



Province of
British Columbia
Ministry of
Forests

PEST MANAGEMENT PROGRESS

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

Volume IX, Number 2 (File 312-20)

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A VISION OF SERVICE TO 2000

Faced with changing demands from society and government, including fiscal restraint, and new opportunities in forest health, we in protection are re-thinking who we are, what we do, and where we should go as a team. Ideas and opinions from several sessions in recent months have been summarized in a two-page draft statement of our outlook and strategic goals.

We believe that our greatest resource is our people: expert, dedicated, and enthusiastic. Our common goal is to help people manage and protect the forests of British Columbia so that we can secure and sustain all of the forest resources.

Our forest health strategic directions are to "Improve forest productivity through implementation of an integrated forest health program", and "Increase security of the forest resource and other ecosystem values through an aggressive pest detection and control program". We are working with these strategies to articulate measurable program goals.

Recently a forest health program has been proposed as a component of the silviculture five-year budget plan, and an integrated program is being developed. We are very optimistic that despite ups and downs, forest health treatments will continue to become more prominent in many forestry programs, particularly in silviculture.

- J. Muir, 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 Health 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

Some Changes in Branch Hats. In recent months we have had some changes in jobs and people at Protection Branch.

Bob DeBoo is recuperating from a disease known as "chronic fatigue syndrome" and John Muir is acting manager, Forest Health. Bob is working part-time, reviewing his files, and preparing for a secondment to Research Branch where he will be developing a forest health research program.

Jeff Beale will move from his regional forest pathologist position in the Vancouver Forest Region to become forest health officer at Protection Branch. In January, after completing his forest pathology master's thesis at the University of British Columbia, Jeff will be responsible for pest damage appraisals, and integration of our program with other essential Ministry programs.

- J. Muir, Protection Branch, Victoria.

Forest Health Expands. At the last meeting, the Forest Pest Review Committee, chaired by J. C. Cuthbert, Chief Forester, changed its name to the Forest Health Committee. The Committee - like the former Pest Management Section in Protection Branch - emphasized that a name change from Forest Pest to Forest Health better reflected the positive goals of our programs: to improve forest productivity and to increase security of the forest resource and ecosystem values by preventing and reducing damage by forest pests. Forest Health also emphasizes our belief that the forest - not the pest - is our major concern.

The challenge for the Forest Health Program in the future is to show how it will support forest management goals to implement integrated resource management, and to demonstrate that the concept of forest health is valuable and practical.

- J. Muir, Protection Branch, Victoria.

Protection Manual Review. A review of the Protection Manual, Volume 11, Pest Management, was prompted by recent changes and developments, including a Ministry review of policy manuals, and new regional directives and procedures. Also, the recent publication **Field Guide to Pests of Managed Forests in British Columbia** supersedes some of the identification sections of the manual.

Forest management and forest health responsibilities have also changed recently with the implementation of pre-harvest silviculture prescriptions, including pest assessments and treatments. District staff play a key role in the process.

The manual review is being conducted by contract. In a preliminary verbal report, the contractor made several recommendations, including:

- the manual should be revised with the major goal to help district staff deal with pest problems;
- identification features should be removed from the manual;
- keys should be re-organized into flow-charts to help select treatment options and consider integrated resource management issues; and
- format should be changed to condense the material, and to facilitate revisions of sections.

A final report, including a draft revised bark beetle management chapter as a prototype of the new manual organization, will be circulated to ministry staff and cooperators for comment before extensive revisions are undertaken.

- J. Muir, Protection Branch, Victoria.

Pest Control Projects Review. A contracted review has been underway for several months at Protection Branch to summarize the results of the pest control projects amounting to almost \$1,000,000 funded by the Canada - British Columbia Forest Resources Development Agreement, 1985-90. Projects were funded by provincial direct delivery in the Intensive Forestry Program.

A detailed summary table is being prepared to show what was accomplished per pest and per forest region for the major forest health activities, including detection surveys, damage appraisals, and control treatments.

Recommendations for follow-up activities, and the status or potential of operational control treatments are also included.

A one or two-page summary per project is also being prepared. Approximately 40 project reports are being edited or prepared to document the results of the activities.

The project review report will be available in April 1991.

- J. Muir, Protection Branch, Victoria.

Pest Codes. Thanks to Silviculture Branch, the pest codes revised in June 1990 have now been published on waterproof field notebook paper as ministry form FS 747 SIL 90/6. Ministry staff may order it from Technical and Administrative Services Branch.

For the growth and yield permanent sample plot program, Inventory Branch has recently requested revisions to the intensity ratings that accompany the pest codes. Ratings will be used to characterize damage by the most important pest for each tree. The ratings are included in the draft minimum standards procedures being circulated under the auspices of the Forest Productivity Councils. For information, contact Will Smith, Inventory Branch.

The codes are available for revisions and upgrading at any suitable time. Changes agreed to by silviculture, protection, and inventory will be implemented on Ministry forms and systems, including the management licensee silviculture information system that reports pests on the pre-harvest silviculture prescription.

Definition of pest codes has been an important step in designating what we are concerned about in forest health, and rating the intensity of pest damage on a tree or plot will help us measure the occurrence and effects of pests.

- J. Muir, Protection Branch, Victoria.

Forest Health Job Description Reviews and Reclassifications. On April 24, 1990, Human Resources Branch reclassified several regional forest entomologist and pathologist positions from licensed science officer (LSO) 2 to LSO 3. Fully qualified incumbents received retro-active reclassifications to July or October 1989.

Other incumbents will be reclassified when they become fully qualified. Protection Branch is presently coordinating a reclassification review for district forest health technicians currently staffed at the FT-3 level. Other reclassification reviews are ongoing or planned for staff at Protection Branch to reflect changing responsibilities within the provincial Forest Health Program.

- J. Muir, Protection Branch, Victoria and R. Hodgkinson, Prince George Forest Region, Prince George.

Update on Inventory/Protection Cooperative Projects. In fiscal year 1990/91, Inventory Branch cooperated with Protection Branch in the improvement of the Pest and Injury Codes Table. New pest and injury codes were added and table format refinements were made. In addition, vast improvements were made through clarification of the "Quantification of Damage" section.

The revised Pest and Injury Codes Table was incorporated into the Minimum Standards Document produced by the Forest Productivity Councils of British Columbia.

- J. Vivian, Inventory Branch, Victoria.

Protection Permanent Sample Plot Matrix. In response to a request from the Forest Productivity Councils, Jeff Beale was appointed by the Pest Damage Appraisal Advisory Committee to chair a protection committee to develop a matrix of permanent sample plots. The plots will be used to determine growth and yield of forest trees in response to effects of important forest pests, and to treatments to prevent or suppress pests.

The protection committee will propose the strata needed, such as tree age classes and site quality classes, and the number of plots needed to characterize tree responses for each combination of the criteria. Matrices have already been developed by the councils to characterize the growth of naturally regenerated young stands, and researchers are developing a matrix to show the response of managed young stands to several treatments such as spacing and fertilizing.

The protection committee has met twice, and has made a progress report to the Productivity Councils. A draft outline of a protection permanent sample plot matrix is expected to be available for review and comment by March 1991.

- J. Beale and J. Muir, Protection Branch, Victoria.

Silviculture Systems and Forest Health Pest Impacts and Treatments. As mentioned in the previous issue of Pest Management Progress, the Forest Service is engaged in reviewing all of the various silviculture systems that may be used in the Province. We can expect greater use of selection and shelterwood silviculture systems, in addition to clear-cutting and seed tree systems now commonly used in British Columbia.

Investigation of silviculture systems and their application to the Province is being handled by the Silviculture Systems Working Group. The Working Group reports to a steering committee which is composed of Forest Service branch directors. The membership of the Working Group includes P. Diggle, Chairperson, (Silviculture), R. Brick (Timber Management), M. Fenger (Wildlife), D. Draper (Research), T. Nash (Vancouver Forest Region), J. Pollack (Nelson Forest Region), P. Fuglem (Fire Management), and J. Henigman (Forest Health). Terms of reference for the steering committee and Working Group are available upon request.

This fiscal year, funds will be committed to evaluate the various silviculture systems throughout the Province, wherever they might possibly be applied. Much of the funding will be used to set up permanent plots for forestry measurement. The Forest Health Section will complete a problem analysis of the impact of different silviculture systems on control of pest problems in forest stands. Recommendations resulting from the problem analysis will be implemented in the following years. In most cases this will entail overcoming our lack of information on pest control in different timber types managed with different silviculture systems. We hope to have forest health related studies conducted in a majority of the permanent study plots.

We have recently awarded a contract to the consortium of Sterling Wood Group Inc., and W.F.S. Enterprises Ltd., to complete the problem analysis. It will provide us with an information survey, including a summary of the opinions of a wide group of pest management specialists on the impact of pests, and the consequences of control, in various timber types, managed with various silviculture systems. An integration of the effects on both timber values and other forest resource values is expected.

- J. Henigman, Protection Branch, Victoria.

Forest Health Information Systems News.

Results of User Group Meeting

The following are system issues and concerns that were discussed at the Forest Health Workshop during the October 25th Protection Information Systems User Group Meeting:

1. Integrated Silviculture Information Systems (ISIS) Liaison Committee
Action: Val Fletcher to collect and circulate ISIS documentation. A meeting of the committee to establish terms of reference will be called.

2. Forest Health business area analysis
Action: Charles Layton of Ernst & Young will conduct a Business Area Analysis to determine Forest Health information systems needs. The contract term is November 1, 1990 - March 31, 1991.
3. Forest Resource Development Agreement /Px project tracking system (more accurately called a "Catalogue of Forest Health Field Trials")
Action: Val Fletcher to create an All-in-One "shared document" as a short term solution. Eventually this information should be part of a database so that information can be properly managed, keyword searches made, etc.- RIB (Reforestation Information Bank) could be used as a model but RIB is not a personal computer (PC) based system.
4. Forest Insect and Disease Survey (FIDS) interface
Action: Cheryl Edwards and Val Fletcher to meet with Allan Van Sickle of Forestry Canada to discuss potential for data exchange/sharing.
5. Geographic Information Systems (GIS) pilot project(s)
Action: Val Fletcher to follow-up with Cariboo Forest Region (M. Hamm) and Nelson Forest Region (R. Stewart) on the application of GIS to their programs, including evaluation of some current initiatives.
6. Mountain Pine Beetle spread documentation and spread model development
Action: On hold until Peter Hall reports on results of the Merritt Forest District calibration project.
7. Beetle project tracking implementation
Action: Peter Hall, Stuart Taylor & Val Fletcher to evaluate this system using feedback from forest district personnel who have been using it. Questions to be addressed are: Does the system need some "cosmetic" changes? Is the system providing the right information to the right people at the right time?
8. Pest stand models
Action: To continue development of PROGNOSIS and TASS coastal root rot models.
9. Pest records inventory
Action: Val Fletcher to visit Kamloops, and possibly one other forest region, to examine their pest incidence ledgers and/or pest record spreadsheets.

10. Standard provincial spread sheets for bark beetles
Action: Forest regions will survey their districts to get examples of the spreadsheets or databases that are used. These may be a mixture of personal computer (PC) based DBASE or Lotus 123 packages. A standard spreadsheet format will be developed and implemented through VAX 2020. (2020 is a spreadsheet available under Information Management in All-In-One).
11. Pest Susceptible Areas (PSA) system update and implementation
Action: Stuart Taylor to work with Val Fletcher to complete documentation, update files, and "spread the word" about what PSA can do for you!

Forest Health Business Area Analysis (BAA)

Ernst & Young Management Consultants were the successful bidders on the Forest Health Program BAA. The project plan consists of five major phases:

1. Project Initiation
 - identification and review of background material
 - development, review and confirmation of a work plan
2. Development of a Business Area Information Model
 - interviews with program staff to develop a Data Model, Process Model, and Application Model to support future applications design.
3. Development of a Technology Plan to support the program information requirements. The emphasis will be on forest region and forest district business requirements.
4. Development of a Migration Strategy to define the logical implementation of the recommended technology platforms and applications from 2 and 3 above.
5. Review and Assessment
 - a summary of the project will be written for review and acceptance by the Ministry.

For more detail on any of the above contact Val Fletcher (Phone: 387-8734).

- V. Fletcher, Protection Branch, Victoria.

Forest Health Training Initiatives - Prince George Forest Region. Forest health staff at the regional office conducted the following training sessions this year:

- seven basic pest identification courses in six forest districts. A total of 130 people attended, representing the Ministry of Forests, private consulting firms and industry. Training was part of two silviculture survey courses, and consisted of a one-day field session on pest identification and management. Entomology topics were also presented at two forest pesticide applicator courses.
- the forest pathologist trained four spacing crews to identify rust infected trees. Most spacing in this region has been conducted with little or no disease training. Good potential exists to reduce the occurrence of rust, dramatically on some sites, as a result of this type of training. Rust identification training will remain a high priority in the future.
- other instruction was provided on demand, i.e. spruce beetle probe training.

- S. Taylor, Prince George Forest Region, Prince George.

PHSP Advertising Time. Reduction in advertising time for Pre-harvest Silviculture Prescriptions (PHSP's) in emergency circumstances is now possible. Advertising for PHSP's can be reduced from seven weeks to five days in exceptional cases concerning insect infestations and blowdown. This amendment to the regulation has been approved by the Lieutenant Governor, Order in Council No. 1291, on August 30, 1990. The details, including the intent of the regulation and procedures to be followed, have been presented in a September 17, 1990 memo to forest region managers, signed by W. Cheston. Please obtain a copy if there is a need. Please note that **all** blocks for harvest require a PHSP regardless of block size or volume. However, the PHSP can be somewhat abbreviated for very minor areas or volumes.

- P.M. Hall, Protection Branch, Victoria.

Geographic Information System (G.I.S.) Pest Incidence Surveys: A Progress Report. The Kamloops Forest Region has a two-fold goal:

1. To quantify, within five years, pest incidence on all Crown-owned forest land within the Kamloops Forest Region.
2. To identify where impact assessments for specific forest pests are needed.

The strategy to achieve this goal involves a yearly survey of 20% of the Crown-owned forest land base using regional G.I.S. forest health standard survey procedures. In order to accomplish this, other disciplines must adopt these procedures and incorporate them into their respective programs.

To date, areas represented by 15 mapsheets have been surveyed using the standard survey procedures. We are now confident that the needed information is being collected, and that any procedure problems have been corrected. The next step is to have these procedures adopted as a provincial standard of forest health information collection. We hope that small businesses will use these procedures in their areas of interest, and that they will become the prerequisite for completion of the pest information section of the Pre-harvest Silviculture Prescription (PHSP).

The strategy is for a proportion of a PHSP area to be surveyed using G.I.S. pest incidence survey standards and for the information to be included in the PHSP. A summary of the data will be given a standard format and supplied to other user groups such as inventory and planning. We would also like to see 10% of all beetle probes conforming to these survey standards in the future.

A G.I.S. Pest Incidence Survey Certification Course will be offered at various locations in the Kamloops Forest Region in the spring of 1991.

- L. MacLauchlan, Kamloops Forest Region, Kamloops.

Cariboo Aerial Survey Grounded for Winter. The annual aerial pest survey in the Cariboo Forest Region was completed on October 19, 1990. The entire Forest Region was sketch-mapped on 1:40 000 forest cover maps from fixed-wing aircraft flying a north-south grid. Lines were flown at 2-km spacing for high priority areas, and at 4-km intervals for low priority areas.

Mapping was done by regional and district Forest Service staff in all but one forest district, where fire activity limited staff availability. Mapping accuracy is better and costs are lower than contract sketch-mapping undertaken in 1988 and 1989.

Infestation figures will be available in mid-December.

- Mark Hamm, Cariboo Forest Region, Williams Lake.

Pest Manager Awards in the Cariboo Forest District. Pest identification and management alternatives were stressed in one-day training sessions held by regional staff in June of this year. Courses were conducted at Alexis Creek, 100 Mile House, Williams Lake and Horsefly.

Competition was ruthless for the coveted Pest Manager T-Shirt, an original design by Bob Hodgkinson. Six elated winners claimed their prizes by scoring highest on a pest management exam.

- Mark Hamm, Cariboo Forest Region, Williams Lake.

