Province of British Columbia
Ministry of Forests

PEST MANAGEMENT PROGRESS

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

Volume V, Number 2 (File: 190-4 PMP) November 1986

Dealing with Insect Defoliators

A resurgence of well-known enemies collectively called "budworms" (Choristoneura, Acleris spp.) and the threat of a new one, the gypsy moth (Lymantria dispar), have many pest management and quarantine specialists preoccupied with determinations of current or potential impacts. In the case of the budworms, traditional concerns for losses in growth and survival resulting from defoliation are compounded by recent investments in site preparation, planting, spacing, weed/brush control, etc. In some instances $1,000/ha or more have been invested to secure a superior forest crop. Many such valuable stands of young trees are now severely infested.

Gypsy moth, although not likely a direct threat to most of British Columbia's coniferous forests, has a nasty habit of indiscriminate egg-laying which serves to accelerate its dispersal and establishment. In the case of shipments of forest products from infested zones, for example, quarantine/embargo situations may result in expensive and laborious phytosanitary inspections and pesticidal treatments.

Thus, forest pest management personnel in B.C. must recognize and incorporate new factors in dealing with these pests: as forestry specialists they must determine with considerable precision overall effects of native defoliators in managed stands prior to selecting treatments, while, concurrently, serving as a senior partner in the B.C. team effort to deter the establishment of a serious new pest at every possible opportunity.

Part of these responsibilities will be enhanced by the work of the provincial Pest Damage Appraisal Advisory Committee which has the overall responsibility for establishing operational standards and procedures and for developing research priorities. At present, the Committee has selected budworm damage as its primary focus.

Where and when spray treatment is contemplated for control of budworms and gypsy moth, the primary alternative will likely be B.t. (Bacillus thuringiensis), the bacterial insecticide. Certainly, recent social pressures as well as an improved performance record will dictate serious consideration of this material. As a result, partnership opportunities with colleagues in Parks and Agriculture Canada in using B.t. will serve to enhance the learning process while increasing odds for success.

The expected results of our current experiences will be: (1) the emergence of the much-needed pest damage appraisal process, that vital and essential bridge between initial detection and treatment decision-making; and, (2) the cementing of strategic working relationships both within the Forest Service and with colleagues in sister agencies. These are good and progressive experiences for all of us.

- R.F. DeBoo, Protection Branch, Victoria

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PEST MANAGEMENT PROGRESS

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Publisher's and Editor's Note:

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

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

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

PEST MANAGEMENT GENERAL

We're Making Progress - aren't we? Bark beetle infestations have been the major forest pest management problem facing the province for the past decade. Great efforts have been expended on reducing these losses using the best methods available. The perception that we are doing unprecedented things to deal with a unique situation may be held by some of those dealing with, or observing, the current bark beetle program. In fact, neither is the case in many respects.

Following are some rather interesting quotes or data from the past -

- "....by modified logging operations, these green "beetle trees" can be removed during winter, kept separate, and so treated that the broods in the bark will be killed before their breeding season opens, it is possible to stop the outbreak in one season.....Practically, this would not be possible....by similar work upon the relatively few trees attacked the succeeding season, it can be brought under nearly complete control, provided the entire infested section is treated.....When only a portion of the infestation can be treated each season, it is usually considered advisable to direct the work towards reducing as rapidly as possible the chief centres of infestation in the whole infested section."

  - From Canadian Bark Beetles. Part II. A Preliminary Classification, with an Account of the Habits and Means of Control by J.M. Swaine, 1918.

- in the same publication, Swaine discusses some direct control methods including floating the logs, sawing in winter and burning the slabs, barking the trees, and cutting and burning infested trees. He states, in addition, "It will often be best to combine two or more of the available methods in order to complete the control work during late fall, winter, and early spring."

- a report on spruce beetle in the U.S. (date and source unknown) gives the following information regarding an outbreak in northern Idaho and western Montana from 1952 to 1956:

  - over 2.2 billion board feet of Engelman spruce were killed between 1952 and 1956;
  - in 1954, 42,000 trap trees were felled and, in 1955, 11,000 trap trees were felled;
  - the Federal Government spent $8,428,500 on a special grant for access roads in beetle salvage areas. The money was spent in the construction of 437.4 miles of road.

- a report by J.C. Holms of the Vernon Forest Entomology Laboratory (FIDS) in 1965 discusses a mountain pine beetle outbreak in the Stuart-Tembleur-Takla Lakes area (Ft. St. James District). Estimates were that over 23,000 trees were killed over about 4 400 ha during 1962 and 1963. Predictions were for continued expansion.

The above selections should provide a history lesson and should be used as a caution for the future. Although management efforts and natural factors will eventually end the current outbreak in many areas, it could happen again if steps are not taken now. Long term preventive practices should be implemented now, where possible, to reduce the chance of future extensive outbreaks.

- P. Hall, Protection Branch, Victoria

Forest Insect and Disease Impact Steering Committee. A survey was conducted in 1986 of "Black Book" users to determine its utility and establish the need for future improvements. Although current utilization is poor, all respondents indicated the necessity of continued improvements to maintain the "Black Book" as a basic source document of insect and disease data for Timber Supply Area planning.

Accordingly, a steering committee was established to improve methods. Committee members will concentrate their efforts on:

- reviewing methods and incorporating results (incidence and impact) of recent surveys;

- developing a process to increase utilization and integrate the "Black Book" into the planning system;

- improving the quality of area and volume figures generated from Planning/Inventory Reports; and

- initiating a "Blue Book" for TFLs and private lands.

Once improvements are complete, an update will be initiated in early 1987 using 1986 survey information. The Protection Branch is coordinating a committee to act as the responsible party for updating and ensuring use of the Black Book in Timber Supply Area plan revisions.

- S. Taylor, Protection Branch, Victoria

PMIS Update. The latest version of the Prince Rupert Pest Management Information System has been released by Dave Gilbert of Protection Branch after the necessary changes were completed by Thunderbear Consultants. Due to

the delay in releasing of the new version, the "old" PMIS will be used in a few of the forest districts in the Prince Rupert Forest Region. Dave Gilbert suggests that the system be approached as a "prototype" until we are confident that the software works.

The report on associated mapping standards is presently being reviewed and will be available in the near future.

- W. Martin, Prince Rupert Forest Region, Smithers

FRDA Pest Control Projects. With the $200,000 allotted under the Forest Resources Development Agreement (FRDA) for pest control by provincial funding, several projects have been initiated.

These include:

- pest damage surveys in plantations in Prince Rupert and Prince George Forest Regions;

- development of root disease survey methods for interior forests;

- dwarf mistletoe damage appraisal methods for lodgepole pine;

- sampling residual roots on areas destumped for root disease control;

- demonstration areas for root diseases, spruce leader weevil, and dwarf mistletoes; and,

- subalpine fir assessment near Smithers.

Based on regional submissions, plans are being made for 1987 projects.

- J. Muir, Protection Branch, Victoria

Ground Surveys of Young Stands. Two contracts were awarded to conduct surveys of young stands (plantations 12+ years old) in the McBride and Prince George Timber Supply Areas. FRDA funding has made it possible to examine a total of 50 stands for insect and disease pests and their effect upon potential crop trees. The surveys consist of continuous strips, 10 metres in width, spaced 200 metres apart. Tallies of pest-attacked trees are summarized every 100 metres. At 100 metre intervals along the strip lines, fixed radius plots are established where all trees are examined and tallied by pest attack status. Data from these surveys will be instrumental in developing pest management guidelines for young stands.

- R. Cozens and K. Lewis, Prince George Forest Region, Prince George

Pest Survey of Young Stands. A contracted survey under the F.R.D.A. of pests of young stands within the Prince Rupert Forest Region revealed no one single pest is a problem. However, in certain localities and certain situations, several pests cause significant damage. These pests include:

- Hylobius in poorly stocked interior PL stands
- Armillaria in PL stands on marginal sites
- Tomentosus in Sx stands on wet and dry sites
- Rusts in 30-60 year old PL stands
- Terminal weevil in dominantly Ss stands
- Moose in poorly stocked stands with a minor PL component
- Late frosts or other damaging agent causing bud damage

Mistletoes, defoliators, and mechanical damage do not appear to be a problem in young stands surveyed. It is recommended that additional studies should address Hylobius, Armillaria, terminal weevil, and Tomentosus root rot, as well as the general susceptibility of PL to pests (re species preference for reforestation).

This survey's conclusions were based on a strip survey (10 m wide) of the dominant type within 105 young (10 - 60 years old) stands. These stands were chosen to be evenly distributed through the southern half of the Prince Rupert Forest Region and were mostly of natural origin (fire or logging). A full report will be available in the spring from Protection Branch or the Prince Rupert Regional Office.

- M. Geisler, Prince Rupert Forest Region, Smithers

Cause of Subalpine Fir Mortality in Bulkley and Morice T.S.A.s. The objective of this FRDA funded survey is to identify and describe mortality factors associated with balsam bark beetle activity. Individual dead or declining subalpine fir were examined along transects within dominantly balsam stands. Preliminary results suggest "reds" were the result of beetle activity while declining balsam had symptoms from a variety of factors. Some had evidence of Tomentosus, others Armillaria. Two other yet unidentified root rots were often associated with balsam decline. Small residuals (advance regen) frequently showed Echinodontium fruiting bodies. Whether these declining trees are predisposed to balsam bark beetle activity is unknown. A full report will be available in mid-February.

- M. Geisler, Prince Rupert Forest Region, Smithers

Large Scale Photography Evaluated for Pest Surveys. The Prince George Forest Region has in excess of 150 000 hectares of plantations of an age where they are susceptible to pest incursion. These plantations are not scheduled for any formal surveys once designated "free growing," yet are at their most

susceptible stage for pest attack. Large scale colour aerial photography may prove beneficial in surveys of such stands for pest activity. Both 70 mm and 35 mm photographic systems are being evaluated for their resolution and applicability when used with helicopters and fixed-wing aircraft.

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

Joint Federal-Provincial Forestry Remote Sensing Study. Dr. Frank Ahern and co-workers of C.C.R.S. along with district, regional, and branch staff of the Forest Service participated in the evaluation of MEIS (Multispectral Electro-optic Imaging Sensor) in mid-August 1986. In particular, MEIS has potential for application in juvenile stand assessment, mountain pine beetle damage mapping, and area cut control.

The MEIS sensor was used to acquire imagery from various heights above ground at three locations in the Telkwa River drainage for the mountain pine beetle mapping experiment and near Chapman Lake for the juvenile stand assessment. With regard to the former, it is hoped that MEIS can provide maps of red attacked trees as is currently done by aerial sketch mapping. In addition to making attacked stands easier to locate for treatment, accurate damage assessment could be merged with the digital forest inventory system to provide more informed options for management planning.

- W. Martin, Prince Rupert Forest Region, Smithers

Pest Management in Nurseries. Cutworms were serious pests at many nurseries throughout the province in 1986. Damage from the cranberry girdler appears to be increasing, and this pest is now suspected of girdling container stock. Several pesticide trials were conducted, and a monitoring program for fungus gnats was initiated.

A program to reduce girdling by adult weevils at Harrop Nursery was successfully implemented. Two carefully timed applications of Belmark appear to have a repellant action reducing the number of weevils that enter the greenhouses.

The Lygus bug continues to be a pest of pine seedlings in the Prince George area and it is suspected of damaging larch seedlings at Vernon Nursery. Operational trials were conducted to reduce damage caused by this pest in both bare-root pine at Red Rock Nursery and container pine at Summit Nursery. Preliminary results indicate that Cymbush provided significant damage reduction and registration for this insecticide will be pursued.

Work with the fungicide Equal® to control liverworts in 2+0 container compounds continued in 1986. Five coastal nurseries cooperated in the program. Results with this product have been erratic to date; it is only effective on young liverwort plants, and application volumes are critical.

Application to register a drench treatment of carbofuran for control of black vine weevil larvae infesting container stock will be made after successful trials this summer. An entomophilic nematode was also tested, but temperatures in September, when control is required, are too cold for it to be effective.

The herbicides MCPA and Goal® were tested for their effectiveness at controlling field horsetail, and their phytotoxicity to Douglas-fir and pine at Chilliwack Nursery. Both herbicides top killed horsetail and held back regrowth for one month. MCPA was phytotoxic to pine. A small trial testing MCPA and Amitrole-T for control of horsetail was conducted at Skimikin Nursery. Amitrole-T provided better control than the MCPA.

Trials with Gesagard® as a post-emergent application were conducted at Surrey Nursery. This herbicide has been tested for several years in B.C. and a package for registration will be prepared this winter.

A program to monitor populations of fungus gnats using yellow coloured sticky ribbons was conducted at several container nurseries. Most nursery personnel did not find the program useful.

