



Province of
British Columbia
Ministry of
Forests

PEST MANAGEMENT PROGRESS

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

Volume X, Number 2 (File 312-20)

December, 1991

WELCOME TO SILVICULTURE

I am pleased to welcome all the forest health staff to the Silviculture Program. As of May 1991, all branch staff were transferred, and as of September 1991 all regional staff were transferred to Silviculture. District forest health staff and programs will be re-assigned to Silviculture within two years.

On October 29-30th, we held a very informative integration meeting at Kamloops with regional and branch managers and forest health staff, to discuss and resolve some of the integration issues and opportunities. I believe everyone was impressed by the positive and enthusiastic interactions of all participants.

I want to emphasize that all of the forest health program elements and functions will be supported in the Silviculture Program. All of us are looking forward to the continuation and improvement of a very productive and beneficial Forest Health Program that will support and extend silviculture goals and improve forest management in British Columbia.

If you have any comments or concerns, do not hesitate to call me.

- P. Ackhurst, Director, Silviculture Branch.

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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 silviculture officer, or advisor who will edit and forward them to Silviculture 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

Forest Health - Silviculture Integration. As indicated in the last issue of Pest Management Progress, the Forest Health Program was transferred in May, 1991 to Silviculture Branch, and the Program at the forest regional offices has been or will be transferred soon. Forest districts will have two years to re-arrange the Program.

We held a very successful integration meeting (see Meetings section of this issue) in late October, and we are working on the following key recommendations from that session:

- develop and compile five-year plan silviculture goals for each forest district
- develop a forest technician or forester job description for the district program
- develop a discussion paper or analysis of a five-year strategic plan for forest health, based on regional strategies and district goals
- review, and if necessary, revise, the strategies to deal with insects, diseases, and animal damage to ensure a complete, well substantiated set of regional and provincial guidelines and standards. Initially the existing forest health manual and all regional guidelines will be collated and re-distributed. A major revision of the manual is planned that will emphasize procedures that can be used by district staff to develop treatment strategies.
- publish, as a discussion paper, a preliminary financial analysis, of several forest health treatments. This will be undertaken by Branch staff.

At Silviculture Branch, two new positions were allocated to the Forest Health Program: Val Fletcher has transferred from Protection Branch to the position of forest health analyst, and a position was allocated to replace Bob DeBoo, the former manager of forest health, who is now on secondment to Forestry Canada, Pacific Forestry Centre. We should have a new manager for the section by early December.

We are very encouraged by the support we have received from Silviculture, and look forward to the continued development of the Forest Health Program.

- J. Muir, Silviculture Branch, Victoria.

Forest Health Program Goals. Recent government changes and discussions of integration with Silviculture Branch have emphasized the need to develop more quantitative goal statements of what we want to achieve in the Forest Health Program.

These program goals should be a prominent feature of the Five-year Strategic Forest Health Plan that we are working on with region staff. To further the development of such goals we offer the following examples:

For bark beetles:

- provincially, to limit outbreaks to 50 000 hectares
- regionally, to detect and take action on outbreaks to limit them to 2 ha

For root disease:

- to limit outbreaks to no more than three trees per ha for root diseases
- to determine thresholds and occurrences where silviculture reforestation goals will not be achieved
- to determine where/what forest areas could be treated to increase productivity.

In the spirit of on-going innovation, we are offering unspecified prize(s) for any improvements or further elaborations directed to us.

- J. Muir and P. Hall, Silviculture Branch, Victoria.

Forest Health Information Systems Initiatives. Prior to the movement of the Forest Health Program from Protection to Silviculture Branch, a Business Area Analysis (BAA) was completed. In general terms, the BAA produced the following:

- An activity model that describes the business functions/processes of forest health and defines the scope of the Program in terms of high-level logical business functions.
- A data model that identifies the key information needed to support the business requirements of the Program and where it is created and used. This model will be used as a planning and management tool and will provide the architectural foundation for all future work. The three major categories of required data identified by the model are land-based data (e.g. pest infestation/geographic area); program data (pest information, policy and procedures); and finance and administration data (e.g. budgets, projects).

- An application architecture based on current systems, program needs and opportunities for the future, and a core set of applications required. These applications include program specific applications (e.g. pest incidence tracking); general ministry applications (e.g. project management); and productivity/office automation (e.g. spreadsheets).
- A technology architecture based on a review of the previously mentioned application requirements, the Ministry's strategic hardware/data management plan, and maintenance and support issues. The technology used in this architecture will be Local Area Network (LAN) based workstations with connection to the IBM (PROFS) mainframe. The IBM mainframe which will provide access to corporate data and systems.
- A development plan with a list of 24 prioritized projects. These projects are not merely a list of systems required but a statement of what needs to be done (e.g. confirm data standards). The projects will be completed in three to five years. The development plan is essentially a migration strategy to move from "here and now" to "where we want to be" for delivery of the program goals.

The following two projects from the Business Area Analysis Development Plan have been initiated:

Project 1: Information Resource Management (IRM) Strategies and Educational Support Material for the Forest Health Program.

The objectives of this study include:

- The confirmation of forest health data standards for pest incidence and intensity and the development of data models to support forest health sampling requirements.
- The development of forest health data management strategies including data acquisition strategies, data distribution strategies, and data management standards and guidelines.
- The review of current Ministry plans (e.g. LAN strategy, resource inventory business area analysis), which will impact the forest health information strategy, and an update of the Forest Health Program Development Plan, as required.
- The development of appropriate presentation materials to assist program staff to promote forest health awareness.

Project 2: Analysis of Forest Health Project Management Requirements

The mechanism that will manage, and track forest health projects along with their objectives and budget will be determined. More specifically the project objectives are as follows:

- to determine the project management function and information requirements of forest health.
- to determine the constraints under which these requirements must operate.
- to define the evaluation criteria from the project management requirements and constraints.
- to identify alternate solutions by assessing the suitability for forest health of the following:
 - project management components in existing or planned Ministry systems (e.g. ISIS "Plans and Goals, Record Activities Components).
 - existing manual and personal computer based tools that forest health staff may be using.
 - packaged ("off the shelf") project management tools currently on the market.
- to prepare an evaluation document on the project management evaluation criteria, solutions and recommendations.
- to prepare a systems requirements document on the functional and operational characteristics of the recommended project management mechanism. It should define the following:
 - Objectives - what the user wishes to accomplish through the implementation of the system and the processes or actions of the system.
 - Context - a high level view of the system in relation to other systems and organizational units.
 - Scope - the business functions the system must support.
 - Constraints - the business, resource and technical boundaries and parameters within which it will operate.
 - Functional Requirements - a description of specific functions that must be performed by the proposed system.
 - Information Requirements - a high level model of the information required.
 - Technical Requirements - a description of the information technology required such as custom software, software packages, hardware and communications.

- V. Fletcher, Silviculture Branch, Victoria.

Habitat/Silviculture/Protection (HSP) Funding. HSP funding has been allocated annually to the Ministry of Environment since 1986 to compensate for the increased workloads of Ministry of Environment staff ensuing from expanded Ministry of Forests programs such as the Forest Resource Development Agreements I and II, the Forest Renewal Program, and the Bark Beetle Program. Funds for HSP coming from these programs have led to increased needs for such Ministry of Environment activities as referrals. The funds are administered by the HSP Committee, which is made up of representatives from the Ministry of Forests, Ministry of Environment, and Forestry Canada.

Funds are allocated to Ministry of Environment regions to allow for referrals and to provide base line studies to develop management guidelines. These guidelines are intended to reduce the need for future detailed site-by-site referrals. In the past, allocations and specific project approvals have been the responsibility of the HSP Committee. In future, however, the intent is to place the project development, prioritization, and approval process in the hands of regional Forests and Environment staff.

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

Hardwood Management Research. Forest health was identified as one of four priority study areas in the new five-year strategic plan for hardwood management research. This strategic plan was prepared by a subcommittee of the Hardwood and Vegetation Management Technical Advisory Committee, chaired by Dale Draper, Forest Science Research Branch.

Information is needed on the nature, impacts, and control of organisms that damage hardwoods. Hardwood forest health research will include the following studies:

- the biology, population dynamics and control of organisms that damage hardwoods;
- the impact of damaging agents on hardwood vigor, survival, growth and yield, and wood quality; and
- the effect of hardwoods on conifer pests such as root rots, in mixed stands, or in alternating rotations.

The following hardwood management research projects that deal specifically with forest health issues are underway:

- an assessment of decay and waste factors and decay organisms for red alder in the Vancouver Forest Region (Eric Allen, Forestry Canada);
 - a birch/root rot study to examine root morphology and infection patterns of paper birch and Douglas-fir in mixed stands, and to compare armillaria root disease groups that occur on paper birch and Douglas-fir in mixed stands (Hadrian Merler, Kamloops Forest Region);
 - a cooperative investigation of the significance of site variables in predicting aspen decay in the Fort Nelson area. (Ken Richardson, Inventory Branch, K. Lewis, Industrial Forestry Services);
 - development of diagnostic tools for poplar disease in British Columbia (Brenda Callan, Forestry Canada).
- K. Hopkins, Forest Science Research Branch, Victoria.

Forest Renewal Plan - Reforestation Research. As part of the Ministry of Forests Research Program, reforestation research is aimed at improving the biological and cost effectiveness of conifer plantation establishment to the free-growing stage, with consideration for other resource values. Studies address plantation establishment systems, including planting site assessment and plantation maintenance. Much of the research has direct implications for forest health and includes the following:

- Herbicide screening trials for *Calamagrostis* spp control, as well as a test of an operational herbicide monitoring system for future province-wide use (Dave Coopersmith, Prince George Forest Region, Telephone: 565-6168).
- Ongoing research into the use of habitat alteration and encapsulated biological repellents to protect coniferous plantations from snowshoe hare damage (Tom Sullivan, University of British Columbia, Telephone: 228-2727).
- A study of root morphology and mechanical stability of planted lodgepole pine in the northern interior. The susceptibility of existing 11-25 year-old plantations to windthrow and the severity of root and stem deformations resulting from improper root development will be investigated (Marek Krasowski, Red Rock Research Station, Telephone: 963-9651).
- A herbicide rate and timing trial on a fireweed-dominated backlog site in the Interior Cedar-Hemlock Biogeoclimatic Zone (Teresa Newsome, Cariboo Forest Region, Telephone: 398-4408).

- An examination of the efficacy of manual cutting treatments, and glyphosate and triclopyr ester applications, on non-crop vegetation and conifer development in the Vancouver Forest Region. (Brian D'Anjou, Vancouver Forest Region, Telephone: 660-7531)
- Research on the use of grass/legume seeding mixtures as a method of controlling brush encroachment along streambank buffer strips. Project results will contribute to our understanding of grass/legume seeding as an alternative regime to controlling competition in pesticide free buffer zones (Paul Courtin, Vancouver Forest Region, Telephone: 660-7533).
- An evaluation of crop tree and vegetation responses to chemical and mechanical weeding treatments of major competition complexes in the Southern Interior. Results will indicate the effectiveness of various vegetation control techniques (Dennis Lloyd, Kamloops Forest Region, Telephone: 828-4129).
- An investigation of the effects of cattle grazing, forage seeding rates, basal scarring, and shoot damage on survival and growth of lodgepole pine (Brian Wikeem, Kamloops Forest Region, Telephone: 376-1331).
- Research on the use of legume and grass seeding for brush control on mechanically prepared backlog brushfields in the Southern Interior Cedar-Hemlock and Engelmann Spruce-Subalpine Fir Biogeoclimatic Zones (Ordell Steen, Cariboo Forest Region, 198-4406).

For further information, contact the project leaders indicated in brackets or Ian Graeme at 387-3041.

- I. Graeme, Forest Science Research Branch, Victoria.

FRDA II - Forest Renewal Research. Forest management is changing rapidly in British Columbia reflecting concerns over environmental health and sustainable development. Forest Renewal Research under Federal Resource Development Agreement (FRDA) II will provide the information and technology required to address these issues and strengthen the scientific basis for sustainable development. Priority areas of the program include conifer plantation establishment and management. A total of 29 projects are now well underway and they include several with direct implications to forest health.

Current research initiatives include:

- An investigation of the use of red alder in managing laminated root rot, *Phellinus weirii*. Information on mixed alder/Douglas-fir cropping regimes will provide foresters with a greater range of management techniques (Rona Sturrock, Forestry Canada, Telephone: 363-0600).
- An investigation of the causes of winter injury to white spruce plantations in the Boreal White and Black Spruce Biogeoclimatic Zone. This research will help foresters identify causes of seedling mortality and improve regeneration success (Marek Krasowski, Red Rock Research Station, Telephone: 963-9651).
- An examination of the impact of different management strategies on the long-term productivity of boreal mixedwood ecosystems. Objectives include preparing initial carbon budget estimates and examining the impacts of harvesting and prescribed fire on the carbon budget (Phil Comeau, Forest Science Research Branch, Telephone: 387-3019).
- A preliminary analysis of the quality and productivity of birch-dominated stands in the Prince George Forest Region (Craig Delong, Prince George Forest Region, Telephone: 565-6133).
- An analysis of cottonwood management problems in British Columbia. Long-term research needs, including the development of rapidly growing, disease resistant hybrid poplar strains, will be addressed in the analysis (Mike Carlson, Kalamalka Research Station, Telephone: 549-5577).
- An investigation of vegetation management techniques on salal-dominated sites with emphasis on long-term productivity and regeneration performance (Bob Green, Vancouver Forest Region, Telephone: 660-7532).
- An examination of the effects of competing vegetation on growth and survival of Engelmann spruce seedlings in the Interior Cedar-Hemlock Biogeoclimatic Zone (Phil Comeau, Forest Science Research Branch, Telephone: 387-3019).
- An ongoing examination of the physiological requirements and competitive processes which exist between fireweed and tree seedlings in the Interior Cedar-Hemlock Biogeoclimatic Zone (Alison Nicholson, Forest Science Research Branch, Telephone: 387-6712).
- Development of a database system for entry and retrieval of vegetation management trial information. The database will be helpful in preparing summaries of vegetation management literature and will assist in identifying critical information gaps. (Phil Comeau, Forest Science Research Branch, Telephone: 387-3019).

- Ongoing development of treatment options for rehabilitation of Engelmann Spruce-Subalpine Fir (ESSF) Biogeoclimatic Zone backlog brushfields. The project includes evaluating site preparation, planting stock, and brushing and weeding options for reforestation sites in the wet, cool ESSF subzone (Craig Sutherland, Cariboo Forest Region, 398-4387).
- Development of prescribed fire impact and smoke emission models. These models will allow land managers to design burning prescriptions which result in reduced emission and increased dispersion of smoke. The project includes a review of smoke management literature (Steve Taylor, Forestry Canada, Telephone: 363-0600).

