: Darcy Ortiz, Great Lakes Forestry Centre, Sault Ste. Marie, (705) 949-9461



From December 8-10, 1987, the Carnation Creek Herbicide Project Steering Committee is holding a workshop in Nanaimo, B.C. The Carnation Creek Herbicide workshop will focus on the implications of experimental glyphosate treatments in the Carnation Creek watershed. Researchers and resource managers will consider the research findings to date, and will discuss the relevance of these findings both to other coastal areas and to future research needs.

Contact: Jack de Lestard, Pacific Forestry Centre, (604) 388-0600



A series of four, CFS-sponsored Tree Seed Testing Workshops will be held at various locations during the winter of 1987-88. The workshop scheduled for the Pacific Forestry Centre, December 8-10, 1987, will accommodate up to 40 participants. Hands-on experience in seed sampling and testing of purity, weight, germination, moisture content, and a number of viability assays using tetrazolium solution, x-ray and excised embryo will be available.

Contact: Dr. George Edwards, Pacific Forestry Centre, (604) 388-0600

SWEDEN & CANADA JOINTLY STUDY LODGEPOLE PINE

In the past decade British Columbia and Yukon lodgepole pine (*Pinus contorta*) has become increasingly important in Swedish forestry. Some 80 million lodgepole pine are planted each year in northern Sweden as it has been found to out-perform both of Sweden's economically important indigenous conifer species, the Scots pine (*Pinus sylvestris*) and the Norway spruce (*Picea abies*).

More than 300 000 ha of forest have been planted over the past 15 years. Up to now seeds from B.C. and Yukon have been used, but plus trees have been selected, Swedish seed orchards have been established and the first plus tree crosses are being produced.

With such a large investment in an introduced species, Swedish forestry officials are concerned about the ability

of the stock to withstand various insect and disease conditions. In 1984 a Sweden-Canada research group was formed, headed by **Dr. Stig Hagner**, director of forestry operations for Svenska Cellulosa Aktiebolaget, a major Swedish forestry company, to investigate the stock's levels of resistance. **Dr. Oscar Sziklai**, professor of forest genetics at U.B.C. is the project's Canadian liaison.

The group's first priority was to set up controlled plantations of lodgepole pine and scots pine in both countries to test each species reactions to insect and disease conditions in the other's natural environment. Seed from plus trees were flown from Sweden to B.C. to the Balco Reforestation Centre in Kamloops during the spring of 1985.

The Canadian Forestry Service has provided funding for this portion of the project under the Canada/British Columbia Forest Resource Development Agreement.

Five sites at Fort St. James, Mackenzie, Fort St. John, Fort Nelson and Whitehorse were planted in the summer of 1986, based upon the insect and disease conditions present. The pathogen surveys were provided by the Forest Insect and Disease Survey staff of the Pacific Forestry Centre, who will also be providing annual examinations of the sites during their regular monitoring of the insect and disease conditions throughout the Pacific and Yukon region.

The Swedish test sites at Garas, Savar and Renberget, were established by the staff of the Department of Forest Yield Research and the Department of Forest Genetics and Plant Physiology at the Swedish University of Agricultural Sciences. Like the B.C. sites, they are in very good condition after the first vegetation period.

The study continues focussing on comparative behaviour of various strains of lodgepole pine and scots pine under pressure from indigenous pathogens of both Canada and Sweden. It is hoped the study will stimulate further cooperation between Canada and Sweden in the fields of forest genetics, tree breeding, pathology, etc. ■

CFS Announces New Programs

Two new programs, the Science and Technology Exchange Program (STEP), and the Forest Industry Internship Program were recently announced by the Canadian Forestry Service (CFS).

The STEP program emphasizes scientific, technical, and professional personnel exchanges between industry and provincial forest management agencies. STEP also accommodates exchanges with universities and research agencies, and can include international exchanges, internships and apprenticeships.

Academic institutions, private industry, forest management agencies and forestry research agencies at all levels of government are eligible for assistance under STEP.

For more information on STEP, contact the:

STEP Secretariat
Research and Technical Services
Canadian Forestry Service
351 St. Joseph Blvd.
Hull, Quebec
K1A 1G5 (819) 997-1107

A second program, the Forest Industry Internship Program, helps provide work experience and training for unemployed and under-employed university, forestry school and technical school graduates.

Candidates are recruited by forest industry companies, and wage costs are shared by the government and the employer for a period of up to 24 months. The work experience spans all segments of forest operations, from development work to head office experience.

Forest industry companies wishing to take advantage of this program can send applications to:

Forest Industry Internship Program
Canadian Pulp and Paper
Association
Sun Life Building, 23rd Floor
1155 Metcalfe Street
Montreal, Quebec
H3B 2X9 ■

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