Forest Nursery Pest Management Update. Several pest management trials were conducted at nurseries across the province, during the 1990 growing season.

Operational trials with the fungicide Ridomil^R to control root rots were conducted for the last year. Results from the past three years have shown that effective control can be achieved, and a request for registration in conifer nurseries will be submitted this winter.

Ambush^R, a synthetic pyrethroid, was effective at reducing terminal damage caused by the *Lygus* bug on pine and spruce at three nurseries. A label extension to include this pest will be requested.

The most controversial pesticide currently used in the nurseries is probably the prestorage fungicide spray. There is an active program to reduce or eliminate this practice because most seedlings are now stored at freezing temperatures. Trials established in 1990, and planned for 1991, will determine if these applications are still necessary.

In cooperation with Beaver Plastics Ltd., a manufacturer of nursery styroblocks, a copper formulation was applied to the upper surface of sample blocks delivered to four nurseries. It was hypothesized that the copper would reduce the establishment and spread of liverworts. Results are very promising to date.

In container culture, root pathogens can be transmitted from one crop to the next when styroblocks are re-used. Effective block sanitation is essential, especially at nurseries with a history of root disease. Extensive trials, testing various sanitizing agents, have been conducted to find products and methods that would effectively control pathogen inoculum without risk to nursery workers or the environment. The ministry is currently producing a booklet entitled, Guidelines for Sanitizing Styroblocks to Control Algae and Seedling Root Rot Fungi.

Mike Peterson of AFS Research is under contract to develop a decision model for *Botrytis* control. The model will use environmental parameters to indicate threshold levels of disease progress. Growers could then determine if fungicide applications are necessary, and the most opportune times for treatment.

A number of different pathogenic fungi have been isolated from conifer seed. These fungi can, under certain conditions cause seed or seedling disease. Trials conducted in British Columbia and the United States nurseries have shown that running water seed treatments can be used to reduce pathogen inoculum. Development of a running water operational system at the Surrey Seed Centre has been initiated.

Work to gain a better understanding of the possible spread of the balsam woolly aphid from reforestation nurseries was conducted in cooperation with Al van Sickle, Forest Insect and Disease Survey technicians, and Lee Humble, of Pacific Forestry Center. Specimens collected from traps around the nurseries are still being assessed. All *Abies* spp grown at nurseries within the regulation area were inspected for presence of the aphid. Presence was determined by looking for damage symptoms. No aphids were found.

Beak Associates Consulting Ltd. is under contract to evaluate operational programs and procedures concerning the use of chemical products at Ministry of Forests nurseries and seed orchards. The review will include an assessment of risk, if any, to people and the environment that may arise from chemical use. Chemicals to be reviewed include pesticides, fertilizers, solvents, and cleaning products.

- Gwen Shrimpton, Nursery Pest Management Officer, Surrey.

Co-Op Students Tackle Assorted Forest Health Projects. This is the third year that the Prince Rupert Forest Region has hired university co-operative education (Co-op) students to do special Forest Health projects. Two students, Kerri Snodgrass and Ken Cripps, did a variety of tasks that included:

- transferring four years of ground probing data to Phero Tech's hazard rating maps and correlating actual mountain pine beetle infestations to the hazard classes;
- establishing a replicate of Leo Rankin's Ips beetle/mountain pine beetle competition experiment;
- establishing a pre-attack injection trial of 3/4 strength MSMA;
- participating in porcupine damage surveys in the Khutzeymateen, North Coast Forest District;

- assisting graduate student research in the Kalum Forest District (porcupine population monitoring study) and in the Kispiox Forest District (root collar weevil impact study); and
- numerous other tasks involving gypsy moth, white pine weevil, Rhizina, and Tomentosus root diseases, etc.

The students are highly motivated and very adaptable, despite their lack of field experience. We have insured that the projects we give them are unique, interesting, and short term, so they are exposed to a full range of forest health problems.

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

Williams Lake - Boitanio Park - Tree Decline Report. As a result of a study initiated by an inter-ministry committee on roadside tree injury, Ministry of Environment employees Jim van Barneveld and Bob Louie, have issued a report on declining trees at Boitanio Park, in the town of Williams Lake.

Numerous Douglas-fir trees along the highway and in the park have been affected - many severely - for several years, because of road de-icing salt. The investigation results substantiated the role and effects of the salt. Recently many affected trees have been attacked by Douglas-fir beetle in or near the park, and there is concern that more trees could be lost without corrective action.

Consequently, the Ministry of Transportation and Highways upgraded the highway culverts so that run-off water from the highway that previously ran into the park will now be channelled into the road drainage system. Local forest region staff are assisting in the replacement of dead and severely injured trees.

Roadside tree injury is a concern in several other locations in the province, and a committee of environment, highways, and forestry staff will continue to investigate occurrences of tree injury, and to determine and recommend preventative or ameliorative measures.

Copies of the report are available on request from J. van Barneveld (387-9945) or J. Muir.

- J. Muir, Protection Branch, J. van Barneveld, Ministry of Environment, Air Management Branch, and A. Planiden, Ministry of Transportation and Highways, Highways Operations Department, Victoria.

Second Edition of Field Guide to Pests of Managed Stands. Due to popular demand this publication has been reprinted and the new supplies have arrived.

The guide is designed to help field personnel in the identification of injurious diseases, insects, abiotic agents, and animals. Each damaging agent has relevant text and color photographs to describe and illustrate its characteristic features. There are keys to identify general groups of damaging agents, and each of these groups has an identification key to the particular species.

If you would like more copies, please contact P. Humphreys at Protection Branch (Telephone: 387-8737).

- P. Humphreys, Protection Branch, Victoria.

Forest Health Internal Reports. In the interests of better communication of knowledge in the area of forest health, please remember that there is an internal report series. This series was established in the early 1980's as a vehicle to help us share any knowledge gained from operational projects or other areas of experience. If professionals or technicians have information to share which can be placed into a technical report format, please consider presenting this information as an internal report. A description of the internal report series and its numbering system can be found in Chapter 16 of the Protection Manual, Volume II.

If you do publish one of these reports, please make sure that the Branch, as well as the Forest Service Library, in Victoria, is supplied with copies. Our librarians would be very grateful.

- P. Humphreys, Protection Branch, Victoria

FOREST ENTOMOLOGY

1990/91 Bark Beetle Program. The bark beetle program continued in 1990/91 with a provincewide total allocation of \$3 million. These funds were primarily directed towards mountain pine beetle management activities, although some funds were made available for spruce and Douglas-fir beetle. Activities covered under the program remained the same as in past years. The two-phase funding process was discontinued. All funds were supplied in a single allocation at the beginning of the fiscal year. Forestry Canada reports indicate that mountain pine beetle is at the lowest level since the mid-1970's. Further efforts are required to maintain this low level and prevent escalation.

- P. M. Hall, Protection Branch, Victoria.

Forest Region Bark Beetle Fund Allocations. Allocations of bark beetle funds to the forest regions were based on project proposals, perceived provincial priorities, and availability of resources. All allocations were made at the beginning of the fiscal year. Regional requests totalled approximately \$5.4 million. Regional levels of funding are as follows:

	AMOUNT REQUESTED	AMOUNT ALLOTTED	NO. OF PROJECTS
Cariboo	889,490	214,500	9
Kamloops	1,884,759	1,045,900	21
Nelson	837,400	585,000	12
Pr. George	842,265	477,000	13
Pr. Rupert	779,860	498,000	8
Vancouver	10,000	5,000	1
Protection Br.			
-MOE* Allocation		130,000	
-SFU** Study		4,500	
-Admin./Contingency		40,100	
TOTAL		3,000,000	76

* Ministry of Environment

** Simon Fraser University

- P.M. Hall, Protection Branch, Victoria.

Treasury Board Report. Continued funding for the bark beetle program in years after 1990/91 is dependent on the submission of a report to Treasury Board discussing the accomplishments and expenditures of the program to date. This report has been completed and forwarded to Treasury Board for review and approval. If approved, funding for 1991/92 is expected to be at a similar level to the current year's funding. The terms of reference of the program must also be reviewed to permit expenditures on important pests other than mountain pine beetle.

- P.M. Hall, Protection Branch, Victoria,

Mountain Pine Beetle Case Study. A case study is being prepared on the benefits and costs of controlling the mountain pine beetle. This study is intended to provide the rationale and justification of continued management efforts and will also establish the format for similar studies of other forest health issues. The mountain pine beetle case study will be completed early in the new year.

- P.M. Hall, Protection Branch, Victoria,

Clearance/Status for Beetle Harvest Blocks. Some concerns have been expressed over delays in obtaining clearance from Timber Harvesting Branch for blocks needing prompt harvest. It seems that the usual time to obtain a clearance may be as long as several months. This should not normally be an issue as, apparently by definition, Chart Areas and Administrative Areas (similar to a Chart Area, but cleared for the Small Business Forest Enterprise Program (SBFEP)) have already been cleared. The forest district must plot the Timber Sale Licence (T.S.L.), Cutting Permit (C.P.), etc. on the most up-to-date base map, complete a clearance request (FS 195), and send the package to Timber Harvesting Branch so that their maps may be updated. Although this may take several months, the permit **can proceed** if there are no conflicts indicated by the clearance. It does not matter who the Chart Area was cleared for since chart areas do not convey ownership. That is, we can issue a TSL under SBFEP within a chart area cleared in the name of one of the major licensees. Rush clearances may be possible for emergency harvesting in areas not included in a Chart Area or otherwise not already cleared.

- P.M. Hall, Protection Branch, Victoria

Okanagan Mountain Pine Beetle Task Force. A task force was established in response to the mountain pine beetle situation in the Okanagan Timber Supply Area to develop a consistent, effective mountain pine beetle management planning method that incorporated other integrated resource objectives. The method defined possible management strategies and tactics. Guidelines were established for selection and application of the appropriate course of action.

The steering committee was comprised of the following:

P. Van Mol	- Kamloops Forest Region
H. Carter	- Fletcher Challenge
J. Wenger	- Penticton Forest District
J. Borden	- Simon Fraser University

The technical committee was comprised of the following:

T. Lacey	- Merritt Forest District
R. Smith	- Vernon Forest District
J. Mottishaw	- Penticton Forest District
M. Geisler	- Kispiox Forest District
L. MacLauchlan	- Kamloops Forest Region
P. M. Hall	- Protection Branch
L. Safranyik	- Forestry Canada
R. Unser	- Fletcher Challenge
D. Dobson	- Contract hydrologist

The planning document is complete and will be presented to the regional manager of the Kamloops Forest Region and the Forest Service Executive in the near future. The method will be first implemented in the Kamloops Forest Region and modified if necessary. Once refined, it will become the standard planning method for developing mountain pine beetle management plans throughout the province. The overall intent is to ensure that the most appropriate course of action is selected and that it is applied in a consistent fashion wherever similar circumstances occur.

- P.M. Hall, Protection Branch, Victoria,

Prince George Forest Region Special Issue Funding 1990/91. This region was allocated \$477,000 for the detection, assessment and control of bark beetles in five forest districts. Thirteen individual projects were initiated to address spruce beetle (two projects) and mountain pine beetle (nine projects). Two regional projects were also initiated. To date accomplishments/activities include:

- placement of 6,800 pheromone baits;
- treatment of 8,000 trees (mostly lodgepole pine) with MSMA; and
- extensive ground probing and sanitation harvesting.

Single tree disposal and other control actions will be conducted in all districts.

- S. Taylor, Prince George Forest Region, Prince George.

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 1990. At each location, between June 19 and 25, 14 of these trees were randomly chosen and injected with 3/4-strength MSMA (240 g/L Glowon^R). The remaining seven baited trees at each location were axe-frilled only and left untreated to serve as checks. Mountain pine beetle attack on these trees began in mid-July and peaked in early August. The objectives of the trial were two-fold: 1) to determine if mountain pine beetle would attack trees treated with 3/4-strength MSMA and not be repelled, and 2) to determine if this dosage of MSMA would successfully prevent brood maturation.

Plot trees were examined for pitch tubes approximately once per week from late June until the termination of the adult flight in August. Although the data have not been analyzed to date, it appears that 3/4-strength MSMA was somewhat repellent to attacking adults. In May 1990, all attacked pine will be felled and sampled in order to determine treatment efficacy. Results and recommendations will be made after the efficacy sampling is complete.

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

Overview of Mountain Pine Beetle Activity - Invermere Forest District. All large areas of identified mountain pine beetle infestations have been removed through logging and pheromone baiting. Two new infestation areas have been identified on Steamboat Mountain and these will be removed by the end of next year. We are now salvaging lower priority stands with aggressive single-load logging. A small cut-block harvesting program is being developed based on this year's survey results. Higher attack densities on the green attack trees, and little or no red attack, has been identified in field surveys.

Pheromones

Seven hundred fifty mountain pine beetle pheromone baits were placed in a 560 ha area. Most of the placement was done by forest licensee crews. The objective was to keep the existing beetle population contained within the approved cut-block, and eradicate any in-flight beetles.

Ninety pheromone funnel traps were placed, as post-harvest monitoring devices, to determine if they can be used on an operational basis to give an early warning of increased mountain pine beetle activity, and to reduce beetle attack on trees along cut-block boundaries. The relationship between the number of beetles caught by funnel traps placed in cut-blocks, and the level of beetle infestation in the surrounding forested area, will also be determined. Results indicate that the funnel traps placed in cut-blocks do attract beetles but the number of beetles captured is generally lower than funnel trap catches in standing timber. This type of funnel trap placement program will be repeated over the next few years in the same areas.

MSMA Applications

A total of 1,360 pine trees were treated with MSMA from mid-July to the end of August. To obtain good translocation, MSMA should be applied when adult mountain pine beetle gallery length is between 3 and 20 cm. This length was suggested by Dr. Yasu Hiratsuka of the Northern Forest Research Station in Edmonton, and is based on an experiment involving the injection of blue stain fungal cultures, taken from Steamboat Mountain, into pine wafers during a drip test. Applying MSMA too early has resulted in reduced beetle attack on the treated tree with additional "spill-over" attack on surrounding trees. We understand that Lorraine MacLauchlan, Kamloops Forest Region entomologist, is conducting a translocation trial to further define the application period. Good results have been achieved with a nine day application window over a two month period, and two or three entries per location. The cost of using this method is about \$8.00 per tree treated.

Ground Survey Crews

Three contract crews have surveyed approximately 1 500 ha since September 24, 1990. They have found several small pockets of green attack (3-60 trees), and a few pockets of red attack. They have also found mountain pine beetle infestations in areas not previously attacked and not found on the overview flight. Some of the areas discovered by the ground probers were attacked in 1982 but no attack had been detected after the fall-and-burn program conducted in the winter of that year.

Fall-and-Burn MSMA Treatments

Our main treatment strategy is to use single load logging or regular logging but a few areas, identified by ground survey crews, are being prepared for fall-and-burn or MSMA treatments in 1991, depending on their location within the timber supply area, and how soon they can be logged. Approximately 1,500 trees will be felled and burned this year.

- E. Begin, Invermere Forest District, Invermere.

Electronic Data Base of Mountain Pine Beetle Infestations and Control Operations in the Invermere Forest District. An electronic data base has been developed with a user friendly program called PCFILE:DB to track mountain pine beetle infestations and harvesting operations. The information has been entered and used for two years with success. Modifications to this data base are relatively easy, so that systems specific to each forest district can be developed to accommodate information requirements from the regional office.

- E. Begin, Invermere Forest District, Invermere.

Use of an Anti-aggregant Pheromone in Mountain Pine Beetle-infested Stands. A joint B.C. Forest Service/Phero Tech project was conducted in the Penticton Forest District, testing the effectiveness of Verbenone in two release devices - bubble caps and aerially applied beads.

A total of 16 ha (4 x 4 ha block) were treated with Verbenone beads using 84 g active ingredient (a.i.)/ha. Another 16 ha block was treated with Verbenone bubble caps, stapled to trees in a 10 x 10 m grid pattern throughout each block (0.8 g a.i./cap). Four 4-ha blocks of approximately equal attack levels were evaluated as controls.

Phero Tech will be publishing results of this and other trials in the near future.

- L. MacLauchlan, Kamloops Forest Region, Kamloops.

