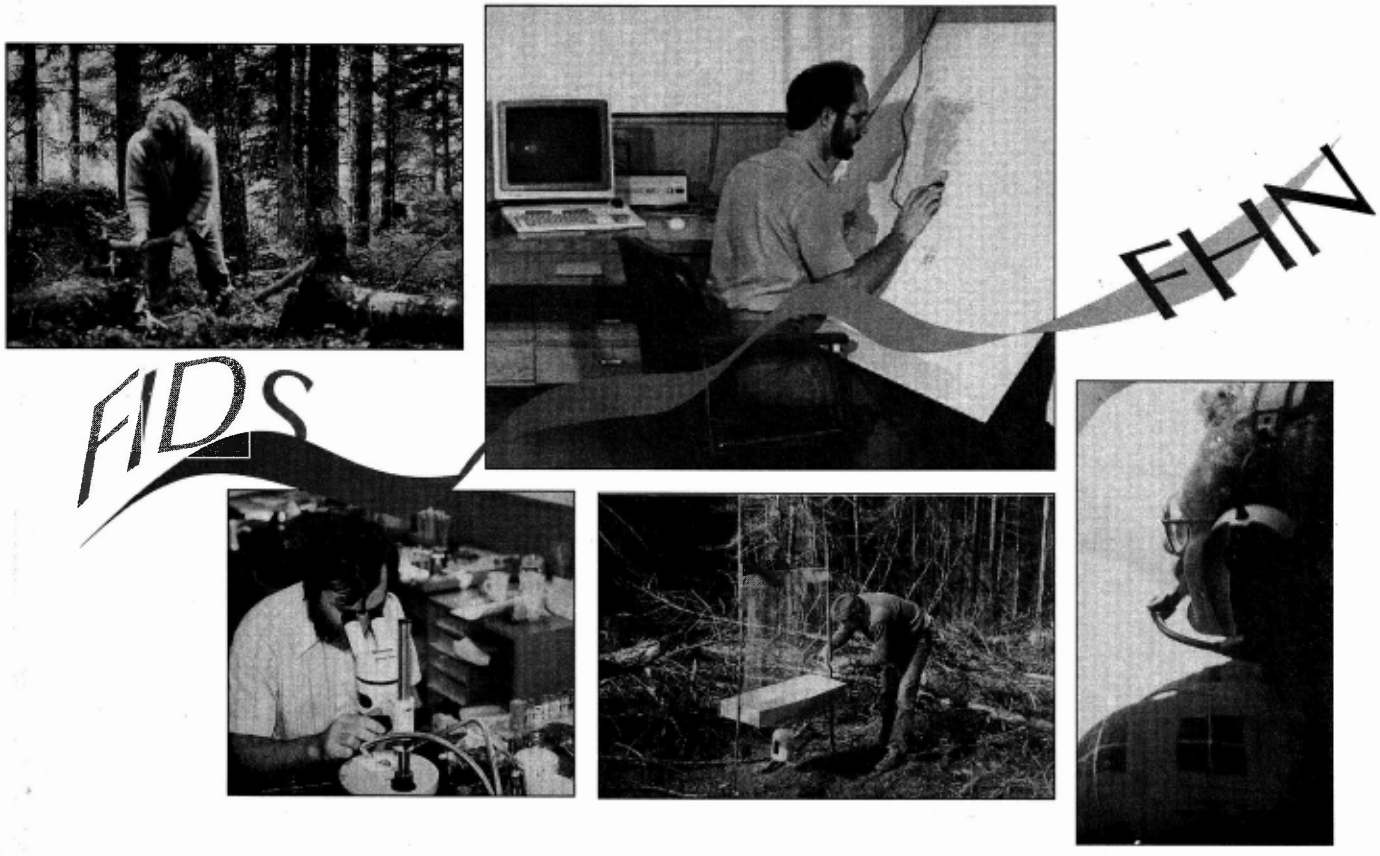
Forest Insect and Disease Conditions Vancouver Forest Region – 1995

Rod Turnquist and Nick Humphreys

Pacific Forestry Centre • FIDS Report 96-5



Natural Resources Canada
Canadian Forest Service

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Canada

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QUEEN CHARLOTTE ISLANDS

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Canadian Forest Service
Transition of FIDS to Forest Health Network

As a result of the Canadian Forest Service (CFS) program review and reorganization announced in the February 1995 federal budget, the CFS had a substantial reduction in resources (37% reduction in staff) and modified its priorities to be more in concert with federal responsibilities in the forestry sector. Overall, the Canadian Forest Service will be reduced to five establishments focusing on science and technology development. Operational forestry activities such as growth and yield, applied silviculture, and the Forest Insect and Disease Survey have been reduced; in this latter case, however, a more nationally focused Forest Health Network (FHN) is being developed.

The Forest Health Network is one of ten Canadian Forest Service Science and Technology networks organized to integrate research among the establishments and seek partnerships with other agencies and stakeholder groups. These networks will promote sustainable forest development and responsible use of Canada's forest resources. The networks reflect the two themes of the Science and Technology program: the acquisition and aggregation of knowledge related to understanding forest ecosystems, and the development of strategies for advancing sustainable forest development. Some of the networks relevant to insects and fungi include: Forest Health, Biodiversity, Effects of Forestry Practices, Pest Management Methods, and Landscape Management.

Forest Health Network - National Priorities

1. To monitor and report on changes in national forest health using an expanded and enhanced, ecosystem-based series of plots.

2. To provide, in collaboration with provincial cooperators, national overviews of major forest disturbances due to air pollutants, insects and diseases, using nationally standardized monitoring systems with a quality assurance program. This will include national level input required by the Canadian Criteria and Indicators Process for Sustainable Forestry, such as:

   - area and severity of insect and disease attack;
   - occurrence and severity of exotic species detrimental to forests;
   - area of catastrophic forest depletion; and
   - indicators of biodiversity, climate change and forest health.

3. To maintain diagnostic expertise and working reference collections to provide the scientific foundation in support of forest biodiversity policies.

4. To maintain the national forest health database with access to all partners. Analysis of data and presentation of information in shared electronic formats will be undertaken.

5. To participate in the planning and conduct of surveys, and pest risk analysis for exotic forest pests in cooperation with Agriculture and Agri-Food Canada.

6. To maintain linkages with other client Federal departments (Environment, Heritage-Parks Canada, Agriculture and Agri-Food Canada) as well as the collaborative efforts with Provinces, universities, industry and international agencies.

7. To develop, test, and standardize monitoring techniques, indicators and predictive models of forest health.

Forest Health Network - Pacific Forestry Centre

In 1996 the Forest Health Monitoring unit at CFS-Victoria will comprise seven senior Forest Health technicians. The insect and disease diagnostic capability along with the permanent reference collections and related databases will be retained, with increased emphasis on forest biodiversity aspects. The geographic information system (GIS) developed since 1984 and the associated historical database will continue to provide support to the Forest Health unit and the national database. The long-term plan is to have a total of six forest health technicians in the Forest Health Monitoring Unit.

The planned staff of the Canadian Forest Service-Victoria, Forest Health Monitoring Unit in 1996 will include:

Forest Health Technicians
Bob Erickson
Rod Garbutt
Nick Humphreys
Peter Koot
Rod Turnquist
Leo Unger
John Vallentgoed

Forest Health Unit Leader
Allan Van Sickle

Associated staff in the Biodiversity and Landscape Management - Decision Support System networks are:

Insectary:	Lee Humble, Bob Duncan, Jane Seed
Herbarium:	Brenda Callan
GIS:	Dennis Clarke

New Partnerships

At this time of transition, we would like to again recognize the very significant support and cooperation provided by many agencies in helping the Canadian Forest Service deliver the annual forest insect and disease conditions reports in British Columbia and the Yukon Territories for several decades. Without cooperation from employees of federal and provincial parks, Agriculture and Agri-Food Canada, the forest industry, and especially the British Columbia Ministry of Forests, the more than 50 years of insect and disease records affecting the nation's forest would not be as complete.

As the Forest Health Network evolves to fulfill the national aspects of the priorities noted above, we hope that this outstanding level of cooperation and partnership continues. We look forward to continued involvement with our clients in research and planning to help develop the Forest Health Network research direction. To this end, we are pleased that there is already agreement between the Canadian Forest Service and the British Columbia Ministry of Forests to undertake a cooperative approach to forest health monitoring that will best meet the needs at both the provincial and federal levels.

We look forward to working together with our partners in 1996 and beyond.

For further information please contact Dr. Allan Van Sickle, Forest Health Unit Leader at

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Introduction

Forest Insect and Disease Survey (FIDS) is a nation-wide network within the Canadian Forest Service (CFS) with the responsibility of: (1) producing an overview of forest pest conditions and their implications, including predictions where possible; (2) maintaining records and surveys to support quarantines; (3) supporting forestry research with field studies, records, Herbarium and Insectary collections; (4) providing advice and extension on forest insect and disease conditions; (5) developing and testing survey techniques; (6) and conducting related biological and impact studies.

Throughout the year, correspondence and inquiries regarding forest pest problems, and requests for publications can be directed to FIDS headquarters at:

Pacific Forestry Centre
Canadian Forest Service
506 West Burnside Road
Victoria, B.C. V8Z-1M5

Ph. 363-0600

Defoliation intensities in this report are defined as follows:

Trace	-	evidence of feeding barely detectable at close range
Light	-	some branch and/or upper crown defoliation, barely visible from the air
Moderate	-	pronounced discoloration and noticeably thin foliage, severe top defoliation
Severe	-	top and many branches completely defoliated, most trees more than 50% defoliated

Mortality due to bark beetle attack, referred to in this report, are defined as follows:

Light	- 10% or less of stand recently killed
Moderate	- 11-29% of stand recently killed
Severe	- 30%+ of stand recently killed

This report outlines the status of forest pest conditions in the Vancouver Forest Region for 1995 and forecasts trends of some potentially damaging pests. Pests are listed by host in order of importance with emphasis given to those capable of damaging outbreaks. Where possible, pest losses are quantified by Timber Supply Areas (TSAs) within Forest Districts. Most of the information was gathered through the monitoring of already known or recently reported insect or disease problems, the detection of pest problems during travels through the region, annual aerial surveys during which major pest problems are mapped for area and severity, and several special surveys and collections.

Several special surveys were carried out during the field season. These included: changes in tree conditions in Acid Rain National Early Warning System (ARNEWS)/biomonitoring plots; five-year remeasurements in the ARNEWS plots; pheromone trapping of defoliators including spruce budworm, western hemlock looper, and gypsy moth; surveys for the recently introduced European pine shoot beetle; Port environ and dunnage surveys; and young stand surveys. Additionally, numerous forest pest-related inquiries from the forest industry, government agencies, and the general public were investigated, causal agents identified, and management options suggested.

During the 1995 field season, special collections were made which contributed to current and continuing studies at the Pacific Forestry Centre, and other research institutes. These collections included defoliator larvae, phantom hemlock looper, bark beetle larvae and adults from Christmas tree farms, collections of infested dunnage from port areas and import sites, and foliar samples from ARNEWS plots.

The FIDS field season extended from early June to mid-October during which samples collected for identification by CFS/FIDS and cooperators totaled 350. This included 290 insect and 60 disease collections, including over 100 collections from pheromone-baited traps set out by insectary staff. The locations where samples were collected and the areas covered during 10.8 hours of fixed-wing and 4.2 hours of rotary-wing aerial surveys are shown in Figure 1.

Forest pest conditions on the Queen Charlotte Islands in 1995 are detailed in this report. The survey, from July 27-August 5, and the report were completed by John Vallentgoed, FIDS Ranger based in Terrace in the Prince Rupert Region (West). Forest pest conditions in the Mid-Coast Forest District were assessed and reported by Bob Erickson, FIDS Ranger based in Williams Lake in the Cariboo Forest Region. The authors wish to acknowledge the support and assistance of the British Columbia Ministry of Forests and Scott Paper with aerial surveys.

Summary

This summary of pest conditions in the Vancouver Forest Region in 1995 lists the most damaging pests, generally in order of importance by host affected.

