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Microwaves vs Bark Beetles

The question of non-thermal effects of microwaves on living material is an issue which has received considerable public attention from time to time. A research project now underway between the Pacific Forest Research Centre (PFRC), and the University of British Columbia (U.B.C.), may provide some answers to the many unknowns surrounding this controversial issue.

PFRC insect pathologist **Dr. Stu Whitney** is teaming up with **Dr. Moss Kharadly** of the Electrical Engineering Department of U.B.C. to determine the minimum microwave energy required to interfere with development of the mountain pine beetle.

Previous research by others has proven that applications of various levels of microwaves do indeed have an effect on development of certain insects and animals. The objective of this particular research is to determine the level at which microwaves affect mountain pine beetle development. A natural extension would then be to determine if this level is environmentally safe and acceptable, and finally, if it is economically feasible for use under natural conditions in an infested forested area.

Dr. Whitney will initially rear the beetles under standardized laboratory conditions at PFRC to keep them healthy and free from microorganisms. At various stages in their development beetles will be transported in an incubator to Dr. Kharadly's lab at U.B.C. where some will undergo specific controlled microwave treament. They will be transported once again back to PFRC where rearing will be completed and the resulting new adults will be performance tested i.e. the ability of treated and non-treated mountain pine beetles to colonize and reproduce in fresh bolts of lodgepole pine will be compared. The beetles are moved via incubator to minimize disruptions in their development that may be attributable to transportation.

"We will be looking for any effects which alter the growth of the beetle or its reproductive capabilities - anything which might put the beetle out of tune with its natural cycle," said Dr. Whitney.

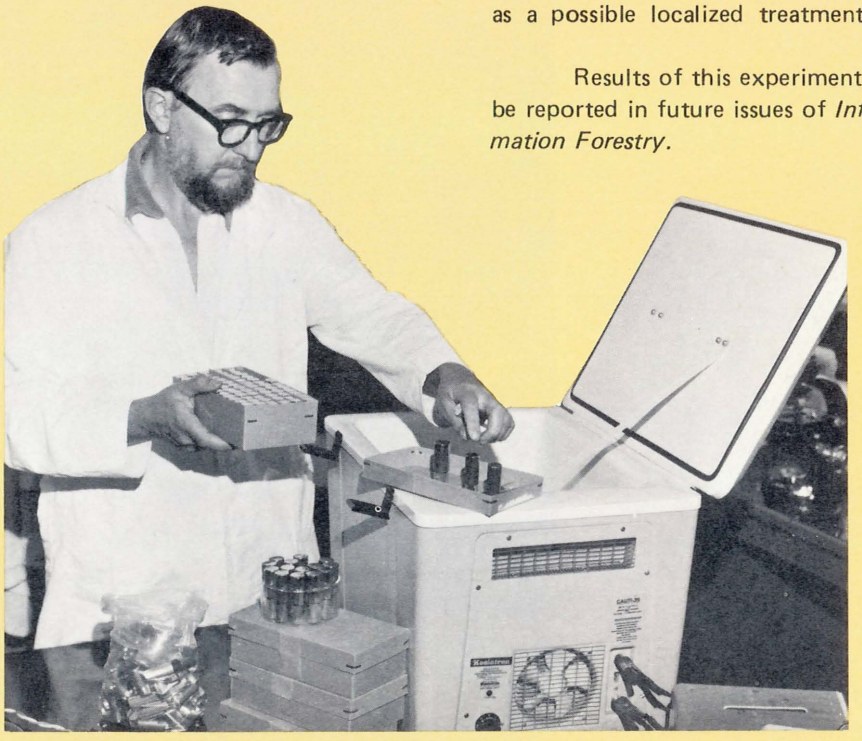
The whole process from rearing to performance testing takes about ten weeks so it is hoped the experiment can be replicated several times over the coming months and that initial results will be available in the Spring of 1981.

"Should we determine that the level of microwave treatment necessary to alter the biology of the specially reared beetles is low enough, the next step of course would be to find out what microwave level is required to affect bark beetles in their natural habitat and to evaluate possible side effects such a dose might have on non-target organisms in the forest environment," said Dr. Whitney.

