



Province of
British Columbia
Ministry of Forests

FOREST HEALTH PROGRESS

A summary of forest health activities in the British
Columbia Ministry of Forests.

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ACCELERATED CHANGES AND FOREST HEALTH

Change is no longer a constant, but is accelerating even faster, especially for us in forest health.

The recent Forest Practices Code immersed all of us in a major new initiative to improve forest management. Thanks to outstanding efforts by our very experienced and expert regional, district and branch staff, forest health is very prominent in most of the code. However, we must rapidly articulate better standards and field guides to resolve forest health practices and planning issues.

Our challenge is not only to develop guidelines, but to integrate all of them within the diversity of insects and diseases, environmental conditions, forest ecosystems, and management objectives and constraints throughout the 95 million hectares of British Columbia! We no longer have the luxury of being able to defer making recommendations because we do not have enough information, or waiting for the results of another 10 to 20-year or longer research project!

Adding to current demands, are recent initiatives to reorganize the Forest Service to better address management issues at districts. Although we cannot predict the final outcome, it is certain that there will be major new opportunities to plan and implement more intensive district forest health activities, and to realize more of the benefits that we expect from forest health treatments and better practices. But we will have to work harder to meet these changes!

- J. Muir, Silviculture Branch, Victoria.

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FOREST HEALTH PROGRESS

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EDITOR'S NOTE

Forest Health Progress is a report to the Forest Health Committee of British Columbia on issues, projects and proposals by Ministry staff. Brief, informal and informative articles are welcome from all staff.

Contributions labeled with an appropriate subject heading should be submitted to the regional forest health forester, or advisor, who will edit and forward them to Silviculture Branch. Forest Health Progress is submitted to the spring (May) and winter (December) meetings of the 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.

EXECUTIVE SUMMARY

Several basic or background forest health projects are reported in this issue of Forest Health Progress including: a discussion paper on an economic analysis of forest health treatments (p. 6); a revision of forest health tables for the provincial tree species selection and stocking guidelines (p. 7); an outline of field guides being prepared for the Forest Practices Code (p. 7); definitions of ten key terms used for forest health surveys (p. 8); and proposed changes to silviculture survey forms to record forest health information (p. 10).

An update on systems development initiatives (p. 11) and forest health training activities and course developments (p. 13) are included. Recently, bark beetle identification and survey field sheets were published (p. 15); and a proposed revised list of provincial damage agent codes and conditions was circulated for approval (p. 15).

A spruce leader weevil project to determine effects of overstory shading is underway in the Cariboo and Prince George Forest Regions (p. 16); permanent sample plots were established to determine leader weevil damage (p. 17); and several projects are underway in the Kamloops region (p. 20). Multi-pest surveys were used to determine weevil hazard ratings in the Kalum and Kispiox Forest Districts (p. 22).

Sixteen projects for monitoring or control trials of insects, diseases and vegetation for tree seeds or seed orchards were continued or initiated (p. 17).

Several projects are underway for bark beetles. For spruce beetle, a benefit-cost study is underway in the Mackenzie Forest District (p. 16), and standard procedures for detection have been revised (p. 24). Helicopter logging mountain pine beetle-infested timber was tried in the Morice Forest District (p. 21). A technical audit of bark beetle management is scheduled for June, 1994, in the Cariboo Forest Region and the Williams Lake Forest District. Impacts of bark beetle outbreaks, and efficacy of treatments to reduce impacts will be determined (p. 22).

An extensive survey for balsam woolly adelgid is planned (p. 23); and a risk assessment study for gypsy moth was completed (p. 23). Agriculture Canada has undertaken several eradication projects for gypsy moth (p. 23).

An operational spray program is planned for western spruce budworm on Douglas-fir in the Kamloops Forest region (p. 20); and permanent sample plots, established to monitor damage by the insect, will be remeasured (p. 20).

For diseases, a stumping trial for tomentosus root rot is planned in the Bulkley Forest District (p. 25); and a tree failure that occurred while working in a blackstain root disease is described (p. 25).

Porcupine damage surveys were undertaken to determine impacts in the Kalum Timber Supply Area (p. 26); and a trial of plastic collars to protect cottonwood whips from voles was initiated in the Kalum Forest District (p. 26).

Two reports on monosodium methanearsonate (MSMA) used for bark beetle control were prepared (p. 27) and are being reviewed by staff in Pollution Prevention and Pesticide Management Branch, Ministry of Environment, Lands and Parks.

- J. Muir, Silviculture Branch, Victoria.

FOREST HEALTH - GENERAL

Recent activities at Silviculture Branch. Forest health staff at Silviculture Branch have been very busy with several issues and projects, and have made substantial progress in recent months.

Everyone is very busy with Forest Practices Code contents and field guides on all of the major forest insects and diseases. Forest health is a prominent subject in the new code thanks to major involvement by regional staff, especially Lorraine Maclauchlan and Stefan Zeglen.

Our forest health strategic discussion paper is almost finalized. However, recent developments in the Forest Service necessitated some major revisions. Although we do not know the final Forest Service organization that will evolve, forest health has been reaffirmed as an essential function. Regional forest health staff were recognized as the source of expert guidance and support to district staff. Forest health continues as one of the most important district issues that influences the direction of plans and activities. Our discussion paper identifies several major opportunities to protect timber and to increase future growth.

Given the new developing approaches to program funding based on district business plans, resource management plans — including forest health issues such as bark beetles — at each district will become increasingly important. Data to substantiate forest health practices and investments will become even more essential. In recent years we have been working very diligently on surveys, damage appraisals, and benefit-cost studies for insects and diseases. Results from these initiatives will be of major importance in developing more intensive forest health activities and realizing potential benefits of such activities.

A key issue for many years has been the credibility of our damage data. The magnitude of potential benefits from a forest health program are so large that they defy belief at times. However, we are fortunate that the data are largely derived from annual surveys and research results from the Canadian Forest Service. We are reviewing surveys operations with Canadian Forest Service staff and Ministry of Forests regional and district staff to determine if there are any opportunities for improvements or efficiencies in conducting surveys. Canadian Forest Service survey data are a good measure of how well we are doing in our forest health activities, particularly for bark beetle and defoliating insects, and we see more emphasis on these types of surveys in future as a measure of program outcomes or effectiveness.

Training Ministry of Forests staff in forest health has been a major activity, and thanks to Kathy Hopkins and others in the training sections, we have made excellent progress in designing and testing forest health courses and modules. We should be in an excellent position to include essential forest practices in our up-dated training sessions.

We are also seeing much more district support for training, and we should be able to achieve a major upgrade of staff expertise in forest health within one or two years. Training will also support the need to develop more extensive district forest health plans, and assist many staff to recognize and deal more effectively with forest health issues that are encountered during routine daily field work.

Research in forest health is one of the key concerns for many of us, and although the problems of encouraging or coordinating research activities are not fully resolved, we have made several significant steps forward. Recently, Canadian Forestry Service Pacific Forest Centre staff have been reviewing their programs and realigning their staff and resources. We expect significant new support to forest health research as a result. Research Branch staff, particularly George Krumlik, are taking a more prominent role in forest health research, and we anticipate more support in some of the environmental or ecosystem-related areas such as biodiversity and wildlife interrelationships with insects, diseases, and animal damage.

- J. Muir, Silviculture Branch, Victoria.

The Economic Value of Forest Health. A report on an economic analysis of all potential forest health treatments will soon be available as a publication. The publication (FS 250 HSI 93/12) is entitled *Options for Forest Health in British Columbia: An Analysis of Forest Health Treatments, A Discussion Paper*. This is the first attempt to comprehensively evaluate the economic returns that may be possible from forest health treatments. The report is being published to raise awareness of what may be available from forest health, and to solicit help in improving our methods of evaluating the benefit of potential treatments in future analyses.