Western spruce budworm populations in the Fraser TSA collapsed following six consecutive years of defoliation. No defoliation was recorded in the region. Populations in the Soo TSA collapsed last year following nine consecutive years of defoliation. The area of **Douglas-fir beetle** attacks increased almost threefold to about 750 ha in 540 infestations, up from 280 ha in 241 infestations in 1994. Most of the increase occurred in the Sunshine Coast TSA. For the third consecutive year, the **phantom hemlock looper** moderately to severely defoliated boulevard and residential trees in south east Burnaby. **Root rots** continue to be a common and widespread problem in all age classes region-wide.

Mountain pine beetle killed an estimated 38 550 trees over 640 ha in 143 infestations, up from 18 450 trees over 465 ha in 156 infestations in 1994. The increase, as well as most mortality, occurred in the Soo TSA. Continued surveys for the **European pine shoot beetle,** a European pest recently introduced to eastern North America, were negative. There was no recorded spread of **European pine shoot moth** populations to native trees at Richmond or other locations. Populations remain endemic in ornamental pines in the lower mainland and southeastern Vancouver Island. The incidence of **pine needle cast** decreased throughout the region, no discolored stands were observed during aerial surveys, down from about 200 ha in 1994.

Spruce bark beetle populations, although remaining relatively low for the ninth consecutive year, increased slightly for the second consecutive year to about 80 ha of recent mortality, up from 50 ha in 1994. Most of this mortality occurred in the Fraser TSA, close to the Kamloops Region. Elsewhere, no mortality was recorded in previously infested stands in the Mid-Coast TSA. **Spruce weevil** populations continued to cause leader mortality throughout most of the host range.

Balsam bark beetle killed mature alpine fir over 1710 ha up from 1320 ha recorded in 1994. Most of this increase was recorded in the Fraser and Soo TSA's. In cooperation with the BCFS, surveys again found active **balsam woolly adelgid** populations, both within and outside the 1992 quarantine zone including, for the first time, confirmation of infested trees east of the Fraser river.

Western hemlock looper populations were monitored as part of an ongoing province-wide calibration of a pheromone trapping system. No current defoliation was recorded.

A conifer sawfly lightly to moderately defoliated amabilis fir and western hemlock over some 200 ha in a tributary to the Phillips River, west of Bute Inlet. This is the first reported sawfly outbreak in this area.

A total of 20 **managed, young stands** were surveyed for pest problems, which included **abiotic damage, needle diseases** and **minor defoliators.** No evidence of acid rain damage was found at 12 **ARNEWS/biomonitoring** plots in the region. **Port environ and dunnage surveys** found previously infested material and live adults in crating and dunnage from several different countries. Additionally, in pheromone traps placed as part of this survey, two Asian ambrosia beetle were caught, one for the first time in North America, and the other for the first time in eastern North America.

No adult male **gypsy moths** were caught in 62 traps placed by FIDS. However, about 39, including two of the Asian Bio-type were caught in traps placed by Agriculture Canada and the B.C.F.S. in various locations in southwestern B.C. This is about the same as 1994. **Western oak looper** populations continued to defoliate Garry oak on Saltspring Island. Some mortality has occured as a result of the continued defoliation. **Winter moth** populations on the lower mainland and Vancouver Island remained low, various deciduous species were mainly trace to lightly defoliated, similar to 1994. **Cottonwood sawfly** populations collapsed following a slight decline last year. For the third consecutive year, infections caused by a recently introduced species of **a poplar rust** were found on hybrid poplars from the Fraser Valley and Vancouver Island. **Northern tent caterpillar** populations remained active for the third consecutive year, lightly to severely defoliating a variety of trees and shrubs at various Vancouver Island and some Gulf Island locations. Defoliation was also recorded, for the second consecutive year, in the Powell River area. The incidence of scorching of Garry oak by the **jumping gall wasp** in the the Capital Region, although continuing for the tenth consecutive year, declined overall for a second consecutive year. Discoloration and premature defoliation caused by the **oak leaf phylloxeran** was again common in the Greater Victoria area, with some branch and very occasional tree mortality, of some chronically infested trees. Light defoliation caused by the **dogwood leaf blight** fungus, continued throughout the host range. The incidence and intensity of **bigleaf maple scorch** remained low in mainland and south-eastern Vancouver Island areas for the third consecutive year. **Birch leafminers** lightly infested birch, for the third consecutive year, in the lower Fraser Canyon and upper Fraser Valley. **Fall webworm** populations were again common in lower mainland areas, but continued to decline on Vancouver Island.

A summary of **new host and distribution records** in the region as well as a table summarizing **other endemic, noteworthy and minor pests** is included in this report.

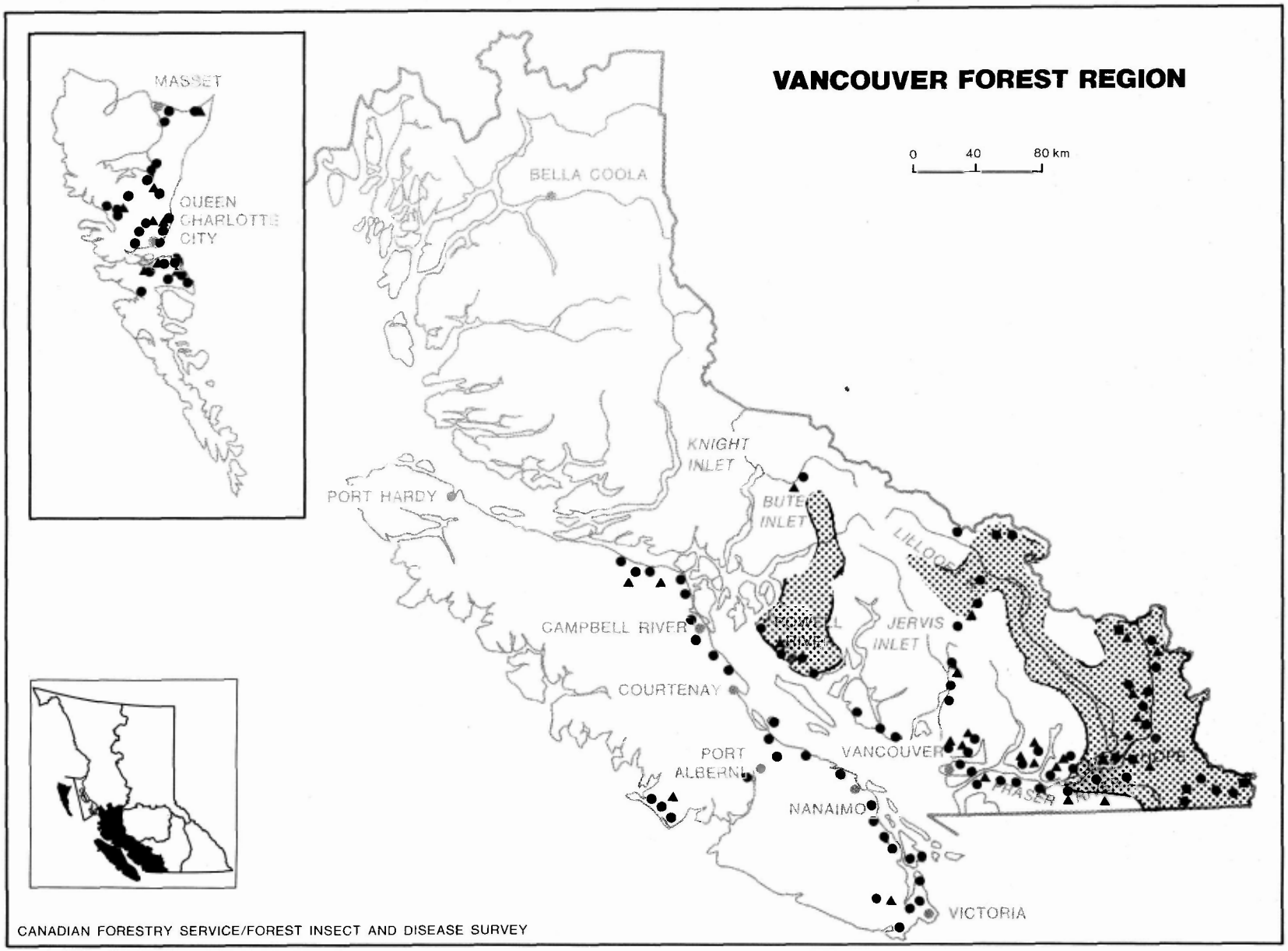

Figure 1. Locations where one or more forest insect and disease samples were collected and areas covered by aerial surveys to map bark beetle and defoliator infestations in 1995.

Douglas-fir Pests

Western spruce budworm
Choristoneura occidentalis

Western spruce budworm populations in the Vancouver Forest Region collapsed in 1995. No defoliation was recorded or observed during aerial surveys in July. Some trace to very light feeding was observed during ground surveys in the Nahatlatch River area and associated drainages. The collapse follows a decline in 1994 when 1910 ha were defoliated in 46 infestations, all in the Fraser TSA near Boston Bar. During this most recent outbreak, there was a total of nine consecutive years of defoliation recorded in two TSA's. Defoliation in the Soo TSA was recorded for eight consecutive years, (1986-1993) while defoliation in the Fraser TSA was recorded for six consecutive years (1989-1994).

Damage

No tree mortality has been recorded during this infestation. Some understory trees in areas with high budworm populations have been moderately to severely defoliated, and may die. Top-kill of up to 1+ metre occurred on semi-mature trees in areas where moderate defoliation has been recorded. These include the North, Blackwater, Salal and Fowl creek areas in the Soo TSA. Top-stripping of up to 1 metre was noted in the 4-barrel main area, above the Nahatlatch River, in the Fraser TSA. Growth reduction averaging 12% was recorded in trees moderately defoliated in 1989 (FIDS file report, 90-6, 1989).

Forecast

No egg mass surveys were conducted in the Vancouver Region in 1995. In 1994, a 40% decrease in the number of egg masses was recorded in the oldest part of the Fraser TSA infestation. This appears to have been the first indication of a declining population. The collapse may, in part, have been caused by a fungus, *Entomophthora* sp., found in mass larval collection from this area in 1994.

A pheromone trapping project started in 1987 to detect population fluctuations, was reduced in 1995. Pheromone-baited dry "Multipher" traps to attract adult males (Table 1) were placed (5/site) in each of three areas of previous budworm activity: Skagit Valley, Anderson River, and Devine. The average number of moths per trap decreased by an average of 70% (range 65-75) at two of three sites trapped previously, while numbers remained very low at the third site. No defoliation was recorded at any of the sites.

Some relationships develop when analyzing number of moths and total annual area defoliated. The regional area of budworm defoliation from 1991 to 1992 almost quadrupled and is reflected in the numbers of moths trapped. In 1993 the area defoliated was almost 5 times less than 1992, with a corresponding decrease in the number of adults trapped. In 1994, the area defoliated was almost half that of 1993, and was reflected in reduced moth catches. In 1995, populations collapsed and moth catches were the lowest recorded at two of the three sites.

Evaluation of trapping data from 11 sites province-wide over 8 years, using the same pheromone lure and dry traps suggests that, depending on how defoliation is classified, a range of 275-450+ moths/trap indicates a 70-90% chance of light to severe defoliation.

Table 1. Comparison of 1991-1995 pheromone sampling results at spruce budworm calibration plots in the Vancouver Forest Region, 1995.

Location	Avg. no. moths/trap				
	1995	1994	1993	1992	1991
Fraser TSA					
Anderson R.	**6**	17	68	257	49
Skagit Valley	***<1**	<1	<1	**16	4
Soo TSA					
Devine[1]	**7**	**29	-	306	150

* Average of 3 traps, 2 destroyed
** Average of 4 traps, 1 destroyed
1 Dropped in 1993, re-instated 1994

Work is continuing at determining threshold levels, based on results from traps at these and other sites province-wide.

Douglas-fir beetle
Dendroctonus pseudotsugae

The area containing recent beetle-caused Douglas-fir mortality almost tripled to about 750 ha in 540 infestations, up from 280 ha in 243 infestations in 1994 (Table 2). Most of this increase, 370 ha, occurred in the Sunshine Coast TSA, near Powell River. This is the first time Douglas-fir beetle-caused mortality has been recorded at these levels in this area; previously, a few trees were recorded as attacked near Lund in 1950, and in 1960, two small infestations were recorded on the Sechelt Peninsula. The area of recent mortality also increased in the Fraser and Soo TSA's, while declining in the Mid-coast TSA.

Table 2. Area of Douglas-fir beetle caused mortality, Vancouver Region, 1995.

