

# Forest Insect and Disease Conditions

Nelson Forest Region  
1985

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**Appendices** - Available on request from the Pacific Forestry Centre, Canadian Forestry Service, 506 W. Burnside Rd., Victoria, B.C. V8Z 1M5

- I Location, area and number of pine and spruce trees recently killed by mountain pine beetle and spruce beetle respectively in the Nelson Forest Region.
- II Maps of mountain pine beetle and spruce beetle infestations in the Nelson Forest Region.
- III Pest Report: "Forest Tent Caterpillar, Trail, B.C.", R. Turnquist, June 1985.
- IV Pest Report: "Larch Budmoth Defoliation of Western Larch, Nelson and Kamloops Forest Regions", R.L. Ferris and R. Turnquist, July 1985.
- V Pest Report: "Spruce Beetle in the Upper Beaver-Duncan River Area, In and Bordering Glacier National Park", H. Peter Koot and R. Turnquist, October 1985.
- VI Pest Report: "Blackheaded Budworm Defoliation of Western Hemlock, British Columbia", C. Wood, L. Unger, R. Andrews, R. Erickson, N. Humphreys, R. Turnquist, October 1985.
- VII Pest Report: "Western Spruce Budworm In British Columbia: 1985 and Forecast for 1986", R. Erickson, R. Andrews, R. Turnquist, November 1985.
- VIII Summaries of Pest Problems in Provincial and National Parks, Nelson Forest Region, 1985.
- IX Summary of Pheromone Trap Program, Nelson Forest Region, 1985.

SUMMARY

This report outlines the status of forest insect and disease conditions in the Nelson Forest Region in 1985, and attempts to forecast population trends with emphasis given to pests capable of sudden damaging outbreaks.

Mountain pine beetle, which remains the most damaging pest in the Region, killed more than one million lodgepole and western white pine over 14 600 ha in 1 780 infestations. This is the fourth successive year of decline, down from 1.9 million trees killed in 1984. The key factors which influenced this decline were host depletion and logging of infested and susceptible stands. Pine needle diseases including red band needle disease, pine needle blights and Elytroderma needle disease were less evident than in 1984 and caused moderate infections of lodgepole, ponderosa and western white pines in scattered locations throughout the Region. Surveys for the pinewood nematode were negative.

Spruce beetle infestations decreased to 570 ha from 3 770 ha in 1984. The decrease coincides with a province-wide downward trend in area.

Larch casebearer populations were reduced, although light to moderate defoliation occurred in the same general area as in 1984. Populations of larch budmoth increased and defoliated 5 800 ha in the third year of infestation. Larch sawfly populations collapsed and no defoliation was recorded. Larch needle diseases continued, but at reduced levels throughout the host range.

Douglas-fir tussock moth populations remained at endemic levels after collapsing in 1984. Western spruce budworm lightly to moderately defoliated Douglas-fir for the eighth consecutive year in Johnstone Creek Provincial Park and surrounding areas. Douglas-fir beetle infestations declined with no current attack found in chronic areas. Western false hemlock looper moderately defoliated Douglas-fir in two locations north of Invermere. Rhabdocline needle cast of Douglas-fir was common, but at reduced levels from 1984.

Western hemlock looper populations collapsed and no defoliation was recorded. Western blackheaded budworm populations were severely reduced with only 150 ha of defoliation recorded, down from 19 000 ha in 1984. Conifer sawfly populations continued at higher levels, causing occasional trace to light defoliation generally and severe defoliation west of Creston.

The western balsam bark beetle complex continued at chronic levels in many high elevation alpine fir stands in the Region. Infestations of two-year-cycle spruce budworm appear to have collapsed, and no defoliation was recorded. Surveys for the balsam woolly aphid were negative in grand and alpine fir stands along the Canada-U.S.A. border.

Forest tent caterpillar populations continued at high levels and defoliated 125 ha of poplar and birch stands in Trail and Warfield areas.

Satin moth infestations in black cottonwood and trembling aspen stands continued along Slocan Lake, near Bridesville and Moyie.

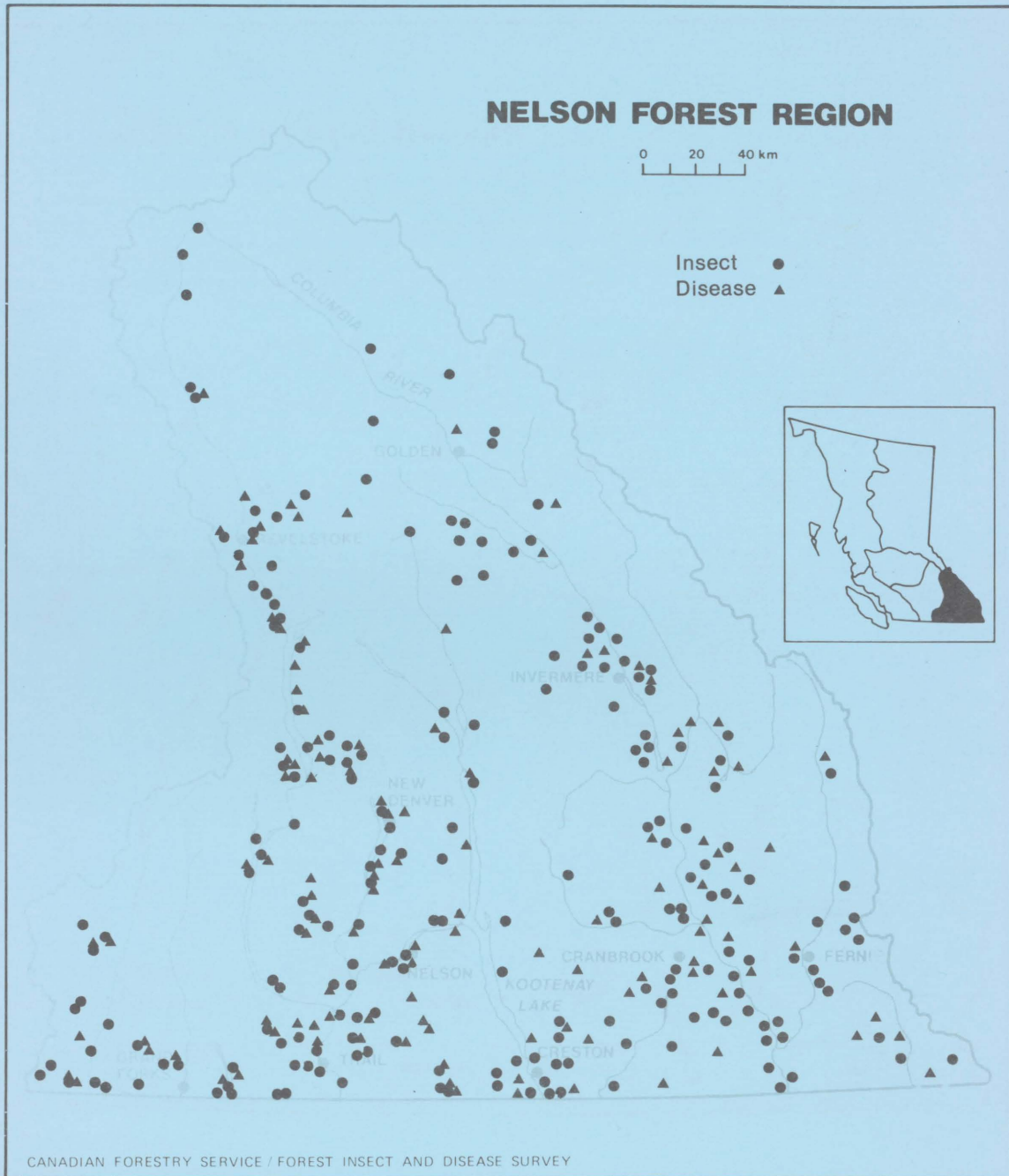
Douglas-fir tussock moth pheromone-baited traps were located in 26 locations in the Region; adult males were trapped at only two locations. Thirty larch casebearer traps in six areas in the Region trapped adults in all locations. A larch budmoth pheromone trapping program involving 72 traps at two locations provided some positive data. No gypsy moths were caught in any of 38 pheromone traps in as many locations.

The 1985 field season extended from May 21 to October 4 and was marked by a prolonged hot, dry summer, with record numbers of forest fires. The hot, dry weather believed responsible for the decreased intensity of various shoot, leaf and needle diseases in 1985 may also be conducive to reduced intensity in 1986.