This research is being seen as a possible preventative technique rather than a control technique.

"We would see this technique being applied to small insipient bark beetle hot spots to prevent them from growing into outbreak proportions. We have no intentions of going into a heavily infested area and treating large stands. At the moment this is seen only as a possible localized treatment."

Results of this experiment will be reported in future issues of *Information Forestry*. ■



Stu Whitney readies a batch of beetles for a trip to the U.B.C. lab to undergo microwave treatment.

Cover photo - Autumn reaches Vancouver Island. Cover and all other photos by Ed Chatelle.

Research team includes: (left) Drs. Eugene Hetherington, Valin Marshall, Patrick Pang, and Jim Dangerfield.

FATE OF NITROGEN FERTILIZER ON SNOW

Scientists at the Pacific Forest Research Centre have begun a five-year cooperative study with the Research and Silviculture Branches of the B.C. Ministry of Forests to determine the fate of nitrogenous fertilizers when applied on snow.

Urea and ammonium nitrate are the fertilizers most commonly used to correct nitrogen deficiency in forest soils. Ammonium nitrate has gradually replaced urea as the main nitrogen fertilizer in Sweden, but it has not been used extensively in North America. Many biological and environmental questions still remain unanswered about this nitrogen carrier.

In the Pacific Northwest urea fertilizer is usually applied to forests during the rainy season (late fall to early spring) in an attempt to reduce losses from ammonia volatilization. Fall application has other advantages, including the availability of equipment freed from competing agricultural demands, application at a time when other forest management operations are reduced, and in some cases, increased tree growth compared to a subsequent spring application. However, late fall applications are often interrupted by snow. The expense of rescheduling crews and the necessity to transport and store fertilizer away from the operational site could increase application costs.

Information necessary for predicting the fate of nitrogenous fertilizers applied to snow-covered forest soil on an extensive practical scale is lacking and it is hoped that this research project, headed by PFRC soil zoologist **Dr. Valin Marshall,** will reveal some of the unknowns. Other PFRC researchers working with Dr. Marshall on this project are: **Dr. Jim Dangerfield,** soil microbiologist; **Dr. Eugene Hetherington,** hydrologist; and **Dr. Patrick Pang,** soil chemist. They will be studying urease activity, water movement and nutrient transformation and movement in the snow and soil. Before urea can be taken up by plants, it must be converted to ammonium by a common soil enzyme called urease.