Creating reasonable estimates of the financial, social and environmental value of long term forestry investments is very important to justify current expenditures. The report focuses mainly on the financial and employment values associated with forest health treatments. Environmental values were not seen to be jeopardized by the forest health treatments, however, no analysis of their value to environmental quality was considered.

The report summarizes the economic value of applying 30 different forest health treatments for reducing damage. Individual rates of return on the treatments vary from 915%, for deploying pheromone and creating trap trees for Douglas-fir bark beetles to -99%, for modifying Sitka spruce stocking plans to reduce white pine weevil damage. Overall, the package of treatments was calculated to create a 198% return on investment. Total direct employment creation as a result of these treatments was estimated to be 83,000 person years.

Copies of this report should be available soon, and we encourage you to review it and invite your comments.

- J. Henigman, Silviculture Branch, Victoria.

A Major Revision of the Forest Health Tables. In 1993, Forest Health tables were printed in the publication *Correlated Guidelines for Tree Species Selection and Stocking Standards for the Ecosystems of British Columbia*. They help foresters evaluate the impact of damaging agents in Pre-harvest Silvicultural Prescriptions (PHSP's). Although useful to foresters, these first tables are difficult to correlate between forest regions. As a result, we have conducted a review and will soon publish new tables which will more effectively summarize and standardize damage agent impacts in the province. (A draft example of a Pest Table can be found on p. 34 of The Tabulation and Graphics Section in this issue.

The new tables will provide a short list of damaging agents for each commercial tree species in biogeoclimatic subzones which we believe pose serious resource management problems. For each listed damage agent there is an estimated probability (presented as low, medium or high) of it occurring in a particular stand in a subzone. When evaluating a particular stand, a forester will know which agents could have an impact on resource management decisions (whether or not the agents are currently present in the stand). And, the forester will know the likelihood of the agent occurring on that particular site. With this information, more specifically structured walkthroughs or surveys can be planned to address the forest health concerns of the site.

This new format allows forest health specialists to more easily ensure that information for all subzones is presented consistently throughout the province. These tables summarize existing information on damage agent occurrence. Over time we will be able to add and refine information to improve the tables.

The new tables should be completed later this summer. Once completed, they will replace the existing tables in the *Correlated Guidelines* and other regional publications.

- J. Henigman, Silviculture Branch, Victoria.

Forest Practices Code Field Guides for Forest Health. A total of 14 Forest Health Field Guides will be written and published between now and October, 1995. The first field guides to be completed will cover the following topics: Root Disease (Oct./94); Mistletoes (Oct./94); Bark Beetles (Oct./94); Defoliators (Oct./94); and Weevils and Shoot Insects (tentatively Oct./94). All other field guides will be completed by October, 1995. The topics of the remaining field guides are: Rusts; Forest Health Surveys; Pests of Young Stands; Damage Appraisal/Risk Assessment; Mammals; Hardwood Issues; Decays, Foliar Diseases and other Miscellaneous Pests; Field Identification Guide; and, Glossary of Forest Health Terms also including keys; pest codes; pest tables and damage levels. If anyone would like more information on the development of these field guides, please contact Lorraine Maclauchlan, Kamloops Forest Region.

- L. Maclauchlan, Kamloops Forest Region, Kamloops.

Definitions of Forest Health Survey Terms. With all the work that has been going into the development of forest surveys, it is only natural that a set of definitions be developed and clarified to help ensure agreement on what is being measured during surveys. Definitions of the following list of terms should help ensure that we all measure damage and the abundance of damaging agents in the same way.

The terms sampling entity, population, sampling unit, incidence, severity, and intensity are defined based on the document *Report of the Forest Damage Measurement Standards Subcommittee* now accepted by the Forest Productivity Councils of British Columbia Technical Advisory Committee. The terms occurrence, risk and hazard are defined based on discussion between Val Fletcher, Jeff Beale and John Henigman, with input from regional forest health staff.

Sampling entity: an object on which a measurement is taken (normally a tree or a stand).

Population: a collection of sampling entities about which we wish to make an inference. Some examples of a population include: trees in a plantation, plots in a stand, or stands in a Biogeoclimatic Ecosystem Classification Unit (BEC) subzone.

Sampling unit: a non-overlapping collection of sampling entities from a population. Some examples of a sampling unit include: a plot, a stand, a polygon, an inventory type group, or a BEC subzone.

Incidence: the proportion (0 to 1) or percentage (0 to 100%) of damage agent affected sampling entities (normally a tree) within a sampling unit (normally a plot or a stand). To avoid confusion, the use of incidence should always be qualified with a description of the sampling entity and sampling unit. Where the proportion of damaging agent affected stands or polygons (sampling entity) is of interest in a higher level sampling unit, occurrence should be used (see the definition for **Occurrence**).

Some examples of incidence include:

- the percentage of branches (sampling entity) affected on a tree (sampling unit);
- the proportion of trees (sampling entity) affected in a plot (sampling unit);
- the percentage of plots (sampling entity) affected within a stand (sampling unit).

Occurrence: the proportion of damaging agent affected stands or polygons within a higher level sampling unit (e.g. inventory or growth type groups, or BEC zones, subzones or variants). Occurrence may be expressed as a proportion or percent. Where the proportion or percent of damaging agent affected trees (sampling entity) in the sampling unit is of interest, please use incidence (see the definition for **Incidence**).

Some examples of occurrence include:

- a stand (sampling entity) has the damaging agent in the inventory type group (sampling unit);
- 80% of pure spruce stands (sampling entities) have a damaging agent in an inventory type group (sampling unit); and
- 20% of the stands (sampling entity) have the damaging agent in the BEC subzone (sampling unit).

Severity: the quantity of damage or the quantity of a damaging agent affecting sample entities within a sampling unit. It is a damage rating measure (an average) that considers only affected entities and is damage type or agent specific. Severity cannot be applied at the stand level, and intensity, growth/yield effects or impacts should be applied at the stand or higher levels.

Some examples of severity are:

- a 20% defoliation of a branch (sampling entity) in a tree (sampling unit);
- a class 6 dwarf mistletoe infection (using the Hawksworth six point scale) for a tree (sampling entity) in a plot (sampling unit);
- a tree (sampling entity) is dead in a plantation (sampling unit); or
- trees (sampling entities) have a "severity code" of 4 in a stand (sampling unit).

Intensity: a general characterization of the total amount of a damage within a specific population which is a function (not necessarily arithmetic) of incidence and severity. Growth quality and mortality are positively related to intensity. One must quantitatively determine both incidence and severity and know their relationship in order to calculate intensity.

Hazard: the degree to which the characteristics of the sampling entity (usually a tree or a stand) make it vulnerable to damage. It is equivalent to susceptibility.

Risk: is the probability and expected severity of sampling entity damage. Risk is a function of numerous components including sampling entity hazard, sampling unit conditions, proximity to damaging agents and the incidence of those agents.

Susceptibility: an equivalent term to hazard (see **Hazard**).

- J. Henigman, Silviculture Branch, Victoria.

Changes Proposed to the Silviculture Surveys Forms to Record Forest Health Information. Three Ministry of Forests field card forms (F.S. 657, 658 and 659) will soon be altered to allow forest health data taken by silviculture surveyors to be recorded. This information is used to help make decisions about the need for and type of silviculture treatments to be applied to all young stands managed by the Ministry. Forest companies may not use the Ministry forms, but can be expected to follow the lead of the Ministry and alter their own forms.