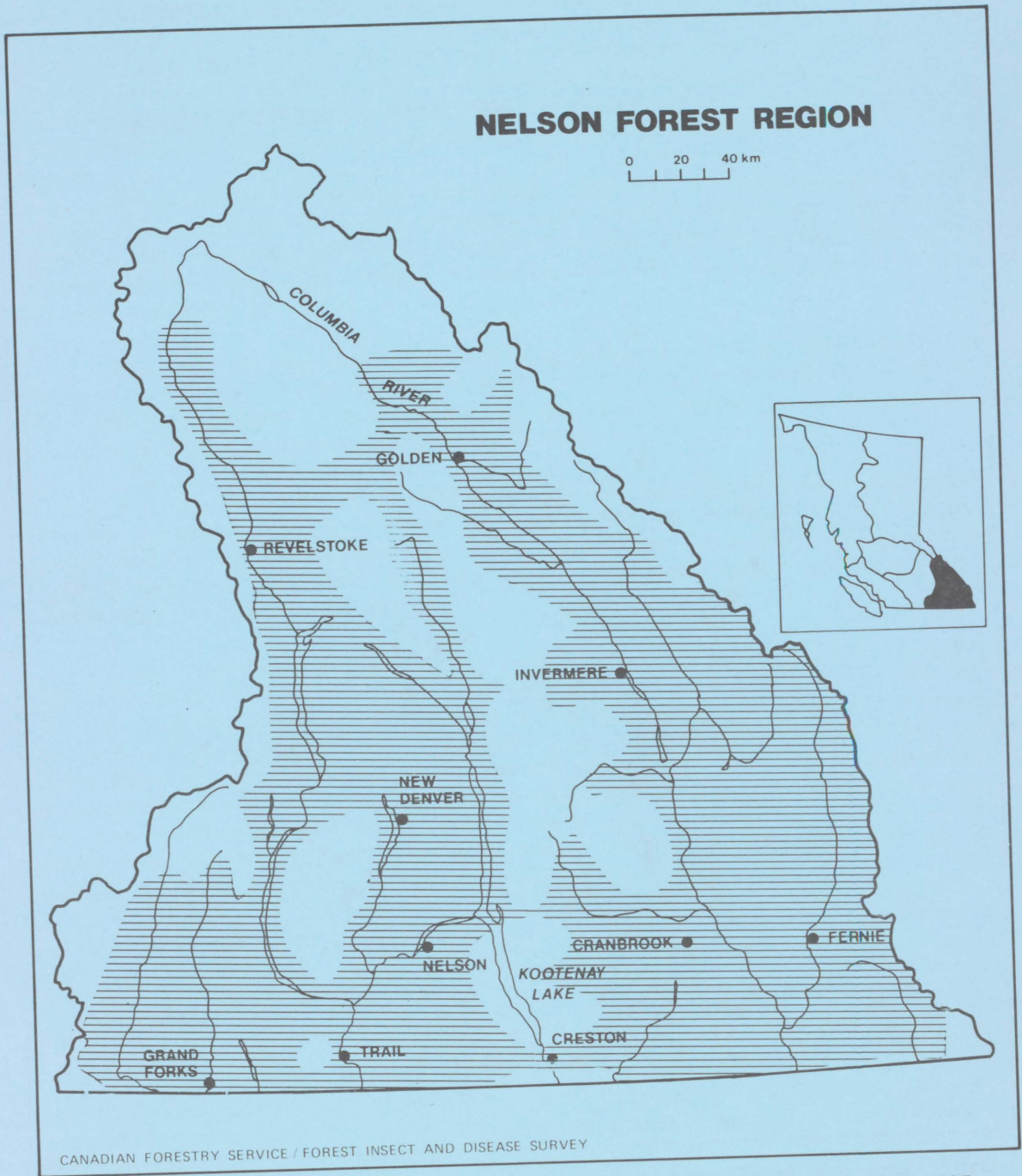
Special spring and fall surveys included collections and assessments of western blackheaded budworm, larch casebearer, larch budmoth, false hemlock looper, forest tent caterpillar, mountain pine beetle and spruce beetle, and plantation pests.

A total of 275 insect and 177 disease collections were submitted by FIDS for identification to the Pacific Forestry Centre. An additional 25 insect and 24 disease samples were collected by provincial agencies, industry and private sources. Locations where one or more collections were made by FIDS are shown on Map 1.

Approximately 40 hours of fixed-wing flying and approximately .5 hour helicopter flying time was provided by the B.C. Ministry of Forests to observe, map and photograph currently active forest pest damage throughout the Nelson Forest Region. In addition, approximately one hour of helicopter flying time was provided by Parks Canada to observe, map and monitor spruce beetle infestation in and adjacent to Glacier National Park. Aerial surveys were not undertaken until mid-September due to the extreme fire hazard during the summer months. As a result, some defoliation was not fully mapped. The area covered by aerial surveys is shown on Map 2.



Map 1. Locations where one or more forest insect and disease samples were collected in 1985.



Map 2. Areas covered by aerial surveys to map bark beetle and defoliator infestations, 1985.

PINE PESTS

**Mountain pine beetle, Dendroctonus ponderosae**

Mountain pine beetle killed more than one million lodgepole pine and western white pine over 14 600 ha in 1 780 infestations (Table 1 and Map 3), a decrease of nearly 6 600 ha from 21 200 ha attacked in 1984. This is the fourth successive year of decline, from 1.9 million trees killed in 1984, 2.1 million in 1983, 4.3 million in 1982 and 10.5 million in 1981. Forest fires have contributed to the reduction in area, particularly in the East Kootenay, where several large areas of beetle attacked timber were burned. Host depletion from previous beetle attacks and timely harvesting of susceptible and infested pine stands has limited the expansion of infestations. Additionally, the rate of expansion continues to decline due to extended life cycles of the insect at higher elevations where many of the infestations are now concentrated.

Volume losses of pine declined by almost 50% to nearly 380 000 m<sup>3</sup> from 685 000 m<sup>3</sup> in 1984. The Invermere TSA continued to have the largest volume loss, almost 60% (188 000 m<sup>3</sup>) of the total. Infestations numbered 1 780, of which 80% were in the Invermere and Cranbrook TSAs. In spite of the general decline, there was some expansion in localized areas south of Cranbrook (Supply Block H) and north of Invermere at Steamboat Mountain (Supply Block C).

Table 1. Location, number, area and volume of pine recently killed by mountain pine beetle as determined from aerial and ground surveys, Nelson Forest Region and National Parks, 1985.

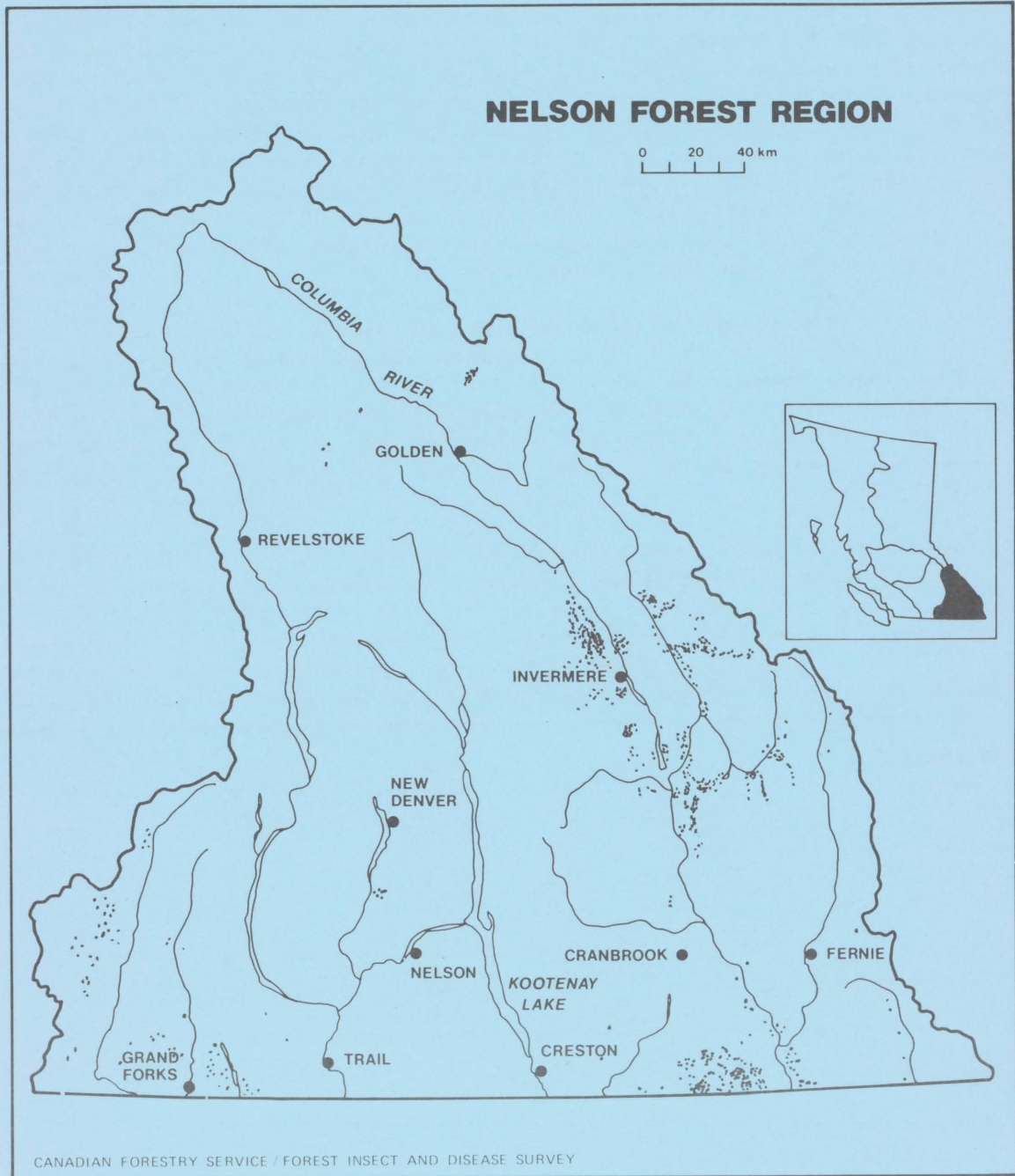
TSA <sup>1</sup> or Park	Tree Species <sup>3</sup>	Number of Infestations	Area <sup>2</sup> (ha)	Number of trees attacked in 1984	Volume loss (m <sup>3</sup> ) 1984 attack
Cranbrook	LP	744	3 850	372 800	134 200
Invermere	LP	674	8 300	521 400	187 700
Golden	LP	14	325	19 400	7 000
Revelstoke	wwP	6	5	150	150
Kootenay Lake	LP, wwP	15	35	2 000	1 000
Boundary	LP	251	1 200	105 600	38 000
Arrow	LP	15	250	23 000	9 200
Glacier National Park	wwP	3	65	350	350
Kootenay National Park	LP	58	600	4 000	1 500
<b>Total</b>		<b>1 780</b>	<b>14 630</b>	<b>1 048 700</b>	<b>379 100</b>

<sup>1</sup>Timber Supply Area

<sup>2</sup>Areas of "grey" not included

<sup>3</sup>LP = lodgepole pine, wwP = western white pine





Map 3. Areas of pine recently killed by mountain pine beetle, determined by aerial and ground surveys, 1985.

