

Forest Insect and Disease Conditions

Vancouver Forest Region
1984

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SUMMARY

This report outlines forest insect and disease conditions in the Vancouver Forest Region in 1984 and forecasts population trends of some potentially damaging pests.

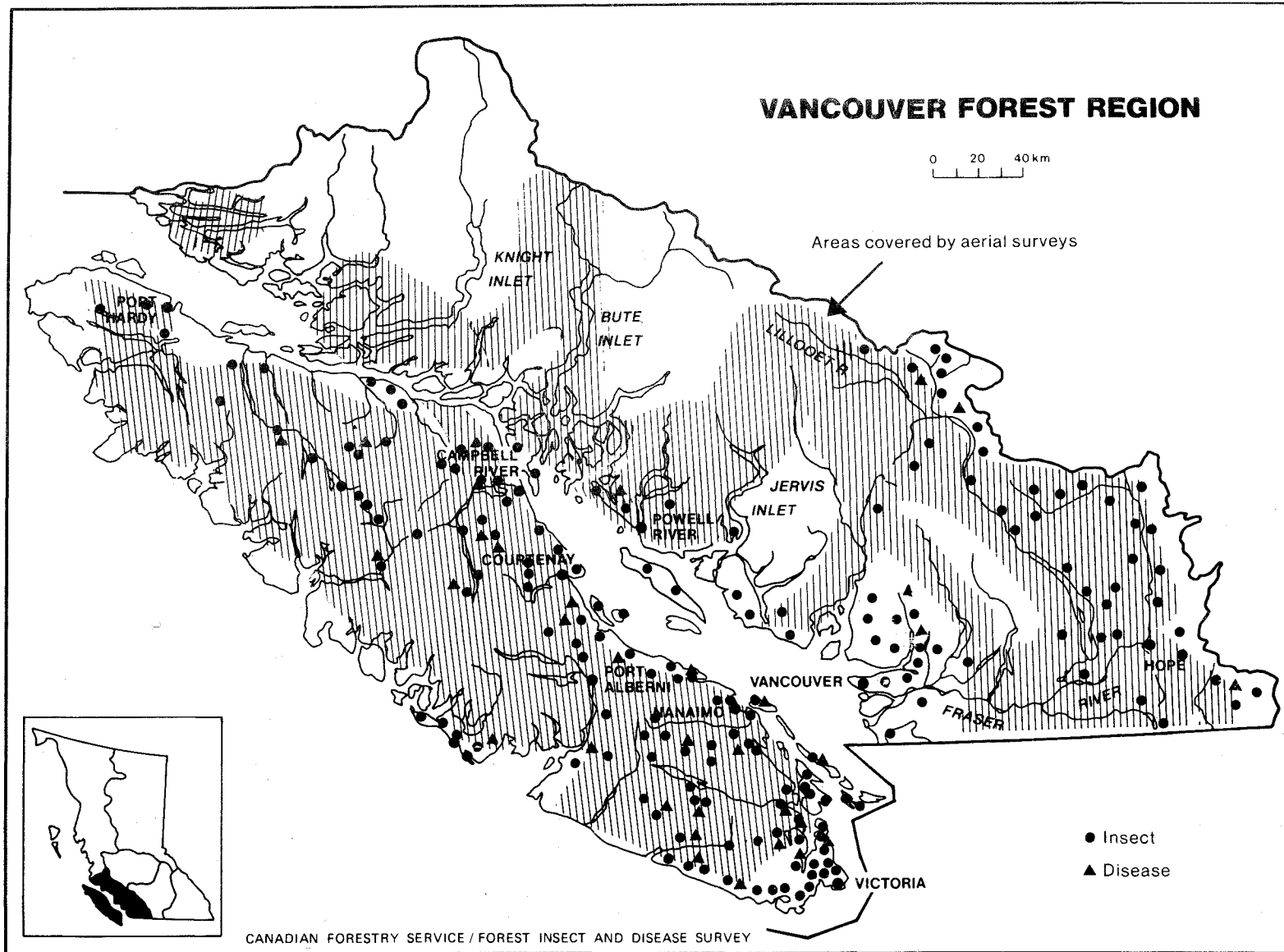
Western spruce budworm populations remained low with no defoliation recorded for the fourth consecutive year. The Douglas-fir tussock moth infestation near Chilliwack collapsed and no larvae were found. The number of mature Douglas-fir killed by Douglas-fir beetle increased for the second consecutive year in the Fraser Canyon and in the Lillooet Lake area. Mortality of mainly amabilis fir and some western hemlock seedlings by a seedling weevil continued near Holberg and Woss Lake on Vancouver Island. Mountain pine beetle infestations increased in area and intensity in the Homathko River Valley and in the Gates River-Birkenhead Lake area. Defoliation of deciduous trees by winter moth was comparable to 1983 in the Victoria area but increased in Duncan and adults were trapped for the first time at Nanaimo and on Saltspring Island. Defoliation of Garry oak by Western oak looper in the Mount Maxwell Ecological Reserve on Saltspring Island decreased substantially. Moderate to severe infections of Dogwood leaf blight continued on the Mainland and Vancouver Island.

The field survey from May 23 to October 25 included a number of special surveys: to collect winter moth larvae for parasitism studies; to collect spruce buds containing budmoths for taxonomic studies in Ottawa; to monitor Provincial parks and campsites for forest pests and gypsy moth; to assess pest conditions at Environment 2000 sites and in young stands on Vancouver Island and the Lower Mainland; to examine western hemlock plantations at Northwest Bay on Vancouver Island for terminal crook disease; to establish permanent study plots and assess stand conditions for acid rain damage at three permanent and more than 100 other locations in the Region; to examine exotic plantations on Vancouver Island and in the Fraser Valley.

A total of 550 insect and disease samples from throughout the Region were collected by CFS-FIDS personnel and 48 by other agencies or individuals.

The number of standard FIDS three-tree beating samples from all hosts which contained larvae decreased significantly to 24% from 86% in 1983 in Mainland forests, and to 68% from 80% in 1983 on Vancouver Island. Locations where samples were collected and areas covered during 25 hours of aerial survey from fixed-wing aircraft in 1984 are shown on Map 1.

Details on forest pests encountered are described by host in order of importance.



Map 1. Area covered by aerial surveys and locations where one or more forest insect or disease samples were collected, 1984

DOUGLAS-FIR PESTSWestern spruce budworm, Choristoneura occidentalis

Populations remained low in 1984. For the fourth consecutive year Douglas-fir stands were not defoliated. In Mainland forests, 14% of the collections from Douglas-fir contained budworm larvae (avg. 1 larva/sample) compared to 13% with an average of five larvae in 1983; only two larvae were collected on Vancouver Island.

Five flight traps baited with 0.1% pheromone concentration by weight, at each of eight stands on the Mainland and at three on Vancouver Island, attracted an average of 3 male adults (range 1-17) per location. Male adult populations declined (from avg. 18 per location in 1983) except at Skagit River but the increase was insignificant (Table 1).

