Forest Insect and Disease Conditions

Nelson Forest Region 1984

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Government of Canada
Canadian Forestry Service

Gouvernement du Canada
Service canadien des forêts

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SUMMARY

This report outlines the status of forest insect and disease conditions in the Nelson Forest Region in 1984, 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 an estimated 1.9 million lodgepole and white pine over 21 200 ha in 1 350 infestations. This is the third successive year of decline, down slightly from 2.1 million trees killed in 1983. 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 much in evidence, causing moderate to severe infections of lodgepole, ponderosa and white pines in scattered locations through the Region. Surveys for the pinewood nematode, a potentially harmful pest of lodgepole pine, were negative.

Spruce beetle infestations increased to 3 770 ha from 2 700 ha in 1983. The largest single area of infestation was in the Pingston Creek drainage, where nearly 800 ha of recent mortality was mapped.

Larch casebearer populations intensified and lightly to severely defoliated 40 000 ha of western larch in southern portions of the East Kootenay. Larch needle diseases increased throughout the host range over about 20 000 ha. Populations of larch budmoth declined to 1 100 ha from 6 600 ha. In this third year of infestation, larch sawfly defoliated 3 000 ha of larch, down from 10 400 ha in 1983.

Douglas-fir tussock moth populations at Rock Creek collapsed after defoliating more than 2 000 ha of Douglas-fir in 1983. Western spruce budworm lightly defoliated Douglas-fir for the seventh consecutive year between Bridesville and Rock Creek. Douglas-fir beetle attack increased to 12 spot infestations, along the west arm of Kootenay Lake. Western false hemlock looper populations returned to near endemic levels near Invermere, following light defoliation on 110 ha in 1983. Rhabdocline needle cast was more widespread and severe in natural stands than in 1983, including Christmas tree production areas. Light infections of older Douglas-fir needles by Swiss needle cast were common near Castlegar, Rosebery and Nakusp.

Defoliation of western hemlock and western red cedar by western hemlock looper declined from 32 000 ha in the Region in 1983 to 100 ha of light defoliation in the Cusson and Ledge Creek areas. Some understory hemlock were lightly defoliated at Mountain Creek Campground. Blackheaded budworm defoliation of western hemlock and western red cedar stands increased dramatically from 120 ha in 1983 to 19 100 ha in the Mica Creek area south to Nakusp, and from Revelstoke east into Glacier National Park. Conifer sawflies increased but caused only minor defoliation in blackheaded budworm infestations.

The western balsam bark beetle complex, at chronic levels in many high elevation alpine fir stands, affected 4 350 ha throughout the Region. Infestations of two-year-cycle spruce budworm declined to only 200 ha from 2 000 ha at Baker and South Fosthall creeks. Surveys of grand and alpine fir stands for balsam woolly aphid along the Canada-USA border were negative.

Forest tent caterpillar increased and moderately defoliated poplar and birch groves near Trail and Satin moth increased and moderately defoliated black cottonwood and trembling aspen at Moyie, the Slocan Valley and, for the second year, west of Rock Creek.

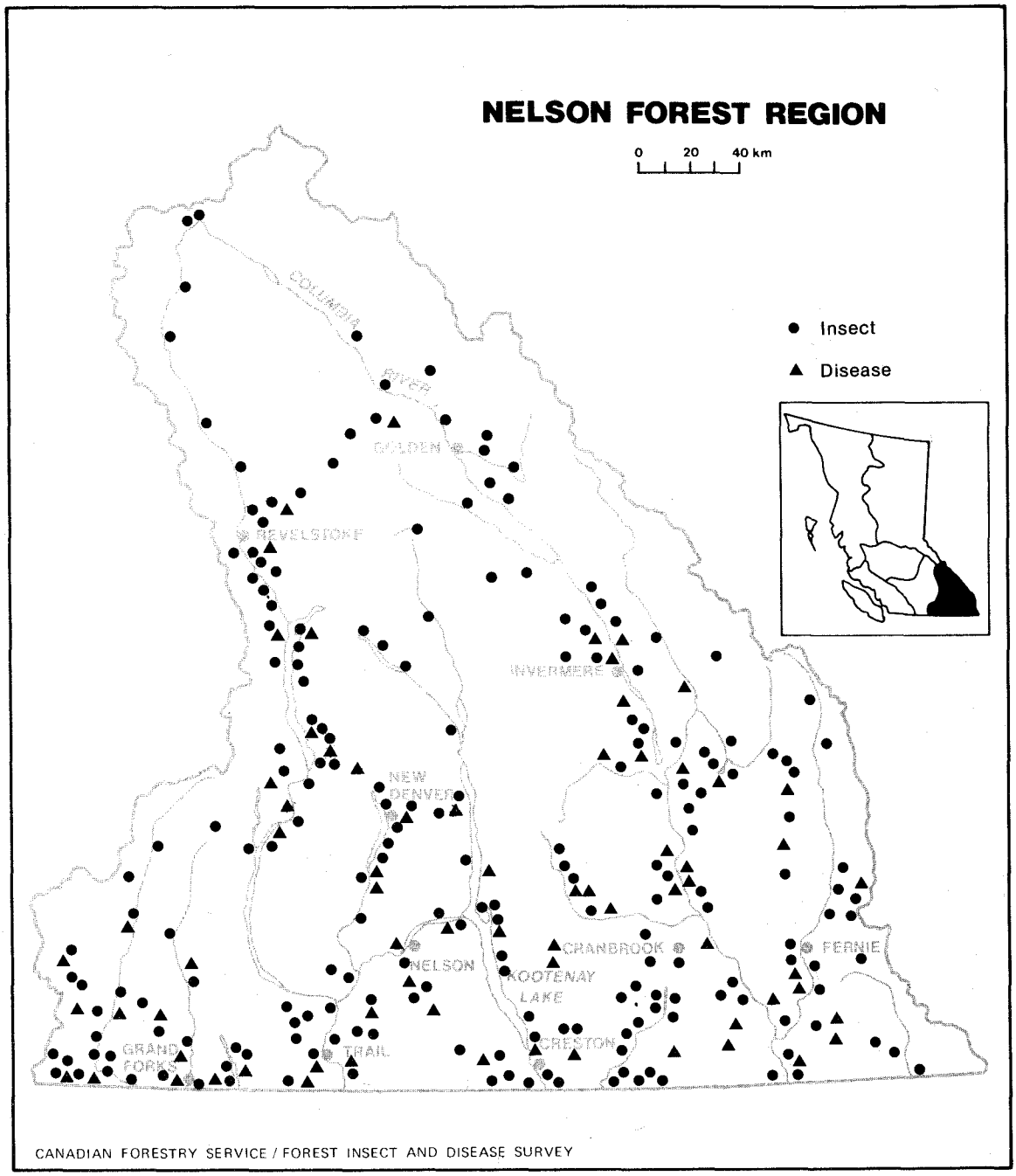
Single pheromone-baited gypsy moth traps at 36 locations, mainly in provincial parks, did not attract any moths. Douglas-fir tussock moth pheromone-baited traps located in two areas of the Boundary TSA were negative. Thirty-one larch casebearer traps at six locations in the West Kootenay trapped adults in all locations. A second year of trapping to test larch budmoth pheromones at Skookum-chuck again provided inconclusive data, as did traps from Hanna and Boundary creeks in the West Kootenay.

The 1984 field season extended from May 21 to October 1 and was marked by cool, damp weather in the spring followed by generally hot, dry weather during July and August. The cool, damp weather is believed responsible for the high incidence of various shoot, leaf and needle diseases, particularly on western larch. These weather conditions may also have an effect on needle diseases in 1985.

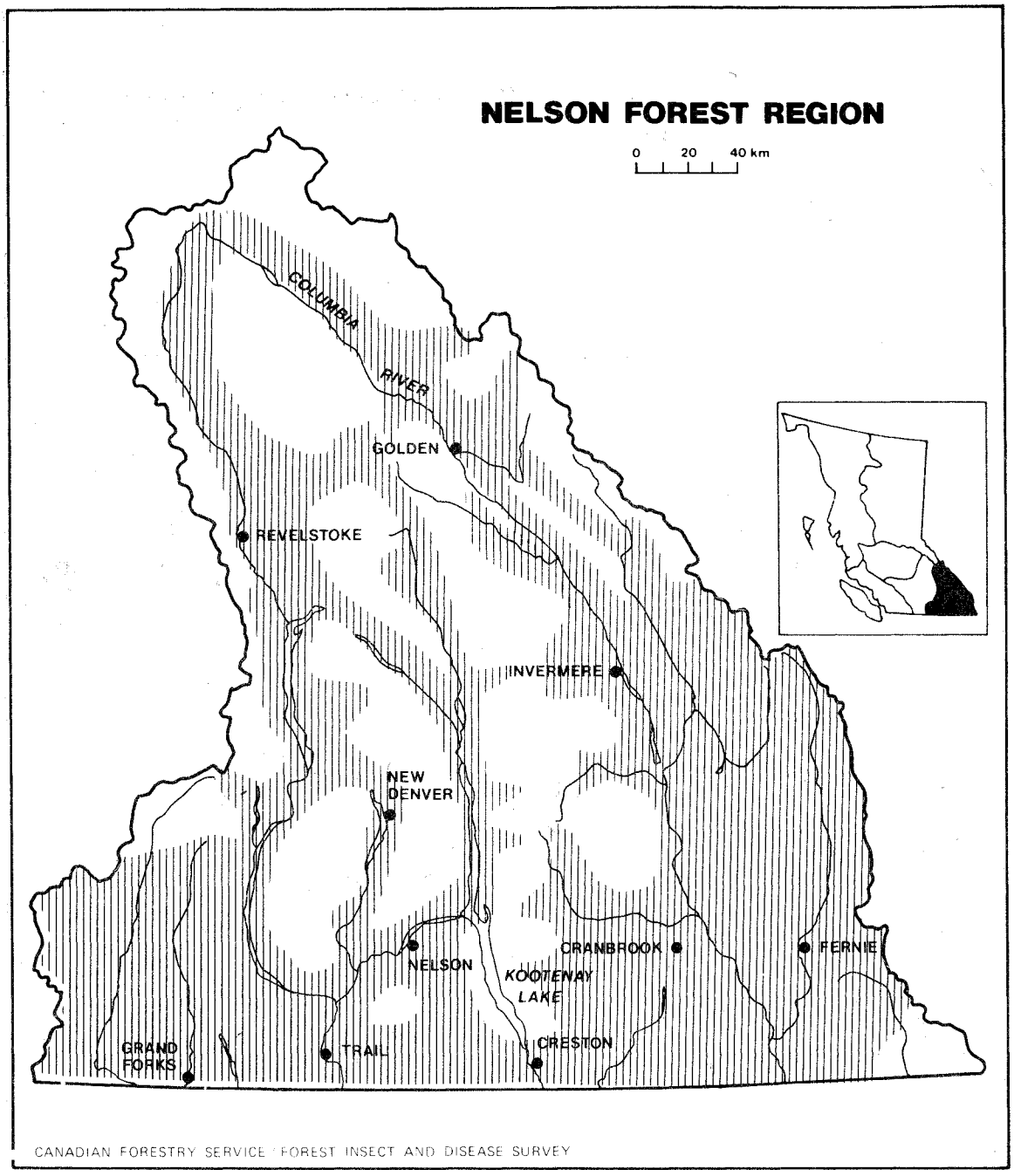
Special spring and fall surveys included collections and assessments of western hemlock looper, larch casebearer, larch sawfly, western blackheaded budworm, mountain pine beetle and spruce beetle populations.