Infestations in the Cranbrook TSA increased slightly in 1985 to 3 850 ha, up from 3 600 ha in 1984. Major infestations include the Ward-Gilnockie creeks area, and along Caven, Bloom and Purcell creeks. Specific areas of expansion include parts of Caven Creek, Cherry Lake, Upper Yahk River and along the Galton Range between the Wigwam River and Phillipps Creek. Much of the expansion was in the form of increases in numbers of small spot infestations, which with larger areas numbered 744 in the TSA. Scattered small pockets of infestation also continue in the Upper Flathead Valley where few trees remain after previous epidemics. Apart from areas along the Galton Range which are too steep for salvage logging, most other areas are being actively addressed through harvesting.

In the Invermere TSA, infestations declined for the fourth consecutive year to 8 300 ha from 14 350 ha in 1984. Reduced levels of beetle activity were found in the designated control blocks adjacent to the B.C./Alberta border, where infestations have generally receded back from the headwaters of the Palliser, Mitchell, Cross and North and Middle White rivers. This decline is the result of harvesting susceptible and beetle-killed stands and the reduced rate of spread at higher elevations where the beetles mature more slowly. Forest fires in the Lussier and North White rivers and the Coyote, Ram and Findlay creeks areas played a major role in depleting beetle populations, some of which were still expanding. Contrasting the overall decline is the notable expansion north of Invermere along Frances Creek and on Steamboat Mountain, particularly the east side, where current attack (1985) averaged 30% of the pine component and the ratio of current attack to red (1984 attack) was 4.5 to 1. In nearby Kootenay National Park the number of beetle-killed lodgepole pine was similar to 1984 with nearly 4 000 killed in 58 infestations. No control action was undertaken in 1985 or planned for in 1986.

Infestations in lodgepole and western white pine stands in the Golden TSA declined by 40% to 325 ha from 520 ha in 1984. Apart from a few scattered pockets of attack of 3-5 trees each near and east of Golden, the only noteworthy infestations were along the Blaeberry River where about 15% of the lodgepole pine was attacked in 3 infestations over 300 ha, similar to 1984. Following a decade of severe infestation, host depletion has reduced populations to endemic levels along Columbia Reach and Bush Arm. No active infestations were noted along the Bush and Valenciennes rivers near the B.C./Alberta border. As in 1984, only a few small pockets of redtops were noted in western white pine along the Beaver River in Glacier National Park.

In the Kootenay Lake TSA, 15 infestations occurred over approximately 35 ha, down from 32 infestations over 570 ha in 1984. Western white pine mortality, probably caused by a combination of white pine blister rust and mountain pine beetle, decreased in the Trout Lake area to only 20 ha of light infestation on the southwest side of the lake. No recent attack was noted in the Duncan Lake or Kootenay Lake areas. Eight spot attacks of 1-5 trees each of both western white and lodgepole pine were mapped at Irishman Creek and along the Moyie River near Ryan. Infestations in lodgepole pine in the Hawkins-Freeman creeks area declined to 6 spots of 2-5 trees each, on approximately 2 ha.

In the Boundary TSA, 250 infestations covered approximately 1 200 ha, up from 109 over 1 025 ha in 1984. In areas of increasing activity, spots of 5-50 trees include Upper Sand, Snowball, Toronto and Volcanic creeks north of Grand Forks, and Treadmill, Parson and Bitter creeks near Christina Lake. Active areas include Mt. Ferroux-Weird Creek, where the beetle problem continues despite extensive salvage logging over the past 4 years, Trapping and Carmi creeks where salvage logging continues, and Rathmullen Creek, an area of high populations slated for logging during the fall of 1985 following a pheromone baiting program. Spot infestations continue in Copperkettle and Split creeks, the Beaverdell area, Pass and Clement creeks north of Greenwood, and Sutherland Creek and Castle Mtn. southeast of Christina Lake, and in the Sheff-May creeks area, west of Grand Forks. Salvage logging on crown land and TFL 8 will continue in 1986; however, beetle populations and the area attacked are expected to remain at or above 1985 levels.

Many infested lodgepole pine along Ferroux-Weird, Trapping and Rathmullen creeks in the Boundary TSA were attacked by ambrosia beetle during the spring of 1985. The presence of ambrosia beetle in pine beetle attacked trees is not uncommon, but it does have export implications as several overseas countries have quarantines on lumber showing signs of ambrosia beetle attack.

In the Arrow TSA, 15 infestations covered 250 ha, down from 27 over 500 ha in 1984. Although chronic infestations along Springer-Lemon-Chapleau creeks continue, the beetle is in higher elevation stands and is running out of host material. Several new, 10-tree spots were mapped near Nancy Greene Provincial Park, west of Castlegar, but no new areas were noted in the Santa Rosa Creek area, near the U.S. border. Spot infestations in western white pine along Trout Lake have died out, and no beetle activity was evident in the Halfway River and Upper Arrow Lakes area.

In the Revelstoke TSA, 6 infestations covered approximately 5 ha, down from 10 over 40 ha in 1984. The only areas of activity were several 10 to 25-tree spots in the Tangier River area and Albert Canyon east of Revelstoke. A small infestation at Crawford Creek, south of Revelstoke, has died out, as have infestations in scattered western white pine in Bigmouth Creek.

Although the incidence of current attack increased overall to 19% (range 0-32%) from 7% in 1984 in 7 areas examined, the increases are expected to be mostly localized in the Steamboat Mountain area of the East Kootenay and the Ferroux-Weird creeks area in the West Kootenay. Elsewhere infestations are expected to continue at static or declining intensities depending on host availability and overwintering brood survival. Harvesting of infested and susceptible pine in 1986 in the East Kootenay may decrease somewhat, as a result of the present surplus of more than 2 million m<sup>3</sup> of fire-killed timber, which has harvesting priority due to its more rapid loss of quality.

### Red band needle disease, Dothistroma (Scirrhia) pini

The incidence and intensity of infections in western white pine and lodgepole pine stands decreased throughout the Region in 1985. Infections in chronic areas such as Nelway and Summit Lake, although decreased, still caused discoloration and premature needle cast.

Red band needle disease, D. pini, the imperfect form of Scirrhia pini, was first identified in the Nelson Forest Region at Hills, south of Nakusp, in 1982. The disease has since been found from the U.S.-Canada border to Begbie Creek, south of Revelstoke, where this year it was found lightly infecting older needles on western white pine regeneration.

In a one ha permanent plot near Summit Lake, an average of 64% of the one-year-old needles of 20 immature western white pine were infected, down from 87% in 1984 and 75% in 1983, but still greater than the 51% recorded in 1982. Defoliation in the lower two-thirds of the crowns averaged 80%, with only current and occasionally, one-year-old foliage present in the mid-crown; 50% of the plot trees had 100% needle loss in the lower crowns. Mortality of 2 or 3 young (2m) western white pine in the plot area appears to have been caused by repeated severe infections of D. pini.

Defoliation of 80-100% continued in the lower crowns of lodgepole pine in the Nelway area, while upper crowns showed considerably less premature needle cast. Many of the trees in this area are taking on the characteristic "lion's tail" appearance, with only current and occasional one-year-old foliage remaining in mid-crowns. Scattered mortality of small (2m) trees continues in this area, again apparently due to repeated severe infections by D. pini.

Dry conditions during spore dispersal in 1985 indicate continuing but declining infection levels for 1986.

### Pine needle casts, Lophodermella spp. and Lophodermium sp.

A pine needle disease, Lophodermella montivaga, lightly infected 10% of the older needles on 100% of lodgepole pine regeneration for 2 km along Terraced Peaks Road northeast of Boundary Creek. L. concolor occurred sporadically in immature lodgepole pine stands along the North White River where 40% of year-old foliage was discolored on 15% of trees. Similar intensities occurred in young pine stands along the lower Bull River.

Another pine needle disease, Lophodermium sp., caused light infections on older needles on 43% of three-year-old planted and natural lodgepole pine in a 20 ha plantation on the Trapping Creek Road. A Lophodermium sp., possibly L. seditiosum was found lightly infecting older needles on pine regeneration in a spruce plantation near the Blueberry-Paulson summit, west of Castlegar.

The hot dry summer of 1985 which inhibited infection of new needles, will result in lower infection intensity, but increased casting of diseased older needles in 1986.

### **Elytroderma needle disease, Elytroderma deformans**

Elytroderma needle disease infected an average of 25% of 1985 needles on 60% of the immature ponderosa pine over a 10 ha area on the east side of Johnstone Creek Provincial Park, west of Rock Creek. This area has a history of Elytroderma infections, and moderate brooming is visible from Johnstone Creek to Midway, indicative of longstanding infections.

### **Pitch nodule moths, Petrova spp.**

A pheromone trapping program to determine the distribution and elevational differences, if any, between the northern pitch twig moth, Petrova albicapitana, and the metallic pitch nodule moth, Petrova metallica, was carried out in the Nelson Forest Region as part of a province-wide trapping program. Individual traps were placed in five locations at different elevations throughout the Region, and adults of one or the other species were found at all locations (Table 2).

Table 2. Location, elevation, species and number of Petrova spp. adults trapped, Nelson Forest Region, 1985.

Location	Elevation (m)	<u>Petrova</u> species	No. of adults trapped
Eugene Creek Road	900	<u>metallica</u>	8
Christina Lake	450	<u>metallica</u>	6
Crescent Valley	500	<u>albicapitana</u>	4
Estella Mines Road	1 800	<u>metallica</u>	55
Tamarack Lake	900	<u>albicapitana</u>	28

Species difference by elevation was not clearly shown by the trapping program in the Nelson Forest Region.

