FIDS Report 92-13

History of Population Fluctuations and Infestations of Important Forest Insects in the Nelson Forest Region 1923-1991

L. Unger
Forest Insect and Disease Survey

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont'd)

INTRODUCTION

This report constitutes a history of some important forest insects in the Nelson Forest Region and adjoining National Parks since the 1920's. Its purpose is to:

1. Designate the species of insects which have caused damage in the past and are presumably capable of causing damage in the future.
2. Record the pattern of population fluctuations.
3. Designate areas that appear to have chronic insect problems.

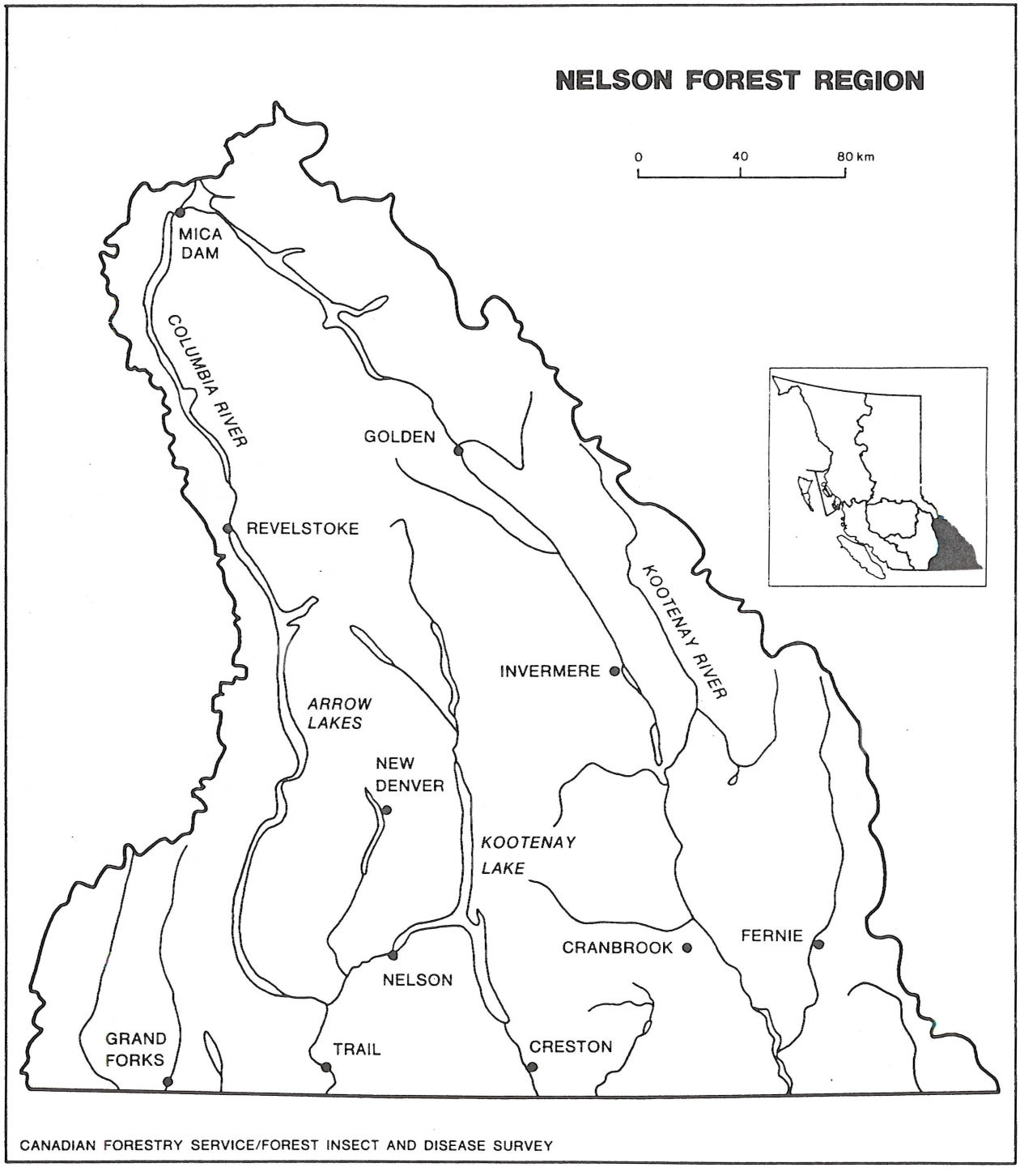
Major forest losses in the Nelson Forest Region and adjoining National Parks have been caused by bark beetles. Infestations of mountain pine beetle were first reported in Glacier National Park in 1923 on western white pine, and on lodgepole pine in 1929 in Kootenay National Park. A large outbreak was reported in 1938 over 9 500 hectares on lodgepole pine in the vicinity of McLeod Meadow in Kootenay National Park. Major infestations of mountain pine beetle occurred during the late 1970's and into the 1980's in the Flathead and Columbia River Valleys, White River drainages, Golden-McNaughton Lake areas and Kettle River on lodgepole pine and in the Bush Arm area on western white pine.

Spruce beetle infestations were reported near Lumberton in 1934, where over 35 000 m^3 of Engelmann spruce trees were killed. Infestations have been sporadic with major infestations in the Flathead drainage in the mid-fifties and again in 1967-70, when infestations covered over 4 000 ha with an estimated 1.2 million m^3 of spruce killed by the spruce beetle. In 1981 the outbreak expanded to 122 infestations on 8 000 ha killing 450 000 m^3 of timber in the Cranbrook, Kootenay Lake, Invermere, Golden and Revelstoke TSAs.

Douglas-fir beetle infestations were reported near Grand Forks in 1933. Beetle-killed Douglas-fir trees have been recorded over the years at Beaverdell, Kettle Valley and Columbia Valley. Throughout the 1980's Douglas-fir beetle caused light to moderate tree mortality in the Rocky Mountain Trench from the U.S.A. border to McNaughton Lake.

Infestations of defoliating insects have covered larger areas, but have been less damaging than those of bark beetles. Infestations of hemlock looper occurred in 1937-38, 1945-47 and 1972-73 in areas along the Big Bend Highway, Revelstoke National Park, Arrowhead, Trout Lake and near Nakusp. Blackheaded budworm infestations occurred in 1939, 1955-58, and 1965-68 in areas along the Big Bend Highway, Upper Arrow Lake, Trout Lake and Lardeau River Valley. Spruce budworm infestations occurred in Kootenay, Glacier and Yoho National Parks and along the Monashee Highway, in 1942-44, 1946-50, 1954-56 and 1971-72. Larch sawfly was first found in the Nelson Forest Region near Fernie in 1930 and infestations occurred in 1932-33, 1938-45, 1948-49, 1965-67, and 1976-79 in western larch stands from Fernie west to Anarchist Mountain, along Kootenay and Slocan valleys and in the Whatshan Lake--Inonoaklin Crossing area. Larch casebearer was first found in the Nelson Forest Region in 1966 and since then has spread throughout the range of the lower elevation western larch stands from Rooseville west to Anarchist Mountain and along the Kootenay and Slocan valleys.

Information contained in this report was compiled from Annual District Ranger Reports and Forest Insect and Disease Survey Annual Reports for British Columbia, from 1920 to the present.


NELSON FOREST REGION
0
40
80 km
MICA DAM
COLUMBIA RIVER
GOLDEN
REVELSTOKE
KOOTENAY RIVER
INVERMERE
ARROW LAKES
NEW DENVER
KOOTENAY LAKE
CRANBROOK
FERNIE
NELSON
GRAND FORKS
TRAIL
CRESTON
CANADIAN FORESTRY SERVICE/FOREST INSECT AND DISEASE SURVEY

PINE PESTS

Mountain pine beetle, Dendroctonus ponderosae

The mountain pine beetle has caused serious losses in lodgepole pine and western white pine stands in many areas of the Nelson Forest Region and adjoining National Parks. Severe infestations occurred in lodgepole pine over 250 square kilometers in and around Kootenay National Park from 1930 to 1945. In the 1950's infestations were concentrated in the Invermere, Steamboat Mountain area of the East Kootenay and in the 1960's infestations were located primarily in Kettle Valley, Upper Kettle River, Whiteswan Lake--Elk Creek area and north of Golden. The 1970's saw major increases in beetle activity in the Elk Creek, White River Valley, Blackwater Ridge and beginning in 1976 in the Flathead Valley. These areas continued to host ever increasing populations into the 1980's. In the 1980's, major infestations developed in the Boundary TSA and the southern Rocky Mountain Trench.

Year	Remarks
1923-24	Infestation reported in Glacier National Park on western white pine.
1928	3 000 white pine were killed east of the Beaver River, with smaller infestation between the Beaver and Bear rivers.
1929-33	Infestations on lodgepole pine first appeared in Kootenay National Park near McLeod Meadows and at Cross River. An infestation was reported near Lumberton on lodgepole pine.
1934	Heavy attacks occurred on lodgepole pine in Kootenay National Park.
1935	Widespread infestation on lodgepole pine in Kootenay National Park, centered at McLeod Meadows and extending for 54 km up the Kootenay River valley.
1937	Plots established in the Kootenay National Park infestation showed an average mortality of 42 % on lodgepole pine.
1938	Active over a considerable area in the vicinity of McLeod Meadows in Kootenay National Park on lodgepole pine.
1939	Infestations on lodgepole pine have largely subsided in the southwestern part of Kootenay National Park. However, there is still an active infestation over 1 560 ha in the centre of the park on the west side of the Kootenay River.
1940	No reports of infestations.
1941	Renewed activity in Kootenay National Park, particularly between Cross River and McLeod Meadows; the infestation is rapidly spreading up the valley in a general northerly direction.

1942 The Kootenay National Park infestation has shown increased activity around Nixon and Dolly Varden creeks.

1943 Infestations were still active in Kootenay National Park, and at the present time 90% of the timber has been killed over 26 000 ha.

1944 Infestation in Kootenay National Park subsiding, though it was still active at the northern end of the infestation.

1945 Infestation in Kootenay National Park continues to decline; only the northern portion remains active, and there the pure stands of lodgepole pine give way to a mixture of pine, spruce and alpine fir.

1946 Infestation at Leanchoil in Yoho National Park is still active. Control was undertaken during the winter of 1945-46. An extensive infestation at Ice River, 16 km south of Leanchoil, which has been more or less active for a number of years showed renewed activity.

1947 Infestation at Leanchoil declined, due mainly to the control work of the past two winters. Only 88 newly infested lodgepole pine were found. The outbreak at Ice River remained active but with very little extension in area. Infestation near the junction of the Amiskwi and Kicking Horse rivers. About 50% of the white pine has been killed in a small area along McDonald Creek, about 13 km south of Nakusp.

1948 No report of infestations on lodgepole pine.

Infestations of white pine at Downie Creek and Mt. MacPherson area near Revelstoke. The infestation along McDonald Creek subsided.

1949 Heavy attack between Forster and Frances creeks; infestation approximately 10 km in length and 3 km in width. Lodgepole pine on Steamboat Mountain between Edgewater and Brisco and east side of the Elk River from Sulphur Springs south was infested. Three hundred and fifty hectares of lodgepole pine infested at Elk Creek Valley and extending out into the main White River Valley; 50 ha at the mouth of Thunder Creek on the north slope of the White River.

An infestation on white pine is well established about 8 km southwest of Arrowhead. Much of the white pine on the west side of the Columbia River at Downie Creek has been killed. From Downie Creek north to Goldstream River, small patches of red-topped white pine were observed.

1950 Infestations in the Windermere Creek Valley, extend from Columbia Gypsum Mine for a distance of about 10 km along the valley bottom to the top of the mountain slopes on the south side of the creek. Frances-Forster creeks infestations are still active and have killed most of the mature and overmature pine. Infestations on Steamboat Mountain have spread west and north along the middle bench above Edgewater and Brisco, but have died down considerably on the lower bench. The infestation along the Elk River, 32 km north of Natal, is

still active and has spread north and east in small patches for a distance of about one mile. Only a few green-infested pine were found at Elk Creek in the White River--Swan Lake area. The infestation at the mouth of Thunder Creek increased slightly. Two infestations were reported at the northeast and southwest ends of Whitetail Lake. Small patches of infested pine also occurred along the road between Findlay River and Whitetail Lake.

Ten hectares of white pine were killed at km 87 Big Bend Highway, 70% of the white pine had been attacked. Two outbreaks covered an area of 6 and 3 ha at km 67 Big Bend Highway. Thirteen hectares infested at km 67 Big Bend Highway. Occasional patches of red-topped white pine observed from Downie Creek north along the Columbia River for about 67 km. At Fortynine Creek an infestation extends over a large area. Active beetle infestations occurred in the Mt. MacPherson area west of Revelstoke, and east of Revelstoke at Greenslide Creek. The infestation on Lot 7919 in the Arrowhead district increased rapidly.

1951 Infestations were still fairly active in the Steamboat Mtn, Windermere Creek and Whitetail Lake regions. The few green infested trees present in the old infestations along Frances-Forster creeks, Toby Creek, Elk Creek and Elk River showed evidence of high beetle mortality. Severe infestations in white pine stands along the Big Bend Highway at Downie Creek, at km 75, and south of Goldstream River continued unabated. Active infestations, old and new, were observed at various points along Upper Arrow Lake. Groups of infested trees were scattered over an area about 8 km long by 3 km wide along Little Fish Creek. In older sections of the infestation, more than 90% of the white pine over 15 cm d.b.h. have been killed. Smaller areas of more recent infestations occur in the following localities along Upper Arrow Lake: on the southeast slope of Pingston Ridge, between Albert Point and Nacillewaet Creek, on Mt. Sproat in patches on the western and southern slopes, between Northeast Arm and Galena Bay, and on the west shore of the Upper Arrow Lake opposite Nakusp.

1952 Infestations on Steamboat Mountain, Frances Creek and Windermere Creek changed little during the past year. The area of infestation along the slopes west of Whitetail Lake increased to about 8 ha. Extensive infestation occurred from Shelter Bay to Sidmouth. A number of newly reported, active, spot infestations were observed in the vicinity of Upper Arrow Lake.

1953 Infestations continued to spread in the Windermere Valley. The Steamboat Mountain infestation spread northward, and the Whitetail Lake infestation expanded in all directions. Infestations persisted in the northern portion of the Upper Arrow Lake, the Nakusp and Granby River areas.

1954 The infestation at Windermere continued to spread both east and west. Expansion slowed at Frances and Forster creeks and Steamboat Mountain. Infested trees were observed along the mountainside west of Whitetail Lake.

Infestations persisted in white pine in the Revelstoke, Big Bend Highway and Upper Arrow Lake regions.

1955 Active infestation on Steamboat Mountain, with 5 groups, each of 20 to 40 infested trees. Small patches of infested pine were common in the Kootenay River basin northeast of Canal Flats. Infestations at Trout Lake, along Beaton Creek, and along the Big Bend Highway had scattered infested white pine.

1956 No new major infestations reported.

1957 Infestations persisted in stands along the western wide of the Upper Columbia Valley from Frances Creek to Whitetail Lake. Infestations continued along parts of the Big Bend Highway.

1958 Lodgepole pine recently killed by mountain pine beetles were observed for 4 km at elevations between 900 and 1 500 m along Windfall Creek north of Greenwood. Infestations on the western side of the Upper Columbia Valley, along Frances Creek and at Whitetail Lake decreased. A general increase in the number of infested white pine trees occurred from Arrow Park northward along Upper Arrow Lake and in the Slocan Valley. A previously unreported infestation on Halfway Creek included 350 red-topped pines. A small infestation was noted on Hoder Creek. Some 175 mature and overmature red-topped white pine were observed between Revelstoke and Frisby Creek.

1959 Current infestations occurred along Lussier River near the junction of Coyote Creek and along Elk Creek at the junction of White River. An unrecorded infestation was discovered along a new roadway in the Kettle River Valley between Damfino and Winnifred creeks. Aerial surveys showed that over 1 000 pine have been killed during the past five years. Infestation along Upper Arrow Lake and Silverton Creek.

1960 Trees were killed at Coyote and Elk creeks, Boundary and Windfall creeks, Enterprise Creek and along the Upper Kettle River. A light infestation persists at Steamboat Mountain. Infestation persisted along Upper Arrow Lake, particularly in the following localities: Arrow Park to Fosthall Creek, Akolkolex River and from Nakusp to St. Leon Creek. Red-top tree counts declined along Columbia River north of Revelstoke.

1961 Infestation expanded at Elk and Coyote creeks and along the Upper West Kettle Valley. Some 75 freshly attacked lodgepole pine were found at Parson. At Bush River, an infestation is active in small lodgepole pine in combination with white pine. Beetles were active in white pine along Fosthall Creek where they have persisted for several years.

1962 There were 3 500 red-topped lodgepole pine in the Kettle Valley between Winnifred and Split creeks. Approximately 1 000 red-topped trees were observed on the south side of and Coyote creeks. Red-top tree counts increased to 5 500 along Upper Arrow Lake. Increased red-topped tree counts also occurred along the Columbia River from Arrowhead to Boat Encampment, along Canoe River and from Beaton to Trout Lake.

1963 Areas of greatest recent lodgepole pine mortality are at Bush River, Redgrave, Elk, Coyote and Waitabit creeks, in the main Kettle River Valley between Bruer and Mohr creeks, and at Upper Worthington Creek near Edgewood. White pine tree mortality occurred from Revelstoke to Arrowhead, along both sides of Upper Arrow and Trout lakes, along the Lardeau River at Howser turnoff and Cooper Creek, along Springer and Enterprise creeks in the Slocan Valley and along the Columbia River at LaForme, Martha and Downie creeks.

1964 Over 3 000 red-topped lodgepole pine trees were counted between Winnifred and Copper Kettle creeks in the main Kettle River Valley. Along the Columbia River from Boat Encampment to Golden, and in the Whiteswan Lake area the number of stems attacked almost doubled in 1963. Tree mortality was evident along the Canoe River and Rogers Pass Hwys., along the east and west shores of Upper Arrow Lake; from Arrowhead to Revelstoke and from Beaton to Trout Lake.

1965 Noteworthy increases in red-topped tree counts were at Coyote Creek, 3 500, and at Redgrave, 2 000. There was a decline in red-topped tree counts in the Kettle Valley and at Waitabit Creek and Bush River. Small increases in numbers of beetle-killed white pine were recorded at Kinbasket Lake and between Beaton and Trout Lake. A sharp decline in the number of red-topped trees was noted along the Upper Arrow Lake from West Demars to Beaton.

1966 There were 3 000 red-topped trees at Redgrave and 2 000 at Coyote Creek. There was a sharp decline in number of red-tops counted along the Upper Arrow Lake and Columbia River. A total of 800 trees were counted in these areas.

1967 Lodgepole pine red-tops were counted at Redgrave, 3 500; along Elk River, 1 000 and along the Canoe River 500. Increase in white pine red-top counts occurred along Trout Lake (1 000) and Upper Arrow Lake (650).

1968 Lodgepole pine red-tops were counted at Slocan Lake (540) and Kallis Creek (400). White pine counts increased at the following localities: Upper Arrow Lake - 1 350, Trout Lake - 1 155, Erie Creek - 530, and Slocan Lake - 455.

1969 Lodgepole pine red-top counts were: 1 500 at Kallis Creek, 2 500 at Redgrave, 2 100 at Coyote Creek and 1 600 at Elk Creek. Only 540 white pine red-tops were counted at Upper Arrow and Trout lakes.

1970 Red-topped lodgepole pine counts declined in 1970; 3 000 trees were counted at Elk and Coyote creeks and at Redgrave. White pine red-top counts increased to 1 800 along the Upper Arrow and Trout lakes.

1971 An increase in the number of lodgepole pine red-tops was apparent in 1971; at Elk Cr. 6 500, Redgrave 850, Bull River 230 and 2 500 at Kallis Creek. There was an increase in number of red-topped white pine along the Upper Arrow Lake at Fosthall Creek 1 000, Pingston 2 600, Shelter Bay 2 000, Pingston Creek 1 700, Cusson Creek 2 000, MacKenzie Creek 1 700, Northeast Arm 1 000, Staubert Lake 1 700 and Trout Lake 1 600.

1972 Red-topped lodgepole pine counts at the following localities were: Kallis Creek 2 000, Elk Creek 2 500, North White River 245, Kootenay River 150, Lussier River 340, Redgrave 975 and Bush River 150. Counts of red-topped white pine at the following localities were: west side of Upper Arrow Lake 8 340, east side Upper Arrow Lake 5 200, Galena Pass 450, Northeast Arm Arrow Lake 490, Shelter Bay to Revelstoke 445, Akolkolex River 190, Incomappleux River 150, Armstrong--Trout lakes 2 815, Lardeau River 790, Duncan Lake and River 885, north end Kootenay Lake 1 345, Erie Creek 1 350, Little Slocan Lake 65, Mt. Revelstoke National Park 110, Tangier River 25, Illecillewaet River 150, Jordan River 85, Columbia River (Revelstoke to Boat Encampment) 650, Kinbasket Lake 125, Bush Arm 400.

1973 Red-topped lodgepole pine counts: Lower Elk Creek 3 530, Upper Elk Creek 870, Jack Creek 675, Haskell Creek 415, Whiteswan Lake 175, Mary Creek 305, Akutlak Creek 160, Lussier River 310, Akai Creek 120, Moberly 20, Copper Creek 55, Blackwater Ridge 3 500.

Counts of white pine red-tops: Trout Lake 1 225, Lardeau River 475, Davis Creek 100, Galena Pass 275, Halfway River 375, Pingston Ridge 1125, Saddle Mtn. 525 and Downie Creek 560.

1974 There was an increase in the number of lodgepole pine red-tops in 1974. More than 29 000 were recorded, with the highest concentrations in the Elk Creek--White River area, along Blackwater Ridge near Donald and at Goathide Creek in the West Kettle River drainage. Localities were red-topped lodgepole pine trees were recorded: Upper Elk Creek 2 064, Elk Creek Canyon 8 633, Lower Elk Creek 9 521, Jack Creek 1 360, Rock Creek 445, White River 1 711, Dry Creek 125, Palliser River 475, Lussier River 300, Parson 125 Blackwater Ridge 4 200, and Goathide Creek 1 000.

There was a decline in the number of red-topped western white pine in 1974. A total of 3 000 red-tops were recorded, with the highest number along Trout and Upper Arrow lakes and along the Rogers Pass Highway. Localities where red-topped trees were recorded: Healy Creek 200, Trout Lake 500, Arrowhead 50, Pingston Ridge 500, Galena Pass 150, Pingston Creek 500, Saddle Mtn 550, Shelter Bay 25, Illecillewaet River 300, Rogers Pass 75, and Beaver River 150.

1975 Mountain pine beetles which have been at outbreak levels for the past five years caused increased mortality of lodgepole and western white pine trees in 1975. A total of over 79 000 red top pines were counted in 1975, compared to 33 000 counted in 1974. The most significant areas relative to damage were in the Elk Creek--White River area and at Blackwater Ridge near Golden. New infestations were recorded in the Kettle Valley at Fiva Creek, Arlington Lakes, Ptarmigan Creek, Greenwood, and Chatter and Prattle creeks north of Golden. The infestation at Goathide Creek, which had been salvage logged in 1972, had red top trees occurring around the perimeter of the logging in 1975. Lodgepole pine red top counts were as follows West Kootenay: Goathide Creek 2 000, Five Creek 2 000, Arlington Lakes 400, Rhone Creek 50, Ptarmigan Creek 125, Greenwood 500,

Memphis Creek 250, East Kootenay: Upper Elk Creek 2 100, Elk Creek Canyon 30 000, Lower Elk Creek 17 500, White River junction 4 370, Rock Creek 1 000, Mary-Akutlak creeks 2 360, Lussier River 800, White River 500, Whiteswan Lake 150, Dry Creek 375, Queen Mary Creek 850, Pedley Creek 50, Kootenay River 25, Toby Creek 30, Parson 300, Blackwater Ridge 6000, Chatter--Prattle creeks 1750.

Western white pine red top counts in West Kootenay: Trout Lake 2 450, Shelter Bay 200, Pingston Ridge 550, Fosthall Creek 100, south Fosthall Creek 725, Plant Creek 550, Cusson Creek 600, Saddle Mtn 550, East Kootenay: Bush River 1 050, Smith Creek 550, Kinbasket River 375, Beaver River 150, Illecillewaet River 250.

Data from the ground surveys, showed an increase in 1975 attack compared with that of 1974, and that most of the 1975 attack occurred within the areas of 1974 attack, with lighter attacks occurring adjacent to the infested stands. Overwintering beetle populations are high in all areas.

1976 Red tops increased slightly to 81 000 lodgepole and western white pine on 8 300 hectares. Major infestations in the West Kootenay in lodgepole pine occurred at Goathide Creek, 1640 red trees; Ptarmigan Creek, 370; Arlington Lakes, 620; King Solomon Mt., 270; Fiva Creek, 1 700; Christina Lake, 135. Beetle-killed white pine occurred at Trout Lake, 130; Plant Creek, 300; Cusson Lake, 500. Infestations are expected to continue at about the same levels in 1977.

In the East Kootenay major infestations were active in lodgepole pine at Bush River 700; Succour Creek, 900; Gold River 300; Blackwater Creek, 2500; Blackwater Ridge, 15 000; Waitabit Creek, 2 000; Beavermouth Creek, 2 500; Redgrave, 500; Donald, 3 350; Willowbank Mt., 800; Blaeberry River, 1 000; Moberly Bench, 250; Nicholson, 225; Horse Creek, 500; Castledale, 125; Horsethief Creek, 200; Toby Creek, 800; Addie Creek, 700; Palliser River 800; Nappe Mt., 100; Dry Creek, 500; Elk Creek, 12 000; White River, 25 450; N. White River, 1 100; Whiteswan Lake, 370; Lussier River, 1 020; St. Mary Lake, 200; Morrissey Creek, 500; Flathead River, 150; Sage Creek, 180.

White pine - Top of the Bend, 2 150; Cummins River, 250; Tsar Creek, 300; Molson Creek, 100; Goosegrass Creek, 150; Lyell Creek, 400; Bush River, 4700; Bush Lakes, 300; Game Creek, 300; Sentry Mtn., 100; Gold River, 250; Smith Creek, 600; The Elbow, 100; Beaver Point, 300.

Listed are those infestations reporting more than 100 red trees. For more complete listing refer to 1976 Nelson Region File Report.

1977 Numbers of lodgepole and white pine killed nearly doubled to 145 742 red tops over 13 394 hectares. The White River System alone accounted for 117 000 of the killed trees over 9300 ha. Current attack was extensive in this area. In the lower Flathead Valley, major flights from huge infestations across the southern border in Montana, contributed to the tenfold increase in mortality at the mouth of Sage Creek where 4 500 trees were tallied on 500 ha.

Infestations in the West Kootenay declined due to rapid detection and logging of small outbreaks. Major infestations in lodgepole occurred at Goathide Creek, 650 red trees; Ptarmigan Creek, 280; Arlington Lakes, 550; King Solomon Mtn., 600; Fiva Cr., 600; and Christina Lake, 155. Notable white pine mortality occurred at Plant Creek, 150; and, Pingston Creek, 200.

