

A Year in Transition

As 1996 draws to a close, change is the order of the day. As this Forest Health Progress report is being written, we have received the news that the Silviculture Practices Branch will now be incorporated into a new Forest Practices Branch. Recently we learned the structure of the new branch and how the Forest Health section will be incorporated into it. Two positions have been re-deployed to other sections, but we understand that the functions and activities will be continued. Doubtless, the new year will bring us many challenges as we work under continuing fiscal restraint.

A great deal has been accomplished during the year, only some of which can be reported here. One of the most exciting projects has been the investigation of the latest CASI (Compact Airborne Spectral Imagery) remote sensing technology which shows promise for identifying stressed trees and may provide the first indication of insect or disease problems. A high definition video camera was used in another application for the same purpose and we are currently reviewing this data to assess its usefulness and applicability to forest health assessments.

With the downsizing of the Canadian Forest Service (CFS), Forest Insect and Disease Survey (FIDS) unit, we have been working on an arrangement between the CFS and the Ministry of Forests to ensure that essential services are maintained, and training for Forest Service staff in conducting overview surveys, is supported by the CFS. In 1997 there will be an even greater reduction in the level of service provided in this area by the CFS rangers with increasing responsibilities falling on Forest Service district staff.

In 1996 all but two of the Forest Health Guidebooks were completed. The Tree Wounding and Decay Guidebook and Pests of Young Stands will shortly be available. This has been a tremendous accomplishment and all of the authors and collaborators deserve our thanks for this outstanding contribution to forest health knowledge and practice.

Two major conferences will take place during 1997, both at Prince George. The Western Forest Insect Work Conference will be held during the week of April 14th, and the Western International Forest Disease Work Conference, September 15-19, 1997. We look forward to seeing many of you at these conferences.

As the holiday season approaches, I wish all of you and your families a very Happy Christmas and best wishes for the New Year.

- R. G. Brown, Silviculture Practices Branch, Victoria.

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FOREST HEALTH PROGRESS

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EDITOR'S NOTE

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

Contributions labelled with an appropriate subject heading should be submitted via electronic mail to S. Turcotte, Silviculture Practices Branch for the spring (May) and winter (December) meetings of the Forest Health Committee.

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

- J. Muir, Silviculture Practices Branch, Victoria.

EXECUTIVE SUMMARY

Several articles on insect, disease and animal damage are included in this report to the Forest Health Committee of British Columbia.

With the demise of CFS "FIDS" report, a new section has been added for regional and insect and disease conditions. Reports are compiled for Prince George (p.5), Prince Rupert (p.7), Cariboo (p.9), and Kamloops (p.8) Forest Regions, plus provincial gypsy moth trapping results (p.6).

Under the general subject of forest health, modifications to Forest Practices Code Section 106 were recommended (p.10) to facilitate treatment of damaging agents on private land where they threaten management objectives in adjacent Crown land. Bark beetle management plan guidelines were updated (p.10) at Lilloett Forest District. Strategic plans for FRBC investments in incremental forest health provincial activities and a research strategy were drafted (p.11). Development of skills training modules is continuing (p.12). Work continues on developing standardized aerial overview surveys (p.12). Several FRBC-funded research projects are underway for seed pest management (p.13). A data base was established for forest health trials (p.14). An inventory of forest health in broadleaved forest types was undertaken in the Kamloops Forest Region (p.14-16). A benefit:cost study for managing mountain pine beetle (p.16-17) was undertaken.

Forest insect management reports included: draft guidelines for licensee and ministry responsibilities for bark beetle management (p.18); strategic plans for bark beetle management in park areas (p.18); surveys for pest incidence and establishment of long-term assessment plots (p. 18) in the Cariboo Forest Region; development of a simulator model for western budworm damage in interior Douglas-fir stands (p.19); report of the Douglas-fir tussock moth control program (p.19), and a study of ecological site conditions and spruce leader weevil (p.19-20).

A threshold based on accumulated temperature was developed (p.20) to predict initial flight of mountain pine beetle from infested logs, and close planting of 2300 spruce per hectare reduced leader weevil damage (p.21) in the Prince George Forest Region. A spruce beetle ground-probe sampling procedure was tested to determine accuracy (p.21-22). Spruce beetle probing accreditation courses were conducted (p.22), and grizzly bear damage to a study site was noted (p.22-23). A trial of baiting treatments and trap trees for spruce beetle was conducted (p.23-24). In the Kamloops Forest District, red turpentine beetle (p.24) and warren's root collar weevil (p.25) damaged spaced and pruned lodgepole pine. An infestation of conifer aphid was determined and assessed on young Engelmann spruce (p.26). Several insect-management proposals are being developed for possible FRBC funding (p.26). An inventory of damaged subalpine fir forests was initiated (p.27).

For diseases, a method to define the relationship between cost of treating stands infected by armillaria root disease, and potential benefits for long-term wood supply, is being developed (p.28). Plots were established (p.28) in young lodgepole pine to determine effects of infection by western gall rust. Extent of tree damage and recovery were assessed for Douglas-fir damaged by frost and dieback; and young ponderosa pine was surveyed for comandra blister rust (p.29). Development of root disease models was continued for southern interior forests (p.29) and coastal stands (p.30). A revised edition of Common Tree Diseases of British Columbia is available on request to the Pacific Forestry Centre, Victoria (p.30). An improved approach to determine risk assessments for armillaria root disease is being developed (p.31). Stumping trials for tomentosus root rot (p.31 and p.32) were remeasured; a study of whitebark pine rust was initiated (p.32), a pruning trial (p.33) and a survey of rust incidence (p.33) were undertaken, and an assessment of tomentosus impact for a TSA (p.34-35) was initiated in the Prince Rupert Forest Region.

A trial to assess protective plastic tubing to protect young seedlings from deer browsing was established (p.36).

Pesticide studies included an assessment of Neem for spruce leader weevil (p.37) and Mimic® (p.37).

For further details about any report, readers should contact authors of the articles.

- J. Muir, Silviculture Practices Branch, Victoria.

REGIONAL INSECT AND DISEASE CONDITIONS

Bark Beetle and Looper Programs for 1995/1996 in the Prince George Forest Region: Forest Health Note No. 1. A new report series has been established in the Prince George Forest Region to help disseminate data on the forest pest problems and programs. Forest Health Note No. 1 contains the results of the bark beetle and western hemlock looper aerial surveys conducted in 1995 and some treatment activities conducted in 1995 and 1996. The aim of this report is to provide forest managers with information that will help them make better strategic decisions on the bark beetle program, and to help standardize the reporting of beetle survey results within the region.

Results are usually reported by planning cells allocated to licensees and the Ministry of Forests (Tables 1 to 10 in the report). The Ministry of Forests is responsible for beetle management on unallocated and small business planning cells. The Ministry of Forests and the forest industry share joint responsibility for the management of beetle problems in planning cells that are allocated to licensees.

Some differences in survey methodology and reporting are apparent between the forest districts represented here. Many of these differences will be corrected in future editions of this report.

Copies of this report are available by contacting Stuart Taylor (565-6100) or any of the other authors: Bruce Doerksen (Prince George Forest District), Steve Bower (Mackenzie Forest District), Steve Lindsey (Ft. Nelson Forest District), Sherilyn Smith (Dawson Creek Forest District), Nathan Voth (Vanderhoof Forest District), Barbara Harrison (Ft. St. James Forest District), and Sharron Schiefelbein (Robson Valley Forest District).

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

Defoliator Conditions in the Fort Nelson Forest District, Forest Health Note No. 2 (October, 1996). An aerial survey of the damage caused by two forest defoliators and the spruce beetle was conducted in the Fort Nelson Forest District during the second week of July, 1996. The results are presented in the report as are detailed comments. The results suggest that the spruce beetle is still a concern and that moderate to severe budworm damage is becoming apparent on 12 200 ha which have been repeatedly defoliated in the past by the eastern spruce budworm.

Copies of this report are available from the Prince George Forest Region (Stuart Taylor, 565-6100) or from the Ft. Nelson Forest District (Steve Lindsay, 774-3936).

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

Gypsy Moth. In 1996, an eradication treatment was carried out on 162 ha in Hope using aerial application of *Bacillus thuringiensis* var. *kurstaki* (*B.t.k.*) (three applications at a rate of 50 BIU/ha). Subsequent trapping in the area at 16 traps/mi² in the block and 32 traps/mi² surrounding the block was negative: no male moths were captured. A second year of negative trapping will be necessary to declare the eradication successful.

A proposed ground spray treatment program in New Westminster where 8 moths were captured in a single trap in 1995 was cancelled by Agriculture and Agrifood Canada due to logistic difficulties in ensuring all properties in the affected area could be treated. Additionally, the Environmental Appeal Board upheld a pesticide appeal and cancelled the spray permit.

The cooperative trapping program continued in 1996, with traps placed by Agriculture and Agrifood Canada, the Ministry of Forests, the Canadian Forest Service, and other cooperators. A total of 52 male moths were caught in the province in 1996. All moths caught have been genetically identified as North American strain; no Asian strain gypsy moths were caught during the 1996 trapping program.

Trap catches were as follows:

Location	No. of Mot
Vancouver Island	
Esquimalt	2
Langford	8
Nanaimo	2
Sidney	4
Sproat Lk. (Port Alberni)	1
Mainland	
Burnaby	2
Cloverdale	2
Coquitlam	1
New Westminster ^a	27
West Vancouver	3

a) 4 1995 egg masses found, 3 1996 egg masses found, 3 female moths found, 1 live pupa found

All moths and other life stages found at the New Westminster site were tightly clustered and well within the boundaries of the cancelled 1996 ground spray treatment area. An eradication program will likely be proposed. Various options are being considered by Agriculture and Agrifood Canada. Other locations with positive trap catches will be trapped intensively to delineate potential treatment areas.

- P. Hall, Silviculture Practices Branch, Victoria.

Summary of Insect Surveys in the Prince Rupert Forest Region. The primary insect of concern in the Prince Rupert Forest Region is still the mountain pine beetle. The number of infestations has increased in all three southern forest districts (Lakes, Morice and Bulkley) this year, although some of the increases may be due to an aggressive detection campaign. Bulkley and Morice Forest Districts have located all infestations with Geographic Information System (G.P.S.) coordinates. Due to the cool summer conditions, many beetles did not fly this year, so the populations did not increase as much as they could have. These conditions also meant that a proposed broadcast burn to control the beetle in Tweedsmuir Park was cancelled. A burn is scheduled for September 1997, and probing and pheromone baiting will be conducted to place the burns in areas of high beetle populations. The insect with the second largest impact on the timber resource is the western balsam bark beetle. This beetle is especially important in Morice and Bulkley Forest Districts, as a large percentage of their allowable annual cut (AAC) consists of subalpine fir. This insect seems to be on the increase, but the difficulty in detecting new infestations, coupled with the three year life cycle makes estimates of attack very difficult. Spruce beetle continued to increase in the Cassiar Forest District, especially in the area of Tatsenshini Park. Rod Garbutt of the Canadian Forest Service estimated 16 500 ha was infested with spruce beetle in the Prince Rupert Forest Region. Spruce weevil continues to be a problem in the Kalum, Kispiox and North Coast Forest Districts, but rehabilitation of heavily attacked sites in the Kalum Forest District is underway. This involves removal of the most heavily attacked spruce trees, and interplanting with lodgepole pine, western redcedar and western hemlock. A 20 000 ha infestation of the green-striped forest looper in the area of the Kwinageese/Upper Nass River confluence is the largest recorded infestation of this insect in the interior of British Columbia. The infestation is expected to expand slightly next year, until a lack of host trees limits the spread. A few smaller infestations near the Skeena River will be watched carefully next year.