TSA	Area (ha)		No. of Infestations	
	1995	1994	**1995**	1994
Sunshine-Coast	**370**	-	**201**	-
Fraser	**215**	100	**205**	70
Soo	**140**	40	**89**	48
Mid-Coast	**25**	140	**47**	125
Totals	**750**	280	**542**	243

Sunshine-Coast TSA

Aerial surveys in July of this year mapped about 370 ha of mortality in 201 infestations. The pockets of mortality ranged in size from small, 2-5 tree, spots, up to 5+ ha infestations. Mortality occurs throughout the Powell Lake area from Cranberry Lake, to the head of Powell Lake in the Powell-Daniels River area. Goat Island, in Powell Lake, has several large infestations and is the area where mortality was first noticed. Mortality was also recorded in the Goat, Windsor, Dodd, Horseshoe, and Lois lakes areas. Most of this mortality is within TFL #39, and many of the larger and more severe infestations are only accessible by boat or helicopter. The BCFS and Industry are cooperating in adjusting cutting permits in order to facilitate salvage logging in the worst of the infested areas. Trap tree programs are also being considered in some areas.

This mortality, previously thought to be caused by root rot, was first looked at in July of 1994. No evidence of Douglas-fir beetle attack was found or observed in the lower boles of the trees. Identification of the causal agent was made in the late spring when the BCFS brought in a faller by helicopter in order to obtain samples from the upper crowns of large, mature trees that had recently been killed. Apparently the beetle initially attacked the upper bole and crown of the trees. Many trees were strip attacked, and did not die the first year of attack. Many of these trees, weakened by the first attack were then re-attacked, and subsequently died. Additionally, a species of *Pseudohylesinus* has been reported found in trees, as well as Douglas-fir beetle. The infestation, mapped during a special helicopter aerial survey, appears to have been ongoing for about +/- 3 years.

Douglas-fir beetle has never been a major pest in this area, and during early attempts to find a cause of tree mortality, was not considered a likely suspect. The past several years of warmer temperatures and lower precipitation may have predisposed the semi-mature trees throughout this area. Several hectares of both recent and older Douglas-fir blowdown, particularly in the narrows between Dodd and Windsor Lakes, were mapped during aerial surveys. Both the BCFS and local forest industry staff also reported incidences of blowdown, in the same general area where mortality was mapped, over the past several years. Beetle populations likely built up in this blowdown, as well as in high stumps and trees felled for road building, prior to attacking surrounding trees.

Fraser TSA

The area of beetle-attacked Douglas-fir increased to about 215 ha in some 205 infestations, up from about 100 ha in 70 infestations in 1994. Most of this increase occurred in the Coquihalla River/Highway area, the Skagit River Valley and the Nahatlatch River area. Several new infestations were mapped in these areas and infestations that were mapped in these areas in previous years expanded. Groups of red trees ranged in size from 2-5 trees to several ha patches, particularly along the Coquihalla highway. Infestations in the Fraser Canyon, between Boston Bar and Yale, and infestations in the Anderson River area, continued at levels similar to previous years.

Soo TSA

The area of recently killed Douglas-fir increased to about 140 ha in 89 infestations, up from 40 ha in 48 infestations in 1994. Most of the increased mortality was recorded near Glacier Lake, between Lillooet and Harrison lakes, particularly within Garibaldi Provincial Park. Increased mortality was also mapped along the Lillooet River near Glacier Lake. About five new infestations were also mapped on ridges above the Ryan River, near the confluence with the Lillooet River, north of Pemberton. Small spot infestations continue to be recorded

along Lillooet River and Lillooet Lake, from Rogers Creek to Joffre Creek. Small infestations were observed again in the Birkenhead River and Gates Lake areas.

Mid-Coast TSA

The area of recent mortality declined to about one-quarter that recorded last year. Only about 25 ha of recent mortality were recorded in 47 infestations, down from 140 ha in 125 infestations in 1994. Mortality decreased in all previously infested areas in the Dean, Talchako, and Atnarko river valleys near Bella Coola.

The beetle prefers material such as felled trees, slash (over 20 cm diameter), stumps, overmature trees, and trees damaged by drought, root rot, logging and road building.

Phantom hemlock looper
Nepytia phantasmaria

Moderate to severe defoliation of mainly semi-mature to mature trees occurred, for at least the third consecutive year, in a residential area in the municipality of Burnaby in Greater Vancouver. Although the FIDS group was first notified of the infestation by the British Columbia Forest Service Regional entomologist in 1994, reports from area residents indicate that some defoliation, numerous larvae, and a large moth flight apparently occurred in the summer of 1993. Some Burnaby residents also reported that there was a small local population in 1992.

Defoliation was recorded, mainly on Douglas-fir and some western hemlock, over about ten square blocks in southeastern Burnaby. The defoliation was centered between Southeast Marine Drive and Rumble Street, and between Gilley and Macpherson Avenues. Most trees were moderately to severely defoliated, with a few trees completely stripped. Some mortality is expected to occurred, particularly on western hemlock that has been completely defoliated. Large accumulations of frass were evident on municipal streets, sidewalks alleys and gutters throughout the area. Although Douglas-fir recovers well, repeated defoliation could cause top-kill or even tree mortality.

Previous outbreaks of this pest occurred in 1956-57 in urban areas of Greater Vancouver and Hope, including: Central Park in Burnaby, Queen's Park in New Westminster and Hope Municipal Park. Defoliation was also recorded at Coquitlam lake in 1982. Douglas-fir and western hemlock were reported killed at Queen's Park, but not at Hope, Central Park or Coquitlam Lake.

Past outbreaks by this looper have collapsed following one to two years of defoliation. The Queens, Central and Hope parks infestations were sprayed with D.D.T. The Coquitlam Lake outbreak collapsed due to high levels of disease. Initial data from two mass collections this year indicates continued low levels of parasitism. Some disease is present this year, and may affect populations in 1996. Unless egg parasitism or disease levels are high, the outbreak may continue into next year. Reports from Vancouver Parks and Recreation staff that a large moth flight occurred in August of this year, is an indication that high populations may be expected next year.

Armillaria root disease
Armillaria ostoyae
Laminated root rot
Phellinus weirii

These two root diseases are chronic problems and are commonly found in all age classes of Douglas-fir stands throughout the Vancouver Forest Region. No specific surveys for root diseases were conducted this year, although some root disease was picked up through young (<25-year-old) stand surveys (see Pests of Young Stands section) and ARNEWS plot surveys, conducted annually in the region.

Mortality from these Armillaria and Phellinus occurs annually, and will continue to occur throughout the range of Douglas-fir. Douglas-fir beetle often attacks root diseased trees, particularly in the Fraser Canyon area. Planting resistant tree species, including some hardwoods, and push-over logging in some sites, are some of the management tools used in areas where severe root disease problems occur.

Pine pests

Mountain pine beetle
Dendroctonus ponderosae

The area of lodgepole pine killed by mountain pine beetle increased, for the first year since 1992 (Figure 2). Current mortality was recorded over some 640 ha in 143 infestations, up from 465 ha in 156 infestations in 1994 (Table 3). Volume loss increased to approximately 28 240 m^3 from 17 160 m^3 last year. The estimated number of trees killed also increased, to 38 550 from 23 400 last year. Mountain pine beetle attacks were recorded in the Soo, Fraser and mid-coast TSA's (Figure 3). The area of attack increased in the Soo TSA, while remaining static in the Fraser and the Mid-Coast TSA's.

Table 3. Recent mountain pine beetle-caused mortality in lodgepole pine as determined from aerial surveys, Vancouver Forest Region, 1995.

	Area (ha)		No. of trees killed		Vol. killed (m^3)		No. of infestations	
TSA	**1995**	1994	**1995**	1994	**1995**	1994	**1995**	1994
Soo	**550**	330	**30 450**	15 300	**22 300**	11 200	**105**	123
Fraser	**50**	90	**4 500**	4 500	**3 300**	3 300	**28**	27
Mid-coast	**40**	40	**3 600**	3 600	**2 640**	2 640	**21**	6
Sunshine coast	**-**	-	**-**	-	**-**	-	**-**	-
TOTAL	**640**	460	**38 550**	23 400	**28 240**	17 140	**154**	156

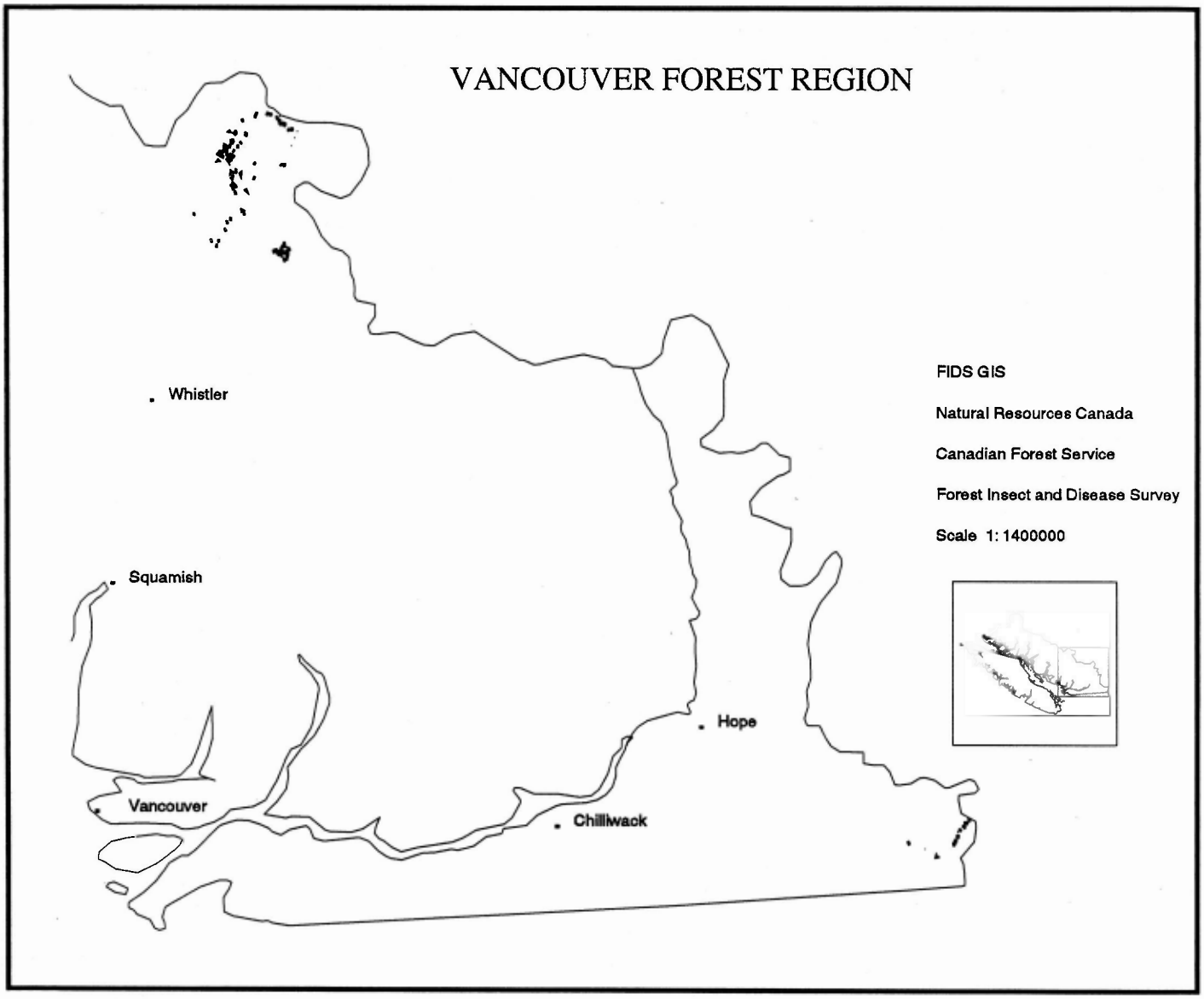

Figure 2. Areas where lodgepole pine recently killed by mountain pine beetle were detected during ground and aerial surveys in 1995.