Applications of Virtuss® (a nuclear polyhedrosis virus) to control rusty tussock moth larvae in greenhouses at Surrey Nursery were ineffective for the second year. Possibly, frequent irrigation in the houses washes the virus particles from the foliage before they are ingested by the larvae.

- G. Shrimpton, Silviculture Branch, Victoria

Fume Damage at Port Alice. Vegetation plots recently established by the Ministry of Environment and Parks, Waste Management Branch, established that some vegetation near the sulphite pulp mill near Port Alice was damaged by sulphur dioxide fumes.

A field trip to the area in August, 1986, confirmed the occurrence of classical symptoms of injury near the mill, with some indications of damage north of the mill site to a distance of 15 to 20 km. Damage was originally noted by inventory crews several years previously.

A further survey will be undertaken to determine the extent and amount of damage.

- J. Muir, Protection Branch, Victoria, J. van Barneveld, Ministry of Environment and Parks, Victoria, and J. Beale, Vancouver Forest Region, Burnaby

Porcupine Update. The North Coast Forest District has plans to acquire six more fishers at the cost of $650.00 per animal this winter. These will be released in Khutzamateen Inlet as were previous fishers in an attempt to curtail porcupine damage. Fords Cove is the next priority area requiring surveys and a fisher release program.

Protection Branch has allocated FRDA money to investigate the porcupine problem in the Kalum Forest District. Approximately 60% of the funds will be spent on establishing line intercept transects to estimate current damage in recently spaced conifer stands in the Terrace area this fall. The remaining funds have been allocated for control of porcupine using a bounty limited to registered trappers in the area this winter. The effectiveness of the bounty will be judged on the level of current damage before (November 1986) and after (summer/fall 1987) implementation of the bounty, with a few transects outside the designated areas eligible for bounty serving as a control. Unfortunately, the presence of active traplines in the Terrace area forces us to look at alternatives other than fisher release at present.

- W. Martin, Prince Rupert Forest Region, Smithers

Forestry Information Centres. Under the direction of the Forest Issues Steering Committee, Information Centres will be established in all region and district offices throughout the province.

These centres will provide comprehensive information on a wide variety of topics relating to forestry practices in British Columbia, including pesticide use, and will be available to both the public and forestry personnel.

- P. Humphreys, Protection Branch, Victoria

Forest Pest Handbook in Prince George Forest Region. An illustrated handbook of the major forest pests of the Prince George Forest Region is nearing completion. It will be an initial reference for field personnel in the identification of 13 forest pest insects and 8 forest diseases. Each section will contain a description of the pest and its life history, damage, management recommendations, and selected references.

- Regional Pest Management Staff, Prince George Forest Region, Prince George

Pest Management Displays. In the past six months, pest management displays have been exhibited at Smithers, Port Alberni, and twice in Victoria. Displays on six topics (mountain pine beetle, root rots, Douglas-fir tussock moth, general pest management, gypsy moth, and pesticides) are currently available and another on "Dwarf Mistletoe" is in preparation. Agencies interested in borrowing these displays should contact S. Taylor, Ministry of Forests and Lands, Protection Branch, 1450 Government Street, Victoria, B.C. (387-8743).

- S. Taylor, Protection Branch, Victoria

Pest Management at Regional Forest Exhibition. In late May, 1986, a forest pest management exhibit was set up at the Prince George Regional Forest Exhibition. Staffed by people involved in pest management functions, visitors learned about basic forest pest management principles. A permanent seven-panel display described various insect and disease problems and control options common to the Prince George Forest Region. This will form a focal point for future regional or district displays.

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

FOREST ENTOMOLOGY

Impact of Bark Beetles on Long Run Sustained Yields. The present yield analysis tools such as MUSYC and FORPLAN do not account for catastrophic losses and their impacts on long run sustained yields. Thus, the impact of the mountain pine beetle infestation on harvest levels in the Cariboo Forest Region cannot be adequately estimated.

To address this issue, Darrell Errico (Research Branch) and Dr. Bill Read (University of Victoria) have extended their work from catastrophic losses caused by fire to bark beetles. Using the Quesnel TSA, a linear program model was formulated that could address the impact of catastrophic losses. The model generates alternative stand dynamic paths through the use of a second matrix that can track infested stands. Infested stands can 'regrow' along a rehabilitation path to 'normal' stands or can be retained in an infested state to grow along a path with long regeneration delays and with alternate stand growth characteristics.

In spite of the ongoing infestation, the model estimates that the impact of the bark beetle on the availability of lodgepole pine, medium sites, in the Quesnel TSA is not significant in the long term. The model suggests that, at the most, given the current level of infestation, the long run sustained yield will differ by no more than 5% from an uninfested state. However, these results do not detract from the very serious issue of short term timber supply disruptions due to large scale, periodic losses of mature timber.

Although the results initially appear to be counterintuitive, especially when compared to the analysis of the impact of fire, the model has adequately accounted for the impact of bark beetles. The essential difference between the fire case where losses are annual and randomly distributed among the age classes and the bark beetle case, is that, in the latter, the losses are periodic and tend to be distributed to the 'mature' age classes.

Although the long term implications of the present infestation may not be significant, the short term disruptions to timber supply are still a significant problem.

The most significant problem in utilizing this model is estimating the extent, intensity, expected mortality, and the periodicity of infestations over the very long term (more than two rotations).

A paper has been written and is intended for submission to Canadian Journal of Forest Research.

- D. Errico, Research Branch, Victoria, and D. Gilbert, Protection Branch, Victoria

Cariboo Region Aerial Insect Survey. For the first time in several years, a partial overview aerial survey using 1:100,000 maps was conducted with the help of the Canadian Forestry Service. The information collected from the survey was used to priorize areas for Sevin treatment and for colour aerial photography.

Once again, a detailed aerial detection survey using grid flying and 1:40,000 maps was completed. Due to the large quantity of data to be processed, final results are still not available. However, the results should indicate a significant reduction in volume and area of lodgepole pine killed in 1985 as compared to the previous year.

- W. Mussio, Cariboo Forest Region, Williams Lake

Aerial Sketch Mapping in Prince George Forest Region. Aerial sketch mapping on 1:40,00 scale colour-xeroxed maps was conducted in the Prince George West, Prince George East, McBride, and Vanderhoof Forest Districts in 1986. Single engine, fixed-wing aircraft flew a total of 290 hours, and a 206-B helicopter flew 12 hours during the months of August and September. In addition, the region sponsored 37 hours of aerial sketch mapping by the Forest Insect and Disease Survey Unit of the Canadian Forestry Service. Sketch mapping will be encoded by attack polygon and analyzed in order to determine volume information and losses on both a Timber Supply Area and a specific basis.

- G. Ensworth, Prince George Forest Region, Prince George

Colour Photos for Mountain Pine Beetle Detection in the Prince Rupert Forest Region. To aid detection and control efforts in the Lakes, Morice, Bulkley, and Kispiox TSAs, the majority of the mountain pine beetle infestations were covered by aerial colour photography. The 6,000 (plus) 1:10,000 colour photos covered approximately 730 000 ha and cost $189,000 (shared by Special Funding, Silviculture, and Section 88). The quality of the photos was excellent (12"

focal length, good weather, 1:10,000 scale) and consequently demand for the photos from other sections and agencies is high.

- M. Geisler, Prince Rupert Forest Region, Smithers

Nelson Region Aerial Overview Forest Pest Survey. The 1986 aerial overview survey for the Nelson Forest Region was again coordinated by the region in cooperation with the districts and the Canadian Forestry Service. A total of 52 hours were flown using fixed wing aircraft, sketch mapping infested areas onto 1:100,000 or 1:125,000 scale topographic maps.

The maps produced from these surveys are being used as an overview of current pest damage on a regional and district basis and to priorize areas where more detailed aerial and ground surveys are required. The number of hectares of mountain pine beetle infestations recorded in 1986 was 24 000, up from 18 000 hectares in 1985, and spruce beetle was 130 ha, down from 1200 hectares in 1985. Other pest damage recorded was as follows: balsam bark beetle 1826 ha, Douglas-fir beetle 15 ha; western spruce budworm 2586 ha; tent caterpillar 496 ha; hemlock sawfly 320 ha; and larch sawfly 192 hectares.

1986 ground surveys indicate significant current mountain pine beetle attack in a number of areas examined to date in the Invermere, Cranbrook, Boundary, and Arrow Districts.

- E. Morris, Nelson Forest Region, Nelson

Bark Beetle Funding. Approximately $8.2 million were allocated to the bark beetle program for the 1986/87 fiscal year. The breakdown of the funding (as of September 30) is given below.

Region	No. of Projects	Allocation
Cariboo	20	$2,451,820
Kamloops	25	1,955,534
Nelson	24	668,783
Pr. George	16	1,153,700
Pr. Rupert	25	1,613,681
Vancouver	1	7,000
Victoria (contingency/rappel)	-	337,018
	110	$8,187,536

The objective of the program remains the same as in the past: to slow the rate of expansion of specific infestations, and buy time in which to implement an orderly management plan. Activities include intensive aerial and ground surveys, single tree treatment programs, directed harvesting, and development of access into affected or threatened areas.

This program has entered its third year and total expenditures to date have been about $20 million. Although a thorough assessment of the program will be carried out, preliminary information indicates that the objectives are being met in many areas.

- P. Hall, Protection Branch, Victoria

Bark Beetle Related Harvesting. More detailed information regarding the harvesting program resulting from the emphasis on bark beetle management will be available for the spring edition of Pest Management Progress. However, a few changes in emphasis have resulted from expansion or contraction of particular infestation areas. In most regions, the harvesting program continues to be a major component of the beetle/timber management effort and logging is being addressed as much as possible to priority infestations.

In Cariboo, reductions in the level of beetle infestations due to weather factors and management efforts have resulted in a shift of harvesting priorities. Licensees are now being encouraged to allocate harvesting capacity in excess of that required for cutting priority green attacked stands to harvesting older red and grey stands. This is most evident in the Chilcotin Forest District where up to 64% of the volume harvested is dead, red or grey, attacked pine. Priority harvesting of currently infested stands will continue; however, the new efforts will derive some benefits from stands already killed.

In Kamloops Forest Region, expanding beetle populations and reductions in harvesting due to the I.W.A. strike will result in beetle attacked stands in excess of the cut capacity for this year. Various options are being considered, including increasing the sale of beetle infested volumes off-quota. Increases in the use of high-lead logging systems to deal with specific problem areas are also being examined.

- F. Renshaw, Timber Management Branch, Victoria

Rapattack and Beetles. Pest management projects were undertaken by Rapattack in a total of five districts (two regions) from September 24, 1986, to October 18, 1986. Total expenditure for the various projects came to $90,557.99, of which $80,290.40 was allocated through the Bark Beetle Contingency Fund. Morice District apportioned $10,267.59 for their own project.

Forty helipads were constructed in the Cranbrook, Kootenay Lake, Grand Forks, and Morice Districts at an average cost of $1,396.70 per pad. Invermere was the only district where the initial objectives were not met. This was

entirely due to the weather which allowed only four days out of eleven to be worked. Two days of cut and burn were done at a cost of $114.98 per tree. As well, helicopter logging was employed on a trial basis for the two remaining days of the project at a cost of $219.39 per tree. Rapattack is an effective approach to dealing with otherwise inaccessible, remote, priority infestation spots.

- M. Dahlie, Protection Branch, Victoria

Cariboo Region Mountain Pine Beetle Lure Deployment - 1986. Forest Service, licensee, and contract personnel deployed 32,686 mountain pine beetle lures during 1986. Approximately 60% of these were used in containment baiting programs with the remainder for cleaning up single tree control areas. Baiting assessment data indicate that an average of 20% of baited trees were attacked over the region.

- R. Heath, Cariboo Forest Region, Williams Lake

Semiochemicals for Mountain Pine Beetle in Prince George Region. A total of 6329 semiochemical lures were used for mountain pine beetle management in four forest districts in the Prince George Forest Region in 1986. Baits were deployed in either grid patterns or on single trees for the purposes of containment prior to harvesting or mop-up after disposal. Semiochemical-baited funnel traps were used in two districts to monitor beetle flight periods and densities. Assessment of the baiting program is in progress.

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

Mountain Pine Beetle Active in Mount Robson Provincial Park. Mountain pine beetle has been resident in isolated areas of Mount Robson Provincial Park for at least two years. During aerial sketchmapping flights in September of this year, some 45 individual patches of recently dead lodgepole pine were identified and mapped in the corridor along Highway 16 within the Park. After assessment by Forest Service and Parks Branch staff, treatment options will be developed. Control activities, if necessary, will be jointly developed to maximize efficacy and reduce spread to neighbouring areas, while minimizing any detrimental impact to the park resource.