A total of 286 insect and 144 disease collections were submitted by FIDS for identification to the Pacific Forest Research Centre. An additional 25 insect and 31 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 45 hours and 5 hours of fixed-wing flying time was provided by the B.C. Ministry of Forests and the Canadian Forestry Service respectively, to observe, map and photograph currently active forest pests throughout the Nelson Region. An additional 2 hours of helicopter time was provided by Crestbrook Forest Industries to survey TFL 14. Increased aerial survey time resulted in additional coverage of some high elevation stands and reflects to some degree the apparent increase of spruce beetle infestations. 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, 1984



Map 2. Area covered by aerial surveys to map bark beetle and defoliation infestations, 1984

PINE PESTS

Mountain pine beetle, Dendroctonus ponderosae

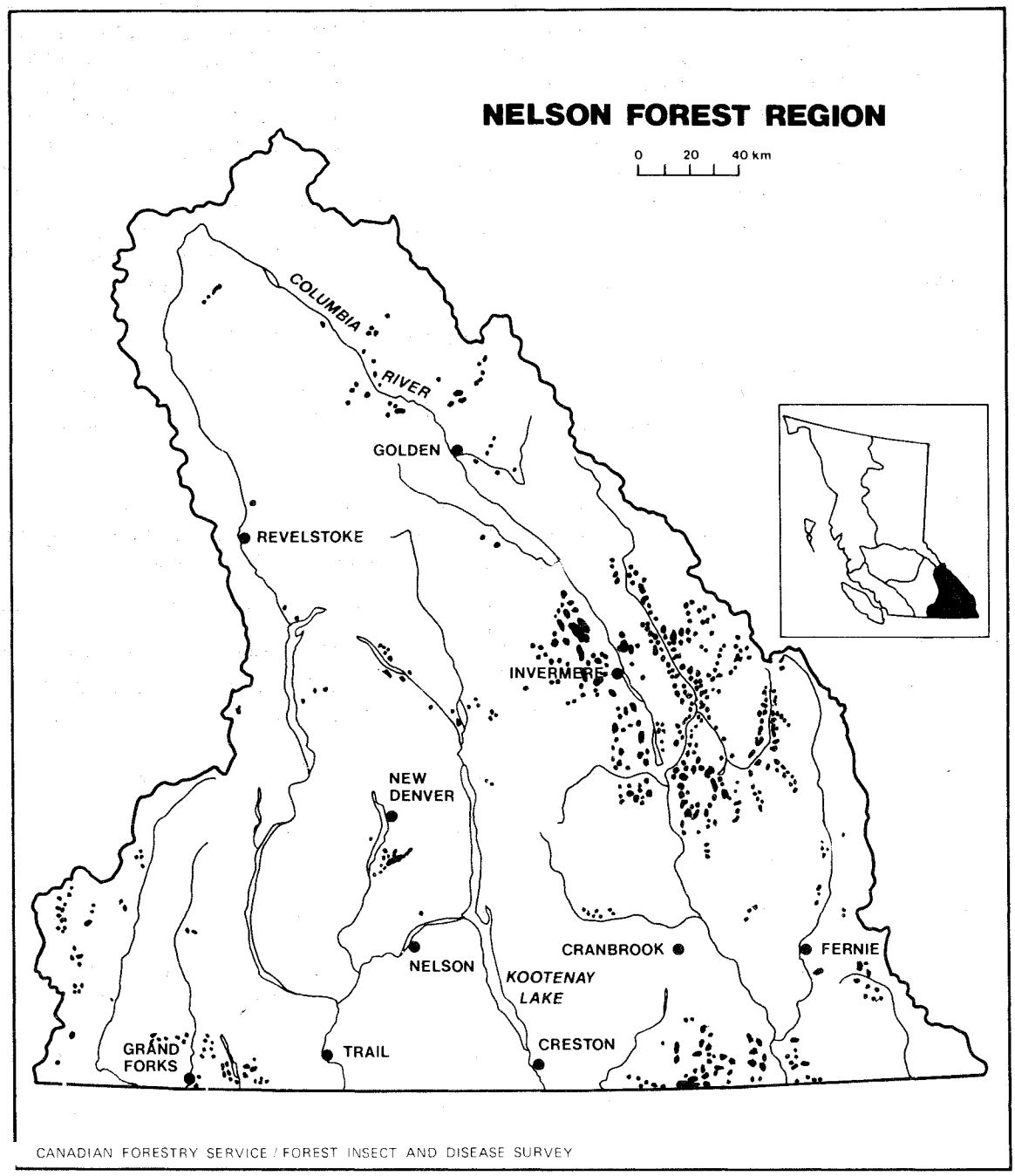
Mountain pine beetle killed an estimated 1.9 million lodgepole pine and white pine over 21 200 ha in 1 350 infestations (Table 1 and Map 3). This is the third successive year of decline, from 2.1 million trees killed in 1983, 4.3 million in 1982 and 10.5 million in 1981. Although there was a reduction in beetle-killed pine, the infested area remained about the same as 1983. Host depletion from previous beetle attack and timely harvesting of susceptible and infested pine stands has limited the expansion of infestations, particularly in the Flathead Valley, the White-Kootenay rivers drainage system and the Bush Arm-Columbia Reach area. Additionally, the rate of expansion continues to decline due to the extended life cycle of the insect at higher elevations where many of the epidemics are now concentrated.

Volume losses of pines declined to nearly 685 000 m^3, from 732 000 recorded in 1983. The Invermere Timber Supply Area (TSA) sustained more than 70% of this volume loss (500 000 m^3). The number of infestations also declined, to 1 350 from 1 700 in 1983, of which 60% were in the Invermere TSA.

Table 1. Location, number, area and volume loss of mountain pine beetle infestations by TSA as determined from aerial and ground surveys, Nelson Forest Region and National Parks, 1984.

TSA or Park	Tree Species	No. of Infest-ations	Area[1] (ha)	Number of trees attacked in 1983	Volume loss (m^3) 1983 attack
Cranbrook	lP	226	3 600	394 000	142 000
Invermere	lP	822	14 350	1 389 000	500 000
Golden	lP wwP	48	520	24 300	8 700
Revelstoke	wwP	10	40	225	225
Kootenay Lake	lP wwP	32	570	11 600	6 850
Boundary	lP	109	1 025	47 000	16 900
Arrow	lP wwP	27	500	23 000	8 400
Glacier Nat. Park	wwP	3	5	50	50
Kootenay Nat. Park	lP	74	600	3 800	1 400
TOTAL		1 351	21 210	1 892 975	684 525

[1]Areas of "grey" not included.



Map 3. Areas of pine recently killed by mountain pine beetle, determined by aerial surveys, 1984

In the Cranbrook TSA, infestations expanded to 3 600 ha from 810 ha in 1983. This increase was primarily due to continued expansion of infestations in the Ward-Gilnockie creeks area along the Canada-USA border, along Gold, Bloom, Wakeman and Purcell creeks west of Koocanusa Lake, and along the Galton Range north of Roosville. Infestations along Ward and Gilnockie creeks which have been active since 1979 increased from 370 ha in 1983 to about 600 ha in 1984. In the Gold-Bloom creeks area, infestations recorded as groups of small spot infestations in 1983 expanded into pockets up to 100 ha. Along the Galton Range where beetle activity has been relatively low in the past, small pockets of 5-20 trees each were recorded along Phillips Creek adjacent to the border and in 5 small drainages further north. Much of the infested timber in this area is at the 1 200 to 1 550 m level and may be inaccessible to harvesting due to the steep terrain. Localized pockets of infestation averaging 5% incidence of attack continued in the Morrissey Creek and upper Flathead River Valley.