The important changes will likely occur to the Silviculture Survey Plot card (F.S. 658) and the Silviculture Survey Summary card (F.S. 659). It is proposed that the three letter codes of damaging agents identified per plot, and the number of live and dead trees affected by each damaging agent be recorded on the Plot card. Information on the Plot cards is totaled and summarized on the Summary card. The calculation on the Summary card for each identified damaging agent, will be the incidence of the damaging agents in the stand, both for hosts and for all tree species in the stand. Host incidence information, will indicate how prevalent the damage agent is on the hosts; and total tree incidence information will help determine the importance of the affected trees to the stand. Draft copies of the revised Silviculture Surveys forms are presented on pages 35-40 of The Tabulations and Graphics Section.

All summarized data, other than comments, will be stored in the Integrated Silviculture Information System (ISIS). As a result, over a period of years a very large data base will be created on the status of forest health in young forest stands. This information will allow us to further evaluate the significance of forest health treatments in developing more valuable forest stands. The integration of forest health information with other silvicultural information in ISIS will result in more comprehensive forest management.

- J. Henigman, Silviculture Branch, Victoria.

Systems Development Update - ISIS and Forest Health. At the November, 1993 provincial Forest Health meeting, a summary of the information systems development plan prepared by LGS Group Inc. was presented by Ed Hoffman, LGS and Val Fletcher, Ministry of Forests.

Since that time Val has been on secondment to Timber Supply Section (Inventory Branch) and we have been unable to fill his position. However, some important groundwork has been accomplished, within the framework of the LGS plan, regarding the project Damage Agent Tracking/Mapview and it's integration with ISIS Phase II.

The release of the first phase of ISIS Phase I will be complete as of this April. The original scope of ISIS included two major releases. Release I was to build the foundation for a silviculture application to replace the History Record system. Release II will consist of additional components (including some related to Forest Health), to facilitate the management and operation of the Silviculture Program and its strong relationship to the Forest Practices Code.

There are two Forest Health systems projects (from the LGS plan) identified as components of the next three years of ISIS Phase II development. These are Project Management and Forest Health Survey, which ties in closely with Damage Agent Tracking/Mapview.

Damage Agent Tracking/Mapview was envisioned in the original LGS plan as a system that would capture spatial and text information about the location and area affected by a damaging agent - i.e. to capture damage agent occurrence and allow this to be mapped.

As the data captured by Damage Agent Tracking would be shared throughout the Silviculture Program, its features and functions would need to be standardized and administered throughout the province, and it would be tightly bound with ISIS through damage agent occurrence and affected area.

During this winter, as a first step in this initiative, and partly in preparation for ISIS Phase II, the ISIS logical data model was updated to include a subject area which identifies and describes the information which is used in the business functions surrounding the tracking of pest occurrence. To create this we had to describe, in a general way for the present, the process of how Forest Health tracks pest occurrence and the information that needs to be gathered in order to track it (i.e. damage agent, size of affected area, location of affected area, etc.). This work will lead to the incorporation of new a type of Forest Health Opening to address the problem of damaging agents that are tracked in mature stands.

Also, as part of the current ISIS GIS (Mapview) initiatives and the Forest Health business requirement to map damage agent occurrence already being recorded by other organizations, a small project involving ISIS GIS forester, Norm Helewa, and the Canadian Forestry Service, Forest Insect and Disease Survey Unit (FIDS) has been

underway to find a way to translate FIDS (ARCINFO) survey maps into a format such that they can be viewed in Mapview. FIDS has determined that their regular translator can be used. Norm will be providing Timberline Forest Inventory Consultants with FIDS files to translate, and will then assess the quality of the translated FIDS files with Mapview. Following the assessment of the translated files, we will examine the feasibility of establishing a more formal mechanism, such as the Canadian Forestry Service or Timberline carrying out the translation on a regular basis.

The LGS plan system called Project Management was an application intended to help Forest Health staff, particularly at the district level, organize, schedule and manage their operational projects/contracts on a day to day basis.

This system had been identified through interviews and surveys as one of the tools most desired by Forest Health staff. During 1991 and 1992, (which was also the period when we began to integrate with the Silviculture Program and ISIS), detailed requirements and an attempt to develop a prototype, using the PC based software called Microsoft Project, was completed. Unfortunately our prototype efforts were confounded by the instability of the software at that time.

Once we have a better understanding of what the current ISIS Phase I Project Management component and what ISIS Phase II Project Management (which plans to enhance the existing project management component to produce, among other things, contract schedules), will be able to do for us, and how that compares to our original requirements, we will be in a better position to determine if we need to pursue the original prototype. If this seems feasible, we will also first solicit some feedback from the regions and districts as to whether they would still like to have a customized Project Management software made available to them.

Also included in ISIS Phase II plans is the project, Forest Health Survey. This application was to allow the capture of detailed specific Forest Health survey data, so that schedules and decisions can be made by Forest Health field staff. This application would build upon Damage Agent Tracking and roll-up information to it.

At the present time it is clear that in order to proceed with systems development, Forest Health needs to do some essential groundwork in order to stabilize its business and define, in a much more exact and provincially standardized way, our unique surveys and treatments. This provincial consensus will involve a lot of communication and formal agreement within the program.

Some of this work is already underway, with the current revisions to existing Silviculture Surveys forms (see John Henigman's article entitled *Changes Proposed to the Silviculture Surveys Forms to Record Forest Health*).

- P. Humphreys, Silviculture Branch, Victoria.

Forest Health Training is Gaining. Development of Forest Health training courses for several key topics and audiences, identified in the Training Strategic Plan is proceeding at a rapid pace. The following is an update on these initiatives:

Forest Health Training for People Producing PHSP's: This course was initially piloted in Powell River on March 3, 1994. As a result of much valuable participation and feedback, a draft course package is now complete and ready for an operational pilot in Invermere, May 5th and 6th. The course package includes sections on forestry activities which exacerbate forest health problems; treatment options and their limitations; and the impacts of treatments on non-timber resources (among others).

At the present, this course deals primarily with prescriptions for conventional clearcuts, but may be enhanced in the future to address forest health considerations in alternative silviculture systems.

Forest Health Training for Silviculture Surveyors: Draft course materials have been developed for this course, in conjunction with Forest Health for People Producing PHSP's, by Laing and McCulloch Forest Management Services. This will be one of six modules designed to prepare people to be accredited as silviculture surveyors, in a new accreditation process being developed by Mike Pedersen, Branch silviculture surveys specialist. Other modules will include eco-classification, basic silviculture surveys, vegetation management, and reforestation recommendations.

There will be an exam at the end of each of the Forest Health modules, but the real test for overall accreditation will be at the end of the process. People will be able to challenge the final accreditation exam, for a fee, but if they fail one portion (e.g. forest health), accreditation will not be granted.

The operational pilot of this course will take place in conjunction with the PHSP course in Invermere, May 2-4, 1994.

The Invermere operational pilot should yield new refinements to both courses. Further revisions will be made by Laing and McCulloch. Also, we will be contracting Joan Holt of EntoPath Management to co-facilitate the two courses, and to prepare her as an instructor for possible future delivery.

Planning and Implementing a District Forest Health Program: On April 19-21, the two northern forest regions, Prince George and Prince Rupert, delivered a specially tailored version of this course to district representatives. This course is intended to provide district forest health specialists with the information and skills that they need to plan and implement a district Forest Health program. The course contains specifics on how to manage various damage agents, including a strong bark beetle section.

