History of Population Fluctuations and Infestations of Important Forest Insects in the Prince George Forest Region

1942 - 1982

Environment Canada
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HISTORY OF POPULATION FLUCTUATIONS AND INFESTATIONS OF IMPORTANT FOREST INSECTS IN THE PRINCE GEORGE FOREST REGION 1942-1982

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Introduction

This report is the history of some important forest insects which have caused tree mortality, volume loss or growth suppression to forests in the Prince George Forest Region since the early 1940's. The report:

1. designates the species of insects which have caused damage in the past and are presumably capable of causing damage in the future.

2. records the pattern of population fluctuations.

3. designates areas that appear to have chronic insect problems.

4. points out the possibility of damage in different areas by insect species not known to have previously caused damage.

Logging in the Prince George Forest Region started in the early 1900's when the Grand Trunk Pacific Railway extended it's line through the Yellowhead Pass. This set off a boom based on tie-cutting and sawmilling. The boom ended with World War I and the lumber industry in the Region remained stagnant until 1939.

With the completion of the major highways and the extension of the Pacific Great Eastern Railway to Prince George in 1956, the forest industry began to expand and consolidate. Small portable mills in the outlying areas were brought into Prince George and pulp mills were built at Prince George and Mackenzie.

The Prince George Forest Region encompasses 29.6 million hectares, of this 17.2 million hectares are productive forest land. The volume of mature timber is 1.6 billion m^3 with white spruce comprising the largest volume (Table 1).

Table 1. Volume of mature timber, Prince George Forest Region

Species Group	Volume (m^3)
Spruce	806, 254, 015
Lodgepole pine	408, 717, 437
Balsam	200, 285, 417
Deciduous	150, 765, 826
Cedar	34, 058, 151
Fir	20, 338, 189
Other	54, 023, 316

The majority of recorded forest losses have been caused by spruce beetle, mountain pine beetle, western balsam bark beetle and Douglas-fir beetle.

Large volumes of white spruce were killed by the spruce beetle during infestations in 1961-65, 1968-70 and between 1978 and 1982. During endemic periods, the spruce beetle persisted in single trees and killed small numbers annually.

Mountain pine beetle outbreaks in lodgepole pine stands occurred from 1956-68 in the Stuart-Takla-Trembleur lakes area developed near Valemont in 1976, and continue to date. Beginning in 1968, infestations started in white pine stands in the McNaughton Lake area and continue to date.

Douglas-fir beetle has killed a moderate number of trees in the limited host area of the Region.

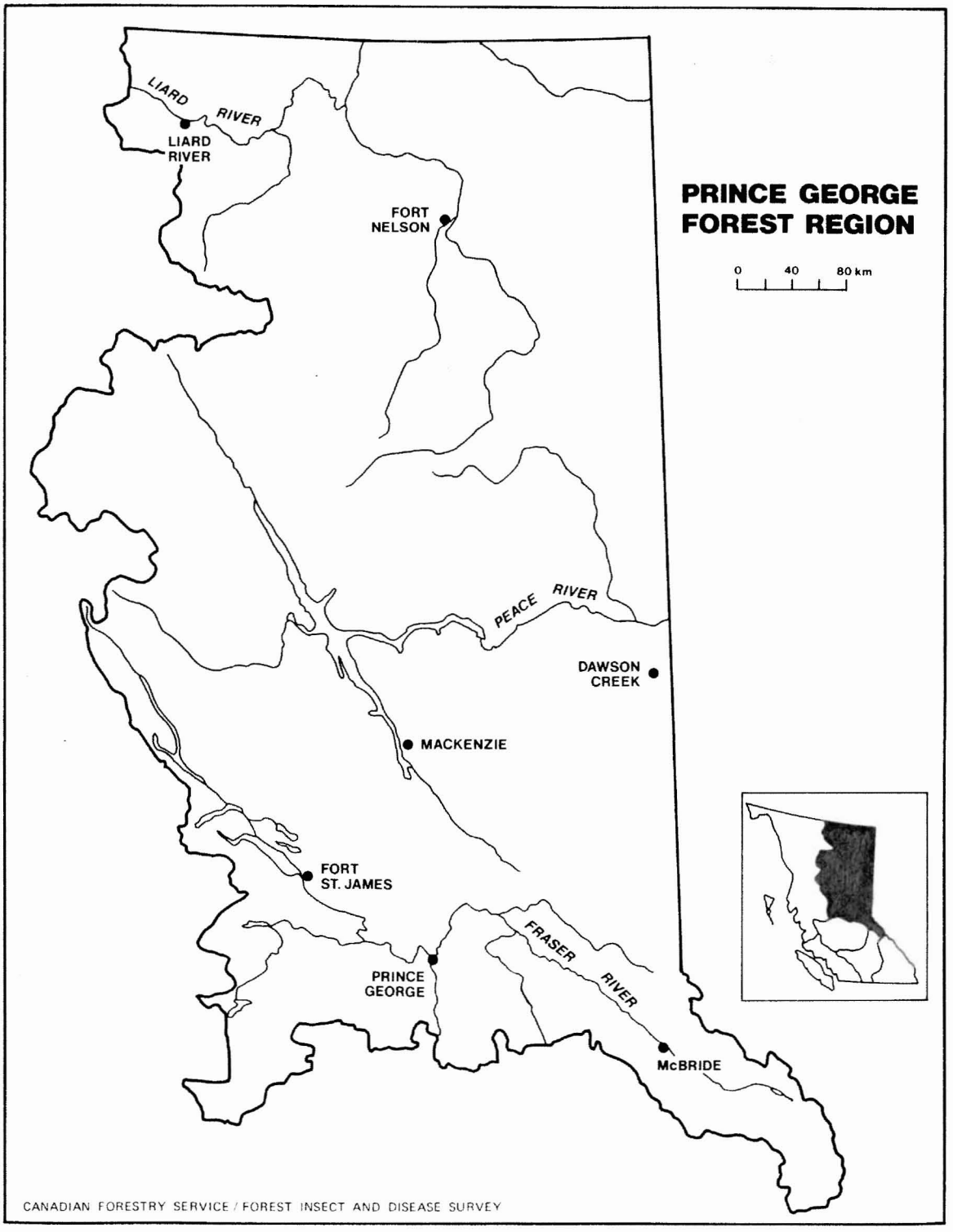
Western balsam bark beetle has killed large numbers of alpine fir annually at higher elevations throughout the region.

One-year-cycle spruce budworm moderately to severely defoliated alpine fir and white spruce stands in the Liard River drainage between 1957 and 1978. Two-year-cycle spruce budworm outbreaks occurred periodically from 1944 in the Stuart-Takla lakes area, Parsnip River Valley, west of McBride and in the Willow-Naver-Bowron River valleys. Western hemlock looper moderately to severely defoliated western hemlock and western red cedar stands between Giscome and McBride from 1953 to 56 and between 1963-65. Western blackheaded budworm lightly to severely defoliated the current growth of white spruce and alpine fir in the Pine Pass - McLeod Lake area and parts of the Rocky Mtn. Trench between 1968 and 1969. Large aspen tortrix moderately to severely defoliated trembling aspen in the Hixon, McBride, Vanderhoof, Dawson Creek and Chetwynd areas most recently between 1979 and 1981. Trembling aspen stands were also defoliated by the forest tent caterpillar between 1954-64 and 1971-74 in the Prince George area. Black army cutworm defoliated newly planted seedlings and herbacious growth in logged areas near Fort St. James and east of Prince George during 1973-74 and 1978.

The information in this report has been extracted from Annual District Reports of the Forest Insect and Disease Survey, British Columbia, from 1942 to 1982.

Map 1

Prince George Forest Region



SPRUCE PESTS

BARK BEETLES

Spruce beetle, Dendroctonus rufipennis

Spruce beetle has destroyed more timber than any of the other three important bark beetles in the Prince George Forest Region, especially since 1960. The majority of forest types contain more white spruce than any other commercial species (Table 1). The first beetle infestations began in 1962 lasted until 1965 and killed 12 572 000 m^3 of white spruce. In 1968 infestations developed and killed 829 500 m^3 by 1969. The latest infestation began in 1978 and continued to 1982 when 4 681 000 m^3 of white spruce were killed.

Year	Remarks
1947-48	No attacks.
1949	Fresh blowdown at Dome Creek, not attacked by Aug. 6 - foliage green.
1950	Few attacked white spruce at Aleza Lake Experimental Station. Slash and blowdown blamed.
1951-52	No attacks.
1953	Outbreak near Sinclair Mills, 7% of stand killed. Outbreak near Red Mountain Creek (Penny District), in 256 ha of mixed stand. Beetle-killed spruce reported 21 km S.W. of Dome Creek.
1954	Scattered beetle-killed trees in Ptarmigan Creek Valley, (windthrow nearby). Small infestations found at Kenneth, Hungary and Slim creeks.
1955	Low populations persisted in Aleza Lake and Sinclair Mills areas. No known tree mortality.
1956-58	A few attacked trees at Aleza Lake; at McGregor River; in windfall at Stone Creek; and a few attacked trees seen at Pine Pass.
1959	Light populations in stumps and logs near Giscome.
1960	White spruce logs on Naver Access Road right-of-way were infested. Beetle was controlled by chemical spray.