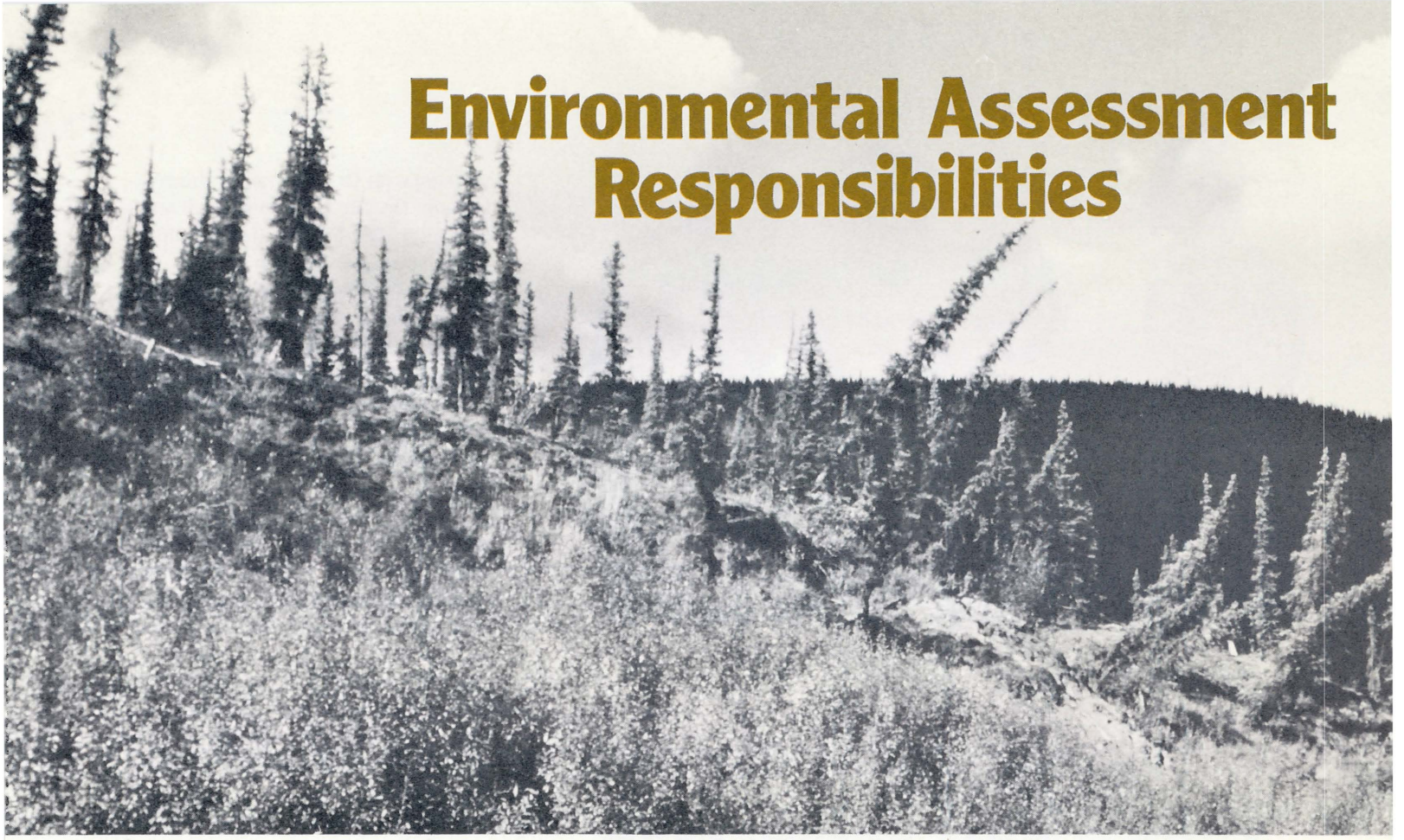
Both urea and ammonium nitrate are subject to significant nitrogen losses, depending on local climatic conditions. Losses with urea occur mainly from volatilization during warm, dry weather and leaching when applied at low temperatures with heavy rains. The mobile nitrate ion from ammonium nitrate is easily leached any time of year with excessive moisture. Also, nitrate from ammonium nitrate, or that produced by nitrification of urea, is subject to denitrification losses, for example as nitrogen gas.

Although losses might be minimized in the Pacific Northwest if urea were applied during the mid-autumn and early spring and summer, precise data are required on tranformation and movements of these two fertilizers before operational guidelines can be developed for their efficient and environmentally safe use.

During this first year of the experiment, emphasis will be placed on locating experimental sites and sampling for urease activity in various B.C. Ministry of Forests installations. The first field plots have been established in a lodgepole pine stand near Spillimacheen and fertilizers will be added this fall.

Laboratory experiments will be set up to study the movement of ammonium nitrates and urea under various water and soil regimes; and procedures will be developed to measure rates and volumes of soil-water flow via the soil matrix and preferred macro-channel pathways in selected coastal sites. ■

Environmental Assessment Responsibilities



Highway construction along the Dempster Highway resulted in thawing of the permafrost level causing some sliding of soil and with it the trees. Result - "drunken trees" along the Dempster Highway.