Some other insects of interest are causing minor damage in some areas. The poplar-and-willow borer continued to damage cottonwood in the Kitimat Valley, with roadside willow also being killed in large numbers. A plantation of lodgepole pine near Ootsa Lake had >10% mortality that was attributed to *Pityophthorus* twig beetles. It is believed that the beetles were able to breed in large numbers in the pruning and spacing slash, and then mass attack the trees. Several lodgepole pine plantations in the coastal-interior transition zone of the Kispiox Forest District were heavily attacked by *Trisetacus* mites. All affected trees had severely deformed, chlorotic needles.

- K. White, Prince Rupert Forest Region, Smithers.

Aerial Surveys in the Kamloops Forest Region. A total of 495 polygons were surveyed by air July-September 1996, totalling 81.2 hours of helicopter time. Subzones within the AT, ESSF, ICH, MS and SBS were surveyed by air and polygons in the ESSF, MS and SBS were ground surveyed. Table 2 shows the relative distribution of air and ground surveys and percent recent (red) and old (grey) attack noted in aerial surveys. Only Kamloops, Salmon Arm, Vernon and a portion of the Merritt Forest District were surveyed in 1996.

Table 2. The number of polygons surveyed by air and ground in 1996 and relative proportion of red and grey trees observed in the aerial surveys. Trees that appeared bright red (or fading) with all their foliage were classed as red trees and all other dead balsam were classified as grey.

BEC	Age Class			
	6	7	8	9
No. of polygons surveyed by air				
AT	0	0	9	1
ESSF	37	36	332	51
ICH	3	1	6	2
MS	8	3	1	1
SBS	1	0	3	1
No. of polygons ground surveyed				
AT	0	0	0	0
ESSF	4	5	32	7
ICH	0	0	0	0
MS	3	2		1
SBS				1
Percent red trees				
AT			0.49	0.00
ESSF	1.54	1.58	1.59	1.57
ICH	3.65	1.33	0.99	0.54
MS	4.85	3.34	4.22	0.80
SBS	0.00		1.21	1.41
Percent grey trees				
AT			6.12	8.85
ESSF	10.36	11.20	13.50	13.62
ICH	16.05	11.65	12.58	3.59
MS	14.71	7.98	17.30	14.48
SBS	0.00		6.70	8.11

- L. MacIaughlan, Kamloops Forest Region, Kamloops.

1996 Annual Aerial Pest Survey: Cariboo Forest Region. The annual aerial pest survey was completed by mid-October this year, even though inclement weather delayed or prevented flying on many days. Forest Districts are now using their maps for stratifying bark beetle infestations prior to commencing beetle probing and control projects. Unfortunately budget cuts have prevented a complete analysis of the aerial survey data so numbers are only estimates at this time.

Overall mountain pine beetle populations have at least doubled in the Cariboo Forest Region with Quesnel and Williams Lake Forest Districts containing the most intense populations. Chilcotin Forest District has the lowest pine beetle population. Douglas-fir beetle is at its lowest level since 1987 except for a few hotspots in and around the Military Training Area, along the Chilcotin River and above Canim Lake. Spruce beetle infestations continue at low levels.

Defoliation by forest tent caterpillar has declined. Small areas of defoliation by western spruce budworm was detected and 2-year cycle budworm had extensive areas of low to moderate defoliation in the eastern Cariboo. Approximately 700 000 ha of pine needle cast, *Lophodermella concolor*, were mapped over all five forest districts with Chilcotin and 100 Mile House Forest Districts recording the bulk of the damage. Current defoliation damage by western hemlock looper was not detected this year.

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

FOREST HEALTH - GENERAL

Forest Practices Code of British Columbia Act - Modifications to Section 106 Dealing with Treatment of Damaging Agents on Private Lands. Section 106 of the *Forest Practices Code of British Columbia Act* allows treatment of damaging agents on private lands if directed by the District Manager. However, current wording of the section makes application difficult because it implies that higher level plans are in place. A change of wording has been recommended that will allow a District Manager to direct treatment on private lands if management objectives in adjacent forests are threatened.

- P. Hall, Silviculture Practices Branch, Victoria.

Licensee Bark Beetle Management Plans (BBMPs) for the Forest Practices Code of British Columbia in the Lillooet Forest District - An Update. In the May 1996, issue of the *Forest Health Progress* I provided an outline of a set of district guidelines entitled *Bark Beetle Management Plans (BBMPs) and the Forest Practices Code of British Columbia*. These guidelines were implemented in January 1996, by the Lillooet Forest District to ensure that licensee bark beetle management operations comply with the *Forest Practices Code of British Columbia Act* and Regulations.

The first formal BBMPs, developed under the new guidelines, were submitted along with the draft 1996 Forest Development Plans (FDPs) by Ainsworth Lumber Co. Ltd - Lillooet Division, and the Lillooet District Small Business Forest Enterprise Program. The BBMP's went through the same review and comment process as the FDP's, revised by the licensees, then submitted as final BBMP's for approval by the District Manager. During the course of the BBMP submission and review process, guidelines were "fine-tuned" to further improve their efficiency and effectiveness.

Comments from the public, First Nations, and other referral ministries and agencies concerning the BBMP process have been very favourable. A complete review of the guidelines will be conducted by district Ministry of Forests and licensee staff in January 1997, one year after their implementation. Any recommended revisions resulting from this review will be made, and the final version will be submitted to the District Manager for approval as Standard Operating Procedures.

For all those who requested a copy of the guidelines from me, I hope they were of assistance to you. If anyone else would like more information on, or a copy of, the Bark Beetle Management Plan Guidelines, please let me know.

- E. Senger, Lillooet Forest District, Lillooet.

A Provincial Strategic Plan for New Investments by Forest Renewal B.C. In October 1996, we were asked to prepare an overall plan for forest health in the province to describe the program activities, goals and opportunities for new investments by Forest Renewal B.C. The plan also is intended to show how current FRBC program areas for forest health under research, land-based enhanced forestry treatments and inventory, and training address or implement forest health provincial goals and objectives.

A key issue to be resolved is how to implement a more intensive investment program.

Although time has not allowed detailed consultations, input from regional and district staff has been solicited and included in the draft plan. The draft will be revised and updated as we learn of more data and opportunities.

The plan will probably be used in future discussions with FRBC staff on possible development of a separate forest health program as a FRBC investment envelope.

- J. Muir and T. Ebata, Silviculture Practices Branch, Victoria.

Forest Health Research Strategic Plan. Thanks to an invitation and financial support from Forest Renewal B.C., we were able to initiate a project to develop a provincial research strategy for forest health, based on an earlier report by ministry and Canadian Forest Service staff. Larry Pederson, Chief Forester and chair of the Forest Health Committee of B.C., approved the project as a committee initiative. The report will be circulated for review and eventually, endorsement by the committee.

An initial draft was used by FRBC staff to prepare a list of current funding priorities for their research program information kit distributed to interested or possible proponents for FRBC funding. Forest health issues are covered in several priority areas including growth and yield, pest management, partial-cutting systems, broadleaf and mixed tree species management, tree genetics, forest ecosystems, and inventory and monitoring methodologies.

A key task in implementing an expanded forest health research activity will be technical review of proposals and targetting efforts to priority issues or subject areas. We will propose that the Forest Health Committee of B.C. undertake this function to support FRBC funding procedures. A technical subcommittee has been proposed to undertake reviews.

- J. Muir, Silviculture Practices Branch, Victoria.

Forest Health - Forest Practices Code Skills Training. Development of skills training modules for essential forest health issues in the Forest Practices Code, especially for guidebooks, is continuing. One pilot session was held on the overview code module that outlines basic forest health provisions in the code for coastal British Columbia regions, and one is planned at Kamloops in January, 1997.

A video overview of code requirements is being finalized.

Other modules under development include bark beetles and defoliator management. A module on root disease management is available.

- J. Muir and T. Ebata, Silviculture Practices Branch, Victoria.

Arrangements with Canadian Forest Service (CFS) for Surveys and Related Services. The 1996 field season was a time of transition for ministry and CFS staff. The former Forest Insect and Disease Survey (FIDS) unit was replaced by a down-sized Forest Health Monitoring Network. Most districts with regional and CFS assistance undertook essential overview aerial surveys. Maps are being digitized by contractors and data will be compiled by CFS for the GIS data base and national reporting.

Development of a standardized survey and training module supported by Forest Renewal B.C. is proceeding on schedule. A draft manual on methods is available from Peter Koot, Pacific Forestry Centre, Victoria. A substantial amount of video footage has been shot to illustrate insect and disease conditions and survey procedures for a training video. Performance objectives have been drafted and are being reviewed. A CD-ROM package will be developed to train and test observers skills in recognition of damage and mapping.

Surveys in 1997 will be the full responsibility of the ministry, although CFS staff might be available for training and quality assurance checking. The ministry is recommending that CFS continue providing essential services such as diagnostic and rearing laboratory facilities, insectary and herbarium, and data bases.

- J. Muir, T. Ebata and P. Hall, Silviculture Practices Branch, Victoria.

Seed Pest Management Program - Update. In 1996, the Seed Pest Management Program was divided into Coastal and Interior Operations. New Biologists were hired to work out of Kalamalka Seed Orchards in Vernon (new FRBC position) and Saanich Seed Orchard in Saanichton (replacement for two Biologists, one resigned and one on maternity leave). In addition to their regular extension and crop monitoring duties, Seed Pest Management staff were involved in the following in-house and Forest Renewal BC funded research projects:

- Development of a sampling plan for predicting adelgid damage to spruce seed orchards.
- Effects of larch adelgid on seed production in western larch seed orchards.
- Management of *Dioryctria* coneworms using sex pheromones.
- Identification manual for *Dioryctria* coneworms in British Columbia.
- Field test of candidate sex pheromones for management of *Contarinia* Douglas-fir cone gall midges in seed orchards.
- Relationship of *Leptoglossus* seed bug feeding to spread of Fusarium seed disease.
- Dispersion of overwintering *Cydia* seedworms through infested cones in Christmas ornament trade.
- *Megastigmus* seed wasp monitoring and damage prediction in Douglas-fir seed orchards.
- Herbicide trials.
- Field dose-response test of sex pheromone for management of *Synanthedon* pitch moths in spruce and lodgepole pine seed orchards (FRBC).
- Management of *Cydia* seedworms using sex pheromones in interior spruce seed orchards (FRBC).
- Pitch moth distribution, abundance, damage assessment, and relationship with rust diseases in lodgepole pine seed orchards (FRBC).
- *Hylobius* root collar weevil control options in lodgepole pine seed orchards (FRBC).
- Field test of entomopathogenic nematodes for management of *Strobilomyia* cone borers in spruce seed orchards (FRBC).
- Use of cone marking pheromones for management of *Strobilomyia* cone borers in interior spruce seed orchards (FRBC).
- Relationship of environmental factors to inland spruce cone rust spore production and germination in interior spruce seed orchards (FRBC).
- *Leptoglossus* seed bug damage assessment (FRBC).