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

Control Zones for Mountain Pine Beetle Management. In October, 1985, the Cariboo Forest Region introduced a concept of mountain pine beetle management

zones called "Programs for Mountain Pine Beetle Control." These zones were introduced to provide standardization of control concepts and address all levels of beetle attack. They therefore are useful even if the beetle isn't epidemic. One of the main benefits realized from the establishment of management zones is that there is immediate understanding if someone states that they intend to initiate a particular action in a particular zone. Both parties understand the type of infestation, where the infestation is located, and the kind of stand the beetle is attacking as well as the priority of harvesting or other control tactics. It also ensures the most appropriate treatment is applied to each area under consideration. The Cariboo Region established three broad zones; the Districts have in some instances modified these broad concepts to more specific definitions that suit the control actions in their particular situations (e.g., total "Direct Control" or "Direct Control mixed with small block harvesting"). If a copy of the "Program for Mountain Pine Beetle Control" is desired, contact the undersigned.

- D. Doidge, Cariboo Forest Region, Williams Lake

Hazard Rating for Mountain Pine Beetle. In May, 1986, preliminary hazard rating maps for mountain pine beetle (MPB) were completed for the Vanderhoof and Prince George West Districts. Species composition was colour-coded and depicted as either Pl-major, Pl-mixed, or Pl-minor. Age classes, albeit dated, were stratified and colour-coded under three categories. Two overlays were added to each map showing MPB infestations in 1984 and 1985. The above classification was an attempt to simplify a system which considers tree diameters and age, phloem thickness, stand density, elevation, and latitude.

When considering all the maps, there appeared to be some degree of attack preference of MPB to Pl-major and mixed stands of age class 6+. Overlays of the 1986 infestation will be added to reinforce our understanding of "early" infestations, and help priorize our detection, access, and control activities in the immediate future.

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

Beetle-Proofing Through Thinning. In cooperation with the Canadian Forestry Service, two demonstration areas have been selected to show the effect of various thinning regimes on resultant mountain pine beetle attacks. Treatments will be applied to mature pine stands in the Merritt and Quesnel Forest Districts. In each area, approximately 5 hectare blocks will be treated under each of the following regimes: remove all trees equal to or greater than 30 cm dbh; remove all trees equal to or greater than 25 cm dbh; remove all trees equal to or greater than 18 cm dbh; and, leave the best 250 trees per hectare, evenly spaced. These demonstration areas will be monitored regarding subsequent levels of beetle attack.

- P. Hall, Protection Branch, Victoria

Ainslie Creek Mountain Pine Beetle "Mop-up" Control Project. In June, 1986, approximately 20 aggregating semiochemical mountain pine beetle baits were placed over a 15 ha area containing unmerchantable lodgepole pine. Adjacent lodgepole pine stands containing mountain pine beetle attacked trees were previously harvested in 1985 and 1986. A reexamination of the lures in August revealed that all of the baited lodgepole pine contained mountain pine beetles. A hack and squirt application of MSMA (monosodium methanearsonate) was undertaken on the trees containing beetles. The application appears to have been successful. An efficacy inspection in June, 1987, will reveal the overall effectiveness of the mop-up project in single tree treatment sites.

- R. Saunders, Chilliwack Forest District, Chilliwack

MSMA Treatments Using the Sure-Shot® Applicator. Later's Chemicals Ltd. provided a custom order of pre-loaded Sure-Shot containers containing 50% Glowon® for an operational trial of the system against mountain pine beetle (MPB). It proved very convenient to handle and load but had two major disadvantages compared to the conventional squeeze bottle/full strength Glowon system:

i) The shape of the applicator head makes it difficult to place properly in the tree frill, thus increasing treatment times and the chance of off-target MSMA release;

ii) The viscosity of full-strength Glowon prevents its use with the Sure-Shot system so the addition of water was necessary. The 50% solution had a reasonable flow rate from its applicator but was not viscous enough to be readily retained by the tree frill and had a tendency to flow out. A slightly stronger strength formulation may at least partially overcome this problem.

Overall, it appears the system's loading/handling advantages are more than offset by its drawbacks, including higher unit costs. Further refinements will be necessary to make Sure-Shot the system of choice in bark beetle programs.

- R. Heath, Cariboo Forest Region, Williams Lake

Mountain Pine Beetle Insecticide Trials. On May 21, 1986, spray applications of the insecticide chlorpyrifos were made on bolts of lodgepole pine infested with maturing mountain pine beetle (MPB). Bolts were treated with either: (1) chlorpyrifos at 5% (a.i.) in diesel oil; (2) diesel oil alone; or (3) left untreated to serve as checks. Efficacy sampling, conducted on June 16, 1986, revealed that chlorpyrifos at 5% (a.i.) in diesel oil was highly efficacious in killing MPB larvae, pupae, and callow adults approximately two months prior to expected adult emergence. Diesel oil alone was just as effective as the chlorpyrifos against larvae, but less effective against pupae and callow adults.

Agriculture Canada has tentatively agreed to pursue registration of chlorpyrifos (Dursban®-2E, 4E) and carbaryl (Sevin®)formulations for use against Dendroctonus beetles. Having the additional options of felling and spraying infested pine in the early spring or fall seasons will considerably extend and enhance our ability to cost-effectively manage MPB at various times of the year.

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

Rehabilitation of Mountain Pine Beetle Killed Pine Stands. Cariboo Forest Region is submitting a proposal for FRDA funding for a project to conduct research into the management of residual lodgepole pine stands after a mountain pine beetle infestation. The objective of the research will be to prevent a major regeneration delay which would produce more back-log in the Region. The project would test various silvicultural treatments in suitable residual pine stands in order to minimize the impact of forest pests on the remaining trees. The most important forest pest in these residual stands is dwarf mistletoe, but stem cankers and rusts will also be considered in the treatment regimes.

- D. Doidge, Cariboo Forest Region, Williams Lake

Lodgepole Pine Beetle in Prince George Forest Region. Lodgepole pine beetle, Dendroctonus murrayanae, is being increasingly discovered attacking the lower boles of mountain pine beetle-damaged lodgepole pine. Observations to date in the Prince George West and Fort St. James Districts indicate that lodgepole pine beetle have not only attacked the root collars of susceptible pine but also the boles as high as 75 cm from the duff-line. Detection and disposal crews should be aware that Dendroctonus adults and larvae in the lower boles of susceptible or "red-attacked" pine may be lodgepole pine beetle.

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

Ips Blitz in the Cariboo. The declining mountain pine beetle (MPB) populations in many areas of the Cariboo Forest Region and resulting increase in partially successful attacks on lodgepole pine has helped generate an Ips pini outbreak. Thousands of healthy green trees were killed in stands currently infested by MPB, including a significant number with diameters greater than 25-30 cm. Emergence from these trees has been very high from both 1986 generations and further mortality is anticipated for 1987. The heavy Ips attacks have also seriously complicated the Region's MPB detection and treatment programs.

- R. Heath, Cariboo Forest Region, Williams Lake

Douglas-fir Beetle Trap Trees. A small cooperative study between the Forest Service and West Fraser Mills Ltd. was carried out near the Blackwater River in the Quesnel Forest District to determine if the efficacy of Douglas-fir trap trees could be enhanced with the use of semiochemicals. Douglas-fir beetle lures containing frontalin, alpha-pinene, and camphene were attached to six felled and standing large diameter fir randomly distributed through an overmature stand planned for logging. Attack densities on these stems were compared to those on six unbaited, felled trap trees deployed in the same stand.

The lower boles of baiting standing trees sustained significantly higher attack densities than either of the felled tree treatments but the level of attack decreased dramatically above 2.5 m. Overall, the baited felled stems absorbed the greatest number of beetles and have mean attack densities over twice that of their unbaited counterparts. These results suggest the addition of semiochemicals to felled trap trees is warranted and further, larger scale studies should be undertaken.

- R. Heath, Cariboo Forest Region, Williams Lake

Efficacy of Lindgren Funnel Traps for Control of the Douglas-fir Beetle. Six pheromone-baited funnel traps were deployed along 5 km of a log fence line where the primary construction material was Douglas-fir to assess whether the traps would reduce the level of attacks on susceptible fence material. Each of the traps caught 200-300 Douglas-fir beetle but did not prevent moderate-heavy attacks on nearby Douglas-fir logs. The traps also caught large numbers of the red bellied clerid, Enoclerus sphegeus Fisher, a most undesirable phenomenon. Scolytid/clerid ratios as high as 3.8:1 were noted. This trial strongly suggests funnel traps will not competitively attract D. pseudotsugae in the presence of susceptible host material. An operational trial near Clinton is planned for 1987 to measure trap efficacy in situations where this material is not immediately available.

- R. Heath, Cariboo Forest Region, Williams Lake

Future Plans for Entomology (1987), Prince Rupert Forest Region. In the new year, two major bark beetle related projects will be undertaken in the Prince Rupert Forest Region.

Lethal trap trees will be prepared this spring in an inaccessible portion of the Houston-Tommy Creek drainage in the Morice Forest District to control a large population of spruce beetles that have resulted from widespread patches of untreated blowdown. The efficacy of this treatment will be determined and reported in a future issue of PMP.

An overwintering mountain pine beetle mortality study will continue this year and will be expanded to obtain a wider range of samples primarily from the Bulkley, Morice, and Lakes Forest Districts. Trees will be sampled according to the method used by the C.F.S. to obtain the "r-value" calculation (i.e., number of live brood/number of entrance holes).

A "Fall and Burn: Does it Work?" report will be updated with new probe and colour aerial photo data and should be ready for review this summer. This report documents the effectiveness of fall and burn in the Prince Rupert Forest Region.

- T. Ebata, Prince Rupert Forest Region, Smithers

Bark Beetle Booklet. A booklet discussing the management of the major bark beetles is currently in the draft stage. This booklet, similar in style and format to "The Real Enemy" is intended as an information aid to both the general public and those closely involved with the forestry sector. Publication is expected this fiscal year.

- P. Hall, Protection Branch, Victoria

Spruce Beetle Hazard Abatement. During the course of reestablishing the southern boundary of Glacier National Park, Parks Canada slashed a 15-20 cm wide strip in August of 1985 across the Beaver River valley. Inspections during the summer of 1986 confirmed that 80 medium to large diameter spruce trees had become infested by spruce beetle. As removal of infested material was not possible, and pesticide application was not an attractive option for the park, a trial was established to determine the effects on brood mortality of delimbing and bucking the infested logs to 75 cm lengths and standing the bolts upright. This operation was intended to increase beetle mortality through drying.

The work was completed by a Parks Canada fire suppression crew in September. It is hoped that the accelerated drying will significantly increase brood mortality during the confirmed two year life cycle. Results will be reported when available.

- D. Gray, Nelson Forest Region, Nelson

Blackheaded Budworm Damage Assessment in the Queen Charlotte Islands. Fifteen permanent growth sample plots have been established by Western Forest Products Ltd. within TFL 24 (Moresby Island) in an attempt to monitor budworm damage and determine growth impacts in defoliated stands. The degree of defoliation and the amount of mortality occurring on these plots will be monitored annually. Increment core samples will be taken at least three years after the collapse of the budworm population to estimate radial growth reductions. Remeasurement will occur after the fifth growing season.

MacMillan Bloedel Limited are also planning to establish a number of similar plots in TFL 39 in the Queen Charlotte Islands.

A naturally regenerated twelve year-old spaced stand of hemlock and sitka spruce has been severely defoliated in the Honna River Valley on Graham Island by a combination of sawfly and blackheaded budworm. A number of semi-permanent plots will be established within this stand to track defoliation, top-kill, mortality, and recovery.

The combination of the above studies should give us much improved damage appraisal information for blackheaded budworm outbreaks.

- D. Heppner, Vancouver Forest Region, Burnaby

Spruce Budworm Threatens Northern Plantations. Over the past two years, populations of the eastern spruce budworm, Choristoneura fumiferana (Clemens), have increased to levels that are of concern to forest managers. Prior to this year, the larvae have fed only in mature spruce trees lightly scattered over an area of 1.5 to 2 million hectares. Plantation examinations in the summer of 1986 indicated light feeding upon the foliage of spruce trees in scattered locations. Since bud damage was common in areas subjected to a second year of defoliation, major concerns regarding the fate of many plantations have been raised. Sampling will continue throughout the winter of 1986/87.