For further information, contact the project leaders indicated in brackets or Ian Graeme at 387-3041.

- I. Graeme, Forest Science Research Branch, Victoria.

A Summary of Forest Health Projects of the Silvicultural Systems Program.

The Silvicultural Systems Program was initiated in 1990/91, largely as a response to the public's concerns about clear-cutting. Forest health has always been represented in the Program. The historic predominance of clear-cutting and associated research has left little room for the study of the other three main silvicultural systems, i.e. seed-tree, shelterwood and selection systems. This program of research, extension, demonstration and implementation will provide sound biological, social and economic information regarding the implementation of all silvicultural systems in British Columbia.

Two committees were established to provide direction to this new program. The Silvicultural Systems Steering Committee, consisting of Ministry of Forests branch directors and a Forestry Canada representative, provides overall direction to the program. The Silvicultural Systems Working Group includes representatives from Forest Service regions and branches, Forestry Canada and the Ministry of Environment. The Silviculture Systems Working Group carries out the day-to-day activities of the Program such as requesting and reviewing project proposals.

The 1990/91 Program budget was trimmed to \$900,000 and funded by the Sustainable Environment Fund. About 13% of this budget was not spent because of a lack of qualified contractors, confusion over budget cutbacks and organizational problems. It is expected that the Program will receive at least \$1.75 million over the next four years, funded by the Forest Renewal Plan and the Forest Resource Development Agreement II. In the first year of the Program forest health was given \$67,000, and in the second year \$149,650.

The following Silvicultural Systems Program forest health projects have been funded and are underway:

- Forest Health Problem Analysis for Silviculture Systems: This comprehensive analysis was initiated in the first year but because of illness the contractor was not able to meet the original project completion date. However, a report has been written and has been reviewed by branch staff. The final report will be available by the end of the year.
- Comprehensive Pest Survey Procedure for Pre-harvest Silviculture Prescriptions (PHSP's) in Partial Cutting Systems in the Cariboo Forest Region: The contractor has reviewed, revised and field tested PHSP procedures in the Region. Revised PHSP procedures should capture more pest information in different biogeoclimatic zones. A report should be available by the end of the fiscal year.
- Pest Risk Assessment by Biogeoclimatic Subzone in the Nelson Forest Region: A series of tables were developed listing biogeoclimatic subzones on one axis, and pest occurrence and significance on the other. The organized information will allow a cross-referencing of pest damage potential with commercial tree species for a particular subzone. The tables, available by the end of the fiscal year, will be used by forestry staff who conduct PHSP's.
- Mountain Pine Beetle Hazard Reduction Through Two Different Partial Cutting Methods in the Prince Rupert Forest Region: Stands in the Morice Forest District have been identified for harvesting. One stand will be harvested using a modified group selection method, and the other will be harvested using a standard "beetle proofing" thinning treatment. This should occur later this winter. Next season, at the time of beetle flight, the preference of the beetles for one stand or the other will be measured.
- Forest Health Implications of Partial Cutting Silvicultural Systems on Dry Sites in the Coastal-Interior Transition Biogeoclimatic Zone in the Vancouver Forest Region: This project has been delayed until next year along with a larger research project of which it was a component. The larger project location will be moved to the Boston Bar area and the associated forest health study will probably be moved as well. The forest health study will monitor the pest situation before and after a partial cutting treatment and will focus on the impact of, or stress caused by, harvesting on the residual trees.
- Hardwood-Sitka Spruce Mixtures as a Tool to Reduce Sitka Spruce Weevil Damage in the Vancouver Forest Region: A preliminary study design has been developed. Before the end of the fiscal year the study design will be confirmed, and all forest sites to be studied will be identified and prepared for planting. The research study will commence next year.

- Acceptability of Western Red Cedar Regeneration in the Interior Cedar-Hemlock Biogeoclimatic Zone of the Kamloops Forest Region: The causes and incidence of butt rot in cedar in different biogeoclimatic subzones were investigated. Field assessments have been made on young trees and on newly harvested mature tree stumps. It is suggested that a complex of pathogens is causing the rot. A report will be available by the end of the fiscal year.
- Decay in Advanced Hemlock and Cedar Regeneration in the Northern Interior Cedar-Hemlock (ICH) Biogeoclimatic Zone: The focus of this project was the identification and extent of major pathogens creating advanced decay in cedar and hemlock. This investigation relates to uneven-aged stand management systems. Stands in all subzones of the ICH in the two northern regions were studied. By the end of the fiscal year a report will be available with maps showing the incidence and extent of the rot.

If you wish to know more about the Silvicultural Systems Program and the forest health projects please contact the author.

- J. Henigman, Silviculture Branch, Victoria.

Pest Standards for Northern British Columbia. Forest health and silviculture staff from the Cariboo, Prince Rupert and Prince George Forest Regions met in August to standardize and refine the following:

- pest assessments and control recommendations made during preharvest silviculture prescriptions, and
- pest standards regarding tree health made during free-growing surveys.

The results will be circulated this fall to collect comments from Ministry staff in these Regions. Additional copies of this work are available from the author.

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

Pre-harvest Silviculture Prescription Pest Survey Procedures for Partial Cuts. Industrial Forestry Service of Prince George has been contracted to develop a pest survey procedure for Pre-Harvest Silviculture Prescriptions in partial cutting systems. Field work to test a two-phased pest survey procedure has been completed in 100 Mile House Forest District, and a final report is expected to be available by April 1992.

- Mark Hamm, Cariboo Forest Region, Williams Lake.

Pest Incidence Surveys. The Pest Incidence Survey, better known as PIS, was off and running again in 1991! Another seven mapsheets have been surveyed using the PIS standard, bringing the regional total to 20 completed mapsheets. The survey has been streamlined slightly and we now feel that it more fully captures all pest incidence, as well giving sound inventory data. Four training sessions were held in the early summer, and another is planned for November. Approximately 75 contractors and Forest Service staff have now had the PIS training in the Kamloops Forest Region.

- L. MacLauchlan, Kamloops Forest Region, Kamloops.

Immature Pine Project. Year two of a joint project with Silviculture Branch has been completed. Year one saw the completion of surveys in young pine stands in the Merritt Timber Supply Area. Each ecosystem was assessed as well as different density stands and stands receiving various treatments. Based on the results of these surveys, 15 permanent plots were established in candidate stands this summer. These plots will serve as long term indicators of pest impact and treatment assessment in different ecosystems and stand densities. A summary of plot data is currently underway.

- L. MacLauchlan, Kamloops Forest Region, Kamloops.

Nursery Pest Management Update. Pest management trials were conducted at several nurseries across the province, during the 1990 growing season. Work to determine if the pre-storage application of fungicides is still mandatory now that stock is frozen was completed. Data showed that sprays were effective at controlling storage mould when applied at recommended rates. Also, residue levels on the seedlings were below those permitted for berry crops. However, it is not necessary to treat stock unless it is pre-disposed to gray mould infestation. Field observations and laboratory assays prior to seedling lift were reliable in predicting if a crop is free of, or pre-disposed to storage moulds.

A cooperative trial with Dr. Paige Axelrood of B.C. Research was conducted to determine if *Cylindrocarpon*-caused root rots could carry over in container nursery stock to become established in plantations. Early results show that when compared to natural seedlings on the same site the nursery stock had significantly more *Cylindrocarpon* colonizing the root system as well as impaired root form and growth.

The growth regulator paclobutrazol was applied to 2+0 spruce summer ship stock. Stock was then planted at a site near Barriere, and at two nurseries. The paclobutrazol induced a strong and immediate bud-set in the seedlings and caused the roots to become abnormally thickened. The trial will be assessed next year to determine if paclobutrazol increased seedling growth and survival on dry harsh sites.

This was the last year of work with the balsam woolly adelgid. Attempts to develop monitoring programs for air-borne crawlers using sticky traps in 1990 and suction traps in 1991 have not been successful. It is unlikely that a nursery certification program for this quarantined insect pest will be developed.

In cooperation with Dr. Murray Usman at the University of British Columbia, the natural insecticide, neem, was tested for control of the variegated cutworm on spruce and Douglas-fir seedlings. Control efficacy looks promising and trials will be expanded in 1992.

A variety of coloured sticky pheromone traps were placed throughout a large Interior bare-root nursery to monitor for thrips. The cards were supplied and analyzed by Phero Tech Inc. A significant number of insects were captured.

- G. Shrimpton, Surrey Nursery, Surrey.

Roadside Tree Injury Committee. The Committee is reviewing a report on a survey of 17 roadside sites where there were observations or reports of injured trees or vegetation.

It appears that most sites have been affected by highway de-icing salt. The salt is suspected to be the major cause of tree injury. More intensive surveys or follow-up remedial projects are being considered by the Committee. A report should be available for distribution by approximately June 1992.

- J. van Barneveld, B.C. Environment, Lands and Parks, and
J. Muir, Silviculture Branch, Victoria.

The Great Port Alberni Forest District Secondment. As many of you may be aware, for the period of April to September of this year I was seconded to the Port Alberni Forest District. I left the fast lane of branch and pesticide traumas for dusty green trucks. My purpose in going to a district was basically to come to know what districts do and how they do it. To achieve this objective two major projects were delegated to me. The first was to set up nine woodlot forest tenures, and the second was to manage the planning of the Toquart Valley Resource Folio Project. A third, lesser project, was the initiation of a public forestry tour of the Qualicum Valley. These projects were selected to allow me to come in contact with all facets of forest management occurring in the District, to experience unfamiliar programs, and to see how the whole forest management process really works on the ground.

The woodlot project involved identifying small parcels of Provincial Forest/Crown Land scattered about the District that could be organized as woodlot tenures. Most of the candidate areas on the east coast of Vancouver Island are currently treed but are not being managed. They are somewhat isolated from other forested areas, are partially surrounded by suburban or rural communities, and are being used in an ad hoc way by local residents. In order to develop the proposed woodlots I had to verify the timber typing; locate roads, streams and other features; determine legal public access and road building needs; calculate a basic Annual Allowable Cut; evaluate the area for other resources, including recreation, fish, wildlife, and hydrology; recommend a silvicultural management plan; and finally, describe an appropriate method to involve the local public in the planning process. For each woodlot proposal a step-by-step set of recommendations were offered to allow the District to award a tenure and to facilitate its ongoing administration.

A major priority of the Port Alberni Forest District is the development of programs which directly involve the local public. To this end, many of the proposed woodlots may be assigned to municipalities or rate payer associations. This differs from the usual Ministry goal of assigning woodlot tenures to property owners in order to enhance forest management on private land. This may pose some interesting Ministry policy issues.

The Toquart Valley Resource Folio project was similar to the planning process which has recently been completed in the Nahmint Valley and in Tofino Creek. An important distinction of the Toquart Folio is that during my involvement the process did not include public input. I acted as the project planner and was generally responsible for shepherding the various resource agency evaluations to completion and ensuring reasonable coordination. The final report for this Folio will be completed early in 1992.

The Toquart Valley is located on the west coast of Vancouver Island in Barkley Sound. About three quarters of its accessible old-growth timber in one Forest License has been logged. The Toquart River system supports a valuable salmon population, and the valley has significant recreation, landscape and heritage resources. The slopes of the valley are particularly unstable and this poses obvious problems to road construction and the protection of fisheries habitat.

In addition to chairing meetings of the Resource Folio Committee, I was able to conduct a marbled murrelet monitoring project, and to assist in a geological slope stability field study of the Valley.

A forestry tour of the Qualicum Valley is being developed by the District for the general public, public representatives and administrators, and university forestry students. Each audience will be addressed in a self-guided 30 km road tour of the Valley. Visitors will be able to view the human and forest history of the Valley, its ecology, and the forest management that has taken place there over the years. I helped to identify items of interest and assisted the District in setting up a contract to have tour brochures created. Be assured that rot root will be a subject of the tour.

What did I learn from all of this? Well, I did learn how to cruise timber (and use a compass), how to spot *Phellinus weirii* and *Armillaria ostoyae*, and what the staff of Port Alberni Forest District do and how they do it. Life in that district is very enjoyable, though hard work and long hours are required. By comparison to branch, day to day issues are generally very tangible rather than conceptual, and there is little time available to "read the manual". To be useful, guidance from branch and region must be brief and to the point.

The one philosophical truth that I discovered is that concerning forest management by the B.C. Forest Service - **"THE DISTRICT DOES IT"**.

The branch and region may assist, advise, consult or attempt to set the rules, but the district does it. Any initiative that would thwart the ability of the district to get on with the job is not productive. Just because a district has done, or could do it wrong, is not justification to limit its authority to do what has to be done. For many of you this may sound obvious, but to me the discovery was humbling.

If you have any questions concerning my secondment at the Port Alberni Forest District, please contact me.

- J. Henigman, Silviculture Branch, Victoria.

Forest Health Tour of South East Alaska. For one week in June, Prince Rupert Forest Region forest health specialists toured the Alaska panhandle escorted by Gene Lessard, USDA Forest Service Entomologist in Anchorage, and Dr. Paul Hennon, Pathologist, from the U.S. Forest Service State and Private Forestry office in Juneau.

The object of the tour was to exchange ideas on common forest health problems shared by the two organizations.

The tour began in Ketchikan following a scenic ride aboard the Alaska ferry. We were met by Paul Hennon who arranged a float plane tour of the southern portion of the Tongass National Forest. We stopped at Prince of Wales Island to examine a hemlock dwarf mistletoe experiment and demonstration area. We then flew to Petersburg where we took a driving tour of Mitkof Island to examine some severe porcupine damage in hemlock plantations. From Petersburg, we flew to Baranof Island to examine grizzly bear damage on yellow cedar and to see Paul Hennon's research site where he is trying to determine the cause of yellow cedar die-back. Yellow cedar decline is a severe problem throughout southeast Alaska. We continued north where we flew over the remnants of a massive spruce beetle outbreak in Glacier Bay National Park.

Our air tour ended in Juneau but continued on the ground where we met the rest of the pest management staff of the State and Private Forestry office. They then took us to a hemlock spacing/pruning trial within the Juneau city limits which was being damaged by porcupines. We had a long discussion with the local silviculturalist, Bill Fell, on the possibility of using his trial to record the impact of porcupine under different silviculture treatment regimes.

After gorging ourselves at an "all-you-can-eat" king salmon barbecue, we boarded the Alaska ferry for a 27-hour trip back to Prince Rupert. We have already planned to provide a reciprocal tour of our region's forest health problems this summer, but it will be hard to beat the scenery and hospitality we experienced.

