



Province of
British Columbia
Ministry of
Forests

PEST MANAGEMENT PROGRESS

A summary of pest management activities in the
British Columbia Ministry of Forests.

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Learning From Experience

Recently, staff of the B.C. Forest Service have been encouraged to gain experience in other programs and offices via temporary work transfers or special assignments. Staff at Protection Branch, for example, have already gained first-hand exposure to district office operations through direct involvement for several months. A member of the Forest Health (Pest Management) Program has also benefitted from participation in Fire Management's Unit Crew activities during the past fire season.

Protection Branch and most regional offices also gained much respect during the past two years for the cooperative education programs in B.C. Here, opportunities for students have also been beneficial for the B.C. Forest Service. For example, one student, after involvement at Branch and at a Regional Office, has chosen our business as the new objective in her career path. Another has returned for a second shift with us. As a result, students are now having direct involvement in our work while we are better able to produce higher quality products and services with their help.

Also, a respected Forestry Canada entomologist has just completed a one and one half year assignment at our Branch. Working together on a variety of important projects has created better appreciation of the need to collaborate and to work on problem-solving together.

Finally, an instructor from B.C. Institute of Technology's Forest Technology Program elected to work with B.C. Parks, Forestry Canada, and the B.C. Forest Service, during his year-long "recharge the batteries" leave. Undoubtedly, the agencies and the students at BCIT will all share in the gains from these work assignments.

We anticipate more such positive experiences and encourage you, our readers, to participate as possible.

- R. F. DeBoo, Protection Branch, Victoria.

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PEST MANAGEMENT PROGRESS

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PUBLISHER'S AND EDITOR'S NOTE

Pest Management Progress is intended to provide factual information on projects and proposals by Ministry staff.

Contributions labelled with an appropriate subject heading should be submitted to the Regional Protection Officer, or Advisor who will edit and forward them to Protection Branch. Pest Management Progress is submitted to the Spring (May) and Winter (December) meetings of the B.C. Forest Pest Review Committee.

Authors should be contacted for any clarification as the contents of this report do not necessarily constitute official statements of the Ministry of Forests.

PEST MANAGEMENT GENERAL

Pest Susceptible Areas - A New Pest Management Information System. Over the years many unnecessary hours have been spent, by inventory and forest health specialists, assembling inventory data in a suitable format to determine susceptible areas and volumes at risk from pests. A new system has been developed to ease this task. Now data can easily be assembled for basic forest inventory headings such as forest type group, site quality and various age classes for any combination of Timber Supply Areas (TSA's).

The system is currently in test mode, for use by branch staff only, and was developed on a spread sheet format using data from planning files. Seventy-four spread sheets were produced (a net and gross one for each TSA) and simple arithmetic calculations can be executed between them. As new TSA analyses are conducted, and new net and gross areas/volumes determined, this system will be updated. It is anticipated that annual updates will only be required on a handful of TSAs.

Currently the system is suitable for both regional and branch use. It can be expanded for district use and its full utilization is dependent on the operator's experience with spread sheets.

- S. Taylor, Protection Branch, Victoria.

Prince Rupert Pest Field Guide Goes into Third Printing. Demand for the Prince Rupert Forest Region's Pest Field Guide has depleted our stocks and necessitated yet another reprinting. This field note book is printed on waterproof paper and has color photos depicting the common pests of the region. The text highlights the symptoms, hosts, in which silviculture survey the pest would be encountered, and what management considerations there are at present. Expected date for delivery of 300 copies is mid-February, 1990.

The new issue will also contain a one-page supplement in the same format on Rhizina root disease. For those wishing to obtain this supplement, please contact the Prince Rupert Forest Region protection section by January 15, 1990.

- Tim Ebata, Prince Rupert Forest Region, Prince Rupert.

New Pest Management Staff in the Rupert Region. For the first time in nearly a year and a half, the Prince Rupert Forest Region pest management contingent is fully staffed.

Mr. Bill Young our new pest management forester, hails most recently from the beautiful Robson Valley where he was the silviculture resource officer. He brings with him a wealth of knowledge in district silviculture, timber and protection. The new forest pathologist is Mr. Stefan Zeglen who has nearly completed his Master's degree on Armillaria root disease from Utah State University after graduating in 1986 from U.B.C. Forestry. Their short-term plans are to become familiar with the region by touring the districts and in the long-term they will be getting down to the business of writing detailed pest management plans with each district and for the region. The future for pest management in the Prince Rupert Forest Region is looking bright.

- Tim Ebata, Prince Rupert Forest Region, Prince Rupert.

Job Functions - Job Descriptions. As part of our strategic planning for the 1990's, descriptions of the position of Pest Management Forester (Forest Health Officer) have been reworked and reclassified at the LSO3 (Licensed Science Officer) level. Staffing action has been completed for the Cariboo, Prince Rupert and Prince George Forest Regions.

Presently, we are working on revising of the descriptions for Regional Forest Entomologist and Forest Pathologist.

Similar projects are underway for the three companion positions at Protection Branch. All three jobs require willingness to work as team players and to actively pursue opportunities to ensure healthy forests.

- R. F. DeBoo, Protection Branch, Victoria.

Young Lodgepole Pine Pest Survey. Red foliage was noticed in a twelve year old natural stand of lodgepole pine during a post-spacing survey. In 1986 Comandra rust was diagnosed as the pest responsible for this phenomenon. Approximately 10% of the trees in this stand had been killed since a 1984 spacing treatment. It was not known how many more trees would fall prey to Comandra rust. A 2.5 hectare survey strip was installed to monitor tree mortality and rust impacts.

Subsequent resurveys in 1989 have shown an additional 10% mortality since 1986 as well as an alarming amount of green trees with the rust present.

Hastening the rate of mortality was a root weevil, Pissodes schwartzii, which colonized 40% of the rust infected trees.

Gall rust and terminal weevil are adding to the woes of this stand, making the prognosis for this "managed" stand a certain Not Satisfactorily Restocked.

- H. Merler and L. MacLauchlan, Kamloops Forest Region, Kamloops.

Pest Management Audits, Nelson Region. Audits of two major licencees, two small business programs and one Tree Farm Licence holder have been completed.

Results indicate that a major training initiative is mandatory. The target audience should be the Ministry of Forests's resource officers and assistants, their industry equivalents and survey contractors. Agenda items should range from pest identification to management implications and benefits.

Other initiatives at the Timber Supply Area Steering Committee level and Regional Management Team levels are required to acquaint Managers with the problems, solutions and benefits of pest management.

- D. Norris, Nelson Forest Region, Nelson.

Blitz-freeze '89, Prince George Forest Region. Winter damage from the late January arctic front was recorded in all districts in the Prince George Forest Region. The symptoms included dead buds on branches and leaders in the upper crown of larger trees, and up to 100% bud kill and chlorosis of needles on crowns above the snowline in younger trees in plantations. Closeup examination of Douglas-fir, white spruce and subalpine fir buds showed that in most cases the bases of the buds survived, indicated by the presence of a few live, preformed needles and from these bases numerous very short shoots were produced adventitiously. The overall effect was poodle tail-like leaders and branches. All species of determinate conifers other than lodgepole pine were affected by this bizarre frost. In every site there was a small percentage of trees that did not exhibit these symptoms.

Premature needle drop of the inner crown was observed on all conifers being most obvious on pine, where often only the 1989 foliage remained on trees by October. No pathological causes were suspected or were found to have killed the needles. Once again some trees were strangely unaffected, indicating genetic differences both in natural and planted trees.

A third symptom was the death of sexual bud primordia on all conifers, although lodgepole pine suffered least in this regard. Although most pine conelets were killed on some plantation trees, some trees had mature cones in the fall.

This event was the most widespread of its kind in the recent past, although it has occurred periodically over the last fifteen years, as evidenced through branch and stem analysis of older plantation trees in the region. Full recovery is expected for most trees, however, some trees will develop crooks, forks or multiple tops.

- R. Reich, Prince George Forest Region, Prince George.

Summer Co-op Student. Plans are being made to hire a summer university co-operative education student to survey for Rhizina in the Prince George Forest Region, select sites for root rot trials and participate in white pine blister rust pruning trial site selection.

- R. Reich, Prince George Forest Region, Prince George.

Extensive Hail Damage in the Prince George Forest District. On October 16, 1989, Prince George Forest Region and District staff from protection and regional forest sciences investigated a report of widespread "red trees" in the Greg Creek area approximately 35 km southwest of Prince George. Ground observation revealed that extensive and severe hail damage had occurred sometime in June or July, 1989. Subsequent aerial observation revealed one patch of damaged mature lodgepole pine of approximately 500 hectares. A 15 year old pine plantation to the northeast also suffered heavy leader and needle damage. Typical symptoms on younger trees included severe scars and pits on bark and cambium tissue on the southwest side of all exposed trees. Some buds were destroyed and many needles were damaged. Many mature pine and Douglas-fir had been stripped of 50 - 70% of their needles. The unshielded south sides of their boles were a distinct sandy brown or off-color

caused by the "sandblast" of the wind-driven hail. Judging by the position of undamaged trees in the lee of several protective hills, it was estimated that a tremendous wind must have driven the hail stones at an angle of approximately 100° or almost horizontal to the terrain. Further aerial and ground surveys are planned to better delineate the damage before management action is undertaken. A permanent sample plot will be established in the pine plantation to note rates of recovery, mortality or deformities.

- R. Hodgkinson, J. Haley, H. Coates, Prince George Region;
R. Hall and B. Doerksen, Prince George Forest District, Prince George.

Sketch Mapping in the Prince George Forest Region. Sketch mapping was undertaken by Forest Service staff in the Prince George and Vanderhoof Forest Districts in 1989. Sketch mapping contracts were tendered for the Robson Valley, Fort St. James and Mackenzie Forest Districts. Potential contractors were first required to pre-qualify and then were mailed tender packages. Districts will be reviewing the success of their programs and making recommendations for 1990. One of the objectives of the region will be to obtain a consensus on the methodology and map standardization for 1990.

- R. Hodgkinson, Prince George Forest Region, Prince George.

Forest Nursery Pest Management Update. A survey of 24 forest nurseries in B.C. yielded 22 collembola or springtail taxa, half of which were reported for the first time in the province. Initiated in 1988, the project was conducted by J. Battigelli, V. Marshall and G. Shrimpton. The most frequently encountered species was Sminthurinus quadrimaculatus. Only one of the species, Bourletiella hortensis, is a recognized pest of conifer seedlings. The presence of the predatory collembolan, Isotoma viridis and of predacious actinedid mites suggests that under normal circumstances the pest collembola species might be controlled naturally by these predators.

Reforestation nurseries again cooperated in the province-wide gypsy moth trapping program. To date, no moths have been caught at any nursery.

Black vine weevil, Otiorhynchus sulcatus, is a persistent pest in coastal conifer nurseries and traditional control methods have proven to be ineffective. Trials will be initiated in the spring to evaluate the efficacy of entomogenous nematodes in controlling the larval stage of this insect.

A trial with the fungicide Bayleton^R in combination with changes in cultural regimes was found to be effective against Keitha blight of western red cedar at one coastal nursery. Ridomil^R trials at four forest nurseries showed moderate to good results in controlling the effects of Pythium spp. root rot.

A styoblock sanitization trial being conducted by Mike Peterson of Applied Forest Sciences Research Ltd. (Forest Resource Development Agreement project 2.68) has found a variety of fungi on the styrofoam blocks that include Phoma, Cylindrocarpon, Fusarium and Pythium spp. An initial trial of 34 treatments subdivided by concentration or time of exposure has been completed and assessed for fungi survivability. Preliminary results indicate that sodium metabisulfite and heated soaps offer promise, as do ultra violet light and buffered bleach. A second trial is currently under way to examine these treatments more closely.

Liverworts, in particular Marchantia polymorpha, and mosses continue to be a problem in container seedlings. Trials will be conducted next season to evaluate possible avenues for control.

- D. Trotter, Silviculture Branch, Surrey.

The 1989 Bud Kill of Interior Conifers. In the spring of 1989, plantations and young natural stands of Douglas-fir, 'interior' spruce, and subalpine fir in the ICH, SBS, and ESSF (but apparently not in the IDF) biogeoclimatic zones in the central interior showed widespread injury or death of buds above the winter snowline. The probable immediate cause of the bud damage is the sudden cold snap starting about January 31, 1989. Over large areas temperatures dropped suddenly from near freezing to as low as - 40°C. By the end of January, interior Douglas-fir has usually completed chilling requirements (particularly in a mild winter) so that the buds are in a quiescent state and mitosis may have begun in the meristematic tissues during mild spells. It appears that sudden freezing at that stage results in tissue death.

Widespread damage to conifers resulting from unusual climatic conditions is of considerable concern. While the 1989 event probably represents an uncommon set of climatic conditions that are to be expected at infrequent intervals under the present climatic regime, it may also be a harbinger of things to come should the greenhouse effect become real. Damage of the type observed in the spring of 1989 is a typical example of the way in which climatic change will impact conifer forests. It seems wise therefore to record the extent and severity of the current event while the damage is still obvious.

The purpose of this note is to describe the damage and to present a questionnaire designed to elucidate the extent of the damage around the province. The descriptions provided below apply to the situation east of Williams Lake. We would like to know whether they also adequately describe the damage elsewhere. In addition, we would like to establish the relative sensitivity of various species, and the effect of tree age. Could you therefore please complete the questionnaire, located on page 48 and mail it to Dr. van der Kamp or Dr. Worrall.

In Douglas-fir plantations east of Williams Lake various degrees of bud damage were visible above the mid-winter snow line. Buds below that line flushed normally. In the most severe case (type 1), the buds are wholly dead. In a more common but less severe case (type 2), some meristematic tissue at the base of the bud survived and produced two to five adventitious shoots surrounding the dead dome of the original apical meristem. By the end of June these buds were swollen but not open. Richard Reich (now the regional pathologist in Prince George) has shown in his recent MSc. work that such a set of adventitious shoots will develop into a whorl of short (about 2 cm long) shoots, each with a terminal bud. These shoots sit on a short stem segment derived from the portion of the bud that after normal elongation bears the bud scale scars. The following year these terminal buds flush evenly and the resulting shoots compete for dominance, often resulting in two or three-way forks. In an even less severe case (type 3), one or a few of the preformed needles also survive. These needles are fully elongated by the third week of June, but since they are unable to lift the bud scales, they are usually found twisted and curled inside the swollen bud together with the set of developing short shoots. Type 2 and 3 buds break in early July.

The distribution of these bud damage classes on trees also varied. The most severely affected trees bore only dead (type 1) buds above the snow line. Most often however, affected buds (both lateral and terminal) were of type 2 and 3. Within plantations there was also a great deal of variation from tree to tree. Even in the most severely affected plantations around Gavin Lake, a few trees (<5%) flushed normally and were not affected. Others (an additional 20% of all trees) suffered damage (type 1 - 3) to 50 - 90% of the buds while a few buds (usually laterals some distance below the branch or stem apex) flushed normally. Mature trees were only slightly affected. Most appeared to flush normally throughout the crown although a few damaged buds could usually be found.

One common tree response was the flushing of small axillary buds on one, two or three year old and older internodes. These are tiny buds, 1 mm long in the dormant state, that do not ever develop under normal conditions. Apparently such tiny buds are not affected.

Rather similar types of bud damage also occurred on interior spruce and subalpine fir. Lodgepole pine was not affected. Western red cedar showed a great deal of red foliage, but new growth appeared to be normal. We have no information on western hemlock.

- J. Muir, Protection Branch, Victoria,
J. van der Kamp, and J. G. Worrall, University of B.C.,
Vancouver.

Examination of Inventory Growth and Yield Plots for Pest Damage. Twenty-four permanent sample plots established from 1986 to 1988 in the Bulkley and Morice Timber Supply Areas were re-examined specifically to assess pest damage. The objective was to use existing installations to monitor pest activity in the same representative stand types being assessed for basic growth and yield data. This pest information will help to determine the impact of endemic pests which we may have opportunities to minimize.