Year	Remarks
1961	Small populations in the upper Willow R, Genevieve and Hay lakes areas. Light attacks at Tudyah L, Fleming Mills and Chief L; negative elsewhere.
1962	General increase, attacks found at nine locations on Fraser and Crooked rivers. Increased at: Hush L, 100 trees; Grove Fire, 200; decked logs in Torpy R heavily infested; Kerry L, 40 ha 50 cm - 61 cm dbh attacked, 34% of trees over 46 cm attacked. Increase related to fire damage, logging slash and heavy windfall of 1960-81.
1963	Aerial surveys revealed extent of the massive beetle attack of 1962 over 182 000 ha with 10 137 000 m^3 of white spruce over 35 cm dbh killed from Peace River to Bowron S.Y.U.
1964	Aerial surveys in 1969 mapped 103 700 ha and 1 472 000 m^3 a decrease from 1963. Current attack increased. (Cottrell & Ross Int. Rep. 1963).
1965	The total volume of spruce killed at the end of 1964 was calculated as 12 572 000 m^3 over 222 000 ha and in 1965 covered 19 320 ha. The heaviest infestations in 1965 were at: Isodore, Hodda - 465 ha Wansa - Pitoney - 2 335 ha Genevieve-Yardley - 390 ha Moderate infestations at: Firth L - 870 ha Seebach - 380 ha Otter Cr - 430 ha McGregor R - 220 ha Ahbau - 290 ha In the Liard R area, beetles attacked some budworm defoliated trees.
1966	Losses decreased sharply; overwintering beetle mortality 27%, no 1965 attack in new areas. No evidence of recent attack in old infestation.
1967	No white spruce killed although populations remained high in windfall.

Year	Remarks
1968	Infestations increased in standing trees over previous three years; few concentrations in Willow R Valley.
1969	Aerial survey showed heavier 1968 infestation than indicated by ground surveys. Spruce beetles increased due to warm, dry 1967 summer and local abundant windfall. Heavy attacks widespread in the Willow, Naver rivers and Ahbau Cr; sporadic and light in the Parsnip, Crooked, McGregor and Bowron R valleys; a total of 829 500 m^3 or over 18 400 ha.
1970	Population reduced, overwintering mortality calculated at 42% adults and 34% larvae. Adults scarce except in upper Willow R region around Stony L, Rebman Cr and Ahbau L areas; 1245 trees examined in 6 strips, contained 3-1970 attacks.
1971	Population scarce; no tree mortality recorded, small populations persisted in 1968-1969 partially attacked trees, some pitched out.
1972	Population scarce; previous winter severe cold prior to snow cover caused brood mortality in logs, slash and windfall.
1973-74	Population scarce.
1975	No discolored trees were detected. Low populations in windthrown spruce in the Bowron, Willow and McGregor river valleys.
1976	Blowdown during previous winter occurred in several areas. Patches totalling 740 ha at: Narrow Lake, Purden-Bowron Lake, Indian Point Creek, and Indian Lake. Bark samples at Thursday Creek and Narrow Lake contained an average of 15 larvae per .09 m^2.
1977	There was a slight increase in number of attacked green standing trees in the Carp-Weedon lakes area with 1 200 ha of recently-killed spruce. Also 8 000 ha of light mortality southeast of Inzana Lake and 600 ha south of Chuius Mountain. Windfall and standing trees weakened by H_2S fume emissions from a pipeline were attacked from km 141 to km 146 on the Alaska Hwy. Current attack intensity ranged from four to eight per .09 m^2.

Year	Remarks
1978	A large increase in the number and area of recently killed standing spruce in the Fort St. James - Summit Lake area: 21 080 ha light, 6 600 ha moderate and 2 180 ha severe. At Chuchi and Boomerang lakes, average of 7% of the trees were currently attacked, (ranging 0% - 22%). In the Bowron and Willow river areas populations persisted in windfall with 8-16 attacks/.09 m^2. No attacks were recorded in standing trees.
1979	There was a dramatic increase in tree mortality in the region to 53 330 ha; east of Hixon near Stony Lake and north of Fort St. James at Trembleur and Kazchek lakes. Scattered infestations occurred along Bowron, McGregor and Parsnip river drainages and near Takla, Tarnezell and Tchentlo lakes. In the Carp, Weedon and McLeod lakes area infestations continued to decline. The average percent of stems affected in prism cruises in 10 areas were: healthy 60%, current 15%; red 5%; partial 13%; grey 7%. Several BCMF trap tree programs in Hixon and Summit Lake areas were monitored by CFS.FIDS. The results (detailed in Forest Insect and Disease conditions 1979) showed that fallen trees are the most effective attractant.
1980	Large increases continued from the previous year to 64 400 ha: 27 000 ha light, 16 500 ha moderate, 20 900 ha severe. This increase occurred in the Bowron, McGregor and Upper Parsnip river valleys and the Fort St. James areas but declined in the Carp-Weedon lakes area. Bowron - Willow 34 000 ha; severe 20 200 ha; mod 11 500 ha; light 3 100 ha. Parsnip - McGregor 8 100 ha; severe 700 ha; mod 5 000 ha; light 2 400 ha. Fort St. James 13 800 ha; Carp-Weedon lakes 7 700 ha; The average percent of stems affected in 19 stands were: healthy 62%, current 12%, red 10%, partial 7%, grey 9%.
1981	A slight decrease occurred in area of the epidemic to 59 000 ha; 24 000 ha light, 25 600 ha moderate and 9 400 ha severe. The severest recent mortality continued in the Bowron and Willow river valleys; in the McGregor and Parsnip river drainages and the Seebach and Herring Creek drainages. Less extensive mortality occurred in Goat and Morkill river valleys, West Twin Creek, Carp-Weedon lakes; Stuart-Trembleur-Takla lakes and in the Williston Lake area north of MacKenzie.

Year	Remarks
1981 Cont'd	The average percent of stems affected in 18 locations cruised were: healthy 63%; current 2%; red 29%; partial 3%; grey 3%. The volume of spruce killed by spruce beetle in 1979 and 1980 was 3 million m^3.
1982	Epidemic continued with 2 million m^3 killed over 57 500 ha, down slightly from 1981. Light mortality (5%) over 30 650 ha; moderate (6-30%) 14 300 ha; severe (31%+) 12 550 ha. Major infestations in the Bowron-Willow river drainages; near Stoney Lake, Stephanie, Indian Point, Haggen and Pinkerton creeks and Slender Lake; McGregor and Torpy river drainages.

Spruce budworm, Choristoneura fumiferana

Damage attributable to the spruce budworm was first noted in the Smith River region of the Liard River in 1957, at which time a light to moderate population was found extending from km 782 to 848 on the Alaska Highway. This population persisted and in 1962 another infestation broke out near Kledo River, km 528 to 560 Alaska Highway. In 1964 and 1965, several infestations coalesced throughout most of the Nelson - Liard rivers drainage, causing light to moderate damage. This population remained until 1969 when it decreased throughout most of the area other than along the Liard R Valley, and in the Fort Nelson area at km 395. This was believed to be part of the large infestation in western Alberta and Northwest Territories.

Repeated defoliation is believed to have resulted in the mortality of some spruce reproduction along the Smith R Valley as far north as the falls.

A population decline occurred again in 1970 but moderate to severe defoliation occurred annually in the Fireside - Liard Hotsprings area of the Liard R Valley until 1974 followed by light to moderate defoliation in 1975 and 1976 in the Liard R. valley which declined in 1977.

Year	Remarks
1956	No record of damage in reports.
1957	Light to moderate defoliation was noted on the Alaska Highway near Smith R on white spruce, alpine fir, eastern larch and lodgepole pine.
1958	Defoliation decreased.
1959	Defoliation noted and egg survey conducted: 90-900 egg masses per 100 sq. ft. of foliage from km 794 to 860.
1960	Defoliation similar to 1959: up to 90% current foliage, increase in numbers of egg masses.
1961	Decrease in defoliation; egg mass count increased at perimeter of infestation, decreased within. Feeding noticeable only at km 822 where defoliation was light.
1962	Increased area of severe defoliation of white spruce and some eastern larch over 390 km^2.