For details please contact Robb Bennett, Seed Pest Management Officer, 250-652-6593.

- R. G. Bennett, Silviculture Practices Branch, Victoria.

Forest Health Trials Database Nearing Completion. Last summer, University of Northern B.C. cooperative education student Andra Bismanis visited the offices of all regional and some district forest health specialists to extract basic data on the status of forest health operational and research trials. The objective of the project was to provide a single repository for forest health specialists to store and communicate the status of all forest health experiments. Following the lessons learned in similar projects like the Reforestation Information Bank (RIB), it was designed to be a "living" database that will be accessible by all users to update their own trial data as it becomes available. The creation of the Ministry of Forests Intranet has made this accessibility possible and as such, will only be available to BCFS Office Vision users.

The four month project involved the collection of the data—through interviews with specialists and examination of countless files—and the design and construction of an MS-Access database. The database design has been completed, however, the initial loading of the large volume of data is not yet completed, but is expected to be ready by March, 1997.

Users will be allowed to search by:

- 1) Pest
- 2) Host
- 3) Region
- 4) District
- 5) Biogeoclimatic zone
- 6) Biogeoclimatic subzone
- 7) Biogeoclimatic variant
- 8) User customized

The flowchart on page 44 in the Tabulations and Graphics Section describes the design of the database.

Users will also be allowed to update any of the trial information at any time. The user's manual and the database will be available on the intranet by April 1997. Further upgrade and customization of the database may be done in the coming year. For more information, e-mail or call the undersigned at TEBATA@MFOR01.for.gov.bc.ca or (250) 387-8739.

- T. Ebata, Silviculture Practices Branch, Victoria.

Forest Health Inventory of Broadleaf Forest Types in the Kamloops TSA. Broadleaves are recognized as preferred and acceptable species in British Columbia on appropriate sites under the Forest Practices Code. Recently, there has been much interest and subsequent research initiated to determine the best management regimes for broadleaf species and mixed conifer-deciduous stands. Little is known about the ecology of deciduous species, nor about the incidence and impact of the various insects and diseases affecting these stands. A comprehensive forest health inventory of deciduous species is

needed to assist forest managers in preparing landscape level plans and more fully understanding stand level implications. A diversity of defoliators, bole-attacking insects, foliar and root diseases, as well as abiotic influences affect these stands. There is no landscape level forest health inventory currently available for deciduous species.

The relative abundance of deciduous types in the Kamloops TSA is detailed in Table 1. The majority of the deciduous component within the TSA is found in the Clearwater Forest District.

Table 1. Area of leading deciduous and coniferous forest types in the Kamloops Timber Supply Area (calculated by B.C. Forest Service Inventory Branch, 1992).

Forest type	Area crown forest (ha)		Total ha	Percent of total ha
	Mature	Immature		
Deciduous	21,060	38,082	59,142	4.4%
Coniferous	758,424	534,491	1,292,915	95.6%
		Total:	1,352,057	

The objectives of this project are to:

- 1) Conduct an exhaustive literature review on all documented pests of deciduous species;
- 2) Conduct ground surveys to determine occurrence and incidence and intensity of major pests affecting deciduous forests in the Kamloops TSA (determine the range of forest health factors that may impact species of *Populus*, *Alnus*, *Prunus*, *Salix* and *Acer*);
- 3) Establish permanent sample plots in select stands that are affected and unaffected by specific pests or pest complexes; and
- 4) Compile a reference pest collection and digital inventory of major pests found in deciduous forest types within the Kamloops TSA; and
- 5) Develop a field guide to pests of broadleaf trees.

Approximately 68 person-days were spent surveying 131 polygons on 52 mapsheets. The surveys covered 14 different biogeoclimatic zones as detailed in Table 1. The majority of the surveys, however, were in the ICHmw, IDFdk and IDFmw.

Table 2. Listing of polygons surveyed and area of polygon, by biogeoclimatic zone and subzone.

Biogeoclimatic zone	No. of polygons surveyed	Total area of polygon (ha)
BGxw	2	25
ESSFdk	1	20
ESSFwk	2	109
ICHmk	6	256
ICHmw	48	2,926
ICHwk	2	218
IDFdk	29	873
IDFmw	18	1,142
IDFxh	8	174
IDFxw	2	42
MSdm	3	78
MSxk	5	67
SBSmk	3	76
SBSmm	2	100

Frost cracks and damage by moose and bear were common on aspen. The diseases *Phellinus tremulae*, *Cytospora schryosperma*, and *Ceratocystis fimbriata* were common on aspen while *Phellinus ignarius*, *Poria obliqua* and *Fomes fomentarius* were common on birch. Twig blight (*Venturia* spp.) was abundant in all stands of aspen and cottonwood. General decline was also fairly apparent. Instances of severe infestations of ink (*Ciborinia whetzelli*) were noted near the Clearwater River, south of Wells Gray Provincial Park.

Defoliators were not abundant. The most common arthropods included aphids, tingids and mites. Carpenter ants, ambrosia beetles and wood borers were often associated with damage caused by moose or frost cracks. *Saperda calcarata* was abundant on small aspen in the IDF zones. Top kill of birch was noticeable throughout the ICH, often but not always, associated with bronze birch borer.

- L. Maclauchlan, Kamloops Forest Region, Kamloops.

Determination of Benefits and Losses in Managing the Mountain Pine Beetle, *Dendroctonus ponderosae*, in the South Okanagan: Comparison of Managed and Unmanaged Stands. The following is an FRBC-IN project that was conducted in the Kamloops Forest Region.

The overall objectives of this operational forest health inventory is to generate data needed to advance the level of forest management practised on provincial Crown land. The project will assess the long term impact of mountain pine beetle on lodgepole pine stands in the Penticton and Vernon Forest Districts within the Okanagan Timber Supply Area (TSA) as well as a few select stands within the Merritt TSA. A comparison will be made

between stands that have been managed to varying degrees to reduce mountain pine beetle impacts and those stands where no beetle management has occurred. The data generated from this project will determine which management strategies and tactics for the mountain pine beetle are most effective and what the impact is on a stand and TSA of no beetle management.

Large scale infestations of the mountain pine beetle have been ongoing in British Columbia since the mid-1970's. Extensive areas of interior lodgepole pine forests have been affected, with resultant mortality to the large diameter component and loss of 80% or greater of the merchantable volume. In many areas, aggressive beetle management was implemented including the use of attractant baits combined with single tree extraction of infested trees, single tree disposal (chemical or burning), small patch harvesting and conventional harvesting of infestations. However, not all areas affected by the mountain pine beetle could be addressed. Infestations in many areas of the south Okanagan have now collapsed, leaving residual stands with varying structures. The eventual fate of these stands where the beetle was left to run its course was not clearly known, so a project was initiated in 1994 to determine their status. The next step in the process is to determine the effects and end result of the various levels of beetle management and compare this to the "no management" scenario. Information is necessary to determine the following to improve or modify future beetle management guidelines:

- the present structure of the residual stands left after treatment or if left untreated;
- comparison of the effectiveness of a wide range of beetle management tactics;
- the need for rehabilitation or future commercial prospects after certain treatments or if left untreated; and,
- a refined criteria and quantification of hazard rating systems to allow better estimates of potential loss given initial stand structure, beetle management tactics in a stand, biogeoclimatic zone/subzone, and outbreak history.

The area inventoried included select stands throughout the Penticton and Vernon Forest Districts that met certain criteria. A sub-sampling of stands will occur in the Merritt Forest District as well, to give a full coverage of treatment regimes in the sampling matrix. Lodgepole pine stands were selected for sampling in each of the following categories:

- i) Single tree treatments (fall and burn; monosodium methanearsenate (MSMA) treatment);
- ii) Infested tree removal (helicopter; single tree extraction);
- iii) Sanitation harvesting (small patch cuts; clearcuts);
- iv) Roadside baiting and treatment; and
- v) Past infestation but no treatment.

To date, a total of 599 plots have been established totalling 3,951 ha sampled. The plots were located within candidate stands in the IDF, MS and ESSF. The number of plots within treated and check areas is 479 plots and 120 respectively. A full summary of results is to be completed by spring.

- L. Maclauchlan, Kamloops Forest Region, Kamloops.

FOREST INSECTS

Bark Beetle Responsibilities. A document outlining recommendations for responsibilities for management actions directed at bark beetle has been prepared and forwarded for consideration by Operations Division. The document provides guidelines to District Managers as to the area to be considered under a Forest Development Plan by a licensee for various bark beetle management activities.

- P. Hall, Silviculture Practices Branch, Victoria.

Bark Beetle Strategic Plans for Parks in the Chilcotin Forest District. B.C. Parks, the regional forest entomologist and the Chilcotin Forest District forest health officer have teamed up with Forest Renewal B.C. to produce strategic bark beetle management plans for all provincial parks and protected areas in the Chilcotin Forest District. This project will also involve detection and control of bark beetles in specified hazard areas within T'sy-los Park. This is a pro-active attempt to define where beetle management is required to protect provincial forest adjacent to parks and protected areas from expanding beetle populations generated within parkland. This long term planning and management process may eventually expand to cover all parks within the Cariboo Forest Region.

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

Surveys for Pest Incidence and Permanent Sample Plots in Young Pine Stands. Surveys for pest incidence (SPI) in young lodgepole pine stands in the Cariboo Forest Region were carried out during the summer of 1996. Approximately 800 SPI plots were established throughout representative ecosystems covering all five forest districts. Permanent sample plots were established to monitor damage for Warren's root collar weevil, *Hylobius warreni*; western gall rust, *Endocronartium harknessii*; stalactiform blister rust, *Cronartium coleosporioides*; comandra blister rust, *C. comandrae*; pine needle cast, *Lophodermella concolor*; lodgepole pine dwarf mistletoe, *Arceuthobium americanum* and pine terminal weevil, *Pissodes terminalis*. The project is funded through Forest Renewal B.C. and 800 plots will be sampled annually for four years. The information will contribute to our knowledge base of pest incidence, long term pest damage and pest hazard and risk rating. Information on the effects of spacing, pruning and fertilizing in young pine stands with high pest incidence will also be collected.

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

Western Spruce Budworm - Forest Vegetation Simulator (Prognosis). The Forest Vegetation Simulator (FVS) (Prognosis) model has been a much discussed model for growth and yield projections in multi-aged, multi-storied stands. The base model has been calibrated for use in British Columbia for interior Douglas-fir. A number of companion models exist to simulate the actions and impacts of damaging agents. These companion models include root rots, bark beetles, and western spruce budworm. There has been ongoing work over the past few years to bring the root rot sub-routines to a point where the FVS/Root rot combination could be used to develop management guidelines in appropriate stands.