- T. Ebata, S. Zeglen, and S. Harrison, Prince Rupert Forest Region, Smithers.

Mountain Pine Beetle Model. A new replica of the mountain pine beetle is now on display at Silviculture Branch. This very realistic, detailed and lightweight 1-metre long model is the creation of a local artist, Mr. Stan Fletcher, and sits on its own stand in a plexiglass case. The beetle has been designed so that it can be removed from its case and hung from a ceiling, if desired. Please contact us if you would like to borrow the beetle for any public events, workshops etc.

- P. Humphreys, Silviculture Branch, Victoria.

Pest Treatments and the Annual Allowable Cut. A Nelson Forest Region internal report entitled, Augmenting the AAC Through Pest Treatments, was published this spring. In 1990, over 400 forest cover polygons in the Region were surveyed for pest incidence and commonly measured stand characteristics. Average annual growth in each polygon was calculated three ways to estimate possible gains through treatment of forest pests. The average predicted growth rate, based on stocking with preferred species, was significantly higher than the average growth rate based on current inventory map labels in each ecosystem represented. The report highlights the huge productivity losses due to forest health agents, such as root diseases, bark beetles and dwarf mistletoes and outlines the philosophy behind productivity management as realized through the Forest Health Program.

A video and slide/tape show, based on this report are available from the undersigned upon request.

- R. Stewart, Nelson Forest Region, Nelson.

Movin' On. On the occasion of his official "buy out" in mid-October, Bill Young bid farewell to forest health and the Prince Rupert Forest Region. Bill had served as forest health forester for over a year after coming to Smithers from the Robson Valley Forest District. He departs to take on the challenge of an operations manager position in the Clearwater Forest District. The remaining "three amigos" wish Bill well in his new posting and look forward to the first edition of the *Highway 5 Guide to Fine Dining*.

- S. Zeglen, R. Reich and T. Ebata, Prince Rupert Forest Region, Smithers.

FOREST PATHOLOGY

Pinewood Nematode Update. Restrictions on the movement of British Columbia forest products into the European Economic Community (EEC) are continuing because of the pinewood nematode issue. The EEC has required that all North American wood products imported into the EEC be kiln-dried to eliminate the nematode. A one-year exemption was negotiated with some countries, notably the United Kingdom, based on a bark-free certification program that was developed by the Council of Forest Industries of B.C. The certification program being administered by the Council, and Agriculture Canada Plant Health is working well.

Negotiations and missions to the EEC countries are continuing in an effort to obtain an on-going exemption for B.C. lumber.

Research projects to develop more practical and economical methods for disinfecting wood products are also underway.

- J. Muir, Silviculture Branch, Victoria.

Root Disease Surveys - Small Business Forest Enterprise Program (SBFEP). During the 1991 field season, the Kamloops Forest District completed over 700 ha of root disease surveys on 20 proposed SBFEP timber sales. The survey data is being used by timber staff to prepare Pre-Harvest Silviculture Prescriptions and delineate treatment units, and by silviculture staff to complete stumping projects.

The survey method is a 100% coverage, probe-type survey using 50-metre wide strips. The costs range from \$33.75/ha in the Interior Douglas-fir (IDF) Biogeoclimatic Zone (dry belt) to \$49.96/ha in the Interior Cedar-Hemlock (ICH) Zone.

Stumping is currently underway on about 70 ha in the ICH zone. An excavator is being used to do the stumping and the costs are about \$925/ha.

The main species of root disease fungi encountered were *Armillaria ostoyae* and *Phellinus weirii*. *Ionotus tomentosus* and *Phaeolus schweinitzii* were also observed.

- D. Piggin, Kamloops Forest District, Kamloops.

Armillaria Root Disease of Lodgepole Pine in the Transition Zone in the Cariboo Forest Region. Those persons who have been following this stirring tale since the beginning, will know that this past summer was the third co-op student term spent attempting to develop a sampling method to determine losses caused by armillaria root disease where lodgepole pine is the primary tree species, using colour aerial photos. The ground truth sampling method involved the use of 10 x 3 metre pixels (Merler/Norris) in areas stratified by canopy cover using colour aerial photos. This ground sampling method was also used during the summer of 1990, but it was tied to different criteria for stratifying the canopy closure. It didn't work (see PMP, December 1990).

The photo stratification criteria were fine-tuned for another attempt in the summer of 1991. Using this new and improved stratification method involving crown thinning or openings, dead or dying trees, and patches of deciduous trees, the latest sacrificial student took to the field. It also didn't work. The student examined 13 sites - no armillaria root disease was detected. As this was the second summer of attempting to make this sampling method work, it was decided to abandon the project even though the students insisted that they were getting close and that given more time were sure to "bag" that elusive and legendary quarry, "*Armillaria lodgepolicus*".

The fact that no armillaria was detected does not indicate that there is no root disease in the zone. In fact we know that armillaria does occur in this area, because it has been detected during Pre-Harvest Silviculture Prescription Surveys and Timber Cruises. Problems that may have contributed to the failure of the second attempt may be:

1. The individuals interpreting the photos may have been too inexperienced.
2. Known infection centres on the aerial photos should have been ground checked and the photos re-interpreted.
3. The scale of the aerial photos, 1:15 000, may be too small. A scale of 1:10 000 might be better.
4. There is probably a low incidence of armillaria in the Moffat Supply Block. The method may work in areas of higher infection incidence.

Because of the Co-op student's perseverance in attempting to detect armillaria where there was none, he was granted a reward - his next project was to survey known infection sites in Douglas-fir (see the following article on armillaria in the Interior Douglas-fir (IDF) Biogeoclimatic Zone).

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

Armillaria Root Disease in Spaced Juvenile Douglas-fir Stands in the Interior Douglas-fir (IDF) Biogeoclimatic Zone. A section of the IDF Biogeoclimatic Zone exists in the 100 Mile House Forest District, and because of the difficulty of regenerating these areas to Douglas-fir, a type of shelterwood harvesting is used. The shelterwood method most commonly used is diameter limit harvesting. Once harvesting is completed, and most of the merchantable volume has been removed, the residual juvenile Douglas-fir is spaced. This particular stand, near Young Lake, east of 70 Mile House, was harvested in the 1960's and spaced in the 1980's. Normally, no problems would occur, but, in this case the type of shelterwood harvesting used had promoted an increase of armillaria fungus inoculum in the Douglas-fir stumps. This fact is verified by the presence of a large infection site across the road from the spaced area. Surveys of the spaced area indicate that 30% of the area is infected and many trees are dying. I believe that this infection percentage is conservative, as large openings are now appearing in the stand.

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

Gallop ing Armillaria. This particular phenomenon of armillaria root disease was first reported in the December 1989 issue of Pest Management Progress. To refresh the reader's memory, the infection site is near Tzenzacut Lake, west of Quesnel. The lodgepole pine stand was 13 years old at the time of spacing, in 1987. A July 1989 survey indicated that 43% of the crop trees were either dead or dying from armillaria root disease. A subsequent survey in April 1991 indicated that mortality is still occurring at an average of 3% per year.

Duncan Morrison of Forestry Canada may install a controlled spacing experiment adjacent to the infected area in 1992.

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

Robson Valley Forest District: Armillaria Root Disease in the Northern Portion of its Range. Two summer students assessed young stands for incidence and extent of armillaria root disease and other pests. The intent of the assessment was to test several survey methods that could be used to delineate problem areas where intensive silviculture investments would not be advisable.

Several stands with unacceptable levels of disease were identified. A 50 m x 50 m stem-mapped plot was established in two of these stands. These plots will yield long term results on mortality and spread rates.

A training field tour for forest district staff, licensees and contractors highlighted the results of the project.

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

Tomentosus Root Rot Detection Made Simple. To date, the lack of survey methodology specific to tomentosus root rot has hampered our ability to address this problem. This year a new approach to tomentosus detection and evaluation was initiated in the Dawson Creek Forest District.

This development was triggered by the discovery of a very extensive mixedwood area infected with tomentosus, by Dave Parminter, timber resource officer in Dawson Creek. Extensive ground checks were followed by some helicopter surveys in an attempt to delineate the infected area.

Upon determining that the infected area was very large (thousands of hectares), a plan was developed to combine a root rot survey with the standard timber cruise on five small business blocks.

The root rot survey combines an assessment of percentage of area inside root disease centres along the cruise grid, as well as an ocular assessment of crown health and a root health check of three main roots of all spruce in each plot using a cordless drill. The drill is lightweight, fast and gives reliable results.

This technique should greatly enhance our preharvest detection ability. Combining the root rot assessment with the timber cruise will yield standardized information that can be easily analyzed and evaluated.

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

Tomentosus and Silvicultural Systems. As part of the Date Creek silvicultural systems megaproject in the Kispiox Forest District, a survey will be conducted to detect and map tomentosus root disease. The survey will cover up to 350 ha divided between 16 stands scheduled for one of four different harvesting methods. All the spruce and pine trees will be identified and tagged within these stands. "Before and after" comparisons of the extent of root disease will be made on the harvested areas to test the accuracy of survey methods using only above ground symptomolgy. Comparison will also be made between a detailed post-harvest survey and the pre-harvest cruise.

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

Progressive Approach to Stem Rusts in the Mackenzie Forest District.

During this past year a major change was made in the way stem rust problems have been addressed in the Mackenzie Forest District. All sites scheduled for juvenile spacing were surveyed for pests prior to treatment. This was done through silviculture contracts, licensee surveys and by two forest health summer students.

The pre-treatment surveys done by all these groups successfully identified stands with high levels of stem rusts, i.e. western gall rust and comandra blister rust. These stands will be given special consideration during spacing or avoided in order to allow natural thinning to continue.

Twenty stands that had been juvenile spaced in the last four years were also surveyed. Several of these were not satisfactorily restocked (NSR) due to rusts. Ninety hectares of these NSR stands were rehabilitated in 1991 by an underplanting of white spruce. Credit is due to the entire silviculture staff for their cooperation on this project.

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

Dawson Creek: Western Gall Rust Capital of B.C. A 1990 survey of young pine stands in the south Chetwynd area of the Dawson Creek Forest District showed that the levels of stem rusts and atopellis canker were very high. This year silviculture staff incorporated a multi-pest survey into their pre-stand tending survey. They identified high pest levels in several stands and as a result were able to avoid treating these stands. Levels of western gall rust were as high as 60% stem infected individuals. Gall rust population dynamics were also studied.

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

Decay in Advanced Regeneration. Examination of mature stands in the Interior Cedar-Hemlock (ICH) Biogeoclimatic Zone of the Kispiox Forest District led to the discovery of large amounts of internal stem defect in advanced cedar and hemlock regeneration. This defect is caused by various decay fungi which are of minor concern when clearcutting. With the advent of partial cut harvesting systems in northern B.C., the potential impact of these decay fungi is greatly enhanced.

A contract was awarded to Industrial Forestry Service of Prince George to examine the problem throughout the northern extent of the ICH zone in both the Prince Rupert and Prince George Forest Regions. The major objectives of the project are to determine which species of fungi are most commonly responsible for internal stem defect, and to determine how extensive the distribution of defect is within the northern extent of the ICH zone.

Twenty-four stands within six ecological variants were sampled this fall. Stems which might be considered for retention in a partial cut system were felled and examined in order to determine if they were decayed and the extent of the decay if present. Wood samples were taken to obtain cultures of decay organisms. Mensuration and ecological site classification data were also collected. Fungal identification from cultures and data analysis is ongoing. A final report is expected next spring.

- S. Zeglen, Prince Rupert Forest Region, Smithers, and
R. Reich, Prince George Forest Region, Prince George.

Vanderhoof Forest District Young Stand Surveys. For the third consecutive year, Vanderhoof Forest District's Resource Officer, Protection, Mike Dittaro, has planned and executed a forest health survey of young lodgepole pine stands. The surveys include both pre- and post-treatment stands. The objectives are to identify problem stands and areas and to develop an information base to augment silviculture activities.

Mike's efforts have greatly enhanced the pathology program in the Vanderhoof Forest District in both young and mature stands. In mature stands, surveys have been conducted to detect mistletoe, the red belt of mistletoe brooms, and mysterious circles of red trees suspected to be caused by lightning.

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

FOREST ENTOMOLOGY

1991/92 Bark Beetle Program. With the acceptance by Treasury Board of a report justifying the Bark Beetle Program, the funds were incorporated into the Ministry's base budget and annual issue papers are no longer required unless additional funds are necessary. The total funds available in 1991/92 were \$3 million. Resources were directed primarily towards reducing losses to the mountain pine beetle, but some funds were directed towards spruce beetle, Douglas-fir beetle, and Douglas-fir tussock moth. In general, activities covered under the program remained the same as in past years. Survey information indicates that mountain pine beetle infestations continue to decline somewhat; however, other bark beetles have increased.

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

Regional Bark Beetle Allocations. As in the past, allocations to the forest regions of bark beetle funding were based on project proposals, provincial priorities, and availability of resources. All allocations were made at the beginning of the fiscal year. Regional requests totaled approximately \$5.2 million. Allocations were as follows:

	Amount Requested \$	Amount Allocated \$
Forest Regions		
Cariboo	752,220	365,000
Kamloops	1,633,639	815,000
Nelson	789,010	540,500
Pr. George	1,013,750	590,000
Pr. Rupert	780,100	516,000
Vancouver	8,500	6,500

Silviculture Branch

- MOE Allocation*	130,000
- SFU** Ips Study	4,500
- Hazard Rating	20,000
- Administration	12,500
TOTAL	3,000,000

* Ministry of Environment

** Simon Fraser University

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

Bark Beetle Program Audit - Boundary Forest District. An in-depth technical audit of the Boundary Forest District bark beetle program was completed in the summer of 1991. The audit team was comprised of entomology, timber administration, silviculture, and management specialists. The report detailed the efforts made by the District in managing mountain pine beetle and presented a number of recommendations that could make the District's program more effective and efficient.

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

Beetles and Budworm - Short and Long Term Strategies. Currently, the mountain pine beetle is in outbreak status in several areas of British Columbia. This situation is the result of the existing extensive host material and the favourable climatic patterns of the past several years. Province-wide, mountain pine beetle infestations exist on some 43 000 ha, concentrated in the southern portion of the province. This outbreak level is in contrast to over 500 000 ha infested in 1984. Our belief is that our management approach has contributed to the decline.

The strategy taken by the British Columbia Forest Service has been one of aggressively addressing the current problem to bring long term losses within the capability of our normal harvesting and management programs. Neglect of the current infestations, and taking no action to reduce their rate of spread will only create large areas of dead pine stands.