- R. Cozens and R. Hodgkinson, Prince George Forest Region, Prince George, M. Peterson and R. Simpson, Fort Nelson Forest District, Fort Nelson

Western Spruce Budworm Treatments (1986). A B.C. Parks-Forest Service operational trial of Bacillus thuringiensis (Bt) to reduce damage by spruce budworm was undertaken at Paul Lake Park in the Kamloops Forest Region in 1986. Approximately 200 hectares were treated with Bt at a rate of 30 BIU's per hectare. Advanced larval development and less than optimal weather conditions at the time of spraying may have reduced the overall effectiveness of the treatment. However, the objective of foliage protection was met to some degree and the operation provided valuable training which will be of use in future operations.

- P. Hall, Protection Branch, Victoria

1987 Western Spruce Budworm Management Plan, Kamloops Forest Region. The budworm defoliated 408 000 hectares in the Kamloops Forest Region during 1986, with approximately 70% of the infestation occurring in the Kamloops Forest District. Infested areas increased by 100% over 1985 and preliminary findings from egg-mass surveys indicate that severe defoliation is expected again in 1987.

A management plan for the western spruce budworm is currently being developed in the Kamloops Forest Region. This plan has dual objectives, which are:

1) evaluate the need for a 1987 treatment program and, if justified, develop treatment proposals outlining options; and,

2) initiate a long-term damage appraisal study to obtain information on losses in multi-storied and intensively managed stands, to provide a more complete data base on which to base future operations.

Methods employed to accomplish objective (1) include:

- aerial surveys for defoliation conducted to a greater intensity and level of accuracy than in previous years;

- identification of areas and investments in infested high value stands such as faller's selection areas, seed orchards, intensively managed stands, and others;

- estimation of growth, mortality, and form losses in valued stands. The Canadian Forestry Service (CFS) has provided a model designed to estimate losses which are amendable to control. In addition, budworm impact on future harvests will be assessed;

- identification of treatment options and costs, and comparison with possible benefits.

Control, if justified, will involve foliage protection of high valued stands with an insecticide (B.t. or chemical). Such areas would most likely have to be treated annually for the duration of the outbreak or possibly every two years. However, the area contemplated for treatment would be insufficient to disrupt the population dynamics of the outbreak and treatment would be confined to non-chronic areas where severe damage had not previously occurred.

Objective (2) will be accomplished by establishing permanent sample plots (PSP) in the spring or fall of 1987. Existing PSPs and recent CFS reports will form the basis from which future data needs are determined.

The 1987 treatment program will be based on the best available information and the dual approach adopted will ensure that future decisions are based on more complete data.

- R. Edward, Kamloops Forest Region, Kamloops, and S. Taylor, Protection Branch, Victoria

Western Spruce Budworm in Nelson. A western spruce budworm egg mass survey in the Rock Creek-Bridesville area suggests that an increase in the light to moderate defoliation seen in 1986 can be expected in 1987. Samples from four sites yield a prediction of moderate defoliation, while a fifth site yielded a severe defoliation prediction. Five sites from the same area sampled by FIDS all yielded predictions of severe defoliation for 1987.

- D. Gray, Nelson Forest Region, Nelson

Western Spruce Budworm in the Cariboo. Western spruce budworm has been defoliating Douglas-fir stands near Clinton for eight years. The Cariboo Forest Region has spaced some of the regenerated and residual stands of young Douglas-fir in the infestation area. The budworm's defoliation is causing top kill in some of these spaced stands. Cariboo Region will examine all the managed stands this winter and spring to obtain data and develop a plan of action if it is deemed the level of damage is unacceptable. Some control action against the budworm may be warranted.

- D. Doidge, Cariboo Forest Region, Williams Lake

Terminal Weevil Working Group. Various people representing the B.C. Forest Service, Canadian Forestry Service, and universities have met periodically to discuss directions to be taken with respect to research and operational guidelines for terminal or leader weevils (Pissodes spp.). The most recent meeting was in August of 1986. Research priorities were discussed and refined further; incidence and impact surveys and methods were deemed of greatest importance followed by items such as evaluation of clipping as an effective management option, investigations on particular aspects of biology and population dynamics, and evaluate brushing and shading to reduce damage.

It is hoped that the development of this priority list of needs will provide guidance to those contemplating work in this area. Additional working groups for other pests such as black army cutworm would be beneficial.

- P. Hall, Protection Branch, Victoria

Pissodes strobi Infesting Spruce in the Cariboo. Some of Cariboo Forest Region's spruce plantations are reaching the susceptible size for terminal weevil attacks. The Region intends to determine the number of plantations which have reached susceptible size, ground check these areas to confirm the presence or absence of the weevil, and to assess the intensity of the attacks in the infested plantations. This exercise should provide a data base for any subsequent attempts to control the weevil. Although not a major problem at

present, its current incidence in susceptible stands coupled with the large amount of spruce planted in the Region strongly suggest the weevil could develop into a major problem.

- D. Doidge, Cariboo Forest Region, Williams Lake

Leader Weevil Survey in the Chilliwack Forest District. Young spruce plantations within the Chilliwack Forest District are monitored annually in September for the presence of leader weevils (Pissodes strobi). To date the weevil has not been detected in any of the District's major spruce component plantations; however, P. strobi was identified in a minor component of 15 year old Engelmann spruce (Picea engelmanni). (P. engelmanni is an introduced species being planted at higher elevations within the Vancouver Forest Region.) The spruce was within a primarily Douglas-fir (Pseudotsuga menziesii) plantation located at Stoyoma Creek, Boston Bar in the Southern Submaritime Wetter (CWHb5) and the Southern Subcontinental IDF (IDFe1) Biogeoclimatic Units. The presence of this insect may have a potential future impact on planted Engelmann spruce in the Vancouver Forest Region.

- R. Saunders, Chilliwack Forest District, Chilliwack

Leader Weevil Control Trial. As reported in earlier editions of Pest Management Progress, a trial investigating the control of Pissodes strobi Peck through the manipulation of a deciduous overstory has been established. Three plots of 1.725 hectares each have been stem mapped, treated, and measured. Electronic data logging equipment is being used to record micro climatic parameters and their modification by the various treatments. Hardware problems precluded the collection of data for most of the 1986 season, but the system is now operational for the 1987 season.

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

FRDA Leader Weevil Proposals, Prince Rupert Forest Region. Two FRDA proposals have recently been submitted to Protection Branch for approval. These proposals outline two projects that will examine the attack dynamics of the leader weevil (Pissodes strobi) in Sitka spruce plantations in the Kalum Forest District.

The first project will examine the distribution of past attacks and also plot future attacks within 10 and 25 year old Sitka spruce permanent sample plots occurring mainly in the Kitimat Valley-Terrace area. Each plot contains 144 trees planted on a grid pattern. Attacks will be dated and plotted on mylar overlays for each year resulting in a series of overlays recording the location of each attack. Thus, the pattern of attack can be examined for each year and will be used to determine the weevil's rate of spread and clumping patterns.

The second project was designed to annually monitor weevil damage in plantations having low (5% of the stems attacked annually, medium (5-10%), and high (10%) levels of damage (as identified from four years of strip surveys in the Kitimat Valley during 1982 to 1986). Fifteen plantations (5 each attack category) will be sampled intensively each year. The resulting data will permit the district to determine if the level of weevil damage increases with time.

- T. Ebata, Prince Rupert Forest Region, Smithers

Lodgepole Terminal Weevil Damage Appraisal in the Cariboo. Thirty permanent fixed-area damage appraisal plots covering a range of stocking densities and stand treatments have been established in the Cariboo Forest Region to assess the impact of the lodgepole terminal weevil, Pissodes terminalis. Data collected in each plot included current/previous attack history and height, tree vigour index, damage type, and number of laterals competing for dominance. The study's primary intent is to determine short and long term growth and form loss implications associated with P. terminalis in a variety of management situations. It is hoped the data will be useful in determining the need for control programs.

- R. Heath, Cariboo Forest Region, Williams Lake

Black Army Cutworm Damage in Prince George Forest Region. Black army cutworm (BAC) infestations were generally more localized in 1986 compared to 1985 in the Prince George Forest Region, but damage was more severe in the southern portion of the Prince George East Forest District. At one 13 hectare block which had been burned in July 1985, BAC stripped most of the needles and new buds on 10,000 newly planted 2+0 pine seedlings. Virtually all of the herbaceous vegetation was also heavily defoliated. BAC defoliation to herbaceous vegetation is usually detectable immediately prior to planting, and it is recommended that such areas be delineated and carefully assessed before any scheduled planting is considered.

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

Black Army Cutworm in Nelson Forest Region. The anticipated black army cutworm infestations on spring 1986 planted blocks in 1985 burn areas failed to materialize. Fifty duff samples from three fires contained only three larvae. Very cool late spring weather after the collection date may have been a factor in further reducing larval populations. Thirty pheromone baited traps in three 1985 burn areas caught an average of 14 adults per trap suggesting moderate to severe seedling defoliation may occur in 1987 if sufficient herbaceous vegetation is not available.

- D. Gray, Nelson Forest Region, Nelson

Black Army Cutworm Parasitism in Prince George Forest Region. A collection of 100 black army cutworm (BAC) pupae from an infested cutblock in the Prince George West Forest District were reared at the Prince George Regional office in 1986. To date, staff of the Forest Insect and Disease Survey Unit (C.F.S.) have identified Erigorgus species (Ichneumonidae) as the cause of 64% pupal mortality. An additional 24 unemerged pupae are being subjected to an artificial winter chill and subsequent rearing to force emergence of suspected other Ichneumonid species. Two pupae may have been killed by NPV virus, and eight unemerged moths were found in pupal cases.

- R. Hodgkinson, Prince George Forest Region, Prince George, and L. Humble, Canadian Forestry Service, Victoria

Black Army Cutworm Study in the Prince George Forest Region. Black army cutworm (BAC) defoliation to newly planted spruce seedlings in 1984, as measured in 1985, caused reductions in leader heights, leader and seedling mortality and leader deformations. At five sites with active infestations inspected in 1985, densities of 1-13 larvae and/or pupae per square metre of duff sample resulted in 0-71% of seedlings being defoliated to various degrees.

Succulent herbaceous vegetation such as Indian hellebore, Veratum viride, were preferentially defoliated by larvae over other vegetation. Natural mortality of BAC at four locations ranged from 44-54% and the impact of parasites varied per location. Development of a reliable and operational "defoliation hazard index" will require further field sampling in many locations.

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

Peridroma saucia, Variegated Cutworm in Cariboo Region. On August 9, 1986, tree planters working on an area at the east end of the north arm of Quesnel Lake discovered thousands of insects feeding on newly planted spruce seedlings. The defoliator was subsequently identified as Peridroma saucia, variegated cutworm, an insect normally considered a nursery pest. The area being planted (75 hectares) had been prescribed burned on July 16, 1986, however, at least three-quarters of the area had regrown sufficient ground cover to absorb the feeding of the cutworms. The cutworms started feeding on the planted seedlings as soon as they were planted, in some instances within 15 minutes of planting. As many as 56 larvae were counted on a single spruce seedling in extreme cases. Planting was immediately halted until the cutworm pupated. District staff observed that the cutworm resumed feeding on the ground cover as the seedlings hardened-off, two weeks after planting. The variegated cutworm completely stripped some of the seedlings, including the terminal bud, resulting in the same type of damage characteristically caused by black army cutworm.

It was originally thought that the cutworm would overwinter as a second instar larvae like the black army cutworm, but was still in the pupa stage, on October 15, 1986, and will probably overwinter as a pupa. It is also uncertain how many generations the variegated cutworm will have in a forest situation, and this will be monitored in 1987 using pheromone traps and duff sampling. The biggest question is where did the variegated cutworm originate? Was it transferred in the egg stage from the nursery, or is it endemic in the area? Pheromone traps will be used to determine incidence in other areas in the Interior Wetbelt as well as to determine the flight dates.

Summer planting in the Interior Wetbelt makes variegated cutworm as potentially damaging as black army cutworm, especially if there is more than one generation per year.

- D. Doidge, Cariboo Forest Region, Williams Lake

Gypsy Moth Survey. The B.C. Forest Service has again cooperated with Agriculture Canada (Plant Health) and the Canadian Forestry Service (FIDS) in a province wide pheromone trapping survey for gypsy moth (Lymantria dispar). Forest Service traps were placed primarily in recreation sites and other forested areas while the other agencies concentrated their efforts in parks and urban centres. The Forest Service placed approximately 1200 traps in 1986.

Overall, with all agencies reporting, several positive catches were made. Locations of significant catches include: Chilliwack, Colwood (near Victoria), Kelowna, and Clinton. Egg mass surveys are underway in most of these areas to determine treatment requirements for 1987. Other positive catch locations will be intensively trapped next year.

The Forest Service will continue to participate and expand its involvement in this program in 1987.