This work with FVS will likely continue in 1997/98. Further, an effort will be made to calibrate, validate, and/or complete development of the western spruce budworm sub-routines for British Columbia. The budworm routines include a foliage model, a budworm population dynamics model, and an impact model. First stages will involve verification of the foliage and damage sub-routines using British Columbia data sets. Further work will be carried out to bring the model components to an operational status by cooperators from the Ministry of Forests, Canadian Forest Service, and the USDA Forest Service. Development and implementation of the model is planned over a five year period.

- P. Hall, Silviculture Practices Branch, Victoria.

Douglas-fir Tussock Moth Program Report. Nuclear polyhedrosis viral stocks were used operationally against Douglas-fir tussock moth during the recent 1991-1993 outbreak. All indications are that this new treatment was successful in preventing large scale damage in affected stands. Further, various trials carried out during the outbreak provided information that will allow refinements to the use of the virus. A journal publication detailing this program is being prepared.

- P. Hall, Silviculture Practices Branch, Victoria and
L. MacIaughlan, Kamloops Forest Region, Kamloops.

Relationship Between White Spruce Vulnerability to the White Pine Weevil and Ecological Site Conditions in the Interior of British Columbia. A correlation study was conducted on 80 sites in 1995 to develop an empirical model to rate stands of white spruce for their susceptibility to spruce weevil (*Pissodes strobi*) (Peck) attack at the equilibrium phase of the outbreak based on ecological, stand and vegetative variables. In total, 15 ecological and stand variables were assessed, as were 14 vegetative species.

The variable reduction strategies used to reduce the number of independent variables included: bivariate analysis of independent variables with the dependent variable (current weevil attack), Pearson product-moment correlations, principal component analyses, all-possible subset regressions and step-wise regression. The criteria to select the "best" regression models included real-world biological meaning, maximization of the coefficient

of multiple determination, maximization of the F-ratio, minimization of the standard error of the estimate, and minimization of model complexity.

The "best" multiple regression solution included the independent variables: stand age, stand density and elevation ($F(3,71) = 18.025$, $p = 0.001$). Two independent variable ordering techniques both confirmed that density was the least important variable and that elevation and stand age were the most important. Further, analyses indicated that a slope position, slope percent, humus content, and perhaps one or two vegetative species may serve as useful predictors of weevil attack. Finally, some "simple rules" are presented that allow the practitioner to apply the results to predict weevil attack prior to harvest.

A draft report on this project is available from the senior author: Stuart Taylor 565-6100. Co-authors are: S. Lindgren, (University of Northern British Columbia), J. Ackerman (University of Northern British Columbia), and R. Alfaro (Forestry Canada).

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

A Technique to Manage the Early Season Transport of Infested Mountain Pine Beetle Wood Based on Accumulated Temperatures. Linear regressions were conducted between accumulated temperatures, above the mountain pine beetles' activity threshold of 16°C, and beetle trap catches for five separate years near the town of Prince George. These regressions yielded significant results for four of five years when predicting the first primary flight for this beetle. The lowest accumulated temperature versus beetle flight threshold for any year was found in 1996 with 80 degree days over the 16°C threshold. This threshold was tested against six years of data in the Prince George area and performed better than the practice of selecting a static date to stop the transport of infested wood. The accumulated threshold approach offers an additional 8.5 hauling days in the spring over the alternative of selecting a static date. Further, this technique can complement the approach of directly monitoring the beetles' flight and offers the further advantage of being able to utilize temperature data that are commonly collected from 54 British Columbia Forest Service weather stations in the Prince George Forest Region.

A draft report on this project is available from Stuart Taylor (565-6100).

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

Close Planting Reduces White Pine Weevil Damage to White Spruce. Tree height, diameter, form and number of stem defects were recorded in a 31 year old white spruce plantation established at three spacings (2.1*2.1, 3.0*3.0 and 4.0*4.0). These plantations are currently (1995) attacked at a rate of between 2.8% to 10.7% and even at that rate significant differences between the total number of defects at the close versus both medium and wide spacings were noticed. Also, significant differences between the close and both the medium and wide spacings were noticed for tree diameter. The optimum level of tree density may be a compromise between the volume lost due to reduced diameter at the closer spacings and volumes saved at the closer spacings through reduced defects. However, a recommendation is made to increase the current planting levels in the Prince George Forest Region from 1 600 - 1 800, to the level of 2 300 stems per ha investigated in this study. This recommendation should only be applied to areas that have or will experience heavy weevil pressure.

A draft report on this project is available from the senior author: Stuart Taylor (565-6100). Co-authors are: R. Weisgerber (Prince George Forest District), J. Stork (University of Northern British Columbia), and R. Alfaro (Forestry Canada).

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

Confidence Limit Testing for Spruce Beetle Probing Continues in Prince George Forest Region. As a follow-up to an earlier study in a moderately-infested stand, a further test was undertaken in the Prince George Forest Region to assess the accuracy of the current spruce beetle probing methodology in a lightly-infested spruce stand. A consulting firm originally probed the 67 ha. block in the Blackwater area of the Mackenzie Forest District in October 1995. Sampling units were 100 m long by 10 m wide probe lines or strips spaced 100 meters apart in a parallel grid as per the interim procedure. Spruce beetle attack in the stand was approximately 4% 1995-attack, 1% 1994-attack, and 11% 1993-attack (or previous). On May 23, 1996, prior to any new beetle attacks, the same block was re-probed by having the contractor offset 50 meters.

The data are currently being analyzed by comparing the results of the first, second, and combined probes. We will also examine the spatial pattern of the infestation based on level of incidence.

Some spruce beetle-infested stands require detailed and systematic information from across the block. In many cases, such blocks are road-accessible second-pass logging areas where retention of remaining reserves is important for wildlife cover and corridors, riparian protection, and/or green-up or landscape concerns. Infested areas that are under an Aboriginal land claim would be another example where detailed and systematic data would be critical. Such locations require intensive and systematic survey information so that "hot spots" or even single infested trees can be mapped.

It is expected that improved mapping of incidence "strata" in more sensitive areas will aid planning and justification of spruce beetle management activities such as sanitation harvesting or trap tree deployment.

- R. Hodgkinson, Prince George Forest Region, Prince George and
V. Fletcher, Silviculture Practices Branch, Victoria.

Spruce Beetle Probing Accreditation Courses in Prince George Forest Region. In three courses in the fall of 1996, approximately 70 personnel were trained in spruce beetle ground detection procedures in the Prince George Forest Region. Trainees from the Prince George Forest Region included staff from consulting companies, major licensees, B.C. Forest Service District offices, and First Nations organizations. One session in September included attendees from a consulting company in Penticton and graduate students from Simon Fraser University. Ten federal and consulting company staff from the Yukon are also still accredited. Along with holders of 2-year certificates from 1995, approximately 115 personnel are currently accredited in the Prince George Forest Region.

Target attendees for the course are mainly people who conduct ground probes and classify spruce beetle attacked trees during probes or walkthroughs, or who administer probe contracts and/or check the field work of others. The course has received a confirmed seven education credits from the Association of B.C. Professional Foresters. The course outline appears annually in the B.C. Continuing Studies Network Natural Resource Management Spring Catalogue. The next series of courses will start in early September 1997. For more detailed information on course content or for a complete list of accredited probers, please contact the undersigned.

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

Spruce Beetle Emergence for Hibernation or How a Grizzly Bear Can Wreck a Research Site. Funding was obtained from Forest Renewal B.C. (FRBC) in May 1996 to assess if spruce beetle emergence for hibernation behaviour could be predicted by climatic factors, and to assess if such emergence could be prevented by felling infested trees at an optimal time. By determining the relationship (if any) between the percent emergence and climate, we hope to develop a model to predict beetle emergence for hibernation and a subsequent decision-support system that will allow ranking of areas for more efficient sanitation logging in the second winter after attack. This will, in turn, maximize potential yields from forests by minimizing attacks in adjacent susceptible stands. We also hope to determine the feasibility of felling infested spruce in advance of harvesting in order to prevent emergence of immature adults, thereby improving the efficacy of subsequent sanitation logging.

Three spruce beetle infested sites were selected in the Mackenzie and Prince George Forest Districts in the ESSFm3/04 and 01 and SBS wk2/05 biogeoclimatic zones, respectively. At each location, 30 1995-attacked spruce were selected and a meteorological station was installed in early May 1996. Ten random spruce at each location were felled in late May-early June and an additional 10 were felled in early August. Beetle emergence traps were installed on all trees in mid-August and subsequently removed along with associated phloem in early- to mid-October.

On entering one of our research sites in the Prince George Forest District to conduct efficacy sampling in October, it soon became apparent that a grizzly bear had visited. Approximately 90% of the beetle collection vials (containing antifreeze) had been ripped from the emergence traps and many of the latter had been punctured with incisors or partially torn from trees. The weather station had two relative humidity sensor shields pulled down and there was miscellaneous vandalism to temperature probes and wiring. Saving the best for last, Mr. Grizzly ripped off the protective case for the car battery power supply, disconnected the leads, bent one of the rebar stakes securing it to the ground, tipped it over, and bit through the battery case into the sulphuric acid electrolyte! Fortified with ethylene glychol and sulphuric acid, we hope he enjoys hibernation! Following repairs, we may have to eventually re-locate this station to avoid further damage.

Funding will be sought from FRBC for a continuation of this research into at least 1998. Contact any of the undersigned for further information.

- R. Hodgkinson, Prince George Forest Region, Prince George, A. Stock, Nelson Forest Region, Nelson, B.C., and S. Lindgren, University of Northern B.C., Prince George.

Evaluation of Various Baiting and Trap Tree Treatments to Control Populations of Spruce Beetle. Spruce beetle (*Dendroctonus rufipennis*) baits sold commercially contain two components, frontalin and alpha pinene, or three components, frontalin, alpha pinene and +mcol. The newly added component, +mcol, has shown to improve the efficacy of the spruce beetle bait in certain locations (Alaska). A number of baiting trials were conducted in 1995 and 1996 to determine how to deploy the new spruce beetle bait most efficiently to produce the most efficacious results in given circumstances. The trials tested the efficacy of the 2-component bait (old), 3-component bait (new) and no baiting in stands infested with spruce beetle deploying conventional trap trees, lethal trees and standing, live baited trees.

The 3 trials are as follows:

Trial 1: Stands with light to moderate levels of spruce beetle attack will be divided into blocks of about 4 ha in size, and will be given one of the following treatments:

- 1) 50 m grid baiting of standing spruce using 3-component baits
- 2) 50 m grid baiting of standing spruce using 2-component baits
- 3) conventional trap trees dispersed throughout block
(no baits - use one of trial 2 unbaited areas)

Trial 2: Trap trees will be felled in units of 3-4 trees per unit, spaced about 50 m apart. Each unit will be either baited with the 3-component bait, 2-component bait or left with no bait. Bait treatment will be randomly selected for each unit of trap trees. Each replicate should optimally cover approximately 4 ha.

Trial 3: Large diameter, green spruce trees will be treated with 1/4-strength MSMA and will be given one of the following treatments:

- 1) left standing and baited with 3-component bait, or
- 2) felled, with no bait.