### **Western pine shoot borer, Eucosma sonomana**

One hundred young ponderosa pine were surveyed at each of two locations in the West Kootenay; near Hugh Keenlyside dam where no damage or larvae were found, and near Christina Lake Golf Course, where shoot borer damage was confined to two stems but no larvae were found. This potentially damaging pest attacks the terminal shoots of young, open-growing ponderosa pine, its principal host, causing stunted growth and leader mortality. It is also known to attack lodgepole pine and Engelmann spruce.

### Pine adelgids, Pineus spp.

In a 20 ha plantation at Trapping Creek, 4% of three-year-old planted and natural lodgepole pine were moderately infested with Pineus coloradensis while 53% of western white pine regeneration in a 20 ha Douglas-fir plantation at Makinson Flats were lightly infested by Pineus pinifoliae. Although considered minor pests, both are capable of causing some growth loss; however, serious effects are not expected to occur at either location.

### A pine needle blight, Leptomelanconium pinicola (cinereum)

Infection levels of this needle blight increased in ponderosa pine stands in the Elko-Baynes Lake-Grasmere area where up to 60% of the 1984 foliage was infected, as compared to 25% in 1984 (1983 foliage). With the exception of 1980, this blight has been common in the area since 1977, causing significant premature needle loss, which averaged 30% per year. Elsewhere, intensity levels were similar in scattered immature ponderosa pine near Norbury Lakes and in the Skookumchuck and Premier Lake areas.

For the period 1978-82, when severe infections occurred annually, radial growth reductions of 40% were recorded in several samples of mature ponderosa pine from the Elko-Baynes Lake area. After periods of severe infection and blighted needles have been cast, the foliage may take on a characteristic "bottle brush" appearance.

### Pinewood nematode, Bursaphelenchus (lignicolus) xylophilus

No pinewood nematode was found during surveys in the Nelson Forest Region in 1985. Stem discs and wood chips from upper, mid and lower sections of stressed or dying lodgepole pine were examined from Dry, Redding and McLatchie creeks and Pickering Hills in the East Kootenay and from Trapping, Kuskanax, and Springer creeks and Champion Lakes in the West Kootenay.

Although the nematode was not found in 8 wood samples, and several woodborer (Monochamus sp.)<sup>1</sup> larvae, several native bacterial feeding nematodes were successfully isolated.

The pinewood nematode was recently discovered in Ontario, Manitoba, and the United States and was responsible for mortality of pines over large areas in Japan during the past three decades. Surveys are required to provide phytosanitary certification for export of wood products to several countries.

### Rodent damage

Flagging associated with debarked branches was prominent on immature and mature lodgepole pine in the East Kootenay, including Yahk, Cranbook, Kimberley, Wardner to Elko and Kooconusa Lake. Similar damage

<sup>1</sup> a nematode vector

was also found on scattered, immature lodgepole pine in the Terraced Peaks area of the West Kootenay.

Squirrels are the suspected causal agent, wounding up to 10% of branches on 50% of pines in widely scattered groups. Though not directly affecting tree growth, open wounds can provide an infection court for various pathogens. Conversely, rodent chewing of about 60% of the western gall rust (*Endocronartium harknessii*) cankers appeared beneficial by reducing sporulation in a 25 ha stand of juvenile lodgepole pine at Old Town on Perry Creek.

### SPRUCE PESTS

#### Spruce beetle, *Dendroctonus rufipennis*

Spruce beetle infestations in mature Engelmann spruce stands covered 575 ha (Map 4), down considerably from 3 770 ha in 1984 and 2 700 ha in 1983. Volume loss from the 1984 attack in 44 infestations mapped during aerial surveys<sup>3</sup> declined to 19 070 m<sup>3</sup> (Table 3), down from 116 350 m<sup>3</sup> in 1984 and 51 000 m<sup>3</sup> in 1983. Logging of infested and susceptible stands, particularly in the Upper Duncan River and Pingston Creek areas, along with host depletion and natural control factors such as woodpecker predation, has contributed to the decline. A considerable reduction in area and volume loss is evident throughout British Columbia, and the decline in the Nelson Forest Region also reflects this trend.

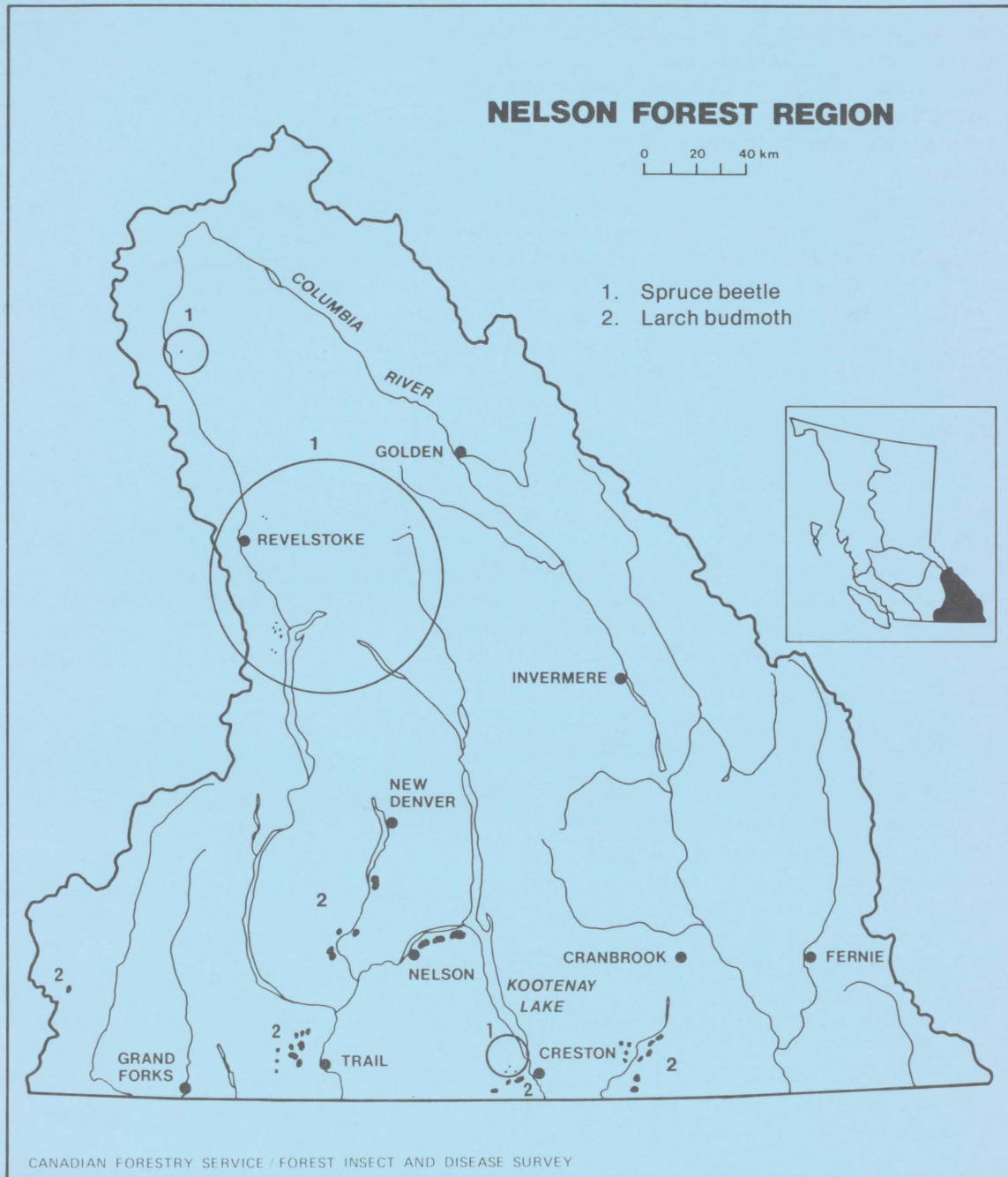
Table 3. Timber Supply Area (TSA), number of infestations, area and volume of mature Engelmann spruce recently killed by spruce beetle, Nelson Forest Region, 1985.

TSA or Park	No. of Infestations	Area (ha) <sup>1</sup>	Volume (m <sup>3</sup> ) <sup>2</sup> under attack	Red volume (m <sup>3</sup> ) 1984 attack	Current volume (m <sup>3</sup> ) 1985 attack
Revelstoke	30	380	92 610	15 030	1 850
Kootenay Lake	3	40	11 340	570	230
Arrow	7	75	14 210	1 950	280
Glacier National Park	4	80	26 950	1 520	540
Total	44	575	145 110	19 070	2 900

<sup>1</sup>Areas of "grey" not included

<sup>2</sup>Total spruce volume in infested areas

Spruce mortality in the Revelstoke TSA decreased to 375 ha in 1985 from 1 650 ha in 1984. The Pingston Creek drainage and South Cranberry Creek accounted for most of the spruce beetle infestation area, approximately 350 ha, down from 800 ha mapped in 1984. The only other areas of activity were Nicholls Creek, south of Bigmouth Creek, where 2 spots of 5 trees each were mapped and the Upper Tangier River where 2 areas totalling 25 ha were noted.



Map 4. Areas of recent tree mortality and defoliation detected during aerial and ground surveys, 1985.



Infestations in the Kootenay Lake TSA declined to only 40 ha of current attack, from 890 ha in 1984 and 450 ha in 1983. All of the infestations were in the Salmo-Creston Skyway area. Infestations in the Upper Duncan River area, adjacent to Glacier National Park collapsed, mainly due to extensive salvage logging and trap tree programs. No new areas of attack were mapped on crown land; however, approximately 80 ha of light attack were mapped inside Glacier National Park. An escaped slash fire which scorched and thus predisposed trees to attack, along with windthrow and a slashed line along the Park boundary, has created a potential for further population buildup in this area. However, the general reduction in beetle vigour and population levels will slow this potential buildup, and timely removal of predisposed trees, if necessary, would reduce any problem. Further surveys and assessments of beetle populations will continue in 1986 and 1987 to monitor the beetle's status.