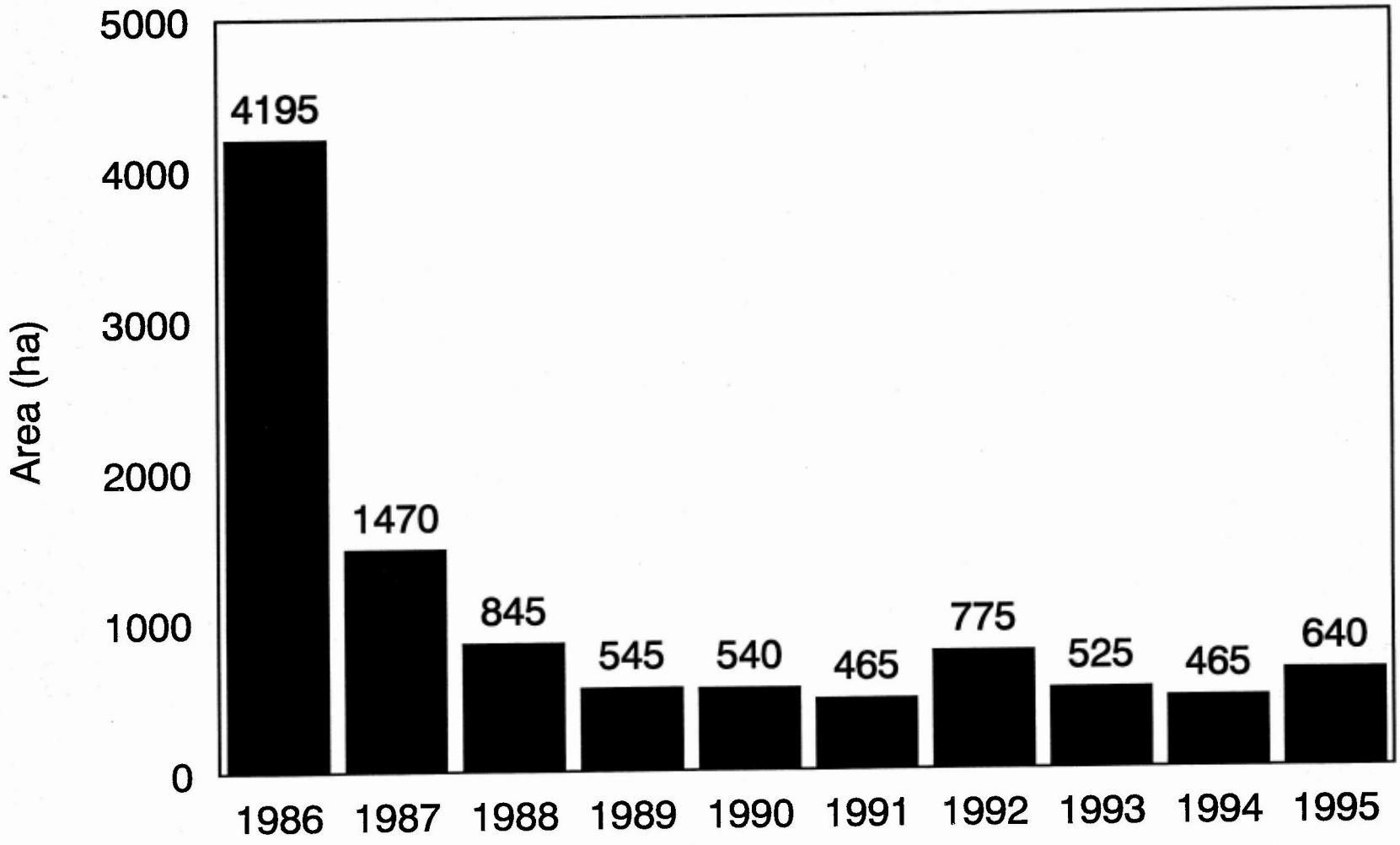

Figure 3. Mountain pine beetle, a ten year history by area, 1986-1995, Vancouver Forest Region.

Soo TSA

In the Soo TSA the area of attack increased to 550 ha from 330 ha. The largest and most intense infestations continued to occur in the Birkenhead Lake and River areas. Infestations in this area, both within and outside Birkenhead Lake Provincial Park, increased and expanded. Infestations in the Birkenhead River Valley from south of Gates Lake to the Mt. Currie area increased. Smaller spot infestations continued in the Blackwater Creek and Gates River areas. Infestations near the mouth of Joffre Creek along Lillooet Lake, as well as an infestation on a ridge just south of the mouth of Lizzie Creek, also increased. Pheromone trapping to contain infestations, as well as salvage logging, mainly in the Birkenhead area, is continuing.

Fraser TSA

All mountain pine beetle mortality continues to occur in Manning Park. The 50 ha recorded this year, mainly in the eastern portions of the park, is down from the 90 ha recorded in 1994, but similar to that recorded in 1993. Fifty ha of recent attack was recorded despite the fact that over 2000 red trees were extracted from the park by helicopter logging. This logging was allowed in small, <1 ha patches, in an attempt to reduce mountain pine beetle broods by removing infested trees. A cut and burn program, which has been ongoing for several years, continued as well.

Parks agreed to limited tree extraction due to requests from the BCFS in the adjacent Merritt Forest District in the Kamloops Forest Region. Mountain pine beetle populations in the Merritt District have greatly increased, and it was hoped that logging in the park might reduce the amount of brood available for the 1996 flight. Despite the logging and cut and burn program, red-topped lodgepole pine continue to show up, particularly in the eastern portions of the park. Provincial parks staff will evaluate the effectiveness of the control program before proceeding with a similar action in 1996.

The continuing lack of beetle activity in the rest of the TSA is largely a result of host depletion and harvesting of previously infested stands.

Mid-coast TSA

Mortality continued in the Dean River area, northwest of Bella Coola, at the same levels recorded in 1994. Although the area of mortality was the same as 1994, the number of infestations increased to 21 from 6. This is the third consecutive year of mountain pine beetle-caused mortality in this TSA. Prior to 1993, 5 ha of recent mortality were recorded in 13 infestations in the same general area in 1990.

Sunshine Coast TSA

For the seventh consecutive year, no significant beetle attacks were mapped in this area. Only occasional scattered single tree attacks were reported, mainly in the Homathko River valley. As recently as 1986, an estimated 2770 ha of infested lodgepole pine were mapped along the Homathko River.

Pine shoot beetle
Tomicus piniperda

No pine shoot beetles were found during surveys to detect the presence of this introduced pest. Over 1800 Scots pine Christmas trees, as well as cut and damaged Scots pine stems and branches, were surveyed at five sites in the lower mainland. Between 200 and 500

trees were examined at each location for any evidence of insect activity. The lower mainland sites examined ranged from Langley, near Vancouver, to east of Chilliwack. Although no *T. piniperda* was found, a native scolytid, *Orthotomicus caelatus*, was collected from cut stumps and recently cut stems at three locations in the Fraser Valley.

The pine shoot beetle is considered a serious pest in Europe and Asia. Adults feed on shoots causing branch mortality, and in heavy infestations they cause serious growth reduction. Attacked trees stressed by environmental factors, (drought, etc.) have died. The beetle was first detected on Christmas tree stock in Ohio in 1992. It has since been found in six states and, in 1993, was found in southern Ontario.

European pine shoot moth
Rhyacionia buoliana

There was no reported or observed activity of this pest in native trees in 1995. Infested Douglas-fir and adjacent Scots pine found in Richmond in 1989-90, were destroyed following confirmation of the shoot moth in native Douglas-fir.

The shoot moth is an established pest in ornamental pines on Vancouver Island from Victoria to Courtenay, in the Fraser Valley from Vancouver to Chilliwack, and in the Okanagan Valley. Up to 50% or more of new tips of Scots pine Christmas trees were infested at one location near Chilliwack, as well as in ornamental Scots pine at some greater Victoria sites. A major concern is the possible spread of this pest to native trees.

Pine needle cast
Lophodermella concolor

The incidence of pine needle cast decreased throughout the host range in the Vancouver region in 1995. No discoloration was mapped during aerial surveys, down from the 200 hectares recorded in 1994. Discoloration of year-old foliage continued to be common, but at lesser levels than 1994, in the eastern half of Manning Provincial Park. Lodgepole pine needle cast in Manning Park is almost endemic, but has been particularly severe the last few years. Many trees have only the current year's foliage left after repeated severe infections.

Spruce Pests

Spruce beetle
Dendroctonus rufipennis

Spruce beetle populations increased slightly, for the second consecutive year, after remaining at low levels for seven straight years. Approximately 80 ha of recent mortality was recorded, up from 50 ha in 1994, the first year any appreciable mortality was recorded since 1986. Mortality was recorded in the Fraser, Sunshine and Soo TSA's. These infestations are not expected to cause extensive mortality. The mature spruce component through most of the southern portion of the region is minimal, and beetle populations should not pose a serious threat.

Fraser TSA

About 25 ha of recent mortality was mapped, for the second consecutive year, near the Coquihalla highway summit. Additionally, about 20 ha of mortality was recorded, in small groups of recently killed trees, in Log Creek, and the back end of the north and south fork of Ainslie Creek. Some mortality was also reported in the north fork of Scuzzy Creek. A few recently dead spruce were also recorded in Manning Park, on islands in the Similkameen River, just east of Manning Park lodge. The mortality in the Coquihalla area is a result of increasing attacks in the Merritt Forest District spilling over into the extreme eastern portions of the Chilliwack Forest District.

Sunshine TSA

Aerial surveys recorded about 30 ha of spruce mortality, all in valley bottom spruce, near the headwaters of Powell River, and in Filer Creek. This is the first time in several years that this area has been surveyed, some of this mortality may have occured previously. Spruce in these narrow valley bottoms are often predisposed to bark beetle attack by flooding.

Soo Tsa

A small group of about 5 ha of mortality was recorded in the upper Birkenhead River, above Tenquille Creek. This area is also subject to periodical flooding.

Spruce weevil
Pissodes strobi

The spruce weevil continues to be a significant pest of leaders on immature Sitka spruce throughout the host range in the region. No specific surveys for this pest were carried out this year; however, reports from the BCFS and industry indicate that the weevil continues to be a serious problem in young spruce stands.

Weevil attack has been a chronic problem in the Vancouver Region for several decades. Mild winters and warm summers, along with the establishment, through reforestation, of abundant preferred host material, have resulted in continued weevil attacks. Repeated attacks by the weevil can lead to a reduction of merchantable volume at rotation age due to crook, stem decay, and other deformities. Current research efforts at the Pacific Forestry Centre, in conjunction with the B.C.F.S., are focusing on resistant trees, biological control, stand density and species mix, tree resistance, and deciduous overstory/overtopping effect.

Sitka spruce defoliators
Zeiraphera vancouverana
Egira simplex
Elatobium abietinum

These defoliators infested Sitka spruce in Pacific Rim National Park on Vancouver Island. The three defoliators (a budmoth, *Z. vancouverana*; a conifer cutworm, *Egira simplex*; and the green spruce aphid, *E. abietinum*) combined to moderately defoliate Sitka spruce along a 2-3 km stretch adjacent to Long Beach.

Most of the damage appeared to have been caused by the conifer cutworm, which was still feeding on the current foliage during the first week of July. Less severe older feeding damage was also noted on current foliage in the same trees and was attributed to the spruce budmoth. Large budmoth flights were observed at the time of the cutworm collections. Up to 100% of the current foliage was eaten in scattered patches along the Long Beach highway.

Defoliation of older foliage by the green spruce aphid was reported from this area earlier this spring.

This is the first time the conifer cutworm, *E. simplex*, has caused noticeable defoliation on Sitka spruce in coastal British Columbia. However, in the 1960's, 4000 ha of coniferous forest was defoliated in Oregon.

True Fir Pests

Western balsam bark beetle-fungus complex
Dryocoetes confusus, Ceratocystis dryocoetidis

The area of alpine fir killed by balsam bark beetle increased to 1710 ha from 1320 in 1994. Although the area increased, the total volume and number of trees killed declined slightly. An estimated 69 020 alpine fir were killed in 1995, compared to 71 660 trees in 1994. The volume of timber killed also decreased slightly, to 75 150 m^3 from 78 035 m^3 in 1994 (Table 4). This reduction in volume and number of trees killed is a result of most infestations being recorded at a low intensity, especially in the Mid-coast TSA where most mortality occurred. Elsewhere, in both the Soo and Fraser TSA's, the area, volume and number of trees killed increased.