Assessment of efficacy was based on the following observations: occupancy of standing or felled bait trees by spruce beetle; amount of attack surrounding bait trees; percent occupancy by spruce beetle and competing beetles; and gallery parameters. Data from these trials is presently being analysed.

- L. Maclauchlan, Kamloops Forest Region, Kamloops.

Red Turpentine Beetle in Pruned and Spaced Stands: Lodgepole pine trees in the IDFdk1 biogeoclimatic zone of the Kamloops Forest District were attacked by red turpentine beetles, *Dendroctonus valens*. The trees were pruned and spaced in 1994/1995. Six study areas were set up near Dardenelles Lake and Georges Creek to create a preliminary hazard rating model for susceptible stands.

For the model, a number of tree measurements were taken in 1995 and 1996 from six stands, data were pooled for all six sites and then divided into DBH classes. Beetles preferentially attacked trees with larger DBH, higher total height, less live crown, a higher pruning lift, larger average pruning scar diameter, and trees that had a greater estimated surface area of all pruning scars ($p = 0.05$). Using the above tree attributes, and the observed attack frequency, a multiple linear regression equation was calculated.

The equation which best correlated with observed frequency of attack ($r^2=0.88$) included the following: DBH; tree height, pruned height; ratio of pruned height:total height; number of pruned whorls; number of pruning scars; average diameter of pruning scars; and estimated surface area of all pruning scars. The equation did not consider population dynamics. Further studies are currently underway to evaluate the level of mortality.

This equation successfully predicted attack within a single DBH class over all six sites. However, it was less able to correlate the frequency of attack in mixed DBH stands. To overcome this problem, a ratio of DBH:Total Height replaced both DBH and height in the equation ($r^2= 0.86$).

The beetles also preferentially attack trees located more than 60 m from the edge of the block, as well as stands with a low basal area and low relative density. Distance to edge, basal area and stand density were not included in the regression.

Trees in two stands which were pruned and spaced in the fall of 1996 were measured and the relative hazard predicted. This prediction will be tested against observed attack in 1997 to test the regression equation. Based on early results tree mortality is low. The regression equation may be used to prepare stand management prescriptions and to prioritize stands as to their hazard of attack. Such information may lead to modification of silviculture plans in these high value stands.

- D. Piggin, K. White and D. Lux, Kamloops Forest District, Kamloops.

Warren's Root Collar Weevil. An unusually high proportion of young lodgepole pine trees were attacked by *Hylobius warreni* in the Montane-Spruce Biogeoclimatic zone, near Paxton Lake. The trees were 20 years old and the stand had been spaced twice. Preliminary estimates indicate a >90% attack frequency. A number of trees had multiple attacks. Tree mortality is currently low however; based on the degree of girdling of some of the trees, incremental loss can be expected over the next several years. Damage appraisal plots have been established to observe mortality patterns.

Hylobius warreni will successfully complete development in stumps after the tree is cut. It was hypothesized that high attack frequencies resulted from spacing a stand with a moderate *Hylobius warreni* population. The weevil population apparently concentrated in the remaining trees.

To test this hypothesis, four hectares in a fifteen hectare block, scheduled for spacing, have been set aside to act as a control. The frequency of attack in the unspaced area will be compared to a similar number of trees in an adjacent stand (30 m buffer zone) which has been spaced. The frequency of attack, DBH growth loss and mortality will be monitored over the next several years.

- D. Piggin and D. Lux, Kamloops Forest District, Kamloops.

A Conifer Aphid on Young Planted Spruce: In 1995, a conifer aphid (*Pineus similis*) was found deforming and killing lateral branches of juvenile (2-9 years old) Engelmann spruce trees in the Cahilty Creek area of the Kamloops Forest District. A subsequent survey of all spruce plantations revealed that *P. similis* was in every stand. There was a concern that continued attack could cause mortality in some of these trees.

From a total of 55 forest cover openings surveyed in a preliminary reconnaissance for *P. similis* attack, 8 were chosen as the sites of permanent plots. A total of 1529 trees were examined in 12 plots, with ten plots in the Cahilty Creek area, and two "control" plots (low incidence) in the vicinity of Birk Creek. The goal of the study was to determine the effect *P. similis* attack had on growth, degree of mortality, and the probability (and effect) of repeat *Pineus* attack.

Early results indicated that although trees can outgrow moderate attack, heavily infested trees will lose branches. Stressed trees may be more heavily attacked than unstressed trees and planted trees are more frequently attacked than naturally regenerated trees. Attack observed in 1995 and 1996 was not as severe as in 1994 leading to the conclusion that climatic factors may play an important role in the build up of adelgid populations. Weather data and growth increment data from the 1996 survey have not yet been analyzed. A report of results should be available in March 1997.

- D. Piggin, E. Clemmer, K. White and D. Lux, Kamloops Forest District, Kamloops.

Proposals Submitted to Forest Renewal British Columbia. A wide variety of proposals will likely be submitted to Forest Renewal British Columbia for possible funding next year. Topics being considered for submission regarding forest entomology include the following:

- surveys to refine the known range of balsam woolly adelgid
 - hazard rating for bark beetles in suitable districts
 - demonstration of planting strategies utilizing spruce stock resistant/tolerant to damage by terminal weevil
 - development of a hazard rating method for balsam woolly adelgid
 - development of a hazard rating method for balsam bark beetle
 - compilation and standardization of historical gypsy moth trapping data
 - developing diagnostic tools for the Internet/World Wide Web
 - support to specialist conferences, workshops, and symposia
- P. Hall, Silviculture Practices Branch, Victoria.

Forest Health Inventory of *Abies* Forests. The balsam bark beetle (*Dryocoetes confusus*) (Swaine), has been identified as the most serious cause of mortality of subalpine fir in British Columbia. However, the incidence and impact of this beetle is not well quantified at the stand or landscape level. The objectives of this project are to:

- 1) Quantify the incidence of current and past attack by the balsam bark beetle throughout the Kamloops Region;
- 2) Estimate impact (volume loss) by ecosystem association, caused by balsam bark beetle in the Kamloops Forest Region; and,
- 3) Develop a hazard index for the balsam bark beetle in the Kamloops Forest Region.

Table 1. Area, in hectares, of subalpine fir in the Kamloops Forest Region within four age classes, as calculated by B.C. Forest Service Inventory Branch, 1992.

<i>Abies lasiocarpa</i> Age Class	Area (ha)	Percent of total area
6	28,108	7.6%
7	25,014	6.7%
8	272,338	73.2%
9	46,621	12.5%
All age classes:	372,080	

The specific objective of this forest health inventory is to determine the level of mortality and unsalvageable losses in high elevation ecosystems. The inventory is being conducted in four stages:

- i) Using the inventory database, a report was generated listing all areas with >50% subalpine fir. This database was then stratified by proportion of subalpine fir, ecosystem and age class. A proportional subsample from each stratum was designated for aerial survey.
- ii) Aerial strip surveys, tallying all living and dead *A. lasiocarpa* along strips, was conducted in the select polygons providing an overview at the landscape level of intensity, incidence and impact of *D. confusus* throughout its host range in the Kamloops Forest Region.
- iii) Ground surveys were conducted in a proportion of the polygons surveyed by air. The ground surveys, done to S.P.I. standards, give an estimate of the confidence level attached to the aerials surveys. The ground surveys will also verify mortality agents.
- iv) Large scale permanent sample plots (min. 0.25 ha each) will be installed across the range of subalpine fir based on incidence and hazard as determined in stages i-iii above (planned for 1997/98).

This forest health inventory will definitely assist in the forest land use planning process for high elevation ecosystems in the Kamloops Forest Region.

- L. Maclauchlan, Kamloops Forest Region, Kamloops.

FOREST DISEASES

Determining Levels of Expenditure for Treatment of Armillaria Root Disease Based on Forest Level Objectives: Methods and Analysis. This project was initiated to deal with two issues. The first is the Chief Forester's expectation that "...studies on the effects of armillaria to be completed, and these effects to be quantified, prior to the next Allowable Annual Cut (AAC) determination", (*AAC Rationale for Arrow TSA, October 1995*). The second issue is determining an acceptable level of treatment for armillaria infected stands, and linkage to forest level timber supply objectives. How much should be spent on treating armillaria infected stands, and what is the benefit in terms of timber supply?

In attempting to address these issues, a forest level database and model for the entire TSA has been created. Armillaria is accounted for in two ways. Existing information on the level of incidence and percent area coverage by biogeoclimatic zone and subzone is used to stratify the forest level database information. Yield curves are being generated from the PROGNOSIS forest vegetation simulator, and root rot incidence is being modelled using the root rot simulator that is part of the PROGNOSIS model. In addition to these curves, the analysis will also be done with existing yield curves generated by VDYP and TASS. Root rot infection, and activities to treat it are defined explicitly in the model, including treatment cost information.

The output from this project will be a methodology that defines the relationship between the cost of treating infected stands, and the potential benefits derived in terms of future timber supply over time. This methodology will clearly demonstrate the kinds of data that are required to answer this question, and how it should be used in an analysis. So far, it is clear that existing information is sorely inadequate, with respect to both the measure of armillaria incidence across the forest, and its impact on the growth of existing and future stands. It is hoped that this analysis will help to direct energies to alleviating this lack of information. A first draft of this analysis should be available in January, 1997 for review and comment.

- M. Messmer, Silviculture Practices Branch, Victoria.

Western gall rust: *Endocronartium harknessii*. Western gall rust was noted on young lodgepole pine in 1994 on an area near Nyland Lake in the Quesnel Forest District. Because of the obvious young age on infection, 2 - 3 years in a seven year old stand, nine permanent plots were established in 1996. These 3.9 metre plots were over a one hectare reserve. Infection of the trees on these plots varied from 0 - 42%, the highest being a plot of 19 trees of which 8 were infected. A tree was deemed infected if it had either a stem or branch infection. The majority of infections were on the stem. These excellent plots were established by cooperative education students Larissa Miller, University of Victoria and Melanie Kurrein, Simon Fraser University.

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

Douglas-fir Dieback: *Sclerophoma semenospora*. This report is on the third and final examination of permanent sample plots established to track *Sclerophoma semenospora*, which had infected Douglas-fir after the cold winters of 1984-85, and the intense frost in the summer of 1987.

The permanent plots were located at Gavin Lake, Keithly Creek, and Horsefly River, all in the Horsefly Forest District. The plots were established in 1987 in 15 and 16 year old Douglas-fir plantations. In 1987, the infection levels of *S. semenospora* were: Keithly Creek, 43%; Gavin Lake, 57% and Horsefly River, 48%. The overall average recovery by 1996 was 93%.

Recovery from the original defect (dead tops) was also tracked. The main criterion was, "Will these trees make future crop trees?". Field examinations in 1996 noted the only major visible defect left after nine years was that 8% of the Douglas-fir had double leaders.

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

Comandra Blister Rust on Planted Ponderosa Pine. Comandra blister rust was observed on ponderosa pine near Dairy Creek in the Kamloops Forest District. Detailed surveys indicate a 20% current infection 5% mortality. Transect plots have been established in three stands, planted from two separate seed lots, to study disease impact. The movement of the disease through the stand, considering climatic and site factors, location of alternate hosts (Bastard Toadflax), and host seedlot will be studied. Preliminary results indicate that seedlot and wind direction may be the two most important criteria.