Root Disease Training: The original package, piloted in Nelson Forest Region last fall, is undergoing revision and expansion to incorporate other root diseases, including tomentosus. A pilot of the revised package is tentatively planned to take place in the Cariboo Forest Region in late May or early June, 1994.

Forest Health for Stand Tenders: Cariboo Forest Region has produced a Forest Health for Stand Tenders training package for forest workers, and this is being used as the basis for a provincial package which is still under development. We hope to have a first draft for review by July of this year.

Stand Tending training for the professional and technical audience who make prescription recommendations and supervise treatments was rolled into the Forest Health for Silviculture Surveyors package.

Forest Health Training Strategy: A final draft of the training strategy, incorporating review comments received from regional and district staff is now available.

Bill Atkinson of Draaken Science Communications, has completed the first draft of an implementation plan for the training strategy. This document contains several recommendations on the many possible training tools that we could use to more effectively deliver our courses. Copies are available for comments and review from the undersigned.

Other: During the provincial Forest Health Specialists meeting, held on April 12th and 13th, 1994, a training need was identified regarding maintaining forest health in mixed stands. We will be investigating this and pursuing its incorporation into the Forest Health training strategy.

The four or five Forest Health Forest Practices Code field guides, which are scheduled for completion this fall will have associated training needs. We will be working together with the field guide working groups on how best to do this as the project unfolds.

For more information, please contact the undersigned.

- P. Humphreys and K. Hopkins, Silviculture Branch, Victoria.

Bark Beetles of British Columbia Field Identification Sheets. Two sets of waterproof identification field sheets on the bark beetles of British Columbia are now available from Silviculture Branch, Training and Extension. One set, entitled *Bark Beetles of British Columbia*, provides a short description of the insect and damage symptoms, damage, tree species attacked, and distribution, plus a full page of color photographs. The format is identical to that used in the *Field Guide to Pests of Managed Forests in British Columbia*. The other set contains brief descriptions of signs and symptoms and life-cycle plus clear black and white sketches of the most characteristic features of each species, including adult, larva and egg gallery configurations and the location of pitch tubes on the tree.

Both sets are intended for use in bark beetle training for surveys and field identification.

- P. Humphreys, Silviculture Branch, Victoria.

New Provincial Standard Damage Agent and Condition Codes. A revised list of provincial Damage Agent and Condition Codes has been sent out for official approval from all Silviculture Branch Managers, Regional Managers, the Directors of Research, Integrated Planning and Inventory Branches, as well as the Secretariat of the Forest Productivity Councils.

The list has been updated, as a result of several years of field usage and recommendations from regional specialists and specialists from other branches.

The new list will become part of the corporate database and will be used across the Ministry, e.g. in Forest Inventory, Growth and Yield, Nursery, Cone and Seed and Silviculture Surveys (PHSP to Stand Tending, as well as special Forest Health surveys).

Each damage agent has two separate codes, a three-letter field code and a seven-letter species or condition code. For agents that have scientific names, the seven-letter code consists of the first four letters of the genus name, followed by the first three letters of the species name. These seven-letter codes will be used by Inventory, Growth and Yield corporate database and are not relevant to Silviculture surveys at this time.

Based on further input by regional specialists, a subset of this list will become the revised version of the current Silviculture Surveys Damage and Condition Codes reference form (FS 747).

- P. Humphreys and J. Beale, Silviculture Branch, Victoria.

FOREST INSECTS

Spruce Beetle Benefit Cost Analysis in the Mackenzie Timber Supply Area. In 1994, a project was initiated in this Timber Supply Area to analyze the social, economic and environmental costs and benefits of different management options. Two different drainages have been selected for analysis, each in a sensitive wildlife and fisheries area. The management scenarios that have been selected for analysis include:

1. Beetle management under the current Integrated Resource Management (IRM) guidelines;
2. Beetle management under the IRM constraints found in the Interior Fish Forestry Guidelines; and
3. A management regime that represents a compromise of the first two.

This contract will also identify any critical age class imbalances that occur in the timber profile and when they will occur, i.e. non-salvageable losses from pests like beetles traditionally result in earlier timber fall downs than would normally occur.

The project is also expected to determine how the TSA's existing incremental silviculture program can address, (i.e. usually through spacing), any fall down that occurs.

This project is still in progress and further details can be obtained from S. Taylor.

- S. Taylor, Prince George Forest Region, and
W. Arthur, Ministry of Environment, Prince George.

Effects of Overstory Shading on White Pine (Spruce) Weevil Damage to Interior White Spruce and its Effects on Spruce Growth Rates. A retrospective study was conducted in 1993 which quantified the effects of overstory shading on both white pine (spruce) weevil and leader growth on interior white spruce. The study was undertaken in the Prince George and Cariboo Forest Regions of British Columbia, where the weevils were causing extensive damage to plantations of interior white spruce. Shading on the spruce trees was measured by calculating the Light Interception Index and percent overstory cover on individual white spruce trees at the centre of a 2.52 metre radius plot. Current weevil attacks decreased significantly with increasing overstory cover and the rate of decrease was greater in heavily versus lightly attacked stands. Shading also decreased leader growth. These results indicate that the optimum level of overstory removal may be a compromise between volume loss due to overstory competition and volume gain due to decreased weevil attacks. Several management recommendations were presented regarding weevil control in areas of heavy brush and high weevil hazard.

The critical question regarding the tradeoff between reduced spruce growth and decreased damage from the weevil, hopefully will be answered this summer by Dr. Alfaro's work. Individuals interested in more details on this work should contact S. Taylor, Prince George Forest Region.

- S. Taylor and C. DeLong, Prince George Forest Region, Prince George, L. Rankin, Cariboo Forest Region, Williams Lake, and Dr. R. Alfaro, Pacific Forest Centre, Victoria.

Permanent Plots to Monitor White Pine (Spruce) Weevil Damage in the Susceptible Subzones in the Prince George Forest Region. A cooperative project between the Ministry of Forests and the Canadian Forest Service was initiated in 1993 to monitor the incidence of white pine (spruce) weevil in the susceptible biogeoclimatic subzones of the Prince George Forest Region. Fifteen permanent plots have been located in eight different subzones and an additional four sites will be established in 1994. All plots will be measured annually by Canadian Forestry Service to obtain information on pest incidence and how it fluctuates over time. Long term data on pest incidence will undoubtedly be important in assessing control options for the various subzones. A report of the results from 1993 is available from Nick Humphreys at Pacific Forestry Centre.

- S. Taylor, Prince George Forest Region, Prince George, and N. Humphreys, Pacific Forestry Centre, Victoria.

Seed Pest Management Report, Spring 1994. At the time of this writing (early April) our field season has been underway for over two months with our regular monitoring of late winter/early spring orchard insects (larch cone, balsam and hemlock woolly aphids; green spruce aphid; and redcedar cone midge) and the set-up and monitoring of new and continuing pest management trials. After the relatively pest-free year and bumper cone crops of 1993, initial indications are for reduced crops and higher proportions of cone and seed insects in 1994.

Those involved in natural stand cone collection are reminded that the Seed Pest Management lab is always available for consultation and will perform pest analysis and monitoring of any natural stand cone crop destined for Tree Seed Centre processing.

Current monitoring and trials:

Green Spruce Aphid, *Elatobium abietinum*. To date, one Engelmann and two Sitka spruce orchards have required treatment for green spruce aphid in 1994. Diazinon successfully reduced the Engelmann spruce aphid population to a very low level. As of early April, two applications of insecticidal soap had reduced high populations in the Sitka spruce to moderate levels. Other coastal spruce orchards had low to very low populations (see project reports below):

Balsam Woolly Adelgid, *Adelges piceae*. Populations of balsam woolly adelgid increased in amabilis fir orchards in late 1993 after a period of relative quiescence. Orchard applications of insecticidal soap have adequately contained this build-up.