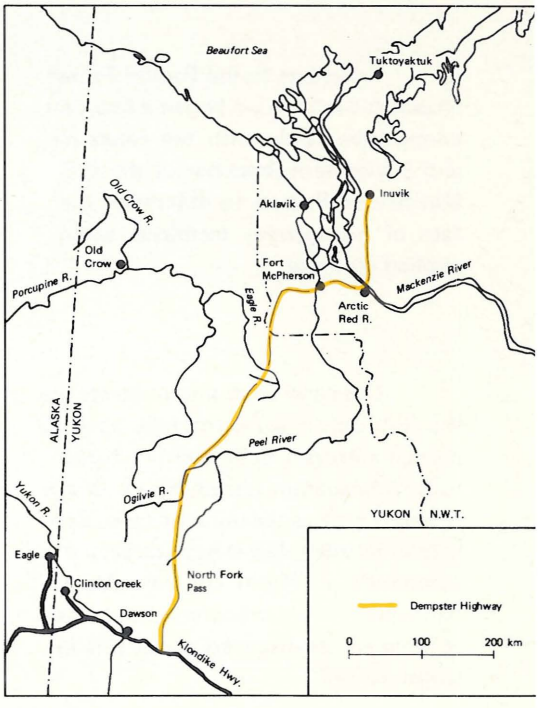
In July, 1979, Foothills Pipe Lines (Yukon) Ltd. revealed plans to construct and operate the Dempster Lateral Natural Gas Pipeline from the MacKenzie Delta, Northwest Territories (N.W.T.), to a point near Whitehorse, Yukon Territory (Y.T.), some 1200 km apart. (See Fig. 1). The implementation of these plans will demand an immense engineering effort as well as measures to secure the integrity of the pipeline and to prevent, minimize and mitigate impacts on the environment.

As part of its responsibilities, the Canadian Forestry Service, under the direction of PFRC research scientist **Dr. Walter Stanek,** undertook a survey to identify representative vegetation types and associated environmental factors, specifically soil chemical properties, and to provide information for future revegetation programs and a biophysical inventory along the Dempster Lateral Gas Pipeline route from North Fork Pass, Y.T., to Peel River, N.W.T.

Early in 1980, the CFS conducted an environmental screening of the work proposed under the Canada / British Columbia Subsidiary Agreement on intensive forest management as it applied to this particular project. Those areas to be reviewed included reforestation of inadequate restocked lands, juvenile spacing, fertilization, increased protection of treated areas and implementation of contracts.

Using the environmental design considerations identified in the screening procedure, it was determined the project did not require further environmental evaluation and could proceed as planned.

Also subjected to environmental evaluation were four oil pipeline proposals: the Foothills Oil Pipeline Ltd.'s from Skagway, Alaska to Keg River, Alberta; by the same company, from Delta Junction, Alaska to Alberta; the Trans Mountain Pipe Line Company



Ltd.'s from Low Point, Washington to Edmonton; and, the Kitimat Pipe Line Ltd.'s from Kitimat, B.C. to Edmonton, Alberta.

The objective of the assessments was to identify major concerns including those pertaining to terrain, seismicity, permafrost, geotechnical stability, stream crossings, unique vegetation, commercial forests, revegetation, parks, aesthetics, fire hazards and vegetation criteria, and to provide summary estimates as to the preference of one route over the remaining three.

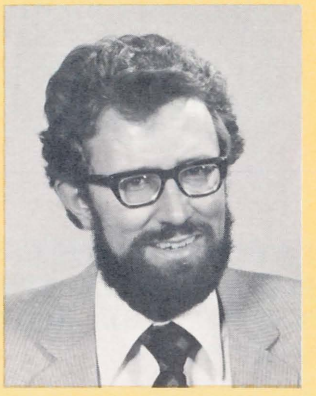
A gold gravel dredging proposal in a relatively remote area of the Yukon Territory was also assessed with regard to vegetation-revegetation. The proponent was advised to provide additional information with regard to overburden disposal, revegetation, preventation of siltation and fire hazards. ■

PFRC Staff Appointments

Ross Macdonald, Director, PFRC, is pleased to announce the following new staff appointments:

Dr. Jim Dangerfield has been appointed Acting Program Manager, Forest Resources Program. He replaces **Dr. Terry Honer** who has been seconded to the office of the Assistant Deputy Minister, **Les Reed,** to work on a forest resource data program. In his new position, Dr. Dangerfield will be responsible for research and operations studies involving land classification, improving quality and production of seedlings, developing improved regeneration methods and silvicultural practices to enhance the productivity of coastal and interior forests. Federal responsibilities in seed certification and testing also fall under the Forest Resources program area.