In the Arrow TSA, four areas of approximately 75 ha of light attack occurred between South Fosthall and Fosthall creeks. No spruce beetle infestations were mapped in 1984, although 575 ha were mapped in 1983. Other previously infested areas such as Vanstone and Caribou creeks showed no recent attacks.

Spruce beetle populations in the East Kootenay are mostly back to endemic levels after several years of infestation in localized spruce stands.

Barring the unforeseen occurrence of excessive windthrow before beetle flight and with the continued use of trap trees and monitoring in hazard areas, spruce beetle populations should continue on a declining trend.

#### **Cooley spruce gall aphid, Adelges cooleyi**

Galls caused by the Cooley spruce gall aphid were found on 100% of immature Engelmann spruce in a 10m x 40m acid rain monitoring plot near the Blueberry-Paulson summit, west of Castlegar. No fresh galls were observed and light damage was confined to the lower third of the crowns in all trees. In a 40 ha, 10-year-old plantation in the same area, 60% of the young spruce were lightly infested with fresh galls. At Quartz Creek, west of Donald, 95% of 12-year-old Engelmann spruce averaged one gall per branch throughout a 70 ha plantation. Aphids infested 100% of 15-year-old spruce in a 75 ha plantation along the North White River, averaging 2 galls per branch; 15% of trees were severely infested with up to 10 galls per branch. The galls are of little importance under normal forest conditions, but may cause branch tip dieback, stunting, and deformity in younger trees if heavy infestation persists.

LARCH PESTS**Larch casebearer, Coleophora laricella**

Defoliation of western larch continued at substantially reduced intensity throughout much of the host range, but mostly in eastern portions of the Region where 40 000 ha were defoliated in 1984.

Defoliation was generally light to moderate around Cranbrook, east to Elko and along Koochanusa Lake south to the B.C.-Montana border, near Canal Flats and at Anarchist Mountain east of Osoyoos. Very light defoliation occurred from Moyie Lake to Yahk, near Creston, and at Fruitvale. Light defoliation was also evident for the first time at Wilson Creek near Slocan Lake which is relatively isolated from casebearer populations elsewhere in the West Kootenay. Defoliation averaged 8% (range 0-35) at 11 permanent sampling sites between Anarchist Mountain and Elko. Needle mining by young larvae was very light in August after initial defoliation by the previous generation in May-June. Defoliation was occasionally associated with discoloration caused by larch needle diseases Hypodermella laricis and Meria laricis, but not to the extent that occurred in 1984. Precise separation of damage caused by C. laricella and the larch budmoth, Zeiraphera improbana, was more difficult when they occurred in the same general area at mid-slope along a valley.

Assessments of overwintering larval populations at 10 locations in the Region indicate only negligible to light defoliation for larch stands in 1986 between Anarchist Mountain and Elko. Predictions are based on the number of larvae per 100 fascicles of foliage (Table 4).

Table 4. Predicted defoliation of western larch in 1986 by larch casebearer based on overwintering larval populations, Nelson Forest Region, 1985.

Location	Avg. no. overwintering larvae per		Predicted <sup>1</sup> defoliation, 1986
	45 cm branch	100 fascicles	
Jaffray	3.7	2.5	Negligible
Koochanusa Lake	1.6	1.3	"
Ellenvale Creek	8.0	3.6	"
Cranbrook	11.1	6.7	"
East Arrow Creek	8.6	5.1	"
Rykerts	4.8	4.3	"
Salmo	2.3	1.7	"
Thrus	11.4	8.8	"
Fruitvale	69.8	39.8	Light
Anarchist Mtn.	8.5	4.6	Negligible

<sup>1</sup>Defoliation: Negligible - no visible defoliation or discoloration;  
Light - 1-25%; Moderate - 26-50%; Severe - 51+%

The incidence of pupal parasitism in June by both native and introduced parasites increased to an average of 14% from 2% in 1984 in 16 areas examined. As part of a continuing biological control program, 4 900 male and female Chrysocharis laricinellae and 29 Agathis pumila parasites from Austria were released against the larch casebearer. These were

introduced from mid-June to early August in six infested stands near Cranbrook, Wycliffe, and Elko in the East Kootenay and Wilson Creek in the West Kootenay.

Pheromone-baited traps were deployed for the second consecutive year to monitor casebearer populations and spread beyond known distribution limits. Individual traps averaged 69 moths each at 6 locations and indicated a northward migration within the range of western larch.

#### **Larch budmoth, Zeiraphera improbana**

Larch budmoth outbreaks continued for the third consecutive year, increasing to 5 800 ha in 43 infestations, up from 1 100 ha in 10 areas in 1984, but down from 6 600 ha in 36 locations in 1983. Infestations mapped mostly from ground observation (see Map 4) were between 1 200 and 1 800 m elevation. Aerial surveys carried out in mid-September (when larch is discoloring naturally) made delineation of defoliated areas difficult, thus the actual area defoliated and numbers of infestations may be higher than reported.

Budmoth feeding in the Hanna-Murphy creeks and Nancy Greene Summit areas continued for the third consecutive year. Defoliation was also noted on Red Mountain, Old Glory and along Big Sheep Creek. Defoliation was noted for the first time in the Mt. Ferroux-Little Nipple Mtn. area of the Boundary Forest District, adjacent to the Kamloops Region. Scattered, light defoliation was noted in the Valhalla Range on the west side of Slocan Lake, above Slocan City, Winlaw and Passmore in the Slocan Valley. Defoliation was also recorded along the west arm of Kootenay Lake, from Five Mile Creek to Procter, and occasionally scattered in the Kokanee Creek area. Discoloration occurred along Summit and Maryland creeks, and above the South Salmo River, south of Ripple Creek in the Salmo-Creston Skyway area. Budmoth outbreaks were also mapped east of the Moyie River from Stone to Manson creeks, in the American Creek area, and between Irishman and Englishman creeks, west of the Moyie River.

This is a continuation of the fourth larch budmoth outbreak in the Nelson Forest Region since 1965, but only the third time that defoliation has been recorded in the East Kootenay.

Parasite information from four mass collections at three locations in the West Kootenay showed an average parasitism level of 31% (range 4-70%) of which 58% were Diptera and 42% Hymenoptera parasites. Unfortunately, little is known about the biology of the larch budmoth or its parasites in British Columbia, so little inference can yet be drawn from this information.

The larch budmoth population in the Nelson Forest Region was originally thought to have consisted of two separate races or subspecies, as occurs in Switzerland. However, a pheromone trapping program consisting of 36 traps of five different concentrations at each of two locations in the West Kootenay has narrowed identification to one race or

subspecies, based on time of flight and attraction to pheromone concentration. Additional studies will be pursued in 1986.

**Larch sawfly, Pristiphora erichsonii**

After three years at epidemic levels in the East Kootenay, sawfly populations collapsed. Factors contributing to the collapse were parasitism and rodent predation of pupae. Examination of larch stands formerly defoliated at Lost Dog Lake, Skookumchuck, Fernie and Sparwood showed no signs of sawfly feeding. Several isolated pockets of trace defoliation were noted in juvenile stands in the Flathead River Valley. Sawfly populations are expected to remain low in 1986.

**Larch shoot moth, Argyresthia laricella**

Twig mining by this shoot moth killed up to 35% of branch tips on 15% of immature western larch at Ellenvale Creek near Radium. Damage occurred on about 10 ha, a portion of which was recently thinned. Consequences of damage may include some crown deformity which will impact more severely on the thinned area since tree density is less.

**Larch needle diseases, Hypodermella laricis and Meria laricis**

The incidence and intensity of larch needle diseases generally decreased throughout the Region, probably due to drier conditions less favorable to spore dispersal during bud burst and needle elongation.

In the West Kootenay, light to moderate infections by H. laricis were found from west of Castlegar to Anarchist Mtn. Intensity averaged 15%, while from 20 to 100% of crowns were infected at Trapping Creek, Boundary Creek, Conkle Lake Road, and near the Rosslund cutoff. Infections were generally heavier in the lower crowns, and on younger stems. Along Conkle Lake Road, site of the most severe infections in 1984, several young stems appear to have suffered mortality due to repeated severe infections.

In the East Kootenay, H. laricis infections were more sporadic and of lighter intensity than in 1984. The most serious foliage discoloration was at Ram Creek where 40% infection occurred on 100% of larch on 200 ha. Along White River, 90% of immature roadside larch had 25% of the crowns infected over 10 ha. Similar larch stands north and south of this area were basically disease free. Immature larch along Flathead River averaged 70% infection on 50 ha.

Infections by M. laricis were also light to moderate, with heavier infections on younger stems. Intensity averaged 20% in the West Kootenay where from 30 to 90% of stems were infected at Memphis Creek and along Slocan Lake, at Fauquier, along Mosquito Creek, north of Nakusp, and in the Winlaw and Ymir areas.

### A top-kill of western larch

A top dieback, not associated with porcupine or rodent damage, was found on immature larch in the Salmo and Mosquito Creek areas. Damaged trees were up to 10 m tall and in isolated pockets of 1-10 trees. The causal agent may be a stem canker with symptoms characteristic of a dieback disease, Potebniomyces coniferarum, but the absence of fruiting bodies prevented positive identification. Repeated severe infections of larch needle diseases, Hypodermella and Meria laricis, or repeated defoliation by larch casebearer, Coleophora laricella may have caused the dieback.