Table 4. Estimated true fir mortality by western balsam bark beetle-fungus complex, by TSA, as determined from aerial surveys, Vancouver Forest Region, 1995

	Area (ha)		Number of trees killed		Volume killed (m^3)	
TSA	**1995**	1994	**1995**	1994	**1995**	1994
Mid-Coast	**1080**	1010	**61 935**	68 175	**67 435**	74 235
Fraser	**460**	260	**5 175**	2 925	**5 635**	3 185
Soo	**170**	50	**1 910**	560	**2 080**	615
Total	**1710**	1320	**69 020**	71 660	**75 150**	78 035

This is the third year of increased mortality due to balsam bark beetle attacks in the Mid-Coast TSA. Infestations expanded, although they declined in intensity, in Crag Creek, a tributary of the Dean River north of Bella Coola. The increases in the Fraser and Soo TSA's are the first since 1990.

This beetle is a chronic pest in many subalpine fir stands in the Region. The sporadic and frequently remote occurrence and the retention of red foliage for several seasons makes a consistent and accurate annual assessment of damage caused by this pest difficult.

Balsam woolly adelgid
Adelges piceae

A cooperative survey to update the known distribution of balsam woolly adelgid (BWA) continued in 1995. The CFS/FIDS in cooperation with the BCFS and industry sampled both mature and immature stands adjacent to selected portions of the 1992 Quarantine Zone boundary. As well as confirming the presence of the adelgid at locations within the current quarantine zone, the adelgid was found at several locations beyond the known distribution and outside the (1992) Quarantine Zone.

The adelgid was found on true fir at seven locations outside the 1992 Quarantine Zone on central Vancouver Island. Five of these findings were on mature amabilis fir at Wowo Lake (gouting visible on sampled trees), Browns River, Pearl Lake, Tsable River and Poum Lake. The adelgid was also found on mature grand fir at Menzies Bay and on immature grand fir at Nile Creek. The discovery of infested grand fir at Menzies Bay, north of Campbell River, confirms the presence of the adelgid near all locations on Vancouver Island where *Abies* seedlings are grown for reforestation.

On the mainland, besides confirming the presence of the adelgid on symptomatic true fir at locations within the quarantine zone, there were five locations outside the zone where BWA was confirmed on immature trees. The most significant of these sites was the Anderson River where, for the first time, BWA has been found east of the Fraser River.

Hemlock Pest

Western hemlock looper
Lambdina fiscellaria lugubrosa

Western hemlock looper populations remain at endemic levels in southwestern B.C. Pheromone traps placed at two locations on the lower mainland were part of a continuing province-wide effort to calibrate a pheromone trapping system for the early detection of looper outbreaks. The program, which started in 1992 (Table 5), in cooperation with graduate students from Simon Fraser University, has been testing lure strength and trap types to determine the most effective combination. FIDS took over the program in 1994, and in 1995, a decision was made to use a single trap type, Universal, and a single lure strength, 10 micrograms.

Pheromone traps were placed on the mainland, for the fourth consecutive year, at Rolley Lake Provincial Park, near Mission, and at the University of British Columbia (U.B.C.) Research Forest near Maple Ridge. These sites have a previous history of high looper populations, but no defoliation. Low numbers of larvae were detected through standard FIDS beating samples at both of the lower mainland sites. No current defoliation was detected at any of these sites, and low number of adults were caught in the traps. A few larvae were also collected in FIDS standard beating samples at another location in the UBC Research Forest, and at two locations near Coquitlam lake.

Table 5. Location and number of adults caught in a dry, universal trap baited with 10 microgram western hemlock looper lure, 1992-1995, Vancouver Forest Region.

Location	**1995**	1994	1993	1992
Rolley Lake Provincial Park	**205**	307	367	55
U.B.C. Research Forest	**156**	120	49	39

Based on trap results to 1993, tentative thresholds for predicting outbreaks were set. For universal traps baited with a 10 microgram lure > 5000 adults indicates potential for severe defoliation, > 2500 - 5000 adults indicates potential for moderate defoliation, 400 - 2500 adults indicates potential for light defoliation, and < 400 adults indicates nil defoliation. All of the Vancouver Region sites fall into this last category.

Multiple Host Pest

A conifer sawfly
Neodiprion abietis complex

Reports of conifer defoliation in the east fork of the upper Phillips River, west of Bute Inlet, were investigated by the BCFS this summer. An aerial survey recorded about 200 ha of light to moderate defoliation. Both amabilis fir and western hemlock were defoliated, with the amabilis fir moderately, and the hemlock lightly, defoliated. Samples obtained at the site were identified at the PFC insectary as a conifer sawfly complex.

Historically, aside from the Queen Charlotte Islands, and one outbreak from 1978-1981 on northern Vancouver Island, conifer sawflies have not caused significant defoliation in coastal areas. In 1950, high populations, but no defoliation, was recorded from Drury inlet (North of Kingcome Inlet) to Redonda Island. In 1960 high populations, but no defoliation, were recorded on the Sechelt Peninsula. These were the only reported high populations on mainland coastal areas.

Special Surveys

Acid Rain National Early Warning System (ARNEWS)/Biomonitoring plots

Annual assessments of tree condition, mortality, acid rain symptoms, and insect and disease conditions were made at the 11 existing and one new ARNEWS/Biomonitoring plots in the Vancouver Region. The new plot was established this year in the Long Beach Model Forest near Ucluelet. These plots were established to detect early signs of damage to Canadian forests due to aerial pollutants, and to monitor changes in forest vegetation and soils. No acid

rain symptoms were recorded on any vegetation at any of the sites. In addition to the annual survey, 5-year assessments and measurements were made, including tree mensuration data, shoot length and foliar retention, soil collections, and foliar collections for chemical analysis. Data from this third 5-year assessment will be compared to the previous data and examined for any indications of changes, especially in soil and foliar chemistry results.

Although chlorotic foliage was again common on amabilis fir, the incidence continued to decline. Foliar discoloration was present in plots 910, 912, 913, and 914, all located in the north shore watersheds of Greater Vancouver. On average, about 10% of the mainly older foliage in the lower to mid crown, was discolored on an average of 30% (range 20-60%) of the trees in these plots, compared to about half (56%) of the trees in 1994, and almost all trees (98%) in 1993. Samples taken this year in the Coquitlam watershed, at plot 914, and the Capilano watershed, plot 910, found a variety of causal agents. Two needle blights, *Phaeocryptopus nudus*, and *Lirula* sp., along with a secondary fungus, *Stegopezizella balsameae* (following *Lirula* sp.) were present at plot 914, while Fir-lady-fern rust, *Uredinopsis longimucronata,* was found at plot 910. Although these various foliar diseases were common, natural foliar die-back in dense, closed canopy stands also contributed to this discoloration.

About 10% of the western hemlock in half the mainland plots had less than 5% foliar discoloration, mainly chlorotic older foliage in the lower crowns. This is similar to last year, and was attributed to natural shading and competition in closed canopy coastal stands. Additionally, samples taken for foliar analysis found scarred lesions on the underside of otherwise healthy new and one-year old shoots near plot 910, Capilano River. To date, no cause or damaging agent has been determined, although animal feeding damage is suspected.

Although there was no foliar discoloration reported or observed on Douglas-fir in plots on Vancouver Island, light discoloration was common at plot 912, upper Seymour River. About 20% of the foliage on half the trees were lightly discolored. Both Swiss needle cast, *Phaeocryptopus gaeumannii*, and a needle cast, *Rhabdocline* sp., were collected at this plot. At plot 903, Saltspring Island, trees in and outside the plot have been blown down due to the presence of laminated root rot, *Phellinus weirii.* Some of these trees have been attacked by Douglas-fir beetle, *Dendroctonus pseudotsugae*. Additionally, a single tree in plot 911, lower Seymour River, is dying and has recently been attacked by bark beetles. This tree is adjacent to several other trees that were killed by armillaria root disease, *Armillaria ostoyae*.

Tree mortality was recorded in seven plots where a total of 14 trees died (Table 6). The largest single cause of mortality was shading and suppression which killed 10 trees. Two of these ten trees were also attacked by the Pacific silver fir beetle, *Pseudohylesinus sericeus*. This bark beetle is often associated with stressed, dying trees. Additionally, two trees died as a result of storm damage. These two trees, which had most of the live crown broken off in previous years, finally died this year. The Pacific silver fir beetle was also found in one of these trees. One tree was killed by Armillaria root disease, *A. ostoyae*, and one tree, a red alder, in plot 928 was dead at plot establishment. The 1995 mortality represents <2% of the total number of trees in all the ARNEWS/Biomonitoring plots in the Vancouver Region. To date 137 trees, or 17% of the total, have died, all from natural causes.

Table 6. Current and cumulative tree mortality in ARNEWS/Biomonitoring plots, Vancouver Region, 1995.

Plot number and location	Tree sps[1]	Total trees at plot est.	Mortality			
			1995	1984-1994	Total	**Cause in 1995**
901-Shawnigan Lk.	dF	120	**5**	25	30	**Shaded/suppressed**
	W	8	-	4	4	- -
	wwP	2	-	-	-	- -
902-UBC forest	wH	32	-	14	14	- -
	wrC	15	-	6	6	- -
	B	3	-	1	1	- -
903-Saltspring	dF	100	-	27	27	- -
	wrC	2	-	-	-	- -
904-John Hart Lk.	dF	30	-	1	1	- -
	lP	1	-	-	-	- -
909-Jones Lake	wH	57	**2**	9	11	**Shaded/suppressed**
	dF	2	-	-	-	- -
	wrC	1	-	-	-	- -
910-Capilano R.	aF	57	**2**	13	15	**One tree shaded, suppressed with *Pseudohylesinus sericeus*. One tree with root rot, *Armillaria ostoyae* and *P. sericeus***
	wH	17	-	-	-	- -
	wrC	1	-	-	-	- -
911-Seymour R.	dF	36	**1**	7	8	**Storm damaged, top broken off in 1993**
	wH	2	-	-	-	- -
912-Seymour R.	dF	24	-	4	4	- -
	wH	23	-	4	4	- -
	aF	5	-	-	-	- -
913-Or Creek	wH	46	**1**	1	2	**Shaded/suppressed**
	wrC	20	-	2	2	- -
	aF	3	-	1	1	- -
	dF	2	-	-	-	- -
914-Coquitlam Lk.	aF	36	**2**	-	2	**One tree shaded, suppressed and *Pseudohylesinus* sp. One tree storm damaged, top broken in '94, also with *Pseudohylesinus* sp.**
	wH	29	-	-	-	- -
916-Saturna	dF	56	-	3	3	- -
	lP	1	-	-	-	- -
	wrC	1	-	1	1	- -
928-Long Beach	aL	51	**1**	-	1	**New plot 1995, one tree dead, at establishment**
Total		783	**14**	123	137	
Percent mortality			**<2**	16	17	

[1] dF-Douglas-fir; W-willow; wwP-western white pine; wH-western hemlock; wrC-western red cedar; B-birch; lP-lodgepole pine; aF-amabilis fir; aL-red alder

The total number of trees at the time of plot establishment of plots 901-903 included trees less than 10 cm dbh. These tree were included before guidelines for minimum tree diameter were introduced. Most of the accumulated mortality in these plots has been a result of small-diameter trees dying due to shading, suppression and competition in dense, closed canopy stands. All but one of the dead trees in plot 916 were standing dead at the time of plot establishment.

These plots will continue to be monitored in 1996.

Pests of young stands

A total of 20 young stands were surveyed for pest incidence and intensity in the Vancouver Forest Region, including the Queen Charlotte Islands (QCI) in 1995. Detailed information on the QCI young stand surveys are contained in that section of this report. The stands surveyed ranged in age from 5-25 years old, and were located in two Biogeoclimatic zones: Coastal Western Hemlock and Interior Douglas-Fir. A total of 2210 trees representing 10 species were examined, of which 1732 (78%) were pest-free.

This is the sixth year of the current young stand survey format, and the level of pest free trees after 6 years of surveys averages 70% (range 54-86) in this region. Root diseases, while causing the most damage, continue to occur at low levels in stands surveyed. Needle diseases and gall adelgids continue to be very common, but because they have been recorded at generally low levels, have caused little long term damage.