A local contractor with demonstrated experience in pest identification examined the plots. The total cost of the project was under \$10,000. Pest damage on each tree in every plot was identified by causal agent. Pest caused scars were noted by height and aspect and general stem form was recorded (e.g. good, medium, poor). An increment core was taken from a large lateral root of trees suspected to be infected by Tomentosus root rot. These plots will be re-examined in two to five years. Plans for the 1990/91 season are to examine the remaining installations in the Region.

- T. Ebata, Prince Rupert Forest Region, Smithers.

Timber Supply Area (TSA) Planning and Two Mountain Pine Beetle (MPB) Models. Plans are in progress to utilize two MPB models in the Merritt and Boundary TSA analyses. One model, MPB SPREAD, was developed at Forestry Canada and can be used to predict the treated and untreated spread rates for MPB. However, this model's prediction capabilities for various treatment activities need further refinement. The other model, developed by Research Branch, will provide a better understanding of the long-term dynamics of the MPB. Both

models have the endorsement of the Pest Damage Appraisal Advisory Committee and their use in these TSA's represent efforts to more accurately understand the short and long-term impact of this pest.

It is hoped that this work will lead to both improved planning techniques at the TSA level and an enhancement of existing methods for site-specific prescriptions.

- S. Taylor, Protection Branch, Victoria.

Roadside Tree Injury. An inter-ministry working group is coordinating evaluations of injury to trees at roadsides throughout B.C. Region and Victoria branch representatives of the Ministries of Highways, Environment and Parks and Forests are included.

A detailed evaluation has been undertaken at Williams Lake where tree injury has been extensive, particularly at Boitano Park. Further work is also planned to evaluate other occurrences of tree injury at roadsides, and to determine cause(s) and remedies.

- J. Muir, Protection Branch, J. B. Van Barneveld, Ministry of Environment and Parks, Waste Management Branch, and A. Planiden, Ministry of Transportation and Highways, Victoria.

Williams Lake Tree Deaths Probed. Mortality of Douglas-fir in a downtown Williams Lake park was investigated over the past six months. Some of the deaths were attributed to Douglas-fir beetle, but many other stressed trees and trees killed by unknown factors were identified.

Representatives of the Ministry of Transportation and Highways and the Ministry of Environment and Parks joined those from the Forest Service and the City of Williams Lake in an investigation of the cause of the damage.

Foliage and soil sample tests revealed that stress and mortality were due to de-icing salt in runoff water accumulating in the park. The Ministry of Highways has agreed to consider relocation of culverts under Highway 97 which at present contributes to the toxic runoff, and is also looking into alternate de-icing products for the area.

An irrigation program for Boitano Park is being considered by the City of Williams Lake, and the Forest Service has offered to fill-plant deforested areas. Work will continue over the winter to rehabilitate the park.

- M. Hamm, Cariboo Forest Region, Williams Lake.

Pest Risk Assessments. Guidelines are being developed for assessing the risk of pest infestations as part of the pre-harvest silviculture prescription. An assessment is now required by regulation to fulfill the licensee's responsibility for basic silviculture on forested areas that are designated for harvesting. Specifications have been developed for acceptable trees at the 7 to 15 year old period when the free growing assessment is made, but standards are required for the whole rotation period.

A preliminary draft of procedures to deal with major forest diseases was prepared following a meeting of pathologists and specialists in January, 1989. The draft has been discussed with regional and district staff, and some refinements are being made. The operational version should be completed in January 1990, and will be presented for approval to the Silviculture - Protection Action Committee. Comments or suggestions are welcome.

- J. A. Muir, Protection Branch, and R. Winter, Silviculture Branch, Victoria.

Road Show Report. A total of 10 seminars/workshops have now been presented across the province. Entitled "You and Forest Pests," the sessions cover topics of importance for the success of all Forest Service programs. Team work, regional priorities, planning, pest prevention, and resource allocations have recently been major components. Workshop sessions are usually attached to allow participants an opportunity to deal with planning and problem solving.

Most recently, the Regional Forestry Manager for Prince Rupert Forest Region led a staff specialist team from region and branch during presentations at Prince Rupert and Terrace. Additional sessions are planned there and in Vancouver Forest Region this winter.

For information about a session in your community, please contact the undersigned.

- R. F. DeBoo, Protection Branch, Victoria.

The Forest Health Program Initiative. Announcement of the Executive decision to define and initiate a comprehensive B.C. Forest Service Forest Health Program is contained in a memorandum to all region and district managers. A four page attachment outlines the concept, program responsibilities, the major problems, some opportunities, current plans, and activities.

If you have not had occasion to read this benchmark announcement, please contact the undersigned for details or for copies of the documents.

- R. F. DeBoo, Protection Branch, Victoria.

Life In The Ministry of Forests for a Co-Operative Education Student. As a member of the University of Victoria, Biology Co-operative Education Program, three of my work semesters have been with the Ministry of Forests: two in the Cariboo Forest Region and one in Protection Branch. As a student I have found that you are given as much responsibility as you are prepared to accept. I was asked to perform both challenging and interesting duties in the Forest Health Program. These included: 1) Conducting distribution and incidence surveys for Pissodes strobi in the Prince George Timber Supply Area and the Cariboo Forest Region 2) Establishing permanent sample plots in the Cariboo Forest Region to test the effects of clipping and brushing on Pissodes strobi incidence 3) Spruce leader clipping and parasite augmentation trials in the Cariboo Region and 4) Literature reviews of high priority pests (as identified by the Pest Damage Appraisal Advisory Committee), so that knowledge gaps could be identified and future projects developed. The Ministry of Forests has enabled me to gain valuable work experience in a professional environment. I look forward to working with you again in the future.

- K. Lewis, University of Victoria Coop Program, Protection Branch, Victoria.

FOREST ENTOMOLOGY

Bark Beetle Program. 1989/90 is the sixth year of the current bark beetle management program. Approximately \$40 million will have been expended on management activities by the end of the year. Activities include aerial and ground surveys, directed harvesting, pheromone purchase and placement, and single tree treatments. Access development is no longer funded under this program.

As of 1989, mountain pine beetle infestations cover about 62 000 ha. Various modeling and other evaluations have shown that the program has been effective in reducing the spread rate of infestations and protecting stands at risk. This program is expected to continue in the next year.

- P. Hall, Protection Branch, Victoria.

Regional Bark Beetle Funding - 1989/90. A total of \$3.5 million was made available for bark beetle related activities in 1989/90. Most of this has been allocated to the regions; however, \$700,000 has been frozen by Treasury Board pending review.

The expected allocation of the \$3.5 million is shown in the table below:

<u>Forest Region</u>	<u>Allocation</u>		<u>Total</u>
	<u>First</u>	<u>Second</u>	
Cariboo	158,000	247,500	405,500
Kamloops	720,000	320,000	1,040,000
Nelson	581,000	144,000	725,000
Pr. George	383,000	230,000	613,000
Pr. Rupert	183,000	353,500	536,500
Vancouver	5,000	0	5,000
Protection Branch	175,000	0	175,000
Total	2,205,000	1,295,000	3,500,000

The Protection Branch allocation includes funds provided to Ministry of Environment, Recreational Fisheries and Wildlife Branches, to support increased workloads resulting from the bark beetle program.

- P. Hall, Protection Branch, Victoria.

Bark Beetle Funding Process. This year has been the second year in which funds have been allocated in a two phase process. This process has proved to be awkward and inefficient in light of the release of funds, timing and mid-season budget changes. In 1990/91 it is intended that all available funds be allocated at the beginning of the year. Protection Branch will maintain the responsibility for reallocating funds throughout the year as regional surpluses or deficits are identified.

- P. Hall, Protection Branch, Victoria.

Mountain Pine Beetle Hazard Rating. A hazard rating trial was established in the Penticton Forest District in 1989. This trial utilized a refined hazard rating system developed by Forestry Canada and incorporated factors relating to stand age, basal area of susceptible type, stand density and elevation. The system also included a factor for risk based on proximity to existing beetle infestation centres. The rating system was applied to the entire district. The resultant maps will provide a good basis for developing beetle management strategies for both affected and unaffected areas. The method will be further tested using a data base maintained by Forestry Canada.

For use of this system, or others, it is likely best to delete the risk factor when doing large area rating. Hazard of loss to beetles is dependent on stand conditions and is therefore relatively stable over time. Risk, however, can be expected to change from year to year. Therefore, it is likely more useful to map hazard and then use overlays of beetle incidence to indicate danger (high hazard + high risk = high danger). The danger rating can then be used to allocate treatments. Hazard maps alone are useful in more long-term planning of development or harvest levels.

Finally, it must be remembered that hazard assessments can be overridden if beetle population pressure is high. That is, when beetle populations are large and active, normally low hazard stands can be heavily affected.

- P. Hall, Protection Branch, Victoria.

Mountain Pine Beetle Spread Model. This model was developed by Dr. A. Thomson of Forestry Canada and provides a means to evaluate management efforts or predict losses should nothing be done. The model utilizes inventory data compiled by compartment for selected Timber Supply Areas. Currently, Timber Supply Areas included on the system are Boundary, Cranbrook, Invermere, Merritt, 100 Mile House, Quesnel, Bulkley, Golden, Kamloops, Okanagan, Prince George, and Williams Lake. Others will be added.

This model will be useful in evaluating effects of treatment and in examining various treatment strategies. When fully documented and running, it is expected that the model will be made available to region and district staff for planning purposes.

- P. Hall, Protection Branch, Victoria.

A New Reporting System for Bark Beetle Projects. Over the last eight years about 40 to 50 million dollars have been spent on bark beetle prevention and control activities in British Columbia. Obtaining these funds, and keeping them, has necessitated a regular reporting system which directs information from districts back to regions, branch, and the Treasury Board.

This project proposes to replace the existing report mechanisms of Protection Branch, i.e. paper reports with hand collations, with a computerized one developed on the VAX network. It is not the intent of the project to take over the financial management obligations of administrative staff with their Financial Management Information System. The new system should provide quicker and easier storage, retrieval, and summary of bark beetle projects funded under the Bark Beetle Program.

The proposed system is currently in the testing stage and has been field tested in three districts with an aim of improving the format and refining the user's guide. Further trials are necessary and will be scheduled in the future. It is anticipated that the system will generate project reports for 1989.

- S. Taylor, Protection Branch, Victoria.

Helicopter Logging of Mountain Pine Beetle Infestation. In a cooperative arrangement between the B.C. Forest Service and B.C. Parks, a medium 204 helicopter will be used to log approximately 174 green-attacked and 35 red-attacked lodgepole pine from two mountain pine beetle infested areas within Mt. Robson Provincial Park in mid-November, 1989. All attacked trees will be felled and limbed on site and then hoisted and flown to pre-approved nearby decking areas. Logs will then be immediately hauled to a timber processing facility. Extraction of beetle killed timber will ensure volume recovery and generate revenue to directly offset helicopter extraction costs. Earliest projections suggest total costs may approach fall and burn costs.

- R. Wiltsie and D. Cinnamon, Robson Valley Forest District, McBride,
R. Hodgkinson, Prince George Forest Region, Prince George.

Penticton Battles the Mountain Pine Beetle. Through the Small Business Enterprise Program, numerous areas are being prepared for partial cutting. Due to many concerns such as watershed, environment and aesthetics etc., in the Okanagan, treatments such as beetle-proofing are being promoted in the area in order to keep some timber on the land until mountain pine beetle levels are reduced to the point where regular harvesting schedules can resume.

The hydraulic watershed in the Okanagan Timber Supply Area was rated for risk-hazard by Phero Tech Inc. A hazard overview, using information extracted from Ministry of Forests' inventory data base made it possible to make a general assessment of the susceptibility of each stand. Stands assessed to be in the top 33% of those at risk to beetle attack (Shore and Safranyik 1989) were intensively sampled for susceptibility and risk. The data accumulated from this intensive sampling was then used to run the INDIDS program which includes a mortality and rate of loss subroutine.

The results of this endeavour are now being evaluated by Forestry Canada and the Forest Service to develop a contingency plan for continuing this risk/hazard rating exercise.

- L. MacLauchlan, Kamloops Forest Region, Kamloops.

Analysis of the Impact of Mountain Pine Beetle on the Long-Run Wood Supply of the Merritt Timber Supply Area. A preliminary analysis has been conducted to determine the possible impact of mountain pine beetle on the long-term wood supply for the Merritt Timber Supply Area (TSA). The analysis used techniques developed by W. J. Reed of the University of Victoria and D. Errico, Research Branch. In addition to the data normally required for timber supply analyses, such as age-class distributions and yield tables, these techniques require additional long-term information pertaining to pests. This includes how pest population levels fluctuate over time; the extent of an infestation or proportion of area attacked; when an infestation occurs; and the volume or value loss per unit area, or growth and yield, of an infested stand.

Age-class data and yield tables were obtained from Inventory Branch. Information on the mountain pine beetle was obtained with the assistance of D.M. Shrimpton of Forestry Canada. This information was based on his extensive knowledge of the beetle, as well as results of simulations performed using a computer model developed by A. J. Thomson of the Forestry Canada. The model estimates the area which might be attacked over the next few years. Due to the imprecision of the information, particularly that describing long-term beetle behaviour, extensive sensitivity analysis was performed to test a range of damage severity.

Even without beetle infestation the projected wood supply shows a fall-down occurring in several decades. This is because the current harvest level is the estimated maximum long-run sustained-yield level. The analysis indicated that the major potential impact of beetle infestation is to significantly alter the nature of the fall-down, producing a much steeper decline. This is an outcome of the reduction, by infestation, of the mature volumes of lodgepole pine which presently support the current harvest. The analysis showed no impact of bark beetle in the long-term. This is due to the age selectivity of the beetle, which mainly infests lodgepole pine stands greater than 80 years old. Future stands of pine are expected to be managed at rotations less than 80 years in length and therefore beetle damage in subsequent rotations should be negligible.

The above results are based upon the premise that the current harvest level will be maintained for as long as possible, even in the presence of beetle infestation. An immediate reduction in allowable cut, in response to beetle infestation, would result in a more gradual fall-down effect. The penalty of course, is the reduced harvest.

- D. Errico, Research Branch, Victoria.

Bark Beetle Update - Nelson Region.

Mountain Pine Beetle. Based on aerial overview surveys carried out in 1989, mountain pine beetle infestations are active on 32 000 hectares in the Nelson Region, down from 35 000 hectares in 1988. Major areas of infestation are in the Boundary, Cranbrook and Invermere Forest Districts, which account for 94 percent of the infested area. Ground surveys carried out to date indicate continuing infestations in 1990.

Spruce Beetle. Based on aerial overview surveys, spruce beetle continues to remain at low levels with no major infestations recorded in 1989 in the Nelson Forest Region.

- E. Morris, Nelson Forest Region, Nelson.

Bark Beetle Funding, Nelson Region (1984 - 1989). During the period 1984 - 1989 the Nelson Region will have received 4.9 million dollars in special Bark Beetle Funding for mountain pine beetle and spruce beetle control. Funding breakdown by five major activities was as follows: Surveys - \$2,428,000; Access - \$1,182,000; Single Tree Disposal - \$600,000; Pheromone Containment - \$350,000 and Administration/Equipment/Supplies - \$344,000.

- E. Morris, Nelson Forest Region, Nelson.

Increased Cut due to Mountain Pine Beetle Infestation. With the higher levels of mountain pine beetle infestations in two districts in the Nelson Forest Region, the Chief Forester has approved a lift in the Annual Allowable Cut. The increase is for three years - Boundary Forest District (Tree Farm Licence No. 8), 130,000 m³/year (1988 - 1990) and Cranbrook Forest District 523 000 m³/year (1990 - 1992).

- E. Morris, Nelson Forest Region, Nelson.

Diameter Estimates in Lodgepole Pine Stands for Mountain Pine Beetle Susceptibility Rating. A pilot project undertaken in the Boundary Forest District will determine the feasibility of obtaining diameter information in lodgepole pine stands using photography or air calls. The following questions will be addressed:

1. Can stand diameters in lodgepole pine stands be reliably estimated using 70 mm photography?

2. Can diameter classes be reliably estimated using air calls?
3. Is there a relationship between stand density and crown closure that would allow the substitution of crown closure as a means of predicting stand diameter classes?

If one or more of these methods proves feasible, it could be used in the re-inventory of a Timber Supply Area to determine the mandatory rating of stand susceptibility to mountain pine beetle attack.