Table 1. Number of adult male western spruce budworm in pheromone-baited traps, Vancouver Forest Region, 1983-84.

| Location | Number of adults per trap | | | |
|-------------------------|---------------------------|-------|---------|------|
| | Range | | Average | |
| | 1983 | 1984 | 1983 | 1984 |
| <u>Fraser Canyon</u> | | | | |
| Log Creek | 15-28 | 1-15 | 22.8 | 8.0 |
| Gilt Creek | 0-7 | 0-3 | 1.6 | 0.6 |
| Rhododendron Flats | 1-7 | 0-1 | 2.6 | 0.2 |
| Skagit River | 0-0 | 0-1 | 0 | 0.3 |
| <u>Pemberton</u> | | | | |
| Haylmore Creek | 43-93 | 10-21 | 72.7 | 17.0 |
| Twin-One Creek | 10-34 | 2-12 | 21.0 | 5.0 |
| Owl Creek | 18-82 | 0-2 | 50.6 | 0.8 |
| Railroad Creek | 2-11 | 0-5 | 5.4 | 2.0 |
| <u>Vancouver Island</u> | | | | |
| Highlands Road | 2-20 | 0-2 | 10.4 | 0.6 |
| Fuller Lake | 1-14 | 0-2 | 8.8 | 0.4 |
| Green Mountain | 2-6 | 0-4 | 4.6 | 1.6 |
| Averages | | | 18.2 | 3.3 |

Two Douglas-fir branches from each of three trees at Haylmore and Twin-One creeks and at Rhododendron Flats were examined for egg masses but none were found. This, with low numbers of larvae and reduced numbers of adults in traps, indicates that populations will continue at very low levels in 1985.

Douglas-fir tussock moth, Orgyia pseudotsugata

Tussock moth populations collapsed at the Chilliwack Golf Course and at Cassidy and Victoria on Vancouver Island as predicted. The cause of the decline was attributed to the high incidence of a nuclear polyhedrosis virus (NPV) on Vancouver Island and to chemical control at Chilliwack in 1984. No larvae were found in standard beating samples throughout the Region. Populations are expected to remain low with no defoliation in 1985.

Douglas-fir beetle, Dendroctonus pseudotsugae

The number of Douglas-fir trees killed by this bark beetle in 1984 increased to 530 up from 295 in 1983. The beetle-killed trees occurred in scattered groups of 5 to 100 trees, covering an estimated 235 ha at 19 locations mainly in the Fraser Canyon, Lillooet Lake and Lillooet River areas (Table 2).

Table 2. Location and number of Douglas-fir trees killed by Douglas-fir beetle as determined from aerial surveys, Vancouver Forest Region, 1983-1984.

| Location | Number of dead trees | |
|--|----------------------|------|
| | 1983 | 1984 |
| <u>Fraser Canyon Area</u> | | |
| Saddle Rock | 55 | 100 |
| Gilt Creek | 55 | - |
| Ainslee Creek (2 areas) | 10 | 15 |
| North Bend | 10 | 30 |
| Chapmans | | 35 |
| Anderson River (2 areas) | | 15 |
| Uztlius Creek (2 areas) | | 10 |
| west of Boston Bar airport (3 areas) | | 30 |
| Nahatlatch Lake and River (scattered) | 20 | 80 |
| Kookipi Creek | 10 | - |
| west of Boston Bar | - | 20 |
| Spuzzum Creek (2 areas) | 60 | 50 |
| Gordon Creek | 25 | |
| <hr/> | | |
| Subtotal | 245 | 385 |
| <hr/> | | |
| <u>Pemberton area</u> | | |
| south of Lilloet Lake (2 areas) | - | 10 |
| west side of Lilloet Lake (2 areas) | - | 25 |
| Twin Two Creek | - | 30 |
| west of Specht Creek | - | 10 |
| north of Gates Lake | - | 10 |
| Haylmore Creek | - | 10 |
| Blackwater Creek | - | 5 |
| Birkenhead Lake | - | 25 |
| Tenquille Creek | 50 | 20 |
| <hr/> | | |
| Subtotal | 50 | 145 |
| <hr/> | | |
| TOTAL | 295 | 530 |
| <hr/> | | |

At Mount Maxwell Ecological Reserve on Saltspring Island where new attacks in mature trees have persisted for two or three years, one currently attacked tree was found. At Strathcona Provincial Park, 5% of the Douglas-fir trees within a 1984 fire perimeter were lightly attacked; all attacked trees had been stressed by fire or stem damage and averaged only 10% live crowns. Near Turnbull Lake, north of Port Alberni, six mature, felled Douglas-fir were severely infested and could pose a threat to adjacent trees. Current beetle attack was not found in a survey at Rath Trevor Provincial Park on Vancouver Island, where 6 attacked trees were found in 1983.

Bark beetle populations could, under favourable climatic conditions, continue to increase in 1985.

Swiss needle cast, Phaeocryptopus gaeumannii

Light infections of this native needle disease, which affects all but the current year's foliage of Douglas-fir and results in premature needle loss, was again widely distributed in the Region in 1984 (Table 3). The pathogen was first identified as a major cause of premature needle loss of Douglas-fir in the Region in 1979 when 1 000 ha in Upper Klanawa River Valley were severely infected.

Table 3. Locations and intensity of Swiss needle cast infections of Douglas-fir, Vancouver Forest Region, 1984.

| Location | Percent of trees infected | Infection intensity* |
|-------------------------|---------------------------|----------------------|
| <u>Mainland</u> | | |
| UBC Forest | | |
| 1. North Alouette River | 40 | moderate |
| 2. Marion Lake | 20 | Light |
| <u>Seymour River</u> | | |
| 1. Spur 4 | 100 | Severe |
| 2. Block 228 | 80 | Light |
| 3. Block 229 | 90 | Light |
| 4. Block 249 | 80 | Light |
| 5. Block 271 | 30 | Light |
| 6. Block 272 | 10 | Light |
| Spuzzum Creek | 33 | Light |
| Urquhart Creek | 12 | Light |
| Nahatlatch Lake | 50 | Severe |
| Green River (Pemberton) | 1 | Light |
| <u>Vancouver Island</u> | | |
| Dewdney Seed Orchard | 98 | Light |
| Pacific Seed Orchard | 2 | Light |
| Tahsis Seed Orchard | 37 | Light |
| Koksilah Seed Orchard | 40 | Light |
| Harmac Seed Orchard | 30 | Light |
| Quinsam Seed Orchard | 100 | Light/moderate |
| Snowdon Seed Orchard | 100 | Moderate/severe |
| Glantz Lake Road | 100 | Light |
| Jordan River-Loss Creek | 100 | Light/moderate |
| Shawnigan Lake | 15 | Light |
| Renfrew Road | 5 | Light |
| Upper Nitinat River | 80 | Light |
| Robertson River | 100 | Light |
| Gordon River | 80 | Light |
| Ritherdon Creek | 100 | Moderate/severe |
| Rath Trevor Park | 100 | Light/moderate |
| Browns River | 100 | Light/severe |
| Tsable River | 80 | Light |
| Quinsam Lake | 50 | Light |
| Upper Campbell Lake | 50 | Light |
| Elk Falls Park | 100 | Light |
| Lawson Lake | 100 | Severe |
| Memekay River | 100 | Light/moderate |
| Granite Bay (Quadra I.) | 90 | Light |
| AVERAGE | 64 | |

*Light - up to 30% needles infected
 Moderate - 31 - 60% needles infected
 Severe - 61%+ needles infected

At Dewdney Seed Orchard, infection increased to 98% in 1984, despite fungicide control applications in 1983 which had reduced infection levels to 3% from 13% in 1982.

Branch and tree mortality caused by this pathogen has not been observed but could result from repeated years of severe infection.