Most of the surveys (80%) were in stands that had some silvicultural treatment, many under the Forest Resources Development Agreement (FRDA). The different silvicultural treatments examined were: spacing, planting, chemical brushing and weeding, and fertilizing. Fifty percent of the treated stands examined were spaced, while the other three treatments represented 10% of stands examined, each. The results of the survey are summarized in Table 7. Minor pests, or pests that affected only a few trees, are not included in the table.

Four of the 20 young stands surveyed were classified as impact category 4 (see Appendix 1). This shows a level or type of pest damage that indicates a resurvey (within 2-5 years) of the stand might be necessary to assess stocking levels and acceptability of stem form. Root diseases and top deformities were the main reason for this recommendation.

The Cooley spruce-gall adelgid was the most common pest encountered, affecting 139 trees overall, or 6% of all trees surveyed. Needle diseases and poor form, (including crook, sweep, fork, multiple tops and dead tops), were the next most common pests, affecting 114 and 75 trees each (5% and 3% each, respectively). The most damaging pests (causing mortality) were abiotic damage and Armillaria root disease which affected six and three trees, respectively, or <0.5% of the total trees surveyed.

Although 10 tree species were recorded during the young stand survey, only six are included in the table. Amabilis and grand fir are listed together under the true fir heading; Sitka and Engelmann spruce are listed under the spruce heading; and lodgepole, western white and ponderosa pine are listed under the pine heading.

Table 7. Summary of pests of young stands surveys, by host and pest in descending order of importance, Vancouver Forest Region, 1995.

Host/pest	Severity index[1]	Affected no. of trees	Affected no. of stands	% of trees affected[2] average	% of trees affected[2] range
Douglas-fir - 887 trees in 14 stands, 620 trees (70%) pest free					
Armillaria root disease	6	3	2	1	1-2
Sunscald	6	1	1	1	1
windthrown	5	1	1	1	1
Dead/broken top	3-4	12	6	3	2-5
Spruce budworm	2-4	91	1	98	98
Multiple tops	3	23	6	5	2-8
Browse	3	21	1	19	19
Atypical growth	3	4	2	3	2-4
Fork/crook	3	1	1	1	1
Cooley spruce-gall adelgid	2-3	136	3	82	64-100
Rhabdocline needle cast	2-3	36	3	21	12-31
Western hemlock - 760 trees in 18 stands, 725 trees (95%) pest free					
Drought	6	3	1	5	5
Dwarf mistletoe	5	1	1	1	1
Mechanical damage	2-5	7	3	2	1-3
Basal sweep	2-5	4	3	1	1-2
Competition	3-4	4	2	2	2-3
Lean	3	4	2	3	2-3
Fork/crook	3	2	1	3	3
Atypical growth	3	1	1	1	1
Sirococcus tip blight	2-3	8	2	4	3-6
Western red cedar - 193 trees in 16 stands, 165 trees (85%) pest free					
Browse	2-4	8	2	16	6-25
Atypical growth	3	6	3	13	8-23
Competition	3	1	1	1	1
Keithia leaf blight	2	11	5	38	11-100
Pine - 180 trees in 4 stands, 109 trees (61%) pest free					
White pine blister rust	5-6	6	2	2	1-5
Western gall rust	3-5	2	1	1	1
Multiple top	3	3	2	2	1-3
Lophodermium needle cast	2	62	1	78	78

(Cont'd)

Table 7. Cont'd)

Host/pest	Severity index[1]	Affected no. of trees	Affected no. of stands	% of trees affected[2] average	% of trees affected[2] range
Spruce - 109 trees in 4 stands, 44 tree (40%) pest free					
Competition	6	3	1	3	3
Dead/broken top	3-4	2	2	1	1-2
Multiple tops	2-4	5	2	3	2-4
Fork/crook	2-3	2	2	1	1-2
Spruce budmoth	2-3	45	3	10	2-14
Spruce aphid	2-3	15	2	4	3-6
Spruce needle blight	2-3	3	2	3	1-4
True firs - 81 trees in 7 stands, 69 trees (85%) pest free					
Drought	6	1	1	1	1
Blowdown	5	1	1	1	1
Lean	4	1	1	1	1
Dead/broken top	3-4	1	1	1	1
Multiple top	3	5	2	2	1-3
Sunscald	3	1	1	1	1
Needle rust	2	2	1	2	1-2

[1] Severity index:
1. pest-free
2. minor damage, minimal impact
3. significant loss of current growth potential
4. net volume loss or loss of significant long-term growth potential
5. life threatening or severely deforming
6. recently dead or dying

[2] Percent of trees affected includes all trees from stands in which the pest occurred.

Port area quarantine surveys

Special surveys were undertaken this year, in collaboration with Agriculture and Agri-Food Canada, to evaluate the potential for the introduction of exotic pests associated with dunnage in and around the port of Vancouver. The surveys were twofold, consisting of on-site examination and collection of infested material at ports and receiving sites of material shipped from overseas. In addition, pheromone trapping was carried out adjacent to ports, near landfill sites, and areas where exotic tree species have been planted.

Surveys at ports and receiving sites of material shipped from overseas found the following insects, or insect damaged material: Ambrosia beetle galleries in exotic hardwoods from Australia at docks in Squamish; large Cerambycid borings in crating from China from an import location in Burnaby; Scolytid galleries under bark in crating from Israel at Abbottsford; and adults of an Asian powder post beetle, *Sinoxylon anale*, active in crates from India at a

Burnaby import location. This powder post beetle was also found in pheromone traps placed in forested areas adjacent to this Burnaby location. This is the first flight record for this species from a forested area.

In subsequent trapping surveys with Lindgren funnel traps and three different lures, two Asian ambrosia beetles were found. One of these beetles, *Xylosandrus germanus* was found at 2 of 24 locations surveyed in Greater Vancouver, Richmond and Surrey. This is the first recovery of *X. germanus* in western North America. Additional surveys will be required to determine hosts in B.C. Another ambrosia beetle, *Xyleborus perforans*, was found on Reifel Island, near the mouth of the Fraser River. This is the first recovery of *X. perforans* in North America. These ambrosia beetles have a wide, host range, and attack primarily hardwoods. Additional surveys are needed to determine which hosts, if any, *X. perforans* is currently active in, or if it only represent a recovery of adults flying from infested dunnage on nearby vessels, or from discarded crating.

Deciduous Tree Pests

Gypsy moth
Lymantria dispar

There were no adult male gypsy moths caught in 62 pheromone-baited sticky traps at 48 sites throughout the Vancouver Region, including three traps in the Bella Coola Valley, in 1995. Most of the traps, placed and retrieved by CFS/FIDS were in Provincial Parks (50%) and private campgrounds (25%) and the remainder in national parks and rest areas.

In additional surveys, information available to date indicates that 39 adult males, 37 of the European strain, and two of the Asian biotype were trapped in the Vancouver Forest Region in traps placed mostly by Agriculture Canada. This is about the same as 1994. Thirty-three adults were trapped between Vancouver and Hope, while six were found on Vancouver Island.

Western oak looper
Lambdina fiscellaria somniaria

The western oak looper killed Garry Oak and Douglas-fir over an estimated 50 ha on the north side of Burgoyne Bay on Saltspring Island. The oak looper has been active at varying levels on the Saltspring Island for at least 15 years in Mount Maxwell Provincial Park, the adjoining Ecological Reserve and nearby private lands. Scattered Douglas-fir mortality has occurred over the past two-three years, and Garry Oak mortality only occurred this year.

Although populations subsided somewhat in 1995, mostly severe defoliation occurred on Garry Oak for at least the second consecutive year. Moderate to severe defoliation of the current growth of Douglas-fir also occurred for the second consecutive year. Although this insect is not usually associated with mortality, the length and recent severity of the infestation, combined with site factors, has resulted in mortality to both oaks and Douglas-fir.

Winter moth
Operophtera brumata

Defoliation of boulevard, ornamental, fruit and other deciduous trees by the winter moth continued at low levels in urban areas of Vancouver, and at a few locations in Victoria in 1995, similar to 1994.

Trace and light defoliation of deciduous hosts, mainly ornamental, boulevard, fruit and other deciduous trees, was reported in areas of the lower mainland, some for the seventh consecutive year. Very light defoliation of Garry oak continued in the Victoria area in 1995, mainly in the same areas as in previous years. Most trees were lightly defoliated, with occasional heavier defoliation in the lower crowns.

A cottonwood sawfly
Nematus currani

Populations of this native defoliator collapsed this year, following four consecutive years of high populations. No defoliation was observed or reported during aerial and ground surveys. In 1994 about 600 ha were lightly to severely defoliated, 730 ha in 1993, 680 ha in 1992, and about 50 ha in 1991.

The collapse is attributed, in part, to infection by entomopathogenic fungi, *Beauveria* spp. and *Entomophthora* spp., isolated from dead larvae collected in 1993. The infestation peaked in 1993, declined in 1994, (the year following the collections of entomopathogens), and collapsed this year.

Most of the defoliation occurred from the Herrling Island group, east of Agassiz, to Matsqui Island, near Mission, on islands within TFL 43, managed by Scott Paper. Native black cottonwood was the major host and suffered the most severe defoliation. However, some hybrid poplars in managed plantations at Harrison Mills and Carey Island, as well as one or two other small islands, had been lightly defoliated. The trees were defoliated early in the growing season, and had time to refoliate. Little growth loss occurred in native poplars, and the hybrids were not defoliated severely enough to affect tree growth. Growth loss usually occurs only after several years of severe defoliation.

This was the first recorded outbreak of this native sawfly in British Columbia. Previously, defoliation had been limited to single or small groups of trees at widely scattered locations.

A poplar rust
Melampsora medusae f. sp. *deltoidae*

The poplar rust *M. medusae f.* sp. *deltoidae*, which is pathogenic and very damaging to many hybrid poplar clones used in commercial plantations, has not yet been collected from native cottonwood, *Populus trichocarpa,* in British Columbia. It was found on hybrid poplars in the Fraser Valley and on Vancouver Island again this year, where it had first been found in British Columbia in 1993.

Damage in British Columbia plantations was much lighter on susceptible *P. trichocarpa* x *deltoides* clones this year. Commercial nurseries have been removing susceptible clones and replacing them with more resistant hybrids. Mortality of susceptible clones has not yet been reported in B.C., but has occurred in plantations in the United States, where the rust has been established since 1991.

The Eurasian poplar rust, *Melampsora larici-populina*, discovered in Oregon and California in 1991 and in Washington State in 1993, where damage to hybrid poplar plantations has been low, is still not known to occur in Canada.

Northern tent caterpillar
Malacosoma c. pluviale

The northern tent caterpillar was again common and widespread on Vancouver Island and some of the southern Gulf Islands, in some locations for the fourth consecutive year. Populations were also common in the Sunshine Coast area for the second consecutive year, and in some higher elevation Fraser River tributaries near Boston Bar. Isolated populations were also found at Railroad Pass near Pemberton.

Defoliation of deciduous trees and shrubs, particularly alder, was again severe and widespread in patches throughout the Greater Victoria area, on some Gulf Islands, and the east coast of the Vancouver Island as far north as the Comox area. In the Sunshine Coast area, mainly light to moderate defoliation occurred in widespread areas from Powell River to Lund. Populations were light south of Powell River, and none was observed in the Gibsons to Earl's Cove area. On Texada Island, patchy moderate to severe defoliation of alder was again common.

Populations are expected to persist in historically active areas next year. Infestations have historically persisted from 3 to 5 years.

Jumping gall wasp
Neuroterus saltatorius

Discoloration and premature defoliation on Garry oaks caused by the jumping gall wasp on southern Vancouver Island, declined overall in most areas for a third consecutive year. This followed annual increases in damage since 1986 when the gall wasp was first observed in the area. Severe leaf scorch, however, continued for the second consecutive year at Deep Cove, Duncan and Maple Bay.

The continued decline in gall wasp populations, particularly south of Brentwood Bay is due to increased parasitism, predation, and host resistance. Populations are expected to continue to decline in 1996, mostly in areas where high populations have persisted for up to nine years.

Trees infested by the gall wasp are readily identified by the small (1.0 to 1.5mm) round mustard seed galls attached to the underside of infested leaves.