- P. Hall, Protection Branch, Victoria

Douglas-fir Tussock Moth Virus Purchase. The final payment has been made to the U.S. Forest Service for 6000 hectare-equivalents of the nuclear polyhedrosis virus specific to tussock moth. Delivery of the virus supply is expected in the near future. This material will be available for use at the beginning of the next tussock moth outbreak which is expected late this decade or early next. Use of this material should result in an early collapse of the outbreak and represents the opportunity for true "control" of a defoliator outbreak.

- P. Hall, Protection Branch, Victoria

Regional Insect Collections. Protection Branch, in cooperation with the CFS-FIDS, has assembled insect specimens and other materials to provide a representative insect collection to each regional office. These collections will represent the most important insects found or expected in each region. Construction of display boxes should be completed early in the new year, at which time the collections will be completed and forwarded to each regional office. These collections will be maintained by regional pest management staff and are intended to be used in conjunction with displays and other training aids.

- P. Hall, Protection Branch, Victoria

Efficacy of Three Insecticides on the Leaffooted Bug. Leptoglossus occidentalis Heidemann (Hempitera: Coreidae) were exposed to Diacide® (diatomaceous earth), dimethoate (0.1 and 1.0%, a.i.) and permethrin (0.1% and 0.01% ai) in both laboratory and field tests and to malathion (0.1% a.i.) in a laboratory test. In field tests, permethrin and dimethoate caused significant mortality for two weeks after sprays were applied and permethrin continued to be effective for a third week. Diacide was not effective in field tests or in one of two laboratory tests but was effective in the other laboratory test. Malathion, dimethoate, and permethrin caused significant mortality in both laboratory tests.

- D. Summers, Silviculture Branch, Victoria, and D. Ruth, Canadian Forestry Service, Victoria

FOREST PATHOLOGY

Pinewood Nematode. Surveys of wood chips at mills throughout B.C. have revealed several occurrences of the nematode. B.C. Forest Service Regional, District, and Branch staff have cooperated with Agriculture Canada (Plant Health) to collect the wood chips which have yielded the nematode following processing of the chips and identification of nematodes by Ottawa staff. At the time of writing, six positive finds of both forms of the nematode have been reported from samples from Prince George and Cariboo Forest Region.

Further surveys to pinpoint the occurrences are possible, depending on development of methods to trap the vector (sawyer beetle) and associated nematodes.

- J. Muir, Protection Branch, Victoria

Root Diseases and Backlog Reforestation. Under the Forest Resources Development Agreement (FRDA), two projects are underway to examine the occurrence of root diseases and suitable prescriptions for treatment sites.

1) In interior B.C., Pathocon Consulting is examining root diseases in the cedar hemlock zone (ICH) and the Douglas-fir zone (IDF).

   Root diseases, especially Armillaria root disease, are playing a major role in creation of not satisfactorily restocked (NSR) areas. In 15 sites examined, up to 5% of the planted and natural trees have been killed by root disease in the past year. A field guide for assessing root diseases on current NSR areas is being prepared.

2) In coastal stands, the Sterling Wood Group is examining root diseases and assessment methods for areas planned or recently rehabilitated. Coastal sites are mostly occupied by alder, maple, and other hardwood species that were established 20 to 40 years previously on Douglas-fir sites in the drier western hemlock suzone. These sites have a very high probability of being infested by laminated root rot, according to results of the Vancouver Forest Region root disease survey.

   - J. Muir, Protection Branch, Victoria

Aerial Photography aids Harvesting Plan. Salmon Arm Forest District was able to use a 70-mm helicopter boom to take large scale aerial photographs of a Douglas-fir stand infected with Phellinus weirii. Regional and District Inventory, Protection, and Small Business staff were able to use the photos to identify and delineate affected areas. This allowed a site specific harvesting plan to be made in light of the root disease. The use of 70-mm photography in assessing root disease will be attempted in other districts next year.

- H. Merler, Kamloops Forest Region, Kamloops

Armillaria sp. Causing Mortality in Douglas-fir Plantations in Valemount. During a recent field trip to the Valemount area, Douglas-fir trees exhibiting root rot symptoms were observed in two plantations. Armillaria sp. (mellea, obscura, ostoyae ?!) was identified as the cause. Symptomatic trees occurred in patches, and a significant number of trees were affected. This is the first reported case of significant damage occurring due to Armillaria in the Prince George Forest Region.

- K. Lewis, Prince George Forest Region, Prince George

Tomentosus Root Rot Update. This is one of our more important pest management problems in the Prince Rupert Forest Region and will receive considerable attention in the next decade.

A species resistance trial has been established in the Burns Lake Forest District near Tercer Lake. A root disease survey conducted during August,

1986, established an incidence level of 16-17% in three 6 ha blocks. Two hectares of spruce, lodgepole pine, and Douglas-fir will be planted in the spring of 1987 within each 6 ha block providing a randomized complete block design with three replicates per treatment. This trial should provide an indication of the merits of planting lodgepole pine and/or Douglas-fir on tomentosus infected sites where white spruce might otherwise be the preferred choice.

A small-scale protection field trial has been initiated to establish whether Roundup® applied as a hack and squirt treatment to infected spruce prior to logging might limit the spread of tomentosus root rot. Sixty infected spruce have been identified and marked. Thirty of these will be treated while the other thirty will serve as controls. The effectiveness of the treatment will be assessed by planting spruce seedlings around each of the marked stumps and monitoring mortality through time. In addition, root material from decaying root systems will be excavated and attempts to culture the fungus from treated and untreated trees will provide further evidence as to the effectiveness of the treatment.

A tomentosus demonstration has been established in a 23-year-old spruce plantation at Jones Creek in the Bulkley Forest District. Ten infection centres have been stem mapped and permanently marked to investigate rates of spread of tomentosus root rot in young spruce plantations. Two infection centres have been similarly stem mapped in an adjacent mature stand, mainly for training purposes.

A root disease survey funded by FRDA is underway in a small business sale in the Bulkley Forest District which will be logged this winter and destumped next summer/fall. Two different machines, a D8 and an excavator, will be compared as to their effectiveness in removing tomentosus infected stumps and minimizing site disturbance. The stand is a mixture of white spruce and aspect with a minor component of pine.

With the effort of regional Inventory, Research, and Protection staff, at least one growth and yield plot installation will be established at a 45-year-old spruce stand infected with tomentosus root rot in the Morice Forest District. With several installations of this kind, we should be able to quantify what sort of gains in AAC can be achieved through control of this disease.

- W. Martin, Prince Rupert Forest Region, Smithers

Site Preparation Treatments in Tomentosus Root Disease Sites. Logging companies in the Prince George Forest Region have been approached and asked for their cooperation in the establishment of trials to examine the effect of various site preparation techniques: scarification, trenching, mounding, etc., on the development of root disease in plantations. Due to the slow-moving nature of root disease fungi, it is necessary to establish trials now to try and provide management options for future spruce plantations.

Proposals for FRDA funding are forthcoming depending upon the amount of interest demonstrated by companies on whose tenures the trials would be established.

- K. Lewis, Prince George Forest Region, Prince George

Tomentosus Root Disease Study in Spaced vs. Unspaced Stands. Root excavation and stain/decay mapping have been completed in plots located in spaced and unspaced spruce. Approximately 150 trees and stumps were nondestructively excavated and their roots sampled with an increment corer. Maps were prepared of all trees, stumps, and their roots showing the extent of stain and decay. The plots are permanently located and reserved, to be remeasured every 5-10 years. This data should provide further knowledge on the biology of Inonotus tomentosus and on the effects of spacing in a root disease area. A report of the first excavation results is in preparation.

- K. Lewis, Prince George Forest Region, Prince George

Dwarf Mistletoe in Kamloops District. Coordination of a survey and volume loss assessment for lodgepole pine dwarf mistletoe is being done in the Kamloops Forest District by pest management staff. The survey is being done with a strip cruise and fixed radius plots. Volume loss assessments are being done by tree dissection. Intermediate results along with a dwarf mistletoe management plan were presented to the Kamloops TSA steering committee.

- H. Merler, Kamloops Forest Region, Kamloops

Mistletoe Incidence and Severity in McBride Forest District. The Prince George Forest Region mistletoe survey was extended to the McBride Forest District by a contract to survey 125 km of roadside and establish 25 plots in lodgepole pine (major species) stands. The results showed the areas most heavily infested and identified areas requiring control measures. Approximately 64% of the km's surveyed in pine-major types had some mistletoe, 39% of the km's travelled had greater than 2/3's of the trees infected. Height over diameter curves stratified by Dwarf Mistletoe Rating were prepared from the data collected for use in estimating volume loss.

- K. Lewis, Prince George Forest Region, Prince George

Calculation of Volume Loss Due to Lodgepole Pine Dwarf Mistletoe by Stem Analysis. The effect of lodgepole pine dwarf mistletoe on individual trees must be determined in order to calculate individual tree and stand volume losses due to mistletoe. A contract is in preparation to perform paired tree comparisons and stem analysis on trees from selected plots in the Prince George Forest Region Region. The overall objective of this study is to

accurately determine the effect lodgepole pine dwarf mistletoe has on individual trees, and use this to estimate stand losses. These estimates may be applied to results from the roadside survey to estimate losses on a PSYU, district, TSA, etc., basis. Roadside survey data will aid in plot selection and modified "variable stand density tables" will be used to correct for different stand densities. A pilot study is proposed to work out details and cost estimates prior to writing the main contract. Sampling procedures, analysis and application of the data have been determined through discussion with CFS and Research, Inventory, and Protection Branches of the B.C. Forest Service.

- K. Lewis, Prince George Forest Region, Prince George

Individual Stand Survey and Operational Trial Establishment in a Mistletoe Infested, Spaced Stand, Mackenzie Forest District. A trial to examine spacing effects on spread and development of lodgepole pine dwarf mistletoe was established in the Prince George Forest Region near Mackenzie. This is the second trial of this type to be established in the Prince George Region (the first was reported earlier). The permanent plots will be remeasured each year and can be used for demonstration purposes. In addition, an individual stand mistletoe survey designed by H. Merler, Kamloops, was tried. The strip survey was effective in stratifying the stand into infestation severity levels for use during stand management operations. The data collected would be beneficial for decision making at the individual stand level.

- K. Lewis, Prince George Forest Region, Prince George

Standard Operating Procedure for Dwarf Mistletoe. A comprehensive standard operating procedure for dwarf mistletoe has been reviewed and finalized for the Nelson Forest Region. The document should be ready for distribution by mid-November 1986.

- D. Norris, Nelson Forest Region, Nelson

Larch Mistletoe Operational Trial. A larch mistletoe operational trial will be established at Howser Creek. The objectives are to test the dwarf mistletoe response to spacing and larch response to spacing in both infected and uninfected areas. District juvenile spacing operations were suspended due to fire hazard concerns and will not be restarted until 1987.

- D. Norris, Nelson Forest Region, Nelson

Douglas-fir Dieback in the Cariboo Forest Region. Frequent observations of extensive dieback in otherwise healthy Douglas-fir plantations have triggered a relatively intensive survey program to quantify the extent of damage and

losses attributable to the phenomenon in the Cariboo Forest Region. It is strongly suspected that much of the dieback is caused by a previously innocuous secondary fungal pathogen, Sclerophoma spp. A canker, identified as Dermea pseudotsugae, has also been noted on many young trees. Suspect stands in the 10 to 15 year age class are being surveyed using parallel 5 m wide transect lines. Data collected includes extent of top kill, tree response to attack (fork, crook, etc.), location of initial attack, diagnostic symptoms, vigour of attacked and adjacent healthy trees, year of attack, and percentage of trees attacked. Preliminary data suggests that up to 80% of some plantations may be affected. Permanent sample plots are also planned to track progress of the disease(s) and their consequences.

- R. Heath, Cariboo Forest Region, Williams Lake

Young Douglas-fir Leader Dieback. Recent observation of significant leader dieback of Douglas-fir in plantations has lead to a survey of the plantations throughout the Prince George Forest Region. The dieback, thought to be caused by Sclerophoma spp., causes top mortality, multiple leaders, stem crooks and branch dieback. Most of the plantations examined so far have from 1 to 70% of the trees attacked (average approximately 30%). The problem appears most severe on poor fir sites. This disease has the potential to disrupt stocking and tree quality of Douglas-fir. A report of disease incidence and severity, and estimates of impact is in preparation.

- K. Lewis, Prince George Forest Region, Prince George

Canker of Douglas-fir in Older Plantations. A twelve year-old Douglas-fir plantation has been exhibiting symptoms of stem cankering and mortality. A recent collection included the fungus Sclerophoma semenospora. Up to 5% of this stand has died from this canker. We have requested that the impact and biology of this fungus be investigated.