This, admittedly, short term impact would reduce the available timber resource, increase protection costs, and entail expenditures in rehabilitation and replanting which could not be offset by revenues from the timber harvested from infested sites. The Annual Allowable Cut for many management areas in southern British Columbia is fully committed and no great flexibility remains to write off areas.

The provincial beetle management program utilizes pheromone baiting to monitor and to concentrate local beetle populations to enhance the effectiveness of sanitation harvesting and other treatments. We are aware that the use of baits, without subsequent follow-up, may actually aggravate the problem; however, as stated in our procedures, baits must only be used when some sort of follow-up is planned and likely. This includes timely directed harvesting, or other treatment, to remove the concentrated beetle populations.

Once the extensive infestations have slowed, or subsided, the objective is to implement more long-term approaches to minimizing future losses. Practices such as encouraging alternate species, "beetle proofing" remaining pine stands, and managing pine more intensively, or on a shorter rotation, will be implemented as the existing older growth stands are brought under management. Currently, these more long term practices are being encouraged wherever possible.

In British Columbia, we have taken the position that no one technique can be expected to be suitable for all situations or conditions. Rather, the desire is to use the best technique or combination of techniques to deal with specific circumstances that consider resource values, stand objectives, and other aspects of integrated resource management. We are also trying to encourage the use of such techniques as "beetle proofing" where feasible. Demonstration sites have been established in several areas of the province.

We are also trying to establish a policy that blends the need for long term prevention of budworm caused damage through stand manipulations with the need to protect existing stands. While long term conversion obviously is necessary and desirable, some control of the budworm in specific target stands will be a continuing need, as all susceptible stands cannot be converted in a short time frame. Also, some direct control will likely be necessary in converted stands in special circumstances. For instance, even-aged management of dry belt Douglas-fir is difficult if not impossible in some areas of the province. The preferred management system is one of selective harvesting. Such management requires that understory trees be protected as they represent the next pass and they are also the most susceptible to heavy damage by the budworm.

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

Bark Beetle Standard Operating Procedure. Standard Operating Procedures (SOP's) are guidelines approved by the regional manager for conducting forest management activities. A new SOP, approved on August 1, 1991, identifies the responsibilities of the Ministry of Forests, the forest industry, and others on various tenures for the bark beetle management program within the Prince George Forest Region. This SOP also includes the definition of funding sources. Copies have been sent to district offices within the Region. Additional copies are available from the author.

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

Cariboo Aerial Survey. The annual aerial pest survey in Cariboo was completed on September 30th. Mapping was done by regional and district forest service staff.

The entire Forest Region was sketch-mapped on 1:40 000 scale forest cover maps from fixed-wing aircraft flying a north-south grid. Lines were flown at two-kilometre spacing for high priority areas, and at four-kilometre intervals for low priority areas.

A mountain pine beetle outbreak at Chilko Lake is contained within the direct control perimeter of Franklyn Arm. Another new infestation was observed on the Homathko River, also in Chilcotin Forest District. A dozen spot infestations were discovered in other districts, indicating populations are increasing again after early cold weather in 1984 and 1985 reduced an earlier widespread outbreak.

Douglas-fir beetle damage is decreasing slightly, due to wetter summer weather combined with management efforts. Of the bark beetles, this one is still causing the most damage in Cariboo.

Small pockets of spruce beetle damage were detected in Quesnel Forest District.

Damage by western balsam bark beetle was severe in Franklyn Arm and Edmonds Creek by Chilko Lake in Chilcotin Forest District. Other small infestations occurred throughout the Region.

Defoliation by western hemlock looper was moderate to severe in the Quesnel Lake area of Horsefly Forest District. This is the most severe defoliation by this insect to occur in Cariboo over the last ten years.

Defoliation by two-year cycle budworm was light in the Quesnel, Horsefly and 100 Mile House Forest Districts.

Forest tent caterpillar caused moderate to severe defoliation in Horsefly and 100 Mile House Forest Districts.

No significant defoliation by western spruce budworm or Douglas-fir tussock moth was detected from the air.

Infestation figures will be available in mid-December.

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

AWK Oil Treatment of Mountain Pine Beetle in the Prince George Forest Region. On June 20, 1991, Agricultural Weed Killer No. 1^R (AWK), a low content aromatic mineral oil with insecticidal properties, was sprayed on a series of lodgepole pine bolts infested with mountain pine beetle adults. A further series of bolts cut from the same infested trees were left untreated to serve as checks. All bolts were then covered with muslin cotton in order to capture emerging adults. Emerged beetles were counted weekly from mid-July until late August. Bark samples were cut from bolts in late September to assess mortality of new adults. Although the data have not been analyzed to date, it appears that adult emergence from treated bolts was reduced by at least 71%. A complete report with recommendations will be available in the spring.

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

Pre-attack Injection of MSMA against Mountain Pine Beetle. In the Vanderhoof Forest District in early June, 1991, 40 lodgepole pine trees were baited with mountain pine beetle semiochemicals. On June 25th, 1/2-strength MSMA (160 g active ingredient /L) was injected into every second tree. Non-injected trees were left to serve as checks. All baited trees, and those directly adjacent, were examined for pitchtubes from early July to late August. There were 78% more attacks on check trees than on treated trees, thereby indicating that 1/2-strength MSMA has a repellent effect. Based on these results and those obtained in past years using different dosages, the application of MSMA cannot be recommended as a consistently effective chemical for pre-attack treatment of lodgepole pine. However, the author will investigate the potential of other insecticides or herbicides for potential use in the pre-attack injection strategy.

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

Co-op Students Monitor Mountain Pine Beetle Flight. In the summer of 1991, 24 Lindgren funnel traps baited with mountain pine beetle semiochemicals were deployed in the Prince George Forest District to monitor the duration and intensity of the mountain pine beetle flight. Two Cooperative Education students from the Forest Health Section of the Prince George Regional Office monitored the flight from early July until late August. Results indicated that these traps could be successfully used to measure population pressure between sites without the need to bait individual trees. Therefore, there is little or no need to dispose of or harvest beetle infested trees. Such monitoring is also useful to optimize the timing of MSMA injections and, where required, regulate the application and cessation of log hauling moratoriums.

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

Rupert Region Verbenone Trial Inconclusive. A replicate of the Phero Tech Inc. province-wide test of the mountain pine beetle repellent verbenone was installed this summer near Morrison Lake on the north side of Babine Lake. Bubble-caps containing verbenone were stapled to trees, stumps and logs on a 10 x 10 m grid in early July. Each treatment block was 5 ha and was paired with a nearby control block.

In late September, the trial site was sampled for currently attacked trees but very few of these trees were located in either the treatment or control blocks. This result was very surprising since each block contained numerous red trees infested with mountain pine beetle brood. The effectiveness of verbenone for protecting standing timber from attack is still unknown.

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

Bowron Lake Park Blowdown Surveyed. In 1990, it was determined that more than 800 hectares of blowdown in the Park presented a minor but significant risk of spruce beetle outbreak.

Consequently, 300 lethal (MSMA) trap trees were deployed this spring in the areas of the Park with the most active spruce beetle populations. Lindgren funnel traps were also placed throughout the park and monitored during the beetle flight period.

This September the entire blowdown area and its fringes were surveyed. No significant spruce beetle populations were found. The trap trees themselves were only moderately attacked. In addition, phloem condition in the 1990 windthrow has, in most cases, deteriorated past the point of usability by the insects.

An inter-agency task force made up of specialists from the Ministry of Parks, Forestry Canada and the B. C. Forest Service will meet late in November to review survey results and outline plans for 1992.

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

Spruce Beetle - Mackenzie Forest District. The Forest Service, in cooperation with Fletcher Challenge Canada and Finlay Forest Industries, conducted aerial surveys to detect spruce beetle infestations on approximately 3 million hectares. Results from these surveys indicate that there are 30 500 hectares of infestation. Currently, 7 000 hectares have been ground probed and the results will be used to make control recommendations. Operational beetle control plans will be developed and completed for all management units by late February, 1992. Also, a new forest health coordinator position has been advertised and should be filled by mid-December.

- A. Kneeland, Mackenzie Forest District, Prince George Forest Region.

Students Seek Scolytids in Cariboo. University of Victoria co-op student, Tanya Luszczyk, and forest technician, Joe Felker, organized, hired and trained a crew of ten high-school and university students to conduct ground surveys for the Douglas-fir beetle in July and August of 1991. Students probed trap tree sites and new infestations throughout the Cariboo Forest Region. The crew also carried out spruce leader weevil clipping on an operational trial site in Horsefly Forest District.

This was the second year that the regional office has hired a student crew, and will probably be the last. In 1992 it is expected that three of the five forest districts will have students employed to carry out probes.

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

Western Spruce Budworm. Defoliation by western spruce budworm has dramatically expanded in several areas of the Kamloops and Nelson Forest Regions. Infested stands include areas that are managed under selection harvesting regimes and therefore depend on the understory for future harvest. This understory is most severely affected by the budworm and extensive tree mortality can be expected if the outbreak continues. Other stands affected include those where substantial silvicultural activities, such as thinning and spacing, have been carried out. These investments are at risk.

Trials of *Bacillus thuringiensis* Berliner var. *kurstaki* (*B.t.k.*) in the Kamloops Forest Region since 1986 have been effective in protecting understory crop trees. Further, an evaluation by Deloitte and Touche Management Consultants of the viability of *B.t.k.* treatment to control the budworm indicated that it was a cost beneficial activity.

Proposals are being prepared for a treatment program of selected infested stands in affected forest districts. The objective of such a program would be to protect foliage and minimize mortality and other forms of damage until the surrounding infestation subsides. This program, if accepted, will be implemented in 1992 and will continue as needed. As well as direct treatment, the program will incorporate long-term approaches to reduce future damage from budworm outbreaks.

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

Western Spruce Budworm - 1991. The Kamloops Forest District is currently planning a western spruce budworm control project in conjunction with the regional entomologist and a number of other districts. At this time candidate areas are being identified and mapped for inclusion into a 5-year action plan.

The western spruce budworm control project will focus on protecting silvicultural investments such as juvenile spacing, commercial thinning, plantations, selectively logged areas, and Woodlot Licences.

In the Kamloops Forest District the priority for treatment will be as follows:

1. Areas of high silvicultural investment (i.e. thinned or brushed from about 1985 to 1991, or scheduled for thinning from 1992 to 1995).
2. Western spruce budworm permanent sample plots, research plots or plantations.
3. Uneven-aged stands logged since 1973 (for naturals) where loss of seed cones and understory trees would affect stocking status or free-to-grow status.
4. Areas of high use or visual impact for recreation, parks, and communities.

- D. Piggin, Kamloops Forest District, Kamloops.

Western Spruce Budworm Control Operations in the Kamloops Forest Region.

In 1991, the Kamloops Forest Region saw a tremendous increase in western spruce budworm defoliated area and severity of defoliation compared to 1990. Of the seven districts in the Region the Vernon and Penticton Forest Districts sustained the heaviest damage (please refer to figures on pages 58 and 59 in the Tabulations and Graphics section). The 1991 infestation was predicted in the Vernon area and a small control program was implemented using *Bacillus thuringiensis* Berliner var. *kurstaki* (Dipel 132^R). Second instar larval sampling in the spring verified the prediction of a large budworm population. Four treatment blocks, approximately 4000 ha, were delineated, and application began on June 15, 1991.

The accomplishments of the 1991 budworm program can be summarized as follows:

- The problem was correctly identified and a strategy was implemented.
- The population was sufficiently reduced in treated areas to achieve some degree of bud and foliage protection.
- Experience was gained on the methodology of aerial pesticide application.

Problems identified from the 1991 budworm program were mainly due to inadequate support in terms of funding and staffing levels. Limitations resulting from inadequate support necessitated a strategy of treating the area once at the best estimated time of insect/host development in order to decrease the amount of time the spray plane was on standby. This led to lower elevation site larvae being too far advanced, and higher elevation site larvae not adequately advanced at time of treatment.

Also, due to technical difficulties the spray program was delayed for three days and thus the opportune window of treatment was lost, i.e. the rains began!!

It was obvious from this experience that pre-planning and sufficient field personnel are essential to a successful spray program.

A proposal to treat 50,000 ha of high priority Douglas-fir sites in the Kamloops Forest Region in 1992 has been submitted and will be refined as the results of fall egg mass sampling are collated.

The strategy for selecting the 1992 treatment areas is:

1. Identify areas with predicted (in 1991) moderate to severe defoliation by performing fall egg mass sampling and spring second instar larval sampling.
2. Rank these areas for treatment, with added value stands predicted to undergo moderate to severe defoliation in 1992, ranking highest. Areas chosen for treatment must not have undergone three or more consecutive years of moderate to severe defoliation levels. Added value stands include those receiving previous, or planned investment including plantations, juvenile spacing and selectively logged sites.
3. Aerially treat the ranked stands with *B.t.k.* and promote stand vigor through implementation of silviculture treatments as identified in regional guidelines.

Preliminary results of the egg mass surveys indicate a declining population in much of the Kamloops Forest District and a static population in the Vernon Forest District. These results will reduce the overall area planned for treatment.

- L. MacLauchlan, Kamloops Forest Region, Kamloops.

Western Spruce Budworm Permanent Sample Plot Assessment and Plans.

The 1991 defoliation assessment of 60 permanent sample plots established throughout the Kamloops Forest Region is now complete. These plots were established in 1987-1988 as part a study of the impact of budworm on Douglas-fir stands. The plots are due for a full inventory remeasurement in 1992 at which time further work will be done on volume loss estimates and impact. Some of the plots were also treated with *B.t.k.* in 1987 and 1988. Preliminary data comparing treated to untreated plots in the Kamloops Forest District indicate that there is a significant difference in mortality in the treated versus untreated plots. Mortality is primarily in the understory component of these plots.

The first stage of this project produced an uneven-aged growth model, developed by Dr. Rene Alfaro, Forestry Canada, which estimates volume losses due to different levels and periods of budworm defoliation. Dr. Alfaro will be using the plot remeasurement data and annual defoliation estimates to further refine impact models for these interior Douglas-fir stands.

- L. MacLauchlan, Kamloops Forest Region, Kamloops.

Green Plan Proposal - Spruce Budworm impacts in Northern British Columbia and Alberta. Damage appraisal specialists from Forestry Canada have received funding for the first year of a Green Plan proposal to jointly develop experimental standards on a single test case. This project will run for six years and will involve cooperation between the Forest Pest Management Institute, appropriate Green Plan networks, the B.C. Ministry of Forests, the Alberta Forestry Service, and Forestry Canada staff, i.e. pest and forest management planning and decision support staff.