- E. Morris, Nelson Forest Region, Nelson.

Canada/USA Beetle Proofing Trail. The Invermere Forest District in cooperation with the Canada/USA Lodgepole Pine Committee has set up four 5-hectare blocks where partial cuts have been made for beetle proofing trials. Number of stems per hectare left on the four blocks are 300, 425, 550 and 675. In addition two 5-hectare blocks with approximately 1,400 stems/ha will be used as controls. Preliminary results to date show blowdown/snowdown and wind breakage on the 300 and 425 stems/ha blocks.

- E. Begin, Invermere Forest District, Invermere.

Mountain Pine Beetle Pheromone Bait Trial. The Boundary and Invermere Forest Districts participated in a trial with Simon Fraser University (SFU) to test the effectiveness of a two component mountain pine beetle bait (myrcene removed) with the regular Phero Tech bait. If the SFU bait is effective it would be more economical to manufacture. Results of this trial are being analyzed by Dr. John Borden, SFU.

- J. Holitzki, Boundary District, Nelson.

Digital Scanner for Detecting Mountain Pine Beetle Green Infested Trees. The Cranbrook Forest District participated in a trial for detecting green mountain pine beetle infested trees using a digital scanner. The work is a cooperative effort between Inventory Branch and Canada Centre for Remote Sensing. The contact for this project is Roaul Wiart, Manager, Remote Sensing, Inventory Branch, Victoria.

- A. Krane, Cranbrook Forest District, Nelson.

Western Spruce Budworm Status. Western spruce budworm has declined in the North Thompson area but persists in the Okanagan and other parts of the Kamloops Forest Region. The Bacillus thuringiensis application and damage appraisal trials begun in 1987 continued in 1989. This study will continue until the budworm outbreak subsides and during the post-collapse recovery phase. Information gleaned will provide a basis for future treatment decisions and loss estimation.

- P. Hall, Protection Branch, Victoria.

Chilcotin Chokes Pine Beetle Bid for Timber. Early cold weather in 1984 and 1985 collapsed the general outbreak of mountain pine beetle over the Chilcotin Plateau, but populations of the beetle at the southern end of Chilko Lake were relatively unaffected by the cold, and continued to expand.

This summer's aerial survey of the Chilko Lake area has been reviewed together with ground survey data from the autumn and winter of 1988 and 1989. Assessment shows that single-tree eradication has been moderately successful in holding the 2 600 ha infestation to the southern and western part of the area. We may be cautiously optimistic that continued aggressive detection and control will be even more successful.

Further assessment and aggressive effort is required this fall and winter to consolidate the holding action, and further effort will be required over the next several years.

- M. Hamm, Cariboo Forest Region, Williams Lake.

Douglas-fir Beetle Blow-up in Williams Lake. An outbreak of Douglas-fir beetle in the Cariboo on 2 800 ha is mainly concentrated in the Williams Lake Forest District. Much of the damage has occurred in areas visible to the public, in environmentally-sensitive areas along the steep, dry slopes of the Fraser River, and in mule deer winter ranges where mature and overmature Douglas-fir is essential to maintenance of habitat values.

Information meetings have been held with local interest groups, the City of Williams Lake and the Cariboo Regional District. Major forest licensees are cooperating with the Small Business Forest Enterprise Program to employ a variety of methods to concentrate and reduce beetle damage.

- M. Hamm, Cariboo Forest Region, Williams Lake.

Western Spruce Budworm Program. The Kamloops Forest Region is in the process of wrapping up its third and final year of the western spruce budworm program. Only 550 ha were sprayed with Bacillus thuringiensis (B.t.) in 1989, of which 150 ha were part of Forestry Canada's work to register a new B.t. product. The budworm population in the North Thompson region was low and therefore the original spray blocks were not treated this season. The population shifted in intensity from the Shuswap and North Thompson regions to the Okanagan where areas of moderate and severe defoliation were recorded.

Spray results from Tree Farm Licence 49 (200 ha) and White Lake (100 ha) are as follows:

Area and Sampling Date	Mortality per 100 buds		Population Reduction due to <u>B.t.</u>
	Spray Block	Check Block	
Tree Farm Licence 49			
Post-spray 1	38.5	(-122.6)	72%
Post-spray 2	96.3	(-620.0)	99%
Post-spray 3	58.1	(-207.0)	86%
Post-spray 4	80.9	(-172.8)	93%
Post-spray 5	76.7	65.0	34%
White Lake			
Post-spray 1	11.6	64.2	--
Post-spray 2	93.4	56.3	85%
Post-spray 3	93.6	82.2	64%
Post-spray 4	87.5	69.4	59%

The annual plot assessments are near completion and a final report and western spruce budworm strategy will be completed this winter.

- L. MacLauchlan, Kamloops Forest Region, Kamloops.

Blackheaded Budworm *Bacillus thuringiensis* (B.t.) Spray Trial - Holberg, B.C.
An experimental trial was conducted this summer by Forestry Canada, with the co-operation of the B.C. Forest Service and Western Forest Products Ltd. to test the operational efficacy of B.t. on the western blackheaded budworm, *Acleris gloverana*. Dr. I. Otvos of Forestry Canada was the research scientist responsible for the project.

The objective of the trial was to test B.t. operationally in west coast conditions to gain registration data for its use against the blackheaded budworm. B.t., at present, is not specifically registered for this budworm.

Three blocks (105 ha) of immature hemlock, approximately 30 years old were sprayed in mid-July using fixed-wing aircraft equipped with Micronair spray nozzles. The application rate was 30 billion international units (BIU)/ha or 2 L/ha. The weather at the time was not optimal, however, it was agreed that it was a good test of operational conditions.

One pre-spray and three weekly post-spray larval samples were collected. Foliage samples were also collected immediately after the B.t. application.

Although the data analysis has not been completed yet, it appears that budworm numbers were reduced by about 50% due to the B.t. spray. Examination of treated foliage at Sault Ste. Marie, showed very good numbers of droplets deposited on the needles. Laboratory bio-assays, where treated foliage was fed to budworms, resulted in high levels of mortality.

The results of this trial will be formally reported and published in due course by Dr. Otvos.

- D. Heppner, Vancouver Forest Region, Vancouver.

Blackheaded Budworm Defoliation Impacts on Young Hemlock/Spruce Stands in the Queen Charlotte Islands. A series of tagged trees were established in two young hemlock/Sitka spruce stands following defoliation by the western blackheaded budworm, Acleris gloverana, in the Queen Charlotte Islands. Both stands received light to moderate levels of defoliation in 1986, with some individual trees being severely defoliated. In 1987, both stands were again lightly defoliated with some of the defoliation being attributed to a sawfly, Neodiprion spp.

The stand most affected by the budworm/sawfly was spaced during the caterpillar feeding period in 1986. It appears that the insects from cut trees migrated to the remaining standing trees, thus concentrating the feeding effects on these trees. The degree of defoliation in this plantation was significantly heavier than in adjacent unspaced stands (this site was visited during the spring 1987 Forest Pest Review Committee Meeting field trip).

The objective of tagging a sample of these trees was to track their survival and recovery after defoliation. There had been concern regarding stocking densities after spacing and tree mortality. The level of defoliation of each tree was also assessed and classed annually.

Upon reassessing these trees this summer it was found that in the most heavily affected stand only one of the 63 tagged trees had died. This level of mortality, which seemed to represent the stand as a whole, occurred fairly evenly over the stand. There was no clumping of dead trees.

In the other less affected unspaced stand, no trees died as a result of defoliation. Additionally, there was no top-killing in either stand and all living, otherwise unaffected trees, now appear healthy.

It appears that young hemlock/Sitka spruce stands in the Queen Charlotte Islands can withstand one or two years of moderate defoliation without appreciable damage.

Increment cores of these tagged trees have been taken and are currently being analyzed for growth losses by Dr. R. Alfaro at the Pacific Forestry Centre in Victoria.

- D. Heppner, Vancouver Forest Region, Vancouver.

Douglas-fir Tussock Moth. The number of moths caught in pheromone traps around the region increased from 1988, but the population does not seem to be nearing the outbreak stage in any one area. A summary of 1988 and 1989 trap catches are as follows:

	DISTRICT					
	Kamloops		Vernon		Merritt	
	1988	1989	1988	1989	1988	1989
Total moths caught	331	429	69	128	78	89
Ave. no. moths/trap (all traps)	7.9	8.4	3.5	6.4	5.6	6.4
Ave. no. moths/traps (positive traps)	9.7	11.0	6.3	21.3	11.1	8.1

Egg mass surveys are being conducted this fall to determine if there are populations building in some areas and whether a spray program using nuclear polyhedrosis virus (NPV) is necessary for 1990.

- L. MacLauchlan, Kamloops Forest Region, Kamloops.

Incidence of White Pine Weevil in the Prince George Timber Supply Area. The distribution and incidence of the white pine weevil, *Pissodes strobi* (Peck) (Coleoptera: Curculionidae), has been investigated in the Vancouver, Cariboo and Prince Rupert Forest Regions. These surveys have never been stratified by biogeoclimatic units, nor extrapolated for analysis at a Timber Supply Area (TSA) level. Therefore, a *P. strobi* incidence survey, stratified by biogeoclimatic subzones, site class and age, was conducted in the Prince George TSA. Fifty-eight second growth, spruce plantations were randomly chosen to be surveyed for attack damage from white pine weevil. In each plantation, systematic strip sampling was performed. The grand mean proportion of spruce stems attacked was 3.25% with a range of 0 to 26.6%. There was a general trend of increasing attack with increasing site moisture, site and age class, but this trend was not statistically significant. The data collected from this study should be analyzed by the computer simulation model, Spruce Weevil Attack Trial, to determine the yield enhancement opportunities due to *P. strobi* attack in the Prince George TSA.

The final report is expected shortly and the second phase of the project, yield enhancement opportunities in the Prince George TSA, will be initiated in 1990.

- S. Taylor and K. Lewis, Protection Branch, Victoria.

White Pine Weevil in Young Stands. Two interior spruce plantations which were planted in 1986 have already shown significant damage from white pine weevil. The plantations have 2% infestation levels even though the trees are less than 1 m tall. At this size and age weevil attack results in loss of half the tree height. The source of the weevils appears to be adjacent 10 to 15 year old plantations which have infestation levels greater than 5%.

- L. Rankin, Cariboo Forest Region, Williams Lake.

Clipping Caper Continues in Cariboo for White Pine Weevil (*Pissodes strobi*). An operational clipping and parasite/predator augmentation trial on a 35.5 ha interior spruce plantation at Antoine Lake in the Horsefly Forest District was completed for the second straight year. Clipped leaders were put into plastic buckets covered with screens with 1.68 mm square openings (Hulme et al. 1986). The weevil cannot escape but associated parasites and predators are able to return to the plantation to parasitize and prey on *P. Strobi*. A total of 966 leaders were clipped from the plantation. There was a 10.6% decrease in infested leaders from the previous year. An additional 3,250 leaders were clipped from another heavily infested location near Mitchell Bay on Horsefly Lake. The leaders were pooled and placed in 61 plastic buckets and hung from deciduous trees throughout the plantation. The clipping cost totalled \$186/ha for the Antoine Lake plantation. When the costs of clipping additional leaders from Mitchell Bay were factored in, the price rose to \$292/ha.

- L. Rankin, Cariboo Forest Region, Williams Lake.

White Pine Weevil Survey in Golden. An extensive survey was carried out in Golden Forest District this fall to determine the distribution and intensity of the weevil, *Pissodes strobi*, infestation. Sixty-one spruce plantations of susceptible age were surveyed using a systematic transect line method. Results indicate approximately 450 ha of spruce plantations with significant weevil infestation, with intensity ranging from 5% - 55% of weevil damaged spruce trees per site. Some conclusions were drawn regarding high-hazard areas, and silvicultural practices will be used to control weevil damage in these areas. Silvicultural options for high-risk sites include planting an alternative species, prescribing a mixed plantation, or allowing a deciduous overstory to establish itself on the plantation. Sites over 1,200 meters in elevation showed no weevil infestation, and will be considered no-risk areas. Pest management will continue to monitor younger spruce plantations in the district as they reach susceptible age. Predator enhancement, pesticide stem implants, or pheromone trapping will be implemented on new infestations if ongoing research into these methods prove them to be effective. Copies of the survey method and summary calculations are available from pest management at Golden.

- E. Williams, Golden Forest District, Nelson.

Root Collar Weevil Workshop. A one-day workshop on the biology, impact and control of Warren's root collar weevil was held in Hazelton on August 16. The featured speaker was Dr. Herb Cerezke of the Northern Forestry Centre who described the results of over twenty years of his work on the weevil in Alberta. The objective of the workshop was to update district and licensee staff and contractors on the potential of this pest to impact on the local timber supply. As mentioned in previous Pest Management Progress issues, 1988 surveys and silviculture survey information revealed an alarming infestation rate in young pine stands in the Kispiox Forest District.

To our relief, based on Dr. Cerezke's observations of our most heavily infested plantations and his description of the insect's biology and impact on pine, it became apparent that intense damage would only be likely in a small number of specific stand types. Overall mortality is anticipated to be less than 5%. Lodgepole pine has an amazing capacity to tolerate root collar girdling. No effect on growth is observed until girdling exceeds 60% of the circumference. Mortality usually results when more than 80% of the root collar is girdled.

The most significant damage can occur in six to 20 year old plantations with deep organic layers that are surrounded by heavily infested mature stands. These high risk plantations could be identified at the pre-harvest silviculture prescription stage. Alternative species (e.g. spruce is considered resistant to damage), increased stocking, or site preparation to minimize duff depths (e.g. prescribed fire) could be recommended to minimize the risk of damage.

A complete transcript of Dr. Cerezke's talk is available from the Prince Rupert protection section.

- T. Ebata, Prince Rupert Forest Region, Smithers.

Forest Resource Development Agreement (FRDA) Root Collar Weevil Survey in the Kispiox Forest District. This summer, a 30 plantation survey was performed throughout the Kispiox Timber Supply Area (TSA) by Mr. Geoff Byford, University of B.C. Forest Entomology MSc. candidate. This FRDA funded survey of randomly chosen plantations was done to determine the level of weevil damage throughout the TSA and to see if any correlations between site and weevil abundance could be made. The weevil was found in all pine plantations but at a much lower infestation level than anticipated. Mortality rarely exceeded 5% in the most heavily infested plantations. A full report will be available by January 1, 1990 and will be distributed upon request.

- T. Ebata, Prince Rupert Forest Region, Smithers.

Warren's Root Collar Weevil (Hylobius Warreni) Survey. To assess the distribution and damage caused by Warren's root collar weevil in the Cariboo Forest Region, a survey was conducted in naturally regenerated and planted young stands. The total height, DBH, tree response to the weevil attack and the presence of other insects or diseases was recorded for infested and uninfested trees within plots. Preliminary results indicate that the root collar weevil prefers semi-moist and moist biogeoclimatic subzones. Dry subzones with thin duff had very low weevil incidence. Weevils selected the larger trees in a stand at all stand densities. Percent weevil infestation decreased with increasing stand density. There was an average infestation level of 19.6% of total stems in planted stands, 13.6% in spaced stands and 3.8% in natural stands. Spaced stands have weevil populations which are concentrated when spacing occurs and this may cause increased mortality and growth loss. Surveys will be continued in the summer of 1990 to delineate the biogeoclimatic subzones most at risk from the root collar weevil.

- L. Rankin, Cariboo Forest Region, Williams Lake and K. McKenzie, Co-op Student, University of Victoria, Victoria.

Gypsy Moth Status. Gypsy moth trapping was again conducted province-wide by Agriculture Canada, the B.C. Forest Service, and Forestry Canada. Moths were captured in several locations in the province using traps placed in urban areas. Forest Service traps placed in recreation areas and other high use forested areas were all negative. Moths were trapped as follows:

<u>Location</u>	<u>Moths Trapped</u>
Parksville	8 males (+ 2 female + 1 egg mass)
Saanich Peninsula	5 males
Thetis Lake Park	1 male
Chilliwack	1 male
Cultus Lake	1 male
Ft. Langley	1 male
CFB-Jericho (Vancouver)	1 male
Manning Park	1 male
West Vancouver	5 males
Kelowna	1 male

Egg mass surveys will be conducted this fall and winter to provide information on the need for treatment in 1990. Some treatment with Bacillus thuringiensis is likely.