### European larch canker, Lachnellula willkommii

This disease, potentially damaging to all age classes of western, alpine and eastern larch, is currently established in New Brunswick, Nova Scotia and some eastern states. Although surveys to detect this pathogen in western larch stands in the Region were negative, one sample was found of a related saprophytic fungus, Lachnellula occidentalis, which does not affect tree growth.

## DOUGLAS-FIR PESTS

### Douglas-fir tussock moth, Orgyia pseudotsugata

The tussock moth population remained low in 1985 after collapsing in 1983, following three consecutive years of defoliation in the Rock Creek and Christina Lake areas. No larvae were found in beating samples throughout the old infestation area. Seven pheromone traps (0.1% (z)-6-heneicosen-11-one) were placed at Rock Creek and at Christina Lake Golf Course to monitor adult males. Two adults were found in traps at Christina Lake Golf Course, and one at Rock Creek. Populations should remain low in 1986 and no defoliation is expected.

In a separate pheromone trapping program, to determine the distribution of Douglas-fir tussock moth, five traps each were placed at 12 locations in the West Kootenay and at 12 locations in the East Kootenay. No Douglas-fir tussock moths were trapped in any of the 24 locations. However, rusty tussock moth, Orgyia antiqua badia and pine tussock moth, Dasychira grisefacta were found in most locations (see Table 5).

The negative collections at the 24 trapping locations reflect the current endemic population. The trapping program may be repeated during a period of higher populations.

An assessment in the Rock Creek area indicated that most trees were recovering from the 1982-83 tussock moth infestation. Thin crowns, top-kill and mortality is evident in 1-5% of these stems; however, other factors such as root rot may also be involved.

Table 5. Location of Douglas-fir tussock moth pheromone traps and number of adult males trapped, Nelson Forest Region, 1985.

Location	<u>Orgyia</u> <u>pseudotsugata</u>	<u>Orgyia a.</u> <u>badia</u>	<u>Dasychira</u> <u>grisefacta</u>
Rock Creek	1	0	16
Christina Lake Golf Course	2	0	1
Wilson Creek Rd. (Nakusp)	0	9	97
Eugene Creek Road (Beaverdell)	0	8	86
Fauquier	0	3	4
Clanwilliam (Revelstoke)	0	19	14
Galena Bay	0	5	18
New Denver	0	5	7
Kaslo	0	10	9
Downie Creek	0	11	7
Mica Creek	0	26	15
Blewett (Nelson)	0	26	21
Duncan Dam	0	8	172
Fruitvale	0	11	6
Golden (east)	0	9	27
Kingsgate-Shorty Creek Road	0	44	29
Newgate	0	4	35
Michel Creek	0	11	38
Crowsnest Pass	0	5	72
Cokato Rd. (Fernie)	0	16	21
Elko	0	8	11
Grasmere	0	0	41
Lazy Lake Road (Wasa)	0	0	89
Creston (North)	0	5	59
Gold Creek Road (Cranbrook)	0	11	81
Skookunchuck	0	0	153

#### Western spruce budworm, Choristoneura occidentalis

Moderate to heavy defoliation by C. occidentalis occurred over approximately 60 ha as compared to 100 ha in 1984, in and around Johnstone Creek Provincial Park. However, up to 70% defoliation was observed, an increase in severity from the 25% recorded in 1984. Populations have persisted between Rock Creek and Bridesville for the past eight years, but have not spread beyond this general area.

#### Douglas-fir beetle, Dendroctonus pseudotsugae

Douglas-fir bark beetle attacks generally decreased in the West Kootenay. No recent attack was noted along the north shore of the west arm of Kootenay Lake, where 12 spot infestations were mapped in 1984. Logging and lack of host material contributed to this decline. One small spot infestation was mapped along the north shore of the northeast arm of Upper

Arrow Lake, down from seven spot infestations in 1984.

No current attack was recorded at Christina Lake Golf Course, where nine trees previously defoliated by Douglas-fir tussock moth were attacked over the past two years. In the Rock Creek area, a survey of 20 Douglas-fir previously defoliated by the tussock moth found two old attacked trees, but no current attack.

**Western false hemlock looper, Nepytia freemani**

Larval populations increased, causing moderate defoliation in two small spots north of Invermere, where trace defoliation occurred in 1984. The upper crowns of immature Douglas-fir were up to 70% defoliated on 50 ha in a Christmas tree production area near Wilmer and Forster Creek. Loopers have been active near Invermere since 1983, but elsewhere in the Columbia Valley, populations have been low throughout the host range.

An average of 2.1 eggs per sample from overwintering egg population assessments along Westside Road near Wilmer and Forster Creek indicates negligible defoliation in 1986.

Monitoring of larval populations will be expanded in 1986 from early to mid-summer in Christmas tree growing areas, as defoliation can be detrimental to the marketability of this product.

**Armillaria root disease, Armillaria sp.**

Armillaria root disease, which is common throughout the Nelson Forest Region, severely infected two 10-year-old Douglas-fir plantations south of Revelstoke. At Begbie Creek, where the disease centers were easily seen as pockets of 2-4 or more dead trees, 21% of Douglas-fir in a 50 ha plantation were infected with Armillaria sp. root rot. Near Shelter Bay, 10% of Douglas-fir in a 40 ha plantation were infected. This disease is of major concern due to its ability to survive in stumps or roots for 50 years or more and re-infect young stock. Management alternatives include stump removal prior to planting, planting of resistant species, or accepting a certain percentage of mortality and growth loss in Douglas-fir plantations.

**Rhabdocline needle cast, Rhabdocline pseudotsugae**

Rhabdocline needle cast infection of current and one-year-old Douglas-fir needles was common in the West Kootenay in Douglas-fir plantations examined in 1985. At Begbie Creek, 80% of 10-year-old Douglas-fir in a 50 ha area were infected, 70% lightly and 10% moderately. At Shelter Bay, 53% of planted Douglas-fir over approximately 40 ha were lightly infected, while 26% of 5-year-old stock in 20 ha at Makinson Flats had light infections.

Infection levels in the East Kootenay declined from the previous two years. At Ram Creek where infections of regeneration Douglas-fir were severe for three consecutive years, only 10% of needles were infected on 25% of trees. Some trees are recovering from up to 60% defoliation.

Similar infection levels were recorded at Norbury lakes. Along the Fort Steele-Mission Rd., 20% of immature Douglas-fir averaged 35% foliage infection on 150 ha. Some minor growth loss may result from repeated infections; however, the disease is not considered a serious pest in natural forest conditions.

#### **Conifer-poplar rusts, Melampsora medusae and M. occidentalis**

These rusts, which differ from each other only in telial hosts and spore size, were common in Douglas-fir plantations examined in the Region. At Makinson Flats, 95% of planted stock were up to 50% infected; at Begbie Creek, 86% of the trees suffered up to 20% infection; at Shelter Bay, 57% of the trees had similar light infections. Along Jubilee Mtn. Lookout Road, nearly all immature Douglas-fir suffered up to 20% foliage infection. These rusts are capable of causing seedling mortality; there is no practical control in natural forests.

#### **A dieback of Douglas-fir, Sclerophoma pithyophila**

This parasitic microfungus which usually attacks trees stressed by drought or frost and causes stem cankers and dieback, caused light top and lateral dieback on 44% of 5-year-old Douglas-fir in a plantation at Makinson Flats, and on 18% of 10-year-old stock in a plantation near Shelter Bay. The Makinson Flats area is a known frost pocket, which probably predisposed the trees to infection by S. pithyophila, while the Shelter Bay site is in a bowl-like area, and moisture stress likely predisposed stems in this site. Repeated infections could cause the damaged trees to be predisposed to attacks by insects or pathogens. There is no feasible control in natural forests.

### WESTERN HEMLOCK PESTS

#### **Western blackheaded budworm, Acleris gloverana**

Defoliation caused by the western blackheaded budworm declined significantly to approximately 150 ha, down from approximately 19 000 ha in 1984. Light defoliation was observed from the ground at Cusson Creek, west of Nakusp, and at Goldstream River, north of Revelstoke. Part of this apparent reduction in defoliated area may be due to a mid-September aerial survey, normally undertaken in mid-summer when discoloration is most visible, along with the severe natural discoloration of western red cedar (cedar flagging) which made the cause of discoloration difficult to differentiate.

Early season sampling of western hemlock indicated moderate to high larval populations, 88% of random and Permanent Sampling Station three-tree beatings within the outbreak areas were positive, containing an average of 32 larvae, range 1-185, per sample. In the oldest area of the outbreak at Bostock Creek in Glacier National Park, populations were at their lowest level since 1981. Some top-kill and possible minor tree mortality as a consequence of 1984 defoliation was observed on intermediate and understory hemlock at Cougar Creek in Glacier National Park.



Rearings at Pacific Forestry Centre from field collections showed larval parasitism to be high. Collections from seven locations averaged 36% parasitism, range 0-65%, and mortality due to unknown causes was also high. Ninety-six percent of parasites reared were from the order Hymenoptera, with Glypta sp. and Apanteles sp. the most common, and 4% were from the order Diptera.

Very few eggs were found in samples collected from three locations in the Nelson Forest Region (see Table 6), further indication of a population collapse probably due to increased parasitism levels.

Table 6. Location, average number of healthy, blackheaded budworm eggs and predicted defoliation for 1986, based on twenty 45 cm branch samples per location, Nelson Forest Region, 1985.

Location	Avg. No. of healthy eggs per 45 cm branch	Predicted defoliation <sup>1</sup>
<u>Revelstoke TSA</u>		
Goldstream River	1.0	Trace
<u>Arrow TSA</u>		
Cusson Creek	.3	Trace
<u>Mt. Revelstoke National Park</u>		
Hamilton Creek	1.5	Trace

<sup>1</sup> Trace defoliation	-	5	healthy	eggs	per	45	cm	branch
Light defoliation	-	5-26	"	"	"	"	"	"
Moderate defoliation	-	27-59	"	"	"	"	"	"
Severe defoliation	-	60+	"	"	"	"	"	"

#### Western hemlock looper, Lambdina fiscellaria lugubrosa

Western hemlock looper populations remained at endemic levels after collapsing in 1984, following two consecutive years of defoliation. Only two larvae were found in beating samples throughout the old infestation area, and no defoliation was recorded.