The spruce budworm in northern Alberta and British Columbia has been chosen as the test case and the project will develop uniform methodology and protocols for assessing pest impacts on forest resources. This methodology will then be applied to other areas in Canada in a series of replicated experiments. The objectives of this project are:

- to assess current impacts of spruce budworm defoliation on the productivity of white spruce stands in northern British Columbia and Alberta;
- to develop predictive models that will allow forest managers to incorporate pest impacts into forest management decision making and allowable cut calculations; and
- to clearly define the effects of spruce budworm on selected ecosystem functions, including:
 - successional relationships;
 - resource allocation and compensatory changes in needle retention, photosynthetic efficiency, etc. and
 - root rots as a modifier of the above relationships.

This will be a retrospective study, based on aerial sketch maps and the examination of shoots. It will provide a basis on which to stratify and select stands for further study. In both provinces sub-plots within selected stands will then be established where growth and yield changes due to defoliation will be measured.

Further details on this project are available from the author.

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

Spruce Budworm and Spruce Bark Beetle in the Fort Nelson Forest District. The Fort Nelson Forest District presently has two major pests of concern: the spruce budworm, *Choristoneura fumiferana*, and the spruce bark beetle, *Dendroctonus rufipennis*. The spruce budworm is found throughout most of the district. History records indicate that it has been cyclic here since the initial surveys of the 1950's. The most recent outbreak has been expanding for the past five years. During Forestry Canada's 1991 aerial survey, 398 155 ha of light to severe defoliation was observed, more than triple the 123 750 ha defoliated in 1990.

The Ministry of Forests treated approximately 553 ha of mature seed-production stands in the Liard River and Clarke Lake areas and at the junction of the Fort Nelson and Snake Rivers. These areas were aurally treated in late May and early June 1991 with two applications of the biological insecticide, *Bacillus thuringiensis* Berliner var *kurstaki* (*B.t.k.*). We anticipate satisfactory results. Our District will be informed of egg mass survey results by the Forest Insect and Disease Survey Unit of Forestry Canada and the region. These results will help us determine if a 1992 *B.t.k.* program is necessary.

The spruce bark beetle was first found in the Kotcho Lake area in January, 1991. The beetle is believed to have existed there at endemic levels until 1987. At present the licensee, Tackama Forest Products Ltd., is employing conventional trap trees in its proposed cut blocks in this area. October 1991 ground probes determined that these trap trees are highly effective in controlling the beetle population. During the 1991 season the bark beetle appears to have done only light damage to the spruce in these areas but heavy damage has occurred where there are no trap trees present. The licensee will continue to expand its trap tree and monitoring program of the spruce bark beetle in the Kotcho Lake area.

- S. Matlashewski, Fort Nelson Forest District, Fort Nelson.

Spruce Budworm Control in the Fort Nelson Forest District Between May 31 and June 6, 1991, approximately 525 hectares of mature spruce seed-production stands in the Fort Nelson Forest District were treated with double applications of the biological insecticide, *Bacillus thuringiensis* Berliner var. *kurstaki* (*B.t.k.*), in order to reduce defoliation by the spruce budworm, *Choristoneura fumiferana*. Three locations, encompassing a total of five blocks, were aerially treated with 2.4 L/ha of Dipel^R 132 (30 Billion International Units/ha). The first application was to 3rd and 4th instar larvae and the second, five days later, to peak 4th instar larvae.

The range of prespray larval densities on understory sample trees was approximately 2 - 6.5 larvae per 100 buds, a dramatic drop from the 27 - 77 larvae per 100 buds encountered in 1990. There was a 52% population reduction after treatment, adjusted for natural mortality. Current defoliation in the mature canopy was 19% in the check area and 8% in the treated area. Defoliation in the understory on all blocks was less than 5%. Limited egg mass assessments of three to five blocks by Forestry Canada have revealed egg mass densities similar to those found in 1990. A decision will be made this fall as to whether these stands warrant a treatment in 1992.

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

Douglas-fir Tussock Moth. An area of approximately 265 hectares, located west of Kamloops was identified as having moderate to high populations of Douglas-fir tussock moth.

Three formulations of the nuclear polyhedrosis virus (NPV) were applied. A new batch of Virtuss^R was made and supplied by Dr. John Cunningham of the Forest Pest Management Institute, Forestry Canada. An older batch of Virtuss was also used, as well as the American-made NPV virus, TM Biocontrol-1^R. The area treated with each product was:

New Virtuss	60 ha
Old Virtuss	100 ha
TM Biocontrol-1	40 ha
Total:	200 ha

All virus products were applied using a Heller 12E helicopter equipped with a Simplex spray system and Beecomist nozzles. The new and old Virtuss was applied at a rate of 10 litres per ha (12.5 g/ha of virus product). The TM Biocontrol-1 was applied at 10 litres per ha (4.5 g/ha of virus product). The spray mix consisted of 25% food-grade molasses, 10% Orzan (sunscreen), and 75% water. The molasses/water/Orzan solution was premixed the evening before application and the virus was added the morning of application. All areas were treated the same day.

Results of the treatment, based on egg mass surveys in the fall, indicate that the virus was very successful in reducing tussock moth populations. Estimates of expected 1992 defoliation in treated areas are nil or only trace damage. High to severe defoliation is predicted for the control area.

The program will likely continue in 1992 with treatment of new spots but the total area treated will likely be less than 500 ha. New infestations will continue to be treated as they arise during this outbreak cycle. Use of the virus should avoid extensive defoliation and tree mortality.

- L. MacLauchlan, Kamloops Forest Region, Kamloops.

Mating Disruption Trial in Hedley for the Douglas-fir Tussock Moth. The Kamloops Forest Region assisted Forestry Canada in executing a mating disruption trial in the Hedley area this summer. Approximately 7.7 ha were treated on August 1st, 1991, with Douglas-fir tussock moth pheromone (Z-6-heneicosen-11-one) at a rate of 0.036 kg/ha. The pheromone bead/water mixture was applied using a 206 helicopter equipped with spray booms and nozzles. Fall assessments of the trial were promising but a background level of virus in the population may mask the results.

- L. MacLauchlan, Kamloops Forest Region, Kamloops.

White Pine Weevil Shading Trial Installed in the Kalum Forest District. Three replicates were created of a trial to determine if white pine weevil attack rates are affected by varying degrees of overstory removal. Two replicates are located in the Kitimat Valley, south of Terrace, and the third is in the Nass River Valley, north of Terrace. Each replicate consists of three 1-hectare blocks. One block was brushed normally (i.e. all deciduous overstory was removed). The second block had brush removed in 15 m wide strips separated by 5 m wide untreated strips. The strips were oriented east-west so that maximum shading occurred without physical competition with the spruce leaders. Large alder and cottonwood stems were girdled instead of felled, to protect the spruce understory from damage. The final block was untreated.

Next summer, permanent sample plots will be placed within each block to determine the annual rate of attack by the white pine weevil.

One of the problems of establishing the trial was to find untreated stands that were large enough to incorporate the three 1-ha blocks and buffers. Results of the trial may indicate where brushing and weeding can be deferred because of the severe weevil damage hazard.

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

Climatological Assessment of White Pine Weevil Susceptibility in the Prince George Forest Region. Air temperature is important for the development of the white pine weevil. In 1976, McMullen produced guidelines on the temperature requirements of the weevil. In 1991, Sieben developed a susceptibility rating system for spruce weevil infestation in the biogeoclimatic subzones of the Prince George Forest Region using air temperature data from Atmospheric Environment Service climate stations. Degree day lapse rates were calculated to allow extrapolation to biogeoclimatic subzones with no data.

Growing degree-day normals above the threshold temperature of 7.2°C were accumulated for May to September by interpolation from published values for 5 and 10°C. Three categories of susceptibility were defined: likely (> 800 degree-days), possible (720-800 degree-days), and not possible (< 720 degree-days).

The results conform closely with survey data in the south-eastern portion of the Region, particularly with the susceptibility of the high and low elevation sites in some subzones. However, this assessment needs to be verified with more field data. Improvements in the climate station coverage will also be considered.

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

Warren's Root Collar Weevil Survey in the Prince George Forest Region. A contract to compile the reported incidence of Warren's root collar weevil, *Hylobius warreni*, in plantations in the southern Prince George Forest Region was recently completed. Field inspections during phase two of this study in the spring of 1992 will confirm and quantify the impacts of reported infestations. Further information is available from the undersigned.

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

Gypsy Moth. The pheromone trapping survey for gypsy moth has resulted in a number of moth catches at various locations on Vancouver Island and the Lower Mainland. Locations include Victoria, Parksville, Comox, Courtenay, Vancouver, and North Vancouver.

The most important of these locations is Vancouver. Of the 23 moths caught throughout the city, the majority were concentrated in two areas - the West End/Stanley Park, and the Alberta Wheat Pool/ Pacific National Exhibition Grounds.

Due to concerns over introduction of the Russian strain of the gypsy moth, in which the female is capable of flight and wide dispersal, specimens were sent to Cornell University for DNA fingerprinting to positively establish which strain was caught. Results from the first batch of samples were received by Agriculture Canada on September 16th. Of the seven moths tested, six were identified as belonging to the Russian strain. These moths were caught in the West End/Stanley Park area and in the neighbourhood of the Alberta Wheat Pool.

The Gypsy Moth Committee of the B.C. Plant Protection Advisory Council has met to discuss available options. Treatment plans will be developed by the Committee. It is likely that some sort of treatment will be recommended for the Vancouver sites even if no egg masses are found. In past eradication programs in the province, treatment has been comprised of three aerial and three ground applications of the bacterial insecticide, *Bacillus thuringiensis* Berliner var. *kurstaki*, (*B.t.k.*). Aerial application by helicopter will be impossible for most of the Vancouver sites, with the exception of Stanley Park, due to high structures. Therefore, the proposed program will likely be one of serial ground applications of *B.t.k.* followed by extensive and intensive pheromone trapping. Delineation of the Vancouver treatment area will be difficult due to the dispersal characteristics of the Russian strain. In effect, it will be impossible to establish an affected area with any great confidence.

Background work in preparation for a treatment program has begun. This includes developing an environmental impact/risk statement and developing a communication and information strategy. Other concerned agencies and organizations will also be involved. These will include the City of Vancouver, Council of Forest Industries of B.C., and local public interest groups.

The Forest Service will continue to support Agriculture Canada's survey and control efforts. Forest health funds were used to assist Agriculture Canada in the egg mass surveys. Regional and branch Forest Service staff will also participate in planning the 1992 program once all information is assembled, and will assist in whatever way possible with public information programs which will likely include a series of public meetings.

The 1992 gypsy moth program will likely be the most extensive to date and may include some treatment at Parksville, and possibly Colwood, as well as Vancouver. The potential successful introduction of the Russian strain of gypsy moth must be dealt with quickly and sites must be treated in the coming year. The urgency to treat is due to the possibility of rapid spread of mated flight-capable females.

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

Seed Orchard Beneficial Insect and Arachnid Surveys - 1990 and 1991. In 1990 a beneficial insect survey of southern Vancouver Island seed orchards was initiated. The following is a list of predator insects and arachnids collected in 1990:

1990

brown lacewings	Neuroptera:Hemerobiidae
green lacewings	Neuroptera:Chrysopidae
dusty-wings	Neuroptera:Coniopterygidae
pine ladybird beetles (<i>Mulsantina picta minor</i>)	Coleoptera:Coccinellidae
ladybird beetle (<i>Neomysia subvitatta</i>)	Coleoptera:Coccinellidae
click beetles (<i>Ctenicera suckleyi</i>)	Coleoptera:Coccinellidae
plant bugs (<i>Deraeocoris brevis</i>)	Hemiptera:Miridae
minute pirate bugs (<i>Tetraneura latipennis</i>)	Hemiptera:Anthocoridae
syrphid flies	Diptera:Syrphidae
ants	Hymenoptera:Formicidae
predator mites (<i>Anystis agilis</i>)	Arachnidae:Acari
spiders	Arachnidae:Araneae

The 1991 survey resulted in the addition of the following predators to the list of beneficial seed orchard insects:

ladybird beetles (<i>Stethorus punctillum</i>)	Coleoptera:Coccinellidae
soldier bugs (<i>Podisus sericeiventris</i>)	Hemiptera:Pentatomidae
microphysids (<i>Loricula bipunctata</i>)	Hemiptera:Microphysidae

As long as resources permit, the surveys will continue, not only for the purpose of collection and identification, but also to obtain quantitative information such as numbers collected per branch and per tree; spatial distribution patterns within the tree and across the block; seasonal occurrences; treatment windows; and active feeding times.

The surveys also provide biological control information. Following the 1990 survey, the potential of each predator for biological control was considered. The brown and green lacewings, and ladybird beetles were determined most likely to provide successful biological control. Biocontrol will also continue to be investigated.

In addition to the beneficial insect inventory and the biological control potential analysis, the surveys are also contributing to the eventual publication of a seed orchard insect field guide.

Green Spruce Aphid. Green spruce aphid, *Elatobium abietinum*, can cause chlorosis, needle loss, stress and mortality of spruce trees. A 1991 seed orchard survey demonstrated that they are present from mid-January to mid-June on southern Vancouver Island. To obtain information about population dynamics, climatic influence, damage progression and damage thresholds, a trial was conducted on potted spruce at the Saanich Test Nursery. Aphids were isolated on branches and regularly monitored. The number of aphids, their sizes and movements were noted. Visible damage and climatic data were also recorded. The data have yet to be analyzed.

- M. Schmidt, Silviculture Branch, Victoria

RANGE PEST MANAGEMENT

Forest and Range Vegetation Management Research. The following projects are underway:

- A review of available information and research needs for use of manual brushing in B.C. (Phil Comeau, Forest Science Research Branch);
- A review and analysis of literature and experience on sheep grazing as a vegetation management tool in temperate forests (Brian Wikeem, Forest Science Research Branch);
- Determination of nitrogen fixation by Sitka alder in the southern interior of British Columbia (Phil Comeau, Don Sachs, Forest Science Research Branch);
- Quantitative screening of the competitive effects of common coastal non-crop species (Phil Burton, University of British Columbia);
- Plant community shifts resulting from operational vegetation management treatments and their impacts on wildlife in B.C. (Brian Nyberg, Forest Science Research Branch);
- A comparison of seeding mixes applied to site prepared areas for vegetation control in the wet climatic region (Chris Thompson, Nelson Forest Region);
- Provincial strategy for monitoring impacts of vegetation management on wildlife habitat and biodiversity: a problem analysis (Brian Nyberg, Forest Science Research Branch);
- Monitoring changes in biodiversity during hardwood and vegetation management trials (Tony Hamilton, Ministry of Environment, Wildlife Branch);
- Effectiveness of repeated manual cutting for release of Engelmann spruce from mixed-shrub communities in the Revelstoke Forest District (Phil Comeau, Forest Science Research Branch).