The B.C. Forest Service continues to support Agriculture Canada's lead role in survey and eradication efforts for gypsy moth.

- P. Hall, Protection Branch, Victoria.

Protection Manual (Volume II) Chapter on Forest Defoliators. A first draft of this chapter was completed during the summer. Final editing and refinements are underway and are expected to be completed by early in the new year.

- P. Hall, Protection Branch, Victoria.

New Pest In Cariboo. Seedlings in an interior spruce plantation located near the Roaring River in the Horsefly Forest District were damaged by a common and previously harmless beetle called Syneta carinta (Chrysomelidae). Bob Duncan from Forestry Canada identified this cerambycid-like beetle. It has yellowish-brown elytra with a shiny black head and thorax. Minor damage has been reported by the larvae feeding on conifer roots and adults feeding on foliage of mature trees. As far as is known this is the first reported damage to seedlings by these beetles. The beetles were concentrated in a 20 ha section of a 170 ha cutblock where 23% of seedlings examined had one or more beetles feeding on them. Beetles were observed feeding on bark and buds which resulted in dead buds and some girdling of the trees. Mortality was less than 1%.

- L. Rankin, Cariboo Forest Region, Williams Lake.

Cone and Seed Insect Control. Hydraulic applications of the systemic insecticide Metasystox-RR will successfully control cone and seed insects on Douglas-fir. During the last two years, trials have been underway to test the efficacy of this material on interior spruce.

In 1989, Metasystox-R was applied as a foliar spray or poured directly into holes drilled into seed orchard spruce trees just below the first lateral branches. Both treatments resulted in excellent control of the spruce cone maggot.

This information, along with the results of several other trials will be combined in an attempt to gain minor use registration for Metasystox-R for the control of cone and seed insects on spruce. The package will also contain data supporting the use of injected Matasystox-R as a control for cone and seed insects on Douglas-fir.

- D. Summers, Silviculture Branch, Victoria.

1989 Aerial Pest Survey Results for the Cariboo Forest Region. The 1989 aerial survey of pest damage in the Cariboo was flown from July 15 to September 30. The results are presented in the table below.

Volumes of killed trees and stands infested were not available in time for publication. Area and volume loss calculation facilities will soon be available to all through selection of the 'PST' option of the VAX protection information system main menu. Area/volume loss calculation will appear as 'BTL' on the menu under the 'PST' option.

The aerial survey this summer again was done by contract. It was supplemented by the work of the Cariboo Forest Region staff and Bob Erickson of the Forest Insect and Disease Survey Unit at Forestry Canada. Insects and areas surveyed were as follows:

PEST	AREA INFESTED (ha)
mountain pine beetle	2 600
Douglas-fir beetle	2 800
spruce beetle	6
balsam bark beetle	2 100
western spruce budworm	---
2-year cycle budworm	2 800
forest tent caterpillar	3 200
climatic (winter) damage	2 600
flood damage	150
windthrow	230

Douglas-fir beetle infestations have increased about 40 times over those recorded in 1988, primarily a result of drought over the past two years. Areas surveyed in August, 1988 which had a scattering of single-tree damage now have scattered infestation polygons of three to five hectares in size.

Most of the new mountain pine beetle (MPB) kill is in the Chilko Lake area, where the core of the existing outbreak has intensified and four new spots have appeared in the control zone. MPB damage outside this area is scattered and confined mostly to single-tree infestations.

Two spots of spruce beetle were located in 1989; one at Mary Creek northeast of Quesnel, and one at McKay River southeast of Horsefly.

Balsam bark beetle damage increased significantly over some 140 ha mapped in 1988. Much of the infestation is found in Quesnel and Horsefly Forest Districts.

Western spruce budworm damage was minimal this year. Two-year cycle budworm damage also decreased in the first year of the life cycle for the insect.

Forest tent caterpillar defoliated stands throughout the eastern part of the Cariboo Forest Region, causing moderate to severe defoliation by Montana Lake and Bridge Lake in the 100 Mile House Forest District.

A thaw followed by a severe frost in February of this year caused widespread damage throughout the region: most affected were western red cedar and western hemlock in the wet belt.

- M. Hamm, Cariboo Forest Region, Williams Lake.

FOREST PATHOLOGY

Rhizina Ravages Prince Rupert Region. Rhizina undulata root disease, known commonly as English tea break disease, has returned with a vengeance in 1989 to the Prince Rupert Forest Region after the Forest Insect and Disease Survey Unit (FIDS), Forestry Canada, gave warnings of its presence in the Kispiox Timber Supply Area last year.

An average of 23% (range 1 to 74%) of newly planted seedlings were killed by September 1989 and another 10% on average are suspected to be affected by the disease (and subsequently will die) in the Lakes, Morice, Bulkley, Kispiox, and Kalum Forest Districts. Details of the 1989 infestations are reported in a October FIDS Pest Report entitled "Seedling Mortality Caused by Rhizina root disease, Prince Rupert Forest Region, 1989."

After surviving a brief episode of media attention about the catastrophic losses of seedlings, silviculture and pest management staff produced an action plan at the fall silviculture resource officer's meeting in Smithers to deal with the problem. The action plan was based on the facts presented at the meeting by the Prince Rupert Forest Region FIDS rangers, Rod Garbutt and Al Stewart, who gave a short summary of the disease's biology, impact and management and their survey results. From this information the resource officers decided to continue planting during the next season as scheduled, but, if possible, use the trees destined for recently burned blocks to plant Not Satisfactorily Restocked (NSR) plantations nearby. Another suggestion was

to avoid planting seedlings within 30 cm of a Rhizina killed seedling since the disease is still virulent near the dead seedling. Local licencees having Rhizina problems have performed regeneration surveys and will be replanting those blocks that are NSR.

In the long-term, Rhizina hazard areas will be identified through regeneration and FIDS surveys and, within these areas, planting will be delayed for one year and spring burning will be promoted. Additional training of field staff and contractors is also planned to help identify the disease and its symptoms.

- T. Ebata, Prince Rupert Forest Region, Smithers.

Root Removal Trails - Knappen Creek. This 40 ha patch was partially logged to leave patches of natural regeneration and seed trees, and to remove mountain pine beetle and dwarf mistletoe infected stems. Unfortunately the patches of given natural regeneration were all root rot centres.

Smallwood Creek. A five hectare stand of "Kootenay Mix," infected with Phellinus and Armillaria root diseases, will be push-over logged and removed with a KMC 180 grapple equipped skidder. Forty-eight prism plots were established to estimate volume (Sampling Error = 12%) so that any extra harvested volume that occurs over and above our cruise estimate can be properly ascribed to the treatment and not to cruising or statistical errors.

Both the pixel survey (95% of pixels infected) and the cruise (96% of plots infected) indicated very high infection in this stand.

The area was then relogged and four treatments will be applied:

1. treat as per the original prescription.
2. plant and pray (i.e. plant away from stump - accept reduced stocking).
3. destump with excavator.
4. destump and root rake with excavator.

As each treatment will be 10 - 12 hectares in size, cost data should be more generally applicable.

A five hectare patch of timber was left unlogged, as a biological control and as a wildlife sanctuary.

Pope and Talbot and the Boundary Forest District are cooperating in operational trial boundary establishment, plot establishment/remasurement while the region will pay for the destumping.

- D. Norris, Nelson Forest Region, Nelson.

Basal Lesions as Pre-Harvest Silviculture Prescription (PHSP). Suppressed and intermediate red cedar trees usually have basal lesions, partially healed scars, usually under tightened bark, when Armillaria is present in significant amounts in a stand. These lesions are useful indicators in PHSP walkthroughs, pixel surveys or timber cruises. N.B. Timberline Consultants can use fire damage codes to record and compile Armillaria infection codes, without adding

more than 1 - 2% to field work costs. Complete root disease surveys can be piggy backed onto operational or drainage cruises or, for that matter, inventory plots.

Basal lesions have been found in western hemlock, grand fir, spruce and rarely in Douglas-fir. Nelson Forest Region has some raw video footage of various basal lesions in western red cedar.

- D. Norris, Nelson Forest Region, Nelson.

Rhizina Surveys - Nelson Region. Rhizina surveys were conducted throughout the region from late July to early October. Post burn evaluations were done simultaneously and will be calibrated by pre-post burn evaluations.

Tentative results appear to be about the same impact as last year. Rhizina infection rates appear to be a function of:

- (1) Biogeoclimatic zone (especially the ICH group and transitional to that zone).
- (2) Burn intensity (impact rank 2 to 4, creates the highest risk for Rhizina).
- (3) Decadency of original timber type (more decadents = more Rhizina).

Rhizina seems to affect fireweed, as fireweed in mortality zones is stunted.

The University of B.C. has been funded by the Forest Resource Development Agreement to isolate this fungus from seedlings and via seedling inoculation, to develop a graduating symptomology description for tree seedlings.

- D. Norris, Nelson Forest Region, Nelson

Push-over Logging, Caterpillar and Backhoe Destumping Trial. In 1987, a destumping trial was carried out by Evans Products Co. Ltd. near Kinbasket Lake.

Trees were push-over logged with a 235 backhoe; stumps were removed with the 235 backhoe and with a D-7 caterpillar tractor.

A comparison of the three stump removal techniques indicates that push-over logging gave the best overall results. Caterpillar destumping removed the most roots but at the expense of very high and undesirable amounts of soil disturbance. Backhoe stumping left too many roots and appears to require slash removal prior to treatment in order to be effective.

Push-over logging combines good root removal, good duff retention and mineral soil exposure and the potential for improved wood utilization in comparison to conventional logging. With better skidding techniques this method of stump removal would appear to be preferred.

- D. Norris, Nelson Forest Region, Nelson.

Pixel Survey Method for Root Rot Detection. A new survey method was used to determine the levels of Armillaria and Phellinus root rot in stands planned for harvest through the Small Business Enterprise Program. The pixel survey, developed by D. Norris, Nelson Forest Region pathologist, involves dividing the survey area into pre-determined striplines. Pixels (3m X 50m) are located right and left along the length of the striplines. If root rot is positively identified within a pixel, it is marked as infected. At the end of the survey a total percentage of infected pixels can be calculated to give a reasonable estimate of root rot infected areas.

This particular survey method is easier to use than line intercept methods. For more information regarding the pixel survey method, please contact the pest management officer at the Kootenay Lake Forest District, 825-4415.

- J. Schafthuisen, Kootenay Lake Forest District, Nelson.

Inonotus tomentosus in the Prince George Forest Region. What options are available for the control or alienation of tomentosus root disease? To date, much of the focus has centered on mechanical or chemical means of removing or destroying inoculum on a site. Species substitution and biological means of displacing the pathogen could also hold promise in a future where an environmentally conscious public may dictate the way we combat pests. Tomentosus has been observed killing both young and old spruce, subalpine fir and pine in the Prince George Forest Region. What about Douglas-fir? Several sites in the Prince George Forest District, supporting severe root disease problems, host very healthy Douglas-fir which are outgrowing even the unaffected spruce.

To assess the opportunities available through control strategies, species susceptibility trials, yielding both short and long-term susceptibility values, will be established on sites affected with tomentosus across the region. All districts in the region have tomentosus, and thus will benefit from these trials.

Treatments such as destumping and chemical applications, as well as biological control methods will also be tested to provide short and long-term estimates of losses resulting from no treatment and gains to be made through the various treatments.

- R. Reich, Prince George Forest Region, Prince George.

Rhizina Root Disease. Reports from Ministry staff and Forestry Canada Forest Insect and Disease Survey technicians indicate that Rhizina root disease of planted conifer seedlings is a problem in some localities.

The disease is caused when spores of the fungus Rhizina undulata are activated by wildfire or prescribed burns to germinate, and in the next spring, or early summer, the mycelium attacks nearby planted seedlings. Dark brown brain-shaped fruiting bodies appear in July - August near affected seedlings.

Surveys to determine the extent of the damage were undertaken in 1988 when the disease was noticed in several areas in the south-western interior of B.C., and have continued in 1989 with funding from the Canada - B.C. Forest Resource Development Agreement, Intensive Forestry Pest Control Subprogram.

Preliminary results from the Nelson Forest Region suggest that most injury from the disease is associated with intermediate intensity burns on certain sites. Work is underway to characterize the damage-prone sites, and to develop guidelines to avoid the losses.

- J. A. Muir, Protection Branch, Victoria, and D. Norris, Nelson Forest Region, Nelson.

European Leafy Mistletoe. Members of a committee of the B.C. Plant Protection Advisory Council recently evaluated the status of the European leafy mistletoe, Viscum album, that was discovered at four locations in Victoria in 1988.

Surveys in Victoria in late 1988 indicated that the mistletoe had been disseminated by people, and had not been spread by birds to nearby susceptible trees. Apple trees are the only known host trees.

The committee recommended to the council that the known mistletoe infestations appear to pose no threat, and that no action should be undertaken at this time. The infestations will be monitored, and the property owners will be encouraged to avoid distributing the seeds and plants as Christmas decorations to other people.

- J. A. Muir, Protection Branch, Victoria.

Another Cure for Root Rot. Researcher Walt Thies, USDA Forest Service, Pacific Northwest Research Station, Corvallis, has shown that chloropicrin is a very effective chemical treatment for laminated root rot, caused by the fungus Phellinus weirii, in Douglas-fir trees.

B.C. foresters and scientists visited Walt's trial areas in northern Oregon in September, and were very impressed with the treatment. The fungicide was recently registered in the USA as a stump treatment for laminated root rot. The treatment eliminated the fungus from the stump and the roots for a distance of at least 2.5 m from the stump. The chloropicrin is poured into 2 cm diameter holes drilled into the stump, and then corked with a wood dowell. The cost is approximately the same as removing stumps with an excavator, but the chemical treatment offers other advantages such as ease of treating only a few stumps, little expenditure for equipment, and no site disturbance. Some potential disadvantages are that a pesticide permit will be required for use in B.C., and that the chemical is being reviewed for registration status by Agriculture Canada.

Particularly impressive in Oregon was the treatment of live trees with the fungicide. Most of the trees survived, even those with severe symptoms of root rot. Seven years after treatment, the trees had recovered and were growing very well. The treatment did not test the potential of this treatment in areas such as recreation sites and parks where it is important to try to preserve infected trees.

Members of an ad hoc group in B.C. are looking for potential sites for treatment trials in, for example, harvested areas, recreation sites, young stands that will be spaced or commercially thinned, or sites that will be selectively cut. Sites should be relatively uniform, with eight to 10 or more infection centres of root rot, and relatively accessible. Anyone interested in cooperating in this trial work is invited to contact me for further details.

- J. A. Muir, Protection Branch, Victoria.

Cutting Back the Losses to White Pine Blister Rust. A 48 hectare stand of western white pine in the Salmon Arm Forest District was pruned in 1984 to reduce the impact of blister rust. The stand was surveyed in 1989 to check the success of the pruning after five years and to assess the need for a second pruning lift.

In 1984 the stand contained 249 white pine per hectare: 71.5% healthy, 4.4% dead, 4.4% stem cankers, and 19.7% branch cankers. The trees were pruned to an average height of 1.0 meter at a cost of \$131/ha.

A sample of 100 trees was taken in 1989. Of these 45% were healthy, 7% were dead, 22% had stem cankers below pruning height, 2% had stem cankers above pruning height, 21% had branch cankers below 2.4 m height, and 3% above. Lower branches were missed on 4% of the trees.

The results indicate that the pruning was only moderately successful. There appears to be a much higher number of stem cankers than originally thought, most near the base of the tree. A second pruning to 2.4 meters or 2/3 of the live crown, would render 2/3 of the remaining white pine canker-free.

- J. Wright, Salmon Arm Forest District, Salmon Arm.

Update on Tomentosus Spacing Trial. Progress will be made this winter in the completion of a Tomentosus spacing trial, funded by the Forest Resource Development Agreement, with the mechanical spacing of three one-hectare blocks located in a heavily infected 50 year old white spruce stand near Knockholt in the Morice Forest District. In the spring, another three one-hectare blocks will be chemically spaced by hack and squirt application of Vision^R. The trial will determine if spacing will reduce the rate of spread and the impact of the disease. Crop trees will be selected based on normal operational criteria and known infested trees will be removed.