Outbreaks in the Invermere TSA declined for the third consecutive year to 14 350 ha from 16 240 ha in 1983. Infestations continued at reduced levels in the White-Upper Kootenay-Lussier river drainages, where more than 8 million trees have been killed since 1971. Much of this decline is the result of harvesting susceptible and beetle-killed stands and the slower rate of spread at higher elevations where beetles mature more slowly. Some notable exceptions to the overall decline is the expansion of attack in pine stands north of Invermere, particularly at Steamboat Mountain where many small localized patches have coalesced to form several large infestations of up to 1 000 ha in which approximately 10% of pines were recently attacked. Elsewhere, increases were noted along the Middle Fork White River at Maiyuk Creek, East White River, Ram and Dutch creeks and parts of Coyote Creek. Near the B.C.-Alberta border, spot infestations numbering 2-20 trees each increased along the Mitchell, Assiniboine and Upper Cross rivers and from Joffre Creek north to Tipperary Lake along the Upper Palliser River. In nearby Kootenay National Park there were 3 600 new faders including nearly 600 trees near Radium, up from 3 100 in 1983. Elsewhere in the Columbia River Valley, outbreaks persisted at similar levels to 1983 and small scattered areas of recent beetle-kill continued at reduced levels from Radium to Golden.

Infestations in lodgepole and white pine stands in the Golden TSA declined more than 60% from 1 500 ha infested in 1983 to 520 ha. Declines occurred in all previously infested areas, except along Blaeberry River where 20% of the lodgepole pine were infested in 2 infestations over 300 ha. Host depletion continued along Columbia Reach and Bush Arm where only a few scattered pockets of 2-20 trees each remain, following a decade of severe infestation. Only a few spot infestations were active in the Bush and Valenciennes rivers and the Beaver River in Glacier National Park. Small epidemics along the Kicking Horse River continued at similar levels to 1983, as did those in Yoho National Park where 350 new faders were recorded.

In the Kootenay Lake TSA, 32 infestations occurred over 570 ha, up from 27 over 140 ha in 1983, in part due to expanded aerial surveys. Western white pine mortality, probably caused by white pine blister rust and mountain pine beetle, increased in the Trout Lake area west of Howser and along the east side of Duncan Lake. Scattered, 2 ha spot infestations occurred in western white pine along the east side of Kootenay Lake, across from Kaslo and along Fry and Glacier creeks. Infestations in lodgepole pine continued at similar levels to 1983 in the Hawkins-Freeman creeks area near the U.S. border, although several spot infestations of 5 to 10 trees have coalesced to form larger pockets up to 250 trees. Infestations declined at Kokanee Creek near Nelson.

In the Boundary TSA, 109 infestations covered approximately 1 025 ha, up from 80 infestations over 820 ha in 1983, due in part to expanded aerial surveys in 1984. Active areas of infestation include the Mount Ferroux-Weird Creek area, Spooner-Stewart creeks, Hagglund-Sutherland creeks, Trapping Creek and West Beaverdell area. Spot infestations of 5 to 50 trees increased north and east of Greenwood from Boundary Creek to the Granby River, in the Volcanic-Miller creeks area, and in upper Lynch Creek north of Grand Forks. The B.C. Ministry of Forests reported current attack in pine stands in the Rathmullen Creek area, east of Eholt. Areas of declining beetle activity include Boomerang Creek, Collier Lakes and Copperkettle Lake area. Although salvage logging on TFL 8 and crown land continues in 1985, beetle populations and area attacked are expected to remain at or above 1984 levels.

In the Arrow TSA, 27 infestations covered 500 ha, compared with 32 over 300 ha in 1983. Although the number of infestations decreased, the area of recent pine mortality increased, due mainly to expanded infestations in chronic areas at Chapleau, Lemon and Springer creeks. New spot infestations of 15 to 50 trees over 25 ha were mapped in the upper Santa Rosa Creek area, west of Rossland near the U.S. border, while infestations continued to decline in the Halfway River area and on the west side of Upper Arrow Lake. Spot infestations covering 15 ha in western white pine continued along the northeast side of Trout Lake, but declined overall throughout the rest of the TSA.

In the Revelstoke TSA 10 infestations occurred on 40 ha, down slightly from 12 infestations on 60 ha in 1983. Scattered western white pine continue to be infested in the upper Bigmouth Creek area, and a small infestation continued at Crawford Creek, southeast of Revelstoke.

Generally, continuing but declining outbreaks and tree mortality are expected in 1985, indicated by 7% current attack in 7 representative stands, similar to 1983 levels. The highest incidence of attack was 17% near Christina Lake and 16% near Dutch Creek.

Red band needle disease, Dothistroma (Scirrhia) pini

The incidence and intensity of infections of white and lodgepole pines increased throughout the Region in 1984, due in part to favourable moist conditions during spore dispersal and infection in 1983. A northward extension of the disease occurred in western white pine stands in the Cranberry Creek area south of Revelstoke, where 50% of the trees in a 1 ha stand of natural regeneration were lightly infected. In the Burton area on Lower Arrow Lake and near Mosquito Creek on the north shore of Lower Arrow Lake, 35% of all the trees in 1 ha stands were infected.

Red band needle disease, D. pini, the imperfect form of Scirrhia pini, was first reported severely infecting older pine needles in the Nelson Region in 1982. Since then, the disease has continued to spread and cause extensive discoloration and premature needle loss of one- and two-year old western white and lodgepole pine needles throughout the Region.

In the Summit Lake-Hills area, 70% of the needles on all of the western white pine were infected in scattered mixed and 1-2 ha pure stands, similar to 1983 levels. Less intense, but still moderate to high (average 50%), infections continued in the Slocan Valley, particularly near Slocan City and Winlaw. South of Nelson in the Ymir-Salmo area, up to 80% of western white pine needles were infected.

In a 1-2 ha permanent plot near Summit Lake, 82% of the one-year old needles of 20 immature western white pine were infected, up from 75% in 1983 and 56% in 1982. The lower 2/3 of the crown on about 75% of the plot trees were up to 100% defoliated and 35% of these trees had only new and one-year old growth in the upper 1/3 of the crown. Mortality of about 1% was evident adjacent to the plot trees, caused by a combination of white pine blister rust and D. pini.

Lodgepole pine stands were infected at similar to higher levels than in 1983, particularly in the Nelway area south of Salmo. Infections ranged from 20-70% of the 1983 needles on up to 100% of the trees in 2 to 1 000 ha stands near Enterprise Creek, in scattered locations in the Slocan Valley, in the Salmo-Nelway area and in the Boundary TSA. In the Nelway area, trees of all age classes were severely infected and stem mortality, apparently caused by D. pini, was evident in immature classes.

Infected lodgepole pine was recorded over more than 500 ha at Dewar and Redding creeks, Bull River, Ryan Provincial Park and near Creston. Intensity of crown infections ranged from 60% on 90% of trees near Creston to 80% of needles on 80% of immature ponderosae pine on 100 ha at Goat River Flats, and 50% of needles on 80% of young white pine at Crawford Bay. Favourable moist conditions during spore dispersal and infection prevailed in 1984 and indicate potential for continued infection in 1985.

Pine needle diseases, Lophodermella concolor and L. montivaga

Light and severe discoloration of one-year old lodgepole pine foliage in the West Kootenay by L. concolor continued for the second consecutive year in the Beaverdell-Carmi-Trapping Creek area in the West Kettle Valley, where about one-third of most trees were infected over several hundred hectares. Similar infection levels were widespread in the Phoenix Mountain-Eholt area, west of Grand Forks and near the summit of Anarchist Mountain. In the East Kootenay, up to 50% of the foliage on most of the immature lodgepole pine in areas up to 150 ha were infected along Quartz and Freeman creeks and near Hosmer.

L. montivaga infected 30% of foliage on 60% of 7-year old lodgepole pine in a 100 ha Environment 2000 thinning project in the Beaverfoot River Valley. Severe foliage discoloration of the lower crown affected nearly all pines for 5 km along Yahk River near Boyd Creek and on several hectares along Ram Creek near Skookumchuck.

Favourable moist conditions prevalent during spore dispersal of L. concolor and L. montivaga in 1984 may result in significant infection of pine foliage in many areas of the Region in 1985.

Elytroderma needle disease, Elytroderma deformans

Systemic infections by Elytroderma needle disease of ponderosa pine were common for the second year in stands from Anarchist Mountain to Christina Lake. Light infection of one-year old needles was evident from Christina Lake to Grand Forks, and brooming, indicative of longstanding infection, occurred from Midway to Anarchist Mountain. At Conkle Lake Road on Anarchist Mountain, 90% of ponderosa pine averaged 35% foliage infection over a 10 ha area, and 50% of trees had light to severe brooming. Infections were common for 5 km along the Findlay Creek Fire Access Road, where 20% of the foliage was discolored on 25% of the pine.

Western gall rust, Endocronartium harknessii

Western gall rust, the most common, conspicuous and destructive stem rust of hard pines in B.C., severely infected 3 ha of immature lodgepole pine along Lamb Creek. Up to 8 galls per tree infected 72% of the 4 m tall stand. Twenty-five percent of these galls were stem galls. In a 2-3 ha area near Enterprise Creek, 44% of young lodgepole pine had stem or branch galls; branch infections were also common on young pines at Lemon Creek Flats.

Removal of infected trees and pruning of infected branches are the only practical means of controlling spread of the gall rust at present.

Stalactiform blister rust, Cronartium coleosporiodes

This blister rust infected 25% of the young lodgepole pine stems over a 1-2 ha area about 22 km east of Castlegar, and many of the young pines up to 2 m tall were killed or broken by snow as a result of the stem cankers. The rust was also present in the Bulldog Road area of the Shields Creek drainage where stem and branch cankers were common in the stand. There are mixed and pure lodgepole pine stands in this area, and the potential for spread is great.