- K. Hopkins, Forest Science Research Branch, Victoria.

Knapweed Research. Three knapweed studies are underway at the Agriculture Canada Research Station in Kamloops. They are:

- a study of the effects of diffuse and spotted knapweed competition on the survival and growth of lodgepole pine and Douglas-fir seedlings. (Brian Wikeem, Forest Science Research Branch, Allen Sturko, Integrated Resources Branch, and Jacob Boateng, Silviculture Branch).
- a study of the efficacy of biological control agents on diffuse and spotted knapweed. The objectives are to determine the relative impact of *Agapeta zoegana*, *Sphenoptera jugoslavica* and *Cyphocleonus achates* on the growth and survival of spotted and diffuse knapweed near Kamloops. The study will also attempt to determine the threshold density of each agent which results in reduced growth and survival of diffuse and spotted knapweed. (Brian Wikeem, Forest Science Research Branch, Allen Sturko, Integrated Resources Branch, and Jacob Boateng, Silviculture Branch).
- A study of the effect of different species and seeding rates of forages on forage stand dynamics and the survival and growth of lodgepole pine on a forest clearcut. (Dr. Michael Pitt, University of British Columbia, and Brian Wikeem, Forest Science Research Branch).

For further information contact the project leaders above or Kathy Hopkins at 387-7795.

- K. Hopkins, Silviculture Branch, Victoria.

Biological Control of Canada and Bull Thistles. The B.C. Ministry of Forests made one new release and had four planned releases of biocontrol agents in the Prince George Forest Region at the time of this report. One new release of *Larinus planus*, a seedhead weevil, on Canada thistle, was made in Robson Valley Forest District in the summer of 1991. Four releases of *Urophora stylata*, a seedhead fly on bull thistle, will be placed in the Robson Valley Forest District when agents arrive this fall.

Releases made in 1990 were checked for survival in the fall of 1991. The *Larinus planus* release in the Vanderhoof Forest District and the *Urophora stylata* releases in the Robson Valley Forest District all showed signs of establishment.

Further bio-control releases on both Canada and bull thistle are planned as agents become available.

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

PESTICIDES

MSMA Supply. MSMA is no longer easily obtained in British Columbia as the product standards are different than those in the United States where the product is produced. Due to relatively low use in B. C. (the bark beetle program is the only user in the Province) the manufacturer is unwilling to continue production of the Canadian product. Therefore, in the spring of 1991, supplies of MSMA were specially formulated by a Vancouver company and purchased by the Forest Service. These supplies were intended to be sufficient for a three-year period. Supplies have been depleted in one year due to expanded usage. An attempt will be made to ensure that a new supply will be available in 1992.

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

MSMA Use. A recent pesticide permit appeal in the Prince Rupert Forest Region on the intended use of MSMA for mountain pine beetle control brought to our attention significant gaps in the toxicology data available for MSMA. Further appeals could influence registration and licensing agencies to withdraw the chemical from use, thereby seriously affecting the efficiency of the bark beetle program. In an attempt to deal with this issue, the following proposals have been made:

- to commission a monograph, or detailed literature review, of North American information on toxicology and other aspects of MSMA and related organic arsenicals; and,
- to provide use guidelines which limit the application of MSMA in areas where risk of public exposure to the pesticide may be high, or in areas where other issues indicate that MSMA use would be controversial.

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

Reporting of Semiochemical Bait Use. In March, 1991, the Pesticide Management Branch of the Ministry of Environment interpreted relevant acts and regulations to mean that operational use of attractant semiochemicals (i.e. baits), other than for monitoring purposes, would require a pesticide use permit or, at least, a special use permit. The use of baits is an integral and important component of the Province's effort to manage bark beetles, especially the mountain pine beetle. Such a requirement would have a significant negative impact on the large scale management program for bark beetles in the province. In response, the Forest Service explained the existing use patterns and requested a return to the status quo, that is, no need for such permits when attractant baits are used for containment and monitoring.

This proposal was acceptable to the Pesticide Management Branch, with the proviso that a report on the level of bait use be provided at the end of each year. The Forest Service will prepare such a report. This report will provide information as to what baits have been used, the amount of baits used, and the use patterns employed. The Forest Service will also undertake to include forest industry use in this report.

It is expected that the regulatory aspects of semiochemical use will be resolved at the federal and provincial level in a few years. We also hope that the Forest Service will be involved in discussions in this matter so that our operating procedures can reflect the regulatory needs. The Forest Service will cooperate to whatever degree is required to ensure that operational programs remain cost effective, environmentally safe, and socially acceptable.

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

Video on the Carnation Creek Herbicide Study. A video which summarizes the results of the Carnation Creek Herbicide Study is currently available from Research Branch. The study, funded by the Forest Resource Development Agreement (FRDA), investigated the short-term direct impacts of a glyphosate application on stream water, vegetation, soils, and stream biota. Potential long-term indirect impacts on water quality, erosion and stream biota were also studied.

The video includes a presentation guide and was prepared for operational foresters, fisheries biologists, and resource technicians. The program will also be of interest to researchers, resource managers, and pesticide applicators. To obtain a copy of the video, contact the Research Branch Communications Assistant at 387-6719.

- I. Graeme, Silviculture Branch, Victoria.

FOREST HEALTH PERSONNEL
Forest Service Personnel fully or partly committed
to forest health related activities

Silviculture 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
Val Fletcher	Forest Health Research Forester	Victoria	356-8763
Vacant	Forest Pathologist	Victoria	387-8739
Jeff Beale	Forest Health Officer	Victoria	387-8743
Pat Humphreys	Forest Health Technician	Victoria	387-8737
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	Forest Health 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
Barry Alexander	Resource Officer Protection	Williams Lk.	398-4339
Von Vickers	Fire/Forest Health Officer	Williams Lk.	398-4690
Mel Dodge	Resource Officer Protection	100 Mi. House	398-3812
Don Wright	Forest Health Officer	100 Mi. House	395-3812

Kamloops Forest Region

Region Staff

Lorraine			
MacLauchlan	Forest Entomologist	Kamloops	828-4177
Vacant	Forest Health Forester	Kamloops	828-4176
Ron Gray	Stand Tending Forester	Kamloops	828-4163
Phil Youwe	Range Resource Agrologist	Kamloops	828-4097

District Staff

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

Nelson Forest Region

Region Staff

Rick Stewart	Forest Health 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	Forest Health Officer	Arrow	365-2131
Ross Elliott	Forest Health Officer	Boundary	442-5411
Art Krane	Forest Health Officer	Cranbrook	426-3391
Rob Beugeling	Resource Officer	Golden	344-7500
Elizabeth Williams	Forest Health Technician	Golden	344-7500
Emile Begin	Forest Health Officer	Invermere	342-4200
Doug McMullin	Forest Health 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	Forest Health Forester	Pr. George	565-6123
Les Herring	Stand Tending Forester	Pr. George	565-6191
Ken Long	Range Officer	Pr. George	565-6138
Bruce Johnson	Range Development Coordinator	Pr. George	565-6139

District Staff

Rick Grayston	Resource Officer - Protection	Dawson Creek	784-2350
Bruce Young	Resource Officer - 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	997-2249
Chris Broster	Forest Health Technician	Mackenzie	997-2249
John Bedell	Resource Officer - Protection	Ft. St. John	787-3483

Prince George Forest Region continued

District Staff

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
Bruce Doerksen	Forest Health Technician	Pr. George	565-7100
Mike Dittaro	Resource Officer-Protection	Vanderhoof	567-6363
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 Zeglen	Forest Pathologist	Smithers	847-7478
Vacant	Forest Health 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
Dave Nakashoji	Forest Health Technician	Morice	845-6200
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
Jeff Fournier	Forest Pathologist	Burnaby	660-7654
Mel Scott	Stand Tending Forester	Burnaby	660-7579

District Staff

Terry Preston	Resource Officer - Protection	Campbell Rv.	286-3282
Eric Meyer	Resource Assistant - Protection	Campbell Rv.	286-3282
John Ingram	Resource Officer - Silviculture	Campbell Rv.	286-3282
Clarence Friesen	Resource Officer - Protection	Pt. McNeill	956-4416
Chuck van Hemmen	Resource Officer - Silviculture	Pt. McNeill	956-4487
Tim Neal	Resource Assistant - Protection	Pt. McNeill	956-4416
Greg Hemphill	Resource Officer - Protection	Chilliwack	794-3361
Brenda Koro	Pest Technician - Protection	Chilliwack	794-3361
Reinhard Muller	Resource Officer - Silviculture	Duncan	746-5123
Nancy McCrea	Silv. Assistant - Silviculture	Qn. Char. Is	982-2621
Sandy McRuer	Dist. Silviculturist - Silviculture	Pt. Alberni	724-9205
Bob Pfannenschmidt	Resource Assistant - Protection	Pt. Alberni	724-9205
Dan Powell	Resource Officer - Protection	Pt. Alberni	956-4416
Nancy McCrea	Resource Assistant - Silviculture	Mid Coast	982-2621
Ron Diprose	Resource Officer - Protection	Sunshine C.	485-9831
Mark Salzl	Dist. Silviculturist - Silviculture	Qn. Char. Is.	557-8447
Rick Machowski	Resource Officer - Protection	Qn. Char. Is.	559-8447
Brian Eccles	Resource Assistant - Protection	Qn. Char. Is.	559-8447
Doug Bacala	Resource Officer - Silviculture	Squamish	898-9671

MEETINGS

Forest Health - Silviculture Integration Meeting. A very productive and informative meeting was held October 29-30, 1991, at Kamloops to discuss the integration of forest health and silviculture.

P. Ackhurst, director of Silviculture Branch, confirmed that the Forest Health Program and activities would continue to be supported, and that opportunities for expanding the program will be pursued. Forest health staff indicated several opportunities for supporting or improving the current goals of the Silviculture Program. All participants agreed that there were several opportunities for expanding both programs with forest health staff participation.

Several recommendations, such as the development of a five-year strategic plan for forest health, were made for follow-up and are being carried out.

- J. Muir, Silviculture Branch, Victoria.

Western International Forest Disease Work Conference(WIFDWC). The August 5-9, 1991 annual WIFDWC meeting was held at Silver Star Ski Lodge, near Vernon, British Columbia

Hadrian Merler, forest pathologist, Kamloops Forest Region, was in charge of local arrangements; Rich Hunt of Pacific Forestry Centre, Victoria, organized the program; and John Muir is preparing a report of the proceedings. Don Norris, forest pathologist, Nelson Forest Region, organized a pre-conference trip through the southern interior of British Columbia to demonstrate root disease-control operations and trials.

All of the B.C. Ministry of Forests regional pathologists gave presentations on their programs and priorities.

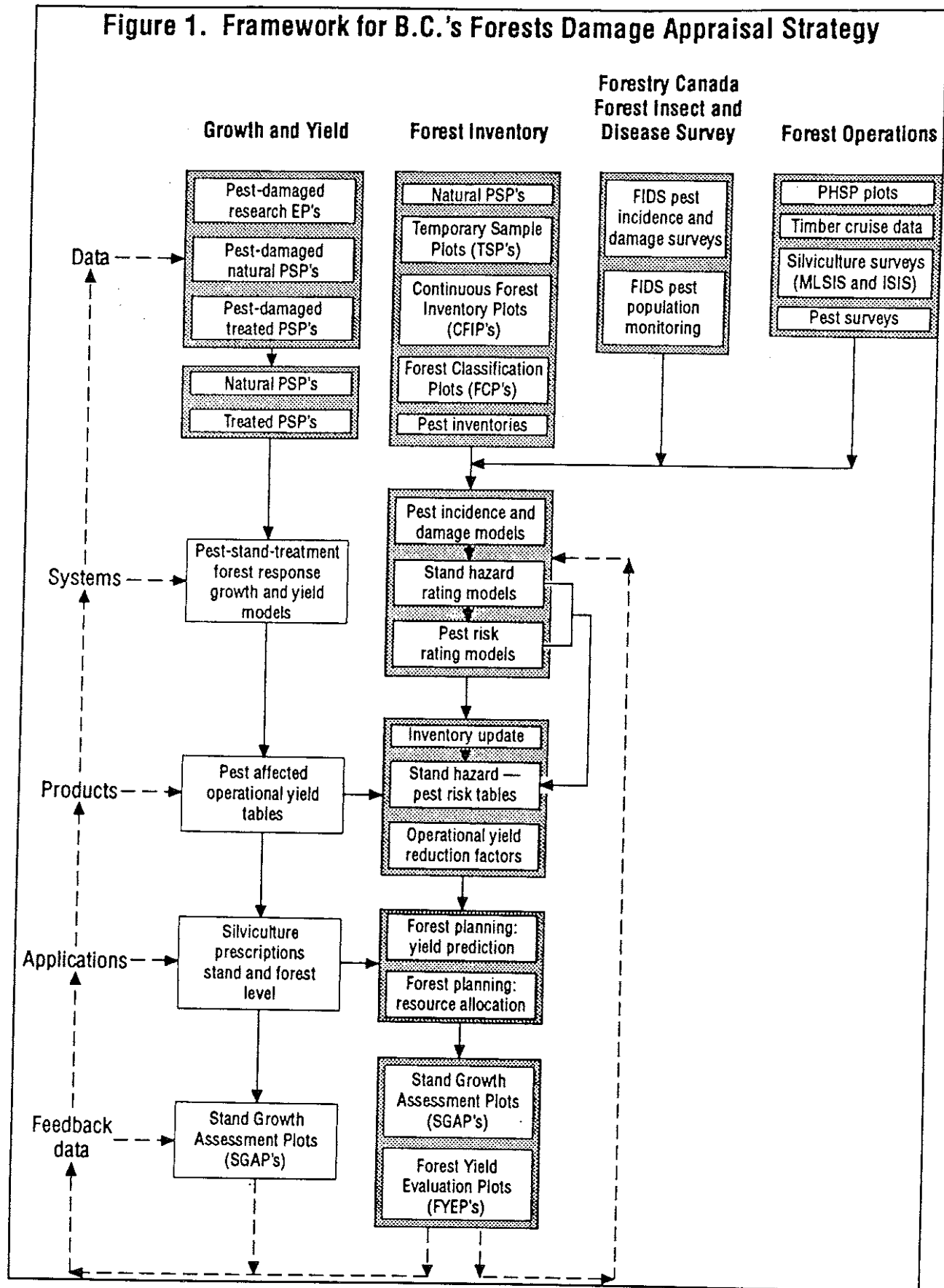
Copies of the August and previous WIFDWC conference proceedings will be available from Kenelm Russell, Forest Health, Department of Natural Resources, Olympia Washington, 98504.