Larch Cone Woolly Aphid, *Adelges lariciatus*. Populations of this adelgid continue to build in western larch orchards at Kalamalka. It was also common in natural stand larch cone collections in British Columbia in 1993.

Hemlock Woolly Aphid, *Adelges tsugae*. In spite of research indicating this insect should be very easy to control, the hemlock adelgid is a persistent problem at some orchard sites. We believe this is related to fertilizer regimes.

Other Gall/Woolly Aphids, *Adelges spp.*, *Pineus spp.* Initial indications are that 1994 will be another quiet year for adelgids in spruce orchards.

Redcedar Cone Midge, *Mayetiola thujae*. After a quiet year in 1993, redcedar cone midge is back in 1994 with a vengeance on the Saanich Peninsula. This is in spite of considerable effort expended in the removal of all old cones (overwintering sites for midge pupae) from redcedar orchard trees. By early April one orchard had 98% infestation of surveyed conelets, with up to 50 midge eggs on one conelet. Infestations in other orchards ranged from over 20% to nearly 80% of conelets. One exception was the container redcedar greenhouse orchard at Yellow Point, which was virtually uninfested.

New and continuing projects:

Spruce Cone Rust, *Chrysomyxa pirolata*. There were low levels of spruce cone rust in 1993 in both orchard and natural stand cone crops. Still, we have some trial data indicating that our low toxicity, user friendly alternative, metiram (presently registered for use on apples) was as, or more effective than the currently used compound, ferbam. No adverse effect was noted on seed production or germination. This trial will be repeated this spring.

Fir Coneworm, *Dioryctria abietivorella*. Although hampered by a low year for coneworms in 1993, the second year of this Green Plan assisted project is well underway. With cooperation from the Canadian Forest Service (Sault Ste. Marie), and especially Simon Fraser University, this year we hope to pinpoint the sex pheromone of the western population of this moth. We are also looking at the basic morphology of adults from lab colonies and wild collections.

Hemlock Woolly Aphid, *Adelges tsugae*. Data from our 1993 trial work showed that the growth regulating hormone, kinoprene, may have a detrimental effect on the development of this adelgid in the field. This trial was hampered by the prolonged cool wet spring of 1993, which resulted in an extended hatching/dispersal period for the nymphs. This trial will be repeated, in conjunction with other control options, in spring, 1994. See also Effects of Fertilizers below.

Larch Cone Woolly Aphid, *Adelges lariciatus*. Trials examining the effects of soap, diazinon, and an EC formulation of azadirachtin (neem seed extract) on this adelgid, and effects of the adelgid on seed production, have been initiated this spring at Kalamalka following two years of population monitoring. Set-up and monitoring of the neem aspect of this and other trials reported below are being handled by Phero Tech.

Green Spruce Aphid, *Elatobium abietinum*. A trial examining the effect of azadirachtin on green spruce aphid has been carried out in the Engelmann spruce orchard at Cobble Hill. Phero Tech is currently analyzing the results.

Redcedar Cone Midge, *Mayetiola thujae*. Making the best of a superfluity of cone midges, we are running a trial in a heavily infested redcedar orchard. Presently a 1-2% active ingredient solution of the currently registered and highly toxic compound oxydemeton-methyl (Metasystox®) is recommended. We will test the 1987 findings of Summers and Crowder of effective control with 0.5% active ingredient.

Interior Spruce Foliage and Cone and Seed Insects. In April, a trial was set up at Skimikin to look at the effect of azadirachtin on interior spruce insects (gall aphids, *Strobilomyia* cone borers, *Dioryctria* coneworms, *Choristoneura* budworms).

Effects of Seed Orchard Fertilizer Regimes on Sucking Insect Biology and Their Control. There is considerable evidence to show that fertilizers, when applied to forest trees already suffering from insect infestations, benefit the insects and not the trees. For instance, nitrogen fertilization of eastern hemlock (*Tsuga canadensis*) infested with hemlock woolly aphid (*Adelges tsugae*) results in doubled fecundity of the insect, no absorption of nitrogen by the tree, and negation of any pest control measures! (We believe this to be the reason we have persistent adelgid problems in some hemlock orchards in British Columbia.) A literature search is underway to lay the groundwork for trials planned to examine the effects of British Columbia seed orchard fertilizer regimes on sucking insects (aphids, woolly aphids, *Leptoglossus*).

Vegetation Management. We are hoping to initiate a trial this year to test a Dow-Elanco soap product, Spectrum®, as a new vegetation management tool in seed orchards.

Cone and Seed Entomofauna Inventory. We are cooperating with a Canadian Forest Service (Sault Ste. Marie) initiative to inventory Canadian cone and seed insects. This year we will try to provide cones and/or extract insects from natural stand cones and seeds of western and mountain hemlock, true firs, yellow cedar, and black spruce.

- R. Bennett, Silviculture Branch, Victoria.

Spruce Budworm Permanent Sample Plots. The 31 permanent sample plots established in 1987 to monitor damage caused by the western spruce budworm, were remeasured this fall/winter. Approximately 462 increment core samples were collected from selected trees in these plots and growth was measured. A cooperative education student from the University of Victoria, Craig Mistal, did the preliminary analysis of the data.

A copy of Craig's work term report can be obtained from the Kamloops Forest Region and additional reports will be made available as analysis progresses.

- L. Maclauchlan, Kamloops Forest Region, Kamloops.

Defoliator Spray Programs in the Kamloops Region. Fall and winter egg mass surveys throughout the Kamloops area have indicated that the Douglas-fir tussock moth population will decrease significantly in 1994. Very few locations had new egg masses, and those areas are predicted to suffer only light to moderate defoliation. It is anticipated that there will be small, isolated patches of defoliation in areas which were not located by our pheromone monitoring and subsequent egg mass sampling. No control programs using NPV are anticipated for 1994 at this time.

Although the area under attack by the western spruce budworm is declining, due to both natural and management tactics, there is still a significant area of Interior Douglas-fir forest which will be suffering moderate to severe levels of defoliation in 1994. Another spray program is planned for 1994, using Foray 48B® (*B.t.k.*). Approximately 13 800-20 800 ha will be treated in locations within the Kamloops, Merritt and Lillooet Forest Districts. Areas within the Vernon Forest District will be monitored closely this spring to determine if there are areas still requiring treatment. Riverside Forest Products will be treating about 1 000 ha of forest within their Timber Forest License, also using Foray 48B.

The western hemlock looper has declined substantially in the Clearwater Forest District, with small patches still active in the Vernon and Salmon Arm Forest Districts. The Kamloops Forest Region will be assisting Nelson Forest Region in a follow-up trial against the hemlock looper using *B.t.k.* The trial will be done in the Revelstoke Forest District.

- L. Maclauchlan, Kamloops Forest Region, Kamloops.

Weevils, Weevils, Weevils. As a result of an excellent workshop held this past January, many weevil-related projects have been continued or initiated this year. Briefly, the projects underway in the Kamloops Forest Region this summer are as follows:

1. Isolation, and testing of the components of a potential oviposition marker pheromone for *Pissodes terminalis*.
2. Bioassays to determine the employment of an oviposition marker pheromone by *Pissodes strobi*.
3. Interspecific responses of *Pissodes strobi* and *Pissodes schwarzi*, using baited pitfall traps.
4. Efficacy of Neem (active ingredient azadirachtin) on the spruce weevil *Pissodes strobi*. Neem will be applied as a spray to the terminal shoots, and weevils will be caged on the terminals.
5. Pest Incidence Surveys in immature spruce stands, and hazard rating of stands.