CONE AND SEED PESTS

Douglas-fir cone crops were generally nil to very light in 1984, consequently no collections were made in natural stands. The only collection made was at Tahsis Seed Orchard in Saanichton where high populations of a cone gall midge, Contarinia oregonensis and seed chalcid, Megastigmus spermatrophus infested most cones. There were unconfirmed reports of high populations of C. oregonensis in seed orchards in Saanichton, Harmac and other Vancouver Island locations. Moderate to high numbers of the seed bug Leptoglossus occidentalis were evident at Harmac and Tahsis seed orchards and in beating samples at Koksilah Seed Orchard in Duncan.

Douglas-fir growth anomalies

Growth anomalies, not readily attributed to known causes, were common in several Douglas-fir plantations on Vancouver Island in 1984. Anomalies were as follows:

- Leaders were missing on 8% of the trees at Copper Canyon, down from 14% in 1983 and at Quinsam River, on 4% of the 2 m high trees. Multiple leaders occurred on 23% of trees at a Nimpkish Road plantation and were common on immature trees at good growing sites, at widespread locations elsewhere on the Island.
- Twisted stems, crooked tops and "shepherd's crook" affected 37% and 3% of the young growth Douglas-fir at two sites on the Nimpkish Road and in roadside trees between Woss and Kelsey Bay.
- Fasciation and rosetting were present in plantations north of Campbell River and in the Woss-Kelsey Bay area.
- Needle chlorosis was most notable in the Green Mountain and Mt. Washington areas.

Micro- and macro-nutrient deficiencies or imbalances, birds, insects, animals, hormones and genetics and other factors are possible contributing factors to the anomalies. However, causal agents were not identified and further study of the problem continues.

Meria needle disease, Meria laricis

This disease, usually occurring on larch, was found for the first time on Douglas-fir at Koksilah Seed Orchard where 10% of the trees were infected. Symptoms of this disease occur in different forms, including browning of the needle tip while the remainder stays green and browning of the tips and yellowing of the needle to the base with a small green band between the tip and the base. In the latter case needles are loosely attached and shed prematurely.

To determine presence and extent of the infection, suspect samples were examined from a number of locations. At Campbell River seed orchards, 17 of 25 samples showed infection, two of four samples from Tahsis Seed Orchard and one sample from Dewdney Seed Orchard were also infected. Infection was also found on Douglas-fir at Elk Lake and Tstable River and at Jump Creek up to 2% of trees over 200 ha were infected.

This disease, like many of the needle fungi, appears to intensify under cool, damp conditions and is less prevalent in dry weather. Weather conditions early in 1985 may determine the extent and intensity of occurrence.

Silver-spotted tiger moth, Lophocampa argentata

Partial defoliation of single branches and single colonies of larvae were less common on Douglas-fir and occasionally on lodgepole pine along the east coast of Vancouver Island from Victoria to north of Campbell River, on the Saanich Peninsula, at Sooke, Lake Cowichan and Cameron Lake. Incidence of defoliation was less than in 1983. However, one 1.2 m Douglas-fir tree was completely defoliated at Mt. Newton Seed Orchard. There was no evidence of the insect on the Mainland.

Low populations are expected to continue on Vancouver Island in 1985.

WESTERN HEMLOCK PESTS

Western hemlock looper, Lambdina f. lugubrosa

Populations of hemlock looper have been low in the Region since 1971 and on the Mainland declined to the lowest level in the past four years (Table 4). On Vancouver Island, only two larvae were found in all collections from western hemlock.

Table 4. Percentage of western hemlock collections containing western hemlock looper and average number of larvae per positive sample, Mainland area, Vancouver Forest Region, 1981-1984.

| Year | Percentage of collections containing larvae | Av. no. larvae per positive sample |
|------|---|------------------------------------|
| 1981 | 16 | 2.0 |
| 1982 | 30 | 9.0 |
| 1983 | 34 | 2.5 |
| 1984 | 5 | 2.0 |

Populations are expected to remain low throughout the Region in 1985.

Phantom hemlock looper, Nepytia phantasmaria

The percentage of western hemlock collections which contained larvae of this defoliator decreased from 4% in 1983 to 2% in 1984. No evidence of the insect was found at Coquitlam Lake where severe defoliation occurred in 1982. Populations will probably remain low in 1985.

Western blackheaded budworm, Acleris gloverana

Populations of this potentially damaging defoliator remained low throughout the Region since the previous outbreak on Vancouver Island declined in 1974. On the Mainland the number of positive collections declined from 44% in 1983 to 20% in 1984 and on Vancouver Island from 10% to 7%. The average number of larvae per collection remained at two to three.

Low populations are expected to continue in 1985.

Green-striped forest looper, Melanolophia imitata

Populations remained at low levels in the Region where 18% of western hemlock samples contained an average of two larvae, down from 35% with three larvae in 1983. Populations were slightly higher in Douglas-fir stands: 2.6 larvae in 27% of the collections.

No increase is expected in 1985.

Conifer sawfly, Neodiprion spp.

Very light defoliation of understory western hemlock occurred at Norm Lake on northern Vancouver Island where the number of larvae in

standard samples increased from 13 in 1983 to 150 in 1984. Moderate populations persisted in hemlock-amabilis fir stands at Haihte Lake, but at Keta Lake and Big Tree Creek where defoliation occurred in 1980 to 1981, populations collapsed. In the Iron Lake, Holberg, Forbidden Plateau and Oyster River areas, larval counts ranged from 15 to 24/sample.

Throughout the Region, 23% of hemlock collections contained an average of 14 larvae, similar to 1983. At Norm Lake, light defoliation could occur in 1985, but none is expected elsewhere in the Region.

Terminal crook disease, Colletotrichum acutatum

This introduced pathogen was not found on planted stock, residuals or natural regeneration western hemlock in the third annual follow-up examination of recently planted stock in the Northwest Bay area on Vancouver Island. The sites are now believed to be unfavourable to the establishment and spread of the pathogen which is an important nursery pest in New Zealand.

Examinations will continue in 1985.

Hemlock tip dieback

From 10% to 95% of the sapling-sized to semi-mature western hemlock trees were infected by an unidentified tip dieback at Rheinhart Lake, Browns River, Mt. Newton Seed Orchard, Kaipit Creek and Mt. Washington on Vancouver Island.

The dieback which affects branch tips and results in needle loss of up to 15 cm was first reported on western hemlock on Vancouver Island in 1981 near Courtenay.

Possible causal agents include a shoot blight, Sirococcus strobilinus which infected some western hemlock shoots in a localized site at Beaver Cove, and a tip blight, Xenomeris abietis which affected shoots of hemlock trees in a localized area at Mt. Washington, Mt. Newton Seed Orchard, Rheinhart Lake and Browns River.

Tree mortality has not been recorded.

TRUE FIR PESTSFir coneworm, Dioryctria abietivorella

The coneworm is suspected to have been the cause of light to severe damage to leaders, laterals and needles in the upper crowns of immature amabilis fir over 3 m and some mature trees over an estimated 15 000 ha in the upper Adam River area, west of Kelsey Bay on Vancouver Island. Similar damage occurred to regeneration for 5 km along Schoen Lake Road and between Rooney Lake and Elk Creek along Hwy. 19 west of Kelsey Bay. South of Kelsey Bay between Memekay River and Middle Memekay River, approximately 90% of the regeneration over 250 ha was lightly damaged as were 80% of regeneration 2 m and taller in the Moriarty Creek and upper reaches of the south Englishman River areas near Parksville. This fir coneworm is more commonly a cone pest and cambium and foliage feeding to such an intensity and extent has not been previously recorded in B.C. Up to 5% leader mortality could occur in some of the more severely damaged areas including Adam River and Memekay River. As the life history of this insect is not fully documented, predictions for 1985 activity and damage loss are premature at this time.