A pine needle blight, Leptomelanconium cinereum

This needle blight declined to low-moderate infection levels in 1984 infecting 10-25% of the foliage in scattered areas up to 10 ha in size. It has been common in immature ponderosa pine stands in the Elko-Baynes Lake-Grasmere area since 1977. Very light infection was also recorded on lodgepole pine at Goldie Creek near Invermere and in the Kerr Creek area, east of Midway.

Reduction of increment growth of about 40% was recorded in mature ponderosa pine in the Elko-Baynes Lake area, for the period 1978-82 when severe infections occurred annually. Following periods of severe infection when blighted needles have been cast, the foliage takes on a characteristic "bottle brush" appearance.

Pinewood nematode, Bursaphelenchus (lignicolus) xylophilus

This nematode, recently discovered in Manitoba and the United States and responsible for mortality of pines over large areas in Japan during the past three decades, was not found during surveys in the Nelson Region in 1984.

Although the nematode was not found in five wood samples and one adult cerambycid beetle (a nematode vector), two native bacterial feeding nematodes were successfully isolated.

SPRUCE PESTS

Spruce beetle, Dendroctonus rufipennis

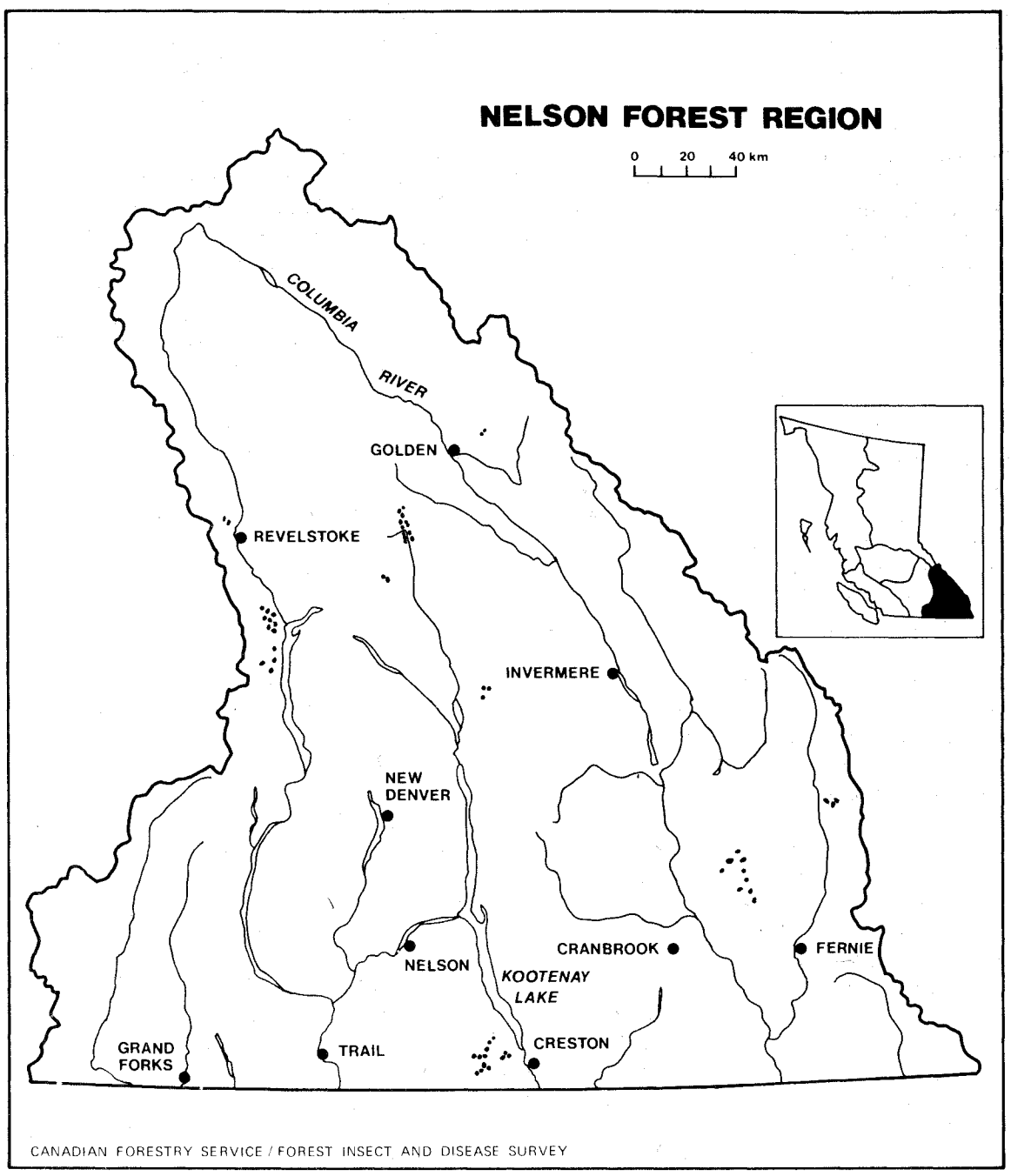
Spruce beetle infestations in mature Engelmann spruce stands covered nearly 3 770 ha, up from 2 700 ha in 1983 (Map 4). Volume loss from the 1983 beetle attack in 115 infestations mapped during aerial surveys more than doubled to 116 350 m^3, up from 51 000 m^3 in 1983 (Table 2). The increase was due in part to expanded aerial surveys, particularly in high hazard areas of Kootenay Lake TSA, not flown in 1983.

Table 2. Timber Supply Area (TSA), number of infestations, area and volume of mature Engelmann spruce recently killed by spruce beetle, Nelson Forest Region, 1984.

TSA or National Park	No. Infestations	Area (ha)	Volume (m^3)[2/] under attack	Red volume (m^3) 1983 attack	Current volume (m^3) 1984 attack
Cranbrook[2]	16	576	112 320	17 005	3 370
Invermere	3	19	4 350	220	130
Revelstoke	48	1 652	404 740	41 295	12 140
Kootenay Lake	30	887	239 490	35 800	7 185
Arrow	11	376	72 190	8 590	2 165
Glacier Nat. Park	7	256	89 600	13 440	2 700
TOTAL	115	3 766	922 690	116 350	27 690

[2/] Includes Top of the World Provincial Park

Spruce mortality in the Revelstoke TSA increased slightly from 1 250 ha in 1983 to 1 650 ha of which 530 ha were light (less than 6% stand mortality) and 1 120 ha were moderate (6-30% stand mortality). Six new infestations in the South Cranberry Creek drainage north of Pingston Creek indicated a northward movement of the beetle into previously uninfested areas. New infestations along Frisby Ridge and along the Tangier River developed in areas which had been declining. In the Pingston Creek drainage scattered infestations declined to less than 800 ha from 1 170 ha in 1983; salvage logging and host depletion contributed to the continuing decline in this area. Two small infestations at Crawford Creek and Arrowhead on Upper Arrow Lake declined, and no new mortality was evident.



Map 4. Areas of spruce recently killed by spruce beetle, determined by aerial surveys, 1984

Infestations increased to nearly 890 ha in the Kootenay Lake TSA, nearly double the 450 ha in 1983. A large portion of the increase, due in part to expanded 1984 aerial surveys, was in 14 areas over 440 ha on the east side of the Salmo-Creston Skyway, an area not flown in 1983. Lethal trap trees, treated and felled adjacent to active infestations in the spring of 1984 on private and crown land in the Toby Creek drainage, successfully absorbed the 1984 beetle flight.

In the Upper Duncan River, 9 infestations covered 330 ha and 7 new infestations over 250 ha were recorded inside Glacier National Park. Non-lethal trap trees felled in 1984 in several areas on crown land adjacent to the Park prior to the beetle flight were removed during recent logging. However, a one-year cycle in part of the population resulted in a larger than anticipated 1984 flight, as reflected in the 7% current attack of standing trees in Glacier National Park. A lethal trap tree program (about 85 trees), salvage logging and slash disposal in the Upper Duncan River-Glacier National Park area is planned to absorb the moderate flight from 8% of the trees attacked in 1983. However, a large part of the 1985 flight is expected to be absorbed by standing green timber in the Park. Further monitoring and assessments of beetle populations will continue in 1985 and 1986.

Elsewhere, in the Kootenay Lake TSA, 3 small patches of about 20 ha were mapped in Howser and Sluicebox creeks east of Duncan Lake, and 50-60 ha in the Upper Westfall River. In the Kianuko-Kamma-Skelly creeks area north of Creston, infestations declined with no new areas of mortality mapped.

Expanded aerial surveys in the Cranbrook TSA mapped 580 ha of infested spruce stands, up from 120 ha in 1983. Most infested stands were unchanged, due mainly to harvesting, the use of trap trees and increased monitoring of the beetles. In the Bull River Valley, mainly Quinn and North Galbraith creeks, up to 10% of the spruce stands were infested in 10 areas up to 50 ha in size. Additionally, 10 locations contained only previously killed spruce where beetle populations have collapsed for lack of suitable host. East of Elkford, infestations continued at Ewin Creek where up to 20% of spruce have been killed. In Top-of-the-World Provincial Park, where infestations have been active since 1981 and lethal trap trees were deployed as a management tool, 20% of the spruce were killed on 125 ha, up 5-10% from 1983. At Foisey Creek in the Flathead Valley a lethal trap tree program was implemented in response to concerns from a local guide outfitter regarding the reopening of access into a valued drainage to facilitate a proposed non-lethal trap tree program.

Only 3 new small spot infestations, up to 5 trees each, were observed in the Invermere TSA at Thunder Creek. Spruce log decks, left as traps along Thunder Creek and North White River, contained only light beetle populations when examined during mid-summer.