In the East Kootenay major areas of mortality occurred at Succour Creek, 120; Blackwater Ridge, 4 900; Beavermouth, 200; Redgrave, 800; Waitabit Creek, 500; Donald, 600; Moberly Bench, 100; Golden West, 150; Golden East, 275; Twelve Mile Creek, 250; Pagliaro Creek, 100; Horsethief Creek, 100; Harrogate, 100; Mt. Taynton, 1 300; Dutch Creek, 400; Doctor Creek, 800; Palliser River, 500; North White River, 950; Fenwick Creek, 350; Colin Creek, 400; Middle White River, 2 000; East White River, 500; Grave Creek, 300; Whiteswan Lake, 950; White River, (East of Whiteswan Lake), 10 000; White River, (North of Whiteswan Lake), 50 000; Elk Creek, 45 000; Blackfoot Creek, 665; Thunder Creek, 635; Cry Creek, 1 000; Lussier River, 1 450; Flathead River (Sage Creek) 4 500. In lodgepole pine and white pine stands mortality occurred at Sentry Mtn., 150; Gold Arm, 140; Columbia Reach, 1 225; Sullivan Arm, 400; Bush Arm, 4 000; and Succour Creek, 500.

Listed are infestations reported to contain 100 or more red trees. For a more complete listing refer to 1977 Nelson Region File Report.

1978 The number of beetle killed lodgepole and western white pine increased threefold with 425 077 trees reported killed over 18 941 ha. The most severely infested areas were the Flathead River Valley (lodgepole), White River (lodgepole), Golden-McNaughton Lake (lodgepole and western white pine), Kettle River and West Kettle River.

In the west Kootenay, mortality of lodgepole pine increased by 50% and western white pine by 500%. Greatest increases were along the West Kettle from Goathide Creek to Arlington Lakes. Areas of major infestations in lodgepole pine in the West Kootenay were: Goathide Creek, 2 350; Ptarmigan Creek, 330; Arlington Lakes, 1 205; Trapping Creek, 125; King Solomon Mt., 250; Fiva Creek, 310; and, Nicholson Creek, 165, while major kill of white pine occurred at Whatshan River, 250; Plant Creek, 140; Pingston Creek, 200; Trout Lake, 475; Downie Creek, 350; Healy Creek, 300; Christina Lake, 105; Erie Creek, 500.

In the East Kootenay major areas of mortality were White-Kootenay River valleys, 210 000; Elk Cr., 55 000; Flathead River valley, 100 000; from Golden to Parson, 2 000; Findlay and Lavington Creeks, 7 500; Toby and Goldie Creeks, 3 000; Palliser--Kootenay--Cross Rivers, 6 500; and Horsethief Creek--Steamboat Mtn., 3 000 in lodgepole pine while white pine mortality occurred at McNaughton Lake, 15 000.

Reported here are infestations numbering 100 red trees or more. For a more complete listing refer to 1978 Nelson Forest Region File Report.

1979 Mountain pine beetle killed an estimated 4.5 million lodgepole and western white pine over 24 000 ha in the Nelson Region. Major intensities occurred in the Flathead River Valley, the White River drainage, West Kettle River and Blackwater area on lodgepole pine and on white pine in Bush Arm. In the West Kootenays lodgepole pine mortality occurred at Kettle River (below Winnifred Creek), 195; Moody Creek, 120; Boomerang Creek, 160; Fiva Creek, 231; King Solomon Mt., 450; Mt. Ferrous, 100; Hall Creek, 1 295; Arlington Lakes--Ptarmigan Creek, 2 250; Goathide Creek--West Kettle River, 3 040; and Chapleau Creek, 750. Western white pine mortality occurred at Trout Lake, 445; Healy Creek, 220; Goldstream River, 1 170; Downie Creek, 1 500; Keystone Creek, 120; Whatshan River, 250; and, Pingston Creek, 510.

In the East Kootenay, major infestations in lodgepole occurred in the Flathead Valley including Akamina--Kishenena creeks, 2 000 000; Elk Creek, 400 000; White-Kootenay river valleys, 1 750 000; Upper Kootenay--Palliser--Cross rivers, 20 000; Findlay--Lavington--Dutch creeks, 3 000; Toby Creek-Windermere Lake, 7 000; Horsethief Creek--Steamboat Mtn., 12 000; Parson--McMurdo Creek--Golden, 1 000; Waitabit Creek--Blaeberry--Blackwater rivers, 77 000; Elko--Caven--Ward creeks, 500; St. Mary River--Alki Creek, 200; and, Blue Lake (N. of Elkford), 300. Western white pine mortality occurred at McNaughton Lake--Bush River, 230 000; Kitchener--Irishman Creek, 300.

Reported here are infestations numbering 100 red trees or more. For a more complete listing, refer to 1979 Nelson Forest Region Annual Report.

Ground surveys showed the amount of current attack to be as great or greater than 1978. At Lemon Creek along the Kootenay River, and at Proctor Lake in the Flathead Valley, approximately 50% of the trees were attacked this year.

1980 Mountain pine beetle killed an estimated 10 million lodgepole pine and western white pine in 3 600 infestations covering 33 400 ha. High intensity infestations continued in the Flathead River Valley, the White River system, West Kettle River and Blackwater area in lodgepole pine and in the Bush Arm and Columbia Reach area in western white pine. Ninety-five percent of the kill was accounted for by the infestations in the Flathead Valley, 7 000 000; and the White--Kootenay river valleys including Elk Creek, Palliser and Cross River valleys, 2 500 000. Elsewhere in the East Kootenay 149 000 lodgepole were killed in the Columbia River Valley including Toby Creek, Horsethief Creek and Steamboat Mtn. Blackwater--Bush Arm, Bush River, 300 000, included both lodgepole and white pine. Other E. Kootenay infestations were at Lodgepole--Morrissey--Corbin creeks and Elk River, 500; and Elko--Yahk--Cranbrook, 500. In the West Kootenay

10 000 trees in western white pine and lodgepole pine stands were killed in the Kootenay Lake--Arrow District in small scattered infestations. In the Grand Forks and Upper Kettle River area 800 lodgepole pine were killed while 12 700 lodgepole pine were killed in W. Kettle River - Rock Creek area.

Cruise data from Carmi, Arlington Lakes and Moody Creek indicated expansion of infestations and increases in mortality in 1981 and in the West Kootenay. Ground examinations in the East Kootenay indicated that outbreaks would continue in 1981.

1981 Mountain pine beetle killed an estimated 10.5 million lodgepole and western white pine in 2 424 infestations over 58 790 ha with volume losses estimated to be 3.4 million m^3. The number of discrete infestation areas declined from 3 600 primarily due to the coalescing of small infestations to single continuous areas of mortality, particularly in the Flathead Valley and White-Kootenay River drainage which accounted for 80% of tree mortality throughout the Region. In table form, by TSA and National Park:

TSA or Nat. Park	No. infestations	Area (ha)	No. of trees	Volume(m^3)
Cranbrook	797	22 760	6 045 000	1 330 000
Invermere	766	23 750	3 680 000	1 629 100
Golden	416	6300	510 000	290 000
Revelstoke	73	1600	2300	2600
Kootenay Lake	50	420	500	550
Boundary	133	2000	178 000	62 300
Arrow	87	1030	80 000	43 000
Glacier Park	16	240	1070	1000
Yoho Park	32	330	1780	600
Kootenay Park	54	360	2350	850
Totals	2 424	58 790	10 501 060	3 360 000

Ground checks and cruises indicated a dramatic drop in population of beetle in the Flathead Valley in 1982 with current attack averaging only 2%. All other areas show similar or increasing infestation levels for 1982.

1982 Mountain pine beetle killed an estimated 4.3 million pine trees over 38 200 ha in 2,600 infestations. The main area of decline occurred in the Flathead River drainage due to host depletion. In the White River drainage there was a minor decline. In the Golden TSA, the main infestation along Bush Arm declined while slight increases where noted along the Blaeberry River. Declining populations were also recorded throughout the West Kettle, while new infestations were recorded in the Kettle River drainage.

TSA or Nat. Park	No. infestation	Area	No. of trees	Volume
Cranbrook	300	8620	1 253 000	450 000
Invermere	1 492	20 100	2 113 000	761 000
Golden	247	5 560	610 000	220 000
Revelstoke	40	50	330	300
Kootenay Lake	35	750	14 000	15 600
Boundary	284	1 400	167 000	60 100
Arrow	88	1 120	134 500	53 300
Glacier N.P.	13	200	400	400
Yoho N.P.	25	200	1 000	800
Kootenay N.P.	84	450	3 400	1 250
Total	2 598	38 450	4 296 630	1 562 750

1983 Mountain pine beetle killed an estimated 2.1 million pine trees over 20 000 ha in 1 700 infestations. Decreases occurred throughout the region with a total collapse in the Flathead River drainage, while host depletion and logging reduced populations along the White River and Bush Arm.

TSA or Nat. Park	No. infestations	Area	No. trees	Volume
Cranbrook	200	810	117 700	42 400
Invermere	1 170	16 240	1 707 500	614 700
Golden	88	1 500	163 500	59 000
Revelstoke	12	60	400	400
Kootenay L.	27	140	2 600	2 900
Boundary	80	820	98 000	3 500
Arrow	32	160	18 900	7 600
Glacier N.P.	9	50	100	100
Kootenay N.P.	94	410	3 100	1 200
Totals	1712	20 190	2 111 800	731 800

1984 Mountain pine beetle killed an estimated 1.9 million pine trees over 21 200 ha in 1 350 ha. Major population decreases were noted in the Bush Arm area while minor reductions were also found in the White River system. Increasing populations were evident in the Gilnockie Creek area and near Steamboat Mountain. Most other infestations remained relatively stable although there were some new infestations recorded in the Kootenay Lake and Boundary TSAs, due to more extensive aerial surveys.

TSA or Nat. Park	No. infestations	Area	No. trees	Volume
Cranbrook	226	3 600	394 000	142 000
Invermere	822	14 350	1 389 000	500 000
Golden	48	520	24 300	8 700
Revelstoke	10	40	225	225
Kootenay L.	32	570	11 600	6 850
Boundary	109	1 025	47 000	16 900
Arrow	27	500	23 000	8 400
Glacier N.P.	3	5	50	50
Kootenay N.P.	74	600	3800	1 400
Total	1 351	21 210	1 892 975	684 525

1985 Mountain pine beetle killed more than one million pine trees over 14 600 ha in 1 780 infestations. The more active areas occurred in the Gilnockie--Bloom creeks area, adjacent to Steamboat Mountain and an intensification of attack in the Christina Lake and Grand Forks areas. Declining populations continued in the Bush Arm area due to host depletion, and also at Trout Lake. Fire destroyed expanding populations in a number of areas in the East Kootenay, most notably in the White, Lussier and Ram creeks areas.

TSA or Nat. Park	No. infestations	Area	No. trees	Volume
Cranbrook	744	3 850	372 800	134 200
Invermere	674	8 300	521 400	187 700
Golden	14	325	19 400	7 000
Revelstoke	6	5	150	150
Kootenay L.	15	35	2 000	1 000
Boundary	251	1 200	105 600	38 000
Arrow	15	250	23 000	9 200
Glacier N.P.	3	65	350	350
Kootenay N.P.	58	600	4 000	1 500
Total	1 780	14 630	1 048 700	379 100

1986 Mountain pine beetle killed 1.2 million pine over 25 670 ha in 3 208 infestations. Populations in the Cranbrook TSA remained stable with new infestation appearing in the Peavine Creek drainage. In the Invermere TSA, beetle populations were rapidly expanding in the Steamboat Mountain area. Major increases continued in the Boundary TSA, in the Granby River--Christina Lake area, Jewel Lake, along Boundary Creek and along the Kettle River. Beetles also remained active in the West Kettle River. In the Arrow and Revelstoke TSAs, there was increased attack on white pine in numerous drainages from north of Revelstoke to south along the Columbia River--Arrow Lakes

and Slocan Lake to the Castlegar area. In Kootenay Lake TSA, increased beetle activity occurred along the the Kootenay River near Nelson, and in the Freeman--Hawkins creeks area.

TSA or Nat. Park	No. infestations	Area	No. trees	Volume
Cranbrook	1 029	3 800	191 100	68 800
Invermere	678	13 600	663 400	238 800
Golden	30	440	11 000	4 000
Revelstoke	94	1 530	3 900	3 800
Kootenay L.	182	400	3 500	3 300
Boundary	960	5 150	327 500	117 900
Arrow	235	750	14 700	7 800
Glacier N.P.	17	75	440	400
Kootenay N.P.	90	1 600	5 500	2 000
Mt. Revelstoke N.P.	8	835	1 700	1 700
Total	3 323	28 180	1 222 740	448 500

1987 Mountain pine beetle killed 1.2 million pine trees over 22 310 ha in 4 196 infestations. The major increasing populations were in the Boundary TSA, especially in the Granby--Christina Lake, Greenwood, Jewel Lake and Ingram Creek. Small new infestations were also noted in the northern part of the TSA at Burrel and Hellroarer--Grano creeks, while activity continued in the western part of the TSA. Infestations in the Invermere TSA generally declined except for areas west of Steamboat Mountain and in the Columbia Lake--Canal Flats area. The main beetle activity in the Cranbrook TSA remained in the Bloom--Caven--Linklater creeks area. Some increased beetle activity was evident in lodgepole pine in the Shields Creek and Robson Ridge areas of the Arrow TSA and in the Hawkins--Freeman creeks area of the Kootenay Lake TSA. Activity in white pine stands throughout the region declined.

TSA or Nat.Park	No. infestations	Area	No. trees	Volume
Cranbrook	1 104	3 450	237 000	85 000
Invermere	787	6 800	283 000	102 000
Golden	13	260	6 000	2 250
Revelstoke	83	20	600	600
Kootenay L.	79	130	1 200	1 100
Boundary	1 736	10 700	628 500	226 300
Arrow	394	950	61 100	25 600
Glacier N.P.	13	10	100	100
Kootenay N.P.	94	1 000	4 000	1 450
Mt. Revelstoke N.P.	12	10	100	100
Total	4 315	23 330	1 221 600	444 500

1988 Mountain pine beetle killed 1.3 million pine over 26 180 ha in 4 767 infestations. In the Boundary TSA, increasing populations continued in the in the east at Texas--McRae--Sutherland creeks; in the south, between Grand Forks and Midway, at Jewel Lake, and in the North Granby drainage; in the west and north increased activity occurred, including the Kettle River, West Kettle and Copperkettle creeks. In the Cranbrook TSA, the main activity remained in the Gold Mountain--Caven Creek area, but increases in the number of small infestations were evident in the Galton Range, lower Elk and Bull rivers and along the Rocky Mountain Trench south of Cranbrook. In the Invermere TSA, expanding populations occurred along the Rocky Mountain Trench, especially from Columbia Lake north to Steamboat Mountain, older infestations in the eastern drainages were reduced to small pockets. In the Arrow TSA, increasing infestations continued in the Nancy Greene Lake, Dog and Shields creeks areas, while populations declined in the white pine stands. Increasing attack was noted in the Kootenay Lake TSA, mainly in the Hawkins--Freeman creeks area.

TSA or Nat. Park	No. infestations	Area	No. trees	Volume
Cranbrook	1125	5 250	204 000	73 000
Invermere	645	3 400	200 000	72 000
Golden	32	10	1 300	500
Revelstoke	34	9	270	270
Kootenay L.	180	147	4 331	2 563
Boundary	2354	15 461	820 061	295 243
Arrow	322	1 298	56 693	23 301
Glacier N.P.	2	2	35	35
Kootenay N.P.	63	600	42 000	15 000
Mt. Revelstoke N.P.	10	3	90	90
Total	4767	26 180	1 328 780	482 002

1989 Mountain pine beetle killed 1.7 million pine trees over 31 786 ha in 5 315 ha. In the Boundary TSA, increasing populations continued in the south, west and north while decreasing in the east near Christina Lake. The more active areas included the Boundary Creek drainages, the Kettle and West Kettle River areas. In the Cranbrook TSA, all populations were expanding including the older infestations in the Gold Mountain--Bloom Creek area. Smaller infestations increased south of Cranbrook in the Rocky Mountain Trench and its side drainages especially the Bull River, Chipka Creek, and the Elk River. Numerous new pockets were noted in the Moyie Lake and Fernie areas. In the Invermere TSA, active populations remained in the Columbia Lake to Frances Creek. In the Arrow TSA, beetles remained stable at Nancy Greene Lake and Dog Creek, but declined in most other areas. In the Kootenay Lake TSA, the main activity remains in the Hawkins--Freeman creeks area.

TSA or Nat. Park	No. infestations	Area	No. trees	Volume
Cranbrook	1665	7 965	524 100	188 700
Invermere	666	2 427	76 100	27 400
Golden	30	8	200	100
Revelstoke	14	5	200	200
Kootenay L.	206	205	15 000	5 400
Boundary	2351	19 566	990 800	356 700
Arrow	269	906	33 200	13 900
Glacier N.P.	11	87	300	300
Kootenay N.P.	99	616	19 700	7 100
Mt. Revelstoke N.P.	4	1	20	20
Total	5315	31 786	1 659 600	599 800

1990 Mountain pine beetle killed 1.1 million pine over 23 016 ha in 4 685 infestations. In the Boundary TSA, increasing populations continued in the north, especially in the Kettle and West Kettle rivers, and at Copperkettle Creek, where infestations are expanding up side drainages. Declining populations occurred throughout the southern portions of the TSA. In the Cranbrook TSA, populations continued to increase at lower elevations in the Rocky Mountain Trench and along its side drainages especially the Bull and Elk rivers and in the Moyie Lake area, but declined in the higher elevations of the Galtons and Gold Mountain. In the Invermere TSA, infestations remained stable along the Toby, Horsethief, Frances creeks and on the east side of Columbia Lake. In the Arrow TSA, expanding populations continued along the east side of Lower Arrow Lake, near Edgewood, and at Gem Hill--Robson Ridge near Nancy Greene Lake. In the Kootenay Lake TSA, the beetles remain active in the Hawkins--Freeman creeks area, but increases were also noted along the Yahk River.

TSA or Nat. Park	No. infestations	Area	No. trees	Volume
Cranbrook	1336	6 580	466 500	167 900
Invermere	465	1 845	69 100	24 840
Golden	28	6	150	102
Revelstoke	15	4	120	120
Kootenay L.	207	360	12 850	5 455
Boundary	2315	12 500	521 759	187 843
Arrow	195	1 110	38 293	25 533
Glacier N.P.	23	41	390	390
Kootenay N.P.	89	566	17 300	6 251
Total	4685	23 016	1 126 582	418 554

1991 Infestations declined to 14 680 ha. Significant increasing populations were recorded only in the Cranbrook TSA, especially in the Rocky Mountain Trench, along the Elk and Bull rivers and Moyie Lake. In the Invermere TSA, infestations increased in the north near near Parson, remained stable in the Steamboat Mountain area, and decreased in the south. In the Golden TSA, numerous new small pockets of infestation appeared along the Columbia River from south of Golden to north of Donald along the Columbia Reach. In the Boundary TSA, declines were evident throughout except for portions of the Kettle River drainage. In the Arrow TSA, populations declined in the south but increased in the north. Beetle activity remained relatively stable in the Revelstoke and Kootenay Lake TSAs.

TSA or Nat. Park	No. infestations	Area	No. trees	Volume
Cranbrook	1 917	8 530	480 000	171 000
Invermere	850	1 320	50 300	18 100
Golden	107	40	800	240
Revelstoke	18	5	90	40
Kootenay L.	48	40	1 400	560
Boundary	720	2 960	136 000	49 000
Arrow	310	875	37 000	14 800
Glacier N.P.	22	35	900	700
Kootenay N.P.	248	860	56 000	20 200
Yoho N.P.	29	10	200	80
Mt. Revelstoke N.P.	18	5	90	40
Total	4 287	14 680	762 780	274 760

Lodgepole needleminer, Coleotechnites milleri

Larvae of this insect, which mine the needles of lodgepole pine, have defoliated extensive areas mainly in Banff National Park; however, defoliation has been recorded in adjacent areas of Kootenay and Yoho National Parks. The species has a two year life cycle; the moths fly in alternate years (generally in even-numbered years in western Canada).

The first recorded infestations occurred in Kootenay National Park in 1942. Infestation continued with varying degrees of damage until 1947. Populations slowly declined until 1965, when unfavorable winter weather conditions reduced the populations to an endemic level. Populations increased in the years 1962-64, but again declined and remained at an endemic level.

Year	Remarks
1942	An epidemic developed in Banff and Kootenay National Parks. The infestation extended through Vermilion Pass as far as Hawk Creek, a tributary of Vermilion River.

1943 A non-flight year. The infestation extended over the same areas as 1942.

1944 Outbreak was more widespread at the following locations: Wapta Lake, Vermilion Summit, Marble Canyon and Hawk Creek in Yoho and Kootenay National Parks.

1945 A non-flight year. Outbreak covered some 52 000 ha in Banff, Yoho, and Kootenay National Parks.

1946 Up to 40% of the lodgepole pine needles were mined in the area of Vermilion Pass and Hawk Creek.

1947 No appreciable spread although the outbreak covered some 78 000 ha in Banff, Yoho and Kootenay National Parks.

1948 Not mentioned in reports.

1949 The infestation extended from Vermilion Pass south as far as the Simpson River and Hawk Creek in Kootenay National Park and from the Amiskwi River in Yoho National Park east to Lake Louise in Banff National Park.

1950 Localized infestation near the Spiral Tunnel in Yoho National Park. Outbreak of medium intensity continued in Kootenay National Park.

1951 Populations were slightly higher in Yoho National Park.

1952 Populations remained at the same levels as 1951.

1953 No appreciable increase in population levels.

1954 Population intensities remained light to medium in Yoho and Kootenay National Parks.

1955 Populations were greatly reduced by unfavorable weather conditions in the fall of 1954. Little or no needle damage was detected in Yoho and Kootenay National Park.

1956 Light infestation levels in Yoho and Kootenay National Parks. At Hawk Creek there were an average of five larvae per branch.

1957 Endemic populations.

1958-61 Populations remained low.

1962 Populations increased in Banff National Park but remained low in the adjacent areas of Yoho and Kootenay National Parks.

1963 Low to medium populations at Marble Canyon and Black and Hawk creeks in Kootenay National Park and near Field in Yoho National Park.

1964	Populations generally reduced by winter mortality. Medium populations at Black Creek in Kootenay National Park but low elsewhere.
1965	Low population levels.
1966	Endemic populations.
1967-91	Not mentioned in reports, however, a very similar insect, Coleotechnites starki has been reported causing some damage in the National Parks.

Pine needle sheathminer, Zellaria haimbachi

This needle miner caused generally light damage to lodgepole and ponderosa pine trees. Isolated infestations were reported in the central part of the region in the late fifties and during the sixties.

Year	Remarks
1958	Light damage was common in the southern Kootenay on ponderosa pine.
1959	Up to 40% of ponderosa pine branch tips were infested near Wardner.
1960	An infestation damaged up to 50% of the branch tips of lodgepole pine at Evans Creek at Slocan Lake.
1961	The epidemic at Evans Creek on immature lodgepole pine declined.
1962	Infestations in the region were moderate, except at Bowman Creek, where up to 60% of the current foliage was damaged.
1963	Several thousand hectares of lodgepole pine were damaged by needle miners along Bowman and Renata creeks and along the Granby River where from 30 to 50% of the pine shoots were infested.
1964	Moderate damage occurred on 1.5 ha of lodgepole pine near Krestova.
1965-66	No damage reported.
1967	Light to moderate damage to lodgepole pine at Ryan and Tochty south of Cranbrook.
1968	Light damage was noted at Ryan, Moyie, Kimberley and Wardner on lodgepole pine trees.
1969-74	No damage reported.

1975	Foliage discoloration to young lodgepole pine along Torrent, Lost Dog, and Skookumchuck creeks, Hahas Lake and near Canal Flats at the confluence of Findlay Creek and Kootenay River.
1976	Previous years infestations collapsed.
1977-85	No significant damage reported.
1986	Populations increased in the southern part of the region covering 1 000 ha. An average of 50% of the foliage was fed on in the Yahk to Cranbrook area. Several hundred hectare were infested in the Kimberley--Meadowbrook area and along Coal Creek near Fernie. Light damage was noted for several kilometers near Kaslo.
1987	Populations declined in the East Kootenay but increased in the West Kootenay. In the Gibbs--July creeks area, 150 ha of lodgepole pine was severely defoliated. Roadside pine were lightly fed on from Grand Forks to Greenwood, along the Kettle River, along State Creek and south of Kaslo.
1988	The infestation in the Gibbs--May--Stacey creeks area increased to 235 ha of moderate feeding. Roadside damage was reduced to 12 km at Greenwood. Only minor feeding was evident over 200 ha in the Driftwood Creek area near Spillimacheen and occasional small patches in the St. Mary Lake area.
1989	The infestation in the Gibbs--May--Stacey creeks are increased to 416 ha of moderate defoliation. Light damage to roadside pine was noted for 5 km along the Conkle--Ripperto creeks road.
1990-91	No significant damage was reported.

European pine shoot moth, Rhyacionia buoliana

This shoot-boring insect was accidentally introduced into eastern United States. It has since spread into B.C. where the first occurrence in the Nelson Forest Region was reported in 1974 at the Hugh Keenleyside Dam near Castlegar.

Year	Remarks
1974	About 150 Mugho pine planted in 1968 at the Hugh Keenleyside Dam near Castlegar were heavily infested. Larvae were also found on 17 Austrian and one Scots pine. All infested shoots were burned and the trees sprayed with dimethoate.
1975	Mugho pine and one Scots pine were lightly infested at Hugh Keenleyside Dam. Clipping and burning of shoots and spraying of infested trees was again undertaken by B.C. Hydro.

1976	Ten infested Mugho pine tips were found at Hugh Keenleyside Dam and burned. No adults were found in pheromone traps near the dam or at Creston.
1977	Pine shoot moth continued to infest Mugho pines at Hugh Keenleyside Dam. A new infestation was noted at the I.C.B.C. office at Trail. Clipping of infested tips and chemical spraying was carried out at both sites.
1978-91	No reports of damage. Quarantine regulations lifted in 1981.

Pine engraver, Ips pini

Beetles attacked all pines but was most common in ponderosa and lodgepole. Populations build up in logging slash and windfall and occasionally attack standing trees. Outbreaks usually last for one season.

Year	Remarks
1958	Some 90 young ponderosa pine trees were killed south of Westbridge in the Kettle River valley. Smaller groups were damaged near Grand Forks.
1959	Numerous small patches of infested ponderosa pine were apparent in the southern part of the region. Patches were observed at Grand Forks, Skookumchuck and Elko.
1960-62	No damage was known to have been caused.
1963	Along Michel Creek, 150 lodgepole pine were killed near Corbin. Top-kill was evident on scattered trees near Wasa Lake.
1964-66	No damage was recorded.
1967	Right-of-way slash and occasional standing lodgepole pine tree were attacked near Kimberley.
1968	No damage was recorded.
1969	In the Kettle River valley there were patches of 10 to 25 ponderosa pine trees infested.
1970-76	No damage was recorded.
1977	Fifty pockets of 2 to 20 trees each of lodgepole and ponderosa pine were killed at Grasmere.