- H. Merler, Kamloops Forest Region, Kamloops

White Pine Seed Production. Two enhanced natural selection-Pw seed production areas have been established, one in the Golden TSA near the Beavermouth River, and the other near Hanner Lake in the Revelstoke TSA. The idea is to manage both areas as white pine seed tree shelter woods so that white pine trees exhibiting reasonable resistance would reproduce and as a result the natural build-up of resistance to blister rust would be enhanced. Both areas have a significant infection of Armillaria root disease.

- D. Norris, Nelson Forest Region, Nelson

White Pine Demonstration Area. In July, 1986, two white pine saplings were found that exhibited bark reaction resistance to white pine blister rust. Five more saplings were found along with the possible parent tree, a 115 year old, 25 metre tall, uncankered tree, with a healthy vigorous crown. The 1.5 hectare area is being set up as the Ingersoll Creek White Pine Demonstration Area, within T.F.L. No. 23.

- D. Norris, Nelson Forest Region, Nelson

White Pine Management Strategies. White pine management strategies are being developed in the Nelson Region. These include support of the CFS tree improvement program, development of enhanced natural selection seed production areas in Revelstoke and Golden TSA, and development of preservation guidelines for those white pine exhibiting "reasonable" resistance as required by policy. A series of small seminars are being held in each TSA with Timber and Silvicultural personnel to discuss the white pine preservation and improvement policy, its ramifications and effect on harvesting and/or silviculture prescription. Good cooperation is being elicited from all districts.

- D. Norris, Nelson Forest Region, Nelson

White Pine Management Plan. A white pine management plan for the Nelson Region is under development by the regional forest pathologist, in cooperation with the regional Silviculture and Timber staff.

- D. Norris, Nelson Forest Region, Nelson

Cooperation with the CFS for White Pine Trials in Root Disease Sites. Northwood Pulp and Timber and the B.C. Forest Service, Prince George Forest Region, are cooperating with Dr. Rich Hunt and Hugh Craig of the CFS in the establishment of white pine seedlings in a tomentosus root disease site. The area is on Northwoods TFL #30 and is scheduled for immediate harvest with a feller-buncher. The purpose of the project is to assess the performance of white pine from various sources with respect to blister rust and susceptibility to root disease.

- K. Lewis, Prince George Forest Region, Prince George

Armillaria Root Disease - Resistant Western White Pine Planting Study. The Cariboo Forest Region, in cooperation with the Canadian Forestry Service, Pacific Forestry Centre, intends to test western white pine seedlings resistant to white pine blister rust planted in an Armillaria root disease infection site near Elbow Lake in the Horsefly District. The Canadian Forestry Service has ordered the white pine stock and the area should be

logged this winter or next spring. The detection survey was completed by the Canadian Forestry Service in August 1986. The study area will be monitored by the Canadian Forestry Service to determine if white pine can be established and successfully grown in an Armillaria root disease infection site.

- D. Doidge, Cariboo Forest Region, Williams Lake

White Pine/Armillaria Testing. Two cooperative projects with the CFS are being undertaken to test resistant white pine in areas badly infected with Armillaria root disease. The area in Smallwood Creek is a medium to good site that was essentially rendered non-productive by Armillaria. The second area is a medium site for Pl, where an extensive Armillaria infection had reduced the tree size to that which would be expected on a low site.

- D. Norris, Nelson Forest Region, Nelson

Isolation of a Fungus Associated With "Exploding Canker" on Mature Douglas-fir and Inoculation of Seedlings. "Exploding Canker" of Douglas-fir occurs primarily on mature trees (occasionally on suppressed understory). The canker appears to result from death of the cambium; subsequent unsuccessful attempts by the periderm to callous over the wound produce a large flare of bark around the canker. Several fungi have been consistently isolated from the canker (Al Funk, CFS, and K. Lewis, B.C. Forest Service). In an attempt to fulfill Koch's postulates of proof of pathogenicity, three of the fungi were inoculated into Douglas-fir seedlings. Unfortunately, after several months, the only mortality occurred in a control. Attempts at reisolation of the fungi are currently underway to determine if any of the fungi were able to colonize the seedling stems.

- K. Lewis, Prince George Forest Region, Prince George

Simon Fraser University Student to Study Lodgepole Pine Cankers. A student in Simon Fraser University's M.P.M. program has begun an examination of lodgepole pine with Atropellis piniphila and Cronartium coleosporioides in the Kamloops Forest District. The study is in cooperation with Balco Industries Ltd.

A stand of mature lodgepole pine has been surveyed and severity rated for the two cankers. Four hundred trees have been marked for removal. A lumber recovery factor will be correlated with the canker severity on these trees. The project will be completed by spring 1987.

- H. Merler, Kamloops Forest Region, Kamloops

FOREST VEGETATION MANAGEMENT

Salal Broom Control Trial (SX 86709 Q). In September, 1986, a small trial was established near Duncan to test the effect of the herbicide Roundup® applied with diesel fuel as a carrier on salal and broom. As a check, an area was treated with the same herbicide, but utilizing water as the carrier. A similar area was also established for manual cutting during the winter of 86/87.

The herbicide treatments were carried out using the CP 3 backpack sprayer. It was noted by the applicator that the herbicide, when mixed with diesel fuel, required constant agitation. In addition, the diesel fuel was messy to use and gave off an offensive odour.

The first assessment of this trial is scheduled for July, 1987.

- G. Ackerman, Silviculture Branch, Victoria

Girdling Tools and Techniques. A detailed review titled "Girdling Tools and Techniques for Control of Red Alder in Forestry and Rights-of-way" is now available for a cost of $4.00/copy. This report is written by Michael Conway-Brown, who has extensive experience in the use of various girdling tools.

The report discusses various tools used, production, costs, advantages over other techniques, and disadvantages/limitations of girdling.

Copies are available from M. Conway-Brown by writing to No-Chem-Do Contracting and Consulting, R.R. #3, Upper Zilinsky Road, Powell River, V8A 5C1.

- R. DeBoo, Protection Branch, Victoria

RANGE PEST MANAGEMENT

1986 Weed Control Program - Kamloops Forest Region. The 1986 weed control program of the Kamloops Forest Region was similar to that of recent years. Time and funding were directed primarily toward Diffuse and Spotted knapweed containment using Tordon® 22K.

Biological Control of Weeds:

In 1986, biological control agent releases were made on Diffuse, Spotted, Russian, and Black (the latter two species not considered as major rangeland problems). Toadflax is scheduled to receive agents next year throughout the region. In cooperation with the Ministry of Agriculture and Fisheries, work has been initiated to look for biocontrol agents suitable for houndstongue.

Since 1970, Urophora seed head flies have been released on knapweed and these flies have spread throughout the infestations in B.C. More recently the Sphenoptera root beetle has been released on Diffuse knapweed and the Metzneria seed head moth onto Spotted knapweed. Each of these agents has done well on at least one site in the province, White Lake near Okanagan Falls for Sphenoptera and Castlegar for Metzneria. The goal is now to get them successfully established elsewhere to increase their rate of natural spread. Both agents have shown limited success for survival in the past. Survival of all agents released, even Urophora flies which are thought to be widespread, must be constantly checked.

- No evidence was found at Metzneria released in 1985 survived last winter (Clearwater, Lac du Boise, Walhachin). Re-releases and additional releases totalling over 60 within the region were made this year. One Walhachin site was left to see if the colony can recover. Metzneria was more successful further south in the Okanagan.

- Seventy Sphenoptera releases were made throughout the Okanagan and to a lesser extent Boundary, Similkameen, and Thompson River areas this year. Limited releases were made at Lac du Bois and in the Lillooet Forest District because this insect is also thought to be more suited to knapweed infestations further south. Fall inspections to date indicate very good establishment.

- Urophora releases were made on "Black knapweed" at Seymour Arm and Salmon Arm and these populations will be monitored to determine survival. Black knapweed is not considered a serious weed problem.

- One release of Calophasia moth larvae was made south of Cherry Creek (Kamloops) on Common Toadflax in October. Additional releases will be done in 1987.

- J. Pethybridge, Kamloops Forest Region, Kamloops

Chemical Control of Knapweed within the Kamloops Forest Region. 731 sites were treated with herbicides for noxious weed control ranging in area up to the size of Coutlee Plateau and Lac du Bois which involved 224 acres of spraying over 6,260 acres of land.

Coordination of our program with that of other agencies and individuals including the regional districts, B.C. Cattlemens Association's members, and the Western Indian Agricultural Corporation was done on site throughout the season.

- J. Pethybridge, Kamloops Forest Region, Kamloops

Mechanical Control of Knapweed. In two instances (Lillooet Forest District) hand pulling weed control contracts were issued in conjunction or instead of chemical control in areas where chemical control could not be carried out. These were successful in terms of increasing cooperation with other groups while stressing the importance of overall weed control. Cost effective weed control by this method is, however, questionable.

- J. Pethybridge, Kamloops Forest Region, Kamloops

Cariboo Forest Region Noxious Weed Control Program. In 1986, the Range Section fielded two spray crews resulting in the treatment of 77 hectares of noxious weeds using 71.52 kilograms of picloram (298 litres of Tordon® 22K formulation). In keeping with provincial policy, top priority was given to knapweed containment. The crews also participated in the program to control the nodding thistle infestation at Alexis Creek. Small pockets of other noxious weeds, including Canada thistle, burdock, blueweed, leafy sparge, toadflax, and houndstongue were also sprayed.

- S. Latin, Cariboo Forest Region, Williams Lake

PESTICIDES

Forest Pesticide Field Guide. The Forestry Issues Steering Committee will publish a "Forest Pesticide Field Guide" for field staff and contractors who deal with pesticides. It will capsulize a wide range of information about pesticide use in forestry to assist personnel in explaining pesticide use to the public.

Because this guide is intended for field use, it will be pocket-sized, weatherproof, and flexible. Information will be presented clearly and concisely and mainly in the form of charts and graphs.

- P. Humphreys, Protection Branch, Victoria

Droplet Spectrums from Gypsy Moth and Western Spruce Budworm Treatments. In May and June of 1986, two aerial insecticide sprays were conducted using four different nozzle types. The gypsy moth treatment at the Chilliwack Armed Forces Base applied Dipel® 88 in three discrete sprays with D7-45, D4-45, and D2-13 nozzles. Near Kamloops, in Paul Lake Provincial Park, Thuricide® 48 LV was applied using Micronair AU 5000 units (rotary atomizer-type nozzles) on trees infested with western spruce budworms.

Initial inspections of droplet size and density indicated that only the Micronair and D2-12 nozzles provided adequate spray deposit. Accordingly, deposit cards were shipped to the Saskatchewan Research Council for an accurate determination of droplet size and density. This information will be used to develop better insecticide application standards.

- S. Taylor, Protection Branch, Victoria

Velpar® Application Guidelines. During the past two years, the Forest Service and Ministry of Environment and Parks have been cooperating in an investigation of the potential for soil movement of the herbicide Velpar. Guidelines for use based upon a tentative understanding of the problem were developed in 1985. New, more exacting guidelines for use will soon be available through the authority of the Pesticide Control Branch as a result of the new data. Anyone considering the use of Velpar should obtain the guidelines from either the Pesticide Control Branch or local Forest Service offices.

- J. Henigman, Protection Branch, Victoria

The Health Safety of 2,4-D. The results of an epidemiological study reported in the Journal of the American Medical Association, Volume 256, September, 1986, indicate that farmers regularly exposed to 2,4-D have a significantly greater rate of non-Hodgkin's disease lymphoma (cancer). This study and a few other contributing studies are currently under review by the Department of Health and Welfare.

Decisions are expected to be made on the continued use of 2,4-D in forestry in the near future. Until Agriculture Canada comes forth with their response to the health risk studies, anyone using 2,4-D should continue to observe all safety precautions and wear appropriate protective equipment.

- J. Henigman, Protection Branch, Victoria

Update on the Status of Garlon®. The herbicide Garlon®, common name triclopyr, has been undergoing evaluation for Canadian registration in forestry since about 1982. This Dow Chemical Canada Inc. product appears likely to provide adequate control of most of the major brush and non-commercial tree species which may compete with commercially grown coniferous trees in B.C. Its range of effectiveness will likely be wider than that of the herbicide Roundup® (glyphosate) though Garlon will not affect grasses.

Many people interested in the subject of forestry, and in herbicide applications particularly, may recall the controversy created in Terrace, B.C., in 1985 when proposed site specific studies on Garlon were blocked

through court injunction. A rather detailed summary of the Garlon issue was published by the Canadian Pulp and Paper Association and was reprinted in Pest Management Progress 4(2), November, 1985. Since that time the evaluation of the herbicide has continued with some good results.