Several locations in the Upper Arrow Lake-Columbia River area and associated drainages showed visible top-kill during aerial surveys; 450 ha of "grey" caused by the recent infestation was mapped. Areas of "grey" include: Pingston Creek, 145 ha; Mt. Revelstoke National Park near West Woolsey Creek, 95 ha; Albert Canyon, 100 ha; and Frisby Ridge, 110 ha.

#### Conifer sawflies, Neodiprion spp.

Defoliation of western hemlock and alpine fir by conifer sawflies was severe in an area 5 km long at Boundary Creek along the B.C.-Idaho border. Many trees were totally stripped of their old growth foliage and some suffered up to 90% total defoliation. Further defoliation could occur in 1986.

Elsewhere, populations continued to persist in areas previously defoliated by western hemlock looper and western blackheaded budworm. Light defoliation of understory trees and of older foliage in the lower crowns of mature trees occurred over one hectare at Keen Creek, west of Kaslo. Trace defoliation was observed at Goldstream River and at Cusson, Upper Koch, Dago and Quartz creeks, areas where populations have persisted over the past several years.

Beating samples of western hemlock in the Region were 71% positive, averaging 59 larvae per sample, up from 38 larvae in 73% of samples in 1984.

#### **Green-striped forest looper, Melanolophia imitata**

Populations of this potentially damaging defoliator continued to decline in western hemlock and western red cedar stands previously infested by the western hemlock looper. While the green-striped forest looper was present in 57% of beating samples in western hemlock, an average of only one larva per sample was found, down from three per sample in 1984 and seven per sample in 1983. Populations should remain low in 1986 and no defoliation is expected.

#### **A top dieback of western hemlock**

A top dieback of up to one metre was common on western hemlock regeneration up to five metres tall in the Dog-Blackbeard creeks area of Upper Koch Creek. A similar dieback also occurred in the Meadow Creek area. Damage samples examined at PFC showed signs of a parasitic microfungus, Sclerophoma sp., sunscald and moisture stress. Sclerophoma sp. commonly colonizes weakened or stressed trees, causing stem cankers, needle blight and dieback. Although secondary in nature, repeated severe infections could cause top dieback, resulting in multiple tops and poor form and predispose infected trees to other pathogens or insects. There is no feasible control in natural stands.

### TRUE FIR PESTS

#### **Western balsam bark beetle complex, Dryocoetes confusus, Ceratocystis dryocoetidis**

Tree mortality by this beetle, D. confusus and its associated blue stain fungus, C. dryocoetidis, is chronic at fluctuating levels throughout many alpine fir stands in the Region.

Recent tree mortality detected during aerial surveys in September ranged from 5 to 15% of the alpine fir component over 260 ha in 30 small infestations. Several larger chronic infestations, such as occurred near Revelstoke and in TFL 14 along the Spillimacheen River and adjacent drainages, were not assessed due to poor visibility at time of flight. In addition, the sporadic and frequently remote occurrence of these infestation defies consistent and accurate assessment from year to year.

Studies have indicated that the beetle rarely attacks more than 10 trees/ha in one year. Approximately 35% of alpine fir mortality is directly due to attack by the beetle, the remainder to the beetle-induced, lesion-causing fungus.

Ground surveys planned in 1985 of several infested stands in the Spillimacheen River Valley in TFL 14, were not completed. These will be considered again in 1986, to obtain additional knowledge of the insect/-disease complex and its association with *Armillaria* root rot, *Armillaria ostoyae*.

#### **Balsam woolly aphid, *Adelges piceae***

In response to reports of the aphid in northern Idaho, nearly 600 grand and alpine fir were examined near the Canada-U.S.A. border at Rykert's, Boundary Lake and Creek, Nelway, Paterson and along Kootenay Lake. Despite the occurrence of such typical symptoms as "storks nest" tops along Kootenay Lake, examinations here and elsewhere revealed no signs of the pest.

There has not been a significant change in distribution of the aphid in south coastal B.C.

#### **Two-year-cycle spruce budworm, *Choristoneura biennis***

Populations of this budworm declined to low levels and no defoliation was noted in the Region. A slight population increase occurred along Bugaboo Creek, but not enough to cause damage.

Pheromone-baited traps at North White River and Bugaboo, Baker and Glenogle creeks were set out for purposes of species identification and averaged 60 male moths each. At the present time, moth density per trap cannot be used for predictive purposes.

#### **A *Cytospora* canker of alpine fir, *Cytospora abietis***

Cankers of this pathogen were found associated with top-kill and mortality of up to three-quarters of the crown on 10% of regeneration alpine fir on 10 ha at Chauncey Creek. This disease is frequently an inhabitant of senescent branches and can lead to serious decadence in mature stands.

### WESTERN RED CEDAR PESTS

#### **Cedar flagging**

Severe discoloration of western red cedar due to cedar flagging, a natural occurrence that is more pronounced in dry years, was widespread in the Columbia River Valley and associated drainages. Flagging was also noticeable in the Slocan Valley and Kootenay Lake area. No long term effects are expected from this occurrence other than premature needle casting.

DECIDUOUS TREE PESTS**Forest tent caterpillar, Malacosoma disstria**

Forest tent caterpillar severely defoliated approximately 100 ha of mixed trembling aspen, white birch, black cottonwood, roadside shrubs and ornamental trees in the Warfield-Violin Lakes Road area, west of Trail. A further 25 ha of moderate defoliation occurred on trembling aspen and roadside shrubs above West Trail.

Egg mass surveys conducted during the fall found a ratio of slightly more than one new egg mass to one old egg mass, indicating continuing defoliation for 1986; however, 44% of these egg masses suffered some degree of parasitism. The presence of egg parasites, along with a naturally occurring nuclear polyhedrosis virus and a cytoplasmic virus found in larval collections, may contribute to a reduction in the population and the area defoliated. Further monitoring of forest tent caterpillar populations will continue in 1986.

**Satin moth, Leucoma salicis**

Satin moth larvae caused up to 50% defoliation of scattered black cottonwood and white poplar in the New Denver and Silverton areas. Defoliation of trembling aspen in small, 1 ha stands continued for the third consecutive year in the Anarchist Mtn.-Bridenville area. No defoliation and no larvae were found in the West Arm (Kootenay Lake) area where a large moth flight was observed in 1984. Occasional ornamental trees suffered trace to light defoliation in the Nelson area, and small numbers of larvae were found in conjunction with forest tent caterpillar in the Warfield area, west of Trail. Defoliation continued at Moyie townsite for the third consecutive year, where mature and sapling size black cottonwood and ornamental willows were 50% defoliated on 15 ha.

Larval parasitism in the New Denver area from two mass collections averaged 33% (range 17-49%), of which 73% were Hymenoptera and 27% Diptera. At Moyie, 7% of late instar larvae were parasitized. The light to moderate parasitism, along with a very light moth flight, indicates a possible reduction in the New Denver and Moyie area for 1986. A moderate moth flight observed in the Rock Creek area indicates continuing populations for the Rock Creek-Bridenville area for 1986.

**Birch leafminer, Lyonetia saliciella**

After one year of reduced activity, leafminers resumed to cause up to 80% discoloration of birches in scattered patches between Parson and Golden, along the Kicking Horse River west of Yoho National Park, the Blaeberry River and along the Illecillewaet River from Glacier National Park to Revelstoke. The largest single infestation occurred along the Blaeberry River in a previously cut-over area of immature birch, where more than 200 ha were affected. In the Columbia Valley an average 60% foliage discoloration occurred along Horsethief and Bugaboo creeks.

Even after more than a decade of continuous infestation, no lasting adverse effects such as top-kill or dieback were noted.

### **Birch leaf skeletonizer, Bucculatrix canadensisella**

No evidence of the skeletonizer was found in 1985, following the population collapse in 1984 at Trail. Little is known about this pest, its parasites and diseases; however, areas of previous outbreaks will continue to be monitored in 1986.

### **Elm leaf beetle, Pyrrhalta luteola**

The elm leaf beetle caused light to moderate defoliation of several ornamental elm trees in Nelson. This introduced species is of little significance in natural forest settings, but it can be a serious pest of ornamentals. It causes skeletonized foliage to turn brown and wither; repeated severe defoliation can make the trees susceptible to bark beetle attack.

### **A birch dieback, Sirococcus sp.**

This dieback, previously unknown on birch in North America, continued to cause twig and new growth dieback in 1985, after it was first collected and identified from the Summit Lake-Hills area in 1984. Further collections of the dieback confirmed its presence on white birch in several locations. Positive collections were made in the Summit Lake area, near Three Forks, at Grohman Narrows, Edgewood, and south of Kaslo. A collection from the Trail area proved negative. Further collections to determine the distribution of this disease will continue in 1986.

### **Gypsy moth, Lymantria dispar**

Pheromone-baited traps placed at 38 locations, mainly in provincial parks, to detect gypsy moth populations, were again negative. Park visitors from outside the Region, particularly from eastern Canada and U.S.A., are considered the primary vector responsible for the migration of this insect. A single adult was caught in an Agriculture Canada trap north of Cache Creek, and 14 moths were caught in 13 of Agriculture Canada's traps in the Lower Mainland.

A spray program using Bacillus thuringiensis was instituted this year in a localized area in Courtenay, following egg mass surveys and larval collections in early 1985. A similar spray program using B.t. was also conducted in Chilliwack. Gypsy moth is a major pest of deciduous trees and some conifers in eastern Canada and part of the U.S.A., including Washington State and most recently in northwestern Montana and Oregon. The trapping program will continue in 1986 for the seventh consecutive year in the Region.