An omnivorous leaftier, Cnephasia longana

Populations severely defoliated conifer seedlings at the Yellow Point Seed Orchard near Nanaimo on Vancouver Island. The most commonly and severely affected were 0.5 m amabilis fir seedlings with an average of 12 to 14 tips damaged and some trees almost totally defoliated. Other hosts were less severely affected: 34% of Sitka spruce averaged two attacks per seedling; 13% of the western hemlock and 9% of Douglas-fir averaged less than 2 attacks per tree.

The leaftier, predominantly an agricultural pest, is most common in damp meadow areas. The most recent major infestations occurred on the Lower Mainland in the early 1960's on strawberries and hosts such as clover, alfalfa and potatoes have also been affected. Damage to Douglas-fir seed orchard stock has also been noted.

Favourable weather conditions in 1985 could result in damage to seed orchard stock, unless control measures are implemented when feeding commences in mid-March.

Balsam woolly aphid, Adelges piceae

Balsam woolly aphid was not found in surveys of three seed orchards on Vancouver Island in 1984.

Recent increases in seed production of true firs may create a more favourable environment for the balsam woolly aphid in seed orchards.

PINE PESTSMountain pine beetle, Dendroctonus ponderosae

The number of lodgepole pine killed by the beetle in the Region in 1984 increased more than $2\frac{1}{2}$ times to 18 600 trees and the infestation area doubled to 4 300 ha (Table 5). The major areas of tree mortality occurred along the Homathko River north of Bute Inlet and in the Gates River-Birkenhead Lake area. Smaller numbers of recently killed trees were recorded in scattered groups in the Silverhope Creek-Manning Park-Fraser Canyon areas. The Homathko River infestation which accounted for most of the increase is west of and probably an extension of major infestations in the western part of the Cariboo Region. Three spot infestations of 35 red-topped lodgepole pine were detected during aerial surveys near Oyster River on Vancouver Island, where pockets of recent pine mortality have occurred for the last 3-4 years.

The mountain pine beetle infestation in mature lodgepole pine stands near Eastgate in Manning Provincial Park was resurveyed and only three currently attacked trees were found within the Park. Following a successful control program the numbers of beetle-infested trees have been reduced from 29 in 1983 and 5 500 in 1981. However, 48 spot infestations of 5 to 500 recently killed lodgepole pine east of the Park to Princeton in the Kamloops Region could, if left untreated, be a threat of re-infestation to extensive mature lodgepole pine stands in the Park.

European pine shoot moth, Rhyacionia buoliana

Persistent shoot moth populations lightly damaged numerous ornamental pines in several east coast locations on Vancouver Island. Small populations infested new tips of about 20 Mugho pines on the University of Victoria campus, where populations have persisted for more than 10 years. An average of 12 to 15 branch tips per tree were damaged on 10-20 Mugho pines in Nanaimo. Light attacks again occurred on scattered single ornamental pines in the Comox area and several Scots pine in a Christmas tree plantation near Mill Bay were suspected to be lightly infested.

Populations are expected to persist in 1985.

Table 5. Number of pine trees killed by mountain pine beetle and area of infestations, Vancouver Forest Region, 1983 and 1984.

| Location | No. of recently killed trees | | Area (ha) | |
|------------------------------------|---------------------------------|--------|-----------|-------|
| | 1983 | 1984 | 1983 | 1984 |
| <u>Fraser Canyon Area</u> | | | | |
| Goodfellow Cr. (Manning Park) | - | 5 | - | 2 |
| Silver Lake (Silver Hope Creek) | - | 10 | - | 3 |
| Utzlius Creek | - | 35 | - | 5 |
| Ainslee Creek | 500 | - | 200 | - |
| Mowhokam Creek | 20 | - | 10 | - |
| west of Boston Bar | 175 | - | 60 | - |
| Subtotal | 645 | 50 | 270 | 15 |
| <u>Pemberton Area</u> | | | | |
| Joffre Creek | - | 50 | - | 5 |
| Specht Creek | 1 250 | 2 500 | 300 | 350 |
| north of Specht Creek | - | 1 500 | - | 200 |
| Gates Lake | 450 | 250 | 300 | 130 |
| Eight Mile Creek | 275 | 550 | 100 | 100 |
| south of Devine | - | 600 | - | 130 |
| west of D'Arcy | 400 | 1 500 | 100 | 700 |
| Spruce-Haylmore creeks | 800 | 90 | 350 | 100 |
| west of Devine | 200 | 515 | 100 | 120 |
| Blackwater Creek | 200 | 25 | 40 | 3 |
| Phelix Creek | 300 | 700 | 80 | 100 |
| Birkenhead Lake | 150 | 75 | 20 | 20 |
| Poole Creek | - | 50 | - | 5 |
| Mt. Currie | 5 | - | 5 | - |
| Owl Creek | - | 35 | - | 5 |
| north of Pemberton | - | 10 | - | 2 |
| Railroad Creek | - | 100 | - | 20 |
| Subtotal | 4 030 | 8 550 | 1 395 | 1 990 |
| <u>Bute Inlet</u> | | | | |
| Homathko River | 2 200 | 10 000 | 400 | 2 300 |
| GRAND TOTAL | 6 875 | 18 600 | 2 065 | 4 305 |

Pine needle diseases

Light to severe infection of lodgepole pine needles by several diseases was common in many areas in the Region. At Strawberry Flats in Manning Park most of the 1983 needles were severely infected and prematurely cast from all trees over a 3 to 5 ha stand by Lophodermium seditiosum and L. montivaga. Less severe infection also occurred at Rhododendron Flats.

Lophodermium sp. severely infected more than 400 ha of lodgepole pine above 900 m elevation along Silverhope Creek, southwest of Hope. The same condition affected all 1983 lodgepole pine needles over about 2 ha southwest of D'Arcy near Pemberton.

On Vancouver Island light infection by Davisomycella ampla affected all lodgepole pine over 10 ha at Jacob Creek near Jordan River. Light infection by Scirrhia pini of mainly 1983 needles occurred on 20% of Scots pine in a 1 ha plantation at Mill Bay. Lophodermella concolor infections were common throughout Vancouver Island; infection ranged from light to severe on 50-100% of regeneration lodgepole pine at Little Qualicum Falls park, at Rath Trevor Park and Myra Falls and was common on roadside regeneration wherever the host occurred.

Pine needle diseases are expected to continue to infect lodgepole pine stands in the Region in 1985 if moist weather conditions prevail during spore dispersal in early spring.

SPRUCE PESTSSpruce weevil, Pissodes strobi

At three spruce plantations on Vancouver Island an average of 17% of the leaders were attacked in 1984 (range 2-29%) and 42% (range 4-48%) prior to 1984 (Table 6) similar to 1983 (avg. 17% current 41% prior).