Shore and Safranyik Come to Chilko Lake. Stand susceptibility and risk rating was applied to the Chilko Lake mountain pine beetle infestation in Chilcotin Forest District.

Cooperative education student Jeff Lemieux used inventory data to create overview susceptibility maps and a beetle-pressure roamer to provide stand risk index. Field surveys were undertaken to check the accuracy of the indices developed in the office. Results prove the method to be cost-effective and exact.

A report on the project, complete with results and a guide to using the method, will be available early in 1991.

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

First Year Results of Bulkley Beetle-proofing. An examination of the Bulkley Forest District's Beetle-proofing trial site at Thompson Creek this fall revealed no new beetle attacks within the spaced blocks. Two current attacks were found in the adjacent control stand. Four spacings of 2 X 2 m to 5 X 5 m, in 6.25 ha blocks, were horse-logged through the winter of 1989 and the spring of 1990. Fish and Wildlife personnel will be conducting a survey of winter range usage by deer this winter to see if spacing may be useful for preserving scarce winter habitat in the Bulkley Valley. No blowdown was observed in the trial area despite a severe windstorm that occurred in May.

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

Survey of Bowron Lake Park Blowdown. Blowdown over 800 hectares of the Park was assessed for spruce beetle outbreak risk by a task force made up of specialists from the Ministry of Parks, Forestry Canada and the Forest Service.

Field work was carried out in August and September by Parks staff, FIDS rangers, and Cariboo Forest regional and district staff. Data were compiled and reviewed last month by the task force.

Susceptible host exists in most areas, but populations of spruce beetle are low in the Park. Outbreak risk at this time is reckoned to be minimal.

Management recommendations provided to the Ministry of Parks included a continued monitoring programme, deployment of trap trees in two areas of the Park, and intensive beetle surveys in 1991.

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

Spruce Beetle - Invermere Forest District. An operational spruce beetle control trial was conducted in the Bugaboo area with the University of Calgary. A helicopter ski company had felled several spruce trees during glading operations in 1988 and 1989. Most of the felled trees had a nicely developing spruce beetle population. Template counts of 4-6 adult galleries were made in the freshly attacked trees, with 28-35 larvae found in other checks. The objective of the trial was to reduce the spruce beetle population to an acceptable level, while not removing any additional mature spruce trees. The spruce beetle pheromone has improved recently, due to the efforts of Dr. H. Wieser and his group of chemists at the University of Calgary. They have been working with Dr. Borden of Simon Fraser University, and Phero Tech, to provide us with a better management tool. This improved pheromone was used successfully for two years in Tree Farm Licence 14 as part of a cooperative program with Crestbrook Forest Industries. It is also being tried in an interprovincial and Alaska program. Results of the Bugaboo trial were good, with 318 beetles captured in funnel traps and only one standing tree attacked successfully. The captured beetles were from trees felled in 1988. A trial will be conducted in 1991 to pick up the beetles that emerge from the 1989 glading.

A development plan, with cutting specifications to prevent spruce beetle infestations, has been created for the use of helicopter ski companies in the future.

- E. Begin, Invermere Forest District, Invermere and H. Wieser and E. Dixon, University of Calgary, Calgary.

Bowron Lakes Park Blowdown. On May 5, 1990, high winds caused scattered patches of blowdown in many areas of the Quesnel Timber Supply Area. Bowron Lakes Provincial Park sustained significant blowdown over 815 ha, concentrated along Isaac Lake. The potential for a resulting spruce beetle increase was recognized and an interagency task force was organized to assess the situation, determine the potential for a spruce beetle problem, and develop suitable management actions. Agencies represented on the task force were the Ministry of Parks, Ministry of Forests, and Forestry Canada. Extensive ground surveys were conducted in the park and the task force reviewed the situation and options. A report was prepared and submitted to the executives of both Parks and the Forest Service.

- P.M. Hall, Protection Branch, Victoria,

Douglas-Fir Beetle - Invermere Forest District. Douglas-fir beetle infestations have been increasing in the District since 1989, mainly in areas where root disease is a problem. The increase in the beetle population is probably due to the dry weather we have experienced over the last five years. It also appears that Armillaria root disease may predispose a tree to attack by the Douglas-fir beetle.

Two infested areas have been identified for harvesting. In three other areas, a tree baiting and post-harvest funnel trap trial was undertaken with Crestbrook Forest Industries, Provincial Parks and the University of Calgary.

In the past, the best way to control the Douglas-fir beetle was to create trap trees. Phero Tech has a Douglas-fir beetle pheromone lure that has improved the effectiveness of the felled trap trees and is also useful in funnel traps for population monitoring. The trial involved the comparison of the Phero Tech lure with a University of Calgary lure in funnel traps, log decks, and as a tree bait. The results were surprising, especially in one area, where a spruce beetle infestation was identified that had not been known to exist. The funnel trap comparison results were: Phero Tech lure - 50 beetles (range: 1-72), University of Calgary lure - 394 beetles (range: 274-876).

A report on this trial should be available by the end of 1990. Further cooperative programs to test this lure will be conducted in 1991 to determine if the same results can be obtained.

- E. Begin, Invermere Forest District, Invermere, H. Wieser and E. Dixon, University of Calgary, Calgary.

Monitoring Douglas-Fir Beetle Flight in the Cariboo. During the spring and summer of 1990, Lindgren Funnel traps were erected to monitor the Douglas-fir beetle flight. Trap captures indicated when the main flight occurred, where beetle population centers were located and whether there were significant variations between forest districts. Traps were distributed in four of the five Cariboo forest districts. In the Horsefly Forest District, a low beetle population made monitoring impractical. The beetle flight began in mid-April in warmer sites, but cooler wet weather in late April and May severely restricted the flight until warmer weather in June. The beetle flight followed roughly the same pattern throughout the forest region with no significant difference in trap catches between forest districts.

Throughout the region 12.3, 52.9 and 32% of the beetles were captured in May, June and July respectively. Only 2.8% of the beetles were captured in August and September. The average capture per trap was 1,202 beetles.

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

Douglas-fir Beetle Infestation Squashed in the Lakes Forest District. An expanding infestation of Douglas-fir beetle that was threatening valuable deer winter range on the north shore of Francois Lake has finally been treated using a variety of methods. The Lakes Forest District selectively logged past, and currently attacked trees, and trap trees, using a small cat, and an ancient arch skidder to minimize ground disturbance. Much care was taken to avoid scarring residual trees. Logs were decked and auctioned on the landing. The District paid for probing, layout, falling and skidding, through the Small Business Forest Enterprise Program and protection funding. Recovery of all costs through sale of the timber was not expected. Inaccessible infestations were felled and burned and an experimental mass-trapping trial will be done this summer in cooperation with Phero-Tech and the University of Calgary, to pull residual beetles out of the stand.

Results of these efforts will be reported in future issues of Pest Management Progress.

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

Student Crew Finds Douglas-fir Beetle in Cariboo. Ten high-school and university students were hired and trained to conduct ground surveys for the Douglas-fir beetle in July and August of 1990. Students probed and marked trees for harvesting, and monitored traps in Williams Lake and 100 Mile House Forest Districts. The student crew also carried out spruce leader clipping for an operational weevil control trial in Horsefly Forest District.

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

Lethal Trap Tree Trial for Douglas-fir Beetle. Eleven sites in the Cariboo Forest Region (Williams Lake Forest District) were selected for a lethal trap tree trial to control the Douglas-fir beetle. Five trees were felled and limbed at each site. Four trees at each site were sprayed with 2% Sevin^R XLR to drip point. The fifth tree was left unsprayed as a control. All trees were baited with pheromone lures. Screen traps were attached to the tree boles to catch beetles killed by Sevin. Bark samples were collected in late July and the number of galleries, average length of gallery and number of live brood

were counted. Lethal trap trees killed 10 times more beetles than conventional trap trees. The mean gallery length was significantly greater in control trees. The average number of "spill-over" trees found at lethal trap tree sites was significantly less than at conventional sites (1.45 vs. 15.97) ($P=0.05$). Lethal trap trees have potential for use in infested areas with difficult access or locations where tree removal must be minimized, such as mule deer winter range.

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

Cariboo White Pine Weevil Clipping Project. For the third consecutive year clipping of leaders infested with white pine weevil *Pissodes Strobi*, was carried out at Antoine Lake in the Horsefly Forest District. Infested leaders were clipped and placed in screened barrels which are left on site over the winter. This allows the parasites and predators to emerge and return to the plantation but not the adult weevils. The number of leaders clipped was 805, a reduction of 10.6% from 1989, and 25.4% from 1988. Reductions would have been more significant except that Workers Compensation Board licencing difficulties in 1989 delayed clipping for ten days, which permitted approximately 8% of the weevils to emerge before the leaders were clipped. This serious delay underlines the logistical problems inherent in a clipping program with only a short control window. Clipping costs averaged \$219/ha (\$9.17/clipper leader) over the three years.

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

White Pine Weevil Survey in the Robson Valley Forest District. This fall a survey was conducted to determine the distribution and incidence of white pine weevil, *Pissodes strobi*, attack. In addition, seven permanent sampling stations were established to estimate the weevil's rate of spread. Weevil incidence levels will be compared to various site factors (site quality, tree density, percent brush cover, etc.) to determine if any significant correlations exist. It is hoped that these results will lead to refined management prescriptions.

All susceptible spruce plantations in the Interior Cedar-Hemlock (ICH) biogeoclimatic zone, northwest of Dunster, were surveyed, as were two randomly selected stands in the Engelmann Spruce-Subalpine Fir (ESSF) zone. Plantations were surveyed using a systematic transect line technique recommended by Protection Branch specialists.

Preliminary results indicate that within this ICH zone 1 020 hectares of spruce plantations are severely attacked (>5% current attack). The average incidence level of current attack in this zone is 20.0% (range 0.6-40.0%). The average incidence level on the ESSF sites is 0.7% (range 0.0-1.4%). Further analysis is required, and a full report will be available in the near future.

- S. Taylor, Prince George Forest Region, Prince George

Does Brushing and Weeding Increase White Pine Weevil Damage? A contract has been awarded for an examination of manually brushed Sitka spruce stands in the Kalum Forest District to see if there is a significant difference in white pine weevil damage between treated and nearby untreated stands. Theoretically, maintaining a deciduous overstory should reduce weevil damage by making the host more difficult to find and the micro-climate less suitable for oviposition. Silviculture standards that require overstory removal to achieve free growing status, may result in an unacceptable increase in weevil damage and produce less volume than if the stands were left untreated. By March 1991, the contractor will have selected and surveyed suitable stands for comparison and should be able to conclude whether overstory removal affects the rate of attack. In the 1991/92 fiscal year, the contractor will establish trials which will compare conventional brushing to treatment of strips of brush in an east-west direction, similar to the trial established by Russ Cozens in the Prince George Forest District. Results of this spring's work will be reported in the next issue of Pest Management Progress.

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

S.W.A.T. with Real Data. Four consecutive years of survey data will be put into Dr. Rene Alfaro's Prince Rupert Forest Region-calibrated S.W.A.T. (Spruce Weevil Attack Trial) computer model. This information will allow the model to make a projection of white pine weevil damage in Kitimat Valley stands. A realistic estimate of the impact of weevil damage will allow forest managers to decide if stand rehabilitation is a viable option.

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

Terminal and Root Collar Weevils - Invermere Forest District. Several areas of root collar weevil, *Hylobius warrenii*, and pine terminal weevil, *Pissodes terminalis*, were identified during surveys conducted during 1988, 1989 and 1990, along the Palliser River. For the last two years, the University of Calgary has conducted trials to assess different pheromones for detecting and controlling root collar weevils. Of

the immature trees checked on Steamboat Mountain, 22% were attacked by the root collar weevil. Approximately 85% of the trees checked in the Palliser River area were attacked by the terminal weevil. Silviculture staff have asked us how to best treat these weevil-infested areas, as a few of them are scheduled for spacing this year. A clipping and parasite release program may be an effective treatment.

- E. Begin, Invermere Forest District, Invermere.

Douglas-fir Tussock Moth. Tussock moth appears to be increasing again in several areas in the Kamloops Forest Region. Pheromone traps and subsequent egg mass surveys indicate the probability of visible defoliation in 1991. Accordingly, plans are being made to deal with known areas of population increase and to expand the pheromone survey effort in 1991 to locate new epicentres. In 1991 virtually all located areas of infestation will be treated. The treatment of choice will likely be the nuclear polyhedrosis virus that has been stockpiled by the Forest Service in preparation for this outbreak. The intent of the treatment is to apply virus to epicentres and terminate the outbreak in the early stages, before significant damage occurs.

- P.M. Hall, Protection Branch, Victoria,

Douglas-fir tussock moth. Results of the 1990 pheromone trapping program by both Forestry Canada and the Ministry of Forests indicated an increasing population of Douglas-fir tussock moth in the Kamloops Forest Region. The results are as follows:

FOREST DISTRICT	NO. OF TRAPS	AVERAGE NUMBER OF MOTHS PER TRAP		
		1988	1989	1990
Kamloops	50	7.9	8.4	17.7
Penticton	10	--	--	25.7
Vernon	20	3.5	6.4	26.0
Merritt	14	5.6	6.6	14.0*
Lillooet	06	0	0.8	08.7

* There was a decreased surface area in these traps compared to the others, so numbers could be low.

Egg mass surveys, conducted in candidate stands this fall indicate that certain stands may be severely defoliated in 1991. Results to date, of the egg mass surveys, are as follows:

Location	Sequential Sampling Egg Masses per Tree Ratio	Predicted Defoliation
Savona	0.56	light
Indian Gardens Road	1.18	moderate
"Bull Pen"	2.73	severe
East of "Bull Pen"	0.66	light
Beaton Road	1.14	moderate
Stemwinder Park	2.95	severe
Winter's Creek	3.00	severe
	2.32	severe
	3.25	severe
Bradshaw Creek	2.0	severe
Rattlesnake Indian Reserve	5.1	severe
	1.7	moderate
West of "Bull Pen"	1.3	moderate
6 Mile Point	2.8	severe
	1.7	moderate
Pat Lake	1.6	moderate
Northeast of Pat Lake	2.3	severe
	13.2	severe
	5.5	severe
	4.8	severe
	4.4	severe
	0.45	light
Olalla	0.31	light

Further egg mass sampling is planned for this winter to delineate the stands infested with Douglas-fir tussock moth. Treatment with the nuclear polyhedrosis virus (NPV) is planned for 1991.

- L. MacLauchlan, Kamloops Forest Region, Kamloops.

Spruce Budworm Control in the Fort Nelson Forest District. On June 12, 1990, approximately 525 hectares of mature spruce seed production stands in the Fort Nelson Forest District were treated with the biological insecticide, *Bacillus thuringiensis* Berliner var. *kurstaki* (*B.t.k.*), in an attempt to reduce defoliation by the spruce budworm, *Choristoneura fumiferana*. Three locations, encompassing a total of five blocks, were aerially treated with 0.9 L/ha of Futura^R XLV-HP. The application was made during good weather conditions by a single engine fixed-wing aircraft equipped with micronair spray nozzles.

Prespray larval densities ranged from 27-77 larvae per 100 buds - a 5-10-fold increase since the last treatment in 1988. These larval densities were approximately 4-10 times higher than populations successfully treated with *B.t.k.* in Quebec from 1985 - 1987. Percent population reduction from treatment here was 37%, adjusted for natural mortality. Percent defoliation was reduced by 38% on treated blocks compared to the check block. Larval rearings by Forestry Canada revealed that adult emergence was approximately 2-3.5 times less on treated blocks than on the check block.

A report on the results will be available this spring. In light of the severe defoliation forecast by Forestry Canada for 1991, plans for a possible further treatment program are now being considered.

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

Blackheaded budworm/B.t.k. Spray Trial - Holberg, 1990. Another spray trial was conducted this summer by Forestry Canada, with the co-operation of the B.C. Forest Service, Western Forest Products Ltd. and three pesticide companies, Abbott Laboratories Ltd., Novo Laboratories, and Chemagro Ltd. The objective was, again, to test *B.t.k.* operationally to gain registration data for its use against the blackheaded budworm (last years results were less than convincing). Dr. I. Otvos, Forestry Canada, was the research scientist responsible for the project.