1978	No new activity but an additional 50 pockets of 1977 attack at Tepee Creek, Wasa to Canal Flats and at Lussier River (500 trees).
1979	Increased activity in the lower Flathead, White and Beaverfoot river areas, and at Toby Creek. Scattered pockets, which amounts to less than 1% of all beetle-killed lodgepole pine in the East Kootenay.
1980	Increasing populations in debris and slash accumulation in spaced stands.
1981	Increasing populations in scattered locations in the lower Flathead River valley and south of Elko, usually in pockets of 5 to 20 trees each.
1982-85	No damage was recorded.
1986	Along the Plumbob--Newgate road, 40 lodgepole pine were attacked, beetles originated from adjacent land clearing slash piles. Common in association with mountain pine beetle infestations.
1987	Lodgepole pine were attacked along clear cut fringes at Mt. Ferroux and Collier Lakes. All mountain pine beetle sites examined had accompanying Ips pini attack.
1988-90	Commonly found in association with mountain pine beetle, especially in the drier areas.
1991	An average of 28% of the current attacked pine in the Jaffray, Fernie and Sparwood areas was from Ips beetles; as local mountain pine beetle populations were greatly reduced by overwintering mortality.

Pine butterfly, Neophasia menapia

This defoliator, which has killed ponderosa pine in the northwestern United States, has occurred on Douglas-fir in coastal B.C. with some reports of minor damage. More commonly, large numbers of adults in flight are reported but little or no defoliation occurs. Occurrence of the defoliator in the Nelson Region has been sporadic since first reported in 1955, from 1962 to 1967 and in 1976; no defoliation has been reported, however, despite the numbers of adults reported.

Year	Remarks
1955	Moth flights common in ponderosa pine stands of Lower Granby River Valley and from Christina Lake south to the U.S. Border.
1962	Two larvae collected on white and ponderosa pine hosts near Crawford Bay and Boswell were the only larvae reported in 6 years. Small adult flights between New Denver and Slocan City.

1963	A few pupae were collected near Kingsgate; no damage. Several butterflies observed in lodgepole pine stands along Canuck and Bugaboo creeks.
1964	Small groups of butterflies observed in ponderosa pine stands near Champion Creek and Deer Park and in Douglas-fir stands from Nakusp to St. Leon. No larvae were collected.
1965	A few larvae were collected at Leman Creek on ponderosa pine and from lodgepole pine at Riondel. Small flights noted along Galena Bay Road.
1966	Small flights in white pine stands at Whatshan Lake and Needles.
1967	Up to five adults in flight in ponderosa pine at Whatshan Lake and Broadwater. Small flights noted in Douglas-fir and white pine stands along Upper Arrow and Trout lakes.
1968-75	Not mentioned in reports.
1976	Moderate numbers of adults in flight in Douglas-fir, ponderosa and lodgepole pine stands near Castlegar, Robson and Brilliant and over an extensive area between Kitchener, Yahk and Kingsgate. No defoliation.
1977-91	Not mentioned in reports.

Pine needle scale, Chionaspis pinifoliae

Preferred hosts are ponderosa and lodgepole pine, but the insect also attacks Douglas-fir, hemlock and spruce. Chronic areas of infestation are in the East Kootenay.

Year	Remarks
1942	Heavily infested young Douglas-fir along the highway from Radium to Windermere.
1943-56	No reports of damage during this period.
1957	Scattered light infestations of this scale were observed in lodgepole pine stands in parts of the region, notably at a locality eight kilometers north of Yahk.
1958	A heavy infestation of pine needle scale on Douglas-fir trees was observed at Elko and between Canal Flats and Springbrook. A predacious lady-bird beetle, Chilocorus sp., was abundant.
1959	A heavy population was present on 4 ha of lodgepole pine in the Bull River area and at Yahk.

1960-62	No reports of damage.
1963	Reproduction lodgepole pine east of Wardner was heavily infested with scale insects; light to moderate infestations were observed at Caithness and along Bull River road.
1964-67	No reports of damage.
1968	Common along dusty roadsides in the East Kootenay.
1969-75	No reports of significant damage.
1976	Severe on the west side of Windermere Lake in mature and Christmas tree size Douglas-fir, and light on lodgepole and ponderosa pines elsewhere in the East Kootenay. Light attacks also occurred on lodgepole and ponderosa pines near Beaverdell and Midway.
1977-79	No reports of significant damage.
1980	Ten immature lodgepole pine near Moyie Lake had 20% of their needles infested.
1981	No damage observed.
1982	Severe damage to fringe lodgepole pine along Freeman Creek, east of Yahk. At Moyie Lake Provincial Park, lodgepole pine was lightly infested. Light damage was also reported on spruce along Cross River.
1983-90	No significant damage reported other than occasionally infested fringe trees at Hellroarer Creek and at Midway.
1991	Moderate numbers on ponderosa pine along Tepee Creek.

Black pine needle scale, Nuculaspis californica

An insect enemy of ponderosa pine. Infested trees have been found in the Cascade area and the south-eastern part of Kootenay Lake.

Year	Remarks
1958	A few lightly infested trees were discovered one kilometer south of Cascade, the first infestation recorded for this species in the region.
1959	No reports of damage.
1960	A new locality record for this pest was the discovery of a few severely infested trees at Kuskonook on the shore of Kootenay Lake.

1961	This species persists on ponderosa pine in company with pine needle scale along the south-eastern part of Kootenay Lake.
1962-91	No reports of damage.

Warren's root collar weevil, Hylobius warreni

Pine root weevils have caused damage to western white lodgepole pine and seedlings and saplings throughout many areas of the Upper Arrow Lake, Revelstoke north along the Big Bend Highway and in the Kaslo area.

Year	Remarks
1955	Larvae, pupae and adults of this weevil were noted on the roots and root collars of western white pine trees at Mackinson Flats near Arrow Park. A high percentage of trees, 10 to 30 cm d.b.h. and less, have been killed.
1956	Weevils were common throughout the western white pine stands of the central portion of the region. Weevils were collected south of Kaslo, near Revelstoke and along Kuskanax Creek. At Kuskanax Creek, some small dead or dying white pine showed evidence of weevil feeding.
1957	Weevil damage was common in the Nakusp and Revelstoke areas on regeneration white pine.
1958	In the Kettle River valley north of Westbridge, lodgepole pine saplings up to 10 cm d.b.h. had been killed by weevil larvae feeding on the root collars. Mature lodgepole pine trees along Damfino Creek, apparently injured by these weevils, have recently succumbed to attack by mountain pine beetle.
1959	Damage common on white pine regeneration trees along roadways in the Nakusp and Revelstoke areas.
1960	Damaged many roadside white pine seedlings between Nakusp and Galena Bay and at Kaslo.
1961-62	No damage reported.
1963	White pine reproduction along the Big Bend Highway between Revelstoke and Boat Encampment suffered root collar damage.
1964-80	No reports of significant damage.
1981	Approximately 5% mortality of lodgepole pine in provenance trial along the White River.

1982	No damage was reported.
1983	Damage was reported in plantations along the Beaverfoot River, 5% and along the White River, 2%.
1984	Two percent of young lodgepole pine were killed in a plantation in the Beaverfoot River valley.
1985-87	No reports of significant damage.
1988	Weevil-killed lodgepole pine were present in four of five plantations examined in the East Kootenay. Three percent mortality occurred in the White, St. Mary and Beaverfoot river plantations and 1% in a plantation at Blackwater River. Some activity was also noted at Trapping Creek in the West Kootenay.
1989	Light damage was noted only in 1 (Beaverfoot River) of 21 young pine stands examined in the region.
1990	An average of 3% of the lodgepole pine were killed in 3 out of 16 plantations surveyed in the region; Lussier River - 1%, Cabin Creek - 1%, Palliser River - 8%.
1991	Damage was present in 2 of 19 young stands, with an average of 3% mortality at White and Palliser rivers.

Mountain pine cone beetle, Conophthorus monticolae

The adults of the white pine cone beetle are small, dark, often shiny cylindrical beetles. The cones are killed by the attack of the adult which bores a small tunnel into the base of the cone stem and then through the axis of the cone.

Year	Remarks
1956	An estimated 60% of the white pine cones along Crawford Creek, on the east side of Kootenay Lake, were infested by this beetle.
1955-65	No damage noted.
1966	White pine cones heavily infested at Castlegar.
1967	White pine cones heavily infested at Crawford Creek.
1968-71	No significant damage noted.
1972	White pine cones heavily infested at Crawford Creek and 8km south of Kaslo.

1973	Infested white pine cones common at Crawford Creek and 8 km south of Kaslo.
1974-75	Infested cones common 8 km south of Kaslo.
1976-77	Infested cones scarce.
1978	Conophthorus spp. damage variable with cone crop; Douglas-fir up to 50% infested; western larch less than 5% and alpine fir less than 10%.
1979	No cone crop; insect assessment low in all areas.
1980	Variable infestations of most conifers.
1981-91	No significant damage reported.

DOUGLAS-FIR PESTS

Douglas-fir beetle, Dendroctonus pseudotsugae

Records indicate that Douglas-fir beetle infestations have been prevalent in the Nelson Forest Region at varying intensities for three decades. The first recorded damage occurred near Grand Forks in 1933. In the late forties sporadic outbreaks occurred in the Beaverdell and Kettle River areas and continued to cause damage until 1954. In the late fifties a greater degree of damage was reported in the Kettle River drainage and near Greenwood. These infestations increased in size during the sixties, including some areas in the East Kootenay near Windermere and Whiteswan lakes. Populations declined generally in 1970, but in 1972 some 275 beetle-killed trees were recorded in the Invermere area.

Year	Remarks
1933	An outbreak was recorded near Grand Forks.
1934-38	No records of activity in these years.
1939	Trees attacked at Columbia Lake.
1940-47	No records of activity in these years.
1948	B.C.F.S. Ranger reported, "Ample signs of Douglas-fir bark beetles in the Beaverdell area".
1949	Sporadic outbreaks occurred in the Beaverdell area. Attacks at 11 locations averaged less than 1 ha.

1950 A few mature Douglas-fir trees were attacked at Km 30 along the Big Bend Highway. No fresh attacks at Beaverdell.

1951 Not reported.

1952 Small infestations of up to 12 trees occurred near Beaverdell and at Hall and Beaver creeks.

1953 Several spot infestations at Ingram Creek in the Kettle River Valley, Jumbo Creek west of Invermere and along the east side of Windermere Lake.

1954 Spot infestations remained active along Windermere Lake and in the West Kettle River Valley. Small infestations appeared in the Kettle River Valley.

1955 Little current attack observed in the region. Small infestations located at Conkle Creek near Carmi and in the Windermere Valley.

1956 Numerous beetles in windthrown trees in Mt. Revelstoke Park, Upper Arrow Lake, Greenslide and Slocan City.

1957 Approximately 100 trees were infested at the north end of Arrow Lake near Arrowhead.

1958 Previous years' infestations were discovered at Whiteswan Lake and Wigwam River. Small outbreaks occurred on Perry Ridge, southwest of Slocan, at Arrowhead, north of Nakusp and in the Kettle River Valley.

1959 Small patches of red-topped trees at Horsethief and Diorite creeks, near Roosville and along the Wigwam River. Beetles were present in small numbers at Lemon Creek, Slocan Lake and near Lardeau. Locations and numbers of trees killed in the period 1956-58 as determined in 1959: Greenwood 152, Rock Creek--Midway 42, Kettle River drainages 240, Edgewood 16, Pend d'Oreille River 18.

1960 Aerial and ground surveys revealed that 978 trees west of the Granby River, 424 trees in the Slocan--Arrow Lakes--Columbia River areas and 322 in the Windermere Valley had been killed in the period 1957-59.

1961 Small patches totalling 249 red-topped trees in the Beaverdell area. Fifty red-tops were counted along the Wigwam River.

1962 Sporadic infestations. Location and numbers of Douglas-fir red-topped trees counted: Wigwam River 20, Canal Flats 20, Dutch Creek 10, Grasmere 16. Occasional red-topped trees were observed near Edgewood.

1963 A total of 717 red-topped trees counted in the Kettle River drainage and 21 near New Denver. In the East Kootenay a total of 935 red-tops were counted in the Windermere Lake--Kootenay River and Elko--Roosville areas.

1964 Aerial counts totalled 950 red-topped trees at Whiteswan Lake, Kootenay and Lussier River drainages, Windermere Lake and in the Elko--Roosville area. In West Kootenay, tree counts were: Kettle River drainage 202, Trout Lake 95.

1965 Beetle activity increased. Red-topped tree counts were as follows: Windermere Lake 30, Whiteswan Lake--White River 765, Gold Creek--Caven Creek 770, Kootenay River 115, Elko--Roosville 40.

1966 Near Meadow Creek slash was heavily infested. Red-top counts were: Trout Lake 35, Whiteswan Lake 425, Kootenay River 55, Toby Creek 15.

1967 Increased beetle activity in the Kettle River valleys. Red-topped tree counts were: West Kettle River 1 256, Kettle River 770. Infestations in East Kootenay, totalled 571 red-topped trees.

1968 Locations of attacks and red-topped trees counted were: Beaverdell Creek 180, Wigwam River 175, White River 170, Little Goat Creek 15, Cranberry Ridge 70, Wallace Lake 50, Bush River 15, Kootenay River 20.

1969 Attacks increased in the West Kootenay. Red-topped tree counts were: Lois Creek 380, Beaverdell 250.

1970 Light damage in the Region except at Whiteswan Lake where 200 red-topped trees were counted.

1971 Scattered patches of red-topped trees along the Lardeau River, Duncan Lake, Arrow Park and Cranbrook gold course.

1972 Increased numbers of red-topped trees were: Skookumchuck Creek 70, Kootenay River 75, Lussier River 40, Columbia Lake 35, Kootenay National Park 25, Wigwam River 55, Duncan Lake 350, Burton 10, Cascade 25, Stewart Creek 25, Greenwood 15, Kelly River 30.

1973 Douglas-fir beetles attacked scattered individual and small groups of Douglas-fir trees in the Lake Windermere area. Counts of red-tops between Fairmont and Radium totalled 175 trees. An additional 60 were observed on the west side of Lake Windermere near Invermere and 55 at Athalmer and Wilmer. Beetle-killed trees appear to have been predisposed to attack by 1973 drought conditions, which will probably continue to have adverse effects during 1974.

1974 Douglas-fir beetle populations remained at a low level. No infestations recorded during aerial and ground surveys.

1975 Small infestations of several trees each observed along south side of Kettle River between Christina Lake and Rock Creek.

1976 Small groups of trees totalling 50 at Lussier River and Whiteswan Lake. Attacks in standing trees declined in Grand Forks--Christina Lake area.

1977 About 50 trees attacked in Lussier River Valley, 25 along Johnston Creek and 10 at Deer Creek.

1978 Groups of 2-5 trees attacked in scattered locations between Elko and Roosville; from Canal Flats to Radium; near Wycliffe and at Kid Creek.

1979 Low populations. At Deer Creek near Castlegar, 10 trees infected with Armillaria ostoyae were beetle-attacked.

1980 Low endemic levels. Scattered, single attacks between Creston and Riondel, Roosville and Parson and at Hamill Creek, east of Lardeau where five attacked trees were predisposed by Armillaria ostoyae.

1981 Found in cold-decked logs and stumps at Andreen Creek near Invermere. Egg counts averaged 65 per 20 cm gallery. Scattered attacks in stumps at Canyon Campground at Radium. Attacks of log decks in several areas from Radium to Parson. Five predisposed trees attacked on west side of Premier Lake.

1982 A total of 150 trees were mapped in the Cranbrook TSA. Groups of 5-15 trees were mapped along Wigwam River, Bighorn and Sulphur creeks and near Grave Lake.

1983 Douglas-fir beetle activity increased with pockets of up to 50 trees recorded along the Wildhorse, Moyie, Lussier, and Wigwam rivers, Bighorn and Lodgepole creeks. At Wickman Creek, 20% of the Douglas-fir over 100 ha was attacked.

1984 Beetle populations increased in the Nelson area where 12 new infestations of 10-25 trees were recorded along the north side of the west arm of Kootenay Lake and three groups of 100 trees at Akokli Creek on the east side of the lake. Infestations at Moyie, Lussier and Wigwam rivers declined, but continued at Premier Lake.

1985 No significant beetle activity was noted.

1986 Beetle activity remained low, with 273 trees attacked in 27 infestations. Along the north side of the west arm of Kootenay Lake 120 trees were mapped in 14 spots, at Arrowhead 25 tree occurred in four spots, 85 trees at Akokli Creek and small spots totaling 40 trees at Kaslo, Balfour and Crawford Bay.

1987 Beetle populations remained low. Five scattered groups of 5-10 trees were mapped at Premier Lake and at Alces Lake.

1988 Beetle populations increased in the Cranbrook, Invermere and Boundary TSAs. Pockets of beetle-killed trees where mapped in the Beaverdell, Midway, Blueberry--Paulson summit, Ingram Creek, and in groups of up to 40 trees along the Rocky Mountain Trench from the U.S.A. border north to Invermere, especially in the Bloom--Wickman creeks area, Wildhorse, Dutch creeks and at Whiteswan Lake.

1989 Douglas-fir beetle populations continued to increase mainly in the East Kootenay. The main concentrations in the Cranbrook TSA were in the Wickman--Bloom creeks, and Wildhorse Creek with smaller pockets scattered along the Rocky Mountain Trench. In the Invermere TSA, rapidly expanding infestations were recorded at Whiteswan Lake and Findlay Creek, smaller patches of tree mortality were scattered along the Rocky Mountain Trench from Premier Lake to Radium. In the Golden TSA, groups of up to 20 trees were killed at Game Creek along the east side of McNaughton Lake. In the Boundary TSA, only minor activity was noted at East Trapping Creek, Nelse Creek and Ingram Creek.

TSA	Area	No. infestations	No. trees
Cranbrook	79	18	620
Invermere	205	87	3 040
Golden	3	10	190
Boundary	5	14	140
Total	292	129	3 990

1990 Beetle populations remained relatively stable with some decline in the east while increasing in the west. In the Cranbrook TSA, the larger infestations at Wildhorse Creek increased slightly but most of the small pockets of activity collapsed. In the Invermere TSA, infestations continued in the Whiteswan Lake and Findlay Creek areas, with smaller groups of recently killed trees mapped in the Premier Lake, Brewer Creek, and Nine Mile Creek areas. In the Golden TSA, beetle activity continued in the Game Creek area. In the Boundary TSA, there was an increase in the number of spot infestations in the West Kettle River valley between Conkle Lake and Beaverdell. In the Arrow TSA, an increasing number of spot infestations occurred along the Slocan Valley. In the Revelstoke TSA, recent tree mortality was mapped in the Bigmouth Creek area. In the Kootenay Lake TSA, scattered groups of up to five trees were noted at Crawford Bay.

TSA	Area	No. infestations	No. trees
Cranbrook	27	16	645
Invermere	25	91	2 915
Golden	2	7	125
Boundary	6	22	160
Arrow	1	7	40
Revelstoke	2	6	50
Kootenay L.	1	2	10
Total	64	151	3 945

1991 Beetles remained active in the Rocky Mountain Trench. Increased numbers of recently killed trees were recorded along Columbia Lake and in stressed trees along McNaughton Lake. Populations declined at Whiteswan Lake and were reduced by logging in the Cranbrook TSA.

TSA	Area (ha)	No. infestations	No. trees
Cranbrook	17	25	500
Invermere	46	112	1 950
Golden	8	34	630
Total	71	171	3 080

Western spruce budworm, Choristoneura occidentalis

Early records indicate that western spruce budworm infestations were first noted in the Nelson Forest Region in 1923. No significant budworm populations recurred until the mid-seventies.

Year	Remarks
1923-28	Budworm was reported at Glade on the Kootenay River near Castlegar. Defoliation occurred on 1 200 ha in the Bridesville--Rock Creek area, persisting until 1928.
1976	Light defoliation of Douglas-fir and western hemlock west of Revelstoke.
1977	Light defoliation continued over 25 ha in the Clanwilliam Lake area, west of Revelstoke. Light defoliation occurred in the Kettle River valley.
1978	Populations continued in the Johnston Creek area where 80 ha of Douglas-fir and western larch were lightly defoliated.
1979	The infestation at Johnston Creek continued to expand with severe defoliation mapped over 200 ha.
1980	Moderate defoliation of the current year's foliage was recorded over 100 ha at Johnston Creek.
1981	Budworm larvae severely defoliated the 1981 foliage over 1 000 ha in the Johnston Creek to Bridesville area.
1982	Only trace to light defoliation was noted in the Johnston Creek to Bridesville infestation area.

1983 Defoliation increased slightly in the Johnston Creek to Bridesville area.

1984 Defoliation continued in the Johnston Creek to Bridesville area on an estimated 100 ha.

1985 Budworm populations persisted in the Johnston Creek to Bridesville area with 60 ha of moderate to severe defoliation.

1986 Budworm populations expanded to over 3 688 ha of light to moderate defoliation. The infestation was concentrated just north of the Canada--U.S.A. border between Anarchist Mountain and Rock Creek.

1987 Light to moderate defoliation was mapped over 1 043 ha in the Rock Creek to Bridesville area.

1988 Budworm lightly defoliated Douglas-fir over 3 275 ha in the Rock creek to Anarchist Mountain area. Light to moderate defoliation was also noted along roadside trees along Conkle Lake road, McKinney Nicholson, Bubar, and Ingram creeks, and in the Greenwood to Phoenix Mountain area.

1989 Defoliation was recorded over 17 600 ha. Severe defoliation occurred in the McKinney Creek drainage, light defoliation was present at Johnstone Creek, Bridesville, Nicholson, Bubar, Ingram, Bauer and Myers creeks areas. Trace defoliation continued in the Phoenix Mountain area.

1990 The infestation in the Ingram to Anarchist Mountain receded to 1 160 ha of light defoliation, mainly at Anarchist Mountain, Johnston Creek, Greenwood to Midway and along the Ingram Range between Ingram and Motherlode creeks. At Clanwilliam, near Revelstoke, 200 ha of Douglas-fir was lightly defoliated.

1991 Mostly light defoliation was mapped over 4 036 ha. Patches of defoliation occurred from Anarchist Mountain east to Baker Ridge and Fisherman Creek near Grand Forks, and north to Cranberry Ridge near Beaverdell.

Western false hemlock looper, Nepytia freemani

The western false hemlock looper is a native pest of immature Douglas-fir and western hemlock in the Nelson Forest Region and adjoining National Parks. In the Windermere Valley, repeated defoliation resulted in top-killing and scattered tree mortality over several thousand hectares in 1947 to 1949. In 1973 an immature stand of hemlock was severely defoliated at Glenbank near Nakusp, some tree mortality was evident. Moderate defoliation of Douglas-fir occurred in several areas in the Windermere Valley in 1975.

Year	Remarks
1947	An outbreak of this looper, covering 100 km², was active between the north end of Columbia Lake and Radium in the Windermere district. Five hectares of this outbreak were within Kootenay National Park. The stand consisted largely of Douglas-fir reproduction in scattered patches of varying size separated by open spaces. This was the first time the false hemlock looper reached outbreak proportions in the Nelson Region.
1948	The extensive infestation first reported in the Windermere district in 1947 was again active, and covered an area from Salter Creek on the west side of Columbia Lake to a point about 16 km north of Radium. As the infestation was a serious threat to the Christmas tree industry the application of D.D.T. from a helicopter was undertaken by the B.C. Forest Service and approximately 4 500 of the main portion of the infested area was sprayed. This treatment, together with disease, has almost completely wiped out the looper population. Few eggs could be found in the area in October.
1949	Infestation collapsed.
1950	Larval populations remained at a low level in areas of old infestations. A small number of Douglas-fir trees have died in the Windermere Valley as a result of severe defoliation during 1947 and 1948, but in general, stand recovery has been satisfactory.
1951	Populations remained endemic.
1952	Larval populations increased moderately throughout the Douglas-fir stands in the Nelson Region. No severe infestations occurred.
1953	A continued, although slight, increase in population density was apparent throughout most of the Nelson Forest Region.
1954	The population density remained unchanged, or decreased slightly.
1955	A slight decrease in the population density of the false hemlock looper.
1956-60	Populations remain at a low level.
1961	Small increase, though still at low population level.
1962	Few larvae were found in the Elko area where they were fairly numerous in 1961.
1963	Twenty-seven per cent of the collections from Douglas-fir in the East Kootenay contained false hemlock looper.

1964 Larval population declined in 1964.

1965-71 Populations remained low during this period.

1972 Increased larval population in the Nakusp area.

1973 False hemlock looper larvae were common in the hemlock looper infestations in the Nakusp area. A stand of immature mixed coniferous trees on 10 hectares at Glenbank near Nakusp was heavily defoliated by a combination of false hemlock looper and hemlock looper. Individual hemlock and Douglas-fir trees were also heavily defoliated on residential properties in Nakusp. Light defoliation was evident on new growth of Douglas-fir regeneration and pole-sized trees along the east side of Lake Windermere from Dutch Creek to Swansea Mountain.

Egg sampling at Nakusp in September indicated that moderate defoliation probably will occur in this area in 1974.

1974 The infestation of western false hemlock looper on western hemlock near Nakusp collapsed in 1974. Light feeding occurred on the new foliage of Douglas-fir along the east side of Lake Windermere from Dutch Creek to Swansea Mountain, and at Premier Lake.

1975 Infestations of western false hemlock looper caused moderate defoliation of Douglas-fir at several locations in the Windermere Valley. Defoliation occurred on 40 ha at Major Creek on Columbia Lake, 9 ha at Dutch Creek, 30 ha at MacCarthy Lakes, 20 ha at Johnson Creek and 10 ha at Stoddart Creek. Severe defoliation occurred on 45 ha at Brady Creek.

Egg counts taken in September indicate a substantial decline in looper populations at Brady Creek, Columbia Lake and Stoddart Creek, probably due to a virus infection in the larvae.

1976 Windermere Valley infestations collapsed; no defoliation evident.

1977-81 Very few larvae collected.

1982 Larval populations increased in the Windermere Valley and in widespread areas in the West Kootenay.

1983 Light defoliation was mapped over 80 ha along Westside Road north of Invermere and on 30 ha south of Dry Gulch Creek. Polyhedrosis virus was present on 25% of the larvae.

1984 Population declined with only trace defoliation noted near Forster Creek along the Westside Road.

1985 Moderate defoliation was recorded over 50 ha on Douglas-fir near Wilmer and Forster Creek, both along the Westside Road north of Invermere where trace defoliation was present in 1984.

1986-91 Populations collapsed in 1986 and remained endemic.

Douglas-fir tussock moth, Orgyia pseudotsugata

The Douglas-fir tussock moth was first reported defoliating Douglas-fir trees at Cascade in 1929. Since 1929 outbreaks have occurred at Cascade, Grand Forks and Kettle Valley 1930-31, 1954, and 1981.