Pathocon Consulting originally set-up the trial area and will supervise and train the spacing crew.

- T. Ebata, Prince Rupert Forest Region, Smithers.

Armillaria root disease: A cooperative root rot control installation in the Alex Fraser Research Forest. The Cariboo Forest Region has entered into a five year contract with the University of British Columbia, Department of Forest Sciences, to study several large areas (40+ ha) of Armillaria ostoya in the Alex Fraser Research Forest. This study will attempt to answer such questions as:

1. What are the losses in productivity due to Armillaria centers?
 - . how fast are the centers enlarging?
 - . what is the productivity of the infected areas?
2. How will the disease transmit to the next generation?
 - . is the disease active in the middle of large centers?
 - . how does the disease survive in the absence of continuous conifer cover?
 - . how readily does the disease spread from hardwoods to conifers?
3. What is the relative susceptibility of various conifers and hardwood species?
 - . how susceptible are interior spruce, lodgepole pine, larch, western white pine, ponderosa pine, aspen, birch and cottonwood?
4. Is stump removal effective in controlling Armillaria?
 - . what is the efficacy of treatments in relation to size of inoculum left on the area?
5. Do scattered Armillaria infection centers provide any benefits?
 - . are root disease centers a natural part of the forest, allowing other organisms, such as ungulates and birds, to survive?
 - . what are the impacts on birds and ungulates?

Research Plan: Initial step is to verify the identification of the causal agent and the extent of the centers. Permanent Sample Plot's will have to be established along the periphery and elsewhere to measure rate of expansion in undisturbed areas. Further refinements of the project will depend on the survey information.

Tentative Schedule:

- 1989 Ground survey, experimental design and plot layout.
Completed at this point - the ground survey and plot layout.
Aerial photography was also scheduled for 1989, however unsuitable weather in August prevented the completion of this phase.
- 1990 Aerial photography, road construction, seed collection.
- 1991 Logging of area, installation of control treatments.
- 1992 Planting.
- 1995 First measurements.

Dr. Bart vander Kamp is the contract supervisor for U.B.C. and responsible for the research plan.

- D. Doidge, Cariboo Forest Region, Williams Lake.

Rusts of lodgepole pine: Endocronartium harknessii, Cronartium coleosporoides and Cronartium comandrae. The Cariboo Forest Region hired a co-operative education student (Justine Richmond) from Simon Fraser University to conduct a study to determine the incidence of rust in the Cariboo in lodgepole pine stands, spaced, planted and natural.

Method: Transect lines and 3.99 meter radius plots at 50 meter intervals. All pine trees in the plot examined for all three rusts.

Results: The mean infection level for Western gall rust, Endocronartium harknessii, was 8.11% for 31 stands surveyed.

The infection levels for the two blister rusts, Cronartium coleosporoides and Cronartium comandrae were less than 1% in the same 31 stands. Stand treatment caused a noticeable trend in incidence levels of western gall rust. Planted stands had the highest level (14.1%), spaced stands were next (5.54%) and natural stands had the lowest (4.54%). Although the over-all incidence of blister rust was low, the highest infection levels were in spaced stands.

Justice Richmond did such an excellent job on her work term report that it will soon be published as an internal report.

- D. Doidge, Cariboo Forest Region, Williams Lake.

Creature from the Blackened Duff - Rhizina root disease, Rhizina undulata. The beast lurking in the duff in the form of sleeping spores waiting to be activated by a nice warm fire has emerged from the dark soil. Rhizina killed approximately 15% of Douglas-fir seedlings on a 1988 burn site near Weldwood's camp on the Cariboo River, as well as scattered lodgepole pine seedlings near the Little River.

- D. Doidge, Cariboo Forest Region, Williams Lake.

Armillaria root disease. In the Quesnel Forest District 31 hectares of lodgepole pine were spaced in September, 1987 on the Tzenzacut Lake road west of Quesnel. A 1% survey in July 1989 indicated losses of 43% in the spaced area caused by Armillaria root disease. Permanent study plots have been established and 70 mm aerial photos were taken of the infested area so we can follow the progress of the infestation. Examination of the non-spaced adjacent area indicated that Armillaria was present but very difficult to identify because of the high stocking level and other damaging agents such as rodents and blister rusts.

- D. Doidge, Cariboo Forest Region, Williams Lake.

FOREST VEGETATION MANAGEMENT

COMB: A Computerized Bibliography on the Ecology, Utilization and Management of Several Species which Compete with Conifers. COMB is a computerized bibliography which includes citations and abstracts of published references dealing with the ecology, competitive status, utilization, and management of several plant species which compete with conifer seedlings in British Columbia. This computerized bibliography was developed to simplify the acquisition of reference materials by operational, research, and extension staff.

The database can be searched for references dealing with specific topics, and citations and abstracts can be displayed on screen or printed. Users of the current version of the computerized bibliography must have an IBM-PC or compatible microcomputer and dBASE III PLUS¹. The COMB package includes programs for use with dBASE III PLUS which simplify these searches.

The species presently included in the database are:

<u>Alnus viridis</u> spp. <u>sinuata</u>	sitka alder
<u>Athyrium filix-femina</u>	lady fern
<u>Betula papyrifera</u>	paper birch
<u>Calamagrostis rubescens</u>	pinegrass
<u>Cornus sericea</u>	red-osier dogwood
<u>Epilobium angustifolium</u>	fireweed
<u>Lonicera involucrata</u>	black twinberry
<u>Menziesia ferruginea</u>	false azalea
<u>Pteridium aquilinum</u>	bracken
<u>Rhododendron albiflorum</u>	white-flowered rhododendron
<u>Rubus idaeus</u>	raspberry
<u>Rubus parviflorus</u>	thimbleberry
<u>Sambucus</u> spp.	elderberry species

Species currently being added to the bibliography include:

<u>Acer circinatum</u>	vine maple
<u>Acer glabrum</u>	Douglas maple
<u>Acer macrophyllum</u>	bigleaf maple
<u>Alnus rubra</u>	red alder
<u>Corylus cornuta</u>	beaked hazelnut
<u>Gaultheria shallon</u>	salal
<u>Oplopanax horridus</u>	devil's club
<u>Polystichum munitum</u>	sword fern
<u>Rubus spectabilis</u>	salmonberry

Copies of references listed in the bibliography which are shorter than 10 pages in length are on file in the University of B.C. INFORMS Library and at the B.C. Ministry of Forests, Research Branch.

In early 1990, the COMB package will be expanded to include all software required for its use. In addition, database files will also be made available for use with PRO-CITE² software.

Contact Phil Comeau, B.C. Ministry of Forests, Research Branch (387-3019) if you want a copy or if you want further details.

Support for development of the COMB computerized bibliography has been provided by the Canada - British Columbia Forest Resources Development Agreement.

1 dBASE III PLUS is a registered trademark of Ashton-Tate.

2 PRO-CITE is a registered trademark of Personal Bibliography Software Inc.

Reference to specific software does not represent an endorsement of this product by the Ministry of Forests or Forestry Canada.

- P. G. Comeau, Research Branch, Victoria, and S. B. Watts, Faculty of Forestry, University of B.C., Vancouver.

Northern Interior Vegetation management Association. After two years of negotiation, a group of concerned forest licensees, Forestry Canada and the Forest Service have formed the Northern Interior Vegetation Management Association. The association's mandate is to:

- . provide technical information to the members;
- . develop an operational monitoring system to assess vegetation control impacts on crop trees and wildlife habitat;
- . facilitate information exchange among members;
- . educate the public on vegetation management issues; and
- . provide extension services to members.

Membership is comprised of Balfour Forest Products, Dunkley Lumber, Finlay Forest Industries, Fletcher-Challenge, Northwood, Rustad Bros, The Pas Lumber, Weldwood, West Fraser Mills, Forestry Canada and the Cariboo, Prince Rupert and Prince George Forest Regions of the Ministry of Forests, R.G. (Bob) Holtby, P.Ag., has been retained as manager.

Anyone interested in receiving the association's newsletter or obtaining further information may contact Bob Holtby at 564-3770 (fax. 563-1695).

- B. Pamplin, Prince George Forest Region, Prince George.

RANGE PEST MANAGEMENT

Noxious Weed Chemical Containment Program: Kamloops Forest Region. Our seven districts were again deployed in the ongoing battle to hold the advancing lines of knapweed infestations. The main objective of our program is to contain the spread of knapweed onto uninfested rangelands. We have also taken action to contain other noxious weeds, namely houndstongue and toadflax which are also increasing their range. These weeds are treated in association with spraying for knapweed. In parts of the region we have been able to effectively reduce their advancement, and with a continued effort eliminate smaller infestations. The chemical containment program appears to be buying us some needed time while the biological containment program becomes fully operational. The strategy of zoning some areas for chemical control and other areas for biological control is now fully implemented in all our districts.

During the 1989 season there were 580 hectares of roadsides, rights-of-way and grassland openings treated, 17% more than last year.

Two interesting observations were made this year. Some spotted knapweed plants sprayed during July have been found this fall to be re-sprouting from their bases. The re-sprouting has occurred in both single stemmed plants and more vigorous multi-stemmed plants. Also, a heavy infestation of diffuse knapweed in the Pritchard area appears to be giving way to sulphur cinquefoil. The diffuse knapweed plants are not vigorous and have few flower heads and few rosettes present. Could this indicate the success of the bioagent, Urophora spp.? Both of these interesting situations will be monitored next season.

- P. Youwe, Kamloops Forest Region, Kamloops.

Biocontrol Agents for Diffuse and Spotted Knapweed. The Cariboo Forest Region range section continues efforts to establish biocontrol agents on both diffuse and spotted knapweed in the most southern part of the region. Four releases of a buprestid beetle, Sphenoptera jugoslavica, were made in the 20 mile area south of Clinton. One release of the moth, Agapeta zoegana, made in the summer of 1988 was monitored this fall and found to be successfully established. Biocontrol agents established in sites south of Clinton where chemical control is impractical or not possible will reduce potential for the northward spread of knapweed.

The Cariboo Range Section also made an initial release of the weevil, Aphthona nigriticutis, on a large infestation (>20 ha) of leafy spurge Euphorbia esula, in the Canoe Creek area. This release was made with the cooperation of the Canoe Creek Indian Band, since the site is on the Canoe Creek Indian Reserve, but is expanding onto adjacent Crown lands.

- C. Easthope, Cariboo Forest Region, Cariboo.

Urophura Stylata Survival. Bull thistle, Cirsium vulgare, while not a noxious weed of high threat to rangelands, has nonetheless been a significantly persistent and undesirable species. As the subject of increasing concern, any form of control or reduction would be desirable. A seed reducing agent, Urophura stylata, which had previously been established in the south-western part of the province, was consequently introduced in 1988 to two sites in the Smithers area of north-central B.C.

We were able to check one of the sites, Luno Creek, on June 29 of this year and I'm happy to report that they survived their first winter in the 'north.' We counted seven flies in a short survey, and they were mating.

As a result we are anxious to release more of the agents this fall, hopefully including Morice and Lakes Forest Districts.

- W. Erickson, Prince Rupert Region, Prince Rupert.

Biological control of knapweed and toad flax continued to expand. Areas with long-term insect establishment are beginning to show reduction of knapweed biomass and seed production with an increase in forage.

A setback was suffered at the Kamloops rearing plots with a severe winter kill. Most insects were reestablished but no field releases were possible. Field releases of the root boring beetle from collections at White Lake continued this year.

A defoliating moth has been released on toadflax. Previous releases have failed but we hope that an improved release procedure will be successful.

An insect has been released on leafy spurge. It has been established on the prairies and in the Cariboo and we are hoping for similar success here.

Searches and screening for a biocontrol agent for hounds tongue are continuing in Europe.

- R. Tucker, Kamloops Forest Region, Kamloops.

VERTEBRATE PESTS

Porcupine Pest Management Update. Porcupines continue to plague Sitka spruce and western hemlock second growth stands in the Kalum and North Coast Forest Districts. More than 5 000 ha of damage is currently identified. Both districts are annually monitoring the damage.

A great deal of effort is now being directed to develop control techniques:

- . two Masters level graduate students, Andrea Lawson and John Krebs, funded under a South Moresby Replacement Fund grant are working with Dr. Tom Sullivan in the Kalum Forest District to develop a better understanding of porcupine food preferences, and population movements;

- . as a result of an intensive hunting program in the Kalum Forest District, five hundred porcupines were killed by trappers for a fee of \$25 per animal paid by the Ministry. A monitoring program will attempt to relate the reduced population to damage reduction, however, porcupine hunting as an operational control technique will not be initiated at this time;
 - . a great deal of effort has gone into acquiring fishers, predators of porcupines, in order to achieve porcupine population reduction in the north coast area. This initiative has not been very successful to date. However, a larger list of possible fisher suppliers will soon be available.
 - . the Wildlife Branch, will be initiating a field research study centered in the Chilcotin area to learn more about the habitat requirements of fishers. This study, to be conducted with our input, will assist our fisher introductions for porcupine control.
- J. Henigman, Protection Branch, Victoria and T. Ebata, Prince Rupert Forest Region, Smithers.

Porcupine Population Study. A five year porcupine population monitoring study funded by the South Moresby Forest Replacement Fund (SMFRF) began this summer in the West Kalum on Skeena Cellulose's Tree Farm Licence 1. There are four study areas, each approximately 100 hectares in size in two natural and two managed stands. A. Lawson and J. Krebs, two graduate students working with Dr. Tom Sullivan of Mammal Pest Management Ltd., surveyed porcupine damage within the study area and radio-collared ten porcupines. Permanent damage in growth and yield plots and vegetation plots will be installed in all stands this fall. During the winter when porcupines feed on tree bark, the collared animals will be tracked and the amount of damage per animal will be recorded. One objective is to estimate the porcupine's range and determine if population suppression techniques would be successful. Additional porcupines will be collared as the survey continues. Another objective is to determine the fate of porcupine feeding scars on immature hemlock since it is believed to allow the entry of heart rot fungi.

The public will be informed of the porcupine problem, and potential ways of minimizing damage, through a locally produced TV news magazine called the "Skeena Journal." This program should be completed by summer, 1990.

- T. Ebata, Prince Rupert Forest Region, Smithers.

PESTICIDES

Field Calibration of the Pesticide Drift and Deposit Measurement Method. A drift and deposit operational field measurement method was proposed to the Forest Service by Saskatchewan Research Council (SRC) in 1988. A contract was given to the SRC by Pesticide Advisory Committee to develop a data collection method which could be used by all agencies who may be involved in drift and deposit analyses of pesticides. The method had to be reasonably accurate, easily employed in the field and applicable to the various site conditions normally encountered in the province.

In October, 1989, the proposed method was calibrated in field trials in the Chilliwack Forest District. Much of the work was focused on the assessment of aerial herbicide spraying gear and a Simplex system using D8-46 nozzles. Monitoring equipment in the study included Krone-Cote paper, water sensitive paper and roto-rods. The accuracy of this equipment was compared to that available from laboratory air samplers. A report from SRC on the method of calibration will be available soon after the end of March, 1989. For more information on this study, please contact Dr. Jacob Boateng, Silviculture Branch.

- J. Henigman, Protection Branch, Victoria.

Pre-attack Injection of MSMA Against Mountain Pine Beetle. Twenty-one healthy lodgepole pine trees at each of three locations in the Vanderhoof Forest District were baited with mountain pine beetle semio-chemicals in mid-June 1989. At each location, between June 21-26, seven of these trees were randomly chosen and injected with 3/8-strength MSMA (120 g/L Glowon^R) and an additional seven were treated with 1/2-strength MSMA (160 g/L). The remaining seven baited trees at each location were left untreated to serve as checks. Mountain pine beetle attack on these trees began in early July and peaked approximately August 1st.

The objectives of the trial were two-fold: 1) to determine if mountain pine beetle would attack trees treated with these dosages of MSMA and not be repelled, and 2) to determine if 3/8 - strength, and/or 1/2 - strength MSMA would successfully prevent brood maturation. Plot trees were examined for pitch tubes at least twice per week from late June until the termination of the adult flight in August. Although the data has not been analyzed to date, early indications are that both dosages of MSMA were not repellent to attacking adults at two of three locations. In May 1990, all attacked pine will be felled and extensively sampled in order to determine treatment efficacy. If successful, this strategy could extend our time "window" to apply MSMA by three to four weeks in the summer. A summary report on the 1988 and 1989 trials will be available next summer.