Year	Remarks
1963	Populations remained at high levels: Rabbit R and Grayling R, and along Liard R at lower elevations, from km 790 to 867. Kledo R infestation expanded southwards with light to moderate populations from km 512 to 560.
1964	Population expanded throughout most of Nelson - Liard R drainage from valley bottoms to 600 m elevation along Muskwa, Prophet, Fort Nelson, Fontas, Liard, Kledo and Smith rivers linking with the Alberta and N.W. Territories' infestation. Tree mortality reported resulting from spruce beetle attacks on weakened defoliated trees.
1965	Light to moderate defoliation in same areas as in 1964 from km 374 to km 554 on the Alaska Highway and from km 790 to 861.
1966	Light to moderate defoliation in same as 1965 areas with considerable decline in population: Fontas, Fort Nelson, Liard, Muskwa rivers and Kotcho L, light to moderate; Prophet R and Parker Cr, severe; Smith R and Kledo Cr declined sharply.
1967	Increase in extent and intensity of defoliation south and east of Fort Nelson and at km 864 near Liard Hot Springs. Moderate to severe in Fontas, Sikanni Chief, Muskwa, Prophet, Fort Nelson and Liard river valleys (km 395-547, km 790-860) generally 20-80% defoliation in upper crowns.
1968	Populations variable: heaviest defoliation south and southeast of Fort Nelson and at km 864, Liard Hotsprings; light to severe as in 1967. Heavier than 1967 at Parker Cr along Liard R Valley.
1969	Populations decreased, larval mortality resulted in a reduction of defoliation in most areas: Alaska Hwy. km 800-845 - moderate to heavy; " " km 395 - light; " " Smith R - repeated defoliation, some tree mortality.
1970	Population decline, moderate defoliation at km 395 and km 810-864 on the Alaska Highway.

Year	Remarks
1971	Population increase: 100+ per beating. Moderate to severe defoliation of upper crowns; Liard Hotsprings to Fireside, 13 600 ha.
1972	Similar to 1971, with slight decrease in population, light to moderate defoliation.
1973	Similar to 1972 with slight increase, moderate to severe defoliation.
1974	Decrease in defoliation due to cool wet spring, resulting in slow development of larvae and an increase in tree growth.
1975	In the Liard River Valley between Fireside and Liard Hot Springs 30% to 50% of the current growth of white spruce was defoliated.
1976	Defoliation was light in the Liard River to Fireside area and population declined. Beating samples declined to 35 larvae/sample from 124 in 1975.
1977	Population decreased particularly in the Liard-Smith river area. Repeated severe defoliation caused top-kill which averaged 1.2 m on 27% of the trees.
1978-82	Populations remained low in the Liard-Smith rivers and other areas.

Two-year-cycle spruce budworm, Choristoneura biennis

Infestations of two-year-cycle spruce budworm were recorded in the Wells-Barkerville area prior to 1930. The budworm was believed to be one-year-cycle until that time, after which two-year-cycle was recognized and accepted.

From 1950 to 1964, outbreaks occurred in the Prince George Region from Strathnaver to McGregor River and from McBride to Finlay Forks. This infestation caused severe top-defoliation of mature overstory white spruce trees, and some mortality of understory alpine fir, until 1963 when the infestation collapsed.

In 1974 an increase in numbers of larvae as well as light to moderate defoliation of white spruce was found on the southern edge of the Region in the Bowron Lakes region.

Defoliation occurred in the Holmes River Valley and in the Bowron River Valley between 1978-81 and in the Upper Willow River Valley in 1982.

Year	Remarks
1947	Small amount of defoliation on Tonequo Mtn. 235 km^2 along Clearwater Cr near Peace R.
1948-49	Low populations in Prince George Region.
1950	Severe widespread damage N.W. of Indian L to Narrow L and the Fraser, Parsnip, Crooked, Torpy and lower Nation rivers and from Hominka R to Misinchinka R in Parsnip R tributary valleys.
1951	Population heavy but no significant damage. Spread in Crooked R towards Summit L. Light to moderate infestations between Pinchi L and Nation R. Damage to understory wS and alF new foliage on both sides of Fraser R at Penny and Ptarmigan Cr.
1952	Damage not as conspicuous as in 1950 due to cold, wet June. Populations high in Crooked and Pack R valleys but decreased in Pine Pass. N. of Sinclair Mills, populations same as in 1950. Moderate to severe defoliation of alF and wS between km 132 and Manson Cr. road and Nation R mine; moderate to severe defoliation, upper Pine and Willow rivers and severest at Control Cr, 42% alF and 25% wS defoliation.

Year	Remarks
1953	Nation R areas decreased but more recent infestations increased in population.
1954	Western slopes of Rocky Mtns from Parsnip R headwaters to Peace Pass - severe defoliation of new foliage. West of Parsnip and Crooked R valleys; defoliation between 900 and 1 500 m. Nation R mine road; decrease from 1952 but still severe. Light to moderate defoliation north of Fort St. James.
1955	Sampling results indicated a decrease in population in most areas.
1956	Decreased populations in general; up to 10% defoliation of alF and wS in Willow River Valley. Other areas had minor defoliation of current foliage. Largest populations at Fort McLeod, Pine Pass and Lynx Cr.
1957	Decreased defoliation, main populations centered around Lynx Cr, Tudyah and Davie lakes and N. of Buckhorn L. Larvae found from Pine Pass to Mayo, Y.T.
1958	Further decrease in population. Light to moderate defoliation at Takla L.
1959	Spread in the Takla - Trembleur lakes, N. and S. Increase in area and intensity in Fraser and Willow R valleys, S. of Prince George.
1960	Infestation grouped into one in the Willow, Naver and Ahbau river valleys. Separate infestation at McBride and Dore R Valley.
1961	Infestation continued in Willow, Naver and Ahbau river valleys; moderate damage, understory severely affected, total area 3 380 km^2.
1962	Light to moderate defoliation over 4 550 km^2; McGregor, McBride and Willow R areas. Populations decline in all other areas except Pine Pass.
1963	Decrease in Willow - Naver areas and Pine Pass. Moderate defoliation at higher elevations of McGregor and Torpy rivers area.
1964	General decline; small dispersed light populations; Pine Pass, 200 ha of light defoliation.

Year	Remarks
1965	Further decrease, no damage.
1966-72	No defoliation, very few larvae found.
1973-74	Larvae scarce; several adults caught in pheromone-baited trap in 1974.
1975	Low populations persisted throughout the Region. Pheromone baited traps attracted up to an average of 31 male moths per trap at Pine Pass and Beaver Creek.
1976	Larval populations increased slightly to an average of 1-3 larvae per positive sample from white spruce and alpine fir in the Willow and Bowron river drainages. Light to moderate defoliation occurred in the Holmes River Valley from mile 19 to 25. Foliage samples contained an average of 135 egg masses per 100 ft^2 of foliage which indicated moderate defoliation in 1977. The average number of male moths in pheromone traps increased to 77 per trap.
1977	In the Holmes River Valley from km 32 to 37, beating samples yielded 200 early instar larvae and 95% of new shoots were damaged. At Tumuch Lake beatings yielded 6.5 larvae per positive beating slightly higher than the average of 4 in the Willow and Bowron river drainages. Elsewhere populations remained low. Pheromone traps attracted an average of 4 moths per trap, down from 77 in 1976.
1978	Light (6 540 ha) and moderate (3 280 ha) of defoliation of current growth occurred mainly in the Holmes River, Red Pass and Bowron River areas. The number of larvae in three-tree beating samples increased markedly to 12.5 per positive sample. Branch samples had 808 egg masses per 10 m^2 of foliage which indicated continuing population. Pheromone traps caught an average of 32 moths per trap up from 4 in 1977.
1979	Light defoliation occurred on 76 747 ha in the Bowron, Willow, and Holmes river drainages, up from 9 820 ha in 1978. Pheromone traps caught an average of 30 moths per trap.
1980	Defoliation covered 115 000 ha of mature spruce and alpine-fir; 16 625 ha light, 96 855 moderate and 1 485 severe. Affected areas were mainly in the Bowron, Willow, and Holmes river drainages and in the Red Pass area of

Year	Remarks
	Robson Prov. Park. Top stripping of severely defoliated trees averaged 1.3 m and 60% of buds were damaged. Samples of 10 trees at Holmes River averaged 167 egg masses per 10 m^2 of foliage which indicated a continuing population. Pheromones traps, only at Holmes River, attracted an average of 93 adults per trap. There were 15 traps which contained three concentrations of pheromone bait, 0.001%, 0.01% and 0.1% respectively.
1981	Defoliation declined to light in white spruce and alpine fir stands in the Bowron, Holmes and Willow river drainages. Only 4% of the buds were infested at five locations in the Bowron and Willow river drainages. Pheromone traps were used to monitor male adult populations in 1981.
1982	Light defoliation occurred in patches totalling 200 ha in the Upper Willow River drainage adjacent to the outbreak area in Cariboo Region. No defoliation in Bowron and Holmes river drainages.