Table 6. Incidence of spruce weevil attack in spruce plantations, Vancouver Island, Vancouver Forest Region, 1984.

| Location | Percent of trees attacked | | Total |
|-------------------------------------|---------------------------|----------------------|-------|
| | Current (1984)+ | Old (1983 and prior) | |
| Nimpkish Road (Mary Road) | 2 | 4 | 6 |
| Nimpkish Road (Vernon Lake) | 25 | 30* | 45* |
| Sayward Provenance Trials (BCMF) | 29 | 84 | 86 |

+may include old attacks

*estimated

The incidence of current attack declined from 4% in 1983 (year of first attack) to 2% in 1984 at Mary Road; 29%, down from 33% at Sayward Provenance Trials (where only 14% of the approximately 10-year old trees were healthy); and 25% in a 10-year old natural spruce regeneration area north of Vernon Lake, where infested trees contained an average of 3.25 larvae per leader.

Parasites reared from Vernon Lake samples included: a small black dipterous larval parasite, Lonchaea corticus (20.25/leader), a hymenopterous larval parasite, Eurytoma sp. (2.13/leader) and a hymenopterous pupal/larval parasite, Allodorus strigitergum (.75/leader). The importance of these three species as biological control agents of spruce weevil is currently being studied.

Spruce aphid, Elatobium abietinum

Increased spruce aphid populations defoliated coastal Sitka and ornamental spruces in isolated patches on Vancouver Island from Victoria to Campbell River, along the west coast to Port Renfrew and in the Ucluelet-Tofino area.

All the Sitka spruce in the Tahsis Seed Orchard in Central Saanich were defoliated up to 90% and 5% of the spruce at Cobble Hill Seed Orchard were lightly infested. Minor defoliation and small aphid populations affected roadside spruce in the Campbell River area and ornamental spruce in Victoria. Light to moderate defoliation was common at Otter Point; at Jordan River and Sombrio Beach to Port Renfrew there were very small populations with occasional light defoliation. At Mackenzie Beach near Tofino five semi-mature Sitka spruce were 60% defoliated.

Populations could expand in 1985, weather permitting, especially at some seed orchards where the aphid has just become established on newly planted stock.

Spruce budmoths, Zeiraphera spp.

Populations of several species of Zeiraphera including Z. vancouverana, Z. unfortunana and Z. canadensis lightly damaged Sitka spruce buds along the southwest and west coasts of Vancouver Island. Damage consisted of partial defoliation and browning of the new flush.

Up to 20% of spruce buds were infested at Otter Point west of Sooke by Z. vancouverana and at Jordan River and San Juan River where Z. unfortunana was also present. Near Ucluelet Z. vancouverana, Z. canadensis and Z. unfortunana infested 40 to 50% of buds on all shoreline Sitka spruce. At Long Beach, 20% of buds on most trees were infested by Z. canadensis and Z. vancouverana and at Mackenzie Beach near Tofino 40 to 60% of buds were infested by Zeiraphera spp.

Feeding on shoreline spruce in the Campbell River area was very light and similar to spruce budmoth damage but species could not be confirmed. Similar damage is caused by a needle miner, Epinotia hopkinsana which often occurs with spruce budmoth.

Budmoth larvae identified as Z. hesperiana were also found in ones and twos on Douglas-fir at five locations on the Island.

Populations in spruce stands are likely to continue in 1985 but damage should remain minimal.

MULTIPLE HOST PESTS

Seedling weevil, Steremnius carinatus

Mortality and girdling of conifers by the seedling weevil at four 1983-84 plantations near Woss Lake and Holberg ranged from 4-50% (avg. 15%) (Table 7). Survival surveys of 18 1983 plantations in the Holberg area by industry recorded up to 90% (avg. 5%, similar to 1983 levels) mortality of primarily one-year old amabilis fir and some western hemlock, Sitka spruce, western red cedar and grand fir seedlings, in the third consecutive year of weevil infestations in the area (Table 8). A survey of a 1983 1-0 plug Douglas-fir plantation near Cowichan Lake for the weevil was negative.

Table 7. Incidence of girdling of conifers by a seedling weevil, S. carinatus in 1983/84 plantations, Vancouver Island, 1984.

| Location | Year Planted | Stock type | No. seedlings examined | # Seedlings | | |
|---------------------------|--------------|---------------------------|------------------------|----------------|----|----|
| | | | | H ¹ | PG | G |
| <u>Holberg Area</u> | | | | | | |
| Ronning Creek | 1983 | aF ² 1-0 plugs | 50 | 25 | 2 | 23 |
| Eric Lake | 1983 | aF 2-0 Br ³ | 20 | 19 | 1 | 0 |
| | | sS 2-0 Br | 7 | 7 | 0 | 0 |
| <u>Woss Lake Area</u> | | | | | | |
| Alston Creek | 1984 | aF 2-0 Br | 20 | 20 | 0 | 0 |
| | | D-fir 1-0 plugs | 20 | 15 | 0 | 5 |
| | | D-fir 2-0 Br | 60 | 60 | 0 | 0 |
| Oktwanch R. | 1984 | aF 1-0 plugs | 60 | 47 | 6 | 7 |
| | | D-fir 1-0 plugs | 55 | 48 | 2 | 5 |
| | | D-fir 2-0 Br | 45 | 44 | 0 | 1 |
| <u>Cowichan Lake Area</u> | | | | | | |
| Robertson R. | 1983 | D-fir 1-0 plugs | 100 | 100 | 0 | 0 |
| TOTAL | | | 437 | | | |

¹H = Healthy, PG = Partially girdled, G = Girdled

²aF = amabilis fir, sS = Sitka spruce, D-fir = Douglas-fir

³Br = Bare root

At Ronning Creek near Holberg in a weevil control trial, an average of 50% of 1-0 amabilis fir plugs were damaged. There was no significant difference in damage between the control, screefing or pine oil treatments. At Eric Lake near Holberg 4% of the 2-0 bare root Sitka spruce seedlings in 3 survival study plots were partially girdled.

At two Woss Lake plantations, 22% of the 1 - 0 amabilis fir plugs and 16% of the 1-0 Douglas-fir plugs were attacked but less than 1% of the larger 2-0 bare root Douglas-fir and amabilis fir stock showed damage.

Table 8. Percent 1-0 seedlings killed by a seedling weevil near Holberg.¹ Vancouver Island, 1984.

| Location | aF ² | Tree Species | | | |
|----------------|-----------------|--------------|------------------|-----|------------|
| | | wH | sS | wrC | |
| K 400 | 3 | 8 | - | - | |
| K 800 | 5 | 11 | 0 ³ | 3 | |
| K 900 | 11 | - | 4 ³ | - | (gF = 90%) |
| Hathaway Cr. | 18 | 29 | - | - | |
| S 155 | - | - | 0 | 6 | |
| S 153 | 19 | - | 13 | - | |
| SE 80 | 9 | 9 | - | - | |
| Topknot Main | 8 | 8 | 0 | 7 | |
| Moore Lk. Main | 3 | 7 | - ³ | 0 | |
| Macjack R. | - | - | 0 ³ | - | (gF = 18%) |
| Raft Main | 8 | 18 | 29 ³ | 30 | |
| Ronning Main | - | - | 0 ³ | - | |
| R 100 | - | - | 0 ³ | 0 | |
| R 100 | 0 | 0 | 0 | 11 | |
| San Josef R. | - | - | 0 ³ | - | |
| Ronning Main | - | - | 0 ³ | 0 | |
| T 21 | - | - | 0 ³ | - | |
| T 22 | 0 | 0 | - | 2 | |
| Average | 7 | 9 | 4/2 ³ | 3 | (gF = 35%) |

¹Based on survival plot assessment information provided by Western Forest Products, Holberg.