- R. Hodgkinson, Prince George Forest Region, Prince George.

MSMA Ashing Study. As part of a study to assess the efficacy of postattack MSMA treatment on mountain pine beetle infested lodgepole pine, arsenic analysis was done on randomly selected trees. This was also done due to a concern over unknown levels of arsenic in gaseous form being emitted during the burning process in mills. Therefore, bark samples were collected from treated and untreated trees and were analyzed before and after ashing for arsenic content. Burning temperatures simulated those of a beehive burner.

The results showed that when ashed, the treated bark held more arsenic than the controls. Therefore, in species which can accumulate high levels of arsenic naturally such as Douglas-fir, there is more chance of arsenic being released from these trees. Below are some of the results:

RATIO OF ARSENIC CONTENT (TREATED/CONTROL)				
MEANS				
Height of Bark Samples:	<u>Before Ashing</u>		<u>After Ashing</u>	
	4.5 m	6.0 - 9.0 m	4.5 m	6.0 - 9.0 m
Means:	18.9	1.3	76.4	3.0

ARSENIC CONCENTRATION (PPM)						
TREATED TREES						
<u>Before Ashing</u>			<u>After Ashing</u>		<u>Ratio (After/Before)</u>	
4.5 m	6.0-9.0 m	Foliage	4.5 m	6.0-9.0 m	4.5 m	6.0-9.0 m
11.85	11	4.85	349	294	29.5	26.7
18.65	18.6	52	508	453	27.2	24.4
0.35	0.15	0.1	14.5	6.13	41.4	40.9
0.088	0.05	0.13				
32.5	0.88	6.96				
0.35	1.4	0.1				
0.05	0.025	0.075				
4.44	0.075	155				
0.315	0.15	0.15				
0.165	0.13	0.075				
0.165	0.05	0.05				
30.3	1.35	0.83				
7.8	4.38	1.18				
43.8	13	42.54				

ARSENIC CONCENTRATION (PPM)
CHECK TREES

Before Ashing			After Ashing		Ratio (After/Before)	
4.5 m	6.0-9.0 m	Foliage	4.5 m	6.0-9.0 m	4.5 m	6.0 - 9.0 m
1.5	8.2	4.07	7	236	4.7	28.8
0.05	0.1	0.075	3.83	1.86	76.6	18.6
0.15	0.33	0.075	0.65	9.68	4.3	29.3

- L. MacLauchlan, Kamloops Forest Region, Kamloops.

Verbenone^R Trials: Mountain Pine Beetle. Two different formulations of Verbenone were tested this past season. As a joint effort with Phero Tech Inc., 12.5 ha were treated with a polymer bead formulation of Verbenone, applied aerially with a seeder attached to a 206-B helicopter. Dose rate was more than double that used in 1988. A single tree application using a paste formulation of Verbenone was done in a mixed white pine stand with extremely heavy beetle pressure (N. Barriere) and in a lodgepole pine stand with moderate beetle pressure (Dale Creek).

Moderate protection resulted from the helicopter polymer bead formulation application, however, due to low beetle pressure, the results were difficult to interpret. The extreme beetle pressure in the mixed white pine stand trial masked any effect of the paste formulation but results in the lodgepole pine stand were promising. Only 14% of the paste formulation treated lodgepole pine trees were attacked and of these less than one half were mass attacked. Of the mass attacks in the block, only 9% were on treated trees. Phero Tech will be continuing these trials in 1990.

- L. MacLauchlan, Kamloops Forest Region, Kamloops.

Garlon^R 4E Herbicide Soon to be Registered in Forestry. The Dow herbicide Garlon 4E will likely be registered for use in Canadian forestry in 1990. We do not yet know whether it will be available for the 1990 field season. Dow plans to initially introduce the herbicide for ground use only. We assume that a wider registration will follow.

- J. Henigman, Protection Branch, Victoria.

Pesticide Applicator Certification Courses. We have elected not to prearrange pesticide applicator certification courses for this season. This does not mean that getting instruction in pesticide treatment methods is not available or that attending a certification course is not possible.

Certification courses can be arranged for groups that wish them. This can be achieved by contacting me. We can put you in contact with contractors who are capable of offering the course. Some of the course contractors have provided us with their schedule of proposed courses. Alternatively, individual students may study the course material available from the Pesticide Control Branch on their own and arrange to write the examination. It is strongly recommended that individuals studying on their own get some practical demonstration of equipment. We are also willing to assist in having these demonstrations.

We are currently working with the Pesticide Control Branch to increase the difficulty of passing the certification examination. It is preferred that the ability to pass the examination more clearly reflect an ability to competently use pesticides. The Pesticide Applicator Forestry Supplement publication is now being revised to facilitate home study and to ensure that students cover the important information. If you wish additional information on the forestry pesticide certification course, please contact the author.

- J. Henigman, Protection Branch, Victoria.

Pesticide Use Permit Advertising. The Pesticide Control Branch is proposing to change the Permit Regulation very soon to require the applicant to advertise a notice summarizing the permit application. Public input resulting from the advertisement would be sent to the Pesticide Control Branch and would be considered before a permit was granted. The applicant would be given a chance to modify the application to overcome any problems identified by public input. No advertisement of an issued permit would be required. The permit would be posted in the office of the applicant and perhaps at other appropriate locations, and copies of the permit would be sent to individuals who originally made comments on the application. The appeal process for permits would remain unchanged. This plan is consistent with the recommendations of the Ombudsman and should allow the public a more credible method of input. It is suggested that this change will result in fewer appeals. This remains to be seen.

- J. Henigman, Protection Branch, Victoria.

The Economics of Pesticide Use in B.C. Forestry. The B.C. Forest Service, Pesticide Advisory Committee, is undertaking a three phased study of the economics of pesticide use through a contract with Deloitte Haskins and Sells Ltd. Phase two of this project, now underway, is the basic economic assessment of forestry pesticide use and will involve an evaluation of insecticide control of western spruce budworm in the Kamloops area, and an evaluation of herbicide brush control mainly in the Chilliwack area.

Using available information the economist, Marvin Stemeroff, will estimate the value of pesticide use to the province's regional economies. The assessment will quantify the value of pesticide use to timber volume supply and value over time. A determination of the potential impacts on current harvesting rates and subsequent impacts on jobs, income, economic growth, complementary industries and other forest resource uses, will be included in the study.

The insecticide portion of the study is being coordinated by myself and involves a great deal of input from Lorraine MacLauchlan, Kamloops Forest Region, and Dr. Rene Alfaro, Pacific Forestry Centre, Forestry Canada. The herbicide portion of the study is being coordinated by Warren Mitchell, Silviculture Branch.

This phase two project was started in October and we expect it will be completed soon after March, 1990. If you wish more information on this economic analysis, please contact the author.

- J. Henigman, Protection Branch, Victoria.

PEST MANAGEMENT PERSONNEL
Forest Service Personnel fully or partly committed
to forest pest management activities

Protection Branch

R.F. (Bob) DeBoo	Manager, Pest Management	Victoria	387-8740
P.M. (Peter) Hall	Forest Entomologist	Victoria	387-8742
J.F. (John) Henigman	Pesticide Specialist/ Vertebrate Pest Specialist	Victoria	387-8738
J.A. (John) Muir	Forest Pathologist	Victoria	387-8739
P.J. (Pat) Humphreys	Pest Management Technician	Victoria	387-8737

Silviculture Branch

M. (Mike) Wyeth	Silviculturist	Victoria	387-8922
J. (Jacob) Boateng	Brushing and Weeding Specialist	Victoria	387-8905
N. (Nancy) Densmore	Stand Tending Operations Forester	Victoria	387-8912
D. (Don) Summers	Seed Production Pest Management Officer	Victoria	387-3931
B. (Bev) McEntire	Seed Production Pest Management Technician	Victoria	387-8938
G.M. (Gwen) Shrimpton	Nursery Pest Management Officer	Surrey Nursery	576-9161

Cariboo Forest Region

Regional Staff

M. W. (Mark) Hamm	Pest Management Forester	Williams Lk.	398-4441
L. J. (Leo) Rankin	Forest Entomologist	Williams Lk.	398-4439
D.F. (Don) Doidge	Specialist, Forest Pathology	Williams Lk.	398-4442
J. (Jane) Perry	Stand Tending Forester	Williams Lk.	398-4400
C. (Chris) Easthope	Range Agrologist	Williams Lk.	398-4396

District Staff

R. (Richard) McKay	Resource Officer Protection	Chilcotin	394-4315
J. (John) Hoyrup	Resource Officer Protection	Horsefly	620-3417
D. (Dennis) Asher	Resource Officer Protection	Quesnel	992-4400
W. (Wayne) Hendy	Resource Officer Protection	Williams Lk.	398-4341
V. (Von) Vickers	District Pest Management Coord.	Williams Lk.	398-4690
M. (Mel) Dodge	Resource officer Protection	100 Ml. House	395-3812
D. (Don) Wright	Resource Asst. Protection	100 Ml. House	395-3812

Kamloops Forest Region

Region Staff

L. (Lorraine) MacLauchlan	Forest Entomologist	Kamloops	828-4177
H. (Hadrian) Merler	Forest Pathologist	Kamloops	828-4176
R. (Ron) Gray	Stand Tending Forester	Kamloops	828-4163
R. (Rick) Tucker	Range Agrologist	Kamloops	828-4582

District Staff

M. (Mike) Hall	Resource Assistant	Clearwater	674-2265
D. (Dave) Piggin	Pest Management Officer	Kamloops	372-5832
M. (Margo) Hollinger	Pest Management Officer	Lillooet	256-7531
T. (Tom) Lacey	Resource Officer, Protection	Merritt	378-9311
H. (Harry) Spahen	Pest Management Officer	Merritt	378-9311
J. (Jim) Mottishaw	Pest Management Officer	Penticton	492-8721
M. (Murray) Henry	Pest Management Technician	Penticton	492-8721
D. (Dave) Procter	Resource Officer, Protection	Salmon Arm	832-7153
J. (Jim) Wright	Resource Assistant, Silviculture	Salmon Arm	832-7153
E. (Eric) Haupt	Pest Management Officer	Vernon	542-0264

Nelson Forest Region

Region Staff

E. (Ernie) Morris	Pest Management Specialist	Nelson	354-6144
D. (Don) Norris	Forest Pathologist	Nelson	354-6143
G. (Gerald) Reichenback	Stand Tending Forester	Nelson	354-6280
J. (Jack) King	Range Officer	Nelson	354-6243

District Staff

D. (Dan) Reiben	Pest Management Officer	Arrow	365-2131
R. (Ross) Elliott	Pest Management Officer	Boundary	442-5411
A. (Art) Krane	Pest Management Officer	Cranbrook	426-3391
L. (Larry) Hewlett	Resource Officer - Protection	Golden	344-7500
S. (Emile) Begin	Pest Management Officer	Invermere	342-4200
J. (Jim) Schafthuizen	Pest Management Officer	Kootenay Lk.	825-4415
A. (Archie) McConnachie	Resource Officer - Protection	Revelstoke	837-7611

Prince George Forest Region

Region Staff

R.S. (Bob) Hodgkinson	Forest Entomologist	Pr. George	565-6122
R.W. (Richard) Reich	Forest Pathologist	Pr. George	565-6143
S.P. (Stuart) Taylor	Pest Management Forester	Pr. George	565-6123
R.F. (Rob) Bowden	Stand Tending Forester	Pr. George	565-6191

District Staff

P. (Paul) Gevatkoff	Resource Officer - Protection	Dawson Cr.	784-2350
R. (Rick) Grayston	Resource Assistant - Protection	Dawson Cr.	784-2350
B. (Bruce) Young	Resource Officer - Protection	Ft. Nelson	774-3936
L. (Lance) Mitchell	Resource Officer - Protection	Ft. St. James	996-7131
P. (Terry) Corley	Resource Assistant - Protection	Ft. St. James	996-7131
A.R. (Al) Kneeland	Resource Officer - Protection	Mackenzie	997-3310
D. (Don) Courson	Resource Officer - Protection	Ft. St. John	787-3483
R.G. (Roger) Wiltsie	Resource Officer - Protection	McBride	569-2265
A.D. (Dale) Cinnamon	Resource Officer - Protection	McBride	569-2265
F.L. (Fred) Turner	Resource Officer - Protection	Pr. George	562-4121
B.L. (Bruce) Doerksen	Resource Assistant - Protection	Pr. George	562-4121
M.F. (Mike) Dittaro	Acting Resource Officer - Prot.	Vanderhoof	567-6363
M.B. (Mike) Pritchard	Resource Assistant - Protection	Vanderhoof	567-6363

Prince Rupert Forest Region

Region Staff

S. (Steve) Schmidt	Protection Officer	Smithers	847-7477
T. (Tim) Ebata	Forest Entomologist	Smithers	847-7479
S. (Stefan) Zeglen	Forest Pathologist	Smithers	847-7478
B. (Bill) Young	Pest Management Forester	Smithers	847-7477
L. (Lou) Tromp	Stand Tending Forester	Smithers	847-7514
D. (Don) Russell	Range Officer	Smithers	847-7443

District Staff

E. (Erwin) MacDermid	Resource Officer - Protection	Bulkley	847-7555
G. (Gordon) Munroe	Resource Officer - Protection	Cassiar	771-4211
J. (Joe) Katasonoff	Resource Officer - Protection	Kalum	638-3302
K. (Kas) Kopec	Resource Assistant - Protection	Kalum	638-3290
B. (Brian) Atherton	Resource Officer - Protection	Kispiox	842-6581
Vacant	Resource Officer - Protection	Morice	845-6288
S. (Steve) Mitchell	Resource Assistant - Protection	Morice	845-7712
W.T.S. (Bill) Jackson	Resource Officer - Protection	North Coast	627-0457

Vancouver Forest Region

Region Staff

D. G. (Don) Heppner	Forest Entomologist	Burnaby	660-7653
J. D. (Jeff) Beale	Forest Pathologist	Burnaby	660-7654
M. (Mel) Scott	Stand Tending Forester	Burnaby	660-7579

District Staff

T. (Terry) Preston	Resource Officer - Protection	Campbell Rv.	286-3282
T. (Tim) Ewart	Resource Assistant - Protection	Campbell Rv.	386-3282
G. (Greg) Hemphill	Resource Officer - Protection	Chilliwack	794-3361
G. (Grant) Preston	Resource Assistant - Protection	Chilliwack	794-3361
W. (Willie) Giesbrecht	Resource Assistant - Protection	Chilliwack	794-3361
P. (Pat) Hayes	Resource Officer - Protection	Duncan	746-5123
D. (Dennis) Tippie	Resource Officer - Protection	Mid Coast	982-2621
W. (Wade) Matheson	Resource Assistant - Protection	Mid Coast	982-2621
D. (Dan) Powell	Resource Officer - Protection	Pt. Alberni	724-9205
D. (Doug) Walker	Resource Assistant - Protection	Pt. Alberni	724-9205
C. (Clarence) Friesen	Resource Officer - Protection	Pt. McNeill	956-4416
T. (Tim) Neal	Resource Assistant - Protection	Pt. McNeill	956-4416
B. (Barry) Millar	Resource Officer - Protection	Powell Rv.	485-9831
R. (Ron) Diprose	Resource Assistant - Protection	Powell Rv.	485-9832
D. (Debbie) Anderson	Resource Assistant - Protection	Powell Rv.	485-9831
R. (Rick) Machowski	Resource Officer - Protection	Qn. Char. Is.	559-8447
B. (Brian) Eccles	Resource Assistant - Protection	Qn. Char. Is.	559-8447
K. (Keith) Davis	Resource Officer - Protection	Squamish	898-9671

MEETINGS

Canadian Phytopathology Society. The B.C. chapter of the society met at Langley in October, 1989.

Among the several papers and reports presented, two were of particular interest.