This year's trial was similar to last year's (reported in PMP Vol. VIII, No.2, pg. 18-19), however, this year it was enlarged. Three products were tested and the dosage was increased (Futura^R XLV-HP at 40 BIU/ha in 1.2 L/ha; Dipel^R 176 at 40 BIU/ha in 2.4 L/ha; Foray^R 48B at 50 BIU/ha in 3.9 L/ha). Each product was applied to three blocks each of young hemlock (20-30 years old). The blocks varied in size from about 20-30 ha.

Preliminary results show mean larval reductions of 82% for Futura, 95% for Dipel, and 70.8% for Foray. Spray deposit, as examined at Forest Pest Management Institute, Sault St. Marie, showed good numbers of droplets per needle.

Hopefully this year's successful control will lead to the inclusion of blackheaded budworm on the label in the near future.

- D. Heppner, Vancouver Forest Region, Vancouver.

Gypsy Moth. The Ministry of Forests again participated in the provincewide pheromone gypsy moth survey under the leadership of Agriculture Canada. The Forest Service placed and monitored about 2000 traps in nurseries, recreation sites, and other forested areas where gypsy moth introductions were deemed possible.

The provincewide effort resulted in several gypsy moth finds. Areas where the moth was found include the following:

Parksville	2 males
NanOOSE Bay	1 male
Lantzville	1 male
Comox	1 male
Cameron Lake	1 male (Forest Service trap)
Campbell River	1 male
Belmont Park (Colwood)	2 males
Royal Roads College	1 male
Victoria (UVIC)	2 males
Saanich	96 males, 12 females, 36 egg masses

The spray program carried out in Parksville in the early summer of 1990 was apparently successful. The triple aerial and ground applications of *Bacillus thuringiensis* var *kurstaki* (*B.t.k.*) resulted in no moth finds within the treatment area. The two moths found in Parksville were outside of the spray zone.

Treatment plans for 1991 involve a spray program to be conducted on the Saanich Peninsula. All other areas with positive moth finds will be heavily monitored with pheromone traps. The treatment area on Vancouver Island is the largest area yet treated for gypsy moth in British Columbia and also offers the greatest potential for gypsy moth expansion due to the moderate climate and high levels of preferred host trees such as oak.

- P.M. Hall, Protection Branch, Victoria,

Forest Tent Caterpillar Outbreak at Prince George. An outbreak of the forest tent caterpillar, *Malacosoma disstria*, is expected to persist and expand around greater Prince George next spring and summer. Aerial sketchmapping by the Forest Insect and Disease Survey Unit (FIDS) of Forestry Canada in 1990 delineated approximately 194 000 ha of defoliated trembling aspen - almost twice the 108 000 ha infested in 1989. Egg mass surveys by FIDS in the fall of 1990 indicated continued high populations with extensive moderate-to severe defoliation in the Prince George area this spring. Defoliation was variable and spotty in the Peace River area near Pouce Coupe, and from Dawson Creek to Farmington.

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

Yellow-cedar and Trisetacus mites. An eriophyid mite, *Trisetacus chamaecypari*, has been seen over the past two growing seasons (1989,1990) in yellow-cedar seed orchards. In 1989 pollen loss of over 50% was recorded in one orchard (A. Colangeli, pers. com.). In 1990 over 50 mites have been observed on one pollen bud, but the Saanich Peninsula mite population seems to have declined since 1989.

Pollen, first and second year cones, and foliage are all attacked by this mite. Pollen seems to be attacked most heavily. Mites can be seen in increasing numbers as pollen matures in the fall. The mites feed at the base of the pollen cone, girdling the stalk and killing it. Pollen buds turn brown in the fall, and begin to drop before pollen can be released in the spring. Damage to foliage appears as chlorotic patches on the leaves.

A pilot survey was conducted in the fall of 1990 to determine the distribution of mite feedings within the tree and to determine if trees treated with gibberellin A3 (GA3) were more prone to attack by this mite. Samples taken in late October showed that most of the mites were either on the foliage or in the pollen. However, a few mites were seen on cones. Almost all foliar samples had some mites (note: only 8 trees sampled). GA3 treated and untreated trees were equally infested.

Management of these mites will be difficult. Their small size makes it almost impossible to see them with a hand lens. Laboratory examination of samples is required. When feeding in the pollen cones, the mites are not easily killed with an insecticide spray. Only when feeding on foliage are they exposed enough for a treatment to be effective. Insecticide trials against eriophyid mites have yielded inconsistent results. Also, by the time the symptoms are visible the damage is already done. The potential for damage to seed cones will be monitored in 1991. Thank you, Bob Duncan, for identifying the specimens once again.

- B. McEntire, Silviculture Branch, Victoria.

1990 Beneficial Insect Survey. Based on a Saanich Peninsula seed orchard survey of predatory and parasitic insects, lacewings and ladybird beetles exhibit potential for use in biological control programs. Further information concerning insect biological control potential, and an inventory of beneficial insects, their biology and feeding habits, as well as collecting equipment and collection sites, is provided in the report, Southern Vancouver Island Beneficial Insect Seed Orchard Survey, August 1990, which is available from the Silviculture Branch library.

- M. Schmidt, Silviculture Branch, Victoria.

Controlling the Yellow Cedar Gall Midge. A small gall forming midge has been found to cause significant damage to yellow cedar branch tips in a seed orchard on the Saanich Peninsula. Midge damage has reduced cone and pollen production.

During 1988 and 1989, trials were conducted with systemic insecticides in an attempt to control the midge and its damage. Results indicated that the midge can be controlled with sprays of Metasystox^R or dimethoate if the material is applied over the winter. Formation of damaging galls can be reduced if the trees are treated after oviposition but before larval feeding begins in the late summer.

- D. Summers, Silviculture Branch, Victoria.

FOREST PATHOLOGY

Pinewood nematode situation. The economic difficulties with the pinewood nematode situation continue to worsen. Four hundred million dollars in wood products exported to Europe from coastal British Columbia in 1989 are threatened by restrictions imposed by the importing countries. Industry experts state that in 1991 and 1992 Canada might lose markets that currently total \$250 million or more.

The pinewood nematode is rare but widespread in the forests of Canada, but it is not a pest. It is carried by the wood borers, *Monochamus* spp, that are attracted to fire-killed trees. However, in wood products such as chip piles or logs, the nematode can become abundant.

The nematode has been reported as pathogenic only in parts of Japan. Researchers at Simon Fraser University reported that the pathogenicity of the nematode is correlated with climate, and trees are killed only in regions warmer than Canada and Europe. A pathogenic nematode of the same genus is present in Europe, but no trees have been killed except in the warmer areas of southern France. United States nematologists have also expressed doubt about the pathogenicity of the nematode, even in Japan, and point out that there are no scientific data to show that the nematode, in association with the insect vector, is pathogenic.

European countries have imposed a ban on all wood product imports from countries with pinewood nematode, beginning January 1, 1991, except where the wood has been kiln-dried or treated to kill nematodes. A deferment of the requirement has been negotiated for Canada until January 1, 1992, based on a free-of-bark and free-of-grubworm holes mill certification scheme set up by Agriculture Canada and the Council of Forest Industries. The industry group is vigorously implementing the certification scheme, and several mills have been suspended because of violations. In 1991, all violations have to be reported to a central office in Brussels, and three or more incidents will result in a review of the exemption.

Coastal mills in British Columbia will be severely affected by the restrictions. Most of the exports to Europe are large dimension material from coastal mills that are very costly, if not impossible, to kiln dry. Many large pieces are remanufactured in European countries, but with increased costs other building materials would likely be used. The industry group predicts that the loss of access to these markets would have major economic consequences to the British Columbia economy.

Faced with these problems, several projects have been initiated by industry and government. Negotiations are continuing on the international level, and industry is monitoring developments closely. Scientific research projects are continuing at Forestry Canada, Pacific Forestry Centre, and at other centres. A current project by a United Kingdom research entomologist at Victoria has provided data to support an application for exemption of coastal hemlock and cedar. An international cooperative project to develop heat treatment and other treatments of wood products has been proposed, and we are hopeful that funding can be secured.

Locally, a committee of the British Columbia Plant Protection Advisory Council has been trying to keep members informed of rapidly changing developments, and to facilitate action on resolving the issue. Staff of Industry and Development Branch are also participating in the effort to sustain our export markets.

- J. Muir, Protection Branch, Victoria,

Estimation of Root Disease Impact and Options for Management. As soon as managers become aware of the presence of root disease in forest stands, two questions assume priority: What will be the probable impacts of the disease? What can be done to lessen them, with what benefits and costs?

The Stand Modelling Group, Research Branch, in collaboration with Protection Branch, is attempting to provide tools to help managers answer these questions. The following describes these tools, how they are being developed, and how they can be used.

The Tools

The basis for all pest impact assessment is a system for classifying the observed effects of a pest. The most useful classifications are relatively easy to apply, are based on a wide range of field measurements and offer practical guides to pest management. For root disease, these requirements can be best met by:

1. A standard classification for root disease based on broad classes of severity or percent area infected, infection center frequency, and spatial distribution in stands. The classification should be comprised of clear graphical aids, such as pathograms or disease distribution maps, and easily applied tables.

2. Estimates of volume at rotation for a healthy stand, and for an infected stand of a specific disease class, with or without silvicultural intervention (i.e. spacing, precommercial and commercial thinning).
3. Estimates of volume at rotation with root disease control (i.e. stumping, variable planting density, bridge tree removal).

Development of the Tools

The following are the procedures being used to develop the management tools:

1. From a database of results from approximately 200 Phellinus root disease surveys in the coastal Douglas-fir zone, derive broad disease classes with respect to major disease parameters, such as infection severity and infection center frequency, size, and distribution at stand age 50 (mid-rotation).
2. Assign stands to disease classes and calculate ranges and average for each class.
3. Through reverse simulation, derive initial disease parameters, at stand age 1, which produce the average disease conditions at age 50.
4. Use the initial disease parameters to derive inputs to the TASS-ROTSIM growth and yield model. Simulate disease impacts at different stand ages to rotation, with specific silvicultural regimes (planting density, spacing, thinning) and disease control options (do nothing, stumping, bridge-tree removal, host resistance).
5. Compile descriptive statistics and visual aids for assigning stands to their standard disease classification.

Application of Disease Standards

It is anticipated that the root disease standards will be applied in the following way:

1. Choose the visual aid (pathogram) most similar to the disease conditions and stand age for a given stand.
2. Select the appropriate disease parameters from tables showing the standard severity, center frequency and spatial distribution classes. The selection can be based on, in increasing order of accuracy: "guesstimates", stand walk-throughs, disease maps, or disease surveys. The reliability of the choice will affect that of the result.

3. Refer to the yield table corresponding to the disease class of the stand to provide:
 - (a) the volume of the stand if it had not been infected;
 - (b) the volume to be expected if no control actions are taken; and
 - (c) the volume corresponding to different types of silvicultural and disease control interventions.

Reliability of the Method

The stand growth and disease estimates will be produced by combining Ken Mitchell's stand growth model (TASS) for coastal Douglas-fir, with Bill Bloomberg/Robert MacDonald's model of Phellinus root rot (ROTSIM). Both models have been extensively tested. The combined model will be tested to ensure that it produces realistic results for the growth and disease spread and impact (tree growth reduction, and tree mortality).

- Ken Mitchell, Research Branch, Victoria

Disease Plot Remeasurement. The Ministry of Forests has assumed responsibility for remeasuring Forestry Canada's disease plots at Campbell River, Tsable River and Mesachie Lake. The crew completed work at Campbell River, and will continue measuring the remaining plots, as the weather permits.

- Ken Mitchell and Bill Bloomberg, Research Branch, Victoria

Armillaria Ostoyae - Cariboo Forest Region. An *Armillaria ostoyae* survey was conducted in a 100 ha area near Pinnell Creek, which is 30 km north of Williams Lake. The area contained three portions, one portion was unlogged, one selectively logged 35 years ago, and one recently harvested 10 years ago.

The unlogged, as well as the selectively logged portions of this area were cruised, using standard operational cruise procedures, to obtain standing volumes. The survey for *Armillaria* root disease was done using the Strip Method, with traverse lines spaced 100 m apart.

Armillaria root disease was located on 66.2 ha of the 105.6 ha surveyed, or approximately 2/3 of the block. The root disease occurred in both the logged and unlogged portions of the area.

In the northern third of the area, logged about 10 years ago, infection is quite dramatic with numerous saplings, or small groups of saplings, succumbing to the disease. About 2-3% of the total number of stems in the stand exhibit symptoms of recent *A. ostoyae* infection, with consecutive infection "centers" of single or small groups of infected stems, often less than 10 m apart.

The western half of the survey area, selectively logged approximately 35 years ago, shows a general progression of the disease from infected stumps outward into the surrounding immature stand. Scattered residual trees are also infected. Areas of *A. ostoyae* infection are more scattered than in the recently logged area, but infection is more prevalent within groups of stems, with 45-50% mortality occurring in small areas of 0.5 ha or less. Approximately 0.8-1% of the total number of stems in the stand show signs of Armillaria root disease infection.

The unlogged portion occupies the eastern half of the area delineated. About 1/2 of this portion is infected with Armillaria root disease. Areas infected are readily apparent, with all age classes showing symptoms of infection. An estimated 35-50% of the original volume in the stand has been lost due to *A. ostoyae* induced mortality. Individual infection centers were difficult to detect due to the progression of the disease over time, and infection centers have merged to form one large area of infection. There is often less than 15 m between consecutive infected trees or groups of trees.

Mountain pine beetle, *Dendroctonus ponderosae*, and Douglas-fir beetle, *D. pseudotsugae*, attack was associated with Armillaria root disease in infected areas. In non-diseased areas, scattered past mountain pine beetle attack was recorded. No other root disease was found in association with Armillaria root disease.

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

Armillaria ostoyae: A Problem in the Cariboo? Another Chapter in the Continuing Saga. When we left this stirring tale last May, Hannah Dickinson, a cooperative education student, had developed a sampling method to determine losses caused by Armillaria root disease. This sampling method used 10 x 3m pixels (Merler/Norris) in areas stratified by canopy

cover using colour aerial photos. The areas were randomly selected in four biogeoclimatic zones. Mensuration data was also collected on a percentage of the pixels. The sampling method did not work. No Armillaria root disease was found in any of the 66 areas sampled. Why, you say, did this happen? Well, there are a potpourri of explanations, such as:

1. Sample size may have been too small to be representative (5.5 ha out of 20,000 ha).
2. Perhaps only one biogeoclimatic zone should have been sampled to allow direct comparison of the results of each sample, as all the environmental conditions on each sample area in one biogeoclimatic zone would be relatively similar.
3. The sample sites may have been selected incorrectly. A bias may have been introduced when choosing the type of crown closure, as all sites selected had crown closure that appeared healthy.

Another sacrificial student will take to the field in the summer of 1991 to try again. This time, we hope to learn from our error of 1990 by sampling in known infection sites. These sites will be selected using colour aerial photos, but with different stratification criteria for canopy cover - i.e. crown closure that is patchy or open. Previous studies have indicated that there is a 50% chance that openings visible on aerial photos have been caused by root disease. The Cariboo will persevere. Stay tuned for the next installment in the saga.

- D. Doidge, Cariboo Forest Region, Williams Lake

Armillaria root disease and Douglas-fir beetle. Several hundred hectares of Douglas-fir stands southeast of Cranbrook have a chronic infestation of Douglas-fir beetle that has made forest management much more complicated. The stands are a mixture of large, older and small, younger trees that are potentially amenable to selective harvesting and all-aged stand management. However, the beetles periodically kill many of the larger trees.

Recently, regional and district staff determined that many of the trees had symptoms of root disease, such as thin-looking or discoloured crown foliage and bent-over tree tops. Root disease was suspected to be prevalent in 68 per cent of the area, and possibly the cause of the beetle outbreaks. However, definitive features of the disease, such as fans of the fungus under the bark, were sporadic and difficult to find.

To evaluate the association of bark beetle attack with root disease, eight trees, each with a diameter of approximately 60 cm at 1.5 m above the ground, were uprooted, with a large tracked excavator. Trees were examined two days later by Forestry Canada root disease expert, Dr. Duncan Morrison, and Forest Insect and Disease Survey technician, Leo Unger.