High winds in late August resulted in an estimated 88,000 m^3 of

spruce blowdown over nearly 300 ha along Vowell and Bobbie Burns creeks in TFL 14, west of Spillimacheen. Removal of most of the downed stems, highly susceptible to spruce beetle attack, is anticipated in 1985. Blowdown of spruce resulting from the same storm was also reported in Yoho National Park, but no further details are known.

Barring the unforeseen occurrence of excessive windthrow before beetle flight and with the continued use of trap trees and monitoring in hazard areas, the status of spruce beetle in the Nelson Forest Region should not change significantly in 1985.

Spruce weevil, Pissodes strobi

The incidence of attack by the weevil on 5-15 year old spruce regeneration leaders was up to 40% in 3 locations in the Region. Forty percent of one- and two-year old leaders along Cabin Creek in the Flathead Valley were killed and most of the infested trees were stunted, multi-topped and bushy. In the Upper Palliser River area, only 2% of the leaders of young planted spruce were recently infested and healthy trees exhibited good form and vigor. At Baerg Creek there was no evidence of recent attack on 100 naturally regenerated Engelmann spruce examined.

Bertha armyworm, Mamestra configurata

Cutworm larvae were again present at Harrop Nursery in low numbers, but conifer seedlings were not damaged. Pheromone-baited traps failed to attract any male moths of this mainly agricultural pest. No appreciable damage to conifer stock is expected to occur in 1985 if populations persist.

Yellowheaded spruce sawfly, Pikonema alaskensis

Sawflies defoliated 25% of the foliage of immature Engelmann spruce on 1 ha near km 25 along Palliser River. Feeding was mostly restricted to branch tips in lower to mid-crown. Tree mortality or branch dieback is not expected unless severe defoliation occurs in 1985. Populations returned to endemic levels without causing any permanent damage, near Morrissey, Fernie, Sparwood and Paterson, following moderate to severe defoliation of single scattered trees in 1983.

A white pocket root and butt rot, Polyporus tomentosus

Surveys for P. tomentosus were negative in 30-70 year old spruce stands at Alexander Creek, Moyie River, Slocan and near the Blueberry-Paulson summit where 1 050 trees were examined along 1 000 m.

LARCH PESTS

Larch casebearer, *Coleophora laricella*

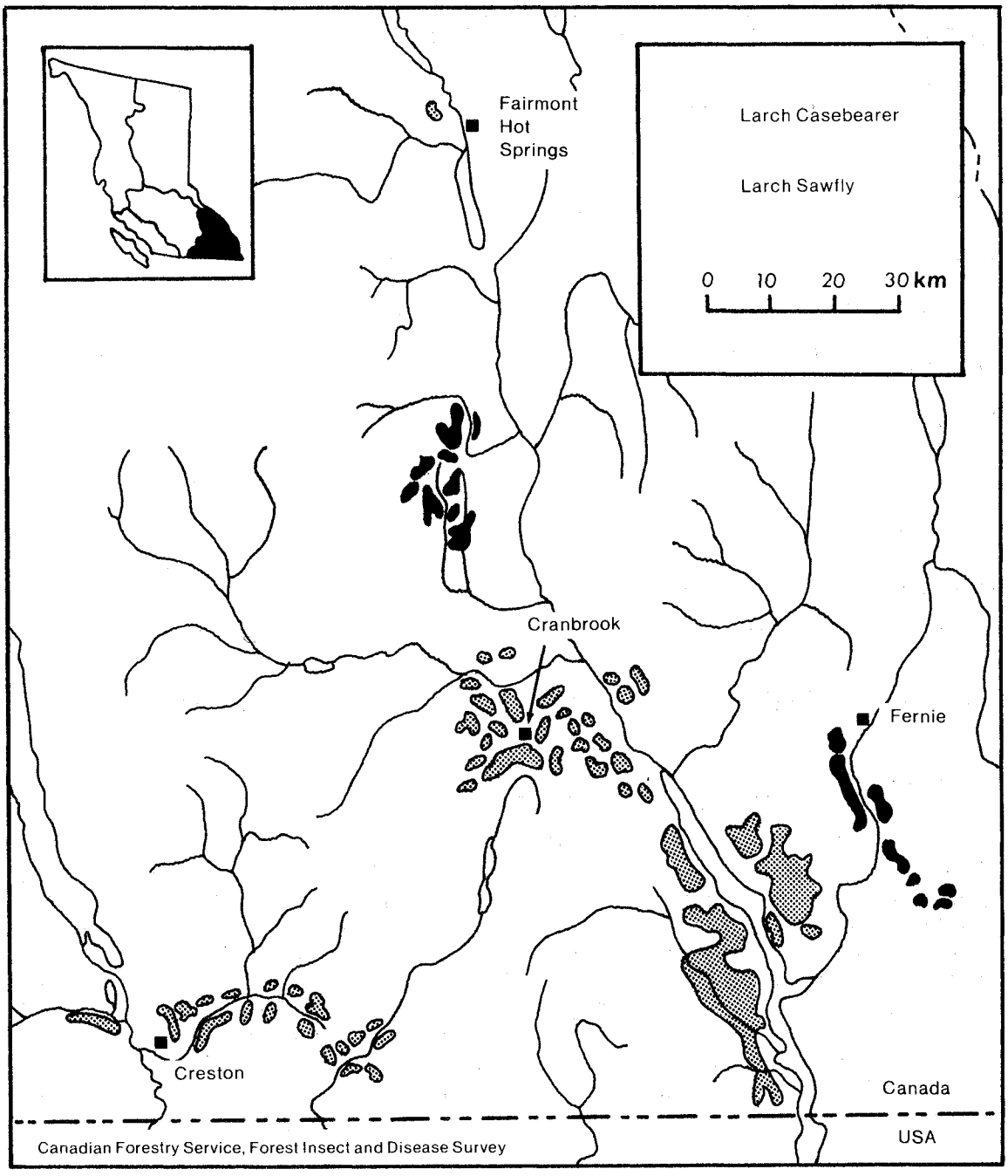
Larch casebearer populations intensified in most western larch stands in southern portions of the Nelson Forest Region, after being delayed for several weeks due to the cool, moist weather in spring. Light defoliation occurred over more than 40 000 ha from Kootenay Lake east to Elko and from Kimberley southeast to the Canada-USA border (Map 5).

The most severe and spectacular defoliation occurred in the immediate vicinity of Cranbrook, the Jaffray-Elko-Kikomun Creek area, and along the west side of Koocanusa Lake from Wardner south to Newgate, including Gold Creek. Light and moderate defoliation was widespread near Summit Creek, Sanca Creek to Sirdar and Creston to Yahk, in the Kootenay Lake TSA; near Wycliffe, Norbury Lakes, northwest of Wardner, lower Wigwam River and north of Elk River in the Cranbrook TSA; west of Fairmont at Ellenvale Creek in Invermere TSA. Defoliation was often associated with discoloration caused by larch needle diseases *Hypodermella laricis* and *Meria laricis*, which frequently made precise separations difficult, particularly in the Creston area and along Kootenay Lake.

Pupal parasitism, primarily by the introduced hymenopterous parasites *Agathis pumila*, and *Chrysocharis laricinellae*, was generally low, affecting an average of only 2% and 1% of the casebearer population respectively in 16 areas. The highest incidence of parasitism by *A. pumila* was 7% in three areas at Creston and 6% by *C. laricinellae* at Rossland. Parasitism by other native insects including *Dicladocerus westwoodii*, *Scambus transgressus* and *Gelis* sp. was less than 1%. Two hundred and forty adult *C. laricinellae* were released in casebearer infested stands at Ellenvale Creek in mid-June and 537 at Cranbrook in mid-August, as part of a continuing biological control program. Introduced from Austria, the parasite has contributed to the decline of previously high casebearer populations in the West Kootenay.

Pheromone-baited traps to monitor casebearer populations attracted an average of 89 male moths each in 16 sites in the Region, mainly beyond the known limits of infested stands. Studies to determine the significance of the number of adults trapped continue, but data indicates a northward migration within the host range, particularly in the West Kootenay.

Assessments of overwintering larval populations at 10 locations in the Region indicate continued light to severe defoliation of larch stands in 1985. Predictions are based on the number of larvae per 100 fascicles of foliage (Table 3).



Map 5 Areas defoliated by larch casebearer and larch sawfly, determined by aerial surveys, Nelson Forest Region, 1984

Table 3. Predicted defoliation of western larch in 1985 by larch casebearer, based on overwintering larval populations, Nelson Forest Region, 1984.

Location	Avg. no. overwintering larvae per 45 cm branch	100 fascicles	Predicted[1] defoliation, 1985
Jaffray	120	76	Moderate
Koocanusa Lake	35	22	Light
Ellenvale Creek	69	25	Light
Cranbrook	95	67	Moderate
East Arrow Creek	27	17	Light
Rykerts	52	26	Light
Salmo	5	4	Trace
Thrums	15	9	Trace
Fruitvale	45	24	Light
Anarchist Mtn.	200	88	Severe

[1]Defoliation: Light - 1-25% Moderate - 26-50% Severe - 51%+

Larch sawfly, Pristophora erichsonii

In this third year of infestation, sawfly populations defoliated 3 000 ha of western larch (Map 5), down from 10 400 ha in 1983. Nearly 1 800 ha of light defoliation north of Kimberley along Lost Dog, Mather and Skookumchuck creeks was recorded for the first time. Defoliation was moderate to severe on 750 ha in the Elk River Valley from Fernie south to Morrissey and east along Lodgepole Creek, where only light discoloration of larch occurred in 1983. The predicted decline of infestations to endemic levels north of Fernie, along Michele Creek, Tie Lake and near Dutch Creek was attributed to several natural factors including parasitism and rodent predation of overwintering pupae.