J. Rahe and colleagues at Simon Fraser University reported that the herbicide glyphosate acts in concert with microorganisms in the soil to kill plants. In pasteurized soils the herbicide was much less toxic. Further work is underway to characterize the responses, and to determine the microorganisms responsible.

D. J. Ormrod, Ministry of Agriculture and Fisheries, Cloverdale, showed a tree injection apparatus that utilizes a backpack sprayer and several tanks to dispense a systemic insecticide. The equipment was set up by local municipal workers, and appears to have potential forest uses.

- J. A. Muir, Protection Branch, Victoria.

Western International Forest Disease Work Conference. The 1989 meeting of the work conference was held in Bend, Oregon in conjunction with the insect work conference. There were over 250 people attending.

Among the numerous concurrent sessions were presentations on pest management in selectively harvested forests, and management of disease and insect outbreaks that often are interrelated.

Copies of previous proceedings are available from Ken Russell, Department of Natural Resources, Olympia, Washington.

- J. A. Muir, Protection Branch, Victoria.

Western Forest Insect Work Conference (WFIWC). The 1989 WFIWC was held in Bend, Oregon in conjunction with the pathology group. The conference was held during the week of September 11. The sessions were well attended and covered a wide range of topics. Field trips included damage by Eucosma and various thinning regimes in ponderosa and lodgepole pine to reduce losses to bark beetles. The next meeting of the Insect Work Conference is scheduled for March, 1990 in Coeur d'Alene, Idaho.

- P. Hall, Protection Branch, Victoria.

Connections With U.S. Forest Service, Region 6 (Washington, Oregon). Pest Management Director Bill Ciesla, visited Protection Branch, the Duncan Forest District office, the Pacific Forestry Centre, and toured the Cowichan Valley with Fletcher-Challenge staff in October. This was a renewal of an important relationship first established with his predecessor in 1984. As well as an opportunity for useful information exchange and for reporting and comparing 1989 operational results, the purpose of this direct linkage between two of the most active western groups conducting pest management operations is to enhance our abilities to ensure forest health.

Our meeting was particularly useful and productive for potential improvements in the following areas:

- . determining the limitations of Bacillus thuringiensis applications for controlling budworm outbreaks.
- . utilizing in part, a Geographic Information System (now in place in the U.S.) to make decisions.
- . planning and organizing operational virus spray treatments during the next outbreak of the Douglas-fir tussock moth.

- R. F. DeBoo, Protection Branch, Victoria.

Symposium and Trade Show at Winnipeg, 1990. Mark your calendar for October 8 - 12, 1990, to attend the National Research Council's Associate Committee on Agricultural and Forestry Aviation event at Winnipeg entitled "Aircraft in Agriculture and Forestry - Industries' Future Needs." The event has Bill Ciesla (USDA Forest Service, Portland), The Honourable Eugene Whelan, and Les Kerr, President of Conair Aviation, as featured attractions.

Please contact the undersigned for additional details.

- R. F. DeBoo, Protection Branch, Victoria.

QUESTIONNAIRE ON BUD DAMAGE --- TEAR OUT AND RETURN TO DR. VANDER KAMP
OR WORRALL (SEE ARTICLE ON P. 7 - 8).

QUESTIONNAIRE: BUD DAMAGE TO INTERIOR CONIFERS IN 1989.

1. Description of Location: (MOF) District _____
Ecological zone _____

2. Please check () the categories that you have observed in your area. Use trees of median damage to rate plantations or stands. If you need to report on more than one zone, please use separate questionnaires.

Degree of damage

Species Affected

	Douglas-	interior	lodgepole	hemlock	larch	other()
	fir	spruce	pine			
All buds above the snow						
line affected (types 1-3)						
Most buds affected(types 1-3);						
some flushing normally						
Only some buds affected but no						
effect on tree height growth						
No damage						

	AGE RANGE (years)				
	<10	10-20	20-40	>40	
Douglas-fir					Use trees of median damage to rate each age class. Check () those age classes in which damage was equal to that described in the first two categories in the previous table
Spruce					
Subalpine fir					
Lodgepole pine					
Hemlock					
Cedar					
Other()					

Please comment on development of symptoms if different from those described above, any effects of topography, estimate of area affected within your district, and any other observations you may have.

Name of respondent _____

Address _____

Telephone _____

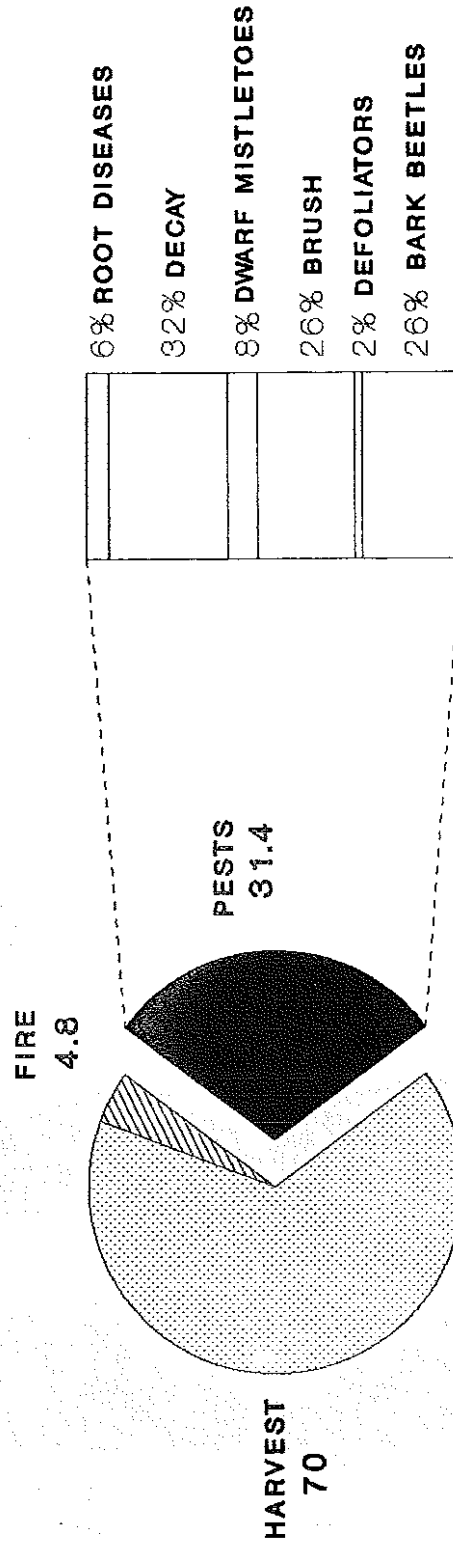
Return to:

Bart J. van der Kamp
John G. Worrall
Dept. Forest Sciences
University of B.C.
Vancouver, B.C. V6T 1W5
Fax: (604) 222-8645

British Columbia

Annual timber harvest, fire & pest losses

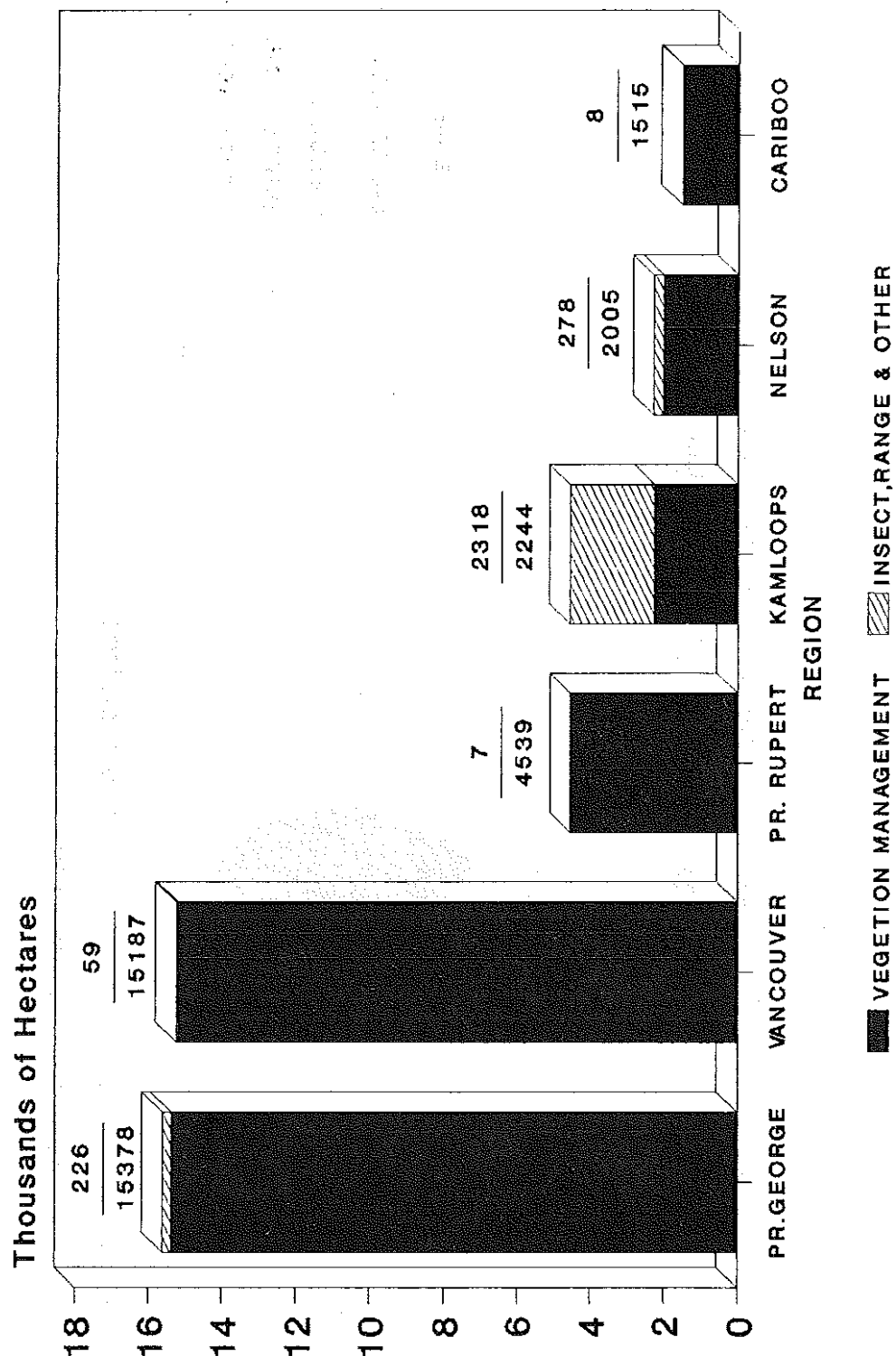
For the period 1984 - 1988



Gross estimates in millions of cubic metres
(regulated lands only)

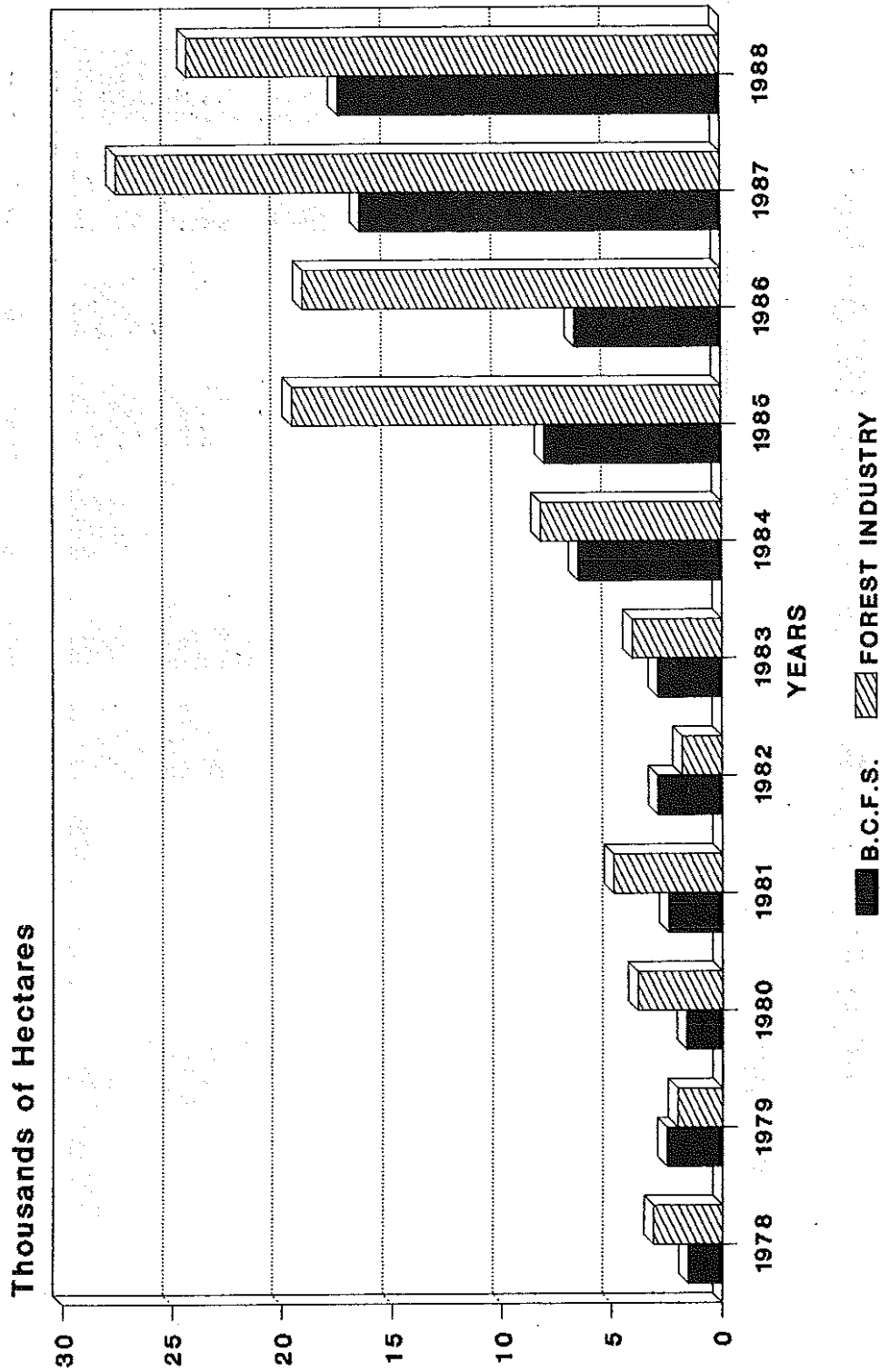
Source: Forestry Canada & B.C. Forest Service

AREA TREATED WITH PESTICIDES PROV. SUMMARY BY FOREST REGION 1988

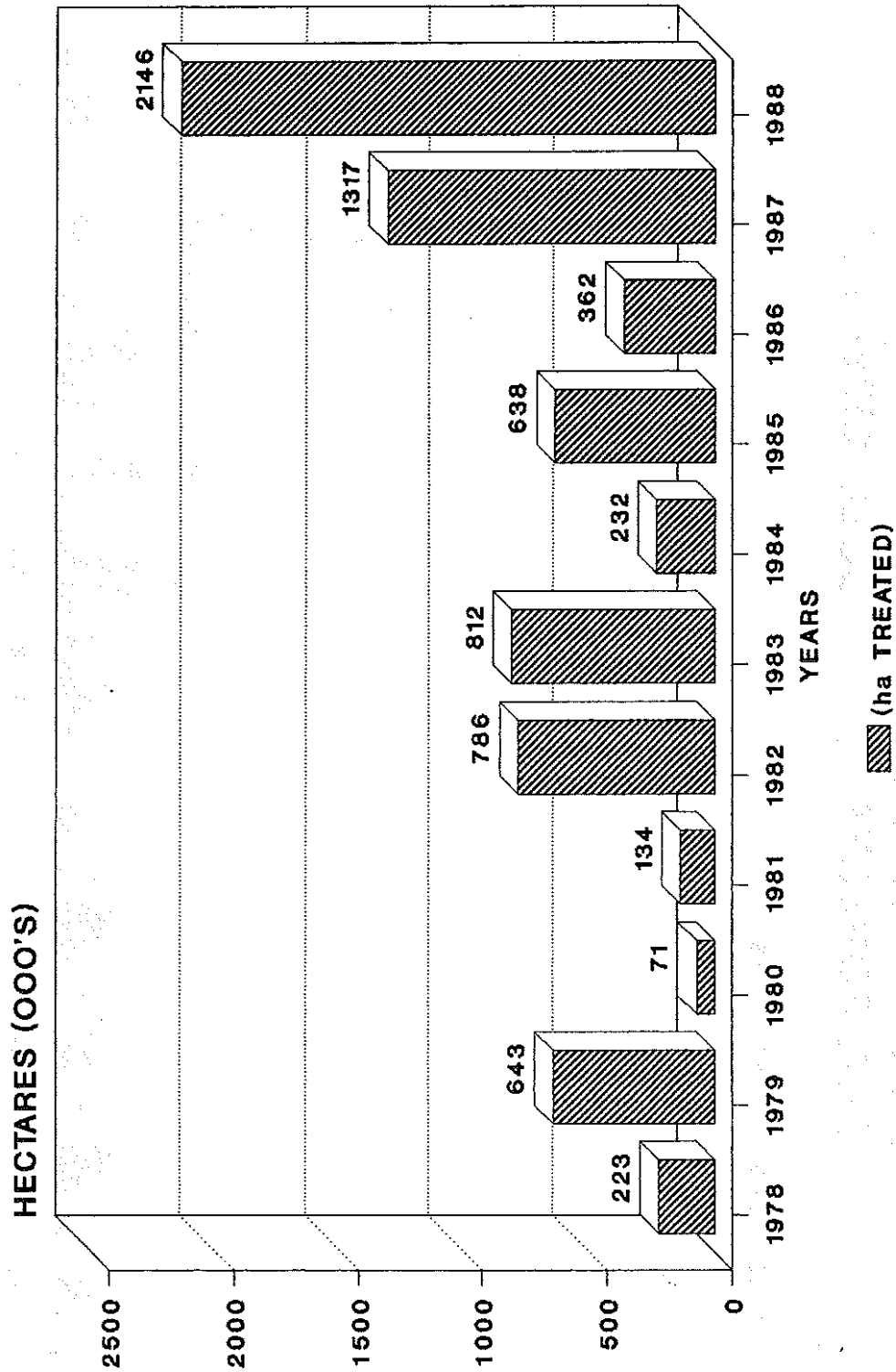


B.C. FOREST SERVICE AND INDUSTRY COMB.