Following the abandonment of the Terrace environmental impact studies by the Canadian Forestry Service, Dow initiated alternative research plans to collect the needed information. During the spring of 1986, Dow met and achieved agreement with the various environmental agencies concerned with Garlon evaluation. Most notably Dow, in agreement with the Department of Fisheries and Oceans (D.F.O.), completed some laboratory toxicity tests on salmonid fish species with Garlon . Acceptance of the results of these tests has allowed the D.F.O. to endorse limited field analyses of the herbicide.

Environmental field research on Garlon was established at the University of B.C. Research Forest near Haney in order to both benefit from other scientific information available there and to minimize public or environmental agencies concerns. This decision has apparently eliminated all controversy about the research.

Initially, a rather comprehensive research study was proposed by Dow's environmental consultants, D. McLeay and Associates Ltd. It involved an assessment of a helicopter aerial spray of a 13 hectare site containing brush and some perennial streams. This was concluded to be too ambitious by regulatory agencies. In its place a limited three-month study was initiated in August, 1986, to evaluate the field toxicity of Garlon 4 to coho salmon and rainbow trout and determine the time period required for hydrolysis of the ester product to its parent acid. The study was conducted using a small pond (0.03 hectares) into which caged fish were placed for study. Garlon was applied by backpack at a dosage rate (8.kg a.i./ha), three times that to be allowed in forestry. Preliminary observations suggest minimal impact to the fish though clear results from the work are still under review. A report is expected during November, 1986.

With expectation of favourable results, a more comprehensive environmental study similar to that originally proposed by McLeay and Associates, may be conducted in 1987. This one-year study would likely investigate the occurrence of Garlon residues in foliage, soil, water, litter and sediment, determine breakdown period, assess down-slope movement and further expand on fisheries toxicity.

Vegetation control efficacy studies are slowly being conducted throughout the province. The B.C. Ministry of Forests and Lands, Vancouver Region, for example, is assessing efficacy on cottonwood, thimbleberry, red alder, black raspberry, willow, and salal. Kamloops Region personnel are assessing efficacy on rhododendron and false azalea. Forest companies including Canadian Forest Products, Fraser Lake Sawmills, and Western Forest Products have been evaluating Garlon to control green alder and salal.

In Ottawa the wide range of studies needed to allow a registration of Garlon are being evaluated by Agriculture Canada and its advisors, including the Department of Health and Welfare, Environment Canada, and D.F.O. At this time, all of the studies need to justify an industrial rights-of-way registration have been accepted and a registration for this purpose is expected soon.

The forestry registration proposal will not likely be made by Dow until 1988. At that time, the final chronic health studies and the needed environmental studies planned for the U.B.C. Research Forest, will be completed. A forestry registration may be possible by 1989.

The B.C. Forest Service endorses the continuing registration studies with Garlon and encourage forest agencies throughout Canada and the province to continue gathering efficacy information on this herbicide.

As a parting note to this ongoing story of research studies, this fall the Deputy Minister, Ministry of Environment and Parks, has asked the Canadian Forestry Service to clarify its future role in field research in this province. The saga continues.

- J. Henigman, Protection Branch, Victoria

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(Forest Service Personnel fully or partly committed to forest pest management activities)

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MEETINGS

Western Forest Insect Work Conference. The 1987 WFIWC will be held in Park City, Utah, in the first week of March. This conference offers an excellent opportunity to discuss current research and issues in forest entomology. This year's conference does not have a theme, but will emphasize "high-tech" approaches in pest management such as information systems, remote sensing, and alternatives to conventional insecticides.

- P. Hall, Protection Branch, Victoria

Western International Forest Disease Work Conference. I attended the WIFDWC meeting September 8-12, 1986, at Juneau, Alaska. Highlights included discussion sessions on stem rusts, root diseases, and dwarf mistletoes; a talk on forest decline in Europe by P. Schutt; and brief presentations of current activities by representatives of the various organizations. New officers for the 1987 WIFDWC meeting to be held August 17-21 at Nanaimo are J. Muir, President, G. DeNitto, Secretary, and J. Kumi, local arrangements (753-1112). Notes on the 1986 meeting are available on request.

- J. Muir, Protection Branch, Victoria

PROGNOSIS Root Disease Model Workshop. A workshop was held October 23-26 at the Priest River Experimental Forest, Idaho, to review the new root disease stand sub-model developed for the PROGNOSIS model.

The sub-model, being developed by a Vancouver company, uses inventory data plus additional information on *Armillaria* or *Phellinus* to project stand growth under various silvicultural and harvesting treatments. With further testing and development, the model could be useful for damage appraisals and silvicultural prescriptions in B.C. Notes on the workshop are available on request.

- J. Muir, Protection Branch, Victoria

Armillaria Root Disease. *Armillaria* root disease is a serious problem in the Nelson Forest Region, especially in the wet belt portion. An *Armillaria* symposium-workshop was held in August with regional and district staff from Protection, Silviculture, Research, and Timber. As a result, a series of operational trials will be proposed and catalogued under the Px system. Some of the trials will involve stumping (but only as a part of an overall treatment process) and a regional processing system is being set up to coordinate and monitor *Armillaria* root disease operational trials. Trials involving stumping will be examined closely to ensure that the sites are suitable.

- D. Norris, Nelson Forest Region, Nelson

Fall and Burn (MPB) Contractor Awareness Day. On October 7, 1986, the pest management staff of the Prince Rupert Forest Region sponsored an informational seminar for potential fall and burn contractors.

This two-fold meeting began with a presentation of safe falling practices and W.C.B. requirements by a local W.C.B. occupational health and safety officer. This matter was addressed because of the Ministry's concern to have this work done safely and the numerous unsafe practices observed in previous years.

The second part of the meeting was to try to help contractors prepare a reasonable bid. The approach was to encourage bidders to utilize probe information available at the district but not included in the tender packages.

The floor was always open to questions or discussion and many of the 23 potential contractors participated. Hopefully, this meeting will have helped in achieving a more successful fall and burn season both for contractors and the Forest Service.

- R. Klassen, Prince Rupert Forest Region, Smithers

STATUS OF BARK BEETLE MANAGEMENT PROGRAMMES IN THE PRINCE GEORGE FOREST REGION IN 1986

	P.G. West	P.G. East	McBride	Vanderhoof	Ft. St. James	Mackenzie	Dawson Cr.	Ft. St. John	Ft. Nelson	Totals
Area (ha) Infested by Bark Beetles	200,000 [a]	1,000	1,200	180,000 [a]	2,000	135	Some scattered spots.	No known infestations.		384,335
Area (ha) Harvested within Bark Beetle Areas - 1986	620	1,500	428	400	300	minor				3,248
Area (ha) Planned for Harvest within:										
1 Year	2,800	1,200	300	1,400	350	minor				6,050
2 Years	2,800	500	500	1,400	400		0			5,600
3 Years	2,800	250	300	1,400	400		0			5,150
Area (ha) "Lost" (Inaccessible or Non-Merch.)	16	400	500	0	1,000		30,000			31,916
Volume (m^3) Infested by Bark Beetles	13,450	250,000	250,000	15,000	175,000		0			703,450
Volume (m^3) Harvested within Bark Beetle Areas	217,000	3,750,000	93,000	120,000	20,000	minor				4,200,000
Volume (m^3) Planned for Harvest within:										
1 Year	800,000	300,000	63,000	420,000	25,000	minor				1,608,000
2 Years	800,000	100,000	105,000	420,000	20,000		0			1,445,000
3 Years	800,000	62,500	63,000	420,000	25,000		0			1,370,500
Volume (m^3) "Lost"	4,000	800,000	63,000	5,000	140,000		6,500			1,018,500
Trap Tree Patches felled in 1985-86 (no. patches: no. per patch: total volume)	31:3-15: 438	scattered decks	0	0	0		8:5:30			39:15:468
Trap Tree Patches planned for 1986-87 (no. patches: no. per patch: total volume)	10:15: 150	0	3 [b]:60:100	0	0		0			13:75:250
Pheromone baits (sites:baits)										
1986	587:3600	0	28:494	35:2175	19:218		0			669:6487
1987	650:6000	0	40:800	45:2500	25:400		0			760:9700

[a] light, patchy attack over this area
[b] Trap Tree "Decks"

SUMMARY OF PROPOSED PESTICIDE USE (1986)

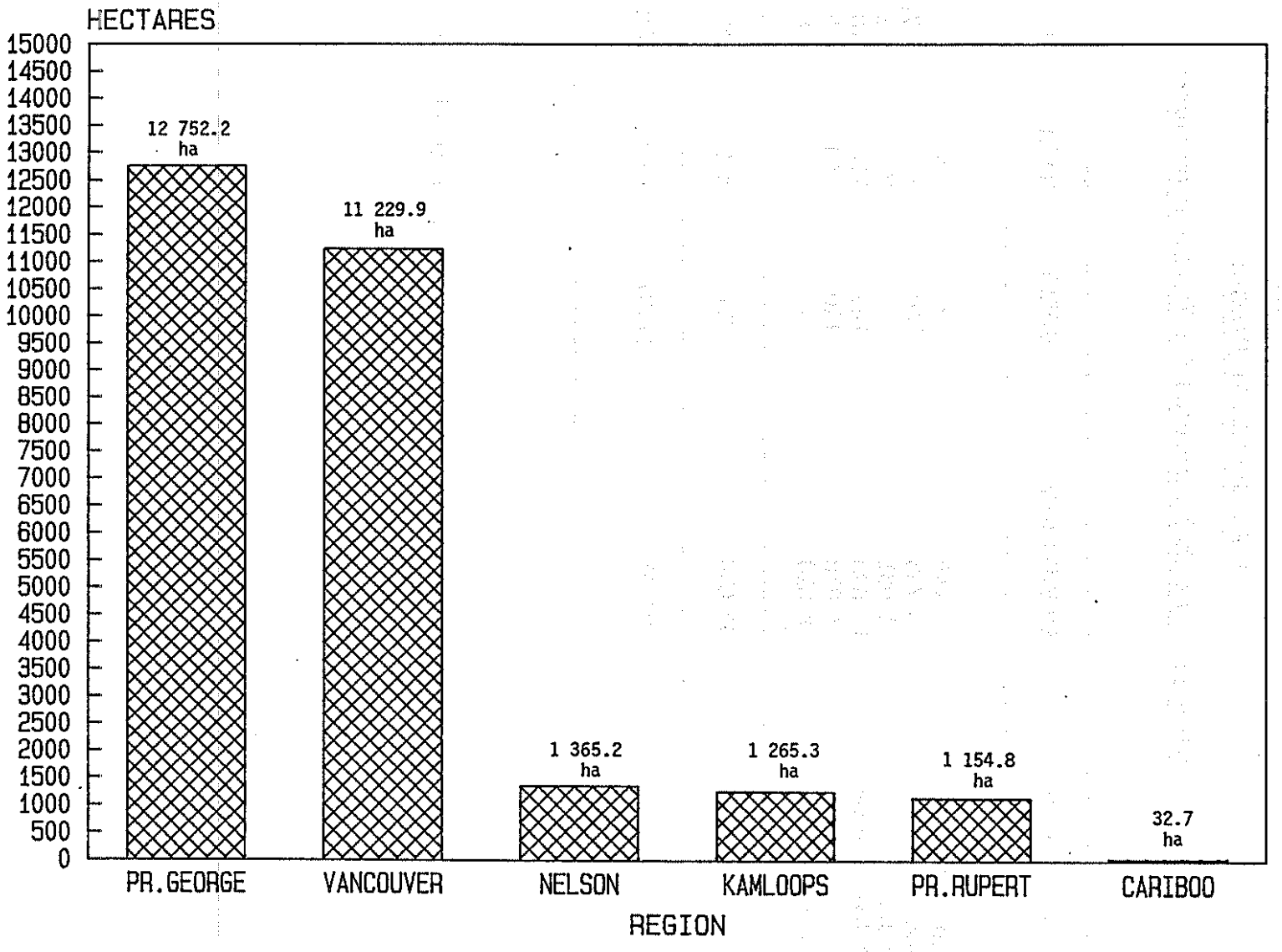
BCFS AND FOREST INDUSTRY

Table 1: Area (ha) Scheduled for Treatment by Purpose

FOREST REGION	SILVICULTURE	INSECT	RANGE	TOTAL
Cariboo	449	73	70	592
Kamloops	6 768	160	374	7,302
Nelson	1 081	-	216	1 297
Prince George	17 890	148	178	18 216
Prince Rupert	4 838	140	40	5 018
Vancouver	8 010	-	-	8 010
Total	39 036	521	878	40,435
%	(96.5)	(1.3)	(2.2)	(100)