An oak leaf phylloxeran
Phylloxera sp. near *glabra*

From 25-100% of the foliage on 10% of the Garry oaks throughout southern Vancouver Island was discolored and subsequently defoliated by the introduced phylloxeran (an aphid-like sucking insect). These levels were similar to previous years, and infestations occur on the same trees each year. This damage has progressively reduced tree vigor and has resulted in branch and occasional tree mortality.

Garry oaks have also been damaged by the phylloxeran on several of the Gulf Islands, on the east coast of Vancouver Island north to Nanoose Bay, and in an isolated Garry oak stand at Sumas Mountain near Chilliwack. Populations are expected to continue on chronically infested trees throughout much of the host range in 1996.

The phylloxeran is identified by examining the lower surface of affected foliage, which is covered with numerous minute orange insects resembling aphids.

Dogwood leaf blight
Discula destructiva

Discoloration and premature defoliation of new foliage on western flowering dogwood was again common throughout much of the host range. Infection by the fungus, chronic in the region for over a decade, has resulted in branch dieback and occasional mortality of heavily blighted understory trees.

Inoculum is retained on twigs, branches, and foliage. Infection occurs when rain splashing causes spores to disperse to adjacent new foliage in the spring. Protection of ornamental trees can be aided by removing and destroying infected foliage on the ground, and pruning dead branches before leaf flush in the spring.

Bigleaf maple scorch

Leaf scorch of bigleaf maple in the region declined for the third consecutive year, following widespread moderate to severe discoloration in 1992. Scorched foliage was evident, at lower intensities, in stands on the lower mainland near Yale in the Fraser Canyon, and on the Sunshine Coast. Trees on southern Vancouver Island and the Gulf Islands were also less noticeably affected except at chronically affected areas near Goldstream Provincial Park and the Malahat.

A bacterium, *X. fastidiosa*, was identified for the first time in 1992 in some, but not all, of the scorched maple leaves from Goldstream and Victoria on Vancouver Island, and from Stanley Park, Gates Lake, and Powell River on the mainland. This was determined by tests at the Pacific Forestry Centre in Victoria using an Enzyme-Linked Immunosorbent Assay (ELISA) kit.

Birch leafminers
Profenusa thompsoni
Fenusa pusilla

Birch trees throughout the mainland were lightly to moderately discolored by the birch leafminers, *F. pusilla* and *P. thomsoni*, for a third consecutive year. Discolored trees were common throughout the lower Fraser Canyon, and the upper Fraser Valley to near Yale, similar to last year.

Larvae mine the foliage resulting in wrinkled and blotched leaves, which prematurely turn brown and give the trees a scorched appearance. Repeated periods of severe defoliation, which in ornamental or shade trees may cause some die-back, can be controlled with proper use of an appropriately registered systemic insecticide. Damage in natural stands is mainly aesthetic and control is usually not warranted.

Fall Webworm
Hyphantria cunea

Defoliation of hardwood trees and shrubs was again common and widespread in the lower mainland and continued at low levels on the east coast of Vancouver Island, where defoliation had been severe between 1989 and 1992.

Numerous tents were again common on alder, birch, willow and various fruit, ornamental and shade trees, particularly in the upper Fraser Valley near Agassiz and Chilliwack, and in the Fraser Canyon from Hope to Yale. Lighter populations were seen between Yale and Spuzzum, Langley and the lower Fraser Valley, the Sunshine Coast and

Powell River, and at Squamish and Pemberton. Populations declined in east coastal areas of Vancouver Island for a third consecutive year to a few widely scattered tents and very light defoliation, mainly in areas where defoliation of branches and occasional small trees was common in 1992.

Defoliation is usually limited to individual branches; however, when epidemic levels occur, trees may be totally defoliated. Infested branches can be clipped and burned to protect fruit and shade trees. Pesticides registered for use against leaf-chewing insects can be applied when young caterpillars are spinning webs, usually in early summer.

New Records of Occurrence and Distribution

A total of seven fungus collections in the Vancouver Region were new records for British Columbia in 1994. Four were new provincial records, and three were new host records. These collections included needle and foliar blight fungi and rusts, mushrooms and saprophytes. Additionally, six insect collections region-wide were new records in British Columbia. Three were new provincial records and three were new host records. These included tortricid moths, leaf miners, engraver beetles and ambrosia beetles.

Other Endemic, Noteworthy and Minor Pests

Table 8. Other noteworthy and minor pests, Vancouver Forest Region, 1995.

Host and pest	Location	Remarks
CONIFERS		
Douglas-fir		
A needle disease, *Hormonema merioides*	Or Creek	On red needles in plantation.
Rhabdocline needle cast, *Rhabdocline pseudotsugae*	Ring Creek, Upper Seymour River	Common on young trees.
Swiss needle cast *Phaeocryptopus gaeumannii*	Upper Seymour River, Southgate River, Or Creek	Moderate discoloration common in young stands in these areas.
Pines		
An ambrosia beetle, *Xyloborinus saxeseni*	Matsqui	In cut stumps from Scots pine Christmas trees.
A conifer bark beetle, *Orthotomicus caelatus*	Matsqui, Hatzic	Common in cut stumps from Scots pine Christmas trees. A new host record.
A needle blight, *Lophodermium seditioisum*	Matsqui Scuzzy Creek	Common on Scots pine Christmas trees, a new host record. Light levels common on plantation lodgepole pine.
Red turpentine beetle, *Dendroctonus valens*	Matsqui	In cut stumps from Scots pine Christmas trees.
Western pine moth, *Dioryctria cambiicola*	Langley	Boring into upper boles of Scots pine Christmas trees. A new host record.
White pine blister rust, *Cronartium ribicola*	Host range	Branch and stem cankers common on western white and whitebark pines.

Table 8. (Cont'd)

Host and pest	Location	Remarks
Sitka Spruce		
Spruce aphid *Elatobium abietinum*	Host range	Common and widespread, mostly in coastal areas; damage varies annually
Mountain Hemlock		
A die-back fungus, *Sclerophoma pithyophila*	Maple Ridge	On seedlings at UBC Research Forest.
Gray mould, *Botrytis cinerea*	Maple Ridge	On seedlings at UBC Research Forest.
Western Hemlock		
Dwarf mistletoe, *Arceuthobium tsugense*	Host range	Endemic, widespread.
Western Redcedar		
Cedar flagging	Region-wide	Common throughout host range.
Keithia blight, *Didymascella thujina*	Region-wide	Common throughout host range.
Western Yew		
Yew big bud mite, *Cecidophyopsis psilaspis*	Host range	Common in coastal areas, kills 25% of buds annually, not found past Whistler (interior sites).
Multiple Conifer Hosts		
A conifer weevil, *Strophosoma melanogrammum*	Powell River	Moderate to severe defoliation of young, +/- 1m tall, Douglas-fir, lodgepole pine, grand fir and spruce, grown for Xmas trees, at a private residence.
DECIDUOUS		
Apple		
Apple ermine moth, *Yponomeuta malinella*	South-western B.C.	Scattered, mostly light defoliation, with occasional trees severely defoliated.

Table 8. (Cont'd)

Host and pest	Location	Remarks
Apple scab, *Venturia inaequalis*	Agassiz	Causing discoloration and premature leaf drop.
Birch		
A decay mushroom, *Panellus serotinus*	Ruby Creek	Common on dead standing trees.
The birch conk, *Piptoporus betulinus*	Ruby Creek	Common on dead standing trees.
Black Cottonwood		
A leaf miner, *Phyllocnistis populiella*	Southgate River	Common on young trees in this area.
Poplar and willow borer, *Cryptorhynchus lapathi*	Southgate River	Found in a few trees in this area.
Poplars		
Conifer-cottonwood rust, *Melampsora occidentalis*	Harrison Mills	Common on a few hybrid poplar crosses.
A leaf blight, *Linospora tetraspora*	Harrison Mills	Causing light leaf blotching on on some hybrid poplars.
Venturia leaf blight, *Venturia populina*	Harrison Mills, Herrling Island, Fraser River.	Moderate to severe infections on some hybrid poplar crosses.
Multiple Deciduous Hosts		
Cherry ermine moth, *Yponomeuta padella*	Greater Victoria, lower mainland.	Scattered, mostly light defoliation, with occasional trees severely defoliated.

Queen Charlotte Islands

Summary

Western blackheaded budworm larval populations, although remaining low, continued to increase from previous years. In assessment of the most recent outbreak, growth reduction was clearly evident in a young stand. Endemic populations of **hemlock sawfly** continued throughout the district, no defoliation was recorded. Minor branch dieback caused by **Sirococcus shoot blight** or **abiotic agents** continued to be common in many areas.

Spruce aphid populations declined to endemic levels, with occasional scattered pockets causing up to 20% defoliation. **Large-spored spruce-labrador-tea rust** infections continued, causing moderate to severe discoloration of current spruce foliage from Tlell to Port Clement with scattered infections continuing to Masset and between Juskatla and Yakoun River. **Cooley spruce gall adelgids** were only found on Douglas-fir east of Queen Charlotte City. No galls were found on spruce in the district.

In **three young stands** surveyed, 70% of trees were pest free while only 1% were killed, primarily in the understory by competition. A number of pests currently causing minor damage or noted at endemic levels are included in table 9 at the end of the report. Notable among these pests were the **green-striped forest looper** which is capable of reaching epidemic proportions and has caused tree mortality in other regions, and deer browse which continues to plague newly planted and unprotected young western red cedar seedlings in the district.

Hemlock Pests

Western blackheaded budworm
Acleris gloverana

Western blackheaded budworm populations increased for the second consecutive year in 1995. Larvae were collected at 6 of 13 standard FIDS larval sample sites scattered throughout road accessible areas of Graham and Moresby islands. Although no defoliation was recorded during ground surveys, a total of 18 larvae were found, averaging 3 per sample and ranging from 1 at several sites to 7 at Lawnhill Point. This is more than triple the number of larvae (5) found last year and far surpasses the single larva found in all samples collected between 1989 and 1993.

In continued assessments, in young stands, of long term effects of the western blackheaded budworm infestation of 1985-88, one plot (#4-east of the Honna River area on Graham Island) was sampled. This plot was part of a system of plots established by BCFS in 1987 throughout the infested areas. Each of these plots consisted of a large number of trees tagged and tallied with 1987 defoliation estimates documented for about 25% of the trees. Unfortunately, the plot was spaced in 1988 and only 10 of the tagged hemlock appropriate for sampling were found. Most of the sampled trees were not among those originally assessed, so no tree-specific defoliation information was available. Estimates of the overall defoliation in the area were made based on aerial survey maps and reports from 1986-88. In 1986 defoliation in the area was generally light to moderate, based on aerial surveys and reports. Overall defoliation in this area was moderate to severe in 1987, based on plot information and aerial

surveys, and in 1988 defoliation was light and much reduced in extent, according to available reports.

An assessment of 10 cores showed a dramatic reduction in radial increment during the outbreak period (see Figure 4). Increment averaged only 0.67 mm in 1988, one year after the most severe recorded defoliation. This average is 363% less then the average of 2.42 mm for the 5 year period prior to the onset of the outbreak. Recovery was already evident in 1989 with a growth rate of 2.53 mm, although part of this dramatic recovery was doubtless associated with the spacing in 1988.

In the province, historically, major outbreaks have occurred approximately every 10 years. The last major outbreak on the Queen Charlotte Islands started in 1985. The positive larval sampling suggests a need for continued ground assessments and aerial surveys for 1996.

Hemlock sawfly
Neodiprion tsugae

Hemlock sawfly populations remained at endemic levels and no defoliation was recorded. Of 23 standard samples, only seven were positive, averaging 2 larvae/collection (range 1-8). The maximum number of larvae continued to be at Marie Lake, where trace, spot defoliation was last noted in 1991. No sawfly larvae were found at the Hangover and Gregory creeks study areas.

Sirococcus shoot blight
Sirococcus conigenus

Minor tip dieback in young hemlock continues in scattered locations in the Queen Charlotte Islands. Sirococcus shoot blight, caused by *S. conigenus*, was confirmed from samples of young regeneration with dead tips at Gregory Creek. Damage was light and scattered.

Minor tip dieback also occurred on 6% of 30-year-old hemlock in a spaced stand near South Bay, and was noted on 4% of 28-year-old hemlock in a spaced stand at Skowkona Creek. At these sites no samples were taken, and while the causal agent may have been Sirococcus blight, such abiotic agents as suppression, shading or frost show similar damage and also commonly occur.