- D. Piggin and D. Lux, Kamloops Forest District, Kamloops.

Western Root Disease Model 3.0. The Western Root Disease Model (WRDM) extension to FVS (PROGNOSIS) is moving closer to widespread application (pending completion of calibration of the base model). Three points are most worthy of mention:

1. Barry Snowdon, Silviculture Decision Support Specialist, has developed a user-friendly front end for the FVS model and its extensions. This utility eliminates the need to construct keyword files, making the model much easier to use, especially for the occasional user. Stand level analysis of growth and mortality responses to various disease levels and treatments can be accomplished in a similar manner to WinTIPSY.
2. The Allowable Annual Cut Mitigation Team in the Nelson Forest Region has found FVS and the WRDM useful in exploring partial cutting options and impacts of various levels of armillaria root disease on MAIs.

3. This winter, the impact of armillaria root disease and treatments on a variety of stand and biogeoclimatic zones commonly encountered in the Nelson and Kamloops Forest Regions will be modelled. The output will be accompanied by interpretation by forest pathologists and presented as a printed reference book. Prescription writers can benefit from the model by looking up scenarios similar to those they are dealing with without having to take time to use the model themselves.
- J. McLaughlin, Silviculture Practices Branch, Victoria.

TASS/ROTSIM Developments. WinTIPSY (with the Root Rot option) will allow users to predict the impact of *Phellinus* root rot on managed forests by accessing disease-affected yield tables generated by TASS/ROTSIM. In order to select the correct yield tables, the user supplies the inoculum level at year zero. Although this may be simple for new stands, what about those many second growth mid-rotation stands which are being considered for commercial thinning? Typically, the inoculum level that existed when the stand was established is unknown. A visual aid, dubbed "pathograms", has been created to assist users to estimate the correct initial inoculum level to enter into WinTIPSY, and thus access the correct yield tables. Pathograms, generated by TASS/ROTSIM, are 1:5000 scale spatial representations of disease centres in stands of various ages, site quality, inoculum levels, etc. Users compare their actual root disease survey maps with the pathograms generated for simulated stands with characteristics most-closely matching the real stand and select the inoculum level which produced such conditions. Development and testing of the pathograms has occurred in the Duncan Forest District, and implementation will be undertaken on a wider scale during fiscal 1997-98.

- J. McLaughlin, Silviculture Practices Branch, Victoria.

***Common Tree Diseases of British Columbia* by E. Allen, D. Morrison, & G. Wallis - Revised Edition.** A revised edition of this popular handbook has been released. As well as containing much of the information found in earlier versions, this latest copy contains a substantial amount of new materials and many new, excellent photographs in its 178, 15 cm x 23 cm pages. Tips for both macroscopic and microscopic identification are included, as well as information about the type and seriousness of damage the diseases cause. This book will prove a useful supplement to the publication *Field Guide to Pests of Managed Forests in British Columbia*. The Canadian Forest Service, Pacific Forestry Centre has offered to send several copies of the publication to each MOF district office in the province. You may also request a personal copy by calling the Pacific Forestry Centre at (250) 363-0600 or faxing your request to (250) 363-6006.

- John McLaughlin, Silviculture Practices Branch, Victoria.

Getting to the Root of the Whole Rotten Problem. Risk assessment of stands infected with armillaria root disease is currently based largely upon the results of various types of incidence surveys, some estimating the percentage of symptomatic stems, others reporting incidence as the percentage of stand area infected, also estimated from observations of symptomatic stems. Dissatisfaction with the current risk assessment method and the application of incidence thresholds indicates that the current approach, although simple to apply, is not adequately meeting our needs. Factors such as species mix, BEC type, and other site and host characteristics are largely ignored when the guidelines are applied rigidly.

Efforts are underway to assess the current survey methods and also to develop a more comprehensive method of site risk assessment. Ideas for an alternative risk assessment method arose through consultations involving the Nelson Forest Region Allowable Annual Cut (AAC) Mitigation Team, forest pathologists and a pedologist. A draft of this work is expected by February, 1997.

- John McLaughlin, Silviculture Practices Branch, Victoria.

Nichyeskwa Creek Tomentosus Control Trial Update. The background for the Nichyeskwa Creek Trial was reported in the December, 1995 edition of Forest Health Progress. Over the past field season there were several developments on the project. The FERIC time and motion study conducted on the stumping aspect of the trial was completed. Stump removal times averaged 27 sec/stump at a cost of \$469/ha including ownership, insurance and interest but excluding profit, risk supervision and transportation. Copies of the report are available from the Regional Pathologist in the Prince Rupert Forest Region.

The stumped and control treatment units were planted with interior spruce in May 1996. Three tree planters from Summit Reforestation were asked to plant the treatment units without regard for the location of any of the stumps. This was done to keep the trial as "operational" as possible. The seedling survival at the end of the growing season was excellent. The trees will be measured for height and calliper growth every five years and survival will be monitored every year. The first of the fallow treatment seedlings will be planted in the spring of 2001.

A residual inoculum study was conducted on the stumped portion of the trial to determine the amount of inoculum that was left in the ground after stumping. David Rusch (Rot Rooters) was awarded the contract. The study involved removing all of the roots from a quarter section of a 3 m radius around 35 infected stumps that had been pulled and inverted in place. It was found that the stumping operation removed 75% of the inoculum volume. The stumping efficacy could have been improved with little additional effort by using an excavator. It remains to be seen if the volume of infected roots left in the ground will have a significant impact on the spruce seedlings.

- A. Woods, Prince Rupert Forest Region, Smithers.

McKendrick Pass Whitebark Pine Survival Study. The McKendrick Pass trial was established in July 1996 to study the survival of a juvenile stand (approximately 30 years old) containing whitebark pine (*Pinus albicaulis*) infested with white pine blister rust (*Cronartium ribicola*). The location of all living whitebark pine was recorded and a 1:1000 scale stem map produced. Each tree was identified with a tag. The data recorded for each tree included root collar diameter, height and disease status. Disease status data included whether the canker was on a stem (S), branch (B), secondary stem (2°S), or branch on a secondary stem (B2°S). The whorl where the canker was located was also recorded, as well as the distance from stem (0 cm for stem cankers). If a stem contained a stem canker (assumed to be lethal) no other cankers were recorded for that stem. Where possible, infections were pruned. Trees containing stem cankers were pruned as long as a secondary stem remained or enough whorls below the canker were present to allow survival. Only 12 of the 119 trees on the site were disease free. Several of the largest, as yet disease free, trees will hopefully produce seeds so that possible resistance can be tested.

Several of the whitebark pines were also heavily attacked by *Pineus pinifoliae*, an adelgid that was apparently cycling between Engelmann spruce where it caused a gall, and the whitebark pines. The largest whitebark pines had as many as 5 female adelgids per needle over much of the three meter tree. The whitebark pine trees on this site will be monitored annually for both white pine blister rust and the adelgid.

- A. Woods, Prince Rupert Forest Region, Smithers.

Nichyeskwa Creek Tomentosus Control Trial Update. The background for the Nichyeskwa Creek Trial was reported in the December 1995 edition of *Forest Health Progress*. Over the past field season there were several developments on the project. The FERIC time and motion study conducted on the stumping aspect of the trial was completed. Stump removal times averaged 27 sec/stump at a cost of \$469/ha including ownership, insurance and interest but excluding profit, risk supervision and transportation. Copies of the report are available from the Regional Pathologist in the Prince Rupert Forest Region.

The stumped and control treatment units were planted with interior spruce in May 1996. Three tree planters from Summit Reforestation were asked to plant the treatment units without regard for the location of any of the stumps. This was done to keep the trial as "operational" as possible. The seedling survival at the end of the growing season was excellent. The trees will be measured for height and calliper growth every 5 years and survival will be monitored every year. The first of the fallow treatment seedlings will be planted in the spring of 2001.

A residual inoculum study was conducted on the stumped portion of the trial to determine the amount of inoculum that was left in the ground after stumping. David Rusch (Rot Rooters) was awarded the contract. The study involved removing all of the roots from a quarter section of a 3 m radius around 35 infected stumps that had been pulled and inverted in place. It was found that the stumping operation removed 75% of the inoculum volume. The stumping efficacy could have been improved with little additional effort using an excavator. It remains to be seen if the volume of infected roots left in the ground will have a significant impact on the spruce seedlings.

- A. Woods, Prince Rupert Forest Region, Smithers.

Pinkutt Lake Rust Pruning Trial. As with the Nichyeskwa Creek trial, the background for this project was reported in the December 1995 edition of *Forest Health Progress*. This trial is designed to indicate if pruning branches infected with comandra blister rust will save lodgepole pine trees. The trial is also designed to determine the distance from the stem at which a branch infection will become a lethal stem infection over time. Currently, the Free Growing Acceptability Guidelines state that a comandra blister rust branch canker must be more than 60 cm from the stem if the tree is to be considered acceptable. Very few branch cankers are found that far out on the branch. This project will determine if the acceptability criteria can allow the canker distance from the stem to be reduced. The location of every branch infection on trees in twelve 20 x 20 m plots was recorded. Six of the plots were pruned in June 1996. The unpruned plots will be monitored annually to follow the progress of the branch infections, and to determine at which initial distance from the stem infections would eventually reach the stem and become lethal. The pruned plots will be monitored to see which pruned branch infections have already reached the stem despite the lack of outside bark indications of infection at the stem at the time of pruning.

- A. Woods, Prince Rupert Forest Region, Smithers.

Morice TSA Rust Incidence Assessment. Following a request from the Morice Forest District, an attempt was made to determine the incidence of hard pine rusts (comandra, stalactiform and Western gall rust) in the juvenile stands in the district. Ryan Liebe and Stefan Quaglia, two Simon Fraser University sciences cooperative education students, surveyed 66 stands located throughout the TSA in June and July 1996. Due to unusually cold weather throughout the summer, the sporulation period of the rusts continued well into July, allowing for the survey to continue. The survey methodology consisted of a series of 3 m wide, 100 m transects at a survey intensity of 0.4 %. A total of 267 transects were surveyed containing 24,631 trees. Only stem galls and branch galls within 10 cm of the stem were tallied for western gall rust. All comandra and stalactiform infections were tallied. Rust incidence was calculated as the number of infected trees tallied out of the total number of lodgepole pine trees. Of the 66 stands surveyed, only four were in >20 % incidence class, and four were in the 10-20 % incidence class. The remainder of the blocks were in the 0-10 % class, with only six blocks completely free of rusts. Several interesting trends were noted in the study. The mean rust incidence was

significantly ($\alpha = 0.05$) lower in blocks that were broadcast burned (3.66 %) than in unburned blocks (6.70 %). Another trend that was noted was that rust incidence, particularly western gall rust incidence, was higher within 10 m of travelled roads than in the interior of the block.

- A. Woods, Prince Rupert Forest Region, Smithers.