Summaries of the above projects will be in the winter issue of Forest Health Progress.

- L. Maclauchlan, Kamloops Forest Region, Kamloops.

Insect Displays. Due to the high use of the insect display made for the Regional Office by F.I.D.S. (Forest Insect and Disease Surveys, Canadian Forest Service), and numerous requests from the Districts for similar displays of their own, one of the cooperative education students hired this summer will collect and assemble displays for one or two districts.

- L. Maclauchlan, Kamloops Forest Region, Kamloops.

Helicopter Logging in the Morice Forest District. Helicopter logging to salvage and sanitize mountain pine beetle infested timber was tried in the Morice Forest District this winter. Unlike other helicopter brood removal projects performed throughout British Columbia, the Morice Forest District treated the harvesting as a Timber Sale and consequently did not subsidize it. The perceived benefits were a reduction in staff time required to set up and monitor the contract and a reduction of cost to the forest district's bark beetle program. Some problems were encountered with the contractor not removing all of the infested timber because of its scattered distribution. Mountain pine beetle infestations in the forest district tend to be found in numerous small patches that are distributed throughout a timber type. These infestations are difficult to harvest efficiently using helicopters.

A "post-mortem" meeting will be held in May to discuss the future of heli-logging for bark beetles in the Prince Rupert Forest Region. Please contact Tim Ebata, 847-7479 or Paul Hatcher, Small Business Forest Enterprise Program forester, Morice Forest District, 845-6200 for more information.

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

Multi-Pest Surveys Used to Ground Truth White Pine (Spruce) Weevil Hazard Rating. Cooperative education student crews will be using the Prince Rupert Forest Region's Multi-Pest Survey to examine the general pest damage level of post-free-growing stands. In the Kalum and Kispiox Forest Districts, surveys will be supplying valuable spruce weevil incidence data to ground truth the degree-day based spruce weevil hazard rating reported in earlier editions of Forest Health Progress. In addition, overstory shading will be assessed using the method developed by Stuart Taylor to describe the relationship between shading and weevil incidence. Results will be available in the fall.

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

Bark Beetles - Technical Audit of Cariboo Forest Region and Williams Lake Forest District. The Cariboo Forest Region and the Williams Lake Forest District have requested a comprehensive technical audit of their bark beetle related management activities. The format and terms of reference for the audit will be similar to those for previous audits conducted in the Penticton and Boundary Forest Districts. The audit team and schedule will be determined in late April, 1994, and the audit is expected to be completed by the middle of June, 1994.

- P. Hall, Silviculture Branch, Victoria.

Bark Beetles - Impact Study. A study will be established to determine actual volume losses to mountain pine beetle once an outbreak has subsided. As well, the residual stand structure will be determined to develop guidelines for recommended silvicultural actions to rehabilitate the stand. A series of plots will be established in several biogeoclimatic zones and in stands with a variety of infestation histories. An attempt will be made to relate the study findings to the current hazard rating system so that quantitative predictions on expected loss can be made. This study was deferred from 1993/94.

- P. Hall, Silviculture Branch, Victoria.

Bark Beetles - Treatment Efficacy. An attempt will be made to evaluate and quantify the effectiveness and success of various treatments to reduce damage caused by mountain pine beetle. The bark beetle program has been ongoing since 1984, expending considerable resources in attempts to reduce the rate of spread of infestations and to protect healthy mature pine stands. A recent benefit/cost study on mountain pine beetle management showed positive benefits given certain levels of beetle "control". However, little quantification on the actual effectiveness of past and current practices was available. This proposed study is intended to rectify this missing information.

- P. Hall, Silviculture Branch, Victoria.

Balsam Woolly Adelgid Survey. Balsam woolly adelgid, *Adelges picea*, is an introduced insect in British Columbia that has caused damage to *Abies* species in the south coastal area of the province. An intensive survey was conducted in the 1970's to delineate infested areas in the province and a quarantine zone was established restricting movement of *Abies* growing stock from infested areas to the interior of the province. Since that time, additional finds of the adelgid have been found just outside the zone and the zone boundaries were subsequently modified. The number of such finds has increased in recent years, possibly due to increased survey effort. The new finds have prompted plans for another intensive survey to determine the spread of this insect. Survey findings will be used to review the adequacy of the current quarantine regulations and to plan management approaches.

- P. Hall, Silviculture Branch, Victoria.

Gypsy Moth Risk Assessment. The gypsy moth risk assessment for British Columbia has been completed. Copies of the report are available from the undersigned. The risk assessment estimates the likelihood of gypsy moth being introduced to the province, the likelihood of the insect becoming established in various areas of the province, the expected outbreak potential of gypsy moth once established, and the impacts on provincial resources.

- P. Hall, Silviculture Branch, Victoria.

Gypsy Moth Treatments (1994). Agriculture Canada carried out gypsy moth eradication projects in five locations during April and May, 1994. The locations treated were: Hope - Kakawa Lake (298 ha); South Vancouver (14 ha); Whiskey Creek (140 ha); Nanaimo (120 ha); and Victoria (120 ha). Except for South Vancouver, all treatments were three aerial applications of Foray 48B® (*Bacillus thuringiensis* var. *kurstaki*) at a rate of 50 BIU (Billion International Units) per hectare. Treatments in South Vancouver were ground applications only. The normal trapping program will be continued this summer.

- P. Hall, Silviculture Branch, Victoria.

Revised Ground Detection Procedures for Spruce Beetle. Procedures for the ground detection of spruce beetle have been revised in the Prince George Forest Region. Forest Health specialists from the region, several districts, Silviculture Branch and consultants participated in the revisions. This standard operating procedure (S.O.P 9.5.3) will be followed by all forest service, licensee, and consultant staff conducting walkthroughs and probes in the region. Approximately 100 personnel to date have been trained and accredited as spruce beetle probers within the region. It is hoped that these procedures will form the framework for a provincial standard. For a copy of the above S.O.P., please contact the undersigned.

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

FOREST DISEASES

"Munich" Versus *Leptographium wagnerii*. On February 5, 1994, "Munich", a malamut/husky cross owned by Brian Dack, a local contractor, was hit by a falling tree while he was in a black stain root disease center.

Munich was standing beside Brian (supervising). Brian was writing notes on survey ribbon (mountain pine beetle probe) when he noticed a bit of movement out of the corner of his eye. A lodgepole pine snag was falling directly toward them.

Brian yelled for Munich to get out of the way—but Munich just wagged his tail. The tree missed Brian by about 2.5 metres. The main bole of the tree hit Munich right across his back and head, pounding him deep into the snow, about 0.6 metres deep!

Brian quickly cut Munich out from under the tree and then dug him out of the snow. Munich had been knocked out cold but he started to yelp while Brian was digging.

Fortunately, because the snow was deep, it minimized the impact of the blow. Munich healed quickly and limped only for about half a day.

The tree fell without warning. Brian indicated there was no sound from the falling tree, and no wind. So be careful in black stain centres—heads up and eyes peeled!

- D. Piggitt, Kamloops Forest District, Kamloops.

Tomentosus Stumping Trial Planned in the Bulkley Forest District. A stumping trial will be established in the Nichyeskwa Creek drainage in the northern section of the Bulkley Forest District. Included in the trial are two smaller fallow range and hardwood cropping trials. This trial will be established by the licensee, West Fraser Mills, but will include some cost sharing with the Ministry of Forests and input from the Range and Forest Sciences sections. The trial will be on a 12 ha site that is planned to be stumped in spring/summer of 1995. An update on the progress of this trial will be found in the next fall or spring issues of Forest Health Progress.