Year	Remarks
1929	Tussock moth infestations reported at Cascade and Kettle Valley area on Douglas-fir.
1930	Douglas-fir tussock moth infestation on Douglas-fir remains active near Grand Forks and Kettle Valley.
1931	The tussock moth infestations reported during 1930 continued and increased in size.
1932	Tussock moth infestations subsided throughout the areas of infestation at Cascade, Grand Forks and Kettle Valley.
1933-53	Tussock moth populations remained at a low level, with no damage reported during this period.
1954	There was a small increase in larval numbers at Cascade, although no defoliation was apparent. A polyhedral virus disease caused high mortality in reared larvae collected near Cascade.
1955	A 2 hectare stand of open-grown Douglas-fir trees near Cascade was fairly heavily infested by the tussock moth. A virus disease greatly reduced larval numbers during the late larval instars.
1956	No larvae were observed near Cascade where an infestation occurred in 1955.
1957-73	Populations remained at a low level during this period. No reports of tussock moth defoliation.
1974	Low population levels. Two tussock moth larvae found at Cascade, the site of past infestations.
1975	Pheromone traps set out near Cascade to trap adult male tussock moths. Eight traps contained 46 adults. No larvae collected in area.
1976	Pheromone traps averaged 14 adults at Kingsgate, 7 at Grasmere and 3 at Cascade. This is the first record of Douglas-fir tussock moth in the East Kootenay.
1977	Pheromone traps averaged the following number of adults per trap: Cascade, 6; Radium, 9; Dutch Creek, 0; Wasa Lake, 0; Grasmere, 1; and Kingsgate, 1.

1978-79	No adults found in pheromone traps and no larvae collected.
1980	Populations increased in pheromone traps at Cascade, Downie Creek, Mica Creek and Fauquier all contained moths.
1981	Small infestation on 20 ha at Christina Lake Golf Course, where defoliation of Douglas-fir averaged 10%. Male cocoons were 68% infected by virus and parasites. Numbers of adults collected in pheromone traps increased at Christina Lake, Eholt, and Rock Creek.
1982	Tussock moth damage increased, covering 270 ha. At Christina Lake, 5 ha were severely defoliated and 15 ha were lightly to moderately defoliated. Scattered pockets of light defoliation were mapped between Rock Creek and Johnstone Creek.
1983	Populations continued to increase with 2 275 ha of light to severe defoliation mapped between Johnstone Creek, Rock Creek and Midway, and north towards Westbridge. High incidence of nuclear polyhedrosis virus was found in the larval population.
1984	Populations collapsed.
1985-89	Tussock moth remained at endemic levels.
1990	No defoliation was noted, but there was an increase in the number of adults in pheromone traps.
1991	Populations increased, with trace to light defoliation near the Christina Lake golf course.

Douglas-fir needle midges, Contarinia spp.

A needle miner which mines the current year's needles of Douglas-fir. It has caused extensive damage to Christmas trees in the East Kootenay. It is common throughout the range of the host in the Region.

Year	Remarks
1952	Douglas-fir needle midges caused damage to Douglas-fir Christmas trees in the Elko region.
1953	Samples of injured Douglas-fir Christmas tree foliage from the Elko area. The midge was common in portions of the Nelson Forest Region.
1954	Heavy infestations in the Nelson Forest Region occurred at Pend-d'Oreille River near Waneta, and at Edgewood, with 75 per cent of the needles mined. Lighter infestations, ranging from 5 to 15 per cent of the needles mined, occurred at Grand Forks, Cascade, Creston, Yahk and Needles.

1955 Heavy infestations observed near Cascade and Grand Forks, where some 50 to 90 per cent of the new needles were mined. Other infestations noted at Granby and Burrell rivers, 25 to 35 per cent of needles infested, Beaverdell and Midway, up to 45 per cent, and Needles and North Castlegar, 15 to 30 per cent.

1956 Needle miners were present in most of the southern portion of the Region east to Kootenay Lake and north to McCulloch. In the vicinity of Cascade Douglas-fir trees on approximately 26 000 ha were severely attacked with up to 90 per cent of the current year's needles damaged. Up to 50 per cent of the current year's needles were infested on trees on the east side of Granby River about 18 km north of Grand Forks.

1957 Heaviest infestation occurred in the Grand Forks area where damage ranged from trace to 50 per cent of the needles on the current year's growth.

1958 Decrease of needle miners in much of the Region. At present they are at a light infestation level.

1959 Needle miners persisted at low population levels.

1960 Light infestations persisted throughout much of the range of Douglas-fir.

1961 In the Invermere district moderate to severe infestations occurred in Christmas tree stands at lower elevations from Brisco south to Fairmont. Low to moderate populations were also present throughout much of the range of Douglas-fir in the southern part of the Region.

1962 Infestations persisted over much of the southern part of the Region. The most severe infestations were along Lower Arrow Lake, along Kootenay Lake, and in the Invermere area.

1963 Infestations expanded from Brisco to Fairmont, from Brilliant to Shoreacres, along the shore of Kootenay Lake, from Sirdar to Crawford Bay, and from Renata Creek south and east along Lower Arrow Lake to Syringa Creek and Sentinel Mtn, and at Whatshan Lake. Many Douglas-fir trees in these localities had 80 to almost 100 per cent of the needles infested.

1964 Douglas-fir needle midges were numerous, notably from Kuskonook north to Gray Creek (90 per cent of current year's needles infested), Thrums to Renata (90 percent), McKay Creek between Kaslo and Lardeau, along the highway from Playmore to Castlegar, and at Lemon Creek. Between Playmore and Castlegar up to 90 per cent of the current year's needles were infested.

1965 There was a decline in populations throughout much of the Region. A 90 per cent infestation of current needles in 1964 declines at Thrums to 37 per cent, at Lemon Creek to 30 per cent, and at Gwillum Creek to 44 per cent.

1966 Populations were light to moderate in the south Slocan Valley and near Coffee Creek.

1967 Populations at low level.

1968 General increase in populations but still light damage.

1969 Little change in density; light damage.

1970 Damage was generally light on Douglas-fir of Christmas tree size in the southern part of the Region. Up to 5 per cent of the new needles were infested at Brisco, Canal Flats, Edgewater and Invermere, and 20 per cent of the new needles infested at Westbridge.

1971 Needle mining by Contarinia again was generally light on Douglas-fir of Christmas tree size.

1972 Damage by needle midges in the East Kootenay was light. The only significant damage was at Invermere where occasional Douglas-fir trees had up to 20% of the new foliage infested and near Grand Forks where 30% of the new foliage was infested.

1973 Damage on Douglas-fir Christmas trees in the East Kootenay was light in 1973; about 5% of the new needles were infested at sample plots at Canal Flats, Invermere, Edgewater and Brisco. Damage was also light in the West Kootenay except at Grand Forks where 30% of the new needles were infested.

1974 Damage levels were generally around 2% of the needles in the Rocky Mountain Trench.

1975 Christmas trees in the East Kootenay sustained only light needle damage. The percent of current year's needles infested was: Edgewater, 5%; Canal Flats, 3%; Invermere, 6%; Brisco, 2%.

1976 Increased damage was noted. The percent of Douglas-fir current year's needles infested was: Edgewater, 10%; Canal Flats, 3%; Invermere, 28%; Brisco, 5%; Radium, 45%. Infestations of the cooley spruce gall adelgid were also high in the same area.

1977 Decrease in the Windermere Valley Christmas tree cutting areas. The percent of Douglas-fir current year's needles infested was: Edgewater, 2%; Canal Flats, 2%; Invermere, 6%; Brisco, 1%; Radium, 6%.

1978 Increased populations. Severe discoloration and premature needle loss on young Douglas-fir trees from Elko to Golden. The percent of current year's needles infested were: Edgewater, 30%; Canal Flats, 75%; Invermere, 25%; Brisco, 25%; Radium, 35%.

1979 Common in pure Douglas-fir stands and Christmas tree production areas in the East Kootenay. Up to 30% current year's needle infested on single tree or localized 1 ha areas.

1980	Common in Kootenay--Columbia River valleys and in the Invermere to Brisco area. Up to 100% of current year's needles infested on single trees of all age classes, to localized 1 ha areas. Douglas-fir stands between Grand Forks and Rock Creek and in the West Kettle River valley north to Beaverdell were infested for the first time in recent years.
1981-91	No reports of significant damage.

SPRUCE PESTS

Spruce beetle, Dendroctonus rufipennis

The first recorded outbreak of the spruce beetle in the Nelson Forest Region occurred along the Moyie River near Lumberton in 1934. Over 35 000 m^3 of Engelmann spruce were killed in this infestation which declined in 1936.

In 1953, infestations occurred in the Boundary Creek area west of Creston. Reports in subsequent years showed that outbreaks continued in this area, in the Hawkins and Bloom creeks drainages and in the Flathead drainage until 1959.

A windstorm in 1964 felled 5 000 ha of spruce and alpine fir trees in the Fernie Ranger District. This large area of blowdown became heavily infested by the spruce beetle. In subsequent years beetle populations increased in standing timber in the Flathead area and in 1968 some 1 570 000 m^3 of Engelmann spruce were infested on more than 6 000 ha.

Throughout the remainder of the 1970's beetle activity remained low throughout the Region, with only occasional small pockets which quickly subsided. In 1980 two major infestations occurred, one covering 500 ha in Copper and Quartz creeks near Golden and the other covering 100 ha at Coursier Lake in the Revelstoke TSA. In 1981 infestations near Coursier Lake expanded to cover 2 500 ha and newly discovered infestations on the east side of Kootenay Summit just west of Creston totalled 2 200 ha. An additional 2 900 ha were infested in the Cranbrook TSA, 2 200 ha in Cabin Creek alone.

Year	Remarks
1934	An infestation near Lumberton killed some 35 000 m^3 of spruce along the Moyie River. Infestations remained active along the Moyie Tie Reserve. An infestation was reported killing trees near McLeod Meadows in Kootenay Park.
1935	Green infested trees were reported along the Upper Moyie River.
1936	No beetle activity reported in standing green trees in Lumberton area. Light infestations in slash.

1937-52 No reports of spruce beetle damage in the District.

1953 Small infestations occurred along Big Sand, Van, Little Jim, Boundary and Lamb creeks. Small numbers of green infested trees recorded along cruise strips at Boundary Lake, Freeman and Canuck creeks.

1954 The 1953-infested trees were logged over winter. In the Bloom Creek Valley 50 trees were infested; at Hawkins Creek 100 trees were infested. The heaviest attacks occurred along Nun Creek where groups of 30 to 40 infested trees were common. Small infestations at Oscar and Grohman creeks.

1955 Small infestations greatly reduced; large populations in log decks and slash. A total of 12 000 m^3 of spruce were killed in Nun, Monk and Summit creek valleys during 1953-55.

1956 Spruce beetle attacks continued in Nun, Monk and Summit creek valleys. Large broods of larvae indicated that there would be destructive populations in 1957. Green attacks were negligible in these areas in 1956 as almost all susceptible trees were already infested.

1957 Aerial and ground surveys indicated that infestations in remote areas had caused more damage than previously anticipated. Mature spruce stands in the valleys of Couldrey, Burnham, Cabin, Storm and Bighorn creeks were depleted by an estimated 100 000 m^3 over the last six years. Losses totalling 16 500 m^3 were recorded in the valleys of Bloom, Ward and Linklater creeks and the infestations remained active. Approximately 2 400 m^3 were killed at Crutch Creek near the International Boundary.

A localized infestation at McPherson Creek, near Fernie, killed some 1 400 m^3. Other infestations were discovered along the Wigwam River and at Malpass and Spruce Tree creeks and at Quartz Creek west of Donald and along the Beaver River in Glacier National Park.

1958 Infestations continued at a declining rate. Active infestations persisted at Bighorn, where 7% of the spruce were attacked, Watson, Russell and Grave creeks. Small, scattered infestations were active in the Little Slocan watershed. Attacks in Cabin, Storm and Sage creeks and along the Beaver River had subsided. An estimated 200 trees were infested at Grave Creek.

1959 Populations persisted at low levels. Approximately 250 m^3 were killed at Foster Creek. No new attacks occurred at Bighorn or Grave creeks.

1960 Low population levels. Small groups of trees infested along the Goldstream River. A few current attacks were noted at Cabin and Bloom creeks.

1961 Light populations in blowdown trees and log decks at widespread localities. Slash at Forster Creek was heavily infested.

1962 Low population levels. Occasional beetles persisted in blowdown trees, log decks and high stumps at Coal Creek near Fernie. An infestation above Shelter Bay covered some 120-160 ha. Small infestation at Evans Lake.

1963 Approximately 12 ha of spruce were infested at Tanglefoot Creek and a few trees were attacked at Quartz Creek west of Donald. A total of 60 infested trees were recorded at Cummins River and 25 south of Bush River.

1964 Small groups of spruce were attacked along the Rogers Pass Highway. Occasional attacks were recorded at Trout Lake. A windstorm felled 5 000 ha of spruce and alpine fir in the Fernie Ranger District. Heavy damage occurred in the Sage, Akamina, Harmer, Grave, Harvey and Lodgepole creeks drainages. Windthrown spruce at Coal and Couldrey creeks contained significant populations. High stumps and slash at upper Coal Creek were heavily infested.

1965 Windthrown spruce at Harvey Pass, Twenty-nine Mile and Lodgepole creeks had large overwintering populations. No standing infested trees were noted this season.

1966 Beetle populations somewhat reduced by logging at Twenty-nine Mile and Lodgepole creeks. Small populations in windfalls and stumps at Coal Creek.

1967 There was a significant population increase in the Flathead area. Light infestations occurred at Storm and Bighorn creeks, and there was a heavy infestation at Harvey Creek. Fall surveys indicated that currently infested trees comprised 13% of the stand at Storm Creek and 30% at Harvey Creek.

1968 Increased beetle activity in high altitude spruce and alpine fir stands. Up to 38% of the spruce on 60 km of cruise strips were currently attacked. Heaviest damage was in the Elk, Bull, Wildhorse, Flathead and Wigwam river drainages. More than 6 000 ha were involved in the infestation, containing a gross volume of 1 160 000 m^3 of beetle-attacked trees.

1969 Major infestations were recorded in drainages of the Flathead, Elk, Wigwam and Bull rivers over an additional 1 200 ha. Previously unrecorded infestations were detected on 5 000 ha in the Kootenay L -Lardeau region at Howser Ridge, Cooper Ridge, Cascade Lake, Pork Creek and in the Kettle River drainage.

1970 Infestations had generally subsided in the Flathead area although populations persisted in the Fording River drainage and at scattered localities east of the Purcell Mountains at Bruer, Placer and Pork creeks and at Howser Ridge.

A previously unreported infestation of 1968-69 was found in the Amiskwi Valley in Yoho National Park; the 1970 attack was light.

1971 The major infestations collapsed in 1971. A few trees were heavily attacked at Slewiskin Creek. Trees "strip attacked" were frequent at Kilmarnock, Line, Burnham and Bighorn creeks.

1972 No new attacks were observed on standing trees, however, there were moderately high larval broods in windfalls at Line, Sage and Bighorn creeks.

1973 Spruce beetle populations remain at low density with only occasional attacks on current windfall in the East Kootenay.

1974-75 Spruce beetle populations remained at low density with only occasional attacks on current windfall in the East Kootenay.

1976 A small infestation occurred at the headwaters of Cultus Creek on the southwest side of Kootenay Lake. Two 2 ha pockets had been attacked initially in 1974. Most infested trees were harvested just prior to the 1976 flight.

1977 Approximately 40 Engelmann spruce were attacked in the spring of 1977 at Swift Creek near Salmo. The trees were logged by mid-summer. Occasional windfall spruce along the North White River contained moderate populations.

1978 Two small new infestations were located at Dago Creek, where 120 ha of blowdown were infested, and at Campbell Creek, where 25% of 50 attacked trees were green attacked and 75% were grey. A small area of blowdown also occurred at Stagleap Park.

1979 Trees in Campbell Creek, attacked in 1978, were severely woodpeckered and showed little evidence of beetle activity. Trap trees and selective logging is planned for the area before the 1980 spring flight. Localized endemic populations in areas less than 2 ha were seen at McLatchie Creek south of Fernie and along the Albert River.

1980 Spruce beetle killed mature Engelmann spruce over 500 ha at Copper and Quartz creeks. At Copper Creek more than 30% of the trees were infested in leave blocks on 300 ha. At Quartz Creek west of Donald, 200 ha were severely attacked. Overwintering brood assessment indicated increasing populations at both locations. At Coursier Lake, south of Revelstoke, 100 ha was infested, 50% of which was attacked in 1979. Sanitation logging and trap tree programs are expected to contain infestations in both areas.

1981 Spruce beetle infestations greatly expanded to 122 infestations over more than 8 000 ha and killed 450 000 m^3 of timber. In the West Kootenay, the Coursier Lake infestation expanded to 2 500 ha from Coursier Lake southward along Pingston Creek. Near Whiskey Point, on the northeast arm of Upper Arrow Lake, an estimated 2 000 trees were killed on 185 ha.

In the East Kootenay, the infestation at Quartz and Copper creeks decreased to a total of 114 ha. In Invermere TSA, small infestations of 1 to 30 ha occurred at Raven's Head Junction, Maiyuk Creek, Thunder Creek and along the Middle Fork White River.

In the Cranbrook TSA, a total of 2 934 ha were infested at: Cabin Creek, 2 200 ha; Weaver--Galway creeks, 26 ha; Larch Creek, 37 ha; Wild Horse River--Nicol Creek, 250 ha; Quinn Creek, 146 ha; Bull River, 77 ha; Top-of-the-World Park, 50 ha.

In the Kootenay Lake TSA, scattered infestations ranging in size from 200 to 700 ha covered a total of 2 200 ha, from Laib creek south to the 49th parallel and also north of Creston along Duck, Arrow, Skelly, Kianuko and Kamma creeks.

In stands cruised at Pingston Creek and Nicol Creek, only 3% of the mature timber was attacked in 1981 while 22% was attacked in 1980.

1982 Spruce beetle activity generally declined in the East but continued to increase in the West Kootenay. In the Revelstoke TSA, severe infestations occurred at Dry Creek and numerous infestations usually around 100 ha extended along the Columbia River, but up to 2 870 ha in the Pingston Creek area. In the Arrow TSA, expanding populations were noted especially along the west side of Upper Arrow Lake, mainly at Ledge, Fosthall and Barnes creeks. In the Cranbrook TSA, there was a general decline in the side drainages of the Bull River but populations remained active in the St. Mary River drainage. In the Kootenay Lake TSA, the only increasing population was in the Topaz Creek area, while they declined at Sanca, Duck, Arrow, Kianuko and Kidd creeks. In the Golden TSA, populations declined in the Quartz and Copper creeks areas but increased in the Glenogle and Beaverfoot rivers areas. In the Invermere TSA, all populations declined in the White and Kootenay rivers system, including those on the west side at Doctor Creek.

TSA or Nat. Park	No. infestations	Area	Volume 1981 attack
Cranbrook	81	2 000	59 500
Invermere	5	30	370
Golden	6	640	158 000
Revelstoke	35	3 420	97 450
Kootenay L.	51	830	22 200
Arrow	19	650	13 120
Yoho N.P.	1	5	60
Total	198	7 475	216 400

1983 Spruce beetle populations continued to decline in the region. In the Revelstoke TSA, major decreases in the Pingston Creek area, while beetle remained active in the Crawford Creek area. In the Arrow TSA, the main beetle activity centered around the Whatshan Lake and Vanston Creek areas. In the Kootenay Lake TSA, declining populations persisted in the Kianuko, Kamma and Skelly creeks areas while the beetle remained active along the upper Duncan River. Limited aerial surveys in the Cranbrook and Kootenay Lake TSAs account for reduced area in these TSAs.

TSA	No. infestations	Area	Volume 1982 attack
Cranbrook	4	120	1 200
Golden	6	50	620
Revelstoke	23	1 350	26 100
Kootenay L.	22	450	6 700
Arrow	5	700	16 350
Total	60	2 670	50 970

1984 Spruce beetle populations increased in the region. In the Revelstoke TSA, new infestations were recorded in the South Cranberry Creek drainage, previously declining populations were reactivated at Tangier and Frisby creeks, while populations at Pingston and Crawford creeks declined. In the Kootenay Lake TSA, increasing populations occurred along the east side of the Salmo--Creston summit and in the Duncan River including Glacier National Park, populations in the Kianuko--Kamma--Skelly creeks declined. In the Cranbrook TSA, populations remained stable in the Bull River drainage, east of Elkford and at Top-of-the-World Park.

TSA or Nat. Park	No. infestations	Area	Volume 1983 attack
Cranbrook	16	576	17 005
Invermere	3	19	220
Revelstoke	48	1 652	41 295
Kootenay L.	30	887	35 800
Arrow	11	376	8 590
Glacier N.P.	7	256	13 440
Total	115	3 766	116 350

1985 Spruce beetle populations declined sharply in the region. In the Revelstoke TSA, declining populations continued in the Pingston, South Cranberry and Tangier creeks. In the Kootenay Lake TSA, low populations persisted in the Salmo--Creston summit area but collapsed in the Duncan River drainage. In the Arrow TSA, beetle activity was recorded only in the South Fosthall--Fosthall creeks area.

TSA or Nat. Park	No. infestations	Area	Volume 1984 attack
Revelstoke	30	380	15 030
Kootenay L.	3	40	570
Arrow	7	75	1 950
Glacier N.P.	4	80	1 520
Total	44	575	19 070

1986 Spruce beetle populations further declined to 114 m^3 over 41 ha in four infestations. The only infestations found were several hectares in Meachen and Perry creeks in the Cranbrook TSA and two small infestation in the North White River drainage of Invermere TSA.

1987 Spruce beetle populations continued to decline with only one eight hectare infestation mapped near the Bugaboo Glacier. Light current attack was found over 20 ha at Airy Creek near Slocan.

1988 Spruce beetle attacked trees were mapped over 225 ha in the region. In the Revelstoke TSA, a 39 ha patch occurred adjacent to recent logging at Kirbyville Creek. In the Golden TSA, flood-damaged trees along the Beaverfoot River were lightly attacked by spruce beetle over 185 ha.

1989 No beetle infestations were mapped. Light beetle activity, mainly in blowdown, was noted at Redding Creek, Monroe Lake, and in flood damaged spruce along the Beaverfoot River.

1990 Small groups of 2-20 trees were mapped in the Kirbyville and Liberty creeks area north of Revelstoke. Scattered light current attack was noted in the Vermilion River drainage following recent blowdown. Beetle activity in blowdown was recorded along the Bush River, Monroe Lake, and at Hoodoo Creek in Yoho National Park.

1991 Populations were generally low. Small infestations were present at Ensign Creek (Blaeberry River), with 37% recent attack over 20 ha and in groups of up to 10 trees along Bush River.

Two-year-cycle spruce budworm, Choristoneura biennis

This defoliator is generally restricted to high elevation alpine fir and spruce forests. The insect has a two-year life cycle; heavier defoliation and moth flights occur during the even years in most of the province, but on odd years in the Purcell and Monashee mountain ranges.

Records of defoliation date back to the early forties, when severe defoliation occurred in the Monashee Mountains and Kootenay National Park. These infestations continued with varying degrees of intensity until 1957, when a general collapse was noted. Sporadic infestations occurred in Kootenay National Park in the late sixties. Severe defoliation occurred in 1972 along the North White River, but populations collapsed in 1974. Sporadic infestations occurred in the Spillimacheen River valley from 1975-81 and in the White River drainage system from 1977-81.

Year	Remarks
1940	Larvae were abundant at Marble Canyon in Kootenay National Park.
1941	Moderate defoliation occurred in Yoho, Glacier and Kootenay National Parks.
1942	Severe defoliation of alpine fir understory trees occurred between Vermilion Crossing and Vermilion Summit in Kootenay National Park. An infestation was reported northeast of Edgewood and an outbreak at Glacier National Park continued.
1943	Not mentioned.
1944	Defoliation was evident an alpine fir and spruce on the Monashee Summit, along the Vernon--Edgewood road. Infestations of the same intensity at Vermilion Summit and Marble Canyon in Kootenay National Park were much larger, and extended westward to Wardle Creek. A large moth flight in Nakusp indicated the presence of a nearby infestation but no defoliation was reported.
1945	Not mentioned.
1946	Light to moderate defoliation of alpine fir and spruce occurred from Hawk Creek to Vermilion Summit in Kootenay National Park and along the Monashee summit.
1947	Not mentioned.
1948	Larvae were numerous in alpine fir--spruce stands near the Monashee Summit. Light infestations occurred in Kootenay and Yoho National Parks.

1949 Infestations were lighter on the Monashee Summit. Noticeable damage occurred in alpine fir and spruce at Marble Canyon in Kootenay National Park and larval samples were obtained in Yoho National Park.

1950 Numerous larvae were collected from active infestations on the Monashee Summit. A large moth flight occurred along the west fork of the Kettle River. Severe defoliation was recorded near Marble Canyon in Kootenay National Park. There were pockets of severe defoliation near the Spiral Tunnel in Yoho National Park.

1951 A light to medium infestation occurred near Marble Canyon. Populations were high in the Yoho River Valley and near Emerald Lake in Yoho National Park.

1952 Moderate populations at Marble Canyon and Vermilion Summit; medium infestation in the Yoho River Valley in Yoho and Kootenay National Parks. A light infestation was reported east of the Bugaboo Glacier.

1953 Numerous larvae at the Natural Bridge, Emerald Lake and in the Amiskwi River Valley in Yoho National Park. Light infestations at Monashee Summit and east of Bugaboo Glacier.

1954 Moderate defoliation occurred near Wardle Creek and there were high populations at Vermilion Crossing in Kootenay National Park. Light population levels in Yoho National Park, at Monashee Summit, Lightning Creek and Kettle River cutoff.

1955 Not mentioned; a non-flight year.

1956 Infestations in Yoho National Park caused moderate defoliation at the Ice River Road, Boulder Creek and Kicking Horse Campground. Light damage was recorded between Marble Canyon and Wardle Creek in Kootenay National Park and at the Monashee Summit.

1957 Larvae were very scarce in all surveyed areas of the Region.

1958 Few larvae were found and defoliation was not noticeable in the National Parks.

1959 Endemic populations.

1960 Low population levels in Yoho National Park.

1961 Light damage in Yoho National Park.

1962-63 Not reported.

1964 Light defoliation between Vermilion Crossing and Tokumm Creek in Kootenay National Park.

1965 Populations were low throughout the Region.

1966 A 40 km-long infestation south of the Paint Pots caused light to moderate defoliation in Kootenay National Park.

1967 No noteworthy damage reported in the Region.

1968 Population declined throughout the Region. Light defoliation in Kootenay National Park at Numa Creek.

1969 High populations at Numa Creek caused severe defoliation.

1970 There was a light infestation along the North White River. Low populations elsewhere.

1971 Non-flight year; low populations along the North White River. High populations along the Vermilion River in Kootenay National Park.

1972 The infestation along the North White River caused severe defoliation of understory over 6 900 ha. An Entomopox virus was isolated from mass collections. Light to moderate defoliation occurred from Vermilion Summit to Vermilion Crossing in Kootenay National Park.

1973 Two-year-cycle spruce budworm damage was not evident along the North White River, where an infestation occurred in 1972, during the first year of it's life cycle.

1974 Spruce budworm populations on Engelmann spruce and alpine-fir along the North White River, collapsed in 1974 without causing any noticeable defoliation.

1975 Heavy defoliation in alpine fir - Engelmann spruce stands occurred at McMurdo Creek from the valley bottom to 1 900 m elevation over 800 ha. Defoliation was light to moderate on 2 800 ha along the south side of the Spillimacheen River Valley from Spillimacheen Mtn. to Caribou Peak.

1976 Light defoliation (25% of new growth) occurred on 200 ha of Engelmann spruce - alpine-fir forest at McMurdo Creek.

1977 About 1 000 ha of Engelmann spruce and alpine-fir were lightly defoliated along North White River and 200 ha in the East White River. Light to moderate defoliation by "off-cycle" spruce budworm occurred on 500 ha at McMurdo Creek. "Off-cycle" budworm are also believed to be present in Glenogle Creek and on 160 ha at the headwaters of Silverton Creek.