Spruce weevil, Pissodes strobi

This insect is probably one of the most serious pests of reproduction white spruce in the Prince George Region. It occurs throughout the Region, attacking and killing the terminal shoots of trees from 8 to 38 years old and up to 15 m tall. The weevil attacks were most severe in widely spaced, even-aged stands, such as plantations.

Damage has occurred annually with intensity varying from 2 to 46% of trees affected.

Year	Remarks
1949	A few scattered attacks between Penny and Dome Cr.
1950	No records in report.
1951	Damaged leaders in open growing stands along Fraser R Valley, particularly at Penny and Goat R. Five per cent of young wS stand at Reservoir L attacked.
1952	White spruce reproduction 30% infested for 3 km at Pine R 13 km N.W. of Azouzetta L.
1953-56	No records in reports.
1957	Common from Penny to Snowshoe; sparse in other areas examined.
1958	Small numbers of attacked wS at Mountview, Castle Cr, and Swede Mtn. Common from km 32 to km 46 near Summit L on Hart Hwy.
1959	Common in Willow R Valley and at Summit and Chief lakes.
1960	Decline from 46% attack to 29% in southern areas. Population light in western region - 5% at Sutherland R plot.
1961	Decline in population, little current damage; 5% at Sutherland R.
1962	In southern areas 5-10% attacks. Western regions light with Sutherland R negative. Wansa L, 12% attack.
1963	Fifteen percent attack at Wansa L. Summit L attack decreased.
1964	Aleza L and Reservoir L attacks up to 10%; Wansa L attack 19%.

Year	Remarks
1965	Wansa L up to 22% attack.
1966	Light throughout the Region.
1967	No record in reports.
1968	Incidence of attack 0-5% throughout 20 plots of 100 trees each.
1969-74	Low populations with periodic fluctuations: less than 5% at Aleza Lake in 1972 and 1973; and an average 2% incidence of attack throughout seven 100 tree plots in 1974.
1975-76	Low populations; Up to 2% of trees attacked in 100 tree plots at Aleza L, Fishhook L., Willow and Chuchinka rivers and occasional roadside trees infested.
1977	Increase in damage: McGregor River two locations: 12% and 30% of the trees attacked; south of Hixon, two locations, 5% and 20% and evidence of past activity on up to 50% of trees with multiple tops at Limestone Creek north of Prince George.
1978	Low populations, damage noted at Hixon and McGregor.
1979	Damage common in Hixon area; 30% of regeneration were attacked at Genevieve Lake.
1980	At Aleza, Davie, and Yardley lakes, spruce plantations were attacked, 18%, 12% and 8% respectively.
1981-82	An average of 7% of the trees attacked at two locations in 1981 and 11% at 16 locations in 1982.

Western blackheaded budworm, Acleris gloverana

This insect has caused severe defoliation of a variety of coniferous trees in coastal areas of B.C. but has not been known to cause significant damage in the Prince George Region. It is common and widely distributed. Previous upward trends in population were recorded from 1953 to 1955, from 1966 to 1969 and from 1973 to 1974. Although white spruce and alpine fir were the preferred hosts, alpine fir was the most heavily defoliated.

Year	Remarks
1947-50	Low populations.
1951	Light defoliation of wS and alF, from Fort St. James to Nation River.
1952	Larvae common in beating samples Ft. St. James to Nation R; no defoliation.
1953	Common throughout Region. Largest collection 44 larvae N. of Fort St. James.
1954	Decrease in population; 16 larvae on wS near Aleza Lake.
1955	Evenly distributed light population, largest collection contained 9 larvae.
1956-62	Low populations in most of the Region, 15 and 18 larvae per sample on wS from km 1 270-1 380 Alaska Highway.
1963-66	Slight increase annually; common in small numbers.
1967	Further increase throughout Region. Light defoliation of wH, wS and alF.
1968	Moderate to severe defoliation at West Twin Creek and Goat River and light defoliation in Torpy and McGregor river valleys.
1969	Infestations collapsed. Populations declined but widespread.
1970-72	Low populations.
1973	Populations quadrupled; common in small numbers with moderate populations in McLeod L, Bowron R, and Uslika L areas.
1974	Light defoliation of alF visible in McLeod L - Pine Pass areas.

Year	Remarks
1975	Populations declined with only a trace of defoliation in the Pine Pass area. Beatings averaged four larvae per positive sample (range 7-55), at Tudyah Lake, Pine Pass, Bowron, McGregor and Nelson rivers.
1976-81	Population continued at low levels with average of 2.4 to 2.7 larvae per positive sample in 1976 and 1977 and little change between 1978 and 1981, east and north of Prince George.
1982	Increase in average number of larvae per positive beating sample to 6, maximum 15 in the McLeod Lake area.

Green-headed spruce sawfly, Pikonema alaskensis

This sawfly commonly occurs on spruce and seldom causes noteworthy damage. Occasionally it may become epidemic in dense plantations of white spruce.

Year	Remarks
1960	Common in very small numbers throughout the Region.
1961	Slight increase in population.
1962-74	Low populations persisted with minor fluctuations: decrease in north and south, increase in west in 1965; general decline with common occurrence in north and a large population at km 960, Alaska Hwy in 1967; an infestation on ornamentals in Peace R area in 1968 and a slight increase in 1972.
1975-82	Similar fluctuations with a slight increase in number of larvae, no damage in 1975; 18% of collections positive, average of 3.2 larvae per collection in 1976; 29% of collections positive, average of 1.5 larvae per collection in 1977; 50% of collections positive, average of 2.8 larvae per collection in 1978 and low populations continued up to 1982.

Cooley spruce gall aphid, Adelges cooleyi

This gall aphid is a pest of white spruce and Douglas-fir throughout the forested area of the Region. Severe damage to white spruce deforms the current growth of both natural and plantation stands of young white spruce. The transformation of branch-tips into galls tends to inhibit linear growth. It is an important pest of young white spruce stands.

Severe attacks on Douglas-fir have caused needle losses which affect tree vigor and increment in young stands.

Year	Remarks
1957	Common on wS throughout the southern part of the Region.
1958-61	No record in reports.
1962	Widespread on immature white spruce and abundant on dF along Hart Hwy. and the Yellowhead Pass area.
1963-65	Common along the Hart Hwy. and near Fraser L.
1966	Abundant on regeneration of dF and wS from Hixon south.
1967	Common in the Vanderhoof area.
1968	Low populations.
1969	General increase in abundance.
1970	Common throughout Douglas-fir range; moderate attacks on young wS.
1971-73	Common on young wS.
1974	Low populations.
1975-79	Low populations.
1980	Two areas were severely infested in the Aleza Lake Experimental Forest; average of 90% of new shoots on young spruce were infested and at Wansa Lake 75% of current shoots were infested.
1981-82	Low populations throughout the Region.

PINE PESTS

Mountain pine beetle, Dendroctonus ponderosae

The principle host tree in the Region is lodgepole pine. Most of the mountain pine beetle activity has been in the Stuart - Takla - Trembleur Lake drainages where infestations occurred from 1956 to 1968, peaking in 1964-65. An increase in the number of lP killed began in 1975 and continued at a low level to 1982 when 9,000 trees were killed (3 300 m^3).

Western white pine stands are also killed by mountain pine beetle attacks. Along McNaughton Lake, mortality began in 1968, and continued to 1982 when 7 000 trees were killed (5 110 m^3).

Year	Remarks
1941	No attack recorded.
1942-47	No records.
1948	Beetles killed approximately 70% of lP on 2 ha at Takla Landing. Other isolated pockets of attack on E. and W. sides of Takla L; the largest on the W. side of Takla Narrows.
1949-54	No records of attacks.
1955	Overmature lP at S. end of Takla L; Bivouac Cr, 300 trees; Leo Cr, 800 trees; Sakeniche R, 300 trees; small groups between Tarnezell and Trembleur lakes.
1956	Attack continued in Takla L area; an estimated 65 000 trees killed since 1948.
1957	Infestation continued in Takla L area over 6 000 ha.
1958	Decrease from 1957 at Takla L. Small population in stumps on Manson Cr Road, only 1 standing tree infested.
1959	Infestation declined; 538 red-topped lP at Takla L south of old infestation.
1960	Small population persisted, infestation at S.E. end of Takla L subsided. Area of infestation 11 200 ha, estimated volume killed 804,000 m^3.
1961	Very light activity. 20 red-topped lP at Tabor L and 5 at Upper Willow R. Population static at Takla L, slight increase at Bivouac Cr. Three new infestations: Kloch L, 175 trees; Kuzkwa R, 730 trees; Tezzeron L, 64 trees. Volume for 1959-60 was 2 630 m^3.