- J. Muir, Silviculture Branch, Victoria.

1992 Western Forest Insect Work Conference. This annual conference will be held during the week of March 2, 1992, at the Lakeside Resort in Penticton, B. C. This conference is usually well attended by pest management/forest health researchers and practitioners from the United States and Canada. Federal, provincial, and state agencies are represented as are many universities. The 1992 conference does not have a particular theme; rather, workshops are intended to cover a wide variety of topics that should appeal to any particular interest. Contact Peter Hall, B. C. Ministry of Forests, Silviculture Branch, if further information is required. The conference program and information regarding registration is also available.

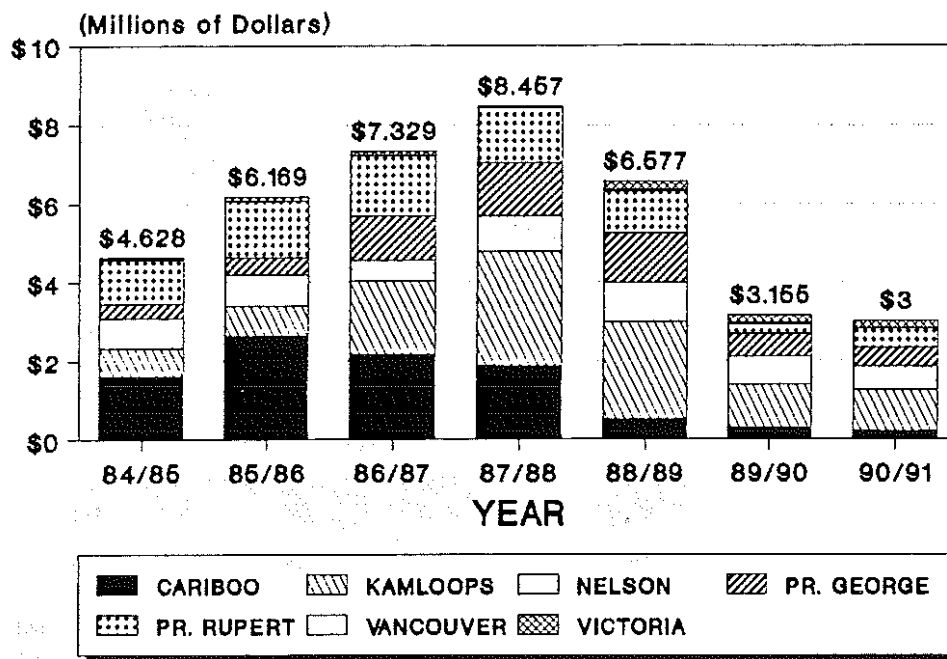
-P. M. Hall, Silviculture Branch, Victoria.

Figure 1. Framework for B.C.'s Forests Damage Appraisal Strategy



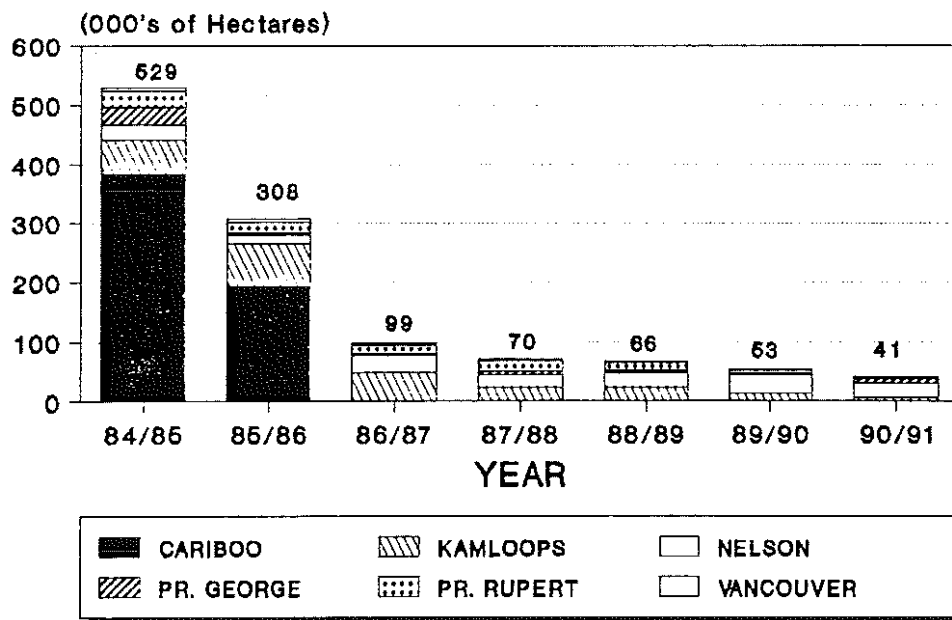
SOURCE: Iles, K., R. Alfaro, K. Mitchell et al. 1991. (Draft). A Forest Damage Appraisal Strategy for British Columbia. A Report to the Forest Productivity Councils of British Columbia by the Pest PSP Matrix Subcommittee. B.C. Ministry of Forests, Silviculture Branch. Victoria, British Columbia.

BARK BEETLE PROGRAM EXPENDITURES



Appendix I

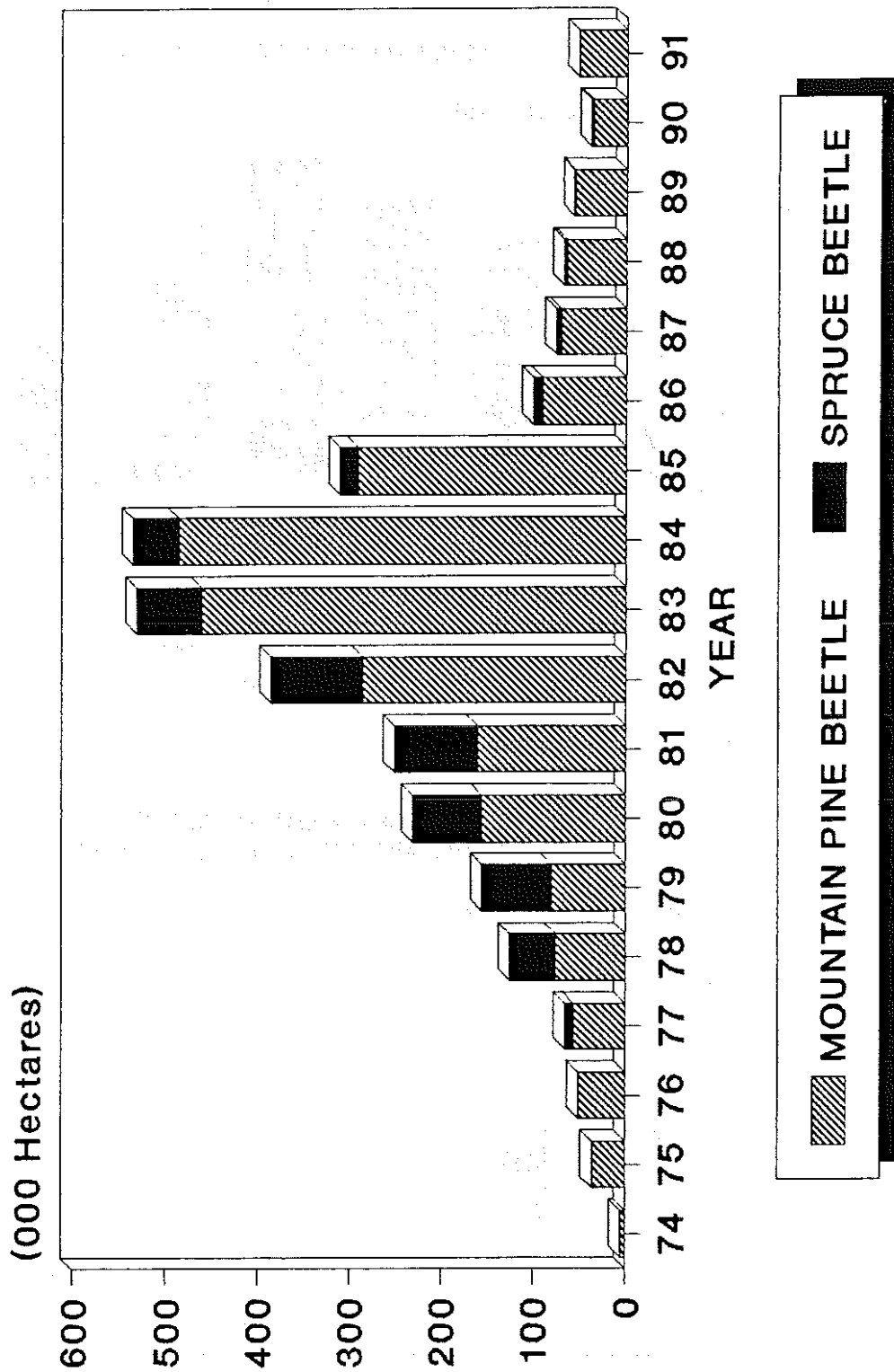
AREA UNDER ATTACK BY MOUNTAIN PINE BEETLE 1984/1991



Appendix II

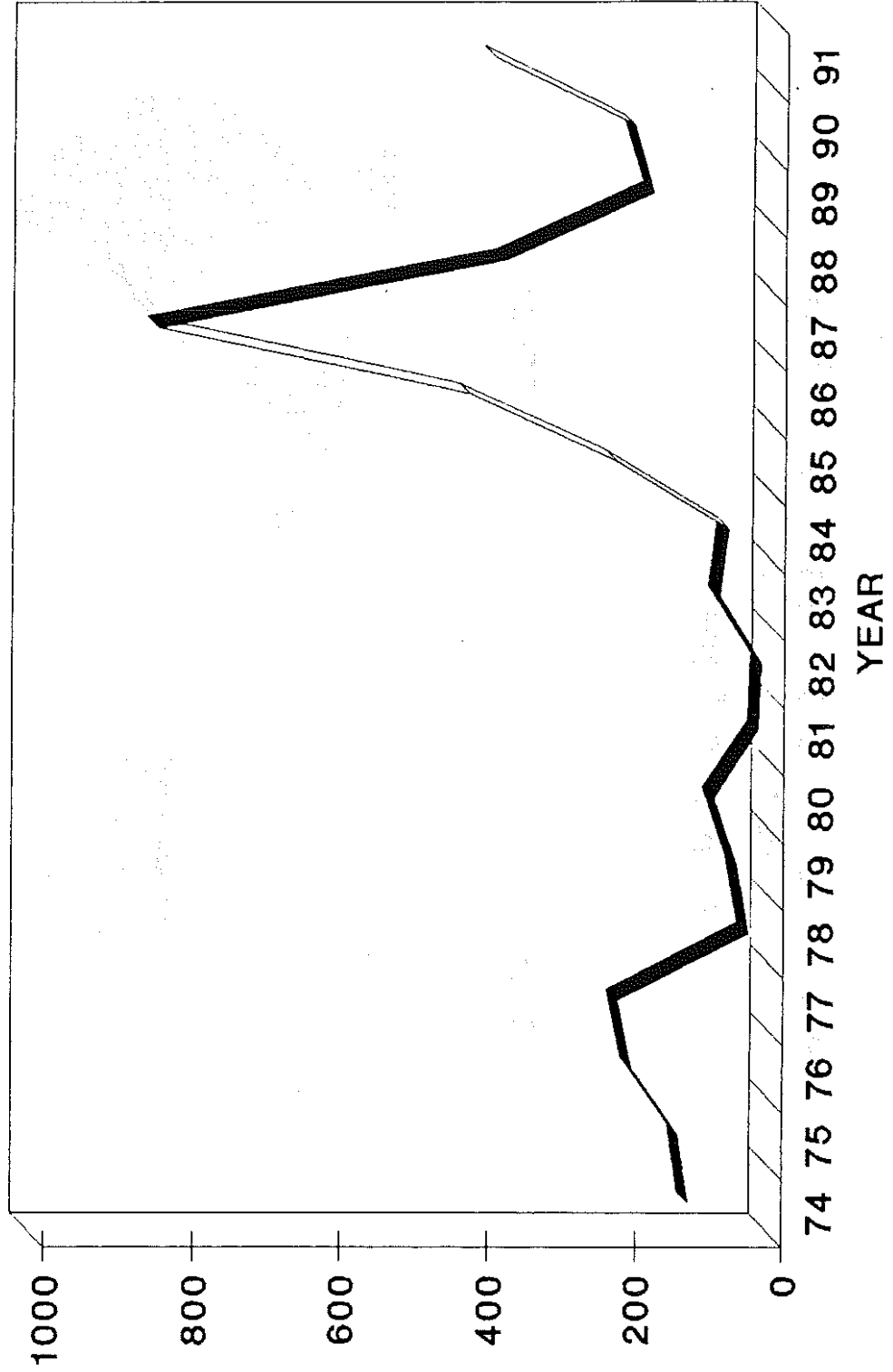
Source: B.C. Ministry of Forests, Silviculture Branch

AREA UNDER ATTACK BY BARK BEETLES 1974-1991



Source: Forestry Canada, Forest Insect & Disease Survey

**TRENDS IN VISIBLE DEFOLIATION OF DOUGLAS
FIR CAUSED BY THE WESTERN SPRUCE BUDWORM
IN BRITISH COLUMBIA (YEARS 1974-1991)**
(000 Hectares)