1978 Variable defoliation occurred on 2 500 ha along North White River and <25% of new growth on 1 200 ha along East White River. Damage was light in the Middle White River and Thunder Creek. Light defoliation of new growth on 2 600 ha in the Spillimacheen River Valley--McMurdo--Caribou creeks area. The Glenogle Creek, Kicking Horse Pass area, damage was light on 750 ha for the second year. Stands in the south fork of Bugaboo Creek (250 ha); St. Mary River (500 ha); Lapointe Creek (200 ha) had light defoliation.

An Entomophthora virus was isolated from populations in the North White River, where it was previously collected in 1972.

1979 Defoliation occurred in 11 areas on 7 020 ha from Blaeberry River south to Sanca Creek north of Creston. Largest infestations occurred at North Fork White River (2 500 ha). McMurdo Creek (1 000 ha) and East White River (1 000) where defoliation intensity was >75%, <50% respectively. Top stripping and bud mortality were found on Engelmann spruce and alpine-fir in the North White River Valley.

1980 Defoliation intensity was generally less than 1979 but just as widespread. Defoliation occurred on 6 350 ha in 12 areas from Blaeberry River south to Sanca Creek. New infestations were found at Vowell, Baker and Redding creeks. Defoliation intensity was heaviest at East White River (75%), Bugaboo Creek - S. Fork (60%), and North White River (50%).

1981 Engelmann spruce and alpine-fir at Glenogle Creek suffered 15% defoliation (total) over 300 ha. Similar defoliation intensities occurred at McMurdo, Bugaboo and Redding creeks.

1982 Moderate defoliation occurred over 200 ha at Baker Creek west of Kimberley.

1983 Budworm defoliated 2 000 ha of alpine fir and spruce along Bugaboo Creek (250 ha), and west of Kimberley at Redding and Baker creeks. In the West Kootenay, moderate defoliation occurred along Fosthall and South Fosthall creeks (500 ha) and 350 ha of light defoliation along Cusson Creek.

1984 Off-year feeding was recorded over 100 ha at Baker Creek and 100 ha at Fosthall Creek.

1985 No defoliation was recorded.

1986 Light defoliation was evident over 500 ha in the upper St. Mary and Dewar river drainages.

1987 Defoliation was mapped over 11 500 ha mainly in the East Kootenay. In the St. Mary River drainage 475 ha of severe, 3 500 ha of moderate and 5 000 ha of light was mapped along Dewar, Lapointe, Redding, Baker and Meachen creeks. Light to moderate defoliation also occurred over 700 ha along Bugaboo Creek. In the West Kootenay, 1 650 ha were lightly defoliated in the Fosthall and Cusson creeks area and 150 ha along Airy Creek near Slocan.

1988 Understory regeneration feeding was moderate along Barnes, Plant and Airy creeks in the West Kootenay. In the East Kootenay, generally moderate feeding was noted along Bobbie Burns, Dewar, McMurdo, and Vowell creeks. In Kootenay National Park, the current year's foliage was severely defoliated along the Vermilion River.

1989	A total of 5 930 ha of defoliation was mapped mainly in the Barnes--Plant creeks area, but also included South Fosthall, Cusson, and Galloping Bench creeks. In the East Kootenay, light defoliation was mapped only on 40 ha in the St. Mary River drainage.
1990	Light defoliation by mature larvae was noted over 600 ha along the upper White River. Immature larval feeding was noted at Plant and South Fosthall creeks in the West Kootenay, and along the St. Mary (250 ha), Bugaboo (125 ha) and over 55 ha along Vowell Creek.
1991	Light defoliation by mature larvae was mapped over 1 528 ha along Bugaboo Creek and St. Mary River, with only trace defoliation noted along Vowell and McMurdo creeks. Immature larval feeding was evident over approximately 800 ha in the Vermilion River drainage between Floe Creek and Marble Canyon, and over 500 ha in the White River drainage.

Cooley spruce gall adelgid, Adelges cooleyi

The spruce gall adelgid is a native pest of spruce and Douglas-fir. Attacks on spruce produce tip galls on current shoots. Galls are not formed on Douglas-fir, but attacks reduce tree vigor and growth. Damage is most prevalent in plantations and on ornamental shade trees.

Year	Remarks
1948	Common on Douglas-fir at Fernie, Invermere, Cranbrook, New Denver, Elko and Radium.
1949	Douglas-fir reproduction in the Windermere Valley showed browning of the needles as a result of attacks by the spruce gall adelgid and winter injury. Aphid damage was also evident in the Golden district. Discoloration of Douglas-fir foliage was noticeable at Edgewater and Invermere.
1950	Feeding by this insect on the foliage of young Douglas-fir, particularly in the Invermere district, continued to be a serious problem to the Christmas tree industry.
1951	The population was generally light and no noteworthy damage was recorded, on spruce or Douglas-fir.
1952-58	No reports of serious damage to Douglas-fir or Engelmann spruce.
1959	Abundant on the needles of the alternate host Douglas-fir in the southern areas of the Region.
1960	This adelgid was numerous at lower elevations in the southern Kootenay region on Douglas-fir.

1961-66 No reports of serious damage to Engelmann spruce or Douglas-fir.

1967 Sporadic heavy infestations on Douglas-fir at Canal Flats and Brisco.

1968 This adelgid persisted in most Douglas-fir stands in the southern part of the Region but was seldom sufficiently numerous to cause noticeable damage to the foliage.

1969 This adelgid was found in high numbers on spruce regeneration and understory trees in the Little Slocan River drainage. Galls were present on 50 per cent on new growth on terminals and laterals. The aphid was generally common on Douglas-fir.

1970-71 Light damage to Douglas-fir Christmas trees in the East Kootenay.

1972-73 Light damage to Douglas-fir Christmas trees in the East and West Kootenays.

1974-75 Light damage to Douglas-fir Christmas trees in the southern areas of the Region.

1976-81 Minor widespread damage throughout Region.

1982 Common in the host range. Severe in specific spruce plantations; Howser 100% and Retallack 100%. In Douglas-fir plantations and Christmas tree areas; Little Wilson Lake 13%, Nakusp 43% and St. Mary light to moderate.

1983 Light damage common.

1984 Common in plantations examined; Blueberry--Paulson summit 60% of the trees lightly infested, Quartz Creek galls on 95% of the trees, and North White River 100% of the trees were infested.

1985-87 Light damage common.

1988 Present in two of five plantations examined; Boundary Creek 85% of the trees with galls, and at Quartz Creek 29% of the trees were infested.

1989-91 Light damage common.

Spruce weevil, Pissodes strobi

The spruce weevil is a native pest that has attacked the terminals of young Engelmann spruce trees throughout the Nelson Forest Region. Leader damage was first recorded in 1948 and sporadic attacks have persisted in localized stands, and more recently in spruce plantations.

1964 Occasional attacks occurred in the Boundary Creek - Greenwood area and along upper Erie Creek. Attacks totalled 55% in the Michel Creek plot.

1965 There was a decrease in the number of trees attacked at the Michel Creek plot.

1966 Not reported.

1967 Examination of the plot at Michel Creek north of Corbin showed that 15% were currently attacked, 55% had old attacks and 30% were healthy.

1968 Weevil attacks declined slightly at Michel Creek where 10% of the leaders were infested.

1969 In western portions of the Region, 7% of 550 spruce trees examined had been attacked.

1970 Damage to Engelmann spruce regeneration was assessed at the following localities: Alexander Creek, 72%; Michel Creek, 44%; Moberly Bench, 26%; Sundown Creek, 20%; Morrissey, 14%.

1971 Not reported.

1972 Seven plots of 100 trees, were established for future examinations.

1973 Not reported.

1974-78 No reports of serious damage.

1979-80 Common throughout the region; less than 10% infested shoots.

1981 Approximately 10% of leaders damaged on regeneration spruce at McLeod Meadows and Dolly Varden Creek in Kootenay National Park, and 5% at Hoodoo Creek in Yoho National Park.

1982 Weevils killed 20% of the leaders over 2 ha along the Palliser River.

1983 No specific damage was reported.

1984 Along Cabin Creek 40% of the one and two year old leaders were killed. In the upper Palliser River mortality was only 2%, and no weevil damage was present in a cutblock at Bearg Creek.

1985-87 Only minor incidence noted at Koch Creek.

1988 Increasing activity was noted in the Golden TSA, where an average of 17% of the trees in three of five plantations had recent weevil damage, Blackwater River, Beaverfoot River and Quartz Creek.

1989	Weevil damage averaged 5% of the 1989 leaders in five of nine spruce plantations in the East Kootenay. The most severe damage was in the older plantations in the Golden TSA and in Kootenay National Park where incidence was up to 17%.
1990	An average of 11% of the 1990 spruce leaders had been attacked in the East Kootenay. Increased attacked was evident in all but one of the plantations; incidence ranged from 3% at Forster Creek to 23% along the Kootenay River in Kootenay National Park. In the West Kootenay, weevil activity remained relatively unchanged at 4% in the two spruce plantations examined.
1991	An average of 14% of the terminals were attacked in four monitoring at Beaverfoot River, Blackwater and Quartz creeks and at McLeod Meadows.

TRUE FIR PESTS

Western balsam bark beetle, Dryocoetes confusus

The first recorded damage to alpine fir stands attributed to this beetle occurred in 1958 but it was felt that the beetle had caused extensive damage in earlier years. An aerial survey was made in 1959 to assess losses caused by the beetle over the previous 12 years. Two major infestations may have begun before 1948, but the greatest mortality occurred in this period. The number of alpine fir trees killed by western balsam bark beetle from 1948 to 1958 was estimated as follows: Granby River 1 275, Inonoaklin River 200, Kettle River 400, Mt. Moore 75% of the stand and along the West Kettle River 40% of the stand.

Year	Remarks
1958	Three large patches of red-topped alpine fir tree were recorded at Burton Creek, Ledge Creek and along Pingston Ridge.
1959	Small infestations persisted in high elevation stands between Lower Arrow Lake and the upper Kettle River.
1960	Populations decreased in the Inonoaklin and Kettle River valleys. Small groups of red-topped alpine fir were noted near Leadville Creek on Thomson Mtn. near Creston and at Boundary Creek.
1961	Not reported.
1962	An estimated 175 red-topped alpine fir trees were killed in high elevation stands at Fish River, Plant Creek and Coursier Lake in the Upper Arrow Lake area, Albert Creek and Downie Creek, and at Evans and Beatrice lakes in the Slocan watershed. Patches ranged in size from a few hectares to several hundred hectares.

1965 Aerial counts of red-topped trees were as follows: Kinbasket Lake 750, Bull River 500, Linklater Creek 250, Bighorn Creek 370, Cabin Creek 300 Yahk River 200, Lamb Creek 150. Several hundred red-tops were counted along Pingston Creek and Fish River.

1966 Small groups of red-topped alpine fir trees were observed at Pingston, Cusson and Fosthall creeks in the Upper Arrow Lake watershed, at Enterprise Creek in the Slocan area and along Keen Creek near Kootenay Lake.

1967 Light damage occurred to high elevation alpine fir stands.

1968 Light, scattered attacks occurred at Couldrey Creek, 310 red-tops, Bush River 25, Cabin Creek 20, Harvey Pass 20, Kinbasket Lake 50, Sage Creek 50, Wigwam River 20 and Wildhorse River 15.

1969 Not reported.

1970 Light to moderate mortality occurred as follows: Granby River 120, Sawyer Creek 25, Slewiskin Creek 15, Fry Creek 100, Lardeau Creek 60, Halfway River 10, Sullivan River 175, White River 20, Bighorn Creek 100, and Flathead River 75.

1971 Light mortality occurred in the East Kootenay. Counts of red-topped trees were as follows: Couldrey - Cabin creeks area 400, Alexander Creek 50, Wildhorse River 200, and Bull River 200.

1972 Counts of red-topped alpine fir trees were as follows: Bighorn Creek 295, Alexander Creek 60, Bull River 50, Palliser River 260, Munroe Lake 60, Luxor Creek 50, Spillimacheen River 390, Bobbie Burns Creek 200, Kootenay National Park 125, and Glacier National Park 40.

1973 Not reported.

1974 Mixed spruce-alpine fir stands above Slocan on the Ottawa Hill have had alpine fir mortality occurring in them for the past several years. Mortality occurs in small patches approximately one ha in size, scattered through stands more than 1 000 ha in extent. Up to 10% of the alpine fir had been killed in these patches. Near the Spillimacheen River an infestation along Whiskey Creek was found to contain approximately 225 red tops in two patches.

1975 An estimated 250 red top - alpine fir recorded along the West Fork St Mary River and 200 along Whiskey Creek a tributary of the Spillimacheen River. Salvage logging started in 1975 in the infestation above Slocan on the Ottawa Hill.

1976 The number of red tops mapped during aerial surveys was 7 900 with infestation areas as follows: Willowbank Mtn., 600; Spillimacheen River, 2 800; Skookumchuck Creek, 700; White Creek, 500; Dewar Creek, 1 400; Morrissey Creek, 500; Harvey Creek, 400; Rampalo Creek, 200; Hellroarer Creek, 300 and Table Creek, 500.

1977 A total of 7 800 red tops were mapped by aerial survey in the following locations: Mt. Mackie, 100; Silverton Creek, 1 200; Pingston Creek, 1 500; Coursier Lake, 500; Spillimacheen River, 2 000; Bugaboo Creek, 500; Blackfoot Creek, 100; Horsethief Creek, 500; St. Mary River, 1 000; Upper Bull River, 100; Olivia Creek, 100; Akoo Creek, 100; and Narboe Creek, 100.

1978 A total of 6 250 red tops were mapped by aerial survey at the following locations: Silverton Creek, 1 000; Galloping Mtn., 1 000; Mt. Moore, 750; Spillimacheen River, 2 000; St. Mary River Valley, 1 000; and Goat River Valley, 500.

1979 A total of 3 100 red tops were mapped by aerial survey at the following locations: St. Anne Creek, 500; Granby River (N. of Cave Creek), 100; Granby River (top end), 700; Goatskin Creek, 50; Big White Mtn., 150; Pingston Creek, 300; Bannock Creek, 200; Greasepit Creek, 500; Sandy Creek, 200; Lasca Creek, 200 and in the East Kootenay: Spillimacheen River Valley, 200.

1980 A total of 8 150 trees were mapped by aerial survey at the following locations: N. Columbia River Valley including Spillimacheen River valley, 2 000; Upper St. Mary River valley including Baker and Redding creeks, 2 500; Silverton Creek, 1 200; Rossland, 550; New Denver, 1 000; Renata Creek, 500; and Schroeder Creek, 400. Further areas of unspecified mortality were located in the Goat River and in Summit Creek west of Creston.

1981 Approximately 22 300 sub-alpine fir red tops were mapped by aerial survey in the following locations: Nichols Creek, 5 000; Louis Creek 1 000; Jumping Creek (Illecillewaet River) 10 000; Pingston and Thor creeks, 1 000; Chapleau Creek, 300; Skelly Creek, 2 000; Upper Blaeberry River, 3 000 (suspect Balsam bark beetle, but not confirmed).

In addition to 32 infestations mapped many more infestations are active throughout the Region within the range of sub-alpine fir. Areas of attack normally are small in size and contain between 1 and 20 trees. The beetle rarely attacks more than 10 trees/ha in any one year.

1982 A total of 75 infestations over 1 150 ha containing 15 000 trees were mapped. In the Arrow TSA, at the head of Fennel and Silverton creeks 2 000 trees were recorded over 210 ha. In the Golden TSA, 12 000 trees were mapped over 320 ha at the head of Blaeberry River. Other small infestations of 5-20 trees were common in high elevation stands.

1983 During limited aerial surveys, only 10 infestations covering 150 ha were mapped, primarily in the Blaeberry River.

1984 Recent tree mortality was recorded over 4 350 ha in 91 infestations, mainly near Revelstoke and in the Spillimacheen River drainage.

1985 Only 260 ha of recently killed alpine fir were mapped in 30 small infestation centers. Chronic areas near Revelstoke and in the Spillimacheen river drainage were not mapped.

1986 Recent tree mortality was mapped over 2 400 ha in 145 widely scattered infestations.

1987 Alpine fir tree mortality was recorded over 800 ha in 75 widely scattered infestations including Glacier National Park, Bachelor Creek--Gold River area in Golden TSA, Mitchell and Albert rivers and Jumbo Creek in Invermere TSA, Skelly and Hawkins creeks in Kootenay Lake TSA, Cinnamon, Bowman, Dog and Renata creeks in Arrow TSA. Chronic areas in the St. Mary, Spillimacheen and Blaeberry river drainages and Silverton Creek are not included in the area figures.

1988 Recent tree mortality was recorded over 1 700 ha in 121 infestations, mainly in the Quartz Creek and in the Kinbasket, Bush, Blaeberry and Spillimacheen river drainages.

1989 Recent tree mortality was mapped over 1 600 ha, with the main concentrations remaining in the Spillimacheen River (1 100 ha) and Vowell Creek (250 ha) drainages but also included 113 ha in 12 infestations in the Lasca Creek drainage, where activity is increasing.

1990 Alpine fir tree mortality was recorded over 1 780 ha, the main concentrations continued in the Spillimacheen River drainage (700 ha), Vowell Creek (250 ha) and Lasca Creek (320 ha). Other areas with small infestations included Beaver River, Kootenay Mountain Range north of Nelson, Skelly Creek, Blazed Creek and near Traverse Creek.

1991 Over 3 800 ha with recent alpine fir mortality was mapped, mostly in the Spillimacheen River--Bobbie Burns Creek area (1 700 ha), Lussier River--Thunder Creek area (165 ha), E. White--Bull rivers (100 ha) and along McNaughton Lake (300 ha). Some of the increase was due to additional flying.

WESTERN HEMLOCK PESTS

Western hemlock looper, Lambdina fiscellaria lugubrosa

The western hemlock looper is one of the most destructive of the defoliator in the Nelson Forest Region. The preferred host is western hemlock and western red cedar, although Douglas-fir, Engelmann spruce, true firs and occasionally western white pine, western larch and some deciduous tree species are attacked. Major outbreaks have occurred in the wet belt forests in 1937-38, 1944-47 and 1972-73.

Year	Remarks
1937	Severe infestations on western hemlock and western cedar in the vicinity of Blackwater Lake (90 km²), west bank of the Columbia River from Gold River to Beavermouth River (130 km²), Trout Lake (100 km²), Revelstoke National Park and Wilson Lake near Nakusp.
1938	Severe outbreaks at Trout Lake (100 km²), Arrowhead, Big Bend Hwy. (220 km²), Revelstoke National Park, Howser and Wilson Lake. Some tree mortality was evident on hemlock and cedar.
1939	The infestations at Trout Lake, Arrowhead, Big Bend Hwy., Revelstoke National Park, Howser and Wilson Lake collapsed.
1940-43	Low populations.
1944	Looper moths were common along the Big Bend Hwy. between Revelstoke and Downie Creek. No defoliation was reported.
1945	An infestation occurred along the Columbia River between 50 and 130 km north of Revelstoke. Defoliation was on both sides of valley with localized severe defoliation.
1946	An outbreak along the Columbia River north of Revelstoke covered 390 km². Looper populations were high from approximately km 72 to 130 north of Revelstoke, defoliation was severe in many parts of the infestation. A large moth flight was reported along Lardeau Creek east of Ferguson.
1947	An outbreak on the south side of Lardeau Creek, southeast of Ferguson, resulted in 90% defoliation of the hemlock and cedar over approximately 2 600 ha. The infestation along the Columbia River north of Revelstoke has almost completely disappeared. Very few larvae emerged from the eggs.
1948	No reports of infestation; the hemlock looper infestations along the Big Bend Hwy. and in the Trout Lake areas have collapsed.
1949	A small population of hemlock looper at Parks, near Salmo, and at Wilson Lake, near Nakusp. Hemlock looper taken in collection in low numbers in the Trout Lake area. No fresh damage was noted throughout the sites of former infestations along the Big Bend Hwy. and Trout Lake areas.
1950	No hemlock loopers were found in 1950 in the Golden District or in the Big Bend area north to Boat Encampment.
1951	A sparse, scattered population.

1952 The hemlock looper population increased moderately. It was common on hemlock and was frequently collected on alpine fir, Douglas-fir and lodgepole pine.

1953 Populations continued to increase gradually; no defoliation was noticeable. The maximum number of larvae to a collection was 4 and the average was 1.5, along the Big Bend north of Revelstoke.

1954 Populations increased slightly in overmature cedar-hemlock stands along the Big Bend Hwy. An average of 11.6 larvae per positive sample were collected between km 58 and km 160 Big Bend Hwy. and an average of 6 larvae per collection in the Blackwater Lake and Czar Creek areas.

1955 Average number of larvae from western hemlock was 10.8, from cedar 7.0, and 13.5 from spruce between Donald and Kinbasket Lake. Light to moderate numbers of larvae collected along the Big Bend from Revelstoke to Boat Encampment. An average 17.3 larvae per positive sample from hemlock.

1956 Hemlock looper numbers decreased in 1956. Thirty-seven collections contained an average of 4.3 larvae each. The highest collection was 18 larvae west of Boat Encampment.

1957 Hemlock loopers were collected infrequently in the Nelson Forest Region. Fourteen collections from hemlock, spruce, Douglas-fir and cedar contained an average of 1.5 larvae each, in the central part of the Region.

1958 Larvae were more numerous in 1958 than in 1957, but no obvious defoliation was observed. The largest collection was from Keen Creek where up to 20 larvae were taken from a single hemlock tree. There was an average of 16.8 larvae per 3-tree beating sample from hemlock at Keen Creek.

1959 Populations increased slightly; 19% of the collections from hemlock contained an average of 2.8 larvae. Twenty-two larvae were taken in a 3-tree beating sample at Crawford Creek. Seven larvae were collected at Keen Creek near Kaslo.

1960 Populations increased along the Big Bend Hwy., but did not cause noticeable defoliation. Twenty-two per cent of the collections from hemlock contained an average of 2.1 larvae.

1961 Hemlock looper persisted at a low population level. Twenty-seven per cent of the collections from hemlock contained an average of 1.9 larvae.

1962 Fairly widespread but generally at low population levels. An average of 22% of the collections from hemlock and cedar contained an average of 2 larvae in the wet belt areas of the Region.

1963 Widespread but generally at a low population density. A total of 13 larvae were collected from hemlock at Kuskanax Creek; 22 larvae from alpine fir near Whitepine Creek along the Big Bend Hwy.

1964 Common in Region but in low numbers. An average of 22% of the collections from hemlock and cedar contained an average of 3.0 larvae. Twenty-eight larvae were collected from hemlock near Comfort Lake along the Big Bend Hwy.

1965 Very few larvae collected. An average of 19% of the collections from hemlock, cedar, spruce and Douglas-fir contained an average of 2.2 larvae in the wet belt area of the District. Twenty larvae were collected from hemlock and 17 from cedar near Rogers.

1966 Populations remained at a low level. An average of 15% of the collections from hemlock, cedar, spruce and Douglas-fir contained an average of 1.8 larvae in the wet belt area of the Region. A maximum of 10 larvae were collected in a sample from cedar at Armstrong Lake in the Trout Lake district.

1967 Populations remained at a low level. An average of 11% of the collections from hemlock, cedar, spruce and Douglas-fir contained an average of 2.7 larvae in the wet belt area of the Region.

1968 Larvae were present in small numbers on western hemlock, western red cedar and Douglas-fir. Seven per cent of the collections from hemlock, spruce, cedar and Douglas-fir contained an average of 1.5 larvae in the wet belt area of the Region.

1969 Larvae were collected in small numbers from hemlock, Douglas-fir, red cedar, Engelmann spruce and western larch.

1970 The increase in hemlock looper populations in the valley of Upper Arrow Lake did not cause noticeable defoliation. Of 60 hemlock collections, 33% were positive, averaging 2.6 larvae.

1971 Populations increased in the Region in 1971 although no defoliation was apparent. Looper larvae were common in beating collections from western hemlock and western red cedar along the Upper Arrow Lake and Koch Creek in the Slocan Valley. Seventy per cent of the collections from cedar and 64% from hemlock contained larvae, with an average of 15 and 8 larvae from cedar and hemlock, respectively.

1972 There was a further increase in hemlock looper populations in mature and overmature hemlock-cedar forests in the wet belt areas of the Region. The largest numbers of larvae were found along the Upper Arrow Lake, from Arrow Park to Revelstoke, and along the Big Bend Highway from Revelstoke to Boat Encampment. Light defoliation was observed in these areas on western red cedar and western hemlock. During September there were large moth flights at Nakusp, Revelstoke, Downie and Mica creeks.

Moderate to heavy overwintering egg populations were present at Mica Creek, Goldstream River and Downie Creek, and a light egg population at Kuskanax Creek near Nakusp.

1973 Larval populations were epidemic in many of the mature to overmature hemlock-cedar forests along the Columbia River and its tributaries from Shelter Bay to north of Mica Creek, from Galena Bay south to Nakusp and at Flat and Quartz creeks along the Rogers Pass Hwy. High larval populations were also found in mixed immature coniferous stands between Shelter Bay and Revelstoke and in the Nakusp area.

A total of nearly 30 000 ha of defoliation was mapped from aerial and ground surveys. There was some mortality of suppressed understory hemlock and cedar, and individual and groups of overstory trees in mature stands along the Columbia River from Shelter Bay north to Mica Creek. Mixed immature coniferous stands, including Douglas-fir, at the Shelter Bay Ferry Landing and at Nakusp suffered tree mortality on approximately 80 ha.

Overwintering egg populations indicate that moderate to heavy defoliation will occur along the Columbia River from Shelter Bay to Mica Creek, light to heavy defoliation along the Rogers Pass Hwy. and light defoliation from Galena Bay south to Nakusp. Large moth flights were reported in the Trout Lake area in 1973.

1974 Western hemlock looper infestations collapsed in many of the mature and overmature hemlock-cedar forests along the Columbia River and its tributaries from Shelter Bay to north of Mica Creek, from Galena Bay south to Nakusp and at Flat and Quartz creeks along the Rogers Pass Highway.

Populations declined in the egg stage and early larval instars. Egg samples collected early in April at Shelter Bay and Mulvehill Creek had up to 80% egg parasitism, primarily by two parasitic wasps, Trichogramma sp. and Telenomus sp. Cool wet weather prevailed during the early larval development and this may have also contributed to the decline.

Only a few overwintering eggs were found in samples taken during October at five localities, indicating low larval populations in 1975.