Seven of the eight uprooted trees had evidence of *Armillaria* root disease, but one tree had only a very small area of diseased bark at the ground level. All of the other infected trees had signs of disease on lateral roots or on sinker roots at a distance of 0.5 to 1.5 m from the root collar area.

These results supported the preliminary observations that *Armillaria* root disease was widespread in the area, and suggest that the root disease was primarily responsible for predisposing the trees to Douglas-fir beetle attack.

In the infected stands, more work will be needed to modify harvesting and management plans to deal with the *Armillaria* root disease. Further excavations are planned to determine the association of bark beetles and root diseases in other areas of the Nelson Forest Region.

- J. Muir, Protection Branch, Victoria, D. Norris, Nelson Forest Region, Nelson, D. Morrison and L. Unger, Forestry Canada, Victoria.

Three year remeasurement of *Armillaria* root disease in a young Douglas-fir plantation. In August, 1987, a 5.3 hectare plot in a 14-year-old Douglas-fir plantation at Hazeltine Creek in the Horsefly Forest District was 100% surveyed. Over 5000 trees were examined. Three years later the remeasurement of a 2.16 hectare *Armillaria* infected portion of the main plot yielded some interesting results. For the remeasurement, all planted Douglas-fir trees were stem mapped and assessed for attack by *Armillaria* using a 10 x 10 m grid.

The incidence (% of total trees that were symptomatic or had died from *Armillaria* attack) increased from 11.2% to 16%, the per cent area infected increased from 55.8% to 64.0%, and the stocking decreased from 782 to 682 stems per hectare. Thus in only 17 years, this affected portion of the plot was Not Satisfactorily Regenerated (NSR). There were 40 small, evenly distributed, root rot centers in the 2.16 ha area. The stocking was 38% lower than that of the unaffected area which had 1,100 stems per hectare.

This plot will yield some useful information on spread rate, incidence and stocking in the next few years. Three people set up the grid, and assessed and mapped the trees in one day. The data compilation and map preparation was done by myself in one day. This seems like an efficient way to get valuable information.

In the new year we plan to establish several 100 x 100 m plots in our oldest spruce plantations to assess various factors of *Tomentosus* root rot spread, such as host species susceptibility and spatial distribution.

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

Tomentosus trial finally established. After a delay of one year, the *Tomentosus* root rot trial near Knockholt in the Morice Forest District is completely established. The trial will be conducted in a 60-year-old spruce stand and is designed to test the difference in *Inonotus tomentosus* root rot rate-of-spread through blocks that have been both manually spaced and chemically spaced using glyphosate. Nine hectares are being studied, of which three hectares were manually treated, three chemically treated and three not treated (control). Permanent and specific rate-of-spread plots will be remeasured every five years.

While establishing the trial it was noted that the estimate of area infected by *Tomentosus*, based on visual symptoms, was inaccurate. The pre-trial root disease survey, conducted by experienced personnel familiar with the disease, indicated that 30-40% of the stand was infected, but later examination of stumps in the annually spaced blocks revealed that 70 to 80% of the trees removed showed evidence of red staining or pitting due to fungal activity.

Further information on this trial (Px-Pr-12) is available from the undersigned.

- S. Zeglen, Prince Rupert Forest Region, Smithers.

Pine Stem Diseases Spacing Demonstration Area in the Dawson Creek Forest District. The Dawson Creek Forest District has areas of fire originated, age class 2 pine stands, many of which require spacing. Unfortunately, many of these stands have an incredibly high incidence of diseases such as western gall rust and *Atropellis* canker.

A 2 000 hectare, 35-40-year-old fire originated pine stand scheduled for spacing over the next few years was the site of a small unreplicated trial demonstration area. The purpose of the project is to collect some data on the feasibility of establishing a fully replicated trial to demonstrate the effects of spacing without regard to stem diseases, spacing which eradicated only diseased stems, and no spacing, on disease levels, stand structure and yield impact.

Four blocks within a 5 km radius, totalling approximately 100 hectares, were spaced in the fall of 1990. A 1% survey was done on three of the blocks prior to spacing. A 100 x 150 m area in each block was left unspaced. This area will then be divided into three subunits which will be treated in the above mentioned fashion.

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

Destumping Trial for Tomentosus Root Rot in the Dawson Creek Forest District.

A 16 hectare spruce pine stand was surveyed for Tomentosus root rot in the fall of 1990, using a sampling intensity of 4%, and 5.63 m radius plots. Disease incidence was fairly high, and the affected trees were evenly distributed over the site in small pockets. Trial layout and destumping will follow next summer. Destumping will occur on four 2-hectare units and the other four randomly assigned units will serve as controls. The entire site will be planted with spruce.

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

Site Discrepancy and Insect and Disease Surveys in the Invermere Forest District.

Two contracts were issued this fall for site discrepancy and forest insect and disease surveys. A preliminary survey demonstrated that there would be 408 m³/ha in an inventory polygon in the absence of root disease, and 61 m³/ha in the same polygon with root disease. The inventory short-form ground call procedure is being used to collect plot data, so that Inventory may take advantage of the information for reclassification purposes.

- E. Begin, Invermere Forest District, Invermere.

Prince George Lodgepole Pine Dwarf Mistletoe Spacing Trial Discontinued. The first lodgepole pine dwarf mistletoe trial established in the Prince George Forest Region (see internal report PM-PG-9) will be removed from the pest management trial catalogue. The trial was established in a stand that was unhomogeneous on several different levels, and in too small of an area to be further stratified. Even though the data were obviously confounded, conclusions were still being made during remeasurements based on the confounded information. This is unfortunate, but in order to maintain credibility, Px trials must have minimum standards. A more detailed analysis of the trial will be available in the new year. Much was gained from the analysis, and the exercise will help to guide future attempts at re-establishing spacing trials in young mistletoe-infected pine stands.

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

Student Summer Projects in the Prince George Forest Region

This past summer the cooperative education student worked on a variety of projects and gained a well rounded experience in the delicate science of forest pathology. Some of the projects included:

- preparing a stem and root map of Tomentosus root rot infected mature spruce in the C.I.F. Willow River Demonstration Forest along an interpretation trail
- sampling and data compilation of a spacing demonstration area in a young pine stand heavily infected with comandra blister rust at Tagal Lake in the Prince George Forest District
- assisting in the remeasurement of a lodgepole pine dwarf mistletoe spacing trial site and preparing a preliminary report on the data analysis.
- also, assisting the forest entomologist on a *Bacillus thuringiensis* var. *kurstaki* (*B.t.k.*) application to control the spruce budworm in Ft. Nelson, and counting pitch tubes on baited mountain pine beetle attacked trees.

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

MAMMAL MANAGEMENT

The Porcupine/Fisher Interministry Steering Group. Following a number of meetings, a Porcupine/Fisher Interministry Steering Group has been formed between the Forest Service and the Wildlife Branch, Ministry of Environment. We have succeeded in developing a plan wherein all issues of concern to the two agencies will be addressed in a coordinated research study. The Steering Group has been identified to represent the agencies and in particular, handle funding and overall program direction. A working group of Forestry and Wildlife staff has been created to actually conduct the work. The Steering Group will meet about two times a year and the working group will maintain close liaison to ensure continuity.

The research program is composed of three sub-components:

Khutzymateen Inlet:

- as the habitat is considered to be poor, the ability of fishers to establish a viable population will be assessed;
- the level of porcupine damage will be determined; and
- the impact of porcupine damage on the North Coast Timber Supply Area will be estimated.

Kalum Valley:

- the effect of introduced fishers on the resident porcupine population will be determined;
- a census of the existing fisher population will be undertaken;
- the level of porcupine damage will be assessed; and
- the impact of the damage on the Kalum Timber Supply Area will be estimated.

Cariboo area:

- an assessment of how to re-establish fisher populations will be undertaken;
- the details of how to transplant fishers from one area to another will be assembled;
- an assessment of fisher habitat needs and use will be made; and
- the best way to harvest fishers sustainably will be determined.

Schedules and budgets for the three projects have been outlined, and we expect to make fisher introductions into the Khutzymateen during the spring of 1991. For more information on the porcupine/fisher studies please call the author.

- J. Henigman, Protection Branch, Victoria.

Controlling Mammal Damage in the Prince Rupert Forest Region In October of this year, Scott Harrison joined our staff as a mammal pest specialist. There has been a growing concern that vertebrates, namely porcupines, hares, and voles, are having major impacts on the productivity of second-growth stands. This new position was created so that projects addressing these concerns will be coordinated. In addition, forest district staff are dealing with wildlife issues as never before, and the mammal pest specialist will provide information to aid in the forestry management of wildlife.

Scott has a great deal of wildlife experience. He studied cougar predation on bighorn sheep as his M.Sc. thesis topic in Resource Ecology at the University of British Columbia, and has worked in conjunction with the B.C. Ministry of Environment's Wildlife Branch. Scott has practical experience in trapping, guiding, and handling all kinds of animals from voles and squirrels, to grizzly bears and cougars. Scott is based in the forest region office in Smithers.

- W. Young, Prince Rupert Forest Region, Smithers.

Fisher Introductions in the North Coast and Kalum Forest Districts. The ongoing fisher/porcupine program continues to gain momentum following the steering committee meeting in October. In the North Coast Forest District, preparations are being made to receive fishers this winter and for their subsequent release in the spring of 1991. In the Kalum Forest District, establishment of experimental and control areas is underway for a study of the predator-prey dynamics of the fisher-porcupine system. The level of any existing fisher populations in the Kalum area is also being determined. This work, as with any operational fisher re-introduction program, will be carried out in close consultation with the trappers of the area. Fisher introductions into the Kalum Forest District, if necessary, are slated to begin in the spring of 1992.

- S. Harrison, Prince Rupert Forest Region, Smithers.

Porcupines and the Timber Supply Area. As the logging and reforestation process continues, the forests of British Columbia are becoming predominantly second-growth. The forest industry will be relying on these stands in the future. A number of forest health issues will play an important role in determining the amount of timber that will actually be available at rotation.

Porcupine damage is one such issue. Long-term impacts of porcupine damage on the timber supply are not yet known. Current damage is being assessed and attempts are being made to reduce that damage with fisher introductions. However, the regional scope of the problem is not clear. It is apparent that where porcupines are present in large numbers, such as the North Coast and Kalum Forest Districts, they are capable of large scale damage to stands. The damage is such that it may be necessary to redefine the free-to-grow stage.

To address the issue of porcupine damage, the forest health staff in the Prince Rupert Forest Region are working with Planning and Inventory to identify stands within the regional timber supply areas that are currently, or will soon be, susceptible to porcupine damage. A series of porcupine damage transects will then be established throughout the Region to monitor the problem. In addition, equations are being developed that will incorporate the impact of porcupine damage into timber supply area yield projections.

- S. Harrison, Prince Rupert Forest Region, Smithers

RANGE PEST MANAGEMENT

Advances in Biological Control of Knapweed. Since 1976, a total of 386 *Sphenoptera jugoslavica* (a root boring beetle) releases have been made in the Kamloops Forest Region. Approximately 48% of these releases have been monitored. Of the monitored releases, those made in the bunchgrass zone showed a 97% establishment, in the ponderosa pine zone, an 81% establishment, and in the Douglas-fir zone, a 68% establishment. We are presently monitoring additional *Sphenoptera* releases to aid in the selection of specific releases and to determine the density and dispersal of the beetles, as well as their impact on the target weeds.

While monitoring a *Sphenoptera* release, a plant was found to have been attacked by both *Sphenoptera* and the moth, *Agapeta zoegana*. The nearest *Agapeta* release was approximately one kilometer away. We presently have 86 *Agapeta* releases in the region and will hopefully observe more plants attacked by both root boring agents.

White Lake, south of Penticton, has long been a collection site for *Sphenoptera* in the province. This year two collection sites were established near Kamloops and Ashcroft. It is hoped that these sites, as well as other successful release sites, will begin to supply insects for release over the next couple of years.

- P. Youwe, Kamloops Forest Region, Kamloops.

How biennial is diffuse knapweed? A trial at White Lake, Penticton, resulted in tagging 100 diffuse knapweed rosettes in the spring of 1989. The rosettes were monitored in August of 1989, and November of 1990. Despite the excellent growing season in 1990, 68% of the plants were still rosettes after the second growing season. Only 22% had bolted (one in the first year). It will be interesting to monitor these plants next year to see what development occurs, and to determine what role *Sphenoptera* may be playing.

- P. Youwe, Kamloops Forest Region, Kamloops.

PESTICIDES

New Edition of the Forest Supplement to the Handbook for Pesticide Applicators and Dispensers. In the last edition of Pest Management Progress, I indicated that the Forest Supplement, used as a forest pesticide applicator certification course manual, was being updated. Unfortunately, the Supplement will not be printed until the spring of 1991. At that time copies will be available from regional offices of the Pesticide Control Branch.

- J. Henigman, Protection Branch, Victoria.

The Federal Pesticide Registration Review Team Proposal. The Federal Pesticide Registration Review Team has recently published a penultimate draft of their report, which includes recommendations. A few of the proposals most significant to forestry interests are as follows:

- The Ministers of Environment, Health and Welfare, and Agriculture will share responsibility for making regulatory decisions under the Pest Management Act and Regulations. These three Departments will establish an interdepartmental Pest Management Committee to develop consensus on regulatory decisions to be made by the Ministers.
- The administration of this legislation will be conducted through the Pest Management Bureau by the Minister of Agriculture. The Pest Management Bureau will include the Pest Management Promotion Office and the Pest Control Product Management Office.
- The Pest Management Promotion Office will promote and, where appropriate, encourage the development of viable pest management strategies that reduce risk of harm to human health and safety, and the environment, while optimizing pest control.
- The system will incorporate extensive public access to information relating to all aspects of the regulatory system. The public will be given notification of, and opportunity for, involvement in the development of new aspects of the regulatory system.
- The legislation will facilitate pre-registration and post-registration access to health, safety and environmental data. Provisions will be made to ensure confidentiality of the data and protection from unauthorized use of the data.

The Review Team proposal does not appear to pose any new difficulties to the registration of forestry pesticides. Proposed registration classifications will not specifically separate forestry from agriculture uses. This should reduce the double standard that forestry pesticide registrations have endured

in the past. The Pest Management Promotion Office will, at least initially, focus most of its attention on agriculture, and perhaps home and garden products. It will promote integrated pest management research, and increase the availability of information on non-pesticide control treatments.

Earlier this fall, the Review Team conducted public hearings across Canada. It will table its final report to the Government by the end of the year. If you would like more information on the Pesticide Review Team or their report please call me.

- J. Henigman, Protection Branch, Victoria.

Changes to the Processing of Pesticide Permit Applications. The review of pesticide applications and the issue of permits is conducted by each regional manager of the Pesticide Control Branch. A new "Guide to Applicants" booklet has been recently published by the Pesticide Control Branch and copies are available from their offices.

Each regional manager of the Pesticide Control Branch will be issuing pesticide permits and will soon create a regional permit review committee for purposes of application referral. This decentralization is consistent with how all other Ministry of Environment permits are issued. For the time being all drafted permits will continue to be signed by the director of the Pesticide Control Branch in Victoria, and all applications will continue to be reviewed by me on behalf of the Forest Service. Over the coming months, however, the referral to the Forest Service will be redirected to staff in each forest region.

Another change in the permit process requires applicants to advertise their applications as soon as they are applied for. This will allow public comments to form part of the permit review process prior to a permit being granted. Where public appeals are requested, the initial appeal will be to the Director of the Pesticide Control Branch. The second level of appeal will be to the Environmental Appeal Board.

We hope these changes will reduce some of the public antagonism that has plagued pesticide use permits in the past.

- J. Henigman, Protection Branch, Victoria.

Expanded Registration of Sevin^R. A trial was conducted in the Kamloops Forest District to expand the use of Sevin on white pine to control the mountain pine beetle. Mature white pine trees, mass attacked by the beetle in 1989, were felled, bucked and treated, following the guidelines for treatment of lodgepole pine using a spray mixture containing 2% carbaryl active ingredient by weight.

Bolts 50 cm in length were cut from 15 treated and five untreated control trees of approximately equal size and attack density. Each bolt was enclosed in a rearing chamber, and checked daily for beetle emergence. When beetle emergence was complete, all bolts were peeled, and the number and length of beetle galleries noted, as well as the presence of parasites/predators.