## **MULTIPLE HOST PESTS**

### **Cone and seed pests**

Cone crops on Douglas-fir and Engelmann spruce were generally moderate to heavy in most areas of the Region. In eight areas examined, the incidence of infestation of Douglas-fir cones ranged from 0-80%, the

average being 46%. The most abundant cone pests were the Douglas-fir seed wasp, Megastigmus spermotrophus, found in 75% of samples, followed by the Douglas-fir coneworm, Dioryctria abietivorella, 63%, the Douglas-fir cone moth, Barbara colfaxiana, 50%, and a Douglas-fir cone scale midge, Contarinia washingtonensis, 38%.

On Engelmann spruce cones examined from 10 locations, the incidence of infestation ranged from 10-78%. The major pests were a spiral spruce-cone borer, Hylemya anthracina, and a spruce seedworm, Cydia strobilella infesting 60% and 30% of samples, respectively. A cone disease, inland spruce cone rust, Chrysomyxa pirolata, infected 20% of cones in 20% of samples examined.

Control of cone and seed pests in most natural stands is not practical, even though there is a need for seed from these areas. Preventative measures against damage are possible and practical only in limited areas such as seed orchards and seed production areas.

In support of a cooperative research study, western white pine cone crops were assessed at 35 locations in the Region. Cone crops were rated as moderate to heavy in most areas examined.

#### **Porcupine damage**

Approximately 5% of young lodgepole pine stems up to 4 m tall in the upper Boundary Creek area north of Greenwood suffered top, branch or whole tree mortality, due to debarking, likely caused by porcupine feeding.

Top-kill of up to 1.5 m was evident in 15% of immature western larch up to 15 m tall in a recently spaced stand along Grizzly Creek in the Slocan Valley. The damage, apparently caused by porcupine, could become significant if they continue to feed on what are now crop trees.

#### **Abiotic damage**

Suspected environmental conditions similar to winter drying or frost and moisture stress are believed to be responsible for severe desiccation of foliage and occasional mortality of immature Douglas-fir at the Highway 3/93-93/95 junction, east of Cranbrook. Damage symptoms appeared most severe along linear depressions in the landscape over approximately 20 ha adjacent to the highway intersection. Soil samples were also taken for analysis of possible chemical residue, but testing was not yet completed at time of writing.

Sunscald and moisture stress caused light needle discoloration and mortality throughout the crowns of 11% of 10-year-old stock in a 40 ha plantation near the Blueberry-Paulson summit. Frost caused light bud dieback on 17% of the trees in the same plantation. Neither of these conditions is serious, and since the trees are relatively vigorous, no long term damage is expected.

Late frosts desiccated new growth of regeneration Douglas-fir and some lodgepole pine and Engelmann spruce near Whiteswan Lake and in several small scattered pockets along the west side of Windermere Lake where up to half the crowns were completely defoliated on Douglas-fir up to one metre tall.

Late frosts were also responsible for causing light bud mortality on 39% of Douglas-fir in a 20 ha plantation at Makinson Flats.

#### **Snow moulds, Herpotrichia spp.**

Snow moulds infected 10-year-old Engelmann spruce in a 40 ha plantation near the Blueberry-Paulson summit. Light infections, confined to the lower branches, were found on 23% of planted spruce and were also found on lodgepole pine regeneration. H. juniperi infected 10% of foliage on 10% of understory western hemlock and western yew (new host record) in a localized area at Tangier River. These fungi, although capable of causing some damage in nurseries, are not considered a serious problem in natural forest conditions.

#### **A snow mould, Apostrasseria lunata**

Scattered mortality of western white pine regeneration and planted Douglas-fir seedlings due to infections by A. lunata occurred over a 20 ha area, 10 km east of Revelstoke. The confirmation of A. lunata on western white pine and Douglas-fir represents a new host record for both species. Currently, there are no practical management alternatives to avoid seedling mortality due to this fungus.

#### **Acid rain monitoring**

An acid rain monitoring plot, part of the Acid Rain National Early Warning System (ARNEWS) was established in the Blueberry-Paulson summit area in 1985. The 10x40m plot is one of six long term study plots established in British Columbia this year, and is part of a nationally standardized series of plots in which changes in vegetation, tree vigour and soils due to acidic rainfall will be monitored and, if necessary, quantified. Three plots were established in the Vancouver Region in 1984, the first year of the national program, and six more plots are planned for B.C. in 1986.

#### **PESTS OF YOUNG STANDS**

A total of 11 young stands, both planted and natural, were examined using a line-plot (fixed radius) system in the Nelson Forest Region in 1985 to identify and monitor pest problems which could affect future crops. Some of the more important pests have already been discussed under individual species headings; however, all pests are summarized in Table 7.

Table 7. Summary of pest problems in young stands, planted and natural, Nelson Forest Region, 1985.

Location	Species <sup>1</sup>	Planted (P) or Natural (N)		Stand Age (years)	No. of trees examined	Pest or problem	% of trees affected	Remarks
Begbie Creek	Df	P	10	44	<u>Amillaria</u> sp. root rot	20	root rot centres common in stand	
					<u>Rhabdocline pseudotsugae</u>	80	generally light infections	
					<u>Melampsora medusae/occidentalis</u>	86	" " "	
					<u>Adelges cooleyi</u>	80	lightly infested	
					deer browse	25		
						poor form and broken branches	14	caused by snow damage?
	wwP	N			4	<u>Cronartium ribicola</u>	50	cankers on branches
						<u>Pineus pinifoliae</u>	25	lightly infested
						<u>Dothistroma pini</u>	25	light infections on older needles
	wC	N			2	<u>Didymascella thujina</u>	100	light infections
alF	N			2	<u>Pucciniastrum epilobii</u>	100	" "	
Shelter Bay	Df	P	10	50	<u>Amillaria</u> sp. root rot	10	individual trees, rather than groups	
					<u>R. pseudotsugae</u>	53	generally light infections	
					<u>M. medusae/occidentalis</u>	57	" " "	
					broken multiple tops	22	caused by snow damage and deer browse?	
					<u>Sclerophoma pithyophila</u>	18	causes dieback and cankers	
	wC	N			6	none recorded		
	wH	N			2	" "		
	wwP	N			2	<u>C. ribicola</u>	50	cankers on branches



Location	Species <sup>1</sup>	Planted (P) or Natural (N)	Stand Age (years)	No. of trees examined	Pest or problem	% of trees affected	Remarks
Makinson Flats	Df	P	5	39	<u>Adelges cooleyi</u>	100	generally lightly infested
					<u>M. medusae/occidentalis</u>	95	generally light infections, 1 severe
					<u>R. pseudotsugae</u>	26	generally light infections
					broken, multiple leaders	44	caused by snow damage?
					deer browse	31	
					frost damage	39	causing light bud dieback
	wwP	N		15	<u>Pineus pinifoliae</u>	53	light to moderate infestations
					<u>C. ribicola</u>	20	branch cankers
Trapping Creek	lP	P&N	3	80	<u>Lophodermium</u> spp.	40	generally light infections on older needles
					poor form	23	caused by snow damage?
Porcupine Forest Road	eS	P	10	53	<u>A. cooleyi</u>	60	light attacks
					<u>Herpotrichia</u> spp.	32	on lower branches only
					sunscald and moisture stress	11	causing light needle discoloration
					bud dieback	17	frost damage
					poor form and broken branches	10	snow damage
	aIF	N		7	poor form and broken branches	10	snow damage
	lP	N		1	<u>Lophodermium</u> spp.	100	on older needles only
Quartz Creek	eS	P	10	54	<u>A. cooleyi</u>	94	light-heavy infestation of branch galls
					mechanical injury	5	minor damage
Beaverfoot River	lP	P	10	68	<u>Coleosporium asterum</u>	95	mostly light needle rust infections
					<u>Endocronartium harknessii</u>	3	stem infections
					<u>Hylobius warreni</u>	2	dead-very light infestation

Location	Species <sup>1</sup>	Planted (P) or Natural (N)	Stand Age (years)	No. of trees examined	Pest or problem	% of trees affected	Remarks
Skookumchuck	LP	N	20	64	<u>Synanthedon</u> sp.	16	pitch moth - mostly basal pitch masses
					<u>Petrova albicapitana</u>	10	light attacks on branches
					<u>E. harknessii</u>	6	light infections on branches
					Rodent damage	6	squirrel-minor branch debarking
					<u>Pineus coloradensis</u>	6	light infestation
					Deer browsing	5	minor damage to branch tips
	Df	N		9	none recorded		
	pP	N		5	" "		
N. White River	LP	P	15	37	<u>C. asterum</u>	27	usually 10% foliage infection
					<u>Petrova</u> spp.	22	occasional pitch nodules
					<u>Lophodermella</u> sp.	16	avg. 15% foliage infection
					<u>E. harknessii</u>	8	mostly branch cankers (light)
					eS	P	
Df			2	none recorded			
	alF			2	" "		
McLatchie Creek	LP	P	14	57	Poor form	39	breakage, forking, bending, mostly from excessive snow
					<u>Lophodermella</u> sp.	4	light needle infections
Windermere Creek	Df	N	16	30	Frost	17	up to 50% tip-kill
					<u>A. cooleyi</u>	33	light-moderate infestation
					browsing	17	mostly minor deer browsing
	LP	P	10	20	<u>C. asterum</u>	10	10% foliage infection
	pP	P	10	6	none found	-	
	eS	N	16	4	<u>A. cooleyi</u>	100	moderate-avg. 2 galls/branch

<sup>1</sup>Df = Douglas-fir; wWP = western white pine; alF = alpine fir; wC = western red cedar; wH = western hemlock; eS = Engelmann spruce;  
LP = lodgepole pine; pP = ponderosa pine.

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