1975 No larvae were collected in the 1973 infestation areas. Elsewhere in the Region populations remained low.

1976-78 Very few larvae

1979 Very few larvae; found in 15% of collection in West Kootenay averaging 1.7 larvae per coll.

1980 Slight increase; 38% of collections in the West Kootenay averaged 5 larvae per collection.

1981	Further slight population increases in 3-tree beating samples but no visible defoliation anywhere in the Region. Larvae were collected in 25% of all beatings from hemlock and red cedar with an average of 12.4 larvae per beating.
1982	Increasing populations defoliated 8 035 ha, primarily centered between the Akolkolex and Cranberry creeks on the Upper Arrow Lake and Downie Creek north of Revelstoke, but smaller patches of defoliation extended north into the Red Rock Harbor area.
1983	Populations continued to increase, covering 32 000 ha. Defoliation was mapped from Fife Creek near Whatshan Lake in the Columbia River valley and north to Canoe Reach on McNaughton Lake. The main concentration remained between Cranberry Creek and Downie Creek.
1984	Populations collapsed with only 100 ha of defoliation noted at Mountain Creek campground in Glacier National Park and at Cusson and Ledge creeks. No tree mortality was noted, but tree top kill was recorded in scattered patches north of Revelstoke.
1985	Populations remained at endemic levels. Tree mortality was mapped over 450 ha, Pingston Creek - 145 ha, Mt. Revelstoke National Park - 95 ha, Albert Canyon - 100 ha, Frisby Ridge - 110 ha.
1986-88	Populations at endemic levels.
1989	Increasing larval populations were noted along the Illecillewaet River and Columbia River north of Revelstoke.
1990	Hemlock looper defoliated 915 ha; light at Albert Creek, Downie Creek, Script Creek, and along Bigmouth Creek.
1991	Defoliation increased to 8 225 ha north of Revelstoke, mainly between Downie Creek and the Mica area, but increasing populations were also noted along McNaughton Lake.

Gray spruce looper, Caripeta divisata

Larvae of the insect were only recorded at low numbers in the region until extensive defoliation was recorded on primarily western hemlock in 1990. The infestations were primarily below 1 000 m elevation and on west aspect slopes. Tree mortality averaged 12% following one year of defoliation, along with an additional 70% top kill.

Year	Remarks
1990	The first significant populations recorded in the region, lightly to moderately defoliated 1 370 ha along the west side of the Arrow Lakes from Nakusp to just north of Arrow Park. Along Slocan Lake defoliation occurred between Wragge and Nemo creeks.

1991	Infestations increased to 3 850 ha. Infestations along Arrow Lake expanded, north to Fosthall Creek and south to Graham Creek. Infestations at Slocan, Box and Duncan lakes declined to light defoliation, with little change in area.

Western blackheaded budworm, Acleris gloverana

An important defoliator of western hemlock, which also feeds on the true firs, spruce, and Douglas-fir. There have been three major infestations recorded in the Nelson Forest Region, - 1939, 1955 and 1965-67.

Year	Remarks
1939	Extensive infestation on hemlock, alpine fir, and spruce at the headwaters of the Illecillewaet River in Glacier National Park and a smaller one at the south end of Kootenay Lake.
1940	No infestations reported.
1941-51	Low populations. No reports of damage in this period by the blackheaded budworm.
1952	General increase in the population density of blackheaded budworm was apparent during 1952.
1953	A further small increase in the blackheaded budworm population level occurred in some areas during 1953; however, no defoliation was apparent.
1954	Little change in the population density of budworm, no noticeable defoliation was recorded.
1955	A medium infestation of blackheaded budworm occurred in mature and overmature hemlock from km 25 to 35, and 55 to 65 on the Big Bend Hwy. north of Revelstoke. The area affected totalled about 25 sq km. The major portion of this infestation occurred on the west side of the Columbia River between altitudes of 800 m and 975 m.
1956	Outbreaks of budworm along the Big Bend Hwy. subsided. No noticeable defoliation was found in this area.
1957	Blackheaded budworm caused slight discoloration of the foliage of decadent hemlock trees along Keen Creek and Wilson Lake in the central part of the Region.
1958	Larvae were numerous on hemlock at Keen Creek but became scarce by mid-July. A localized light infestation was observed in an alpine fir stand along Cabin Creek in the East Kootenay.

1959 Budworm populations declined to a very low level.

1960-62 Budworm populations remained low throughout the Region.

1963 Budworm remained at a low level, with a small increase in a few scattered localities.

1964 There was an increase in the population of budworm on hemlock and spruce at a number of localities in the Region.

1965 The blackheaded budworm was in epidemic numbers in mature and overmature hemlock stands along the Upper Arrow Lake from West Demars to Arrowhead, along the Columbia River north to Revelstoke and Mica Creek, and in the Trout Lake - Lardeau River area.

1966 Blackheaded budworm outbreaks escalated sharply. Aerial and ground surveys showed mature and overmature hemlock stands moderately to heavily infested. Major areas of defoliation were notably in the Upper Arrow Lake watershed from West Demars to Beaton, from Arrowhead to Mica Creek, the Jordan River valley, along Rogers Pass, from Beaton along the west shore of Trout Lake, and the Lardeau River valley from Gerard to Meadow Creek. Heaviest defoliation occurred mainly between elevations of 900 and 1 400 meters along Kuskanax, Keen and Crawford creeks, and near Wilson Lake.

1967 The blackheaded budworm epidemic continued in 1967. Larvae again were numerous, although less so in some of the localities where defoliation had been severe in 1966. Infestations generally extended to lower elevations south and east of the 1966 outbreaks. The most severe defoliation occurred in stands of overmature hemlock, but light to moderate defoliation of current year's growth of Engelmann spruce and alpine fir was evident in high elevation stands at several locations. Hemlock foliage was discolored by the second week of August in scattered areas from 32 km north of Revelstoke south to the International Boundary, and east to Goat River at elevations from 600 to 1400 meters. Defoliation was severe at Inonoaklin Crossing, Mackie Mountain and McRae, Crawford, Gray Giveout and Boundary creeks. The Beaton--Trout Lake infestation was again severe; a new outbreak in the Box Lake--Summit Lake area was heavy. The epidemic along the Big Bend Hwy. declined.

1968 The infestation collapsed by mid-summer. Defoliation was light to moderate and egg populations in the fall were low. The current year's growth of hemlock was moderately defoliated by this pest at Hall and Giveout creeks and Inonoaklin Crossing. There was some virus disease and fairly heavy parasitism of larvae in these areas and few budworm reached the pupal stage.

1969 Low numbers of budworm larvae found.

1970-71 Populations remained low.

1972	Beating samples from western hemlock yielded 20 larvae at Keen Creek and 13 larvae at Koch Creek near Passmore. These were areas of heavy infestations in the last budworm outbreak in the mid 1960's. Beating samples in other areas of the region showed the budworm to be at low population levels with just occasional larva collected.
1973	Budworm populations increased. Beating samples in the Galena Pass area produced over 100 larvae per sample in a mature hemlock--cedar stand. Larvae were also common along the Saddle Mountain and Low Pass roads near Upper Arrow Lake. Larvae were also common in collections along the Big Bend Highway north of Revelstoke.
1974	Budworm lightly defoliated the new growth of hemlock in the Galena Pass area, along the Ferguson--Trout Lake road and along the Saddle Mountain road opposite Nakusp. There was a general increase in larval numbers along the Rogers Pass Highway.
1975	Budworm lightly defoliated the new growth on hemlock trees along the Saddle Mountain road.
1976	All populations declined.
1977	Light defoliation occurred on 250 ha at Matthew Creek.
1978	Populations at Matthew Creek declined. Light defoliation over two hectares at Blaeberry River.
1979-81	Low populations.
1982	Minor increasing populations throughout the region, especially at Bostock Creek in Glacier National Park and at Dewar Creek.
1983	Western hemlock was lightly defoliated over 120 ha along Bostock Creek in Glacier National Park and trace defoliation was evident on alpine fir and Engelmann spruce at Dewar Creek.
1984	Defoliation was mapped over 19 100 ha. Defoliation was generally between 1 000 and 1 500 m elevation from Bigmouth Creek near McNaughton Lake to upper Mcdonald Creek near Nakusp and east of Revelstoke to Rogers Pass in Glacier National Park.
1985	Defoliation was noted only over approximately 150 ha in the Cusson Creek area, west of Nakusp and at Goldstream River north of Revelstoke. Larval parasitism was high.
1986-91	Populations collapsed in 1986 and remained low.

Filament bearer, Nematocampa filamentaria

The first report of filament bearer defoliation in the Nelson Forest Region and adjoining National Parks was recorded in 1971 and continued at epidemic levels in 1972 and 1973. Filament bearer larvae have been found commonly in past hemlock looper infestations along the Big Bend Highway and in the Trout Lake area.

Year	Remarks
1971	A localized outbreak of filament bearer loopers lightly defoliated hemlock trees at km 16 along the Kuskanax Creek road. Trees that suffered the heaviest defoliation were the understory trees in a mature hemlock--cedar stand.
1972	Filament bearer larvae were found in high numbers in mature hemlock--cedar stands along the Kuskanax Creek road from km 134 to 20, and along the Trout Lake road south of the Trout Lake townsite. Heaviest defoliation occurred on the understory hemlock trees with lighter defoliation occurring on the overstory hemlock. Western red cedar trees were not fed on. Deciduous trees and shrubs in the stand were also heavily defoliated.
1973	Filament bearer loopers were epidemic in mature to overmature hemlock--cedar forests on some 20 000 ha in the Upper Arrow and Trout lakes area, along the Akolkolex and Tangier rivers near Revelstoke and along Bremer Creek in the New Denver district. Heavy mortality of suppressed understory hemlock trees occurred in all the infestation areas examined, notably at Kuskanax Creek, Ferguson and Tangier River. No evidence of disease was found, which is indicative of continuing infestations in 1974
1974	Filament bearer populations declined in all areas where they had been numerous on western hemlock in 1973. Light defoliation of new growth was apparent in all 1973 infestation areas. Egg sampling in October indicated the likelihood of low larval populations in 1975.
1975	Filament bearer populations remained low throughout the 1973 infestation areas.
1976-90	Populations remained low.
1991	Slight increase in conjunction with hemlock looper infestation in the Revelstoke and Golden TSAs.

WESTERN LARCH PESTS

Larch sawfly, Pristiphora erichsonii

The larch sawfly was first noted in the Nelson Forest Region north of Fernie in 1930. Since that time it has spread throughout the range of western larch in the Region. Sawflies were epidemic on western larch during the 1940's and again became epidemic in 1964-67 on 150 000 ha where larch trees were moderately to severely defoliated.

Year	Remarks
1930	Larch sawfly was first noted at Graves Creek, a tributary of the Elk River north of Fernie.
1931-32	No reports of larch sawfly found.
1933	The range of larch sawfly extended from Sand Creek to Elko and from Elko north in the Elk River Valley to Wright Creek. Infestations were noted at Fernie and nearby Hartley and Lizard creeks.
1934	Infestations at Sand and Lizard creeks, Hosmer, Corbin, McGillivray and Grave creeks.
1935	The range of the larch sawfly extended to Roosville, lower Flathead Valley, Yahk River Valley and Gilnockie Creek basin immediately north of the Montana border, Gold Creek, Rosen Lake, Bull River, and north to Fairmont Hot Springs. Also found at Lumberton and as far west as Kitchener. Infestations were confined to the Elk and Flathead river areas.
1936	All areas showed a marked decline in sawfly populations. No infestations were noted. The range of sawfly extended as far west as Boswell on Kootenay Lake.
1937	The larch sawfly decreased to a very low level but progressed to Slocan Lake.
1938	This year saw a build-up of the insect over much of the known range from Fernie to Slocan, with infestations at St. Mary's Lake and on the headwaters of Goat River near Kitchener. No extension of range was noted.
1939	Infestations occurred at Kimberley, Moyie Lake, Yahk, Kitchener, Goat River, Creston, and from Boswell to Riondel.
1940	One infestation occurred at New Denver. The insect declined considerably over the remainder of areas mentioned the previous year but extended its range to Whatshan Lake.

1941 Larch sawfly spread to the eastern slope of the Monashee Range. The population was a little higher in most areas but was generally light. Infestations were recorded at New Denver and Summit Lake to the north of Slocan Lake.

1942 Damaging populations were noted at Gray Creek, the Kootenay River Valley west of Nelson, Slocan Valley, and from Nakusp to Needles on the Arrow Lakes. Defoliation was negligible from Creston eastward.

1943 Heavy defoliation between Nakusp and Edgewood, also at Elko and Morrissey. Light to medium defoliation was noted at intervals between these general areas.

1944 Populations were generally low with an outbreak at Arrow Lakes Valley.

1945 An infestation occurred on the Rossland--Sheep Creek Summit. From Nelson eastward the populations were low.

1946 Defoliation at Hall Creek near Salmo. Populations remained low in other areas of the Region.

1947 An infestation appeared at Whatshan Lake.

1948-49 A light infestation occurred in the vicinity of Grand Forks, Eholt and Phoenix. In other areas of the Region the sawfly populations were at a low level.

1950-52 Larch sawfly populations were at a low level.

1953 Larch sawfly were present in small numbers at scattered points, mostly in the Kettle River drainage.

1954-56 Populations remained at a low level. A few larvae were collected near Phoenix in 1956.

1957-60 Populations at a low level.

1961 No larvae found in 1961.

1962 Larch sawfly larvae appeared in random samples from western larch for the first time in several years. Three larvae at Cascade, and two at Kingsgate were collected from open grown trees.

1963 Larvae were collected more frequently and in greater numbers in 1963 from larch than in 1962.

1964 Few larch sawfly larvae were taken in the Nelson Forest Region.

1965 Populations rose to epidemic proportions in 1965. Severe defoliation of larch occurred along the main Slocan River Valley, from Slocan City to Passmore and along the Little Slocan River Valley, from Koch Creek to Bannock Burn Creek. Moderate defoliation occurred at West

Demars, Arrow Park, and Fosthall Creek, along the Kaslo River at Blaylock. Some defoliation occurred at Whatshan Lake, Kootenay Lake, and in the Yahk Forest. Disease appeared to be of little significance in controlling the epidemic. The parasite Mesoleius tenthredinis was present and mammal predation was important in some areas.

1966 The sawfly infestation expanded over much of the range of western larch. Moderate to severe defoliation occurred on sapling and pole-sized trees, up to an elevation of 1 500 m. Predation was significant and parasitism ranged from 10 to 80 per cent. The parasite Mesoleius tenthredinis was more effective than Tritneptis klugii.

1967 The intensity of sawfly defoliation of larch diminished in most of the Nelson Forest Region in 1967. Moderate to severe defoliation was found only in small patches; the extreme heat during August may have been a major factor in the extensive reduction of the larval population. Total area with defoliated larch increased, however, from 147 000 to 158 000 ha. Overwintering sawfly larvae were heavily parasitized by two species of Hymenoptera, Tritneptis klugii and Mesoleius tenthredinis. Tritneptis seemed to be the more important parasite; it was found in all sample plots and was at least three times as numerous as Mesoleius.

1968 There was a general decline of the larch sawfly infestation. The only noteworthy defoliation was at the south end of Christina Lake.

1969 There was a further decline in the sawfly population in much of the Nelson Forest Region. However, heavy defoliation did occur south of Rossland. Defoliation was moderate along the west side of Christina Lake to Cascade, and west of Grand Forks near July Creek. The largest area of defoliation was less than 8 ha.

1970 Larch sawfly populations were at a low level in 1970. No defoliation was found throughout the Region.

1971 Larvae caused light defoliation of pole-sized and mature larch along Kootenay Lake, Kinnaird - Christina Lake Hwy. and along the Rossland cutoff. Populations were low in other parts of the Region.

1972 Larch sawfly again caused light defoliation to pole-sized and mature larch trees in mixed and pure stands along the Blueberry - Paulson Hwy. and along the Rossland Cutoff.

1973 No larch sawfly defoliation found. Larval populations were at a low level.

1974 Only 3 larvae collected along Kettle River Access Road at Damfino Creek.

1975 Suspected larch sawfly defoliation along Salmo-Creston Highway, 8 km west of Creston. Elsewhere in Region no larvae found.

1976 First outbreak since 1967 appeared on 4 ha near Sparwood, where larch were lightly defoliated.

1977 Moderate to severe defoliation (75 to 90%) occurred on 200 ha on west side of Elk River, north of Sparwood along the hillsides at 1 200 to 1 400 m elevation and in the valley bottom on 600 ha where larch were 30 to 50% defoliated.

1978 Infestations expanded to 4 600 ha in the Elk River Valley from Grave Lake - June Creek south along both sides of the Elk River to Sparwood and Hosmer; along the Fernie Ridge to east of Fernie. Larch were generally less than 50% defoliated. Increased populations found near Needles and at Slewiskin Creek - no defoliation. The larch sawfly parasite, Olesicampe benefactor was released for the first time in B.C. at Sparwood.

1979 Infestations declined slightly to 4 000 ha from Line Creek to Sparwood, Hosmer and Fernie. Defoliation intensity varied but commonly exceeded 75% on trees between Sparwood and Fernie.

1980 Infestations declined to only 500 ha of very light defoliation from Sparwood to Fernie. Collapse of populations during early larval development appeared associated with adverse weather conditions. Approximately 465 male and female adult parasitic wasps, Olesicampe benefactor, were released in sawfly infested stands near Sparwood, between Sparwood and Hosmer and north of Fernie.

1981 Small localized pockets of light defoliation occurred, N.E. of Canal Flats, at Mary Anne Creek and at Pommier Creek, S.W. of Skookumchuck.

1982 Defoliation was mapped over 12 000 ha in the East Kootenay. In the Cranbrook TSA, defoliation commonly exceeded 70% from Weigert Creek and the Fording River, along both sides of the Elk River south to Fernie, and from Sparwood east to the Alberta--British Columbia border and south along Michel Creek to Corbin. In the Bull River drainage, moderate to severe defoliation on nearly 2 400 ha occurred along North Galbraith, Galbraith, Tanglefoot and Quinn creeks.

1983 Defoliation averaged 60% over 10 400 ha in the region. In the Cranbrook TSA, defoliation declined between Elkford and Sparwood and in portions in the Bull River, but increased between Elko and Fernie and north of Tie Lake, while remaining the same between Fernie and Sparwood and along Michel Creek. In the Invermere TSA, 2 200 ha was defoliated mainly near Dutch Creek on the west side of Columbia Lake with isolated pockets north of Whitetail Lake, and south of Findlay Creek.

1984 Defoliation was reduced to 3 000 ha with most of it (1 800 ha) recorded as light north of Kimberley along Lost Dog, Mather and Skookumchuck creeks. Moderate to severe occurred in the Elk River valley from Fernie south to Morrissey Creek and east along Lodgepole Creek. Populations declined in all other areas.

1985	Populations collapsed due to parasitism and rodent predation. Trace feeding was noted in young stands in the Flathead River valley.
1986	The only insignificant feeding was evident near Castlegar and along Skookumchuck Creek.
1987	Light to moderate defoliation was recorded over 600 ha along the Elk River valley from Morrissey north to Sparwood, and on 100 ha at Dutch Creek.
1988	Moderate to severe defoliation continued along the Elk River valley between Hosmer and Elko, and at Wigwam Creek. Light to moderate defoliation was also recorded in the West Kootenay over 112 ha in the Miller Creek--Granby River area. There was an average of 84% parasitism by Dibrachys saltans.
1989	Only trace defoliation occurred in the Miller Creek area, all other populations collapsed.
1990-91	Populations were at endemic levels.

Larch casebearer, Coleophora laricella

The larch casebearer is an introduced defoliator of western larch in the Nelson Forest Region. The casebearer entered the Nelson Region some time before 1966 from infestations in the United States. Since first being detected, it has spread rapidly throughout much of the range of western larch below 915 m elevation in the southern part of the region.

Year	Remarks
1966	The larch casebearer was collected for the first time in the region near Rossland. The heaviest defoliation in 1966 occurred near Creston and in the Salmo and Moyie river valleys. A few larvae were found north along Kootenay Lake to Riondel, northward along the Columbia and Kootenay rivers to Thrums and from Laurier, near Grand Forks east to Moyie Lake.
1967	Infestations increased greatly in severity and extent. Severe discoloration of western larch foliage was evident in the Porthill--Creston area east to Kitchener and north to Wynndel. The known range of the insect extends from Roosville in the east, to Christina Lake in the west; the most northerly distribution, south Slocan, 8 km south of Lardeau and north of Cranbrook. Populations declined at most sample points by September, from desiccation caused by extremely high temperatures.

1968 Larch casebearer infestations on western larch continued to expand, and now extends eastward to Fort Steele and Elko, northward to a point north of Kootenay Lake, and westward to Anarchist Mountain. The areas of moderate and severe damage increased in 1968, notably near Fruitvale and Creston, particularly at Porthill and Salmo.

1969 Populations on western larch declined in most areas, possibly due to the extremely cold weather of January. Populations were light near Yahk and there was no noticeable defoliation. From Creston to Kitchener and near Fruitvale defoliation was moderate to severe. The parasite, Agathis pumila, was introduced into the infestation area at Fruitvale and East Arrow Creek.

1970 There was little extension to the distribution of the larch casebearer, however, there has been a general increase in the severity of defoliation. An increase in moderate to severe defoliation was recorded for the Rossland--Warfield area, along Pass Creek road, in the area immediately south of Nelson, and between Salmo and Creston north to Sanca on the east side of Kootenay Lake. No specimens of the introduced parasite, Agathis pumila, were recovered from the release points.

1971 Moderate to heavy defoliation of larch at a number of localities in the southern portion of the Region. The heaviest defoliation occurred along the International Boundary from Paterson east to Roosville, north along the Columbia and Kootenay rivers to Nelson, along the west arm of Kootenay Lake to Balfour and north of Creston to Boswell. Heavy defoliation was confined to stands below 900 meters elevation. One specimen of the introduced parasite Agathis pumila was found at the Fruitvale plot, for the first time.

1972 Distribution of larch casebearer remained about the same as in 1971 except north of Crescent Valley, where larvae were found for the first time at Winlaw in the Slocan Valley. Moderate to heavy defoliation of larch again occurred in these areas. Seven Agathis parasites were recovered at the Fruitvale parasite release plot and three from the East Arrow Creek plot.

1973 The extreme high temperatures during the summer in the areas of larch casebearer infestations caused widespread desiccation of larvae and greatly reduced their populations. Heaviest defoliation by the casebearer occurred along the International Boundary from Cascade east to Roosville, north along the Columbia and Kootenay rivers to Nelson, along the west arm of Kootenay Lake to Kaslo and north of Creston to Boswell. Thirty per cent of the casebearer were parasitized by Agathis pumila at the Fruitvale plot and 6% at East Arrow Creek.

1974 Larch casebearer defoliation of western larch was generally lighter in all infestations in the southern part of the Region. For the first time, casebearer were found in the Fauquier-Burton area and along the Monashee Highway in the low elevation stands 90 km north of the 1973 range.

Overwintering larval populations indicated light defoliation in the spring of 1975.

Samples of late instar casebearer larvae taken at the points where parasites were released in 1969 showed 11% parasitism at Fruitvale and two% at East Arrow Creek by the introduced parasite Agathis pumila.

1975 Larch casebearer defoliation of western larch in the southern area of the Region was generally light in 1975. Moderate defoliation occurred in the Creston-Kitchener area and along the east shore of Kootenay Lake north of Creston to Boswell. Light defoliation occurred in the Salmo-Castlegar and Christina Lake area.

Overwintering larval populations indicate that moderate to heavy defoliation is likely to occur in the spring of 1976 at the East Arrow Creek and Rykerts plot localities, and light defoliation at the Yahk, Salmo and Fruitvale plot localities.

Parasites imported from Europe and Japan were released in 1975 at the following localities, East Arrow Creek, West Creston, Blewett, Thrums, and Pass Creek.

1976 Defoliation of western larch was light at Christina Lake, Salmo and Yahk. North of Creston to Crawford Bay and from Blewett to Thrums, defoliation was light to moderate. New infestations were found at Sparwood near Fernie and Argenta on Kootenay Lake.

Agathis pumila parasites were released at Christina lake and Ross Spur near Fruitvale. The parasite Diadegma nana was released near Creston.

Agathis pumila introduced in 1969 to Fruitvale and East Arrow Creek were found in 5% and 7% of larch casebearer pupae respectively. Chrysocharis laricinellae which has recently been introduced into Washington and other states against casebearer was found in 4 of 5 plots examined: 7% at Yahk, 10% at East Arrow Creek, 15% at Salmo and 7% at Fruitvale.

1977 Defoliation was slightly greater than in 1976 and increased noticeably in the eastern portion of the Region. Moderate to heavy defoliation in the Kootenay River from Blewett to Castlegar, from Fruitvale to Ross Spur, west of Salmo, along the Pend d'Oreille River, along Summit Creek to Creston, at Crawford Bay and from Arrow Creek to Rykerts. Lighter defoliation occurred from Crescent Valley to New Denver and from Wardner to Elko.

In July, 16 male and 36 female Agathis pumila were released at Rossland.

1978 Defoliation was of the same intensity as in 1977 but somewhat more widespread. Moderate to severe defoliation occurred along the Kootenay River from Blewett to Castlegar, at Fruitvale and in the Creston area. Severe defoliation was found in the Pend d'Oreille Valley on the south side of the river. From Kaslo to New Denver and near Edgewood severe infestations occurred in pockets. Damage was more severe in the Elko--Kimberley--Riondel areas where defoliation was light to moderate with scattered pockets of severe on understory and fringe trees.

There were no parasite releases in the Region.

1979 Spring defoliation of larch by casebearer was of similar intensity to 1978 but again more widespread. Defoliation was moderate to severe from Kitchener to Creston and from Creston to Rykerts and north to Kootenay Bay, on the west side of the Creston Valley from the U.S. border to Summit Creek and east from Summit Creek to Blazed Cr. Severe defoliation occurred from Nelway to the Seven Mile dam site in the Pend d'Oreille River Valley. From Nelway to Salmo and west to Fruitvale defoliation was light. Between Nelson and Castlegar along the Kootenay River Valley, defoliation was generally moderate with large patches 50-200 ha of severe. Small patches (5-20 ha) of light to moderate defoliation occurred between Christina Lake and Grand Forks, in the Fauquier, Lardeau and Kaslo areas. Pockets of severe defoliation occurred from Cranbrook to Moyie, between Wardner and Jaffray and south of Cranbrook along Gold Creek. From Fernie to Sparwood in the Flathead Valley and from Cranbrook to Canal Flats defoliation increased slightly.

No parasites were released this year.

1980 Severe defoliation continued in many areas: from Creston to Arrow Creek, south to Rykerts and in the Wynndel area, from the U.S. border to Summit Creek on the west side of the Creston Valley and west to Blazed Creek, southwest and southeast of Cranbrook in the Jaffray-Elko area, from Nelway north to the Salmo-Creston highway, in 5-20 ha pockets from Grand Forks north to Eholt, from Rock Creek to Bridesville and in the McKinney Creek area, along Hwy. 3 near the Anarchist Mtn. summit, northeast of Christina Lake in several 2 ha patches and along the Granby River from Rendell Creek to Howe Creek. Moderate defoliation was common in 2-10 ha patches west of Kaslo along the Kaslo River, from Edgewood to Valley Creek, from Paterson to Rossland, from Fruitvale to Salmo and from Cranbrook to Kimberley.

Light defoliation was visible from Castlegar to Nelson, Arrow Creek to Nelson, in the Christina Lake area, in the Salmo River Valley south of Salmo, from Thrums to Slocan Lake, along the Granby River from Grand Forks to Rendell Creek, on the south side of the Pend d'Oreille River, in the Wigwam and Lodgepole creeks and at Premier Lake near Skookumchuck.

No parasite releases were made in the Nelson Region in 1980.