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

MAMMAL DAMAGE

Porcupine Surveys to Determine Feeding Preferences. Cooperative education students in the North Coast Forest District and from the Prince Rupert Forest Region will be surveying randomly selected 20 to 50-year-old stands to determine the feeding preferences of porcupines. Recent data from long-term survey lines in the Khutzeymateen have shown a drop in feeding as stands get older. Damage appears to be shifting to smaller diameter trees outside of the plots.

The planned surveys should reveal which stands are preferred by porcupines. A minimum of 20 stands will be examined each year in both the North Coast and Kalum Forest Districts. Information from these surveys will eventually be used to develop an impact analysis for the Kalum District Timber Supply Area, along with TFL 1.

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

Vole Collaring Trial for Protecting Cottonwood Whips. Cottonwood is being used to rehabilitate rich alluvial sites in the Kalum Forest District. Successful establishment of cottonwood has been seriously jeopardized by the winter feeding of voles. In the absence of any operational treatments to protect these cottonwood whips, the forest district has chosen to protect each whip with a plastic collar. No proper evaluation has been made on the efficacy of these protective devices, although they do not appear to limit damage to conifer seedlings observed in plantations along the Skeena River. This spring, a large-scale cottonwood trial will be established throughout the Kalum Forest District. Within this trial will be a replicated experiment to test the efficacy of collars. Uncollared trees will be tagged and mapped and re-examined each spring to determine the amount of damage and survival compared to collared whips. More information will be available in future issues of Forest Health Progress.

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

PESTICIDES

Public Health and Environmental Impacts of MSMA. A draft publication entitled *Public Health and Environmental Impacts of Monosodium Methanearsonate (MSMA) as Used in Bark Beetle Control in British Columbia* is now under review by the Pollution Prevention and Pesticide Management Branch (previously the Pesticide Management Branch) and their advisory agencies. This publication summarizes the forestry use pattern, environmental chemistry, metabolic fate, toxicology, exposure and risk assessment of the use of MSMA.

MSMA is a paradoxical pesticide. It is a widely used agricultural herbicide in the United States, but in Canada it is used only for bark beetle control. It is a synthetic pesticide, but MSMA and several similar arsenical pesticides are also universally formed in nature. They are formed by many living organisms, including humans, from the inorganic arsenic that is a normal component of soil, water and foodstuffs. MSMA is a relatively benign chemical, but is based on an element used and feared as a poison throughout history. The legends about arsenic as a poison led to a tendency to lump all forms of arsenic together. Organic arsenicals are very much less toxic than the inorganic forms. Curiously, the formation of methyl arsenicals in the body is the mechanism for detoxifying inorganic arsenic.

A second smaller document entitled *Summary of Cost Information on the Use of MSMA and the Alternative Pile and Burn Treatment Method* has been written to review the comparative costs of MSMA versus piling and burning beetle infested logs. The use of MSMA for control of mountain pine beetle is six times less expensive than the pile and burn alternative. As well, this document is being reviewed by the Pollution Prevention and Pesticide Management Branch and advisors.

Once both of these documents have been reviewed and edited, they will be published as ministry internal publications. We expect them to be ready for publication later this summer.

- J. Henigman, Silviculture Branch, Victoria.

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Carol Reagon	District Silviculture Planner	Pt. McNeill	956-5033
Ron Diprose	Forest Health Technician	Sunshine C.	485-0730
Mark Salzl	District Silviculturist	Qn. Char. Is.	559-8447
Vacant	District Silviculturist	Squamish	898-2100

MEETINGS

Terminal Weevil Symposium - A symposium discussing a wide variety of topics relating to the biology and management of *Pissodes* weevils was held in Vancouver, January 19 to 21, 1994. The sessions were jointly sponsored by the Canadian Forest Service and the British Columbia Ministry of Forests. The meeting was well attended by universities, Ministry of Forests, Canadian Forest Service, industry, and U. S. state and federal forestry agencies. Proceedings of the symposium are available from Dr. Rene Alfaro, Canadian Forest Service, Pacific Forestry Centre.

- P. Hall, Silviculture Branch, Victoria.

Western Forest Insect Work Conference. The 1994 work conference was held March 8 to 10, in Albuquerque, New Mexico. The conference was jointly held with the Western International Forest Disease Work Conference. The meeting was attended by approximately 250 from Canada and the United States. Many of the sessions were devoted to discussions of ecosystem management.

The 1995 Insect Work Conference will be held in early March, 1995, at Rapid City, South Dakota. The 1996 meeting will be a North American Insect Work Conference and will be held in San Antonio. The 1997 conference is scheduled to be held in British Columbia.

- P. Hall, Silviculture Branch, Victoria.

TABULATIONS AND GRAPHICS

DRAFT PEST TABLE PROPOSAL¹

Biogeoclimatic Zone	Engelmann Spruce Subalpine fir							
Tree Species	Douglas-fir		Interior Spruce		Lodgepole Pine		Subalpine fir	
BGC Subzone	wc3	wk1	wc3	wk1	wc3	wk1	wc3	wk1
Insects:								
Douglas-fir beetle	L	L						
Mountain pine beetle					M	M		
Spruce beetle			H	H				
Spruce weevil			H	H				
Diseases:								
Armillaria root disease	M	M	H	H	H	H		
Tomentosus root disease			M	M	L	L		
Rhizina root disease	L	L	L	L	L	L		
Comandra blister rust					L	L		
Stalactiform blister rust					L	L		
Western Gall Rust					L	L		
Mammals:								
Porcupine					M	M		
Red squirrel					M	M		
Snowshoe Hare					M	M		
Voies	M	M	M	M	M	M		

H = High: 67 - 100% stands infested

L = Low: >0 - 33% infested

M = Medium: 33 - 66% stands infested

N = None: 0% stands infested

¹ This is a draft example of the Pest Tables (please refer to article by J. Henigman on p. 7).
Percent occurrence will be measured for each subzone.

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BASIC SITE INFORMATION

INFORMATION ESTIMATED DURING INITIAL
WALK THROUGH OF STRIUM

DESCRIPTION OF ACCEPTABLE PLANTABLE SPOTS

SCREE NO. DEPTH: _____ (m) SCALE SIZE: _____ (m) ACCEPTABLE PLANTING MEDIUM: _____ (m) PLANTING DIFFICULTY: ☐ EASY ☐ MODERATE ☐ DIFFICULT ☐ REVERSE

THESE SPECIES PLANTERS MUST RECOGNIZE: _____ MINIMUM HEIGHT FOR TREES TO BE VISIBLE: _____ (m) (from 13.500 and 720)

VISUAL ESTIMATE OF SITE CONDITIONS

ESTIMATED SLASH COVER: _____ % AVERAGE SLASH HEIGHT: _____ (m)

SLASH CLASS: ☐ HIGH ☐ MEDIAL ☐ LOW ☐ NIL

SLASH DISTRIBUTION: ☐ CONTINUOUS ☐ PATCHY ☐ SCATTERED

ESTIMATED BRUSH COVER: _____ % AVERAGE BRUSH HEIGHT: _____ (m)

BRUSH DENSITY: ☐ HIGH ☐ MEDIAL ☐ LOW ☐ NIL

BRUSH DISTRIBUTION: ☐ CONTINUOUS ☐ PATCHY ☐ SCATTERED

BRUSHES: ESTIMATED DENSITY: _____ %

WORK HAZARD: ☐ HIGH ☐ MEDIAL ☐ LOW ☐ NIL

ACCESS

LAND	ATV	WALK	FLOAT	LAND	WATER
2ND					
4TH					
DISTANCE					
	(m)		(m)		(m)