Year	Remarks
1962	Red-topped lP increased at Bivouac Cr near Takla L and on Kuskwa R, N. of Tezzeron L, where counts of 4,000 and 2,250 were recorded. Infestation remained at a low level near Tabor L (10 trees).
1963	There was a general increase in the number of red-topped pines counted over 1962 at Tezzeron L, Kuzkwa R, Bivouac Cr and Sakeniche R. Alaska Hwy; some 1962-attacked trees were re-attacked.
1964	Increase of 17% in red tops in Tezzeron - Takla lakes area;
1965	Red tops increased 27% due to 1964 attack in Tezzeron - Takla lakes area. 1965 attacks negligible due to heavy larval mortality. Damage for 1963-64 calculated at 37 700 m^3 of lP killed over 3 420 ha (6,000 red trees counted).
1966	Negligible attack; decrease of 79% in red tops. Kuzkwa R, 220 red trees; Inzana L, 250 red trees. 1963-64: 35 650 m^3 - 31,480 trees; 1964-65: 7 570 m^3 - 6,690 trees.
1967	Significant decrease; Takla L, 600 red lP.
1968	Decrease to 100 red lP, Takla L. Localized infestations in lP and wwP in Canoe R Valley.
1969	Decrease in number of lP attacked; only a few red trees.
1970	Populations at low level; Canoe R - 150 red wP.
1971	Populations low. Canoe R, 150 red-tops, mostly at Windfall Cr.
1972	Increase at Canoe R to 750 red-topped wwP.
1973	No new attacks at Canoe R in 1973.
1974	No attacks at Canoe R. Tezzeron - Takla lakes area, no attacks.
1975	Recently killed lP were mapped in the Stuart-Takla lakes area: Whitefish Lake, 150 trees over 16 ha; Nancut Creek, 60 trees 6 ha; Takla Lake, 60 trees, 4 ha; Takla Landing, 20 trees, 2 ha; Wedge Mountain 10 trees on 1 ha.

Year	Remarks
1976	More small infestations were located in the Fort St. James District: Stuart Lake, 50 red trees; Whitefish Lake, 50; Nancut Creek, 90; Cunningham Lake, 80; Takla Lake, 50; Chuchi Lake 140; Chuius Mtn. 120; Hatduatchl Creek 50; Pinchi Lake 15 and north of Valemont at Swift Creek 150. Western white pine were killed along Canoe Arm at Ptarmigan Creek 100 trees; Hugh Allan Creek 75 and 30 at Buster Creek.
1977	The number of beetle-killed pine increased to 4,100 trees, with the largest increase in western white pine along McNaughton Lake, 3,200 red trees. Lodgepole pine were killed at Valemount, 500 trees; Whitefish Lake 50; Nancut, 30; Cunningham L, 55; Chuius Mtn., 75; Hatdudatehl Cr. 95; and eight other small (5-30) spots from Vanderhoof to Takla Lake.
1978	There was a general decrease in the number of red-top pine trees counted. Western white pine were killed along both sides of McNaughton Lake, 1,445 trees. Lodgepole pine were killed at: Swift River, 200; Nevin-Horsey creeks, 125; Nation R., 50; Cunningham L., 30; Stuart L., 30; Tezzeron L., 25; Kazcheck L, 75 and Tsayta L. 25 trees.
1979	An increase in red trees counted occurred with 4,600 trees over 2 200 ha. Western white pine were killed along McNaughton Lake, 2,125 trees on 1 418 ha. Lodgepole pine were killed at several locations; Swift Cr., 2,155 trees on 575 ha; Nevin Cr., 28 on 64 ha; Ft. St. James, 30 on 32 ha; Tezzeron L. 50 on 30 ha; Dem L., 100 on 64 ha; Leo Cr., 50 on 35 ha and Nation L., 125 trees on 60 ha.
1980	Infestation expanded. There was a total of 8 000 ha in 90 separate infestations but no tree numbers. In the McNaughton L. area, 4 400 ha of white pine were attacked. Near Valemount at Swift Cr., it killed over 800 ha and north and west of Ft. St. James infestations totalled 2 000 ha, mainly at Tachie R, Whitefish and Butterfield lakes.
1981	Infestations continued but area was down compared to 1980 because of logging and host depletion. A total of 2,500 lodgepole and 3,800 western white pine were killed over 900 ha, mainly from Valemont to Canoe Arm on McNaughton Lake and northwest of Prince George in the Takla and Tezzeron lakes area. At Swift Creek lP were killed over 125 ha; Canoe Arm wwP over 604 ha; Takla Lake lP over 50 ha; Tezzeron-Trembleur lP over 2000 ha and Purden Mtn lP over 10 ha.

Year	Remarks
1982	Outbreaks continued; 16,000 pine (9,140 1P, 3 190 m^3, 6 860 wwP, 5 110^3 m); Swift Creek, 4 600 1P; Ft. St. James, Takla Lk 4,540 1P; McNaughton Lake, 68,860 wwP.

Engraver beetles, Ips spp.

These species of beetles are usually considered to be secondary pests which invade windthrown, weakened or decadent trees, log decks and slash. In 1965 Ips perturbatus was believed to have killed the upper crowns of white spruce trees which had been lightly attacked by spruce beetles the previous year.

Year	Remarks
1956	Attacked a few standing lP in a logging area near Ormond L and in a few acres of fire damaged trees on the north side of Nechako R.
1957-60	Populations declined in lP at Ormond L and Nechako R. A large population attacked windthrown wS in Stone Cr Valley.
1961	Heavily infested wS blowdown in upper Willow R Valley and in log decks in the Parsnip R Valley.
1962	Log decks along upper Fraser R were heavily infested.
1963-64	Common in slash and in log decks.
1965-67	Attacked and killed the upper crowns of numerous wS which had been lightly attacked by spruce beetle.
1968	Large populations in Willow R Valley killed 200 white spruce on the edges of leave strips.
1969-70	No record.
1971	Heavily infested log decks at Bear L; infested windfalls and log decks in Willow R Valley.
1972-74	Severely infested windfalls and trap trees.
1975	No records
1976	Moderate population in blowdown trees and decked logs along the Bowron, Tumuch and Naver Roads.
1977	Generally, light population.
1978-82	No records of damage.

Lodgepole pine terminal weevil, Pissodes terminalis

This weevil has periodically infested lP pine stands throughout the Region, but the damage has been very light. It prefers young, open growing trees.

Year	Remarks
1963 and prior	No records in reports.
1964	Nine percent of 200 trees infested along Kenny Dam road.
1965	Small populations throughout western part of the Region.
1966	Minor attacks throughout Region: 12% on 5 ha plot at Hixon; 3 trees at Nation R; present at East Pine R.
1967	Present in Hixon area, one attack on bS at Nazko; present at East Pine R.
1968	Twelve dead terminals along Kenny Dam road.
1969-72	No record in reports.
1973	Isolated single attacks on Alaska Hwy.
1974	Light attack; 4-5 dead terminals per km along Kenny Dam road.
1975-76	Low populations, light attack (1-4%) at Bear, Opatcho and Merton lakes and Wasi Cr-Oslinka R. area.
1977	Fewer attacks in the 1976 attacked area.
1978-79	Light damage continued at Sinkut Mtn and Oslika R. area where 130 roadside trees were attacked in 1 km.
1980-82	Low populations; no damage reported.

DOUGLAS-FIR PESTS

Douglas-fir beetle, Dendroctonus pseudotsugae

This beetle is a major pest of Douglas-fir in the Prince George Forest Region. It is mainly confined to the Fraser River and Crooked River valleys, Stuart - Tezzeron lakes area, McBride area, with sporadic distribution south and east of Prince George. Attacks have been recorded since 1944.

Year	Remarks
1944-46	Scattered attacked trees at the northeast end of Pinchi L.
1947	Continued attacks on a few trees at Pinchi L plus scattered groups of trees northwest of Stuart L.
1948	Small patches of D-fir attacked on both sides of Stuart L from Fort St. James to Tachi R, plus some additional attacks on the slopes north of Pinchi L.
1949	All infestations subsided; no new red-tops were reported.
1950	No activity reported.
1951	A few red-tops noted in the Pinchi - Tezzeron lakes area and along the Fraser R south of Hixon.
1952	A few trees were attacked along the ridges between Pinchi and Tezzeron lakes.
1953	Small infestations reported at Pinchi and Tezzeron lakes and on Churchill Mountain.
1954	Light attacks found at Stuart L and Churchill Mountain.
1955-56	Twenty-five trees attacked at Summit L and 15 attacked at Pinchi L.
1957	No increase.
1958	Several hundred red-tops at Stuart L, also several at Chilako R, Angusmac Cr, Isle Pierre Road, and south of Fort St. James.
1959	No increase; 175 red-tops occurred on the south shore of Stuart L, mostly near Tachi village, 10 trees near Mapes.
1960	Noteworthy losses occurred in the Hixon and Stuart L areas.