1981 Defoliation was greatly reduced in most areas. In the East Kootenay moderate (10-50%) defoliation occurred along Summit Creek east to Creston Valley, at Rykerts, Arrow Creek, between Jaffray and Elko on the east side of Koocanusa Lake, several kilometers into Tepee Creek on the west side of Koocanusa Lake and along the Yahk River. In the West Kootenay defoliation occurred east of Anarchist Mtn. summit and along Johnston Creek where damage was moderate and light respectively.

Of the five permanent plots sampled at Thrums, Salmo Rykerts, Arrow Creek and Yahk, only Rykerts showed any damage.

The native parasite Dicladocerus spp. was found in 68% of the pupae examined from an area just east of Anarchist Mt. Summit. Overwintering larvae from sample plots indicated that light defoliation will occur at Rykerts and negligible to no defoliation will occur elsewhere in 1982.

1982 Only light defoliation was noted at several localized patches near Jaffray and Rykerts. Chrysocharis laricinellae parasites were released near Jaffray.

1983 Approximately 60 000 ha of light to moderate defoliation was recorded in the Jaffray, Elko, Koocanusa Lake and at Gold Creek. Light foliage discoloration occurred along Summit Creek, Rykerts, and between Cranbrook and Moyie Lake. The northern range of the casebearer was extended to the Duncan Lake area. Further releases of C. laricinellae were made at Jaffray, Koocanusa Lake, and Slocan Lake.

1984 Defoliation occurred over 40 000 ha from Kootenay Lake east to Elko and from Kimberley southeast to to the Canada--USA border. In the Cranbrook TSA, severe defoliation occurred in the Cranbrook, the Jaffray--Elko--Kikomun Creek area, and along the west side of Koocanusa Lake from Wardner south to Newgate, including Gold Creek. In the Kootenay Lake TSA, light and moderate defoliation was widespread near Summit Creek, Sanca Creek to Sirdar and from Creston to Yahk. Defoliation was also noted west of Fairmont at Ellenvale Creek in the Invermere TSA.

1985 Defoliation was generally light to moderate around Cranbrook, east to Elko and along Koocanusa Lake south to the B.C.--Montana border, near Canal Flats and at Anarchist Mountain. Very light defoliation occurred from Moyie Lake to Yahk, near Creston and at Fruitvale. Defoliation was also recorded for the first time at Wilson Creek near Slocan Lake.

1986 Casebearer populations declined to endemic levels in most areas with only small localized pockets noted at Castlegar, Montrose, Fruitvale, Thrums, Rossland, Keenleyside Dam, Anarchist Mountain, Rykerts, Wycliffe, and along Gold Creek Road.

1987	Populations remained at endemic levels in most areas. Isolated pockets of moderate defoliation were noted at Castlegar, Montrose and Fruitvale. Light defoliation occurred at Thrums, Rossland, Keenleyside Dam, Anarchist Mountain, Meadow Creek and Argenta. In other areas light defoliation was limited to roadside regeneration. The northern most extent of casebearer reached Galena Bay.
1988	Casebearer defoliation was mapped over 486 ha. At Castlegar, 140 ha were moderately defoliated, other areas included areas along Arrow Lake at Stoney Creek, Gustafson to Graham Creek and at Arrow Park, in the Rossland area, at Summit Lake, in the Duncan Lake area, near Thrums (10 ha), Bridesville (5 ha), Fisherman Creek, Crescent Valley and from Meadow Creek to Argenta. In the East Kootenay, defoliation increased slightly but remained primarily on roadside trees; areas included Galloway, Cranbrook, Wycliffe, Kimberley, and along Kootenay Lake from Boswell to Crawford Bay.
1989	Casebearer populations declined to occasional regeneration feeding, only at Castlegar was regeneration moderately defoliated.
1990	Populations remained at low levels. Only small patches of light to moderate feeding were found from Galena Bay to New Denver, from Nakusp to Fauquier, in the Edgewood to Whatshan Lake area, and at Castlegar.
1991	Casebearer lightly defoliated 660 ha of larch along Summit Creek, Goat River and Rykerts Mountain. There was also minor increase in populations throughout most of the East Kootenay. Small patches of light defoliation occurred at Anarchist Mountain, Blueberry Creek and at Castlegar.

Larch budmoth, Zeiraphera improbana

The first recorded infestations of western larch by this budmoth in the Nelson Forest Region occurred in 1965. Approximately 71 500 ha of larch stands were affected in the Region. The largest single infestation, covering approximately 16 000 ha, occurred in the Summit Creek drainage near Creston.

Year	Remarks
1965	A severe, extensive epidemic of larch budmoth occurred in high-elevation larch stands. Areas of moderate to severe defoliation were estimated as follows: East Nelson, 2 000 ha; Central Nelson, 6 000 ha and West Nelson 62 750 ha. Most of the infestations occurred at elevations between 1 220 and 1 800 m.

1966 The epidemic of larch budmoth in mature larch declined considerably. The only extensive infestation, over some 8 100 ha, was near Rossland at the headwaters of Murphy and Big and Little Sheep creeks between elevations of 1 370 and 1 675 meters. Small areas of severe feeding were noted at Christina Mountain (300 ha) north of Sugarloaf Mountain (160 ha) and on Goat Mountain (200 ha).

1967 The larch budmoth epidemic on larch declined in 1967. There was no visible discoloration near Rossland, where the largest and most severe infestation occurred in 1966.

1968 Populations declined to a low level.

1969-72 Populations at a low level.

1973 Larch budmoth caused moderate to heavy defoliation of larch above 1 000 m elevation along the Inonoaklin Valley from two miles west of Inonoaklin Crossing to Edgewood, along the east side of Arrow Lake from Applegrove to Slewiskin Creek near Nakusp and west of Trail along the "Rossland Cutoff."

There were numerous pupae present at Inonoaklin Crossing, indicating a continuing infestation in 1974.

1974 Larch budmoth infestations subsided along Inonoaklin Valley and east side of Arrow Lake from Applegrove to McDonald Creek. Only a few pupae found.

1975 Larch budmoth persisted at light infestation levels near Inonoaklin Crossing. Only a few pupae found.

1976 No larvae found at Inonoaklin Crossing.

1977 Defoliation of western larch occurred on 2 020 ha at: Granby River, 1 450 ha; Kelly River, 420 ha; St. Annes Creek, 100 ha; Thone Creek, 50 ha. All infestations were from 1 200 m to 1 500 m elevation.

1978 Infestations at Granby River, Kelly River. St. Annes Creek and Thone Creek collapsed. New areas of defoliation found at Slocan Lake to Arrow Lake, Halfway River, and at Kuskanax, Slewiskin, Wee Sandy, Holmes, Wilson, Lasca, Caribou, Plant, Cusson, and Rioulx creeks. There was 1 890 ha of defoliation in 1978.

1979 Infestations collapsed. Larval parasitism was 50% at Caribou and McDonald creeks.

1980-81 No larvae or damage recorded.

1982 No damage or larvae recorded.

1983	Budmoth defoliated 6 600 ha of western larch in 36 infestations in the region. Most defoliation occurred in the Kettle and Granby rivers drainages, near Grand Forks and along the Rossland "Cut-off". The remainder of defoliation occurred between Skookumchuck and Invermere, along the White River, and west of Kimberley along the St. Mary River and White and Dewar creeks.
1984	Defoliation by budmoth decreased to 1 100 ha in 10 areas. Damage was found only to the north and west of Trail primarily in the Murphy--Hanna creeks and the Paulson--Blueberry Summit areas.
1985	Budmoth feeding was recorded over 5 800 ha in the region. Defoliation continued in the Murphy--Hanna creeks and Nancy Greene Summit areas. Defoliation expanded to include Red Mountain, Old Glory, Big Sheep Creek. New infestation areas included Mt. Ferroux along the Kamloops boundary, the Valhalla Range, the west arm of Kootenay Lake, along Summit Creek and South Salmo River in the Salmo--Creston Highway area. Defoliation was also noted east of Moyie River from Stone to Manson creeks, in the American Creek area and between Irishman and Englishman creeks.
1986	Populations collapsed with no damage recorded.
1987	No budmoth damage was found.
1988-89	Very light damage noted at Anarchist Mountain and Johnston Creek.
1990-91	No budmoth damage was noted.

A larch looper, Semiothisa sexmaculata

The first record of this pest developing to outbreak size in British Columbia was in 1977. Defoliation on western larch first appears in late August and feed into October before pupating. All infestation have lasted for only one year, and were recorded on north, west and east aspect slopes at elevations from 900 to 1 800 m. No topkill or mortality has been recorded.

Year	Remarks
1977	Larvae defoliated larch over 4 600 ha in Slocan Valley, along Arrow Lakes, the west arm of Kootenay Lake and along the Kootenay River, including Blueberry Creek.
1978-89	Populations collapsed in 1978 and remained at endemic levels.
1990	Defoliation was mapped over 12 000 ha between Creston on the east to Burrell and Howe creeks in the west and the international border in the south to Kaslo, Slocan and Fauquier in the north.
1991	Populations collapsed.

A woolly adelgid on larch, Adelges oregonensis

A small woolly adelgid on the twigs and base of western larch needles. Seldom causes major damage.

Year	Remarks
1949	Western larch, in the vicinity of Kimberley, was heavily attacked by aphids, causing many needles to turn brown.
1948-57	No records of damage occurring.
1958	Young open-growing larch stands over several square Kilometers between Rock Creek Canyon and Camp McKinney, were heavily infested by aphids. The adelgids were so numerous that some trees appeared whitish.
1959	No reports of damage.
1960	A moderately severe outbreak on western larch reproduction in the lower valley of Hallmark Creek in the Creston district.
1961-63	No reports of damage.
1964	Moderate to severe infestations occurred on western larch regeneration along Skookumchuck Creek road, Tanglefoot Creek and near Wardner.
1965	Moderate to severe infestation on regeneration western larch at Tanglefoot and Gold creeks and Flathead River valley.
1966-87	No reports of significant damage.
1988	Light to moderate defoliation at Cedrus Creek along Kootenay River, and along Findlay Creek.
1989-90	No reports of significant damage.
1991	Severe infestations in young larch along the lower St. Mary River.

MULTIPLE HOST PESTS

Conifer sawflies, Neodiprion spp.

There were several species of Neodiprion sawflies found in the Nelson Forest Region. The two sawflies that have caused significant damage are the hemlock sawfly which was found in high numbers within hemlock looper and filament bearer looper infestations along the Big Bend Hwy. and Trout Lake area. Lodgepole pine sawflies defoliated lodgepole pine trees near Beaverdell and Canal Flats in the 1940's.

Year	Remarks
1937	High larval population on hemlock within hemlock looper outbreaks in the Trout Lake area.
1938	Infestation of hemlock sawfly still active in the Trout Lake area within hemlock looper outbreaks.
1939-44	No reports of sawfly infestations.
1945	High numbers of lodgepole pine sawflies on small trees on Wallace Mountain, four miles south of Beaverdell.
1946	Approximately .5 ha of pine infested 12 km south of Canal Flats.
1947	A light infestation along the Big Bend Hwy., 72 km north of Revelstoke on hemlock.
1948	The light infestation reported in 1947 north of Revelstoke on the Big Bend Hwy. was not evident. Hemlock sawfly activity was reported in the Trout Lake area.
1949	Hemlock sawfly still active in the Trout Lake area, however, the population was found to be small and no signs of defoliation was found.
1950	Light populations present in the Glenn Creek, Trout Lake and Ferguson areas. A light isolated infestation of sawfly occurred in a mature stand of hemlock on Kaslo Creek; light defoliation was evident. Larvae were numerous near Sitkum Creek; light defoliation was evident on hemlock.
1951	Populations were sporadically distributed. No reports of defoliation on hemlock or lodgepole pine.
1952-54	No reports of sawfly defoliation.
1955	Larvae were numerous on the Big Bend Hwy. between Revelstoke and Downie Creek in association with the blackheaded budworm, and from north of Kinbasket Lake to north of Donald in association with the hemlock looper on hemlock.

1956 Sawflies less numerous along the Big Ben Hwy. than in 1955; defoliation range from a trace to light, on hemlock.

1957 No reports of sawfly defoliation.

1958 Sawflies increased in several mature and overmature hemlock stands, notably along Leadville Creek, northeast of Kitchener, medium defoliation extended for 2.5 km. The lower crowns of hemlock trees along Wilson Creek were lightly defoliated.

1959 No reports of sawfly defoliation.

1960 The hemlock sawfly was numerous along the Big Bend Hwy.

1961-62 No infestations reported.

1963 Lodgepole pine sawflies caused noticeable defoliation to localized patches of lodgepole pine trees at Yahk Junction.

1964 Sawflies were numerous on hemlock at km 40 Rogers Pass Hwy., and at Canuck Creek.

1965 No infestations reported.

1966 Light defoliation of hemlock along Wilson, Keen and Koch creeks.

1967-70 No infestations reported.

1971 Hemlock sawfly population build-up in areas of hemlock looper and filament bearer looper population build-up along the Big Bend Hwy. and Trout Lake area.

1972 Populations continued to increase.

1973 Hemlock sawfly larvae were found in high numbers in areas where filament bearer infestations occurred in 1973. In the Ferguson area and along Upper Kuskanax Creek sawfly larvae were responsible for some of the defoliation on hemlock. Beating samples taken near Ferguson produced up to 400 larvae per sample. Sawflies were also commonly found in the hemlock looper infestations but in lower numbers. A localized infestation of hemlock sawflies was found at Flat Creek in Glacier National Park, where 600 larvae were taken in one collection.

1974 Numerous hemlock sawfly larvae were found in cedar--hemlock forests along Upper Arrow Lake from Nakusp to Galena Bay and along the Columbia River from Shelter Bay to Goldstream River. Light defoliation was evident on fringe trees at these localities. Larvae were common along Rogers Pass, where light defoliation occurred on western hemlock.

1975 Sawflies were less numerous. At Lauretta Creek in Revelstoke National Park, 175 larvae were collected in a beating sample, and 125 larvae along Tangier River.

1976 Larvae were common throughout the region. Up to 180 larvae per beating sample found north of Revelstoke and in the Incomappleux River valley.

1977 Common in small numbers. Largest collection contained 80 larvae in the Akolkolex River valley.

1978-79 Common in small numbers.

1980 In association with hemlock looper, caused very light defoliation of hemlock and cedar for 10 km along Akolkolex River.

1981 Caused 5% defoliation of understory western hemlock along Bostock Creek in Glacier National Park. Larvae were collected in 34% of all beating samples from hemlock and averaged 11.2 larvae per sample.

1982 Western hemlock was lightly defoliated over 10 ha at Quartz Creek. Moderate larval numbers, ranging up to 200 larvae, were common in association with hemlock looper infestations.

1983 Defoliation of Engelmann spruce was common in the Elk River valley in the Morrissey to Sparwood area. In western hemlock, light defoliation was noted at Quartz Creek, northwest of Golden, and at Koch Creek. Low numbers of larvae were also common in association with hemlock looper infestations.

1984 In Engelmann spruce, light defoliation occurred over one hectare in the Palliser River drainage. In hemlock, light defoliation continued at Quartz Creek. In the Revelstoke TSA, low numbers of larvae were common in association with hemlock looper and blackheaded budworm infestations.

1985 Western hemlock was severely defoliated along Boundary Creek west of Creston. Light defoliation of understory and lower crowns continued in areas previously defoliated by hemlock looper and blackheaded budworm especially at Keen Creek, west of Kaslo, at Goldstream River, Cusson, upper Koch, Dago and Quartz creeks.

1986 Defoliation continued at decreased levels over 400 ha of western hemlock along Boundary Creek west of Creston. Sawfly persisted at light levels at Kokanee, Giveout, Bayonne and Keen creeks.

1987-89 No significant populations were found.

1990 Sawfly caused light to severe defoliation of spruce in the Castlegar and Crescent Valley area. On grand fir, shoot-boring sawfly populations continued to increase in the Creston area, damage was also noted in the Nelway and King George VI Park areas.

1991 Shoot-boring sawfly populations declined in the Creston area, with 34% of the new shoots grand fir infested at East Arrow Creek. Conifer sawfly also increased in conjunction with the hemlock looper populations along Revelstoke Lake. Trace to light defoliation was also recorded at Ferguson, Keen Creek and at Box Lake.

Black army cutworm, Actebia fennica

Black army cutworm was for some time known only as a sporadic pest of herbaceous agricultural crops in central north America. Recently it was recognized also as a pest of newly planted conifer seedlings when for the first time in the Nelson Forest Region, Engelmann spruce seedlings were defoliated in 1973 on 100 hectares of the 1971 "Sue" fire at Blackwater Ridge, and again on 2 800 ha in 1974. In 1975, defoliation occurred on 1 000 ha on a burned over site in the Beaverfoot River valley. Large infestations followed extensive wildfires in the mid 1980's.

Year	Remarks
1973	Defoliation of Engelmann spruce seedlings and most of the ground cover, including fireweed and willow foliage occurred on 100 ha on the site of the 1971 "Sue" fire at Blackwater Ridge. Seedlings at lower elevations were 40% defoliated, but damage was lighter along the upper slopes of Blackwater Ridge.
1974	Moderate to severe defoliation occurred on Engelmann spruce seedlings over 2 500 ha of the 1971 "Sue" fire, with severe damage limited to low lying areas. Also defoliated was deciduous ground cover, including fireweed, willow, rose and alder. Damage losses were estimated at over $100,000. Dylox and the bacterium, Bacillus thuringiensis, achieved 70% control in plots established.
1975	Moderate to severe defoliation occurred on seedlings of Engelmann spruce, Douglas-fir and lodgepole pine on 1 000 ha in the Beaverfoot River valley on sites burned in 1973 and planted in 1974 and 1975. Sparse deciduous ground cover was stripped prior to feeding on seedlings. Parasitism and rodent populations during the pupal stage greatly reduced cutworm populations. Overwintering larval counts indicated the infestation had collapsed. At Bourne Creek north of Revelstoke, cutworms defoliated deciduous plants and shrubs on a 10.5 ha Douglas-fir plantation. No damage occurred to the seedlings.
1976	No additional damage was recorded; all infestations collapsed.
1977-85	No significant populations recorded.
1986	Pheromone trapping indicated increasing populations in the Ram and Gibby fires.
1987	Cutworm larvae severely defoliated spruce and pine seedlings along with ground cover on 1 000 ha of the Ram fire in the Lussier River drainage and severe defoliation of ground cover over 900 ha in the Gibby fire delayed planting.

1988 High cutworm populations developed in the Golden TSA. The most notable areas were at Hunter Creek, Blackwater River, Bush and Redrock Harbors and portions of the Gibby fire. At Bush Harbor 88% of the Douglas-fir seedlings were stripped, at Redrock Harbor all of the Engelmann spruce seedlings had lost over 95% of their foliage in a 100 ha cutblock.

1989 Cutworm populations declined with seedling and herbaceous feeding recorded on 20-30 ha. At Vowell Creek, 20% of the spruce seedlings had all the foliage removed over 25 ha. At Chatter Creek, herbaceous growth was severely defoliated over 2.5 ha but lodgepole pine seedlings were largely unaffected. Scattered pockets of 1 ha were moderately defoliated in a cutblock near Donald.

1990 Cutworm populations further declined, causing defoliation on only 20 ha near Game Creek. An average of 19% of the Engelmann spruce and lodgepole pine were totally defoliated and 81% of the western larch.

1991 Cutworm populations remained low, with moderate seedling defoliation recorded only over 20 ha in one cutblock at Vowell Creek

---

DECIDUOUS TREE PESTS

Forest tent caterpillar, Malacosoma disstria

The major infestations of this insect have occurred on trembling aspen. Outbreaks have occurred from Brisco to Golden, in the Revelstoke area, near Arrowhead, in the New Denver - Slocan areas and in the Trail - Warfield area. Although severe outbreaks have occurred in these areas, tree mortality was generally light.

Year	Remarks
1944	Severe defoliation of willow north of Rossland. Heavy defoliation of trembling aspen between Taft and Revelstoke. Larvae were numerous at Arrowhead and Nakusp.
1945-50	Not reported.
1951	Heavy defoliation of aspen and birch trees in the East Kootenay at Nicholson, 800 ha; Parson, 800 ha; Brisco, 400 ha; Sinclair Creek, 6 ha.
1952	Heavy infestations from Golden to Brisco, along Moberly Bench, in Mt. Revelstoke National Park and along the Columbia River from Revelstoke to Sidmouth.

1953 Heavy defoliation of aspen between Brisco and Donald. High populations defoliated over 4 000 ha in the aspen belts in the Revelstoke area, south to Arrowhead and north along the Big Bend Hwy. Outbreaks at Summit Lake and Three Forks defoliated 1 800 ha. An infestation in the Granby Valley defoliated aspen for 15 km.

1954 The Summit Lake infestation increased to 485 ha. Infestations in the Arrowhead area declined to moderate intensity but extended over 400 ha along Pingston Ridge. Medium to heavy defoliation occurred at New Denver, Retallack, Revelstoke and along the west part of the Big Bend Hwy. The Granby River infestation collapsed due to a polyhedral virus.

1955 Populations completely collapsed due to egg mortality and a disease which attacked the young larvae.

1956 Populations were low.

1957-58 Not reported.

1959 A small infestation north of Nicholson in the Golden area. Colonies observed at Marblehead, north of Lardeau.

1960 Aspen trees in the Golden area were 50 per cent defoliated. Up to 350 egg masses per tree between Nicholson and Donald.

1961 An epidemic between Donald and Invermere caused severe defoliation in aspen belts over an area 100 km long and 16 km wide. Near Warfield 40 ha were severely defoliated.

1962 Severe defoliation from Brisco to Donald, Trail to Robson and Harrop to Gray Creek. In the Slocan Valley, 16 ha of aspen were heavily defoliated. Light defoliation from Invermere to Brisco and along the Kicking Horse Valley. Defoliation also occurred at Waneta, Christina Lake, and Browns and Motherlode creeks. At Summit Lake 16 ha were 100 per cent defoliated.

1963 The outbreak between Donald and Nicholson collapsed. Severe defoliation from Edgewater to Spillimacheen and near Invermere. Fifteen square kilometers of defoliation at Summit Lake. Moderate defoliation in the south Slocan area.

1964 The epidemic generally decreased, however, severe defoliation occurred from Crescent Valley to Slocan, Retallack to New Denver, Slocan Lake to Box Lake and in the Salmo River Valley, along Stagleap and Big Sheep creeks. Infestations in the Columbia Valley subsided.

1965 Further decrease of populations throughout the Region. Infestations collapsed in the Summit Lake--Slocan River Valley areas.

1966-70 Low populations.

1971 Moderate to severe defoliation east of Revelstoke and in the Warfield--Rossland area.

1972 Heavy defoliation along the Columbia River from Revelstoke to Wigwam, from Donald to Parsons and in the Trail--Warfield areas.

1973 Tent caterpillar caused heavy defoliation to deciduous trees in the Trail--Warfield area and moderate to heavy defoliation east of Golden along the Kicking Horse River as far east as Yoho National Park, along the west side of the Columbia River from Golden south to Brisco, and along Windermere Lake, south of Invermere. Overwintering egg counts in September at Trail and Golden indicate moderate defoliation in 1974.

1974 Trembling aspen was defoliated on 490 ha along the west side of the Columbia River near Golden, Parson and Spillimacheen.

1975 No defoliation noted.

1976 Over 1 000 ha of trembling aspen and other deciduous species were defoliated on the Moberly Bench north of Golden and east of Ft. Steele 405 ha of black cottonwood were defoliated. Infestations on the Moberly Bench were heavily infected with virus and many pupae were parasitized.

1977 Infestations on the Moberly Bench and near Ft. Steele collapsed.

1978 Single isolated colonies found scattered in northern portions of the region.

1979-83 Very low populations only.

1984 Scattered moderately defoliated stands were recorded between Warfield and Violin Lake, west of Trail and on 2 ha at West Trail.

1985 Populations increased as 100 ha of deciduous trees were severely defoliated in the Warfield--Violin Lake area, and the infestation at West Trail increased to 25 ha of moderate defoliation.

1986 Deciduous trees on 1 200 ha were moderately to severely defoliated. Defoliation continued in the Trail--Warfield area and expanded west to Rossland, east to Montrose, southeast to Casino and north to China Creek, south of Castlegar. A 100-patch was also defoliated near Crawford Creek on the east side of Kootenay Lake. Minor infestations were noted at Castlegar, Crescent Valley, Eholt and Goat River, west of Kitchener.

1987 The area with moderate to severe defoliation increased to 7 200 ha in 119 infestations. Severe defoliation continued in the Warfield--Trail area and expanded southwest beyond Rossland to King George VI Park, east into Montrose, with spot infestation to Fruitvale. Almost continuous defoliation occurred from Trail north to Castlegar and throughout the Crescent Valley, with numerous spot

infestations to 30 ha along Hwy. 3 to Nelson, along Hwy 6 north as far as Passmore and south to Salmo. A 100-ha patch continued at Crawford Creek on the east side of Kootenay Lake. Minor infestations occurred at Eholt, Fort Steele, McRae Creek east of Christina Lake, Gray Creek, Goat River and Galloway.

1988 Moderate to severe defoliation was mapped over 1 500 ha primarily in the Fort Steele area. Additional scattered patches of light to moderate defoliation were also noted along the Rocky Mountain Trench from Wardner to the Golden--Blaeberry River area. Moderate defoliation continued in the Kitchener, Creston and along the Moyie River north of Yahk. Light defoliation also occurred in the Hosmer area.

1989 Tent caterpillar populations increased in the region with 9 900 ha of defoliation. In the Golden to Blaeberry area, 8 100 ha of severe defoliation was mapped. Along the Kootenay River, defoliation intensity increased in the Wasa Lake area increased but with some reduction in intensity from the Fort Steele area south. Infestations continued in the Hosmer area where 100 ha were moderately defoliated. Small patches of defoliation continued in the Yahk and Creston areas.

1990 Populations decreased with generally light to moderate defoliation recorded over 4 315 ha. The most severe infestations were to the south of Golden in the Parson to Spillimacheen area but light defoliation continued north to the Blaeberry River area. Light defoliation continued in the Creston and Hosmer areas but collapsed in the Fort Steele area.

1991 All populations collapsed.

Western tent caterpillar, Malacosoma pluviale californicum

Infestations occurred on deciduous trees, shrubs and ground cover, along the Big Bend Highway and at Creston, Rossland, Trail, Grand Forks, Golden and in the Elko area. Outbreaks caused heavy defoliation to localized stands.

Year	Remarks
1948	Light, scattered infestations on willow and trembling aspen at Bush River in the Big Bend area. Larvae defoliated large areas of willow southeast of Cranbrook.
1949	Larvae were very numerous on ground cover six km south of Elko along the Elko--Newgate road.
1950	Numerous larvae defoliated wild rose, snowberry and antelope bush from Cranbrook east to Elko and in the Crowsnest Pass area.

1951 Light damage to wild roses occurred in the Windermere Valley.

1952 Aspen trees were defoliated in the Revelstoke National Park and along the Columbia River to Sidmouth.

1953 Larvae defoliated willow and aspen along Inonoaklin Creek and the Granby River. Larvae were common in the Cranbrook and Elko areas.

1954 The infestation at Inonoaklin Creek covered some 4 000 ha. Alder and apple trees were completely defoliated in the Columbia River valley. Larvae were common throughout the Elko district.

1955-57 No infestations were reported.