TRAVEL TIME

HOURS FROM _____ (Location)

ACCOMMODATION ☐ MOTEL ☐ CAMPING (NAME: _____) ☐ NONE ☐ OTHER _____

OTHER (DESCRIPTION OF MAJOR LIMITING SITE FACTORS, TREATMENT OBJECTIVES AND NEARBY PEST OR SITE PROBLEMS)

POTENTIAL ROAD CONSTRUCTION AND MAINTENANCE PROBLEMS: (Show details on map)

SLIDE - Width _____ (m) COLLAPSE: ☐ MEDIAL ☐ LOW ☐ NIL

WASHOUT - Length _____ (m)

NEW ROAD - Length _____ (m)

INDICATE THE PRESENCE OR ABSENCE OF THE FOLLOWING:

MACHINE INACCESSIBILITY: ☐ GOOD ☐ MEDIAL ☐ LOW ☐ NIL

SOIL COMPACTION/HAZARD: ☐ HIGH ☐ MEDIAL ☐ LOW ☐ NIL

WATER BODIES: ☐ YES ☐ NO TYPE _____

HIGH WATER TABLE: ☐ YES ☐ NO DEPTH _____

FISHERIES VALUES: ☐ YES ☐ NO TYPE _____

WILDLIFE VALUES: ☐ YES ☐ NO TYPE _____

RANGE USE: ☐ YES ☐ NO TYPE _____

PEST DAMAGE: ☐ YES ☐ NO TYPE _____

RECREATION VALUES: ☐ YES ☐ NO TYPE _____

OTHER RESOURCE VALUES: ☐ YES ☐ NO TYPE _____

DATA ON THE LEADER HEIGHT, TOTAL HEIGHT AND AGE OF WELL-SPACED TREES, MAJOR COMPETING VEGETATION AND INVENTORY COMPONENT SHOULD BE RECORDED ON THE FIRST PLOT ESTABLISHED IN THE STRATUM, AND EVERY FOURTH PLOT THEREAFTER. PEST TYPE, INCIDENCE AND SEVERITY SHOULD BE NOTED IN THE COMMENTS SECTION, WHEN OBSERVED.

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USE THIS FORM TO SUMMARIZE PLOT INFORMATION FROM THE FS 636 AND TO DECIDE WHAT SILVICULTURAL TREATMENTS ARE REQUIRED.

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SILVICULTURE SURVEY SUMMARY

USE THIS FORM TO SUMMARIZE
WHAT SILVICULTURAL TREATMENTS ARE RECOMMENDED

USE THIS FORM TO SUMMARIZE
WHAT THE VOCAL TREATMENTS ARE RECOMMENDED

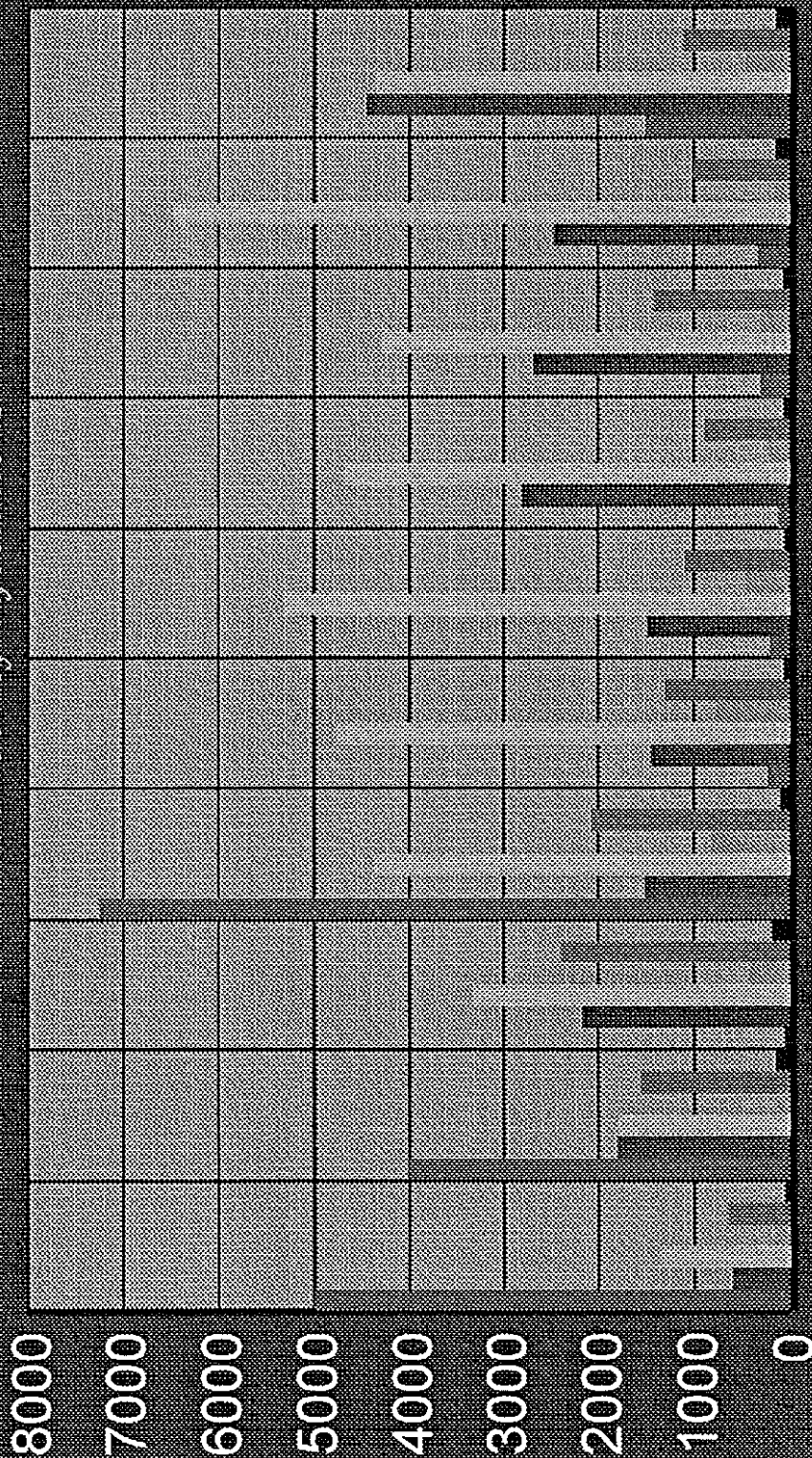
PAGE _____ OF _____

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AREA UNDER ATTACK BY MOUNTAIN PINE BEETLE

1984 TO 1993

Number of Infestations



PUBLICATIONS AND REPORTS

Canadian Forest Service and the B.C. Forest Service, 1993. Environmental Report and Current Status of *Bacillus thuringiensis* var. *kurstaki* Use for Control of Forest and Agricultural Insect Pests. FS 203 HSI 93/7.

Maclauchlan, L.E. and J.E. Brooks (eds.). 1994. Strategies and Tactics for Managing the Mountain Pine Beetle, *Dendroctonus ponderosae*. British Columbia Ministry of Forests, Kamloops, British Columbia.

Maclauchlan, L.E., J.H. Borden and I. Price. 1993. Life history and pheromone response in *Pissodes schwarzi*. Hopk. (Coleoptera: Curculionidae). J. Entomol. Soc. Brit. Columbia 90: 30-35.