Year	Remarks
1961	Dead trees were confined to the Red Rock - Ahbau area; minor losses.
1962	A region-wide drop in tree mortality was evident, with a total of 1,421 trees; volume of 3 180 m^3.
1963	S.W. of Hixon, 1,600 trees, volume 4 050 m^3, were killed and at Stuart L area 700 trees, 1 380 m^3.
1964	Another 584 trees attacked in Stuart - Tezzeron lakes area.
1965	Infestations remained at a low level south of Prince George. In Stuart - Tezzeron lakes area, 804 red tops, 1 250 m^3.
1966	Decreased; 450 trees killed over 2-year period at Castle Cr (McBride); 30 red tops at Pinchi L.
1967	Decrease; Hugh Allen Cr, 126 red tops; Castle Cr decrease; negligible at Pinchi L area.
1968	No record in reports.
1969	Groups of red-tops adjacent to logging or in seed blocks: Barney Cr, 45; Eaglet L, 50; Purden L, 20.
1970	Decline in attack; Canoe R, 215 and Stuart - Tezzeron lakes, 100 trees.
1971	Further decline in attack.
1972	Summit and Bear lakes, 50 red tops, Teapot Mtn, 25 red tops.
1973	Along Canoe R; 200 red-tops observed at Foster Cr.
1974	Occasional attacks at Bear L. Generally scarce.
1975	Single trees killed in Tete Jaune Cache area and north of Prince George near Bear Lake.
1976	Attacked logs 20 miles west of Punchaw Lake and approx. 300 red trees over 12 ha along Barney Creek Road.
1977	Some attacked logs north of Summit Lake and west of Punchaw Lake.

Year	Remarks
1978	A few small patches of 5-10 Douglas-fir trees were killed along Castle Creek near McBride.
1979-80	No tree mortality reported.
1981	200 recently-killed dF in pockets of 5-10 trees at McLeod and Stuart Lakes, McGregor River and in the McBride area.
1982	Small numbers in pockets in Bowron R area.

Douglas-fir needle midges, Contarinia spp.

This needle miner caused periodic damage to Douglas-fir in Christmas tree cutting areas. Larvae feed on the current year's foliage, causing discoloration during the summer, and needle-loss later in the year.

Year	Remarks
1954	Small numbers as far north as Cluculz L.
1955	Chubb L, near Hixon: young trees with 10% needle loss; Summit L, 5% needle loss.
1956-58	Low populations near Isle Pierre, Fraser, Stuart, and Pinchi lakes; near Finmore, Cluculz L, Charleston Cr., and Yellowhead Pass.
1959-61	Low populations over most of the range of Douglas-fir.
1962	Increased widespread populations in Yellowhead Pass area: Mt. Robson, 67% needle loss; Red Pass, 93% needle loss.
1963-66	Low populations; light infestations near Summit, Bear and Cluculz lakes.
1967-74	Low populations, small numbers near McBride in 1971.
1974-82	Low populations.

ALPINE FIR PESTS

Western balsam bark beetle, Dryocoetes confusus

This beetle, in association with a fungus Ceratocystis dryocoetidis which is introduced into attacked trees, killed large volumes of alpine fir in the Region during periodic outbreaks. Although early records are sketchy, there are records of damage as far back as 1923 in the Wells - Barkerville area.

Year	Remarks
Prior to 1958	Intermittant reports of unspecified tree mortality.
1958	Small number of red-tops, km 13 Nation R mine road.
1959-60	Not mentioned in reports.
1961	Low population level; 150 red tops at Lazaroff, Nelson-Kenny lakes and Hixon areas. Extensive tree-kill in Stuart L. area occurred prior to 1961, 90 890 m^3 over 8 560 hectares. Pine Pass area, 27 500 dead trees over 2 200 ha.
1962	Upper Fraser, TFL 30, Purden and Willow R drainages, 4,400 alF trees killed; Table R, 1 250; Scovil Cr, 6 000; Stuart L unit and Misinchinka R, Moberly and Peace units, 20 000 trees, 17 000 m^3.
1963	Widespread infestations; Upper Fraser R Valley, Tchentlo, Kloch, Airline, Humphrey lakes, Takla Lndg., Parsnip R from Arctic L to Anzac and Pine Pass.
1964	Few current attacks, but vast areas of previous attacks (from 1950's) in Purden and Willow R units. Widespread light, old mortality (58 720 ha) and new, light to severe mortality. Active in Callazon - Clearwater lakes and Pine Pass areas. Populations were prevalent for at least 5 years.
1965	McBride and Upper Fraser R tributaries; 6,000 red-tops. Continued from 1962-64: 110 205 m^3 loss over 34 600 hectares. Scattered infestations at Azouzetta and km 235 Alaska Highway.
1966	Several localities; N. and E. Morkill R, 1,200; other red-tops in Upper Slim Cr, McGregor, Raush and Canoe rivers.
1967	Continued scattered extensive damage, McKale, Jaselle, Slim and Kenneth creeks, severe at Burden and Scovil creeks (Takla L); light at Stuart - Tezzeron, Trembleur and Tchentlo lakes areas. Further reduction at Pine Pass.

Year	Remarks
1968	Widely scattered red-tops in mountainous eastern portion; Dome Cr and McBride areas severest. Severe at Burden L and Scovil Cr; light at Morfee, McLeod, Takla and Trembleur lakes.
1969	Widespread, on east side of Rocky Mountain trench in Misinchinka R - Mugaha Cr area; localised severe in Willow R drainage and light in Fraser R Valley and Cariboo areas.
1970	From 1968 to 1970, 14 600 red-tops were counted throughout Pine Pass, Dome, McKale and Thursday creeks.
1971	Reduction in tree mortality to 10% of 1970 counts, - 1 036 red trees.
1972	1 100 red-tops similar to 1971.
1973	Reduction throughout Region to near zero mortality.
1974	Slight increase to 230 red-topped alpine fir seen at Moose L. and Pine Pass.
1975	Slight increase in number of trees to 460; Moose Lake 150; Slim Creek headwaters 85; Link Lake 35; Garbitt Creek 110; Bennett Creek 40 and George Mtn. 40.
1976-77	Dead trees mapped only in Pine Pass, 180 in 1976 and 100 in 1977.
1978	There was an increase in alF mortality but tree counts were not available. Areas of tree mortality were: Pine Pass 250 ha, Everett Creek 250 ha; Kuyakuz Mtn. 200 ha; Limestone Ridge 100 ha and 100 trees at Moose Lake.
1979	A further increase in area of alF mortality to 3 800 ha. Moderate mortality (6-30% of alpine fir affected) over 800 ha at Boling Peak and 200 ha along Takla Lake. Tree mortality over 2 800 ha northwest of Van Decar Creek near Middle River.
1980	Mortality continued at widespread locations; Bivouac Creek, 6% of trees dead over 715 ha; Pyramid Peak near Takla Lake 2 266 ha and 85 ha at Emerald Ridge in Mt. Robson Park.

Year	Remarks
1981	Up to 5% of alF were killed in white spruce - alpine fir stands over 315 ha at various locations in the Takla Lake area; Frypan Creek 125 ha; Lovell Cove 100 ha; West Landing 40 ha and on the southside of Tsayta Lake 50 ha.
1982	Major increase to 24 000 trees over 8 300 ha mainly in Stuart-Takla-Germansen lakes areas.

WESTERN HEMLOCK PESTS

Western Hemlock Looper, Lambdina fiscellaria lugubrosa

Prior to 1940, records of hemlock looper populations were not available, but since 1951 two outbreaks, one from 1952 to 1957 and from 1963 to 1965 were recorded. In the former, the severest defoliation occurred in cedar-hemlock stands in the McBride area, while moderate defoliation was evident in most of the other areas.

Since the most recent outbreak, which caused minor defoliation then collapsed, no increase in the larval population had occurred.

Although cedar-hemlock stands in the Region were severely defoliated, there is no record of tree mortality.

Year	Remarks
1950	Very low populations.
1951-52	Slight increase in populations.
1953	Increase continued with larvae present in 43 collections, highest numbers S.W. of McBride in hemlock-cedar stand; 147 larvae in one collection from western red cedar.
1954	Defoliation of wH and wrC increased, with small patches of light to moderate at Giscome - Eaglet L, Lunate Cr - Slim Cr area and Penny. Some polyhedral virus found in larvae.
1955	Infestations continued with defoliation over about 48 000 ha; 5.8 km S. of McBride the average was over 100 larvae per beating sample.
1956-57	Decrease in population, larvae only found in McBride area.
1958	Low population, small numbers found in southern part of Region.
1959-62	Not mentioned in 1959 report; very scarce between 1960 and 1962.
1963	Increase in population. Large moth flights at Giscome, Sinclair Mills, Summit L and Bear L.
1964	Increased at Aleza L, Giscome, Hansard, S. Summit L and Kerry L. Population doubled since 1963.
1965	Population collapsed in winter of 1964-65.