²aF = amabilis fir, wH = western hemlock, sS = Sitka spruce, wrC = western red cedar, gF = grand fir.

³1-2 stock

There is currently no method available to reliably project 1985 infestation levels, however previous infestations between 1960 and 1980 on the Queen Charlotte Islands subsided after one or two years.

Meadow voles, Microtus sp.

Mortality and girdling of Douglas-fir, western hemlock and western red cedar seedlings and saplings by rodent populations reported by B.C. Ministry of Forests, ranged from 40 to 70% in mixed stands on the east side of Texada Island at several sites in the central part of the Island.

On Galiano Island, 8 to 10% of the trees were killed at two plantations and 12% of the stems were partially girdled at a third site.

Since 1980 vole damage has increased mainly in coastal parts of the Region, especially on moist, brushy sites. Traditionally considered to have a four-year cycle, populations of the animal can number several hundred per hectare; up to 50/ha were trapped on Texada Island in 1984.

Other than trapping, population controls are not known.

Climatic injury

Frost-killed buds and/or dead branches and reddened foliage was evident on Douglas-fir and native pines and ornamental trees over a wide area of the Region in 1984 including Surrey and Sechelt Seed Orchards, Rhododendron Flats in Manning Park, Sasquatch Park at Harrison Lake and on Bowen Island. Flagging of up to 90% of the branches occurred on giant Sequoia at Agriculture Canada Experimental Station at Agassiz and to a lesser degree on a variety of exotic and native trees. Damage was attributed to moisture stress and strong cold winds in December 1983, and late frosts in the spring of 1984. By late summer of 1984, many trees showed signs of recovery and no long term damage is expected.

PESTS OF YOUNG STANDS

Seven immature Douglas-fir or mixed conifer plantations in the Region were examined for evidence of important forest pests (Table 9). The most widespread pest was spruce gall aphid, Adelges cooleyi which very lightly affected 12 to 100% of the Douglas-fir in 5 plantations. Swiss needle cast, Phaeocryptopus gaumannii lightly infected 1 to 33% of the Douglas-fir at 5 plantations and other pests which were present but caused little damage included blackheaded budworm, needle midge, nutrient deficiencies, deer browse and climatic injury. Tree mortality or significant levels of pest damage were not evident.

Sampling at all sites consisted of 12 circular plots 4 to 8 m radius, at 50 m intervals along four transect lines running diagonally across the slopes.

Table 9. Pests of young plantations, Vancouver Forest Region, 1984.

| Location | Host | Plot Area (ha) | No. of Trees examined | Pests | % of trees affected |
|------------------------------------|-------------------------------|-------------------|-----------------------------|--|-----------------------------|
| <u>Mainland</u> | | | | | |
| Urquhart Creek (NW of Yale) | D-fir ¹ | .06 | 115 | Spruce gall aphid D-fir needle midge blackheaded budworm Swiss needle cast | 71 60 21 12 |
| Spuzzum Cr. (NW of Yale) | D-fir | .195 | 134 | Spruce gall aphid needle midge Swiss needle cast | 93 83 33 |
| Cogburn Cr. (near Harrison Lk.) | D-fir | .09 | 105 | Spruce gall aphid climatic injury | 12 3 |
| Green River (Pemberton) | D-fir | .105 | 110 | Spruce gall aphid climatic injury Swiss needle cast | 96 51 1 |
| <u>Vancouver Island</u> | | | | | |
| Mt. Washington Rd. | D-fir, yC, wH, aF, wwP | .12 | 190 | Swiss needle cast climatic injury nutrient deficiency hemlock tip dieback mechanical injury | 28 6 3 2 2 |
| Quinsam R. | D-fir | .24 | 316 | climatic injury Swiss needle cast deer browse scarring & forking leader damage twig miner | 19 7 7 4 4 2 |
| Oyster R. Branch 200 | D-fir, wH, aF, wwP, wrC | .185 | 217 | spruce gall aphid Fork and crook nutrient deficiency deer browse leader damage | 100 14 9 8 7 |
| TOTAL | | .995 | 1 187 | | |

¹D-fir = Douglas-fir, yC = yellow cedar, wH = western hemlock, aF = amabilis fir, wwP = western white pine, wrC = western red cedar.

DECIDUOUS AND ORNAMENTAL TREE PESTS

Winter moth, Operophtera brumata

Defoliation of deciduous trees on southern Vancouver Island by the introduced species Operophtera brumata, continued for the 14th consecutive year, similar to previous years in extent and intensity in the Greater Victoria, Colwood and Saanich Peninsula areas. Defoliation of primarily Garry oak, also broadleaf maple and fruit trees, was generally light to moderate with pockets of severe defoliation in Victoria and on the Saanich Peninsula.

At Duncan where light defoliation was first recorded on less than 1 ha of fruit trees in 1983, populations increased and expanded to light to moderate defoliation of fruit trees and boulevard Garry oak and broadleaf maple over 2 ha. Surveys for larvae in the Lower Mainland were negative, but two larvae were found for the first time on Garry oak on Saltspring Island.

Between 1979 and 1982 a parasite release program in the Greater Victoria area released almost 30,000 larval parasites, Cyzenis albicans and Agrypon flaveolatum. These are now established in infested stands but have not effectively reduced winter moth populations.

The incidence of parasitism of 1984 winter moth larvae by both parasites increased to an average of 48.5% (range 20-79%) up from an average of 42.5% (range 5 - 78%) in 1983. C. albicans affected 43% of the winter moth populations, up from 37.4% in 1983 and A. flaveolatum emerged from 3.4% of the pupae, up from 2% in 1983. Phobocampa sp. and Macrocentrus sp., two native Hymenoptera, respectively parasitized 2% and 0% in 1984 compared to 1.4 and 1.7 in 1983 (Table 10). The sharp reduction in defoliation in 1984 at most release sites suggested increasing effectiveness of the parasites.

Table 10. Number and percent parasitism of winter moth from larval collections at parasite release sites in the Greater Victoria area, Vancouver Forest Region, 1984.

| | <u>No. of Adults</u> | | <u>Adults %</u> | |
|-----------------------------------|----------------------|-------|-----------------|------|
| | 1983 | 1984 | 1983 | 1984 |
| <u>No. of collections</u> | 31 | 34 | - | - |
| <u>O. brumata</u> pupae processed | 7 393 | 6 828 | | |
| <u>O. brumata</u> adults | 3 508 | 3 514 | 47 | 51 |
| <u>Parasites</u> | | | | |
| <u>Agrypon flaveolatum</u> | 152 | 234 | 2 | 3 |
| <u>Cyzenis albicans</u> | 2 765 | 2 946 | 37 | 43 |
| <u>Macrocentrus</u> sp. | 128 | - | 2 | - |
| <u>Phobocampa</u> sp. | 100 | 134 | 1 | 2 |

At Duncan 30% of the localized winter moth population was parasitized by C. albicans; the first documentation of the spread of the introduced parasite to a non-release location.

High populations of winter moth adults at several locations in the Greater Victoria area in November indicated continuing defoliation in 1985. To determine the presence and extent of the pest outside the infested areas, 3 pheromones in 9 live cone traps were located at Duncan, Nanaimo, and on Saltspring Island; these attracted an average of 22 male adults per trap (range 0-43) (Table 11).