	Treatment Bolts	Control Bolts
Mean No. Live Adult Beetles*	0.02	0.42
Mean No. Dead Adult Beetles*	3.30	1.77
Total	3.32	2.19
Mean No. Predators and Parasites	1.37	0.57

* The numbers were standardized to represent mean numbers per 100 cm² of bark surface area.

The corrected beetle mortality was 99.0%

Based on this trial, it appears that Sevin is also effective against the mountain pine beetle when used on white pine.

- L. MacLauchlan, Kamloops Forest Region, Kamloops.

Registration Package Submitted for Minor Use. During the years 1982-1989, trials were carried out to test stem injections of Metasystox-RR against cone and seed insects of Douglas-fir and spruce. Information on the results of these trials has been submitted to Agriculture Canada and the manufacturer in a minor use registration package. The request is for use of Metasystox-R in seed orchards and seed production areas.

The injection technique is simple to use. Holes are drilled every 10-15 cm around the circumference of a tree and the material is injected into the hole with a syringe. There is no drift, as there is with spraying, and the application is automatically adjusted to tree size by the number of holes that will fit around the tree. A similar technique, using Mauget^R injectors has been successful in protecting mature Douglas-fir trees in the United States from western spruce budworm and cone and seed insects.

- D. Summers, Silviculture Branch, Victoria.

Audit of Pesticide use in Seed Orchards and Nurseries. Silviculture Branch has granted a contract to Beak Associates Consulting Ltd. to review the use of chemicals, including pesticides, in Ministry seed orchards and nurseries. The contract requires the consulting company to examine use patterns, application equipment, storage facilities, potential health hazards, and environmental concerns at each site, and make recommendations for improvement. The report is due next spring.

- D. Summers, Silviculture Branch, Victoria.

AWK Oil Trial Against Mountain Pine Beetle. In the Prince George Forest Region in May 1991, Agricultural Weed Killer^R (AWK) oil, a low content aromatic mineral oil with insecticidal properties, will be sprayed on lodgepole pine infested with mountain pine beetle in order to test the product's efficacy in killing newly developing adults prior to their emergence. A post-attack topical application to infested lodgepole pine was successful in 1986 and this new trial will hopefully complete the efficacy data required for a minor-use registration of AWK oil against mountain pine beetle.

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

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

Protection Branch

John Muir	A/Manager, Forest Health	Victoria	387-8740
Peter Hall	Forest Entomologist	Victoria	387-8742
John Henigman	Pesticide Specialist/ Vertebrate Pest Specialist	Victoria	387-8738
Vacant	Forest Pathologist	Victoria	387-8739
Jeff Beale	Forest Health Officer	Victoria	387-8743
Pat Humphreys	Forest Health Technician	Victoria	387-8737

Silviculture Branch

Mike Wyeth	Silviculturalist	Victoria	387-8922
Jacob Boateng	Brushing & Weeding Specialist	Victoria	387-8905
Nancy Densmore	Stand Tending Operations Forester	Victoria	387-8912
Don Summers	Seed Production Pest Management Officer	Victoria	387-3931
Bev McEntire	Seed Production Pest Management Technician	Victoria	387-8938
Gwen Shrimpton	Nursery Pest Management Officer	Surrey	576-9161
Dave Trotter	Nursery Pest Control Officer	Surrey	576-9161

Cariboo Forest Region

Regional Staff

Hugh Freeman	Protection Officer	Williams Lk.	398-4445
Mark Hamm	Pest Management Forester	Williams Lk.	398-4441
Leo Rankin	Forest Entomologist	Williams Lk.	398-4439
Don Doidge	Forest Pathologist	Williams Lk.	398-4442
Jane Perry	Stand Tending Forester	Williams Lk.	398-4400
Chris Easthope	Range Agrologist	Williams Lk.	398-4396

Cariboo Forest Region continued

District Staff

Richard McKay	Resource Officer Protection	Chilcotin	394-4315
Glen Burgess	Resource Assistant Protection	Chilcotin	394-4215
Tom Matzen	Resource Officer Protection	Horsefly	620-3417
Dennis Asher	Resource Officer Protection	Quesnel	992-4400
Brad Powell	Resource Assistant Protection	Quesnel	992-4433
Wayne Hendy	Resource Officer Protection	Williams Lk.	398-4341
Von Vickers	Fire/Pest Management Officer	Williams Lk.	398-4690
Mel Dodge	Resource Officer Protection	100 Ml. House	398-3812
Don Wright	Pest Management Officer	100 Ml. House	395-3812

Kamloops Forest Region

Region Staff

Lorraine			
MacLauchlan	Forest Entomologist	Kamloops	828-4177
Hadrian Merler	Forest Pathologist	Kamloops	828-4176
Ron Gray	Stand Tending Forester	Kamloops	828-4163
Rick Tucker	Range Agrologist	Kamloops	828-4582

District Staff

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

Nelson Forest Region

Region Staff

Rick Stewart	Pest Management Forester	Nelson	354-6144
Don Norris	Forest Pathologist	Nelson	354-6143
Gerald Reichenback	Stand Tending Forester	Nelson	354-6280
Jack King	Range Officer	Nelson	354-6243

District Staff

Dan Reiben	Pest Management Officer	Arrow	365-2131
Ross Elliott	Pest Management Officer	Boundary	442-5411
Art Krane	Pest Management Officer	Cranbrook	426-3391
Larry Hewlett	Resource Officer	Golden	344-7500
Emile Begin	Pest Management Officer	Invermere	342-4200
Jim Schafthuizen	Pest Management Officer	Kootenay Lake	825-4415
Archie McConnachie	Resource Officer - Protection	Revelstoke	837-7611
Peter Martiniuk	Forest Health Technician	Revelstoke	837-7691

Prince George Forest Region

Region Staff

Robert Hodgkinson	Forest Entomologist	Pr. George	565-6122
Richard Reich	Forest Pathologist	Pr. George	565-6143
Stuart Taylor	Pest Management Forester	Pr. George	565-6123
Rob Bowden	Stand Tending Forester	Pr. George	565-6191
Ken Long	Range Officer	Pr. George	565-6138

District Staff

Dave Dunsdon	Resource Officer - Protection	Dawson Creek	784-2350
Rick Grayston	Resource Assistant - Protection	Dawson Creek	784-2350
Bruce Young	Resource Officer - Protection	Fort Nelson	774-3936
Alvin Boyer	Resource Assistant - Protection	Fort Nelson	774-3936
Lance Mitchell	Resource Officer - Protection	Ft. St. James	996-7131
Terry Corley	Resource Assistant - Protection	Ft. St. James	996-7131
Al Kneeland	Resource Officer - Protection	Mackenzie	997-3310
Jim Massey	Resource Officer - Protection	Ft. St. John	787-3483
Dale Cinnamon	Resource Officer - Protection	Robson Valley	569-2265
Lloyd VanDerMark	Resource Assistant - Protection	Robson Valley	569-2265
Fred Turner	Resource Officer - Protection	Pr. George	565-7100

Prince George Forest Region continued

District Staff

Bruce Doerksen	Resource Assistant - Protection	Pr. George	565-7100
Mike Dittaro	Resource Officer - Protection	Vanderhoof	567-6363
Mike Pritchard	Resource Assistant - Protection	Vanderhoof	567-6363

Prince Rupert Forest Region

Region Staff

Steve Schmidt	Protection Officer	Smithers	847-7475
Tim Ebata	Forest Entomologist	Smithers	847-7479
Stephan Zeglan	Forest Pathologist	Smithers	847-7478
Bill Young	Pest Management Forester	Smithers	847-7477
Lou Tromp	Stand Tending Forester	Smithers	847-7514
Don Russell	Range Officer	Smithers	847-7443
Scott Harrison	Mammal Pest Specialist	Smithers	847-7717

District Staff

Erwin MacDermid	Resource Officer - Protection	Bulkley	847-7555
Gordon Munroe	Resource Officer - Protection	Cassiar	771-4211
Joe Katasonoff	Resource Officer - Protection	Kalum	638-3302
Kas Kopeo	Resource Assistant - Protection	Kalum	638-3290
Brian Atherton	Resource Officer - Protection	Kispiox	842-6581
Brian Simpson	Resource Officer - Protection	Morice	845-6200
Jim Highstead	Resource Assistant - Protection	Morice	845-6200
Bill Jackson	Resource Officer - Protection	North Coast	627-0457
Bill Davidson	Resource Officer - Protection	Lakes	692-2223

Vancouver Forest Region

Region Staff

Don Heppner	Forest Entomologist	Burnaby	660-7653
vacant	Forest Pathologist	Burnaby	660-7654
Mel Scott	Stand Tending Forester	Burnaby	660-7579

Vancouver Forest Region continued

District Staff

Terry Preston	Resource Officer - Protection	Campbell Rv.	286-3282
Tim Ewart	Resource Assistant - Protection	Campbell Rv.	386-3282
Greg Hemphill	Resource Officer - Protection	Chilliwack	794-3361
Brenda Koro	Resource Assistant - Protection	Chilliwack	794-3361
Pat Hayes	Resource Officer - Protection	Duncan	746-5123
Wade Matheson	Resource Assistant - Protection	Mid Coast	982-2621
Dan Powell	Resource Officer - Protection	Pt. Alberni	724-9205
Ken Seegmiller	Resource Assistant - Protection	Pt. Alberni	724-9205
Clarence Friesen	Resource Officer - Protection	Pt. Alberni	956-4416
Tim Neal	Resource Assistant - Protection	Pt. Alberni	956-4416
Ron Diprose	Resource Officer - Protection	Sunshine C.	485-9832
Rick Machowski	Resource Officer - Protection	Qn. Char. Is.	559-8447
Brian Eccles	Resource Assistant - Protection	Qn. Char. Is.	559-8447
Keith Davis	Resource Officer - Protection	Squamish	898-9671

MEETINGS

ACAFA Symposium and Trade Show. Over 200 delegates attended the National Research Council's (NRC's) special event on determining industries' future needs in research and development for agricultural and forestry operations. The symposium was held in Winnipeg, October 8-12, 1990. Some 50 speakers discussed particular needs and opportunities in aerial distribution of materials such as seeds, pesticides and fertilizers, in the deployment of aircraft in fire management, and in aerial photography and remote sensing.

Two important documents are expected in 1991: (1) A short list of priorities (opportunities as seen by users such as the B.C. Forest Service) for formal presentation and endorsement by the NRC, and (2) comprehensive proceedings as an official NRC publication. Both should serve us well in the 1990's, especially if research establishments subscribe to these recommendations to improve Canadian operations.

The organizing group, ACAFA(=NRC's Associate Committee on Agricultural and Forestry Aviation), is undergoing review by NRC management. There is some expectation that a stronger, advocate organization will evolve to link researchers to current priorities (reality). All 24 NRC associate committees are currently subject to review. Most of these others will probably be terminated, perhaps with the exception of the Fire Management Committee.

An excellent trade show and technical poster display was included in this event. Over 50 booths and about 20 posters provided additional value for delegates and technical representatives. One of the very best was the excellent booth presented by the B.C. Forest Service. The booth highlighted aircraft use for inventory, silviculture, protection, and integrated resource management which totals almost 40,000 hours annually. Our specific needs were highlighted on a display panel and summarized on a handout (see pp. 70-72). Pat Humphreys of Protection Branch can furnish details about this display upon request.

Please call me at 387-8740 for additional details

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

Western International Forest Disease Work Conference. The September meeting or WIFDWC in Redding, California, was relatively well attended - 65 persons - despite U.S. government travel restrictions, and was a very interesting session.

Organizations in western North America face similar technical and public issues in trying to implement forest health programs. Generally we have to show both our colleagues and the public that forest health treatments are beneficial and essential to integrated forest resource management.

In addition to technical sessions on root diseases and other diseases, some interesting and novel subjects were discussed: inoculating wood decay fungi into live trees to create snags favourable for cavity nesting birds; disease centres of blackstain root disease in even-aged ponderosa pine stands regarded as desirable to create openings and dead trees; and lodgepole pine dwarf mistletoe brooms reported as preferred nesting sites for spotted owls.

Notes on the meeting were distributed to regional forest health staff, and further information is available on request. The 1991 meeting is scheduled for August 6-9 at Vernon or Kamloops, in conjunction with the **Western Forest Genetics Association** meeting. For information about the genetics meeting, contact Mike Carlson, Research Scientist, Kalamalka Research Station, 549-5577. For information about the disease conference local arrangements, contact Hadrian Merler, Kamloops Forest Region.

- J. Muir, Protection Branch, Victoria.

Canadian Phytopathological Society (CPS). A two-day meeting of British Columbia members of the CPS was held October 23-24 at Pacific Forestry Centre, Victoria. Agenda items included a variety of short reports on agricultural and forestry diseases, including white pine blister, rust research at Pacific Forestry Centre, and pinewood nematode research at Simon Fraser University.

A field trip included a visit to sites at Shownigan Lake with laminated root rot and white pine pruned as a prophylactic measure to protect trees from blister rust, conducted by Jeff Beale, Vancouver Forest Region, and Rich Hunt, Pacific Forestry Centre.

These meetings are valuable not only to keep informed of recent developments in pathology, but also to discuss training of future pathologists with academic and government staff, to attract potential forest pathologists to career opportunities within the ministry, and to encourage pathologists and other specialists to participate in the ministry forest health program.

The 1991 meeting is scheduled for mid-October at Simon Fraser University.

- J. Muir, Protection Branch, Victoria,

1991 Western Forest Insect Work Conference. The 1991 Western Forest Insect Work Conference will be held during the first week of March in Denver, Colorado. This conference will be a joint meeting of all North American regional insect work conferences. The theme of the meeting is "Meeting Pest Management Challenges in the 21st Century".

The 1992 Work Conference will be held in March, 1992 in Penticton, British Columbia. The conference is being organized by local forest entomologists in Victoria, Vancouver, and several forest regions. A tentative program will be available by the new year.

- P.M. Hall, Protection Branch, Victoria,

Summary of "Recent Advances in Pest Management" held in Sault Ste. Marie, October 22-23, 1990. I recently attended a symposium, "Recent Advances in Pest Management", where a wide spectrum of concerns, new technology, and insights into the future of pest management in Canada were addressed. Advances in integrated pest management, or as one speaker coined it, "intelligent pest management", are the result of a combination of integration and diversification. Due to the changing environmental, political and economic times in Canada, it is very important to integrate all management techniques to fully protect our forest resource. These include chemical treatments and biological control methods involving microbial insecticides, parasite enhancement, cultural methods, and genetic engineering. In particular, Canada must diversify. We, as forest managers and forest health managers, must keep the doors open for all potential options. Quebec, Ontario and Newfoundland have limited the use of aerially applied insecticides to *Bacillus thuringiensis* var. *kurstaki* (*B.t.k.*) only. While New Brunswick still uses fenitrothion and *B.t.k.*, and is now in a state of sustainable development, Newfoundland faces a very serious 30-year timber supply problem. The eastern spruce budworm is a more drastically devastating pest than the western spruce

budworm, but there are notes to be taken from this situation. If used judiciously, and in an integrated manner, chemical insecticides can and should remain a part of forest management practices. It has taken over 30 years to develop and improve *B.t.k.*, and we cannot afford to cut off all our options and wait for the next biological "cure" to come along.

The underlying messages of the symposium were:

- 1) educate and inform the public
- 2) promote research and technical transfer

Eastern Canada already is facing a "fall-down" in timber supply largely due to budworm outbreaks. Because no appropriate legislation or policies were in place in these provinces, only sporadic protection action took place, and enormous timber losses occurred.

After listening to the various presentations, I felt quite positive about what is happening in forest health in British Columbia. However, there is still a long way to go.

We need policies on how to deal with specific pest outbreaks, and a guarantee of government and industry support for promoting and practising forest health. Also needed is a good, strong forest health research base in British Columbia.

British Columbia is at the forefront in many aspects of forest health and forest management. Two very important economic benefit assessments of pest management were made using two case studies from British Columbia on vegetation management and western spruce budworm control.

Impact assessment models and young stand problems are being addressed. We must continue to promote forest health and to use all of the diverse forest health treatment options and tools that are available.