Assessments to determine population trends, parasitism and disease in overwintering cocoons, were made in September at three areas (Table 4). Preliminary observations, including x-rays, indicate continued decline of populations in 1985. Cocoons were extracted from 1 000 cm^2 duff samples, from beneath each of 10 defoliated trees in each area. Several cocoons from Morrissey were infected by the pathogen Beauveria bassiana.

Table 4. Location, average percent defoliation of western larch by larch sawfly, numbers of overwintering larvae in cocoon per 1000 cm^2 of duff and predicted defoliation, Cranbrook TSA, Nelson Forest Region, 1984.

Location	Average % defoliation	Healthy Cocoons in 1000 cm^2 duff		Predicted[1] defoliation
		No.	%	1985
Fernie Ski Hill	30	63	50	Nil
Morrissey	60	52	80	Light
Lost Dog Lake	50	23	80	Light

Defoliation categories:

[1]Light - occasional branch defoliation
Moderate - 1/3 or less of crown defoliated
Severe - more than 1/3 of crown defoliated

Though repetitive years of defoliation may result in significant increment loss, tree mortality has not been recorded and is not expected to occur.

Larch budmoth, Zeiraphera improbana

Larch budmoth outbreaks continued for the second year but declined to 1 100 ha in 10 areas from 6 600 ha in 36 locations in 1983. The outbreaks were confined to the Murphy and Hanna creeks-Mount Kirkup area, and Blueberry-Paulson summit area north and west of Rossland. Infestations at Dewar Creek and near Skookumchuck and in the Boundary TSA, following one year of defoliation, collapsed. Large areas of moderate-severe larch needle disease infection in the Boundary area may have masked light budmoth defoliation. Pheromone trapping to monitor adult populations produced inconclusive results. Some defoliation is expected in 1985 in the Hanna Creek area based on high numbers of healthy larvae and low parasitism found at this location. Budmoth populations, however, have historically collapsed after 2-3 years consecutive defoliation.

Larch needle diseases, Hypodermella laricis and Meria laricis

The incidence and intensity of larch needle diseases increased throughout the Region, due mainly to wet conditions favourable to spore dispersal during bud burst and needle elongation. Approximately 20 000 ha of needle discoloration was mapped in the Arrow, and particularly

the Boundary TSA.

In the West Kootenay, moderate to severe infection (average 39% of the foliage) by H. laricis increased and expanded from Anarchist Mountain to the Nancy Greene Lake area. Infection ranged from 50 to 100% of the crowns of most trees and discoloration was visible in widespread areas at Anarchist Mt., in the West and Main Kettle River Valleys, Boundary Creek, and Phoenix Mt. At a permanent study plot near Nancy Greene Lake, less than 10% of the plot trees were infected and less than 5% at a plot near Salmo. Trees less than 2 m tall were discolored up to 75%, particularly at Fiva and State creeks. Meria laricis was also present in the Anarchist Mtn.-State-Boundary creeks area, but significantly less than H. laricis. In the East Kootenay, H. laricis severely infected isolated immature larch along Ram Creek and on 250 ha of mature larch along Whiteswan Lake Road. However, foliage infections were generally light with less than 30% of the foliage infected near Skookumchuck, Kootenay River east of Canal Flats and east of Wasa.

Infection of western larch by M. laricis was more severe and widespread in the Region than in 1983. Infection levels in the west Kootenay ranged from 60 to 100% (average 30%) and were common from the Cape Horn area north of Nakusp, south to Fauquier along the Lower Arrow Lake, west along the Monashee Highway, the Mosquito Creek drainage, Slocan Lake and Slocan Valley, Kootenay Lake, and Patterson, south of Rossland. Less severe infection levels were common around Castlegar and Salmo. Trees less than 2 m tall were the hardest hit, in areas such as Mosquito Creek where up to 80% were discoloured. H. laricis was also present in the Kaslo-Arrow Park-Nakusp area, but as a very small portion of infection compared to M. laricis.

The most extensive area of infection by M. laricis in the East Kootenay occurred in the Moyie River Valley south of Yahk where 70% of larch were 80% discoloured on nearly 1 000 ha. Lighter infections over smaller areas up to 100 ha were recorded at Crawford Bay, Toby Creek west of Creston, along Koocanusa Lake, Bloom Creek and near Dutch Creek. In the Creston and Lower Kootenay Lake areas, both needle diseases were equally common, but M. laricis infections were more intense and frequently associated with larch casebearer defoliation.

Although tree mortality is not expected as a result of needle disease infections, dwarf shoots and seedling mortality and reduced increment could occur following several consecutive years of severe infections.

A top-kill of western larch

A top dieback, not associated with porcupine or rodent damage, was common on immature larch in the St. Mary River, Dewar Creek and Lower Arrow Lakes valleys. Damaged trees were typically 1-10 m tall, multiple-topped and in isolated pockets of 1-10 trees. The causal agent may be a stem canker with symptoms characteristic of a dieback disease, Potebniamyces coniferarum, but the absence of fruiting bodies prevented positive identification. Further surveys are planned in 1985.

European larch canker, Lachnellula wilkommii

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, 3 samples of a related saprophytic fungus, Lachnellula spp., which does not affect tree growth, were found in 1984.

DOUGLAS-FIR PESTS

Douglas-fir tussock moth, Orgyia pseudotsugata

The tussock moth epidemic, which defoliated 2 275 ha of Douglas-fir in the Rock Creek area in 1983, collapsed in 1984. This collapse was due largely to a naturally occurring nuclear polyhedrosis virus (NPV) found in most dead prepupal larvae in the fall of 1983. No larvae were found in 1984 beating samples throughout the old infestation area. Seven single strength pheromone traps (0.1% (z)-6-heneicosen-11-one) were placed at Rock Creek and at Christina Lake Golf Course to monitor adult males, but none were caught. Populations should remain low in 1985 and defoliation is not expected.

Western spruce budworm, Choristoneura occidentalis

One hundred hectares of scattered Douglas-fir stands between Rock Creek and Bridesville were lightly (25%) defoliated by the budworm for the seventh consecutive year, down from 60% in 1983. Populations declined to an average of 6 larvae (range 0-25) in 8 standard beating samples between Rock Creek and Anarchist Mountain, from an average of 28 larvae (range 1 to 140) in 1983. Defoliation was not visible during aerial surveys, but ground estimates of light defoliation was mainly in younger stands in the Rock Creek-Bridesville Road area, south of Johnstone Creek Provincial Park. Of 152 larvae from the Rock Creek-Bridesville Road, 27% were parasitized and 11% infected by an unidentified virus. Half the parasitized larvae were affected by Hymenoptera and half by Diptera. The population decline is attributed to the incidence of parasitism and viral infection.

Douglas-fir beetle, Dendroctonus pseudotsugae

Douglas-fir bark beetle attacks generally increased in mixed stands, particularly along the north shore of the west arm of Kootenay Lake where 12 infestations of 10 to 25 trees each were mapped. Control measures are not currently planned and the beetle is not expected to become a major problem in most areas.

Small spot infestations along the Moyie, Lussier and Wigwam rivers and Bighorn and Lodgepole creeks declined, while 3 spot infestations of 10 to 100 trees were mapped in the Akokli Creek area on the east side of Kootenay Lake. In Premier Lake Provincial Park where beetles have been active for the past four years, 8 overmature Douglas-fir were killed.

At Christina Lake Golf Course 8 Douglas-fir previously defoliated by Douglas-fir tussock moth were attacked by D. pseudotsugae in 1983, and removed in the spring of 1984. One tree was attacked in 1984 and it was scheduled for removal before the 1985 flight. All Douglas-fir trees on the golf course were sprayed with Sevin insecticide in 1984 to prevent further bark beetle attacks.

Western false hemlock looper, Nepytia freemani

Larval populations declined to near endemic levels in the Invermere and Radium areas where light defoliation occurred over 110 ha in 1983. Trace defoliation of current needles on Douglas-fir regeneration occurred along Westside Road near Forester Creek. Elsewhere in the Columbia Valley populations were low throughout the host range.

A major factor in the decline of populations was the high incidence of a naturally occurring nuclear polyhedrosis virus in 1983. Populations are expected to decline to endemic levels in 1985, and defoliation should not occur.

Rhabdocline needle cast, Rhabdocline pseudotsugae

Rhabdocline needle cast infection of year-old Douglas-fir needles was more widespread and severe in the Region in 1984. Extensive areas (1 000+ ha) of light to moderate, and occasionally severe, infections were common in immature stands east of Elko, along Wigwam, Bighorn and Cabin creeks and for about 60 km along the Bull River access road where only the new growth remained on some of the most severely infected trees. Infections were also severe in localized pockets throughout Christmas tree production areas between Skookumchuck and Canal Flats. Infection intensity ranged from 20-50% of foliage, in areas up to 100 ha at Michel Creek, East White, Lussier and Goat rivers and Ram and Roan creeks.

Some slight growth loss may result from infections, but permanent damage is not expected unless stands experience successive years of severe defoliation. However, the impact on quality in Christmas tree production areas in the Columbia Valley could be substantial if control measures are not implemented.

Swiss needle cast, Phaeocryptopus gaeumanni

The needle cast lightly infected older Douglas-fir needles in two locations in the Region in 1984. Young roadside regeneration was lightly infected (up to 40%) west of Castlegar and north of Rosebery along Slocan Lake, but overall less than 5% of the needles were discolored and no premature casting of needles was noted. Some premature needle cast and slight increment loss may occur if severe infections continue for several years.