Dr. Dangerfield is a graduate of the University of Alberta having received his B.Sc.Agr. in 1964, his M.Sc. in 1967 and his Ph.D. in 1974. He joined the staff of PFRC in 1971 and has been working in the area of soil microbiology and plant associated micro-organisms within the forest fertilization program at Shawnigan Lake and the container nursery program.

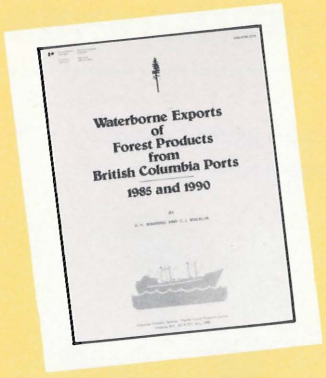


Dr. Fred Peet has been appointed Head, Forest Resource Systems. He will be responsible for image processing, the integration of various mathematical models, the mathematical and physical aspects of remote sensing, and the Computing and Statistical unit at PFRC.

Dr. Peet was born in Vancouver and grew up in Saskatchewan. He studied physics and mathematics at various universities in Canada, the U.S. and Europe, receiving his B.A. in 1964 from the University of Saskatchewan, his M.A. in 1966 from Columbia University, and his Ph.D. in 1970 from the University of British Columbia.

Immediately prior to joining the staff at PFRC Dr. Peet was employed at the Department of Public Works where he was responsible for the development of mathematical computer systems, computer graphics, and thermographic image processing systems. He also worked at the Canada Centre for Remote Sensing developing methods for estimating crop production from satellite data.

NEW PUBLICATIONS

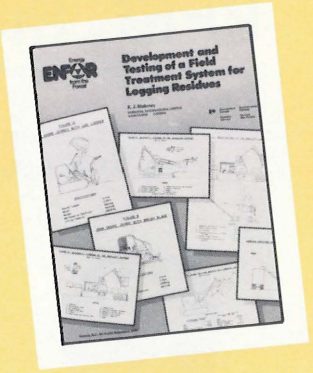


WATER-BORNE EXPORTS OF FOREST PRODUCTS FROM BRITISH COLUMBIA PORTS – 1985 AND 1990

G.H. Manning and C.J. Macklin

Resource availability is changing in British Columbia's six coastal zones. World forest products demands from these zones are derived and compared with resource availability, and growth in shipments to 1990 estimated.

BC-X-211

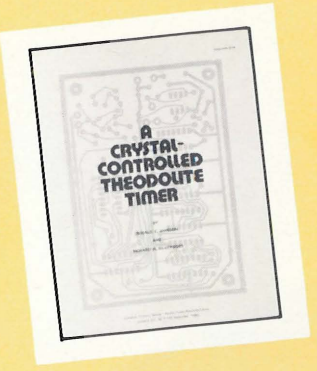


DEVELOPMENT AND TESTING OF A FIELD TREATMENT SYSTEM FOR LOGGING RESIDUES

K.J. Blakeney (Under ENFOR Project No. P-36)

Full utilization of the forest resource has long been the goal of resource planners. The aim of this project was to identify and test methods of reaching this goal.

BC-X-212



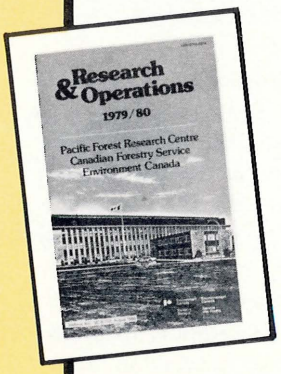
A CRYSTAL-CONTROLLED THEODOLITE TIMER

R.E. Jameson and R.H. Silversides

Details of recently-developed extremely accurate crystal-controlled theodolite timer are presented. Used in pairs during double-theodolite wind measurements, these timers avoid tying up telecommunication channels.