The following is a list of the symposium speakers and the titles of their presentations:

Carrow, R. Future Trends in Forest Pest Management

McNamee, P.J., C.H.R. Wedels, et al. Building Pest Management Support Systems in Canada: It Can Be Done

Cunningham, J.C. and K. van Frankenhuyzen. Microbial Insecticides in Forestry

Fiddler, G and Philip McDonald. Integrated Vegetation Management - Advances and Future Prospects

Nealis, V. Natural Enemies and Forest Pest Management

Sutherland, J.R. Management of Pathogens in Seed Orchards and Nurseries

Helson, B. Novel Botanical Insecticides

Meyer, T.R. Ecological Management of Pathogens in Plantations

McNamee, P.J., T. M. Webb and G.D. Sutherland. A Root Disease Management Model for Western North America

Prevost, Y.H. and R.J. Day. Environmental Architecture - A Silvicultural Design for Reducing Insect Attack

Clarkson, M.E. The Jack Pine Budworm Decision Support System Project

Wagner, R.G. Integrating Plant Autecology and Silvicultural Activities to Prevent Forest Vegetation Management Problems

Jobidon, R. Future Directions for Non-Chemical Vegetation Control in Forestry Research - an Overview

Campbell, R.A. Chemical Control of Weeds

Gjerstad, D.U., et. al. The Potential Benefits from Vegetation Management and Possible Cost of Inaction

Brand, D.G. and D. Leckie. Aerial and Ground Methods for Assessing Forest Regeneration

Sheehy, G. Forest Pest management and Public Values

Milne, G. Sustainable Development and Pest Management

Thompson, A. J. and R. A. Fleming. Legislative and Policy Limits to Successful Integrated Pest Management in Canada's Forests

Godbout, C. and E. Bauce. Pest Management and Forest Resources Planning

Dost, F. N. Risk Assessment and Forest Pest Management

Stemeroff, M. Benefit Assessment of Forest Pest Management

All papers presented at this symposium will be published in a future issue of Forestry Chronicle.

- L. MacLauchlan, Kamloops Forest Region, Kamloops.

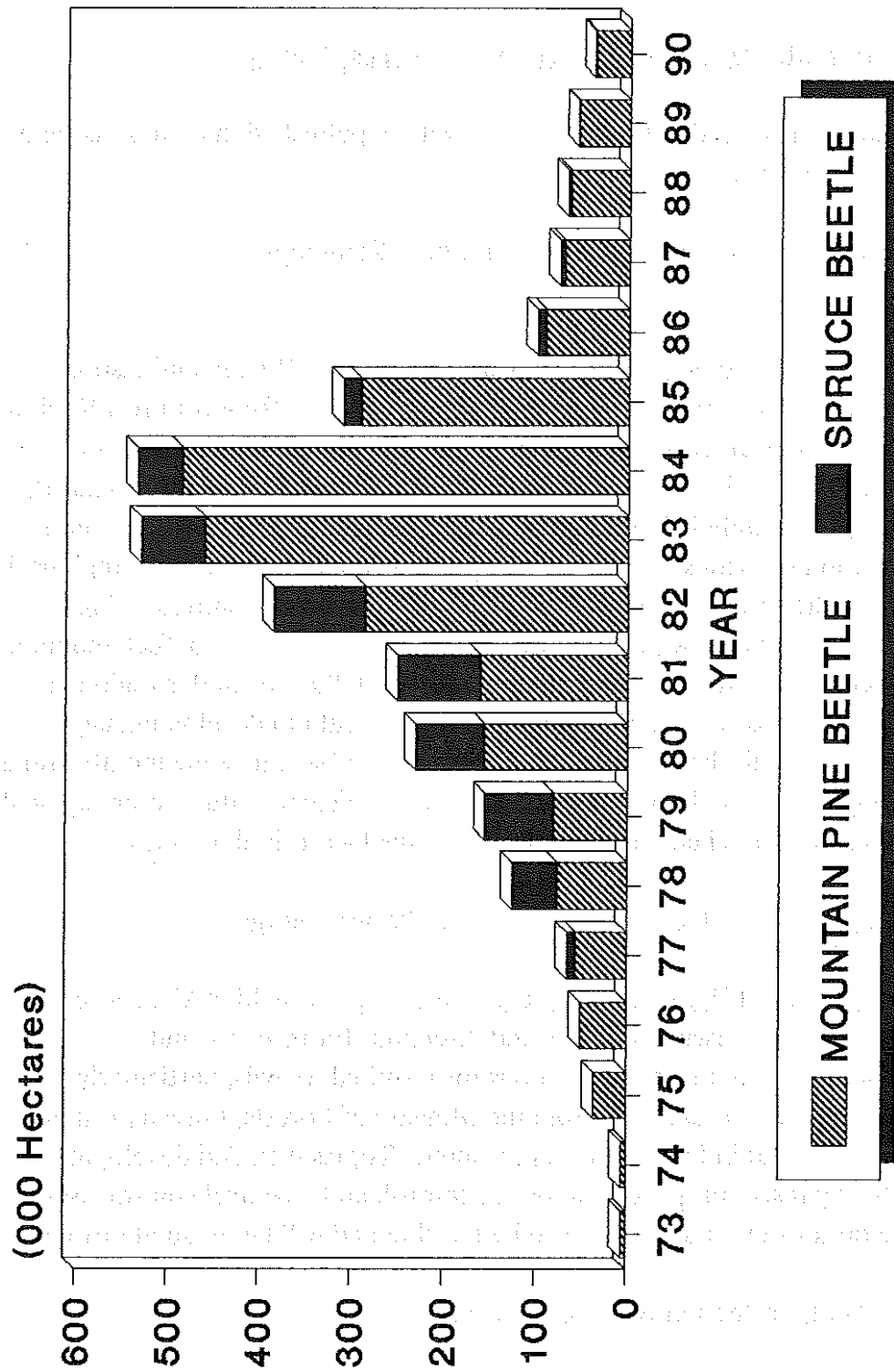
Forest Inter-Regional and District Border Meeting. Region and district forest health staff from the Prince George and Prince Rupert Forest Regions recently met at Burns Lake to discuss and resolve bark beetle issues of mutual concern. Forest district personnel outlined their control programs, exchanged valuable information on strategies, and determined bark beetle suppression priorities and tactics along the borders between forest regions. In addition, the results of Prince Rupert Forest Region's initiatives, using the susceptibility overview portion of the Forestry Canada/Phero Tech mountain pine beetle hazard rating system were discussed. Staff from this region are pleased with the results. They intend to use the data to develop management strategies at both the stand and drainage level, subject to some modifications resulting from local knowledge and past beetle history. Future inter-regional meetings will be scheduled, as required, to deal with similar issues.

- S. Taylor, Prince George Forest Region, Prince George.

Terminal Weevil Research Meeting. A meeting was held in Vancouver on November 21 to discuss progress and directions for research and development of management options for terminal weevils, particularly *Pissodes strobi*. Researchers from the Ministry of Forests, Forestry Canada, universities, and industry were represented. Topics included development of genetically resistant spruce, biological control, and chemical control. Several of the options discussed appear to be feasible and will be pursued further.

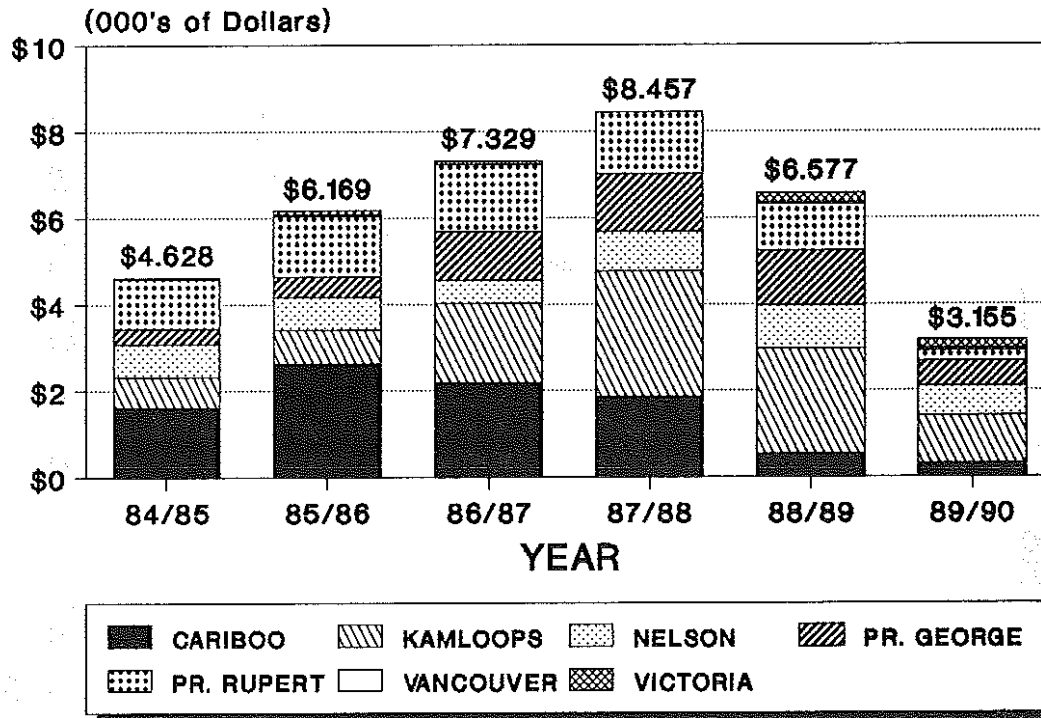
- P.M. Hall, Protection Branch, Victoria,

AREA UNDER ATTACK BY BARK BEETLES 1973-1990

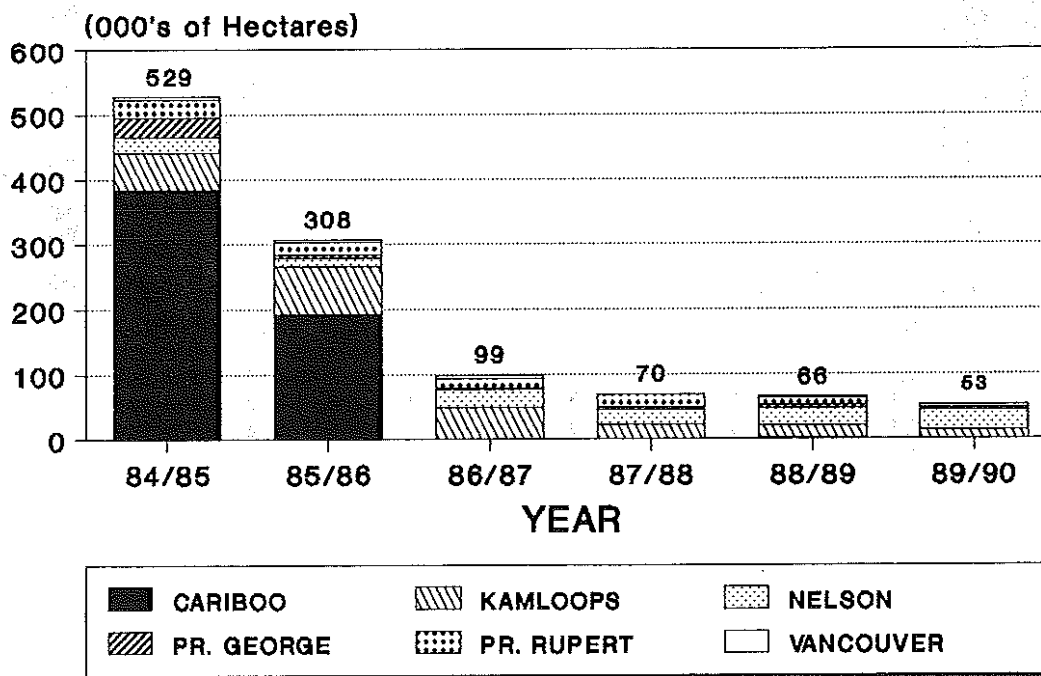


Source: Forestry Canada (FIDS)