Table 11. Male adult winter moth and bruce spanworm caught in pheromone traps, Vancouver Island, 1984.

| Location ¹ | Pheromone | No. adults/trap | |
|--------------------------|---------------------|-------------------|--------------------|
| | | <u>O. brumata</u> | <u>O. bruceata</u> |
| <u>Duncan</u> | | | |
| Nagle St. | (z,z,z) 1,3,6, 9-19 | 43 | 3 |
| Forest Museum | (z,z,z) 1,3,6, 9-19 | 40 | 14 |
| Woolworth Mall | (z,z,z) 1,3,6, 9-19 | 7 | 0 |
| <u>Saltspring Island</u> | | | |
| Beaver Point Park | (z,z,z) 1,3,6, 9-19 | 34 | 3 |
| Golf Course | (z,z,z) 1,3,6, 9-19 | 21 | 12 |
| Mt. Maxwell Eco. Res. | 6513-1 | 47 | 1 |
| <u>Nanaimo</u> | | | |
| Strickland St. | 6505-1 | 1 | 4 |
| Bowen Park | (z,z,z) 1,3,6, 9-19 | 1 | 43 |
| Long Lake | (z,z,z) 1,3,6, 9-19 | 0 | 4 |

¹ one trap/location

Traps were placed 0.6 to 6 km from the known infestation at Duncan and were widely dispersed over Saltspring Island and around Nanaimo. Results indicate widespread populations in both Duncan and on Saltspring Island. Populations at Nanaimo extends the distribution of the pest more than 50 km north of the known range in 1983. While no direct relationship has been determined between number of adults in traps and subsequent defoliation, some larval feeding could be expected on Saltspring Island in 1985 and defoliation may expand in Duncan.

Gypsy moth, Lymantria dispar

Trapping programs by Agriculture Canada caught 25 male adults in 12 traps in the Courtenay area, the second year of positive trapping results in this area. Larvae and egg masses were found and destroyed in the spring. As part of an ongoing cooperative program between Canadian

Forestry Service and Agriculture Canada to monitor male adult populations, 1-10 (total 45) pheromone-baited sticky traps were placed at 7 forested recreation sites on the Mainland and 10 on Vancouver Island but no moths were trapped. One adult was trapped at Cultus Lake and four adults and eight egg masses were found for the first time near Chilliwack.

Detection surveys and treatments to prevent establishment of the moth will continue in 1985.

Western oak looper, Lambdina f. somniaria

Defoliation of Garry oak on 16 ha at Mt. Maxwell Ecological Reserve on Saltspring Island by western oak looper, for the fifth consecutive year, averaged less than 5% (range 1 to 10%), a decline from the 5 to 20% range in 1983.

Larval development was unusually late and many larvae were very small in late July. Attempts to rear 320 larvae for parasite studies were mostly unsuccessful, and 88% of the collection failed to reach maturity. Only 9 parasites (6 Hymenoptera, 3 Diptera) emerged.

Further reduction in populations and defoliation is expected in 1985. One mature Douglas-fir partially defoliated by the looper for three years was partially attacked in 1984 by the Douglas-fir bark beetle. There was no evidence of defoliation of mature Douglas-fir which had been defoliated in 1981 and 1982.

Western tent caterpillar, Malacosoma c. pluviale

Tent caterpillar populations increased throughout the Region in 1984. Colonies completely defoliated roadside deciduous trees and shrubs and fruit trees in east coastal areas of Vancouver Island, Saltspring and other Gulf Islands. Severe defoliation of deciduous hosts was also common on the Lower Mainland between Vancouver and Cloverdale and south to Peace Arch Park on the Canada-USA border.

Previous infestations which persisted for up to nine years indicate that high populations may continue for another five years in the Region under favourable climatic conditions.

Fall webworm, Hyphantria cunea

Defoliation of a variety of deciduous trees and shrubs by fall webworm generally declined on the Lower Mainland and east coastal areas of Vancouver Island. Occasional webs on roadside trees and shrubs were common along Highway 401 from Vancouver to Agassiz from Horseshoe Bay northeast to Lillooet Lake, and along the east side of the lake from Mt. Currie to Rogers Creek. The highest numbers of colonies were in the Agassiz-Kent area.

On Vancouver Island, defoliation also declined considerably; 3 to 4 tents (avg. 1) per tree were common along roadsides from the Malahat north of Victoria to Campbell River, down from an average of 3 per tree in 1983. Damage is expected to continue in 1985.

Dogwood leaf blight, Gloeosporium sp.

The intensity of infection by this leaf blight decreased generally in the Region in 1984 but light to moderate infections continued over a wide area.

From Peace Arch Provincial Park in the south to Powell River in the northern part of the Mainland, 5 to 50% of the leaves on many dogwood trees were infected. From the Saanich Peninsula on Vancouver Island north to Gabriola Island 10 to 40% of the crowns of 30 to 100% of the trees were infected. Annual severe infections of the blight are suspected to be the cause of the increased lack of blossoms on dogwood trees throughout much of the Region, particularly at Alouette Lake Provincial Park and throughout the host range on Vancouver Island.

Persistent severe annual infections pose a threat of branch dieback as well as predisposing the trees to other pathogens. Moist spring weather in 1985 could contribute to continued moderate to severe infection.

Poplar shoot blight, Venturia populina

Severe infections affected many black cottonwood trees along the Silver-Skagit Road. Between Km 32 and 35, more than 95% of the cottonwood were severely infected and many had lost up to 80% of the leaves by mid-July. A 50 ha stand along the Fraser River south of Agassiz, severely infected in 1983, was only lightly infected in 1984. Although most of these trees have an unhealthy appearance, there was very little shoot mortality.

Cypress tip moth, Argyresthia cupressella

Foliar browning, branch and occasional tree or shrub mortality by Argyresthia cupressella continued for the ninth consecutive year on Vancouver Island and the Lower Mainland.

In Victoria moderate to severe attack of cupressaceous trees and shrubs such as Italian, Lawson, Leyland and Monterey cypresses, Oriental cedar and some species of juniper occurred from Gordon Head to Esquimalt and Victoria to the Saanich Peninsula. Light to moderate discoloration also occurred in Duncan, Nanaimo, Comox-Courtenay, Campbell River and in urban areas of the Lower Mainland.

Continued severe discoloration, browning, branch dieback and occasional mortality could occur in 1985.

A systemic insecticide application in March and April and at egg hatch in July could effectively control high populations and reduce damage.

SPECIAL SURVEYS

Environment 2000 Projects

In support of the federally sponsored forestry program, site inspections to assess forest pest conditions were made at five locations in the Region, three on the Mainland and two on Vancouver Island. Diseases, climatic injury and brush competition occurred at four sites, but no insect pests were evident (Table 12).