BC-X-210

➘ Copies of these publications may be obtained by filling out the enclosed card and returning it to the P.F.R.C. Information Office.



RESEARCH AND OPERATIONS, 1979/1980, PACIFIC FOREST RESEARCH CENTRE, CANADIAN FORESTRY SERVICE, VICTORIA, B. C.

This report on forest research and operations at the Pacific Forest Research Centre reflects the progress made during the fiscal year 1979 / 80 in achieving program objectives in British Columbia and the Yukon.

BC-X-213

FIRE HAZARD APPRAISAL IN PRE-COMMERCIALLY THINNED STANDS OF BRITISH COLUMBIA COASTAL DOUGLAS-FIR AND INTERIOR LODGEPOLE PINE

Brad C. Hawkes and Bruce D. Lawson

Reprinted from the proceedings of the Sixth Meteorology Conference, April 22-24, 1980, Seattle, Washington. Quantities Limited

Responsible for discovering two new seed-borne diseases are (left) T.A.D. Woods, Jack Sutherland and Walter Lock.

TWO NEW SEED DISEASES DISCOVERED

Researchers at the Pacific Forest Research Center have recently discovered two new seed-borne diseases which help account for some of the previously unexplained sowing losses in local nurseries.

Dr. Jack Sutherland, a plant pathologist, made the discoveries while trying to determine the reasons for high losses of some seeds and seedlings in local private and government operated nurseries. He was assisted in his discoveries by pathology technicians **Walter Lock** and **T.A.D. Woods.**

The first disease, known as the seed or cold fungus, is caused by the fungus *Caloscypha fulgens.* Dr. Sutherland and T.A.D. Woods found this pathogen in about one-third of all spruce seedlots tested, in about 25% of true fir (Abies) seedlots and three per cent of Douglas-fir seedlots tested. It was not detected in seeds of Ponderosa pine, white pine, lodgepole pine or hemlock (western or mountain). Research has shown that diseased seeds serve as inoculum from which pathogen spreads killing unaffected seeds during stratification and also following sowing in seedbeds or container cavities.

No relationship was found between the incidence of infested seedlots and the year of collection or the geographic origin. However, it was determined that the seeds became diseased when they came in contact with forest duff. Subsequent results showed that incidence of fungus was highest in seeds where cones had been collected from squirrel caches. Consequently, recommendations for control include picking cones from the trees rather than from squirrel caches. However, when it is necessary to pick from the ground, they should be air-dried as soon as possible.

The fungus can be detected by using standard microbial assays; however, an electrophoresis assay procedure was developed which is more rapid and allows for detection of lower amounts of the disease. This latter discoverey was made in conjunction with PFRC chemist **Eleanor McMullan.**

Although this first of two diseases is important, the discovery of the second disease, caused by the fungus *Sirococcus strobilinus,* is perhaps more significant in that besides affecting seeds the disease also kills conifer regeneration and nursery seedlings. Besides local importance, this seed-borne pathogen could be transmitted to other countries on seeds.

In British Columbia the disease is especially prevalent in young spruce seedlings in container nurseries.

Dr. Sutherland and Walter Lock first noticed that the fungus was confined to seedlings with specific seedlots. Herbarium records also showed the fungus was often present on conifer cones leading them to suspect the fungus was seed-borne. Consequently experiments were conducted to develop assay procedures for detecting the fungus. The best method of detection found was to sow the seeds from suspected seedlots in pathogen-free soil mix and germinate the seeds under cool, moist conditions and low light intensity.

Using this procedure it was shown that over half of the seedlots suspected of carrying the fungus yielded the pathogen. Within infested seedlots the incidence of diseased seed ranged from less than one per cent to three per cent. Researchers believe that these seeds introduce the pathogen into the nurseries (especially container nurseries) where secondary spread of the pathogen occurs.

It was also discovered that seeds with abnormal or shrunken contents yielded the pathogen seven to nine times more often than seeds with normal appearing contents. Dr. Sutherland suggests that it may be feasible to eliminate these pathogen-carrying seeds during seed processing.