Tomentosus Impact Assessment: Bulkley TSA. The overall objective of this project is to determine the impact of tomentosus root rot caused by *Inonotus tomentosus* over the past 20 years, in four TSAs in the Prince Rupert Forest Region. A contract for the first year of this FRBC-funded project was awarded to Cedrus Consulting, Smithers B.C. The final report on this project is due January 1997. This specific project will estimate the unsalvaged timber losses due to tomentosus root rot for the Bulkley TSA. The root disease impact assessment will be based on the volume of susceptible species (spruce and lodgepole pine) that is dead standing and dead and down, with an estimate of the length of time that individual trees have been on the ground. The impact assessment will also include an estimate of the number of live trees that are infected. It will be assumed that these infected trees will not survive longer than 20 years. These two volume estimates combined will be considered the impact of Tomentosus root disease. Improved impact estimates for tomentosus and other forest health agents will also lead to more economical use of control treatments.

The sampling scheme used for this project was based on Inventory Branch Permanent Sample Plots containing a spruce component. There were 28 sampled spruce component stands in the Bulkley Forest District, with a total of 43 permanent sample plots. Thirteen of the plots were located in stands less than 30 years old. Each 11.28 meter radius plot was revisited and examined for evidence of tomentosus root rot in the spruce and lodgepole pine trees. The volume of spruce and lodgepole pine killed by tomentosus root rot over the past 20 years was determined including both standing dead and fallen dead trees. The data will be separated into two sections, one for those trees that have died since plot establishment where the date of death is easily determined, and one for those trees that the date of death is less certain.

For both mature and immature stand plots, infected spruce and lodgepole pine trees will have fallen since the establishment of the plots. The measurement data from these trees will be made available so that volume estimates prior to mortality will be easily obtained. The duration of time that the blowdown trees will have been on the ground will similarly be easily obtained since the permanent sample plots are re-measured every five years.

The age of the blowdown trees that had fallen prior to the establishment of the plots was determined by examining scars on surrounding trees that were damaged when the infected trees fell. This information will be used to reconstruct the stand, assuming that dead standing and fallen volume would have remained alive and would have grown at a comparable rate to the surrounding surviving trees in the absence of tomentosus.

The reconstructed volume from both the tagged (post PSP establishment) and untagged (pre-PSP establishment) fallen trees and the standing dead trees will be added to the standing live volume of spruce and lodgepole pine to determine the potential plot volume. This potential volume must be qualified as some of the live standing lodgepole pine and spruce trees will likely be infected with tomentosus as determined by the increment core at the root collar. The infected live trees will have suffered some growth reduction due to the disease. Without further remeasurements, it is impossible to determine the growth impacts caused by infections on the live trees. Instead it will be assumed that these infected trees will die within the next 20 year period. The tomentosus impact estimates for each plot will be averaged to determine the mean volume impact of the disease over the past 20 years for those stands with an interior spruce component in the TSA. The volume loss estimate will be divided into four 5 year intervals and will be qualified as to whether the volume loss was pre or post-PSP establishment. The projected impact for the next 20 years will be made using the volume estimate of the infected live trees. All volume estimates will be made to the nearest cubic meter. Volume estimates will be made using height and diameter measurements and Kozak's Taper Equations for each species respectively.

The final report will consist of a tomentosus impact estimate for the past 20 years for those stands with an interior spruce component in the Bulkley TSA. This estimate will be divided into 5 year intervals and will include the impacts on the volumes of both lodgepole pine and interior spruce. The report will also include a projected impact due to tomentosus in spruce component of stands over the next 20 years based on the live infected trees in the mature stands (>30 years old) and the proportion of infected live and dead trees in the immature stands (<30 years old).

- A. Woods, Prince Rupert Forest Region, Smithers.

MAMMAL DAMAGE

Vexar® Tubing and Ungulate Browsing. Efficacy of Vexar® tubing in deterring ungulate browsing was studied near Frog Lakes (prime deer winter range) in the Kamloops Forest District. Douglas-fir trees were covered with Vexar® tubing in the spring of 1996. The degree of browsing before the tubing was placed will be compared to the browsing rate over the winter of 1996-1997. Similarly, several trees were not covered with Vexar® to act as a control to assess efficacy. The overwinter condition of the tubes will also be monitored since the snow fall expected in the area of the study is quite high. Results will be available in the spring of 1997.

- D. Piggin, E. Clemmer, K. White and D. Lux, Kamloops Forest District, Kamloops.

PESTICIDES

Efficacy of Pre- and Post-Oviposition Application of Neem on *Pissodes strobi* (Peck). Neem was applied as a foliar spray on young interior spruce terminals to reduce attack by, and development of, the white pine weevil, *Pissodes strobi*. Adult emergence from the pre-oviposition treatment was reduced by 20.9% from controls. Treatment of leaders post-oviposition had variable results. Application of neem two weeks post-oviposition, four weeks post-oviposition and at both dates, reduced emergence by no significant difference, 18.8% and 13.2% respectively, compared to the controls. Following emergence from neem-treated leaders, adult mortality was high compared to adults emerging from control leaders. Although weevil populations were reduced slightly by the application of neem, it is doubtful this would be a viable method of control.

- L. MacIaughlan, Kamloops Forest Region, Kamloops.

A Field Trial to Test the Efficacy of Mimic® Against Western Spruce Budworm. *Bacillus thuringiensis* var. *kurstaki* (*B.t.k.*) products are currently the insecticide of choice for use against western spruce budworm, *Choristoneura occidentalis*, when some control action is warranted. In the management of forest defoliators, including the western spruce budworm, a choice of environmentally acceptable products to use against these outbreak populations would be desirable. Although results obtained in past projects with *B.t.k.* have been acceptable, it is still variable and Mimic 240 LV® could offer a comparable, and acceptable, alternative.

Mimic 240 LV is a forest protection product which is designed to control only certain lepidopteran pests. Mimic induces a premature molt in susceptible target lepidopteran species by mimicking a non-steroidal molt accelerating compound (20-hydroxyecdysone) that belongs to a novel class of insect growth regulators. Mimic's active ingredient is azadirachtin. Upon ingestion of this product by larvae, the insect stops feeding within an hour and within a few days goes into a premature molt, making the insect incapable of feeding, thus killing the insect.

The intention of this field trial was two-fold:

1. To test the efficacy of Mimic 240 LV on the western spruce budworm, and
2. to collect data towards expanding the existing (registration) label to include the western spruce budworm.

Results: Due to very cool early summer weather, budworm development was delayed. The Mimic treatment was done at first light on June 17, 1996. The conditions were cool with gusty winds and scattered showers. Mortality was variable, and could largely be attributed to the poor conditions on the day of treatment. However, the outlook for Mimic as an alternative option for budworm control is good.

☐ Block	Time	% Mortality	Abbott's Corrected Mortality
DC - mimic	1	39.2	18.0
	2	65.7	48.1
	3	81.2	51.0
EC - mimic	1	12.4	-18.2
	2	61.5	41.8
	3	92.4	80.2
T1 - check	1	39.4	
	2	51.8	
	3	93.5	
T2 - check	1	25.9	
	2	33.9	
	3	61.6	
T3 - mimic	1	55.2	39.5
	2	89.0	83.4
	3	98.3	95.5
T4 - check	1	32.3	
	2	46.7	
	3	78.1	
T5 - check	1	68.2	
	2	83.8	
	3	79.2	

- L. Maclauchlan, Kamloops Forest Region, Kamloops.

PERSONNEL

SILVICULTURE PRACTICES BRANCH

John Muir	Forest Health Officer	Victoria	387-8740
Peter Hall	Forest Entomologist	Victoria	387-3842
Val Fletcher	Forest Health Sampling/Surveys Specialist	Victoria	356-8763
Tim Ebata	Forest Health Project Specialist	Victoria	387-8739
John McLaughlin	Forest Pathologist	Victoria	387-8737
John Henigman	Forest Health Forester	Victoria	387-8738
Shirley Turcotte	Forest Health Management Secretary	Victoria	953-3582
Bev McEntire	Pest Management Biologist, Seed Production	Victoria	652-7613
Michelle Hall	Pest Management Biologist, Seed Production	Victoria	652-7613
Robb Bennett	Seed Pest Management Officer	Victoria	652-6593
Brian Wikeem	Noxious Weed Biocontrol Officer	Kamloops	376-1331
Marsha De Wolf	Noxious Weed Biocontrol Technician	Kamloops	376-1331
Susan Turner	Noxious Weed Biocontrol Specialist	Kamloops	376-1331

NURSERY AND SEED OPERATIONS BRANCH

Don Summers	Manager, Nursery Extension Services	Surrey	930-3301
Dave Trotter	Nursery Pest Mgmt. Specialist	Surrey	930-3302
Diane Gertzen	Special Proj./Christmas Tree Specialist	Surrey	030-3309

CARIBOO FOREST REGION

Regional Staff

Leo Rankin	Forest Entomologist	Williams Lk.	398-4439
Don Doidge	Forest Pathologist	Williams Lk.	398-4442

District Staff

Bob Mitchell	Forest Health Officer	Chilcotin	394-4700
Derek Poole	Forest Health Officer	Horsefly	620-3200
Brad Powell	A/Forest Health Officer	Quesnel	992-4400
Von Vickers	Forest Health Officer	Williams Lake	398-4341
Don Wright	Forest Health Officer	100 Mile House	395-7873

KAMLOOPS FOREST REGION

Region Staff

Lorraine Maclauchlan	Forest Health/Research	Kamloops	828-4177
Hadrian Merler	Research Associate	Kamloops	828-4176

District Staff

Rob Martin	Forest Health Spec./Woodlot For.	Clearwater	587-6700
Dave Piggin	Forest Health Forester	Kamloops	371-6534
Ed Senger	Forest Health Specialist	Lillooet	256-1277
Pat Byrne	Forest Health Specialist	Merritt	378-8449
Margot Hollinger	Forest Health Specialist	Penticton	490-2242
Savas Koutsantonis	Forest Health Technician	Penticton	490-2250
Jim Wright	Zone Forester, Silviculture	Salmon Arm	832-1424
Wayne Anshelm	Forest Health Specialist	Salmon Arm	832-1428
Eric Haupt	Forest Health Specialist	Vernon	558-1784

NELSON FOREST REGION

Region Staff

Art Stock	Forest Entomologist	Nelson	354-6633
Don Norris	Forest Pathologist	Nelson	354-6143

District Staff

Dan Reibin	Forest Health Officer	Arrow	365-8613
Ross Elliott	Forest Health Officer	Boundary	442-5411
Liz Goyette	Forest Health Officer	Cranbrook	426-3391
Emile Begin	Forest Health Officer	Invermere	342-4200
Julie Castonguay	Forest Health Officer	Kootenay Lk	825-1142
Norm Tennant	Silviculture Specialist	Revelstoke	837-7611
Randy Lessard	Forest Health Officer	Golden	344-7500

PRINCE GEORGE FOREST REGION

Region Staff

Robert Hodgkinson	Forest Entomologist	Pr. George	565-6122
Richard Reich	Forest Pathologist	Pr. George	565-6143