Table 12. Site inspections of Environment 2000 Projects, Vancouver Forest Region, 1984.

| Location | Project | Comments |
|---------------------------------|---------------------------|--|
| <u>Mainland</u> | | |
| <u>Duck Lake Road</u> Site 1 | plantation rehabilitation | Sun scald on occasional seedlings |
| Site 2 | right-of-way enhancement | No pests found. |
| Okeover Arm | plantation rehabilitation | Some D-fir foliage deformity and gF seedling mortality attributed to climatic injury |
| <u>Vancouver Island</u> | | |
| Buckley Bay | brushing | Heavy brush on 1/3 of area continued and area remained NSR, some general spot filling required, no pest problems noted. |
| Comox Lake | juvenile spacing | Fork, crook or scarring noted in 8/24 western hemlock; blister rust on 3/8 western white pine; Swiss needle cast light on 127 Douglas-fir. Dwarf mistletoe on hemlock and blister rust on pine will continue to be problems. Douglas-fir was major crop tree and had no serious pest problems. |

Acid Rain Monitoring Survey

Tree condition was assessed at 3 permanent study plots and 103 FIDS Permanent Sample Sites (PSS) throughout the Region as part of a national program to detect and monitor acid rain damage.

Permanent plots were established in a CFS permanent study area near Shawnigan Lake, on Saltspring Island and the UBC Forest Reserve near Haney. On the Mainland, 37 sites were examined from the Sechelt Peninsula to Texada Island; Squamish, Anderson and Lillooet lakes, Pemberton, Hope in the Fraser Canyon and near Haney. On Vancouver Island, 66 sites from the Saanich Peninsula north to the Holberg area were examined. There was no evidence, however, of damage directly attributable to acid rain or other pollutants. Additional long term study plots will be established in future years and PSS will continue to be monitored.

Exotic Plantations

Twelve plantations were examined in the Region in 1984 to determine the status of forest pests and the long term performance of exotic trees (Table 13). All except one of the plantations examined had been established during the 50's and none had been examined in the last ten years. Plantations on the Mainland were located near Haney, those on Vancouver Island in the Nanaimo area, Tsable and Salmon river valleys, Harmac, Sarita Lake and Tsolum River. The most successful species were red pine and European larch on Vancouver Island, both of which obtained good growth with few pest problems. The least successful were in a mixed stand of cedar, spruce, larch, pine, redwood and several deciduous species. European and Dunkeld larch performed the best at mainland plantations, attaining good height growth but developing many stems with crook or sweep. Corsican pine in the UBC Forest Reserve was generally of poor form and sickly appearance.

Table 13. Condition of trees and pest status in Exotic Plantations, Vancouver Forest Region, 1984.

| Plantation Location and Number | Tree Species | Year Established | Previously Examined | Condition of previous Examination | Results of 1984 Examination |
|--------------------------------|--|------------------|---------------------|--|--|
| <u>Mainland</u> | | | | | |
| UBC Forest XP 193 | Dunkeld, <u>Larix xeurolepis</u> and <u>L. decidua</u> | 1956 | 1972 | very good growth and good tree condition | Diameter range - 15.5-32 cm; average 21.9 cm; height range 11-20 m, average 18 m. Tree form was varied; straight stems - 32%; stems with crook or sweep - 45%; forked stem or top - 20%; broken or dead top - 3%. Light infection by <u>Armillaria</u> root rot but not believed to be cause of tree mortality; low populations of larch sawfly, <u>Pristiphora erichsonii</u> but only light defoliation present. |
| UBC Forest XP 97 | Corsican pine, <u>Pinus nigra</u> var. <u>poiretiana</u> | 1956 | 1972 | generally good growth and tree condition, light infection by a needle disease, <u>Lophodermium pinastri</u> , two trees dead from unknown causes | Diameter range 4.9-20.5 cm, average 13.8 cm; height range - 4-15 m, average 8 m. Tree form varied; straight - 29%; crook or sweep - 18%; forked stem - 8%; forked or broken top - 27%; dead top - 4%; bent or deformed top - 10%; samples from dead trees showed only secondary fungi but suggested site may be too wet for this tree species. |
| UBC Forest Haney XP 165 | Monterey pine <u>Pinus radiata</u> | 1958 | 1970 | some snow bend and breakage - stand generally healthy | Plantation not located. UBC staff reported all trees dead - no cause of mortality given. |
| <u>Vancouver Island</u> | | | | | |
| Nanaimo R. XP 2 | Red pine, <u>Pinus resinosa</u> | 1954 | 1970 | stand healthy with good growth - 10% of stems suppressed | Average diameter - 14 cm; average height - 9.3 m. Severe competition from natural species - 10% of exotic trees were suppressed; no pest problems but plantation was generally declining. |

| Plantation Location and Number | Tree Species | Year Established | Previously Examined | Condition of previous Examination | Results of 1984 Examination |
|--------------------------------|--------------------------------------|------------------|---------------------|--|---|
| North of Tsable R. XP 3 | Red pine, <u>P. resinosa</u> | 1954 | 1971 | Plantation in excellent condition | Average diameter - 16.8 cm; average height - 8.7 m. Stand in excellent condition; dead trees - 2%; suppressed trees - 2%; combined fork, crook or broken top - 10%; minor abiotic damage - 6%; healthy with good form - 80%; no pests recorded. |
| Tsolum R. XP 18A | Norway spruce, <u>Picea abies</u> | 1953 | 1971 | minor <u>Adelges cooleyi</u> and forked tops present | Not examined in 1984 but in 1983 there were many multiple attacks by spruce weevil resulting in bushy crowns and generally poor condition. Average diameter - 13 cm; average height - 9 m. A generally unsuccessfully plantation. |
| Salmon R. XP 56 | Red pine, <u>Pinus resinosa</u> | 1951 | 1973 | excellent condition | Average diameter - 20.6 cm; average height - 15.7 m. Plantation still in excellent condition - healthy trees - 92%; forked stems and minor branch damage - 8%. No insects or diseases recorded. |
| Salmon R. XP 57 | European larch, <u>Larix decidua</u> | 1951 | 1973 | excellent condition | Average diameter - 22.2 cm; average height - 23.8 m. Stand still in excellent condition. Healthy trees - 80%; combined fork, crook or broken top - 18%; dead - 2%. Many stems tend to develop "S" curves with a high, thin canopy resulting in a spindly appearance. No insects or diseases recorded. |

| Plantation Location and Number | Tree Species | Year Established | Previously Examined | Condition of previous Examination | Results of 1984 Examination |
|--------------------------------|--|------------------|---------------------|---|---|
| XP 75 Harmac | mixed cedar, spruce, larch, pine, fir, redwood, ash, poplar, sycamore, oak <u>Chamaecyparis</u> <u>Picea</u> <u>Larix</u> <u>Pinus</u> <u>Sequoia</u> <u>Fraxinus</u> <u>Populus</u> <u>Abies</u> <u>Platanus</u> <u>Quercus</u> | 1956 | 1968 | 225 trees examined pine needle disease - 12%; spruce aphid - 12%; dead or dying trees - 8%; some damage from drought | Plantation is an arboretum of over 40 species, each with 1 to 8 living specimens. New species added and dead ones removed up to 1977. Current average diameter - 20.8 cm; average height - 8 m. Tree mortality - 0-40% per species; tree form varies from good to very poor with forking, crooking, breakage, and extreme bushiness evident in several species. Several needle diseases, dieback and rusts, aphids and pitch moths present. Most successful species was poplar; least successful was larch. |
| Lens Creek XP 173, 174 | mixed pines | 1960 | 1971 | generally healthy | Not located - presumed to be destroyed by flooding. |
| Sarita L. XP 178 | mixed pines | 1958 | 1969 | Severe infection by <u>Scirrhia pini</u> with very poor tree survival | Severe brush competition, severe crook, bent trees, suppression and needle blight common throughout plantation. Occasional trees up to 15 m high, many open spaces indicated poor survival. |



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