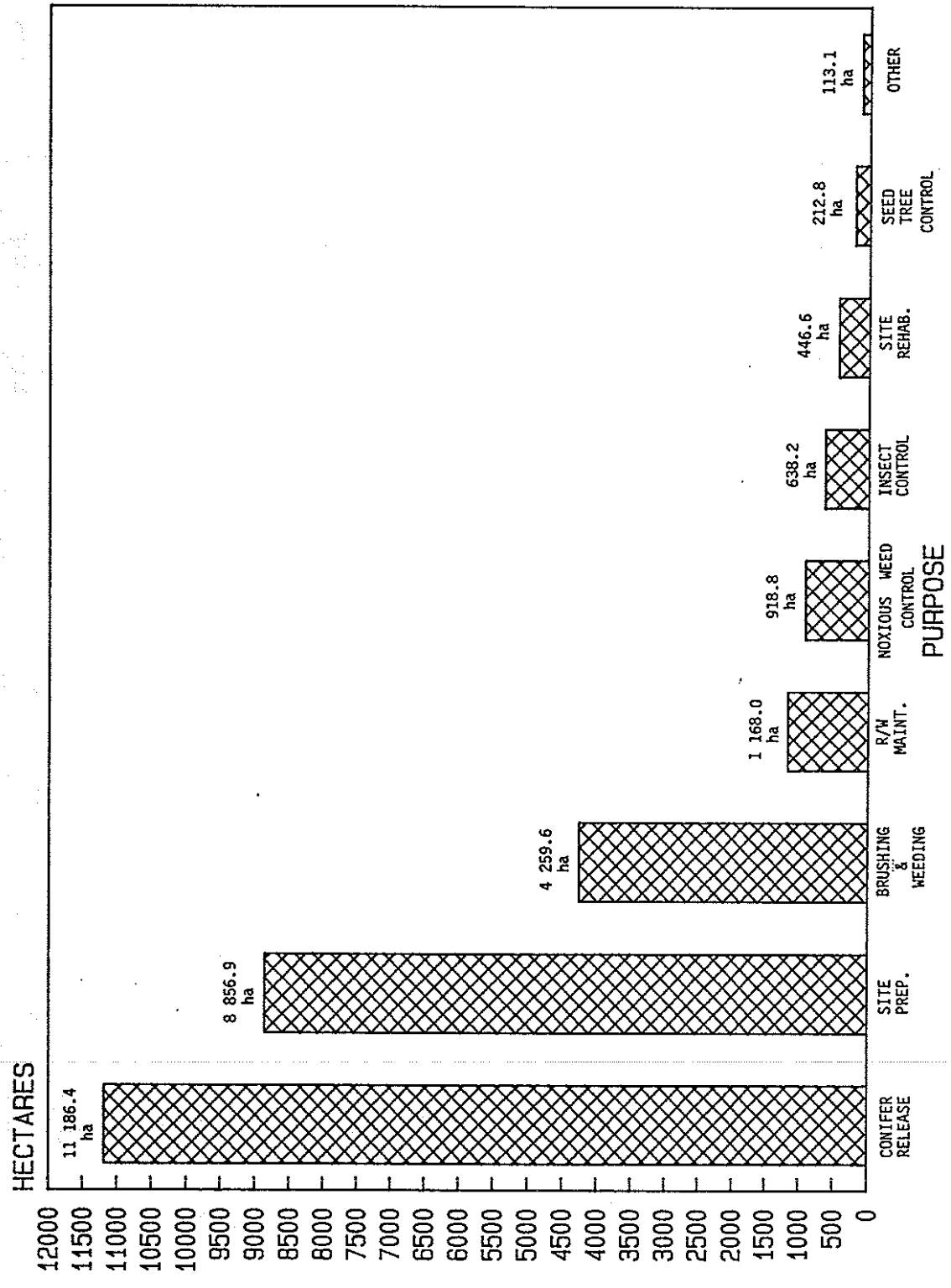
- P. Humphreys, Protection Branch, Victoria

AREA TREATED WITH PESTICIDES BY FOREST REGION, 1985[1]



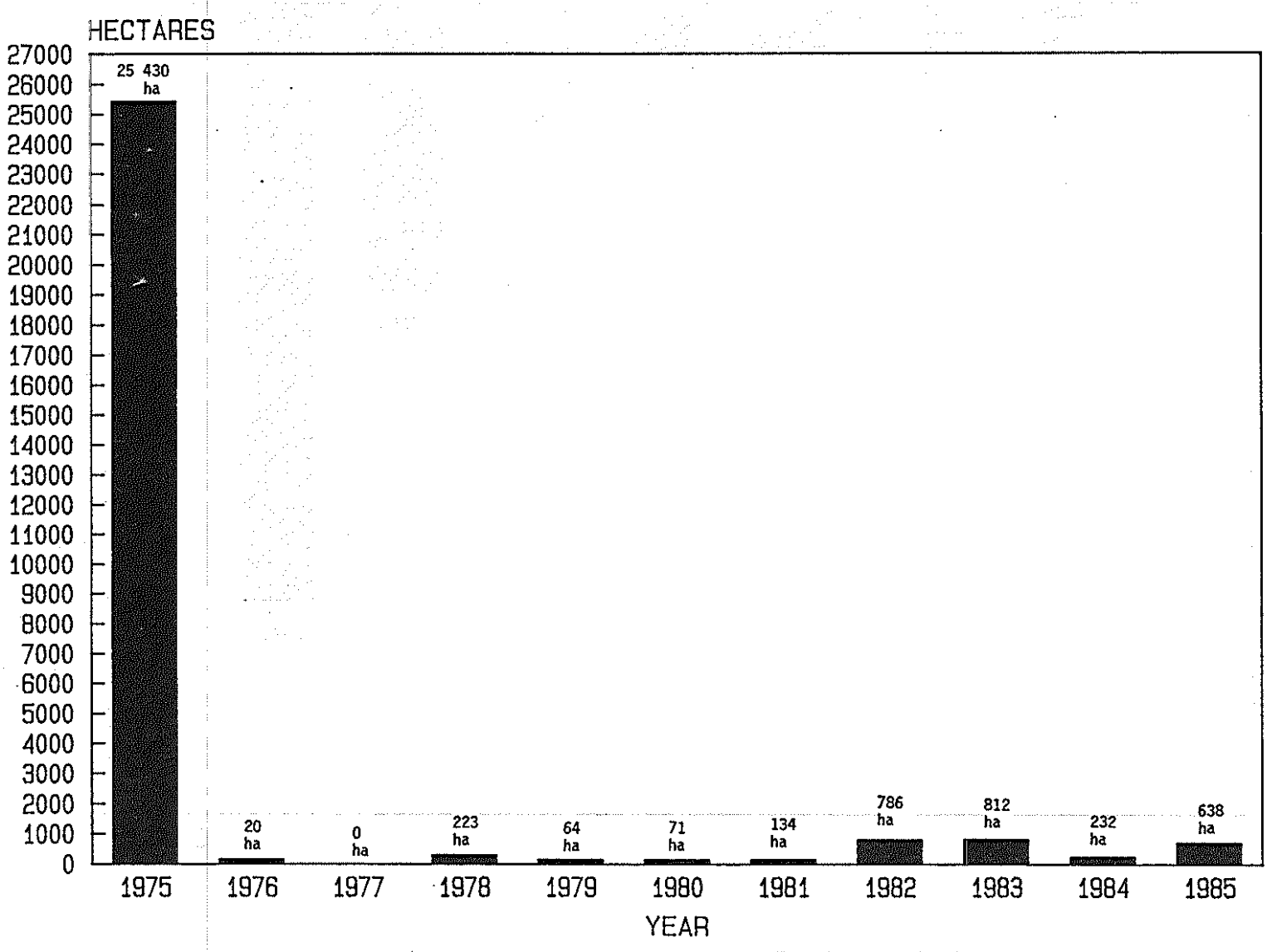
[1] B.C. FOREST SERVICE & B.C. FOREST INDUSTRY COMBINED

SUMMARY OF THE PURPOSE OF PESTICIDE USE BY AREA TREATED, 1985[1]



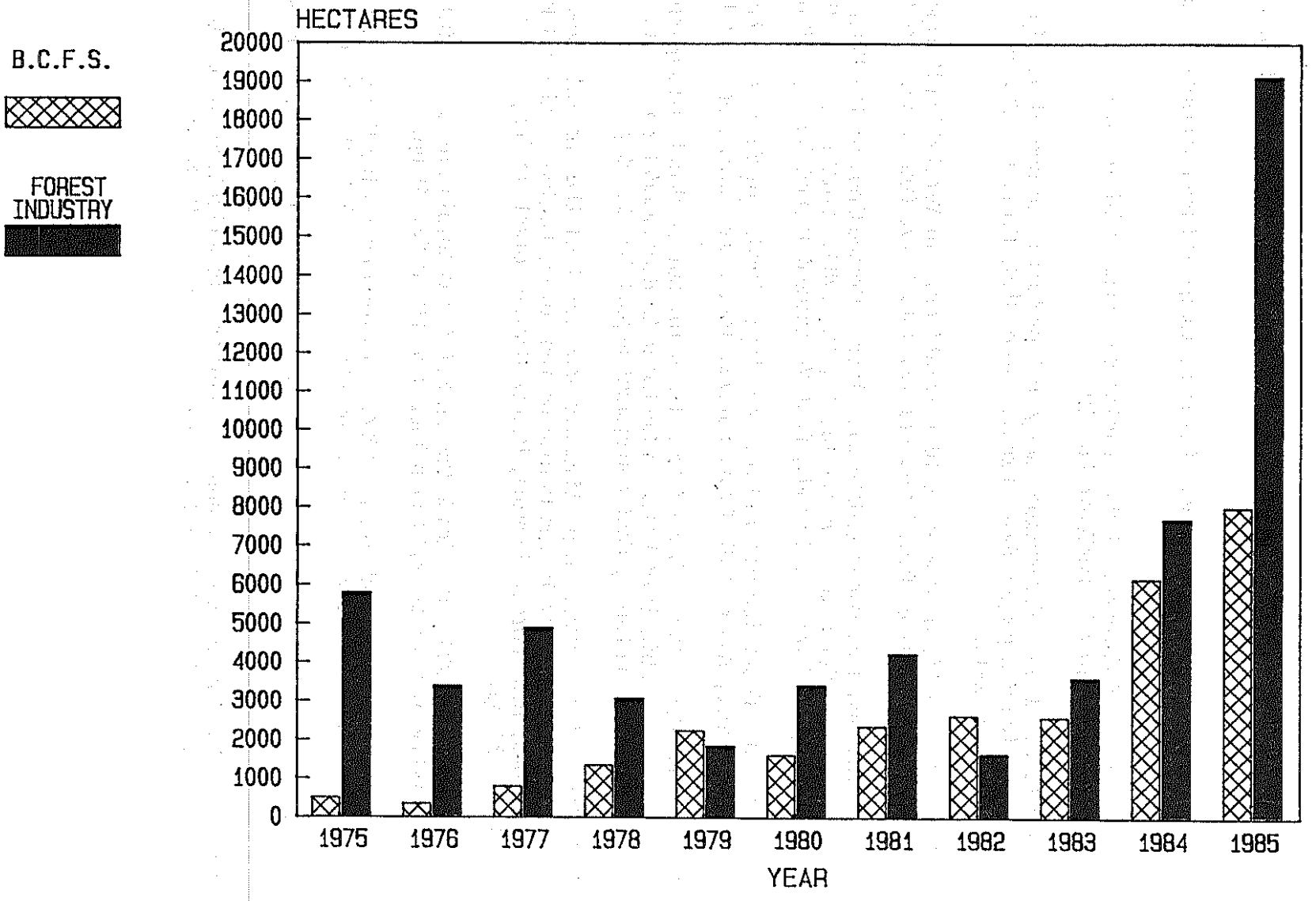
[1] B.C. FOREST SERVICE & B.C. FOREST INDUSTRY COMBINED

TOTAL HECTARES OF LAND TREATED WITH INSECTICIDES FOR FORESTRY PURPOSES, 1975-1985[1]



[1] B.C. FOREST SERVICE & B.C. FOREST INDUSTRY COMBINED

TOTAL HECTARES OF LAND TREATED WITH HERBICIDES FOR FORESTRY PURPOSES, 1975-1985



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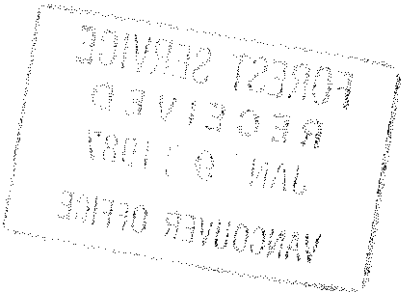
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