1958 Tents were abundant near Ft. Steele and Elko.

1959 Populations declined at Ft. Steele and Elko. Low populations occurred at Koch Creek and at km 32 of the Big Bend Highway.

1960 Low populations.

1961 Light populations were evident at Ft. Steele and near Wardner. Increased numbers occurred along the Big Bend Highway at Downie Creek.

1962 Small numbers of larvae were evident from the Anarchist summit to Nelson, in the Monashee--Burton area and from Waneta to Nelway. They were found in association with Forest tent caterpillar at Warfield.

1963 Populations increased at Summit Lake and along the Big Bend Highway near Aid Lake. Extensive populations persisted at Fort Steele.

1964 Tents were observed at Creston, Sanca, Balfour, Iron Mountain, Erie Creek and in the Rossland--Trail area. Heavy defoliation occurred on 3 900 ha between Summit Lake and Box Lake.

1965 Webs were common only in the Grassy Creek and Erie Creek vaLleys. Infestations in the Summit Lake--Slocan Valley area completely collapsed. Very light populations occurred in the East Kootenay.

1966 No populations reported.

1967 Light populations in the Grand Forks area.

1968 Webs were noticeable along the Big Bend Highway, at Fort Steele and along the Bull River.

1969-70 No populations were reported.

1971 Colonies were common at Fort Steele and along the Wildhorse River.

1972 Light populations at Elko and Grasmere.

1973	Found in association with M. disstria infestations at Golden and along Blackwater Ridge.
1974-75	No western tent caterpillar defoliation noted.
1976	Found in association with M. disstria along Moberly Bench near Golden.
1977	Persisted in small areas near Elko and Golden.
1978	Found near Cranbrook, Elko, from Grasmere to Roosville and at Kikomun Provincial Park where a colony of 5 000 larvae was located.
1979-88	No significant populations.
1989-90	Common in association with forest tent caterpillar infestations in the Golden area.
1991	No significant populations.

Fall webworm, Hyphantria cunea

Colonial defoliation of deciduous trees of which alder, cottonwood, birch and willow are the most important forest hosts. The extensive tents or webs for which the insect is named may be present in quantity on one or more tree species. The caterpillars can cause complete defoliation. The damage is most conspicuous late in summer.

Year	Remarks
1947	Heavy defoliation to willow and alder in the Grand Forks area.
1948	Light defoliation on roadside deciduous trees along the roadside from Grand Forks to Christina Lake. Chokecherry was the preferred host.
1949	Infestations in the Grand Forks, Gilpin and Christina Lake areas. The main hosts were chokecherry and Saskatoon; defoliation was up to 100%.
1950	Infestations still active in the Grand Forks, Gilpin and Christina Lake areas. Defoliation was not as heavy as in 1949; the preferred host was chokecherry.
1951	Light, sporadically distributed populations were observed in portions of the West Kootenay.
1952	Webworm populations continued to increase. Light infestations were common in the Nelson Forest Region.

1953 Light infestations were fairly common along raodsides in the Nelson Forest Region, especially along the Bull River and near Wardner and Waldo.

1954 Webs were more numerous in 1954 than during the previous year. They were particularly abundant along raodsides in the western portion of the region, except in the Grand Forks area, where a decline occurred.

1955-57 No reports of infestations.

1958 The fall webworm was more common on chokecherry, black cottonwood, and other broad-leaved trees in the western portion of the region.

1959 Webworm numbers decreased.

1960 The population in the eastern part of the region declined to a low level.

1961 There was a small increase in the number of webs in Nelson Forest Region. Cherry, black cottonwood and alder were the hosts most frequently attacked.

1962 The webworm increased in the western part of the Region.

1963 Populations decreased in the Region.

1964 An increase in the number of webs was detected in parts of the Region, notably: from Trail to Kinnaird, near Robson, Grand Forks, Christina Lake, Nelson, Ainsworth, and Waneta.

1965 Tents were again evident, particularly on chokecherry, serviceberry, poplar, and alder in the southern part of the Region.

1966 Numerous on chokecherry, cottonwood and serviceberry near Genelle, and from Boswell to Wynndel.

1967 Increases in populations were recorded at Genelle and Wynndel.

1968 Tents were numerous near Genelle and Wynndel on roadside deciduous trees and shrubs.

1969 Heavy concentrations of webs were again observed at Wynndel and near Trail, on deciduous trees and shrubs.

1970 Tents less numerous from Trail to Kinnaird on chokecherry and miscellaneous trees and shrubs.

1971-76 No reports of infestations. Occasional tents found in southern areas of the Region.

1977 Numerous webs occurred on chokecherry in the Castlegar area and from Fauquier to Nakusp.

1978	Light feeding damage of deciduous hosts by colonies between Wasa and Fort Steele, Bull River, Creston, Wycliffe to Kimberley and near Fairmont. In the West Kootenay, chokecherry and apple trees were defoliated from Nelson to Castlegar.
1979	Third consecutive year of defoliation (light) at Grand Forks, from Nelson to Castlegar, and Wynndel to Radium.
1980	Defoliation of deciduous shrubs was 100% over small areas at Christina Lake, Trail south to Waneta, Fairmont, Wasa and near Cranbrook.
1981	Willow, chokecherry and alder were 50% defoliated at Rykerts and Creston. Minor defoliation occurred on fruit trees and deciduous ornamentals at Christina Lake and Grand Forks.
1982	Severe defoliation of white birch along the Kettle River near Midway, and along Boundary Creek near Greenwood. Tents were common along roadside deciduous trees near Wardner and Jaffray.
1983	Light defoliation of roadside was common from Christina Lake to Bridesville, Sanca Creek to Creston and between Bull River and Wardner.
1984-86	No reported damage.
1987	Damage common on roadside deciduous trees between Christina Lake and Grand Forks, and from Slocan to Castlegar.
1988	Only occasional colonies in the Christina Lake to Grand Forks area and along Slocan Lake.
1989-91	No reported damage.

Ugly nest caterpillar, Archips cerasivoranus

This insect was considered of little economic importance. Localized infestations were common in roadside stands on deciduous trees and shrubs and reports of damage were made during the fifties and early sixties. The unsightly damage occasionally caused concern in parks and gardens.

Year	Remarks
1951	Localized, light infestations were observed near Elko.
1952	Light infestations on chokecherry trees along the Kootenay River near Wardner.
1953	High populations occurred near Fort Steele, Elko and Fairmont on chokecherry trees.

1954	Larvae stripped roadside chokecherry bushes between Fairmont and Shuswap Creek in the Invermere area.
1955	Roadside chokecherry has completely defoliated along the highway north of the Invermere Junction.
1956	Webs were observed on trees near Elko.
1957	Webs were numerous in the East Kootenay on chokecherry trees.
1958	Web counts averaged two tents per tree on chokecherry at Ta Ta Creek, Wycliffe and Fairmont.
1959	Light infestations occurred at Ta Ta Creek, Fairmont and Elko.
1960	Not reported.
1961	Light defoliation in the Elko area.
1962	Caterpillar webs were observed on chokecherry at Waneta, Cascade and west of Grand Forks.
1963	Populations declined.
1964	Numerous attacks at Columbia Gardens near Trail. Intermittent damage from Grand Forks to the Anarchist Summit.
1965	Unsightly damage near Trail and between Kuskonook and Creston.
1966-76	No reports of damage.
1977	Common on chokecherry in the upper Columbia River Valley.
1978-91	No reports of significant damage.

Satin moth, Leucoma salicis

Satin moth were first collected in the Nelson Forest Region at Needles in 1963. Since then this insect has been found at several localities throughout the Region. The preferred host of this insect is poplar.

Year	Remarks
1963	Larvae were collected at Needles on black cottonwood. This is the first time this insect has been found in the Nelson Forest Region.
1964	Black cottonwood and trembling aspen were infested with satin moth at Summit Lake north of Slocan Lake, and 8 ha of trembling aspen were infested near Bridesville.

1965-68 No damage reported.

1969 A clump of mature black cottonwood on the public beach at Slocan City was severely defoliated by satin moth larvae. Some trees were sprayed with Diazinon, which reduced populations considerably. Parasites were numerous on the trunks of the infested trees.

1970 No reports of damage.

1971 Heavy defoliation of individual trees in residential properties at Trail and Fruitvale area. This is a new distribution record.

1972 Heavy defoliation of shade trees at the Revelstoke Motel on silver poplars. This is a new distribution record.

1973 Infestation at Revelstoke Motel subsided in 1973. Shade trees around Nakusp were moderately defoliated; most defoliated trees were white poplar.

1974-76 No reports of damage.

1977 Up to 80% defoliation on 140 ha on Red Mtn. near Rossland. No tree mortality reported.

1978 Continued defoliation of up to 100% on 150 ha at Red Mtn. No tree mortality reported.

1979 Red Mtn. infestation collapsed. Defoliation was severe over 200 ha at Topping Creek and 100 ha at Hanna Creek.

1980 Balsam poplar stands up to 100% defoliated at Hanna Creek on 200 ha. This is the 4th year of defoliation in the Rossland area.

1981 No damage found.

1982 The first recorded collection of satin moth in the East Kootenay, at Invermere.

1983 Five hectares of black cottonwood were severely defoliated at Moyie Lake. Large moth flights were noted in the Rock Creek area.

1984 Light defoliation continued at Moyie Lake over 10 ha. Moderate to severe defoliation occurred in small patches up to 2 ha at Summit Lake, New Denver, Rock Creek and Bridesville. Large moth flights were observed in the Harrop--Willow Point--Nelson area. Larvae were also common in association with forest tent caterpillar infestations at Trail.

1985 Light to moderate defoliation continued over 15 ha in the Moyie Lake area. Scattered patches of up to 1 ha were lightly defoliated in the Bridesville--Anarchist Mountain area, and in the New Denver area.

1986	Populations declined but continued to lightly defoliate black cottonwood over 5 ha at Moyie Lake, and small patches of trembling aspen in the Bridesville to Anarchist Mountain area.
1987-89	Only occasional larvae noted.
1990-91	Increasing populations noted in association with forest tent caterpillar in the Golden area, but remained at low levels following the collapse of forest tent caterpillar populations.

Flea beetles, Altica spp.

Flea beetles feed on, and skeletonize, the foliage of alder, poplar and willow both as larvae and as adults. The adults are small, dark, shiny blue and about 0.5 cm long. The mature larvae are slightly over 0.5 cm long, dull brown to black.

Year	Remarks
1948	Outbreaks reported from the vicinity of Ryan on alder.
1949-55	No reports of defoliation.
1956	The foliage of cottonwood bordering the Kootenay River between Wasa and Newgate appeared scorched from flea beetle feeding.
1957	Flea beetles caused browning of willow foliage by early July around the south end of Lower Arrow Lake. Flea beetles severely skeletonized water birch trees in the eastern part of the region, notably in the vicinity of Fort Steele. Lakeshore cottonwood trees between Gray Creek and Boswell were also discolored.
1958	Flea beetle feeding resulted in discoloration of the foliage of mountain alder in the Creston district, birch near Fort Steele, and cottonwoods near Boswell and Gray Creek.
1959	Severe skeletonizing of alder leaves occurred in numerous localities in the region. Beetles were numerous on black cottonwood trees along Kootenay Lake.
1960-63	No reports of defoliation.
1964	Light feeding damage to black cottonwood occurred along Highway #3 east of Elko.
1965	No reports of defoliation.
1966	Heavy defoliation of black cottonwood and alder at Whatshan Lake, Needles and Crawford Bay.

1967	No reports of defoliation.
1968	Heavy defoliation to alder and black cottonwood along the Slocan Valley and in the Trail--Castlegar area.
1969-78	No reports of defoliation.
1979-80	Occasional light defoliation of single trees in upper Columbia River valley.
1981-91	No reports of defoliation.

Pacific willow leaf beetle, Pyrrhalta carbo

Common skeletonizers of willow, alder, poplar and birch leaves, often resulting in severe defoliation over large areas.

Year	Remarks
1945	Extensive damage to willow leaves in the vicinity of Revelstoke.
1946-57	No reports of defoliation.
1958	Beetles caused noteworthy defoliation of willows in the upper Kettle River valley north of Westbridge. Widespread defoliation on willow throughout the region.
1959	Heavy defoliation of trembling aspen foliage occurred around Springbrook. Feeding was common on willow throughout the region.
1960-64	No reports of defoliation.
1965	Severe defoliation on four hectares of willow at Syringa and McKay creeks.
1966	Moderate to severe skeletonizing of willow leaves was noted on more than 400 ha at Saddle Mtn., Summit Lake, from Crawford Bay to Lockhart Creek and around Whatshan Lake.
1967	Moderate to severe skeletonizing of willow leaves at Summit, Arrow and Christina lakes.
1968	Moderate to severe skeletonizing of willow leaves at Arrow Lake north of Broadwater.
1969-76	No reports of defoliation.
1977	Defoliation of willows occurred in the Columbia River valley from Downie Creek to Shelter Bay and on the east side of Upper Arrow Lake from Fauquier to Nakusp and south to New Denver in the Slocan Valley.

1978	Up to 100% of the foliage was discolored from Fauquier to Revelstoke, north of Revelstoke to Goldstream River and in Glacier National Park.
1979	No reports of damage.
1980	Less than 5% foliage discoloration of single willows in widely scattered locations where damage has occurred for many years. Approximately 90% of willows, 60-100% discolored along Mica Dam Road between Carnes and Bigmouth creeks.
1981-85	No damage was recorded.
1986	Roadside willow foliage was severely skeletonized north of Revelstoke from Bigmouth Creek to south of Carnes Creek.
1987	Populations increased as willow foliage skeletonizing expanded north of Revelstoke to the Mica Dam, and south to Nakusp. The most severe feeding continued between Goldstream and Carnes creeks.
1988	Damage to willow continued to expand. Moderate to severe feeding was almost continuous from Revelstoke to Mica Dam, with patches beyond this to Redrock Harbor. Moderate to severe discoloration was also noted along the Illecillewaet from Revelstoke to Jumping Creek. South of Revelstoke damage was common to Shelter Bay, from Galena to Fauquier, and from the Mosquito Creek to South Fosthall Creek drainages. Similar levels of damage was also present in the Bush River area.
1989	Feeding intensity generally declined in the Revelstoke to Mica Dam area. Spotty damage was noted between Revelstoke and New Denver, and from Nakusp to Fauquier. Light feeding damage was also noted along Kuskanax and Steward creeks near Christina Lake.
1990	No damage was reported.
1991	Moderate skeletonization common along McNaughton Lake.

Birch and willow leaf miners

Miners of willow and birch leaves include: a birch leaf miner, Micrurapteryx sp.; birch skeletonizer, Bucculatrix canadensisella; a willow leaf miner Lyonetia saliciella. Usually infestations are widespread and last for several years.

Year	Remarks
1953	A large proportion of the willows in the Slocan Valley and in the Nakusp and Edgewood Ranger Districts were heavily infested by this miner.

1954 Severe infestations in the western portions of the Region. The main infestation extends from Nakusp to Inonoaklin Crossing.

1955 Leaf miner was again abundant on willow in many parts of the Region.

1956 Abundant on willow in the western and central portions of the Region.

1957 This miner was again abundant on willows in the Region. Birch trees, as well as willows, along the Big Bend Hwy. were severely infested.

1958 A medium to heavy infestation of miners persisted in willows in the Region. Leaf miners were abundant on birch at Trout Lake, and on black cottonwood at Summit Lake east of Nakusp.

1959 The occurrence of mined willow leaves was widespread in the Region.

1960 Moderate to severe foliage damage by this leaf miner was again widespread in the Region. The most severe damage occurred on birch at Trout Lake. Extensive leaf-mining on willow occurred along the Big Bend Hwy., and along Lemon and Carpenter creeks in the Slocan Valley.

1961 Birch trees from Bush River to Cummins River and at Trout Lake were again severely infested.

1962 Birch trees along the Canoe River to Boat Encampment heavily defoliated.

1963 Severe infestations in willows and birch extend from Donald Station to Boat Encampment, up the Canoe River, near Johnson Lake, and around Trout Lake.

1964 Moderate infestations on white birch and alder at New Denver - Kaslo, Trout Lake, Donald to Cummins Road.

1965 Moderate infestation on white birch and alder from New Denver to Kaslo, Trout Lake, Donald to Kinbasket Lake.

1966 Infestations in the Trout Lake and Kootenay Lake areas greatly reduced from 1965 levels.

1967 White birch and mountain alder were more severely defoliated than in 1966 in the Kaslo River Valley, along Trout Lake, and along upper Kootenay Lake.

1968 White birch, alder and other species of deciduous trees and shrubs near Kaslo, Trout Lake and Nakusp and along the Big Bend Hwy. between Golden and Boat Encampment were almost completely browned by birch leaf miners.

1969-75 No reports of infestations during this period.

1976 Severe browning of white birch along Kaslo River and from Kaslo to Trout Lake. Extensive infestations in Columbia River Valley from Donald to Spillimacheen, along Kicking Horse River and Beaver River extending into Glacier National Park.

1977 Severe browning of white birch from Kaslo to Trout Lake, from Radium to Donald, Kicking Horse and Beaver River areas, and in Toby and Horsethief Creek valleys (Also Bucculatrix).

1978 Severe browning in Kicking Horse Pass, Crawford Bay to Riondel and Horsethief Creek where 100% of the hosts (birch) were discolored on 2 500 ha. (Also Bucculatrix)

1979 Bucculatrix - Widespread discoloration, but less severe than 1978. Occurred from west of Kaslo and north to Gerrard. In the East Kootenay, discoloration evident from Radium to Revelstoke, Kicking Horse River Valley and National Parks.

1980 Severe discoloration by Bucculatrix in the lower Spillimacheen, McMurdo, Horsethief and Toby Creek areas in the east Kootenay and from Lardeau to Argenta, and north to Berger Creek.

1981 Browning over widely scattered areas in white birch stands from Hoodoo Creek in Yoho National Park to Golden, north of Golden to Donald Station and south to Invermere. Up to 75% foliage affected by Bucculatrix.

1982 Birch and willow were severely defoliated in scattered patches from Horsethief Creek along the Columbia River north to Donald and east to the Beaverfoot River. In Glacier National Park, there was light to moderate damage between Stoney Creek and the north boundary of the park. B. canadensisella lightly to moderately infested white birch along the Columbia River between Trail and Blueberry Creek and at Tadanac. Severe damage was present at Sunnydale.

1983 Birch was severely discolored along the Columbia River from Radium to Golden, west into Glacier National Park, along the Blaeberry River and along the Kicking Horse River east to the Beaverfoot River. Scattered patches of severe defoliation was also noted along Driftwood, Bugaboo and Bobbie Burns creeks, and along the Spillimacheen River. B. canadensisella damage continued at Trail and along the east side of the Columbia River to Genelle covering 500 ha.

1984 Intensity of feeding declined with only light discoloration of birch in the Bobbie Burns, Bugaboo and Driftwood creeks. Scattered light damage was noted between Horse Creek and Parson and along the Kicking Horse River between Golden and Yoho National Park.

1985 Increasing populations severely defoliated birch between Parson and Golden, along the Kicking Horse River west of Yoho National Park, along the Blaeberry River and along the Illecillewaet River from Glacier National Park to Revelstoke. In the Columbia River valley there was moderate discoloration along Horsethief and Bugaboo creeks.

1986	Severe discoloration continued throughout most of the northern part of the region. Scattered patches occurred along the Illecillewaet River between Revelstoke and Glacier National Park, along the Blaeberry River, Horsethief Creek, near Kaslo, Meadow Creek, and between Rapid Creek and Trout Lake and along Frances and Forster creeks.
1987	Moderate to severe browning of birch foliage continued in the Forster to Halgrave Lakes area, between Edgewater and Golden continuing north to Donald. In the West Kootenay, severe discoloration occurred at Meadow Creek, along the Duncan mainline, at Trout Lake near Kaslo,
1988	Moderate to severe foliage discoloration was recorded along Duncan Lake and River, along Kaslo Creek from Keen Creek to Kaslo, and along the Illecillewaet River from Albert Canyon to Cougar Brook in Glacier National Park. Moderate discoloration was also common from Horsethief Creek north to Golden, Donald and Glacier National Park.
1989	Foliage discoloration declined in most areas in the region with the only notable damage being along Kaslo, Schroeder Creek near Kaslo and at Stevens Creek near Whatshan Lake.
1990	No significant damage was noted. Some damage by a birch leafminer, Profenusa thomsoni, was present in the Revelstoke and Castlegar areas.
1991	Light to moderate damage occurred along the Illecillewaet River.

Poplar-and-willow borer, Cryptorhynchus lapathi

The major host of this borer is willow, although occasionally black cottonwood is attacked. In the Nelson Forest Region, it has been reported from a number of localities since 1949. Severe damage to willow occurred around and in Rossland in 1949; at Creston, Wynndel, Trail and Castlegar in 1951.

Year	Remarks
1949	Scattered willow and poplar were attacked near Goat River Falls in the Canyon area, approximately 5 km east of Creston. Populations are well established in willow at Cottonwood Lake, Harrop, Kokanee and Balfour areas, north of Nelson. Severe damage around and in Rossland and 11 km east of Cascade.
1950	Scattered willow and poplar were attacked near Goat River Falls. Borers were active in willow at Cottonwood Lake, around Rossland and along the Cascade Highway.

1951 This weevil is generally distributed throughout the western part of the region and in the vicinities of Creston and Wynndel. The heaviest concentration of damage occurred in willow along the Pass Creek Road and along the highway between Trail and Castlegar.

1952 This borer was prevalent in willow and black cottonwood trees and continued to spread throughout the central portion of the region. Mortality was common among willows at Cranbrook, Cherry Creek, Bull River and Castlegar.

1953-54 No reports of damage.

1955 This weevil continued to attack willow in the Bull River and Cherry Creek areas.

1956 Scattered stands of willow were attacked in the Grand Forks, Edgewood areas and the southern end of Kootenay Lake.

1957 This borer has become a widespread pest of willow and some species of poplar in the region. A few alders were attacked near Brilliant and Edgewood. The willows at Skookumchuck were moderately infested. The infestation reported at Kimberley and Ta Ta Creek in 1955 has almost died out.

1958 Severe damage occurred in the Nelson Region, notably at Skookumchuck Prairie, west of Jaffray, and 20 km north of Fernie.

1959 Black cottonwood trees and willows along the valley bottom from the south end of Kootenay Lake to the International Boundary were infested by this weevil. Damage to cottonwood and willow was evident at Skookumchuck Prairie and 20 km north of Fernie.

1960 Continued infestations in the Kootenay Lake and Fernie areas.

1961 Two noteworthy infestations occurred in the eastern part of the Region; 70 per cent of the willow clumps in the Moyie River Valley, and 60 per cent near Canuck Creek were infested. Other localities of lighter current attack are Morrissey, Fernie, Hosmer and Elk River north of Sparwood.

1962 A small new infestation occurred in patches of willow up to 15 km north of Revelstoke along the Big Bend Hwy.

1963 This borer persisted as a pest in widely scattered patches of willows and black cottonwood.

1964 The known limits of this pest were extended in the Region. It was particularly prevalent in 1964 along the Kootenay and Columbia rivers to a point west of Parson. Severe damage was noted on willow and black cottonwood trees near Summit Lake north of Slocan Lake.

1965 Found at widely separated localities infesting black cottonwood and willow.

1966	A notable infestation occurred along the upper 8 km of Burrell Creek where about 75 per cent of the willow clumps were infested.
1967	Severe localized infestations along Columbia Lake.
1968	Continued infestations at widely separated localities in the Region.
1969-72	Infestations have declined in most areas of the Region. Evidence of old willow mortality common in the Rossland and Retallack areas in high elevation areas.
1973	No infestations found throughout Region.
1974-79	Common on willow throughout the Region.
1980	Single clumps infested at widespread locations. Common.
1981-82	No damage reported.
1983	Borers killed 20% of the small willows in a 200 ha burn along the Blackwater Creek road.
1984-85	No damage reported.
1986	Occasional damage in the Springer Creek--New Denver area.
1987-91	No damage reported.

OTHER INSECTS OF MINOR SIGNIFICANCE

Insect	Host	Locality	Remarks
Arge pectoralis birch sawfly	white birch	Golden, Revelstoke to Downie Creek, Nicholson	Larvae feed gregariously. Light to moderate defoliation 1947-50, Golden area; 1950, Revelstoke to Downie Creek; 1951-52, Golden to Nicholson and 1953 from km 13 to km 80 Big Bend Highway.
Argyresthia laricella larch shoot moth	western larch	Columbia Lake	Killed up to 40% of the terminals in recently spaced western larch; only 1% damage was recorded prior to spacing.
Dendroctonus brevicomis western pine beetle	ponderosa pine	Grand Forks, Kettle valley	1962, 1986 and 1987, scattered small groups of trees killed in Grand Forks area. 200 trees killed in Kettle River valley in 1965. Scattered small groups in the Fruitvale and Castlegar area, 1987. First record in East Kootenay in traps at Roosville in 1990.
Dendroctonus valens turpentine beetle	ponderosa pine	Cranbrook Kimberley	Killing scattered groups of trees, 1989-90.
Erannis tiliana vancouverensis western winter moth	maple, alder	Warfield Fruitvale	Localized severe infestation 1964 and 1990.
Hemichroa crocea striped alder sawfly	alder	west arm Kootenay Lake; Sirdar	Heavy defoliation 1956 along west arm Kootenay Lake; 1957, Sirdar, 1 ha defoliated.
*Melanolophia imitata green-striped forest looper	hemlock, red cedar	Nakusp, Big Bend	1949, larvae common in small numbers Nakusp; light infestation on understory along Big Bend Highway.

(Cont'd)

Insect	Host	Locality	Remarks
Nymphalis antiopa mourning cloak butterfly	willow trembling aspen	Revelstoke	Small groups of deciduous trees and shrubs completely defoliated. A few colonies at Skookumchuck and Mt. Revelstoke National Park.
Nymphalis californica California tortoise shell butterfly	buck brush, willow, wild lilac	Trail--Castlegar, Creston	1941-43, severe defoliation over 208 ha between Kinnard and Birchbank; 1946, about 25 ha infested near Creston at Corn Creek.
Orgyia a. badia rusty tussock moth	western larch lodgepole pine	Kingsgate	1963, 120 ha lightly defoliated. Moths commonly collected in the southern Rocky Mountain trench in traps in 1991.
Pheosia rimosa mirrorback caterpillar	trembling aspen, willow black cottonwood	Big Bend Highway	1950, light to moderate defoliation between Downie and Boat Encampment.
Pikonema alaskensis yellowheaded spruce sawfly	spruce	Wasa Lake, Castlegar	1958, moderate defoliation. 1990, light to severe defoliation Castlegar and Crescent Valley. 1978-81, Fernie
Schizura concinna redhumped caterpillar	tA, apple, chokecherry	Whatshan Lake	1947, severe defoliation.
Semiothisa sexmaculata larch looper	larch	southcentral part of region	4 600 ha defoliated in 1977; 12 000 ha in 1990 from Kootenay Lake to Arrow Lakes.
Trypodendron lineatum striped ambrosia beetle	coniferous trees	general throughout	1957, light infestation on Douglas-fir peeler logs at Slocan Lake; 1981, spruce beetle-infested logs at Creston; common in mountain pine beetle attacked trees.
Zeiraphera fortunana a budmoth	spruce	White River	1964, light defoliation.