Dr. Sutherland, who has been studying seed and nursery diseases for years, has just published a joint report with **Evert Van Eerden** of the B.C. Ministry of Forests, entitled "Diseases and Insect Pests in British Columbia Forest Nurseries". This bulletin (Joint Report No. 12) was prepared to assist personnel in identifying and controlling diseases and insect problems in B.C. forest nurseries. It is available upon special request by writing the Information Branch, Pacific Forest Research Centre, 506 West Burnside Road, Victoria, B.C. V8Z 1M5. ■

HIGHLIGHTS OF MID-SEASON PEST CONDITIONS

The annual forest insect and disease survey in British Columbia and the Yukon was carried out this summer by pest survey technicians of the Forest Insect and Disease Survey (FIDS) staff as part of a national Canadian Forestry Service program.

Technicians were assigned to survey each of the six districts from May to September. Pest populations were sampled at 100 or more permanent sampling stations in each district and additional observations were made in hazard or problem. areas. Areas of major defoliator and bark beetle activity were sketch-mapped and photographed during aerial surveys and ground checks were made this fall.

Warm summer-like weather in April and early May was followed by wet, unseasonally cool weather for the last half of May, June and the first half of July. This did not appear to adversely affect any of the pests, but was certainly of benefit to trees which had been seriously stressed by drought conditions for several years.

Mountain Pine Beetle

As in the past several years the most severe outbreaks continued in the Nelson Forest Region, particularly in the east Kootenay from the International Boundary north along the Flathead River and tributaries to the Mica Dam. Most of the lodgepole pine has been killed in the lower Flathead Valley and adjoining side valleys, and red trees (1979 attacked) were evidence of significant expansion of beetle attacks in Michel, Corbin, Morrisey, Lodgepole and Ram Creeks. This represents a serious threat to mature lodgepole pine stands in the Elk River Valley east of Elko.

In the Kamloops Region infestations are expected to continue to expand in lodgepole pine stands in the Ashnola River Valley and in the Trout Creek drainage at Thirst Lake, Bull and Isintok Creeks. Overwintering beetle mortality in the Cariboo Region was as high as last year, often exceeding 90%; however, as in 1979, populations were still high enough to continue infestations in the areas west of Williams Lake. In the Prince Rupert Region overwintering mortality was light and infestations will no doubt increase.

Spruce Beetle

Spruce beetle-caused tree mortality was prevalent in the southeast portion of the Prince George Region especially in TFL 30 (Monkman) and in Bowron River Valley at Haggen and Wendle Creeks and south to 18 and 14 Mile Creeks. In the Prince Rupert Region the beetle population declined and it appears to remain at an endemic level in all areas examined to date. A moderate infestation occurred in standing Engelmann spruce on approximately 40 ha in Upper Miledge Creek north of Blue River in Kamloops Region. The infestation is three years old and continuing.

Western Spruce Budworm

The spruce budworm infestation in Douglas-fir stands in Vancouver and Kamloops Regions continues to expand and intensify and in the Cariboo Region moderate to severe defoliation in Douglas-fir occurred again in the Hart Ridge area.

Other Pest Conditions

The western hemlock looper, green striped forest looper and saddleback looper appeared with increasing regularity in collections from the coast and interior. Douglas-fir tussock moth appeared again in beating collections from the Kamloops Region but no defoliation has been observed.

Needle diseases of pines and firs were prominent in some interior areas. Stem rust diseases of pines were recognized as serious problems and surveys were commenced to determine their impact on spaced and unspaced stands.

Fall Survey Report

The fall summary, which contains additional details on the above-mentioned pests and others, including the bark beetle and defoliator infestations, will be published once ground appraisal surveys have been analysed with other data. Copies of this report will be made available to *Information Forestry* readers next issue.

The B.C. Forest Pest Review Committee, an inter-disciplinary group charged with providing an accurate overall picture of the forest pest problems and providing recommendations for action, will meet November 27 at the Pacific Forest Research Centre to discuss the results of the summer and fall surveys and make appropriate recommendations. ■

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