District Staff

Bruce Doerksen	Forest Health Technician	Pr. George	565-7100
Sharron Schiefelbein	Forest Health Technician	McBride	569-3748
Nathan Voth	Forest Health Technician	Vanderhoof	567-6363
Barb Harrison	Forest Health Technician	Ft. St. James	997-5248
Steve Bower	Forest Health Technician	Mackenzie	997-2200
Cathy Walker	Forest Health Technician	Dawson Creek	784-2350
Brain Farwell	For.Res & Pract - .Silviculture	Ft. St. John	787-5600
Steve Lindsay	Resource Officer - Silviculture	Ft. Nelson	774-3936

PRINCE RUPERT FOREST REGION

Region Staff

Neil Endacott	Silviculture Officer	Smithers	847-7513
Alex Woods	Forest Pathologist	Smithers	847-7478
Ken White	Forest Entomologist	Smithers	847-7479
Lou Tromp	Stand Tending/Veg Mgmt For.	Smithers	847-7514
Don Russell	Range Officer	Smithers	847-7443
Gerry Pinkerton	Reforestation Forester	Smithers	847-7512

District Staff

Gary Lloyd	Senior Zone Forester	Bulkley	847-6307
Bill Camenzind	Silviculture Specialist	Bulkley	847-6310
Glen Buhr	Silviculture Practices Forester	Cassiar	771-4211
Bob Wilson	Silviculture Officer	Kalum	638-5138
Doug Davies	Zone Forester	Kalum	638-3290
Paul Hanna	Silviculture Officer	Kispiox	842-7600
Todd Bresser	Forest Health Technician	Morice	845-6224
Todd Burgess	A/Silviculture Officer	Morice	845-6200
Ted Traer	Silviculture Officer	Lakes	692-7515
Terry Thrower	Forest Health Technician	Lakes	692-7515
Mike Grainger	Silviculture Specialist	North Coast	624-7460
Mark Vieweg	Resource Officer-Silviculture	Lakes	692-7515

VANCOUVER FOREST REGION

Region Staff

Don Heppner	Forest Entomologist	Nanaimo	751-7107
Stefan Zeglen	Forest Pathologist	Nanaimo	751-7108

District Staff

John Ingram	Resource Officer - Silviculture	Campbell Rv.	286-9300
Buck Tanner	Timber Specialist	Campbell Rv.	286-9300
Lucy Stad	Zone Forester	Chilliwack	794-2100
Reinhard Muller	District Silviculturist	Duncan	746-2700
Shawn Rice	District Silviculturist	Mid Coast	982-2000
Mark Palmer	District Silviculturist	Pt. Alberni	724-9205
Chuck van Hemmen	Resource Officer - Silviculture	Pt. McNeill	956-5034
Ron Diprose	Forest Health Technician	Sunshine C.	485-0730
Allan Sugg	District Silviculturist	Qn. Char. Is.	559-6212
Jeff Fournier	Zone Forester	Squamish	898-2100
Dave Minhas	Zone Forester	Squamish	898-2100

MEETINGS

1996 North American Forest Insect Work Conference. The 1996 North American Forest Insect Work Conference was held in San Antonio, Texas, during the week of April 8, 1996. This meeting was a joint meeting of all regional work conferences and is held every 5 years. The sessions were well attended by research and operational entomologists, administrators from state, provincial, and federal forest management agencies, and others. A wide range of topics were covered in several panels and concurrent workshops. A proceedings will be produced and will be available from the undersigned when ready.

- P. Hall, Silviculture Practices Branch, Victoria.

1997 Western Forest Insect Work Conference. The 1997 Western Forest Insect Work Conference will be held in Prince George, British Columbia, at the Inn of the North, during the week of April 14, 1997. The program committee is comprised of P. M. Hall, L. E. Maclauchlan, R. Bennett, and T. Shore. The local arrangement committee is comprised of R. Hodgkinson, S. Taylor, and S. Lindgren. An initial mailout with details of the conference and a draft program will be forthcoming early in the new year. A final announcement and complete program will be sent out by February. This conference is an excellent opportunity to meet forest health practitioners from universities and government agencies across North America to discuss current and proposed management practices. The Chairperson for the conference is Dr. L. E. Maclauchlan of the British Columbia Ministry of Forests, Kamloops Forest Region.

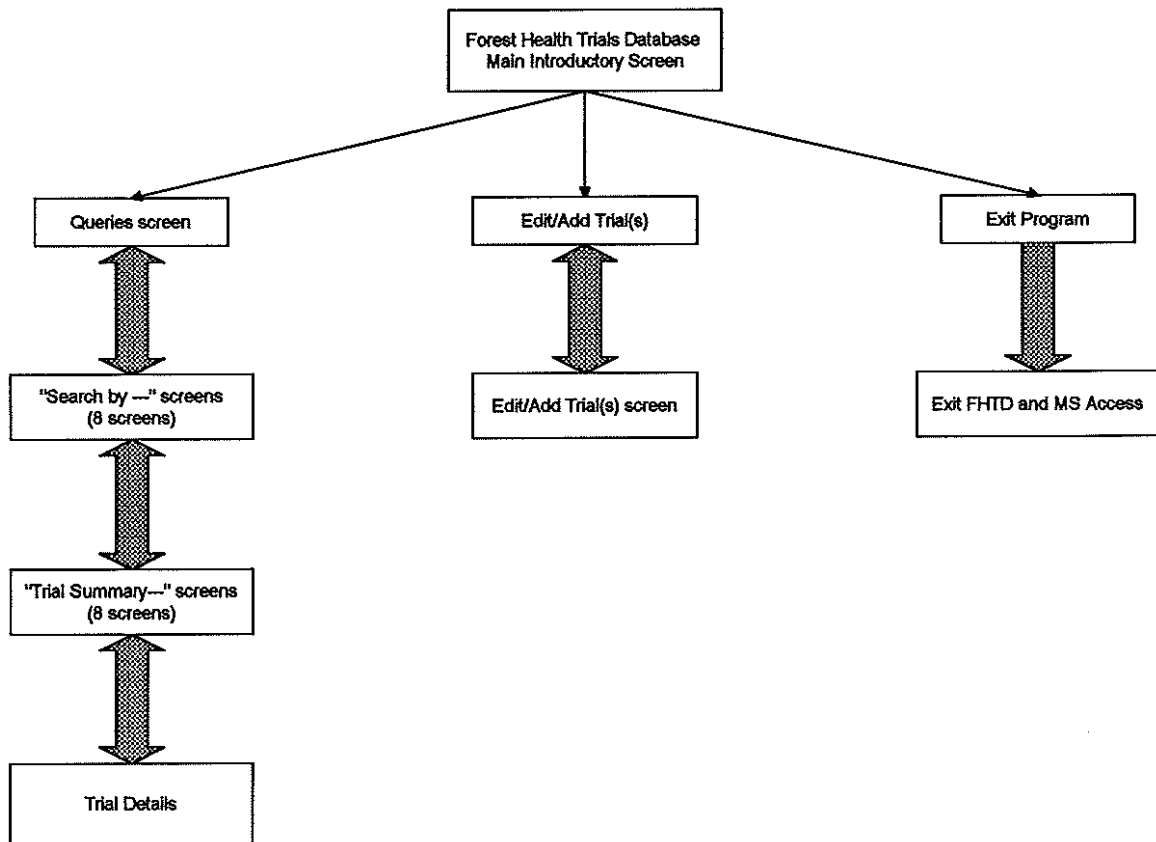
- P. Hall, Silviculture Practices Branch, Victoria.

TABULATIONS AND GRAPHICS

1. Forest Health Trials Database - Screen Flow Chart

2. Forest health Committee of British Columbia
Terms of Reference (revised May 1995)
and
Membership List (1994)

FOREST HEALTH TRIALS DATABASE - SCREEN FLOW CHART



For text, see page 8.

- T. Ebata, Silviculture Practices Branch, Victoria.

FOREST HEALTH COMMITTEE OF BRITISH COLUMBIA

File: 200-20/FHEA

TERMS OF REFERENCE (revised May 1995)

Introduction

Insects and other arthropods, diseases, vertebrates, and vegetation are natural or introduced components of forest ecosystems; many are, or can become, important pests. Under certain conditions some can significantly alter a forest ecosystem and change its value to society.

The intensity of some organisms can vary from low endemic levels of little impact upon human values to large scale outbreaks with catastrophic consequences to economic, ecological, and/or other forest management objectives.

It is necessary that those engaged in forest land management keep informed of the current status of real and potential pests. Furthermore it is necessary that policies related to pest management be examined from an open, system oriented viewpoint and that resultant practices be a reflection of this viewpoint.

Accordingly, in the interests of keeping informed of current forest health status, a "Forest Pest Review Committee" was formed in November of 1974 (now the "Forest Health Committee of British Columbia"). Under the chairmanship of the Chief Forester of British Columbia, the Committee objectives are:

1. to keep informed of the current forest pest situation and management programs through annual meetings as required;
2. to provide a forum for members to discuss and make recommendations to resource managers on better forest health through better forest management;
3. to have Committee members disseminate pertinent forest health information to their respective organizations;
4. to forward comments and/or recommendations to other organizations where the Committee deems it advisable;
5. to encourage the formation of regional forest health committees to recommend programs where forest health problems warrant such action; and
6. to inform the general public of the role, responsibilities, and activities of the Forest Health Committee and to assist in the dissemination of pertinent information on forest health problems and their management.

MEMBERSHIP (1994)

CHAIR

- Chief Forester of British Columbia

MEMBER AGENCIES

- **Industry**
 - a) Cariboo Lumber Manufacturers Association (CLMA)
 - b) Coast Forest and Lumber Association (CFLA)
 - c) Interior Lumber Manufacturers Association (ILMA)
 - d) International Woodworkers of America (IWA) Canada
 - e) Northern Interior Lumber Sector (NIL/COFI)
- **Provincial Government**
 - a) Ministry of Environment, Lands, and Parks:
 - Fisheries and Wildlife Branches
 - Pollution Protection and Pesticide Management Branch
 - Water Quality Branch
 - Parks Branch
 - b) Ministry of Forests:
 - Forest Health Section
 - Forest Regions (six)
 - c) Ministry of Health
- **Academic/Professional**
 - a) Colleges and Technical Schools:
 - B.C. Institute of Technology
 - Selkirk College
 - Malaspina College
 - College of New Caledonia
 - b) Universities:
 - Simon Fraser University
 - University of B.C.
 - University of Northern B.C.
 - University of Victoria
 - c) Professional Pest Management Association of B.C.
- **Federal Government**
 - a) Agriculture Canada:
 - Plant Health
 - b) Environment Canada:
 - Conservation and Protection
 - c) Natural Resources Canada:
 - Canadian Forest Service
- **Special Interest**
 - a) First Nations
 - Nicola Valley Institute of Technology
 - b) Environmental Organizations
 - BC Environmental Network

PUBLICATIONS AND REPORTS

- Allen, E., D. Morrison, and G. Wallis. 1996. Common Tree Diseases of British Columbia. Release of revised edition. 178 pp.
- Taylor, S. P., B. S. Alfaro, C. Delong, and L. Rankin. 1996. The effects of overstorey shading on white pine weevil damage to white spruce and its effects on spruce growth rates. Can. J. For. Res. 26: 306-312.
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