Year	Remarks
1966-74	Low populations with slight fluctuations; slight decline in 1969 and 1970; a slight increase in 1972 and 1973 and a decline in 1974.
1975-77	Populations declined further in 1975 with one larva found and remained low in 1976 and 1977.
1978	Populations increased slightly from Dome Creek to Goat River, with an average of 3.5 larvae per positive beating.
1979-81	Low population persisted, no defoliation apparent.
1982	Increase in number of larvae per positive beating sample from 0 to 3.4 on wH; 0 to 2.7 on wS, throughout Region.

Conifer sawflies, Neodiprion spp.

Commonly found on most coniferous trees in the Region they occasionally lightly defoliate western hemlock in the Upper Fraser R Valley.

Year	Remarks
1952	Common in small numbers on wS in the Fort Fraser area.
1953-54	Low populations.
1955	Light defoliation of wH near Sinclair Mills and Eaglet Mtn (139 and 128 larvae per collection).
1956-57	Low populations.
1958	Light defoliation of wH near Sinclair Mills; common on wS, bS and dF in the western part of the Region.
1959-60	Low populations.
1961-62	Common; 60% of coniferous collections contained larvae; up to 18 larvae collected from dF.
1963-65	Moderate population, common around McGregor; up to 140 larvae per collection on wH near Sinclair Mills in 1965.
1966-70	Not mentioned in reports.
1971-74	Low population, except in 1974 in McBride area where moderate populations caused light defoliation of wH at Dore R, McKale Cr. and on lower slopes of Teare Mtn.
1975	Population increased; defoliated up to 60% of conifers from Bowron River to McBride in tributary valleys of the Fraser River. Average number of larvae per positive sample was 37.7, up from 13.2 in 1974, and 8.2 in 1973.
1976	High populations persisted; light to moderate defoliation (up to 60%) from Hungary Creek to Tete Jaune Cache. An average of 482 larvae per positive sample in the infestation area.
1977	There was a large increase to 64 000 ha of moderate to severe defoliation between Hungary and Slim creeks. An average of 656 larvae per three-tree beating in the infestation area.

Year	Remarks
1978	Populations declined sharply with only light defoliation east of Prince George to McBride. There was an average of 290 larvae per positive beating within the infestation area.
1979-82	The population collapsed in 1979 and remained low up to 1982.

EASTERN LARCH PESTS

Larch sawfly, Pristiphora erichsonii

The larch sawfly, introduced from Europe, is a serious pest of both eastern and western larch. This pest has severely defoliated eastern larch in the Prince George Region west of Prince George, in Monkman Pass east of Prince George and along the Alaska Highway to km 875.

Year	Remarks
1953	Low populations.
1954	Light to moderate defoliation of eastern larch in swamps north of Cluculz L.
1955	Scattered light defoliation of larch, north of Pantage L. Decrease at Cluculz L. with little defoliation evident.
1956-57	Low population.
1958	Present at Cluculz L. but scarce elsewhere.
1959	Increase, low population.
1960	Increasing.
1961	No record in reports.
1962	Moderate populations; Tamarack and Cluculz lakes, Alaska Hwy. km 256-448, Beatton R km 51, Wildmare L, and Hart Hwy. at Bisset Cr.
1963	Increase, same areas as 1962. Increase in extent and severity in Monkman Pass, Hart Hwy. and Alaska Hwy. km 590.
1964	Negative in southern parts of Alaska Hwy. Slight increase at km 875 and a N.W. spread was predicted.
1965	Alaska Hwy. km 260 and Beatton R road, 20% defoliation; Monkman Pass, 100% defoliation. Negative N. of km 875 Alaska Hwy.
1966	Slight increase along Alaska Hwy. km 395-422, with light to moderate defoliation. Light defoliation S.W. of Dawson Creek to Hudson Hope.

Year	Remarks
1967	Fewer areas infested, but increase in local populations in northern stands, Alaska Hwy. km 580. Light defoliation at Fort Nelson, Hudson Hope and Chetwynd.
1968	Sharp decline, light defoliation in parts of Fort Nelson R. drainage.
1969-74	Low populations.
1975-76	Common in eastern larch stands in the Region. A large number of overwintering cocoons in duff samples near Tamarack Lake.
1977	Continued high populations; 95% defoliation over 1600 ha in Bednesti - Tatuk lakes area and light defoliation (less than 30%) in the Peace, Monkman and Liard rivers area. Duff samples indicate a continuing population.
1978	Estimated 2 500 ha moderate to severe defoliation from Bednesti Lake to Tatuk Lake.
1979-82	Populations collapsed.

MULTIPLE HOST PESTS

Ambrosia beetle, Trypodendron lineatum

Populations of this beetle vary with weather and the amount of overwintering windfall, log decks or slash. Unless sawmills utilized logs or log piles immediately after the winter logging was completed, usually prior to mid-May, many logs were infested. Lumber from infested logs is degraded and banned for export due to quarantine laws.

Records of ambrosia beetle attack in the Prince George Region are only available from 1950.

Year	Remarks
1950-54	Low populations.
1955	South end of Takla L; lower trunks of lP attacked after being killed by mountain pine beetle.
1956	Low populations.
1957	Fort Nelson, Haines Rd., light attacks on sS.
1958	Low populations.
1959-61	Low populations.
1962	Varied attacks at many areas from Upper Fraser to Pine Pass, up to 25 entrance holes per 900 cm^2. At Eaglet Lake Mill 28 316 m^3 of logs were affected; at McGregor, 14 150 m^3.
1963	Attacks similar to 1962: Eaglet Lake to Pine Pass, up to 25 entrance holes per 900 cm^2.
1964	Same areas as in 1963 infested plus the Willow and Naver areas; up to 118 entrance holes per 900 cm^2. Most of the attack was in log decks and fresh windthrown wS.
1965	Widespread attack; Prince George to Pine Pass; increases at Valemount, Vanderhoof, Finlay Forks, and Summit L - Bear L area.
1966	Low populations.
1967	Light attack on log decks at Mackenzie.
1968-70	No record in reports.
1971	Moderate attacks in log decks at Ferguson Lake Sawmills, Bear L, and Pitoney L.

Year	Remarks
1972	Light attacks in log decks at Northwood Sawmill at Upper Fraser.
1973-74	Low populations.
1975	Low populations.
1976	Beetles degraded wS logs in a 32 ha blowdown area at Thursday Creek southeast of Prince George; 30 entrance holes /900 cm^2 on 30% of the trees. Attacks also on blowdown trees along the Bowron River, Tumuch Lake and Bowron Coal roads.
1977-82	Low populations; no damage.

Black army cutworm - Actebia fennica

Black army cutworm was first recorded in the Prince George Region in 1973 when larvae severely defoliated conifer seedlings at Bearcub Creek, Dog Creek, km 26 Naver Road and Canoe River.

In 1974 populations increased east of Prince George, but damage to seedlings was light. In 1978, a single infestation defoliated seedlings at Chuchi Lake north of Fort St. James. The population collapsed in 1979 and remained low in 1980 and 1981. In 1982, planted seedlings were severely defoliated in four areas near Prince George, Ft. St. James and McBride. Black army cutworm infestations occur on areas planted after slash burning before a sufficient supply of ground cover has been established.

Year	Remarks
1973	White spruce and lP seedlings were severely defoliated at Bearcub Creek, Dog Creek, km 26 Naver Road and Canoe River. 900 cm^2 duff samples from 20 locations at Bearcub Naver areas contained an average of 16 pupae per sample.
1974	Numerous larvae in new outbreaks at Purden Mountain, Carpet Lake road and Ptarmigan Creek but no lP or wS seedlings were damaged.
1975-77	Low populations. No larvae or damage recorded.
1978	An outbreak severely damaged seedlings over 12 ha at Chuchi Lake north of Fort St. James.
1979	The population at Fort St. James collapsed, no evidence of feeding or larvae.
1980-81	Low populations, no damage recorded.
1982	Newly planted conifer seedlings were severely defoliated in 20-60 ha areas at McLeod Lake; in Prince George area; near Ft. St. James and McBride.

Oregon Fir Sawyer, Monochamus oregonensis

The larvae of the Oregon fir sawyer mine and degrade dying or recently dead or felled conifers, especially spruce.

Since first recorded in 1952, populations have remained low with little extensive damage, except for 1958, 1962 and 1981 at Deserter Cr., from Aleza L. to Sinclair Mills and at Fort Nelson, respectively.