A conifer-aspen rust, Melampsora medusae

Most Douglas-fir regeneration up to 1 m tall over 10 ha of private land east of New Denver were 75-100% infected by the rust, the alternate host of which are poplars, Populus spp. Nearly all of the 1984 foliage on 50% of the immature Douglas-fir were infected at Dry Gulch Provincial Park. These infections were probably brought on by moist weather during the spring, conditions favorable to spore dispersal. Repeated infections can cause mortality of conifer seedlings.

WESTERN HEMLOCK PESTS

Western hemlock looper, Lambdina f. lugubrosa

Western hemlock looper populations, which defoliated 32 000 ha of mature and overmature western hemlock and western red cedar in the Region in 1983 and 8 000 ha in 1982, collapsed in 1984. Light defoliation was limited to 100 ha at Mountain Creek Campground in Glacier National Park and at Cusson and Ledge creeks in the West Kootenay. At Cusson Creek, defoliation was mixed with and difficult to distinguish from defoliation caused by new infestations of western blackheaded budworm, Acleris gloverana.

Tree mortality was not recorded during the outbreak. However, top-kill (up to 2 m) of mature and overmature western hemlock and western red cedar occurred, following two consecutive years of moderate to severe defoliation at Red Rock Peninsula, upper Blanket and Mulvehill creeks and in scattered areas along the west side of the Columbia River north of Revelstoke.

Lichen containing eggs were collected in late September from hemlock at Red Rock Peninsula and Cranberry Creek, to determine the number and viability of overwintering eggs and to forecast 1985 population trends. Eggs were extracted from five, 100 g samples of 'old

man's beard' lichen from each of 5 trees at each location by a bleach vacuum process which enables extracted eggs to be reared for research purposes. The number of healthy eggs per sample declined significantly to 15 from 220 at Red Rock Peninsula and to 11 from 56 at Cranberry Creek, which indicates very light defoliation at both locations in 1985 (Table 5).

Table 5. Location, condition and average number of eggs from five 100 gram samples per location, Nelson Forest Region, 1984.

Location	Healthy	Parasitized	Infertile	Old	Total	Predicted defoliation[1]
Red Rock Peninsula	15.5	17.2	5.8	187.5	226	L
Cranberry Creek	10.7	6.9	3.6	132.8	154	L

[1]Light defoliation (L) - 5-26 healthy eggs per 100 g lichen
Moderate defoliation (M) - 27-59 healthy eggs per 100 g lichen
Severe defoliation (S) - 60+ healthy eggs per 100 g lichen

Parasitism in 1984 eggs averaged 46% (parasitized eggs as compared to healthy eggs), up from 38% in the spring of 1984 and 29% in the fall of 1983. This increase was caused primarily by wasp-like hymenopterous egg parasites Telenomus delmani and Trichogramma minutum, which are largely responsible for the population collapse. The collapse follows the historic trend of western hemlock looper outbreaks which have declined following increased levels of egg parasitism after 1-2 years of defoliation.

Western blackheaded budworm, Acleris gloverana

Defoliation by western blackheaded budworm increased dramatically to approximately 19 100 ha in 1984 from 120 ha of light defoliation along Bostock Creek in Glacier National Park in 1983 (Table 6). Defoliation was generally between 1 000 and 1 500 m elevation from Bigmouth Creek near McNaughton Lake to upper Macdonald (Slewiskin) Creek, south of Nakusp (Map 6), and east of Revelstoke to Rogers Pass in Glacier National Park.

Table 6. Location, area and defoliation intensity of western hemlock and western red cedar by western blackheaded budworm, Nelson Forest Region, 1984.

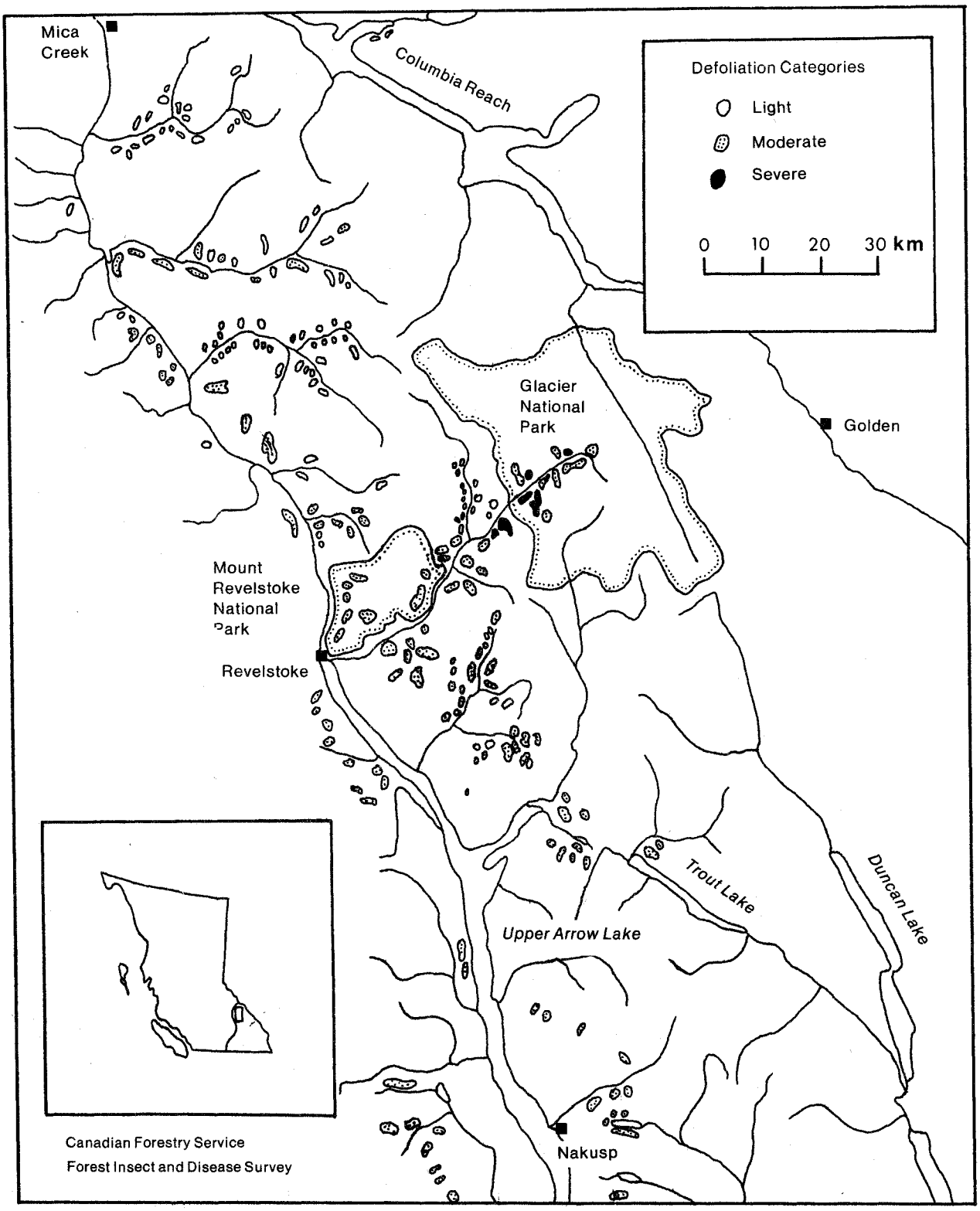
TSA or National Park	Area and Defoliation Class[1]			
	Light (ha)	Moderate (ha)	Severe (ha)	Total (ha)
Revelstoke TSA	3 890	7 700	770	12 360
Golden TSA	1 665			1 665
Arrow TSA		1 230		1 230
Glacier National Park		1 475	1 025	2 500
Mt. Revelstoke National Park		1 345		1 345
TOTAL	5 555	11 750	1 795	19 100

[1]Defoliation: Light - discolored foliage barely visible from the air, some branch tips and upper crown defoliation.
Moderate - pronounced discoloration, noticeably thin foliage, top third of many trees severely defoliated, some completely stripped.
Severe - bare branch tips and completely defoliated tops, most trees more than 50% defoliated.

Two parasites, primarily Mesochorus sp., a late instar parasite, and Apanteles sp., an early instar parasite, were active within the budworm population. However, quantitative data is not available to indicate the percent parasitism and its impact on the population. Parasite studies will continue in 1985.

Populations had been increasing since 1982, particularly at Bostock Creek where 420 larvae were counted in standard beating samples, up from 270 in 1983 and 120 in 1982. About 215 larvae were counted in beating samples at Tangier and Illecillewaet rivers. Elsewhere, beating samples were generally below the elevation where defoliation occurred, and the number of larvae sampled ranged from 0-54 (average 14) and were present in 85% of the samples.

Overwintering eggs on hemlock foliage from five infested stands ranged from 1-29 indicating trace to light defoliation in 1985 in stands defoliated in 1984 (Table 7). However, low numbers of healthy eggs in the infestation at Bostock Creek, in its third year, might indicate a population collapse similar to patterns of previous budworm infestations. Samples contained two 50 cm branches from each of 10 trees per location and eggs were extracted by a bleach vacuum process.



Map 6. Areas of western hemlock and western red cedar defoliated by western blackheaded budworm determined by aerial surveys, Nelson Forest Region, 1984

Table 7. Location, average number of healthy, blackheaded budworm eggs and predicted defoliation for 1985, based on twenty 50 cm branch samples per location, Nelson Forest Region, 1984.

TSA or National Park	Avg. No. of Healthy Eggs	Predicted Defoliation[1]
Revelstoke TSA		
Goldstream River	29.0	Light
LaForme Creek	9.0	Light
Akolkolex River	4.0	Trace
Albert Canyon	12.0	Light
Glacier National Park		
Bostock Creek	1.4	Trace

[1] Trace defoliation - < 5 healthy eggs per 50 cm branch
Light defoliation - 5-26 healthy eggs per 50 cm branch
Moderate defoliation - 27-59 healthy eggs per 50 cm branch
Severe defoliation - 60+ healthy eggs per 50 cm branch

During egg sampling in mid-September, substantial moth flights were evident, which indicates egg laying was not completed at the time sampling was in progress. As a result, the defoliation forecast may be underestimated, especially at Goldstream River and LaForme Creek and to a lesser degree at Albert Canyon and Akolkolex River.