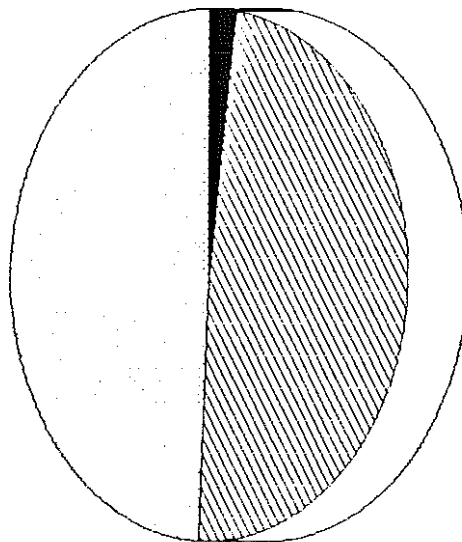


Source: Forestry Canada, Forest Insect & Disease Survey

Severity of western spruce budworm defoliation in the Kamloops Forest Region

1990

Light
92550

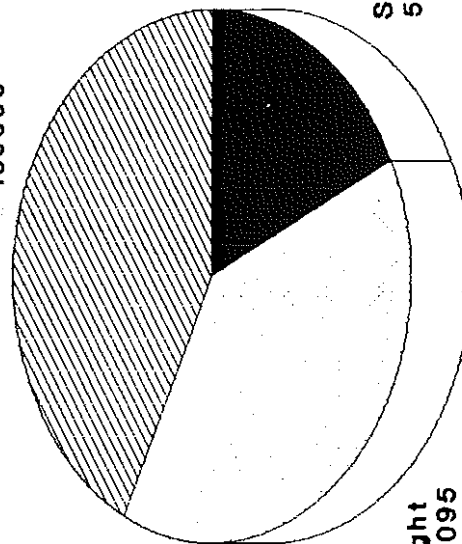


Moderate
91550

Severe
4050

1991

Moderate
139905

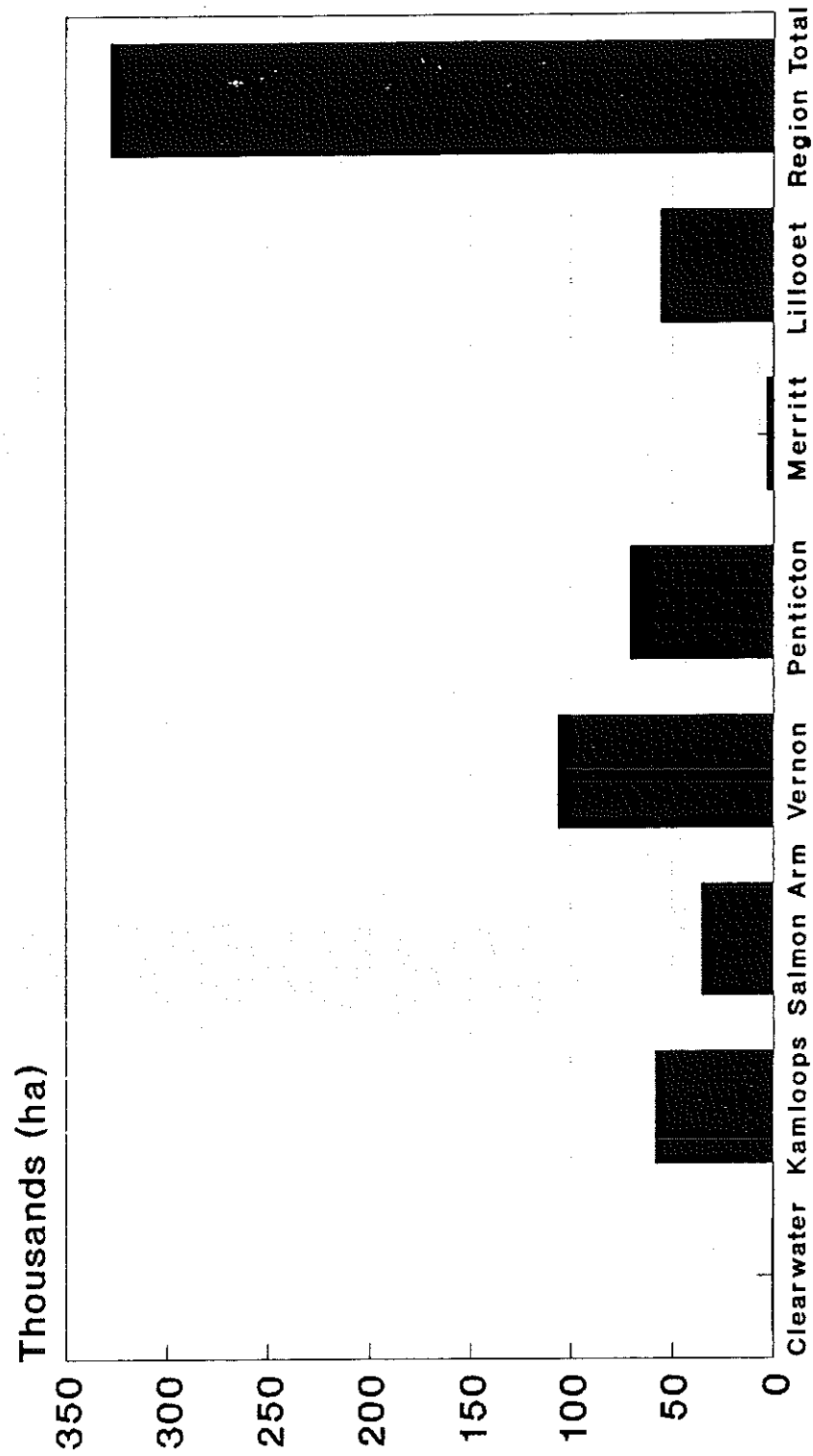


Light
129095

Severe
58565

Source: B.C. Ministry of Forests, Kamloops Forest Region

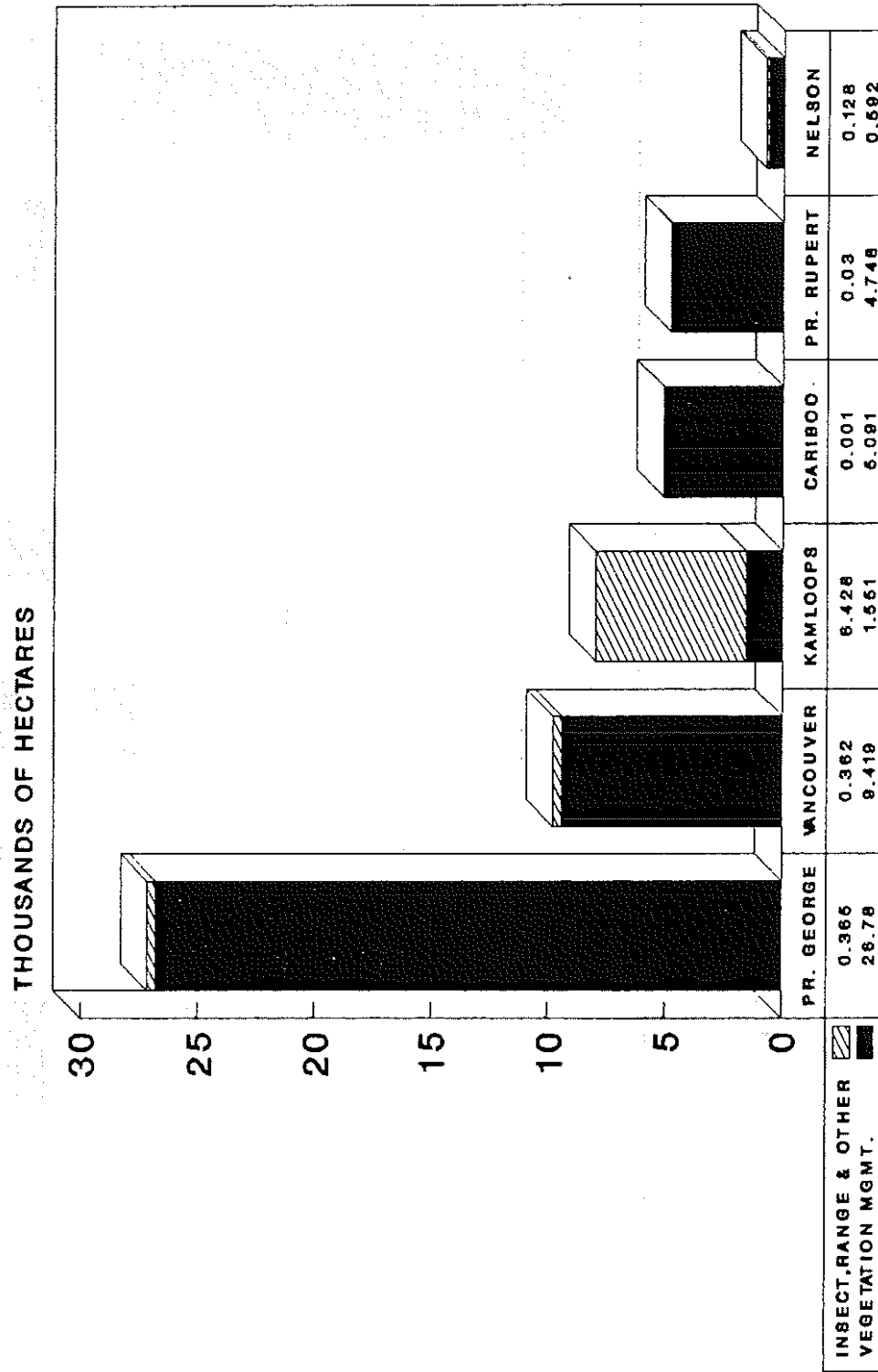
Area of western spruce budworm defoliation in 1991 **Kamloops Forest Region**



FOREST DISTRICT

Source: B.C. Ministry of Forests, Kamloops Forest Region

AREA TREATED WITH PESTICIDES¹ PROVINCIAL SUMMARY BY FOREST REGION 1990

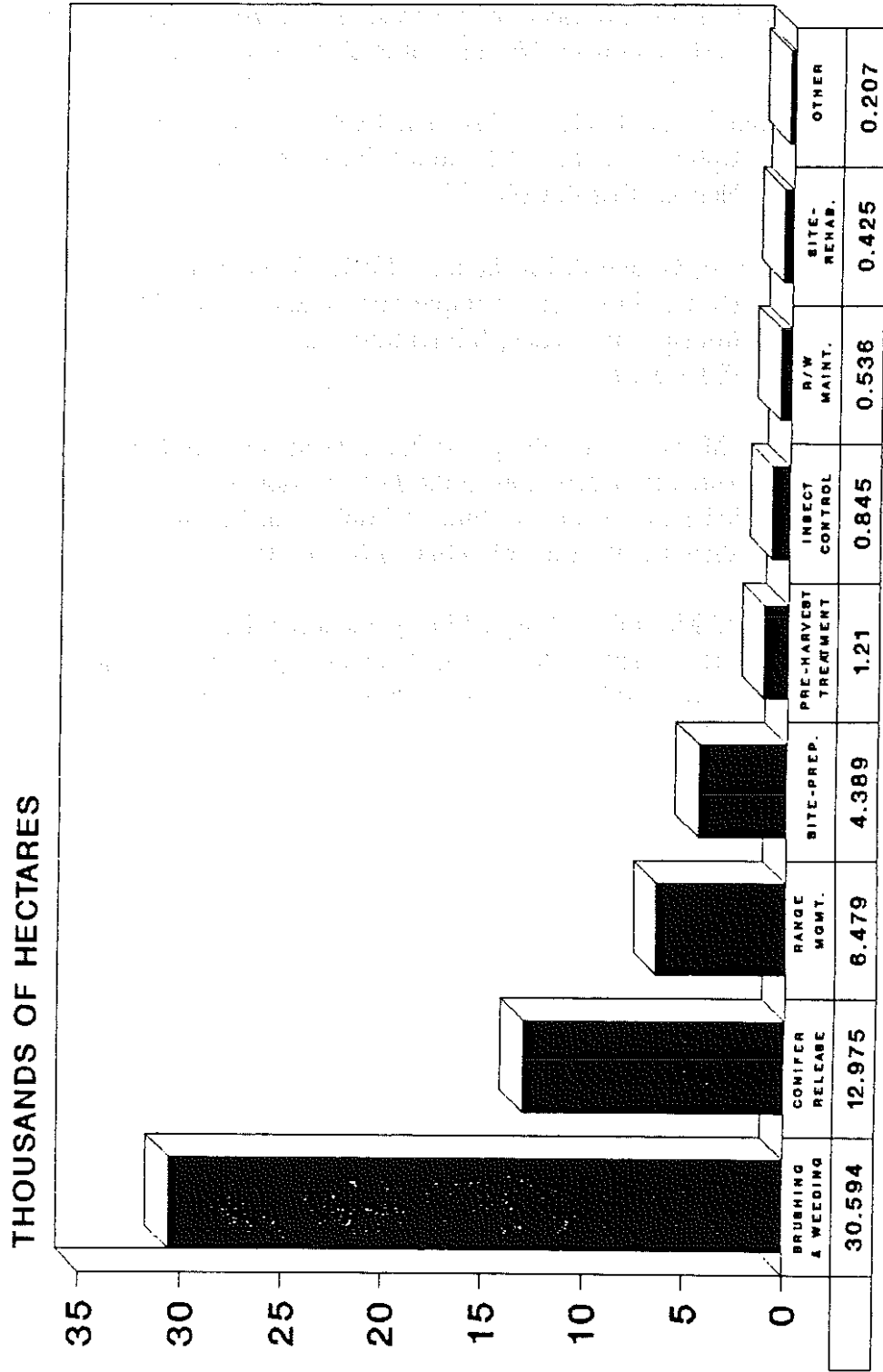


Source: B.C. Ministry of Forests &
 and B.C. Environment, Lands & Parks

REGION

¹ B.C. Forest Service & Industry Combined

PROVINCIAL SUMMARY OF AREA (ha) TREATED WITH PESTICIDES BY CONTROL PURPOSE, 1990¹



Source: B.C. Ministry of Forests
and B.C. Environment, Lands & Parks

CONTROL PURPOSE

¹ B.C. Forest Service & Industry Combined

PUBLICATIONS AND REPORTS

British Columbia Ministry of Forests. 1991. Augmenting the AAC Through Pest Treatment. Nelson Forest Region. Nelson, British Columbia.

MacKenzie, B. 1991. A Cost Benefit Analysis of Root Disease Management Options. British Columbia Ministry of Forest, Nelson Forest Region. Nelson, British Columbia.

Sutherland, G. and P. McNamee. 1991. Demonstration of a Model for Root Disease in B.C.: Example Scenarios of a Dry Site. British Columbia Ministry of Forests, Silviculture Branch. Victoria, British Columbia. PM-PB-79.

Curran, M. and J. Schulting. 1991. Development of Sampling Procedures for Three Root Diseases in the Dry-Interior, Douglas-fir Biogeoclimatic Subzone. British Columbia Ministry of Forests, Silviculture Branch. Victoria, British Columbia. PM-PB-80.

Laing and McCulloch Forest Management Services. 1991. Site Discrepancy Assessment for the Arrow Timber Supply Area. British Columbia Ministry of Forests, Silviculture Branch. Victoria, British Columbia. PM-PB-81.