Spruce Pests

Spruce aphid
Elatobium abietinum

Spruce aphid populations were endemic in most traditional outbreak areas in 1995, although some defoliation was recorded at a few scattered locations. Only ground assessments in accessible areas were completed as inclement weather through much of the survey period precluded aerial assessments.

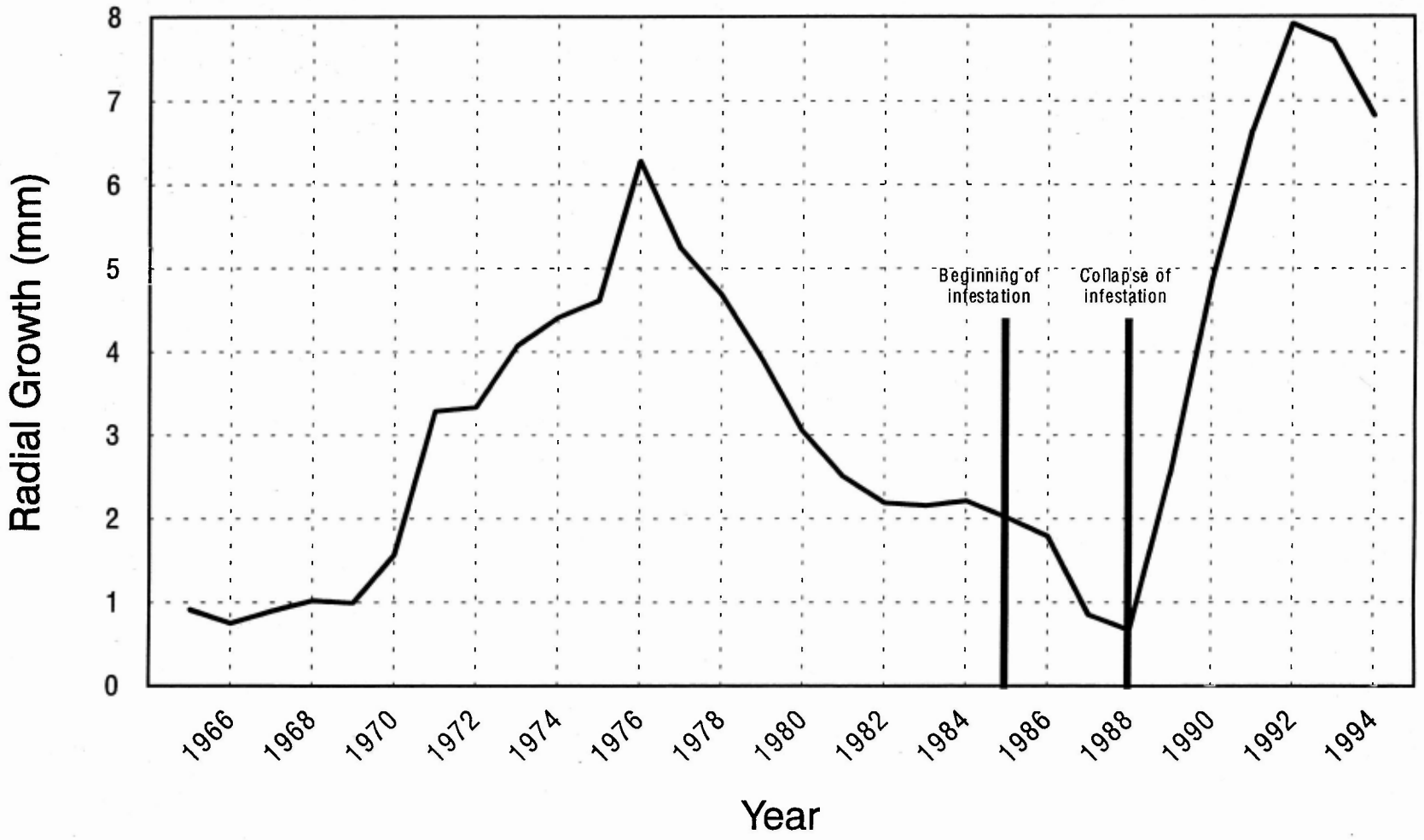

Figure 4. Radial increment of western hemlock in the Honna River plot (#4), defoliated by western blackheaded budworm, Queen Charlotte Islands, 1995.

Localized populations were noted in a number of areas surveyed. In a young stand at Onward Point, 39% of trees were about 20% defoliated over a 12 ha area. Scattered small populations were noted at Sheldens Bay, Peel Inlet and Rennell Sound. Scattered small populations causing trace to light discoloration or defoliation also occurred in isolated patches along Highway 16 from Queen Charlotte City to east of Masset.

Twenty semi-mature trees assessed for levels of defoliation at each of two sites in 1992 were assessed for the fourth time in 1995. At Chinukundl Creek, no new defoliation or discoloration was noted and trees were generally showing good recovery. In 1994, eight trees were severely and five trees moderately affected, while in 1995, only five trees were severely and six trees moderately impacted, while six trees showed only trace remaining damage or no damage at all. No branch dieback or tree mortality was noted.

At Gray Bay, where one tree was killed in 1993, a second is likely to succumb in 1995, and two others are suspect and may not recover. The remaining 16 trees are showing new growth and some recovery, although not as quickly as at the Chinukundl Creek site. Few aphids were noted in the stand and no new feeding damage was evident. If all four trees (one dominant, two codominant and one intermediate) die, this implies 20% tree mortality due to spruce aphid. It also indicates that mortality can occur several years after a severe attack and implies that extreme populations at a specific site over several years are likely to have a severe impact. Mortality due to spruce aphid attack has been recorded a number of times over the years on the Queen Charlotte Islands although protracted losses have not often been mentioned.

Large-spored spruce-Labrador-tea rust
Chrysomyxa ledicola

Infection of current foliage of young Sitka spruce by *C. ledicola* was again notable in 1995. Current foliage continued to be lightly to severely discolored on young roadside spruce (2-4 m) from Tlell to Port Clements, but infections north to Masset were again only scattered. Scattered light to severe discoloration of young plantation spruce was also again noted in areas between Juskatla and the Yakoun River.

Although losses of up to 90% of current needles have been reported causing serious effects on the following year's growth, no top kill, severe dieback, or mortality has been recorded in areas affected for the last five consecutive years.

Cooley spruce gall adelgid
Adelges cooleyi

In Sandspit, for the second consecutive year, no new galls were found on young Sitka spruce located adjacent to the site where several infested semi-mature Douglas-fir were removed in 1993. Near Queen Charlotte City, four young Douglas-fir on private property continued to harbor large populations of *A. cooleyi* for at least the sixth consecutive year. As in previous years, no galls have been found on spruce in this area. In Port Clements, Douglas-fir and adjacent spruce were checked at two sites and no evidence of adelgids were found.

Surveys over the past five years indicate no establishment of this adelgid in any young Sitka spruce in managed or natural settings. Complete removal of Douglas-fir continues to be the recommended procedure to combat this potential threat. The disappearance of adelgids from the Sandspit location following removal of the alternate host amply demonstrates the potential success for this type of corrective treatment.

Pests of Young Stands

Three young, recently spaced stands were surveyed as part of the ongoing province-wide program to assess pests in young stands. The stands were selected primarily on the basis of having received silviculture treatment under the South Moresby Forest Replacement Account (SMRFA) or other special funding programs. In addition to insect and disease concerns, environmental damage, mammal damage and other conditions affecting the health and growth of young stands were examined.

At a spaced South Bay plantation, 67% of trees were pest free while 12% were affected by abiotic agents including competition and mechanical damage. Competition killed 4% of plot trees; mostly in intermediate and suppressed trees. The spruce budmoth, *Zeiraphera* sp., was noted in 40% of spruce but caused only minor tip defoliation. Sirococcus shoot blight, caused by *S. conigenus*, caused minor tip dieback in 6% of western hemlock, while Keithia blight, caused by *Didymascella thujina*, was noted in the single cedar plot tree. In a 13-year-old spaced stand at Onward Point, 57% of trees were pest free. One of 67 hemlock in the plots was infected by dwarf mistletoe, *Arceuthobium tsugense*. While only one infected tree was found during the survey, it is likely that other trees in the stand are infected and that mistletoe activity will expand as dormant plants become activated as a result of increased light in the stand following the recent spacing. Additionally, spruce aphid, *E. abietinum*, caused up to 20% defoliation on 39% of spruce; incidental spruce needle blight and cedar leaf blight were also present. Abiotic agents including mechanical damage, multiple-tops, forking and competition affected 15% of crop trees. At Skowkona Creek in a stand both spaced and pruned, 86% of trees were pest free. Problems such as forks and mechanical damage were significant in 7% of trees; needle blights, tip blights and defoliators caused only very minor damage.

Overall 70% of trees were pest free. One percent mortality occurred, primarily understory trees killed by competition. The only serious problems noted were at Onward Point, where dwarf mistletoe and spruce aphid have the potential to notably impact the stand.

Other Noteworthy and Minor Pests

Table 9. Other noteworthy and minor pests, Queen Charlotte Islands, 1995.

Host and Pest	Location	Remarks
Pines		
Fir coneworm, *Dioryctria abietivorella*	Sheldens Bay	About 5% of western white pine with frass and/or damage at upper crown nodes.
Hard pine adelgid, *Pineus coloradensis*	Sheldens Bay, Jungle Creek	Light to moderate populations on western white pine in trial plantations.
Pine needle cast, *Lophodermella concolor*	Riley Cr.	Continues common to severe on young roadside and bog pine.
Western gall rust, *Endocronartium harknessii*	Riley Cr.	Branch galls common on young roadside shore pine over .2 ha area.
White pine blister rust, *Cronartium ribicola*	Jungle Creek	1 of 8 remaining western white pine saplings cankered. (None at Sheldens Bay).
Sitka Spruce		
Saddleback looper, *Ectropis crepuscularia*	Peel Inlet	Single larva found.
Spruce needle blight, *Lirula macrospora*	Yakoun R., Marie Lk., Skowkona Cr.	Generally light scattered minor discoloration of older needles.
Western Hemlock		
A bark beetle, *Pseudohylesinus* sp.	Gregory Cr.	In one tree killed in single tree selection harvest block.
Green-striped forest looper, *Melanolophia imitata*	Hangover Cr., Riley Cr.	Occasional larvae.
Western Yew		
Yew big bud mite, *Cecidophyopsis psilaspis*	Yakoun R., Marie Lk.	Very common, causing branch deformity and bud mortality.

Table 9. (Cont'd)

Host and Pest	Location	Remarks
Western Redcedar		
Keithia blight *Didymascella thujina*	District-wide	Occasional on young growth, severity variable.
Multiple Host		
Deer browse	District-wide	Common throughout, 47% of seedlings at two sites browsed, mainly cedar but also spruce, (protective collars on 33% of cedar seedlings reduced potential damage level)

Appendix I

PEST IMPACT CODES

- based on the sum of %trees/severity index/stand.
- SI=Severity Index i. e. SI 1 = Severity Index 1

Impact I - No Action Required

- No impact, pest-free
- These are stands where 100% of the trees were pest-free i.e. SI1.

Impact II - Consider Reassessment in 4 years

- Minor damage, occasional significant volume losses.
- 70%>SI3
- 25%>SI4>0
- 3%>(SI5 or SI6 or SI5+SI6)>0

Impact III - Consider Reassessment in 4 years

- Significant current volume loss and potential long-term; reassess within 2 years.
- SI3 >= 70%
- 5%> (SI5 or SI6 or SI5 + SI6) >=3%
- 50%> (SI4 or SI4+SI5 or SI4+SI6 or SI4+SI5+SI6) >=25%

Impact IV - Consider conducting a more intensive survey

- Significant long-term volume losses, possibly resulting in NSR stands. Immediate action.
- 5%>SI5 or SI6 or SI5+SI6
- 50%> (SI4 or SI4+SI5 or SI4+SI6 or SI4+SI5+SI6)

Appendix II

The following related reports are available on request from FIDS.

I. Forest pest conditions in the Vancouver Watersheds and Seymour Demonstration Forest, 1994.

II. Forest pest conditions in Provincial Parks, Vancouver Forest Region, 1994.

Detailed copies of aerial survey maps, pest reports, pest leaflets, monographs and other maps and reports in addition to those listed above are available from the Pacific Forestry Centre upon request.