Conifer sawflies

Increased numbers of larvae were most evident in association with western hemlock looper and western blackheaded budworm populations in outbreak areas in the Revelstoke Timber Supply Area. At Quartz Creek near Donald where sawfly infestations have occurred in western hemlock stands over the past 4 years, 5 ha of roadside western hemlock regeneration were 5% defoliated, down from 10% in 1983. Elsewhere in the Region, an average of 38 larvae per sample, up from 18 in 1983, occurred in 73% of the collections, up from 70% in 1983. However, noticeable defoliation was not evident as sawflies prefer to feed on older foliage and large populations are needed before noticeable defoliation occurs.

Green-striped forest looper, Melanolophia imitata

Populations of this potentially damaging defoliator declined in western hemlock and western red cedar stands previously infected by western hemlock looper, following increases in 1982 and 1983. There was an average of 3 larvae in 12 of 33 standard beating samples, down from 7 in 1983.

ALPINE FIR PESTS

Western balsam bark beetle complex, Dryocoetes confusus, Ceratocystis dryocoetidis

The beetle and its associated blue stain fungus C. dryocoetidis is prevalent in high elevation alpine fir stands throughout the Region.

Recent tree mortality ranged from 5 to 30% of the alpine fir component over 4 350 ha in 91 spot infestations. Large chronic infestations up to 300 ha continued near Revelstoke and in TFL 14 along the Spillimacheen River and adjacent drainages.

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

Ground surveys of several infested stands in the Spillimacheen River Valley in TFL 14 are planned in 1985 to gain additional knowledge of the insect/disease complex and its association with Armillaria root rot, Armillaria ostoyae.

Two-year-cycle spruce budworm, Choristoneura biennis

Infestations of this budworm in alpine fir-spruce stands declined markedly to only 200 ha of light defoliation in two areas, down from 2 000 ha of light to moderate defoliation in 12 locations in 1983. Aerial and ground surveys identified 100 ha of light defoliation at both Baker and South Fosthall creeks where light to moderate defoliation occurred last year.

The reduction is mostly the result of feeding by primarily early instar larvae in the first year of the budworm's two-year cycle. When larvae complete their development in 1985, foliage consumption should increase in both areas and possibly other previously infested drainages including the south fork of Bugaboo Creek and Glenogle Creek.

Balsam woolly aphid, Adelges piceae

In response to the recent report of the aphid in Idaho, up to 100 grand fir and alpine fir were examined in each of eight locations adjacent to the Canada-USA border in the Region. No symptoms such as crown thinning or flattened tops or any signs such as gouting or wool tufts on stems were evident.

There has not been any significant change in distribution of this pest in south coastal B.C.

WESTERN RED CEDAR PESTS

Cedar leaf blight, Didymascella thujina

For the third consecutive year, western red cedar were lightly discolored by the leaf blight in wet belt stands between New Denver and Kaslo. About 20% of the foliage on 75% of the trees near Retallack were discolored. At Mt. Fernie Provincial Park, where the disease has been chronic for several years, 50% of the crowns of nearly all the cedars in the park were infected.

Although the leaf blight is not known to cause permanent damage to infected trees, premature leaf drop does occur and may affect increment growth if severe infections persist for several years.

DECIDUOUS TREE PESTS

Birch leaf skeletonizer, Bucculatrix canadensisella

Skeletonizer populations, which discolored white birch in the Trail area for two consecutive years, collapsed in 1984. Occasional single larvae were found at West Trail and Sunningdale, however, no significant feeding occurred. Very little is known about the birch leaf skeletonizer, its parasites and diseases, and the cause of this collapse was undetermined.

Birch leafminer, Lyonetia saliciella

After causing moderate to severe discoloration of birches in Invermere and Golden TSAs for the past decade, populations declined markedly. Only about 20% of birch foliage was discolored along Bobbie Burns, Bugaboo and Driftwood creeks, down from nearly 80% in 1983. Generally light scattered discoloration occurred along Campbell Road between Horse Creek and Parsons, and along Kicking Horse River between Golden and Yoho National Park.

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

Satin moth, Leucoma salicis

Satin moth larvae moderately defoliated mature individual black cottonwood and trembling aspen at the north end of, and at the municipal campground on, Summit Lake south of Nakusp. Single trees east of New Denver were also defoliated, and a moderate flight of adults was observed. Small 1 ha stands of trembling aspen between Rock Creek and Bridesville were up to 90% defoliated and flights of adults were noted for the second consecutive year in the Rock Creek area. Satin moth larvae were also present, along with forest tent caterpillar, Malacosoma disstria, in a 2 ha stand of trembling aspen above West Trail.

A large moth population in the Harrop-Willow Point-Nelson area deposited egg masses on buildings and telephone poles, and on spruce seedlings at the B.C. Ministry of Forests nursery at Harrop. Nursery staff monitored the emerging larvae on the spruce seedlings, but no defoliation occurred and the larvae died shortly after. The large moth flight indicates a possibility of severe defoliation of deciduous species throughout the west arm Kootenay Lake area in 1985. At Moyie, black cottonwood were 40% defoliated on about 10 ha for the second year, down from 60% on 5 ha in 1983. Diptera and Hymenoptera parasites, which affected 25% of cocoons in mid-summer, could reduce 1985 populations in the area.

Forest tent caterpillar, Malacosoma disstria

Tent caterpillars moderately defoliated scattered stands of trembling aspen, black cottonwood, white birch and miscellaneous roadside shrubs over extensive areas between Warfield and Violin Lake, west of Trail. The caterpillar along with satin moth, Leucoma salicis, also moderately defoliated a 2 ha stand of trembling aspen above West Trail.

A high incidence of nuclear polyhedrosis virus (NPV) and Diptera and Hymenoptera parasites in larvae from Warfield and West Trail could prevent the populations from developing into a serious epidemic.

Poplar shoot blights, Venturia macularis and V. populina

Discoloration and dieback of trembling aspen by V. macularis was common from New Denver to Revelstoke and east to the Columbia and Kootenay rivers. Infection intensity ranged from 15-80% on most trees between Revelstoke and Shelter Bay; between Hills and Summit Lake for the second consecutive year along with a leaf roller, Campsolechia niveopulvella; between New Denver and Kaslo; on the north side of Illecillewaet River near Revelstoke; and along Kicking Horse River between Palliser and Yoho National Park. At Elko, minor shoot mortality occurred on 20 ha, where 95% of foliage was infected; lighter infections were found on small scattered areas at Harvey Creek, Sparwood and Grave Lake.

Unusually severe discoloration and defoliation of pure black cottonwood stands by V. populina occurred on 200 ha at Duck Lake north of Creston. By mid-August, however, many trees had refoliated, despite the severity of infections. In previous severe outbreaks, damage was limited to less than 10% branch dieback.

A birch twig dieback, Sirococcus sp.

White birch in the Summit Lake area were infected by a twig dieback, apparently a species of Sirococcus previously unknown on birch. All of the birch in the Summit Lake-Hills area were infected, with several trees in a small 1 ha area south of Summit Lake up to 50% defoliated. Further collections and monitoring of the dieback will continue in 1985.

Fume damage

Foliar browning of deciduous species attributable to sulphur dioxide fumes was very light in the Trail area in 1984. Leaf scorching was visible on up to 10% of the foliage on scattered birch in the Sunningdale area in Trail and above West Trail.

Gypsy moth, Lymantria dispar

Pheromone-baited traps placed singly in 36 locations, mainly provincial parks, to monitor gypsy moth populations, were again negative. Park visitors from outside the Region, particularly from eastern Canada and USA, are considered the primary vector responsible for the migration of the insect. A single moth was caught in a trap at Adams Lake in the Kamloops Region in 1984, the first time a gypsy moth has been trapped in the interior of British Columbia. Gypsy moth is a major pest of deciduous trees and some conifers in eastern Canada and part of the USA, including Washington State and most recently in northwestern Montana and Oregon. The trapping program will continue in 1985 for the sixth consecutive year.

MULTIPLE HOST PESTS

Cone and seed pests

Douglas-fir and Engelmann spruce cone crops in the Region were generally light. The incidence of infestation of Douglas-fir cones in 10 areas ranged from 26-94%. The most abundant cone pests were the Douglas-fir cone moth, Barbara colfaxiana, a cone gall midge, Contarinia oregonensis, a cone moth, Dioryctria abietivorella, and a seed chalcid, Megastigmus spermatotrophus.

A cone disease, inland spruce cone rust, Chrysomyxa pirolata infected 4% of the Engelmann spruce cones at Mackinson Flats, west of Nakusp.

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

Rodent damage

Porcupine damage commonly occurs on several conifer species in the Region annually, generally on trees of intermediate and older age. However, porcupines recently caused mortality and top-kill of 8-year-old lodgepole pine regeneration over a 50 ha area along the North Fork Moyie River. In a 3 ha area within this stand, 15% of the trees were killed and 35% partially debarked. At Hanna Creek near Rossland, up to 50% of the intermediate sized western larch were top-killed or had multiple tops caused by porcupine feeding.

Debarking of mistletoe cankers, attributed to squirrels, caused flagging on up to 10 branches per tree on 90% of 30-year old lodgepole pine on 30 ha near Dewar Creek. Consequences of this damage relative to mistletoe occurrence are unknown.

Canada