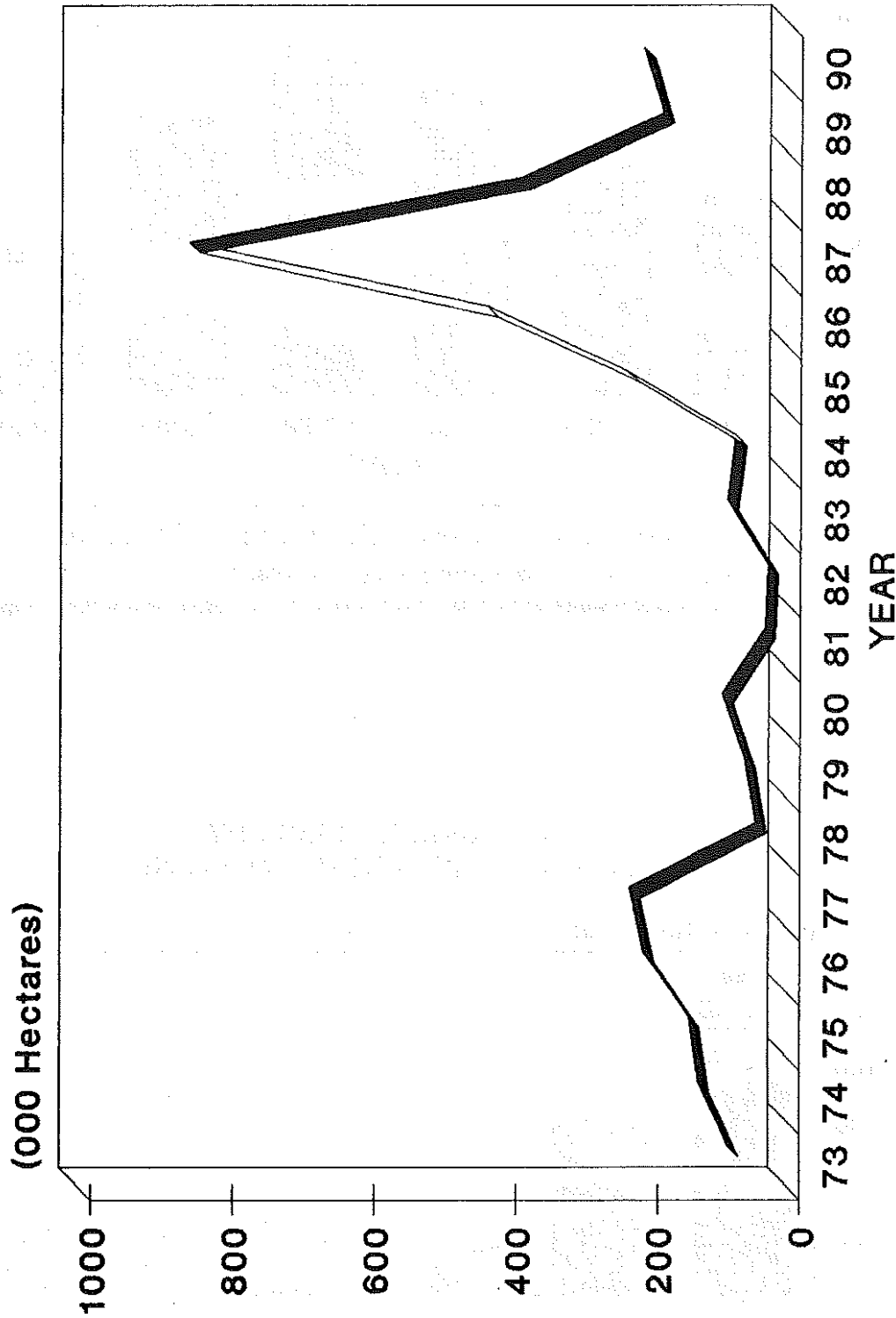
BARK BEETLE PROGRAM EXPENDITURES



AREA UNDER ATTACK BY MOUNTAIN PINE BEETLE 1984/1990



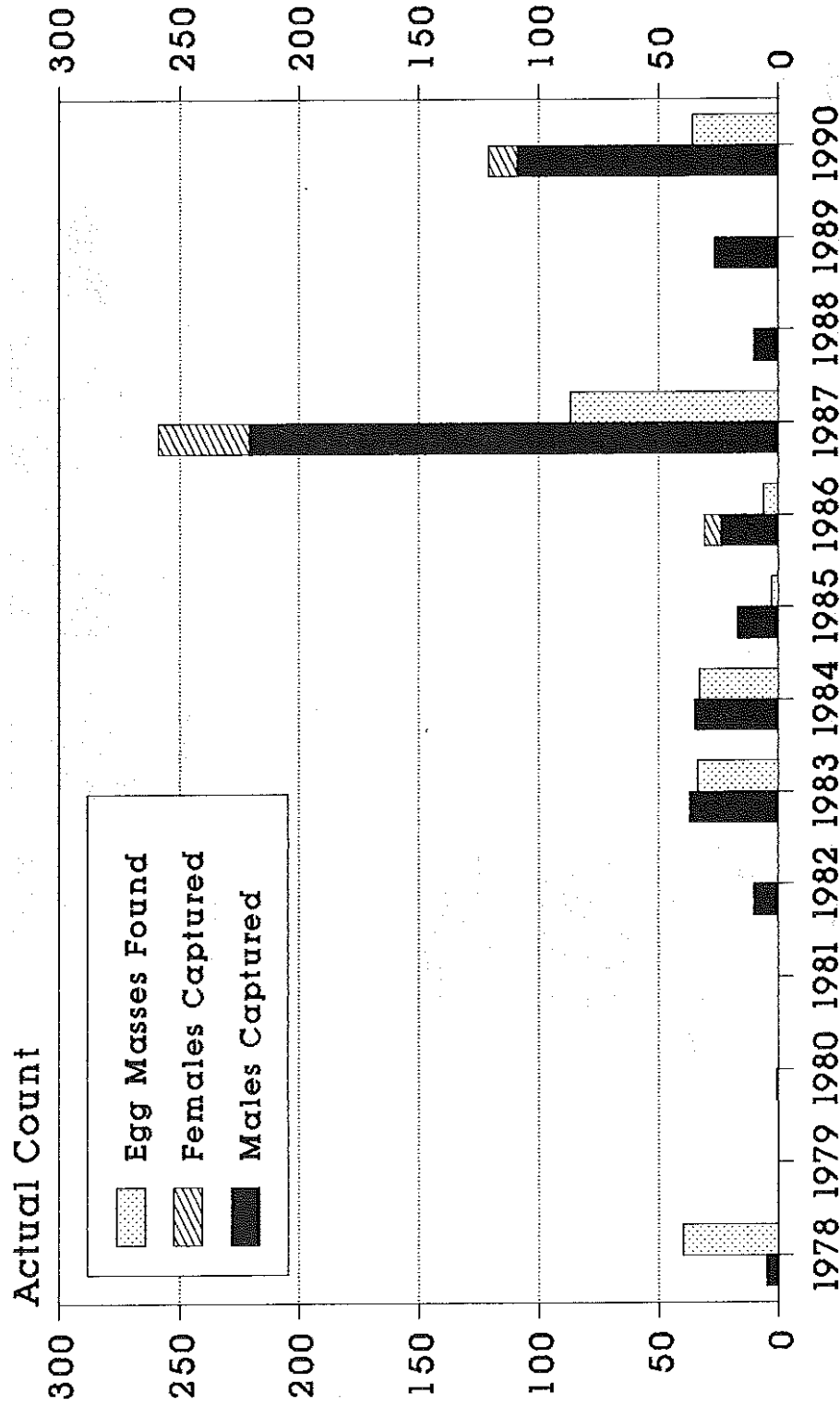
TRENDS IN VISIBLE DEFOLIATION OF DOUGLAS FIR CAUSED BY THE WESTERN SPRUCE BUDWORM IN BRITISH COLUMBIA (YEARS 1973-1990)



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

B.C. GYPSY MOTH SURVEY RESULTS

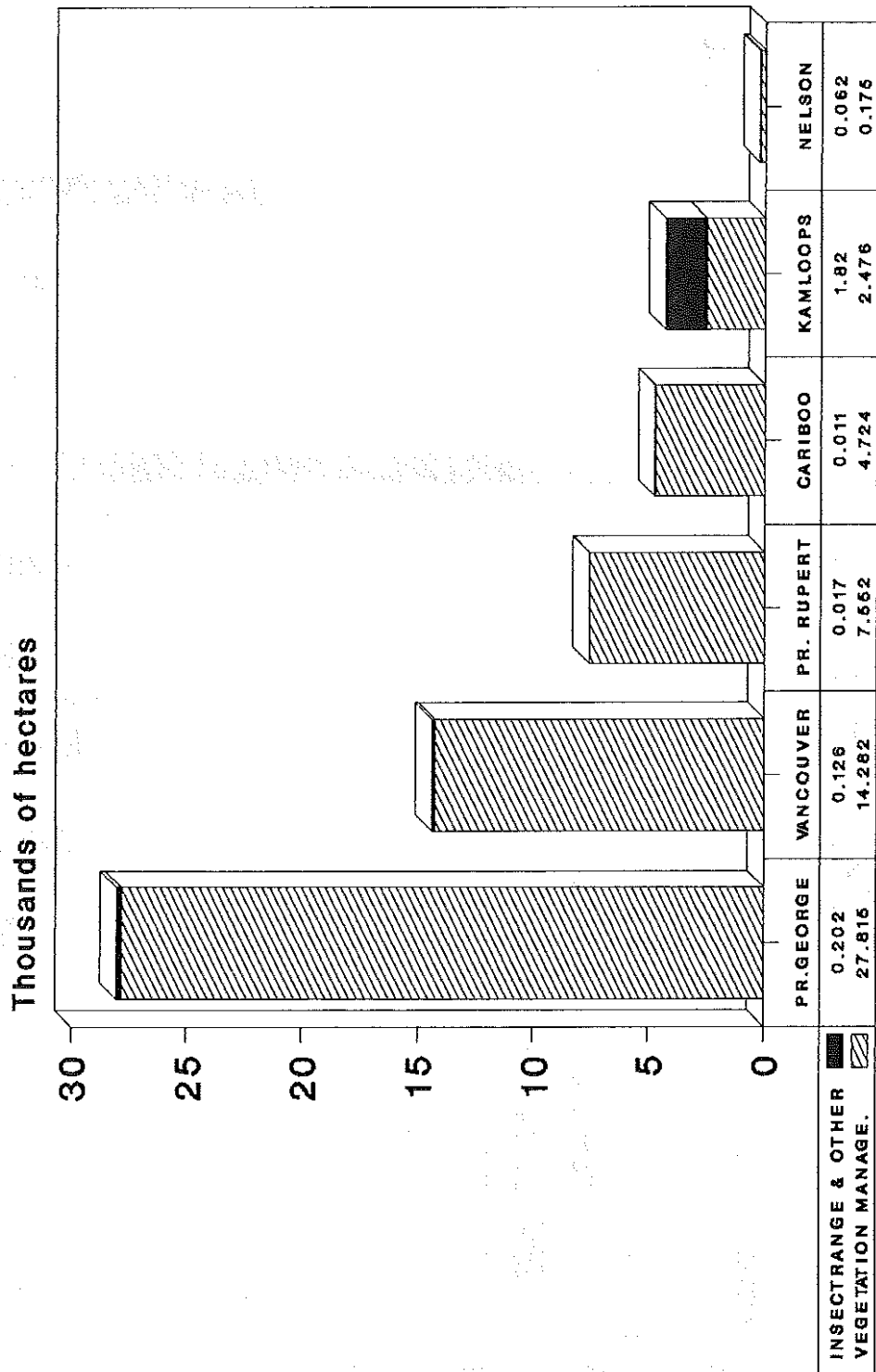
1978 - 1990



Trapping with male attracting pheromones

Source: Agriculture Canada

AREA TREATED WITH PESTICIDES SUMMARY BY FOREST REGION 1989¹

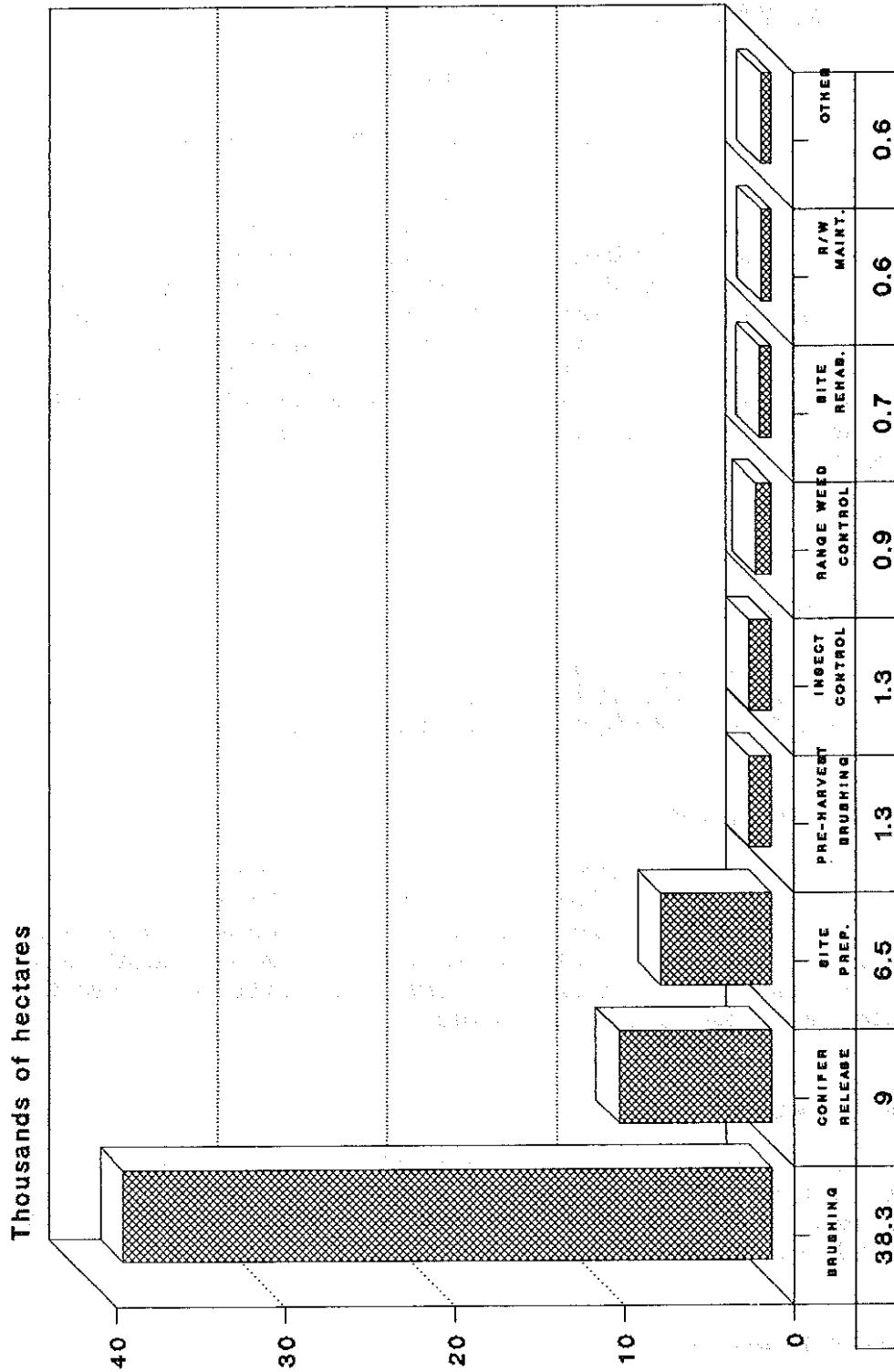


REGION

¹ B.C. Forest Service & Industry Combined

Source: B.C. Forest Service

PROVINCIAL SUMMARY OF AREA (ha) TREATED WITH PESTICIDES BY CONTROL PURPOSE, 1989¹



1B.C. Forest Service & Industry Combined

Source: B.C. Forest Service



British Columbia Forest Service leaflet presented
at ACAFA Symposium (See article on page 58)

FUTURE NEEDS

FOR AVIATION APPLICATIONS IN FORESTRY

Aviation plays a vital role in the functioning of the British Columbia Forest Service. At this point in time, however, the Forest Service has needs that require further expansion and development in the research and development sectors. The benefits derived from addressing these needs would not only be in the sphere of operational efficiency, but also in that of human health, safety, and environmental protection. The following information outlines the British Columbia Forest Service's future requirements, Branch by Branch:

PROTECTION BRANCH

Remote Sensing

The Forest Service requires an interface which links the capabilities of the Global Positioning System satellite through Aircraft Inertia Navigation System to remote sensing imagery.

Navigation Systems

The Loran system is too slow for forestry applications; an improved navigation system for helicopters, without the corresponding payload penalty is needed. Improvements in navigation systems will increase aerial spray accuracy, as well as allow for more accurate and timely field crew development and recovery. This will also prove to be an improvement for operational safety.

Smoke Sampling

The Forest Service requires the ability to conduct aerial particulate and gas measurements, so that the level and composition of smoke from prescribed burns can be correlated with the effects on health and visibility.

Boundary Marking

A need exists for a system of marking swaths and boundaries, that will ensure a high degree of visibility from the air.



Pesticide Application

Development of pesticide aerial application techniques is required to improve deposit and minimize drift. An assessment of the utility of systems, such as the Rapid Pattern Analysis System, should be conducted, to analyze aircraft spray swath performance. Spray boom/nozzle improvements should also be investigated.

Pesticide Additives

A review of the impact of additives on spray efficiency, drift, and non-target species is in order.

SILVICULTURE BRANCH

Cone Collection

Comparisons of the productivity, safety, and efficiency of "bagging" tree tops, versus hydraulic clipping or raking, for cone crop production, should be undertaken.

Aerial Photography

The Forest Service requires improvement in methods of taking low level, high resolution aerial photographs for all types of survey work, including regeneration and brush monitoring. The use of remote control planes, helicopters, blimps, kites, or helium balloons should be further explored.

Fertilization

More efficient use for aircraft in the application of fertilizer for silviculture purposes is needed.

INTEGRATED RESOURCES BRANCH

Full Spectrum Scanning

The Forest Service would appreciate an improvement in, as well as increased usage of, full spectrum scanning imagery to:

- o aid in tree species identification,
- o record incidence of disease, and
- o locate the path of cold air drainages to help solve seedling mortality problems in frost prone sites.



Wildlife Monitoring

A need exists for navigational and herd tracking devices to locate and monitor wildlife.

INVENTORY BRANCH

Imaging Systems

There is a requirement for the techniques/tools for forest stratification, classification and monitoring, by means of airborne and spaceborne imaging systems, such as: Multispectral Electro-optical Imaging Sensor (MEIS), airborne imaging spectrometers (FLI CASI), video, radar and spaceborne systems (Landsat, SPOT, MOS). In the future, ERS-1 and Radarsat may be appropriately applicable systems.

Geocoding of Imagery

The Forest Service has a need for improved geocoding of photographic and digital imagery, including georeferenced video. This would include terrain correction, employing Digital Elevation Models (DEM), ortho photo generation and the use of data from Global Positioning Systems.

For further information on the above topics, please contact the specialists listed below, or write:

British Columbia Forest Service
1450 Government Street
Victoria, British Columbia
V8W 3E7

Protection Branch:	John Muir	(604) 387-8739
Silviculture Branch:	Mike Wyeth	(604) 387-8922
Integrated Resources Branch:	Bruce Sieffert	(604) 387-8787
Inventory Branch:	Dave Gilbert	(604) 387-6722

PUBLICATIONS AND REPORTS

- Alfaro, R.I. and C.C. Ying. 1990. Levels of Sitka spruce weevil (Sic.), *Pissodes Strobi* (Peck) damage among Sitka spruce provinces and families near Sayward, British Columbia. Can. Ent. 122:607-615.
- Humphreys, p. 1990. Pesticide use in B.C. Forestry, 1989. B. C. Ministry of Forests, Protection Branch. Victoria, British Columbia. PM-PB-46.
- Reynolds, N. 1990. A preliminary assessment of the potential impact of *Choristoneura biennis* on forest management decisions in British Columbia. B.C. Ministry of Forests, Protection Branch, Victoria, British Columbia. PM-PB-44.