AREA TREATED WITH HERBICIDES FOR FORESTRY PURPOSES 1978-1988

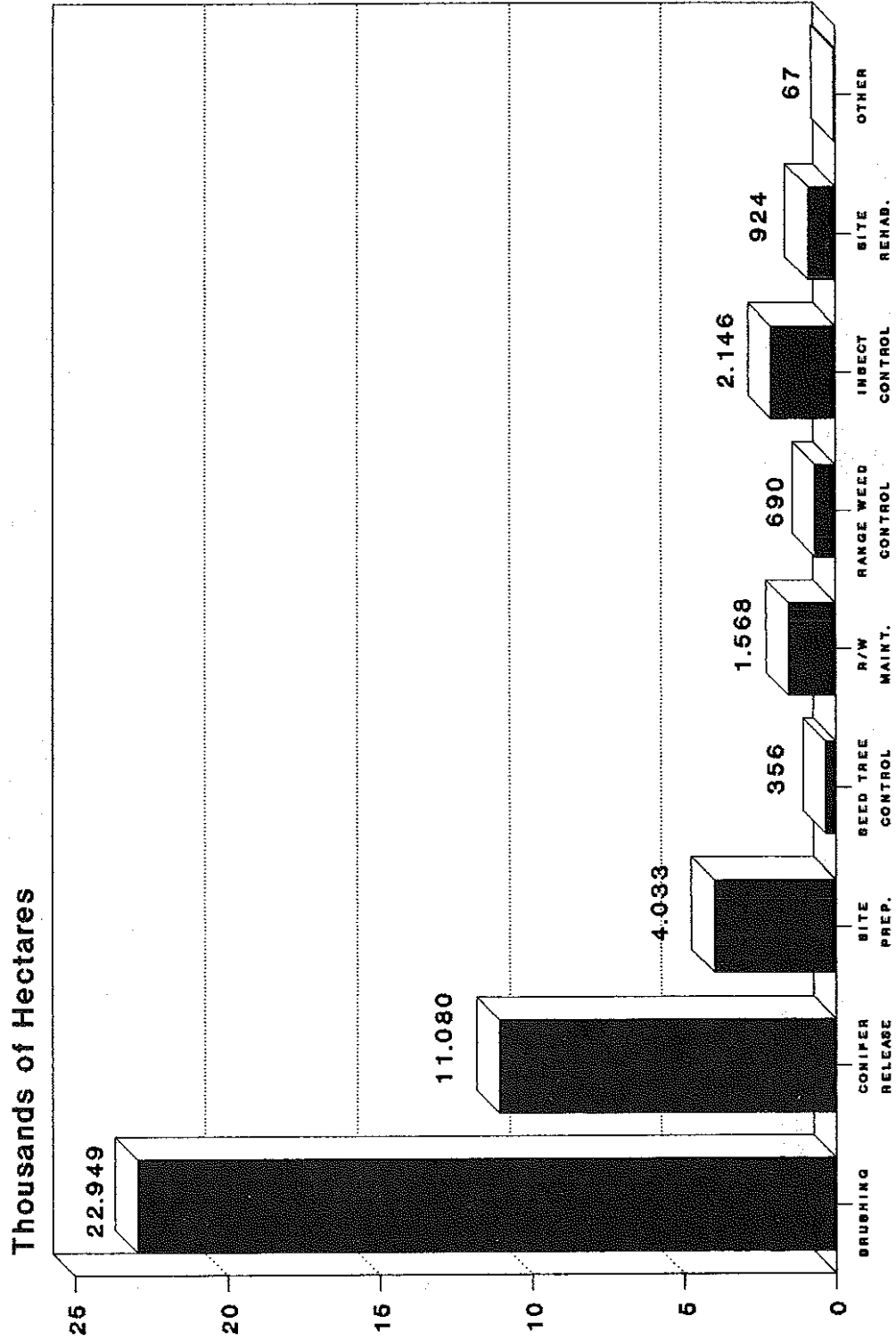


AREA TREATED WITH INSECTICIDES FOR FORESTRY PURPOSES 1978-1988 ¹



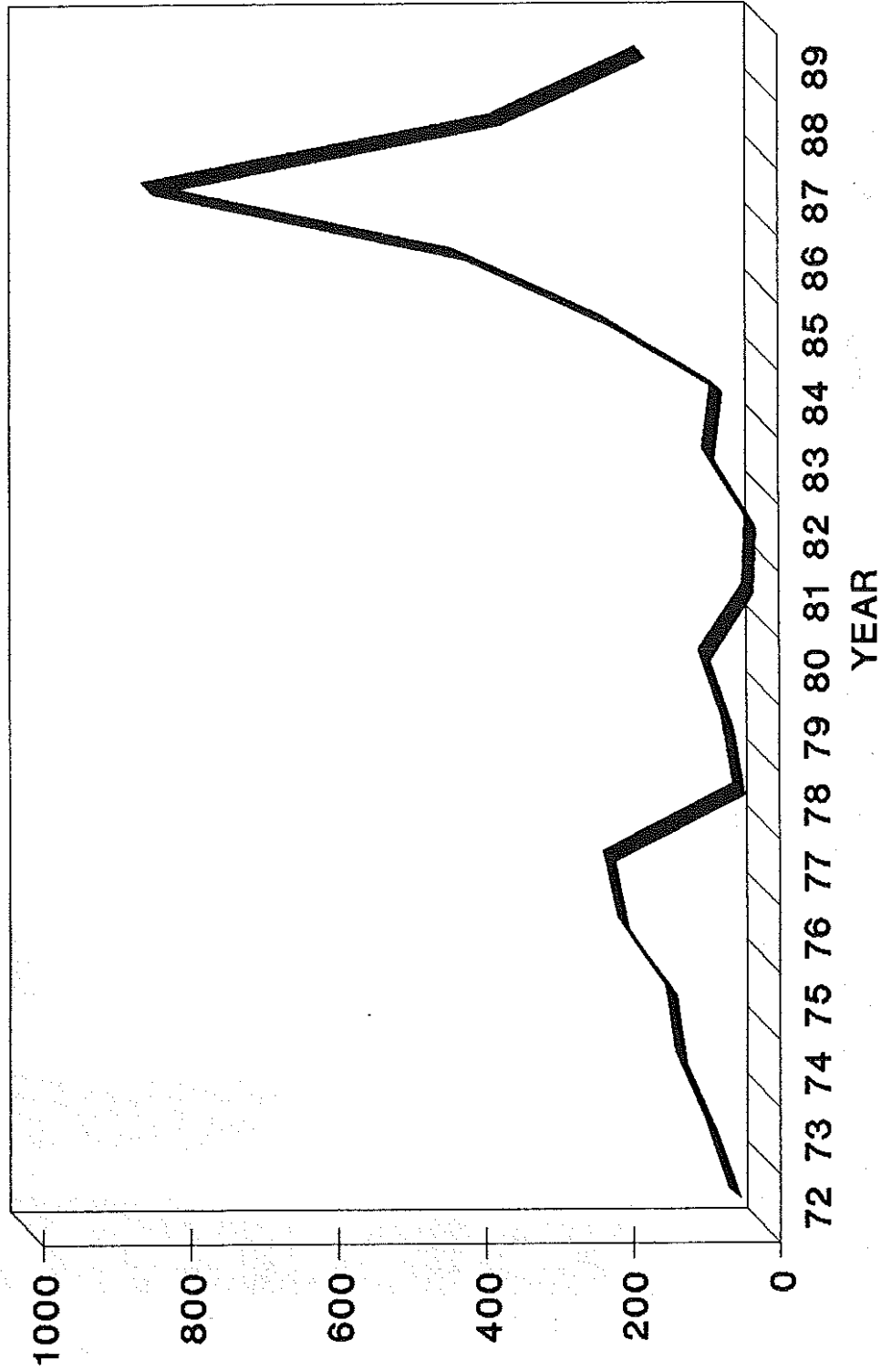
¹ B.C. FOREST SERVICE & IND. COMBINED

PROVINCIAL SUMMARY OF AREA (ha) TREATED WITH PESTICIDES BY CONTROL PURPOSE, 1988¹



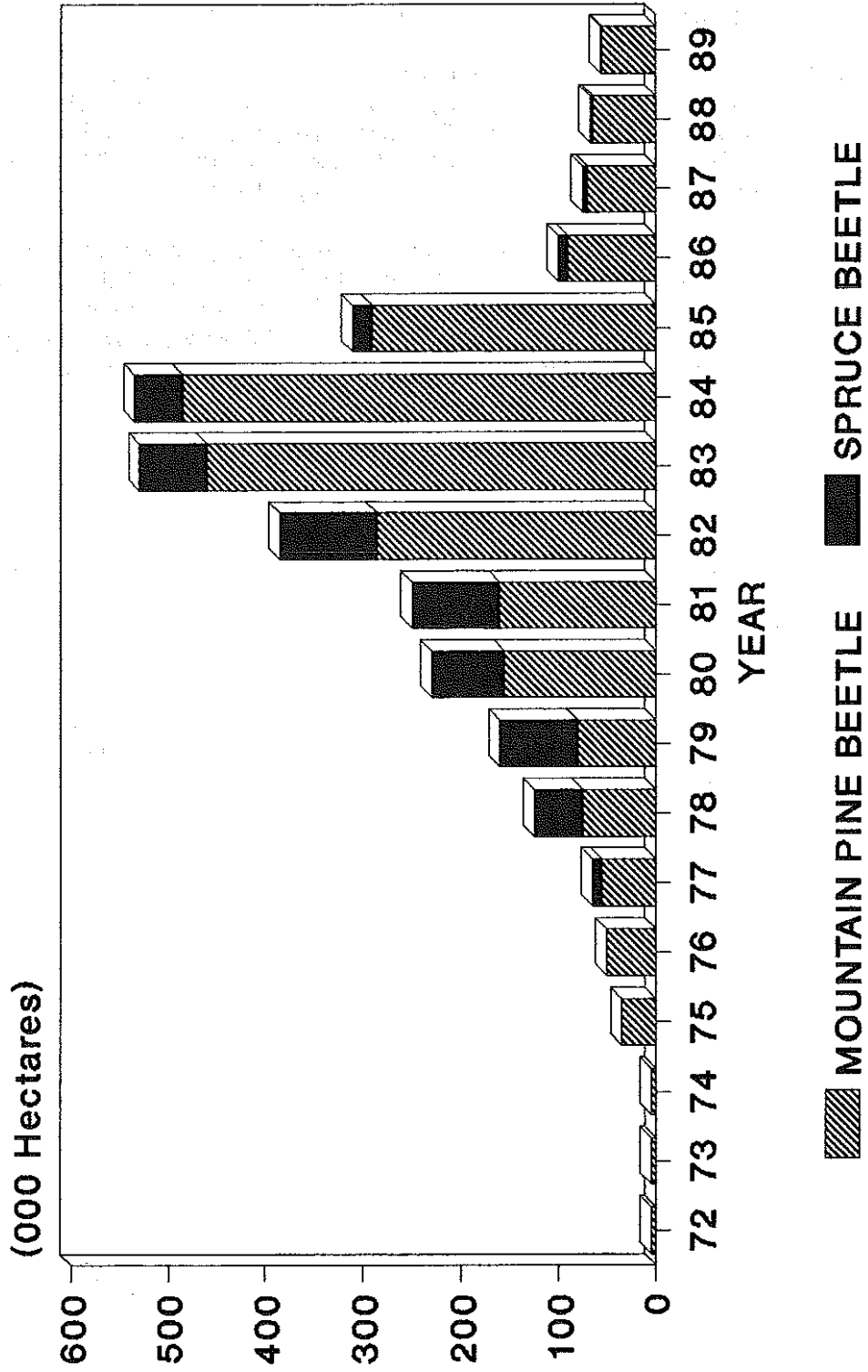
¹ B.C. FOREST SERVICE & INDUSTRY COMBINED

**TRENDS IN VISIBLE DEFOLIATION OF DOUGLAS
FIR CAUSED BY THE WESTERN SPRUCE BUDWORM
IN BRITISH COLUMBIA (YEARS 1972-1989)**
(000 Hectares)



Source: Forestry Canada (FIDS) Prepared by P. Humphreys, Protection Branch, Victoria

AREA UNDER ATTACK BY BARK BEETLES 1972-1989



Source: Forestry Canada (FIDS)

PUBLICATIONS AND REPORTS

- DeBoo, R.F. 1989. Development of the forest pest management program in British Columbia: 1980 - 1989. *Pesticulars*, Newsletter of the Prof. Pest Management Assoc. of B.C. 97(2): 23 - 24.
- Hall, P.M. 1989. The use of mountain pine beetle aggregation semio-chemicals in British Columbia. In Amman, G.D. (editor). Proceedings of a symposium on the management of lodgepole pine to minimize losses to the mountain pine beetle. Kalispell, Montana, July 12 - 14, 1988. USDA Forest Service Gen. Tech. Rept. INT-262, 119 pp.
- Hall, P.M. and D.E. Gilbert. 1989. Insects affecting immature forests - why we study them and what they can do for us. In Alfaro, R.L. and S.G. Glover (editors). *Insects affecting reforestation: biology and damage*. Proceedings of a Meeting of the IUFRO working group on insects affecting reforestation. Forestry Canada, Pacific Forestry Centre, Victoria. S2.07-03, 256 pp.
- Henigman, J. F. 1989. Is reducing pesticide use a goal in forest management? *Pesticulars*, Newsletter of the Prof. Pest Management Assoc. of B.C. 8(2): 24 - 25.
- Hendry, A. and R. D. Cozens. 1989. The incidence and impact of western gall rust on juvenile lodgepole pine in the Prince George Forest District, Prince George, B.C. B.C. Min. For. Int. Rep. PM-PG-11, 28 pp.
- Humphreys, P. 1989. Pesticide use in British Columbia forestry, 1988. B.C. Ministry of Forests, Protection Branch, Victoria. Internal Report PM-PB-42, 77 pp.