Year	Remarks
1952-57	Low populations.
1958	Severe damage to an old deck of logs at Deserter Creek, Narcosli Valley. Estimated 1,500 dF, lP and wS logs were damaged at several burned sites in the Crooked River Forest.
1959-61	Low populations.
1962	A moderate population in logs along the Upper Fraser Valley from Aleza Lake to Sinclair Mills and a light population from Goat River to Moose Lake. At km 568 of the Alaska highway, logs were severely infested with an average of five exit holes per 15 cm^2 of bark surface.
1963	Light populations at Sinclair Mills and low populations throughout the rest of the Region.
1964-80	Low populations, no damage recorded.
1981	Severely attacked decked logs in Fort Nelson Forest Products and Tackama Forest Products yards at Fort Nelson, resulted in significant quality degrading.
1982	No recorded damage.

Western larch borer - Tetropium velutinum sp.

This roundheaded wood borer which attacks most conifers, principally white spruce, was recorded in the Prince George Forest Region only once since 1952.

Year	Remarks
1952-60	Low populations
1961	Larvae numerous in white spruce log decks at several millsites throughout the Region.
1962-82	Low populations; no significant damage recorded.

DECIDUOUS TREE PESTS

Forest tent caterpillar, Malacosoma disstria

Outbreaks of the forest tent caterpillar occurred repeatedly in extensive stands of trembling aspen and other deciduous hosts. Although total defoliation of these stands often occurs, the trees usually recover after the infestation has subsided.

Year	Remarks
1944	Outbreaks in Cutbank and Peace R valleys. Trembling aspen and bCo stripped for miles along river valleys in Pouce Coupe area.
1945	Severe defoliation along Peace R at Taylor Flats, adjacent benchlands and the Kiskatinau R.
1946-47	No records in reports.
1948-50	Low populations. Some disease and parasitism in population along S. portion of Region.
1951	Increase; localized infestations in Prince George and McBride areas. High egg populations at Rearguard, Woodpecker, Tabor L, Yardley L and Hixon.
1952	Increase; infestations along Upper Fraser R valleys at McBride, Dunster, Shere, Rearguard and Swiftwater; also Tabor L, Reid L, and a kilometre south of Salmon R on the Hart Hwy.
1953	Severe defoliation occurred in Prince George, Hixon, and Strathnaver areas, with smaller increases occurring as far north as Salmon R. Isolated infestations near Parsnip R bridge, Cluculz L, and Legrand to Mount Robson. Light defoliation in Prophet, Minaker and Muskwa R valleys. Polyhedral virus caused mortality of larvae at Beaverley.
1954	Severe defoliation from Prince George to Ahbau and northward to Salmon R; McBride to Mt. Robson and spot infestations as far west as Cluculz L.
1955	Infestations collapsed, possibly due to egg mortality from a late frost.
1956	Low populations.
1957	Moderate to severe defoliation from Croydon Station to Dunster, (60% defoliation).

Year	Remarks
1958	Increase in McBride - Tete Jaune Cache area (40-60% defoliation).
1959	From 60 to 100% defoliation of aspen over 45 km^2 in McBride area.
1960	Continuing infestation in McBride area on both sides of Fraser River; light defoliation in Canoe R Valley.
1961	Increase in size and intensity; McBride to Valemount, McLennan R Valley and at Peace R bridge.
1962	Increase to 1 025 km^2; Upper Fraser - Goat R - Mt. Robson; 80 km^2 severe defoliation at Taylor and 80 km^2 at Peace R bridge.
1963	Decrease in population; McBride - Valemount, mostly moderate to severe defoliation. Decrease to light defoliation along Peace River.
1964	Further decrease in population; 13 km^2 of moderate defoliation N. of McBride.
1965	Population collapsed, no defoliation.
1966-70	Low population.
1971	Small populations at Clauminchil L., and McBride.
1972	Light to moderate defoliation, Prince George to Strathnaver and McBride to Mt. Robson; populations mixed with large aspen tortrix.
1973	Major outbreak; up to 100% defoliation common from Prince George to Ahbau, intermittent west to Chilako R., and N. to Salmon Valley; severe in McBride - Mt. Robson areas.
1974	Populations subsided, causing intermittent defoliation of aspen stands around Prince George and McBride. Suspected causes were pupal virus and weather conditions in May.
1975	Defoliation increased to 80-100% over 4 000 ha in McBride area, McKale Creek to Horsey Creek, near Miworth and near Mackenzie. No signs of disease.
1976	Infestations increased to 6 600 ha in the McBride area from McKale Creek to Tete Jaune Cache. Late larval and pupal collection contained nuclear polyhedrosis virus; no egg samples were taken.

Year	Remarks
1977	Infestation increased to 30 400 ha in the McBride area from McKale Creek to Kiwa Creek and from Tete Jaune Cache to Valemont and Alpland in Mt. Robson Park. No diseases found in larvae.
1978	Defoliation subsided to 2 100 ha from McBride to Horsey Creek and near Tete Jaune Cache.
1979	Population collapsed.
1980-82	Low populations, no visible defoliation.

Western tent caterpillar, Malacosoma pluviale

The western tent caterpillar occurs on willow and swamp birch throughout the Prince George Region. Since it feeds on low growing host material, small infestations may go unnoticed, especially on lake shores or swamp edges.

Year	Remarks
1947	Outbreak near Aleza L., severe defoliation of scrub birch and W in swampy areas.
1948-49	Not recorded in reports.
1950	Common in swamps; 40 ha, 12 km S. of Stone Cr on Hwy. 97 partially stripped.
1951	Small infestation at Stone Cr. and 16 km S. of Hixon; decreased at Cluculz L. and Altezega Cr.
1952	Partial defoliation of dwarf birch and W in swamps along Crooked R. Valley.
1953	Infestations subsided; one collection from W near Fort Nelson.
1954	No record in reports.
1955	Nine ha of W and dwarf birch defoliated near Redrocky L.
1956-57	Low populations.
1958	Common on W and bCo near Lazaroff L.
1959-61	No records in reports.
1962	Sixteen ha of B severely defoliated at Aleza L, and 8 ha near Newlands.
1963	High populations and severe defoliation at Aleza L. and Newlands.
1964	Moderate defoliation of dwarf birch over 40 ha at Aleza lake and 5 ha near Newlands.
1965	Infestation subsided.
1966-68	No records in reports.

Year	Remarks
1969	Willow and dwarf birch at Aleza L and Hansard stripped.
1970-74	Low populations; no records in reports 1970-73; small infestation at Norman L on willow in 1974.
1975-82	Low populations continued with no record of defoliation.

Large aspen tortrix, Choristoneura conflictana

The large aspen tortrix is commonly found in trembling aspen stands throughout the Region. Outbreaks often follow or are followed by forest tent caterpillar outbreaks. The severest defoliation has occurred from Dawson Creek to Fort Nelson and in the Vanderhoof and Salmon River areas from 1953-58. From 1970-72 defoliation occurred in the Vanderhoof, Fort St. James, and McBride areas.

In 1978 patches of severe defoliation developed east of Ft. St. John expanding along the Alaska Highway and the Peace River Valley in 1979.

About 38 800 ha were defoliated in 1980 in the Vanderhoof, Fraser-Stuart-Tezzeron lakes area, in the Peace, Ft. St. John, Ft. Nelson, and Liard River Valley. Defoliation continued in the same areas in 1981.

In 1982 populations and defoliation were greatly reduced. Light defoliation persisted in north eastern areas to Muncho Lake.

Year	Remarks
1946	Outbreak near Bear L. (km 730 Alaska Hwy.) on tA, W, and rose shrubs.
1947-52	No record in reports.
1953	Light defoliation at many scattered points along Alaska Hwy. from Dawson Creek to Fort Nelson. Common in association with tent caterpillar from Hixon to Prince George.
1954	North of Vanderhoof, 80% defoliation over 20 ha; Alaska Hwy., km 21-260 and 330-360, 50% defoliation; Beatton Rd. 75% defoliation.
1955	North of Vanderhoof light defoliation over 20 ha; Salmon R. Valley, 75-90% over 200 + ha; Alaska Hwy., kms 128-161 and 203-224, 40% defoliation; Beatton Rd., km 32-48, 50% defoliation.
1956	North of Salmon R. 60-90% defoliation; North of Vanderhoof light defoliation; Alaska Hwy., km 123-157 severe defoliation.
1957	Salmon R. Valley, km 24-43, 50-80% defoliation; Pouce Coupe, Fort St. John, and Hudson Hope - light defoliation.

Year	Remarks
1958	Salmon R. Valley, 50% defoliation.
1959	Salmon R infestation collapsed. Low populations.
1960-64	Small population at Beatton R and Alaska Hwy. km 416 in 1963; at km 16 and km 128 Alaska Hwy in 1964.
1965-69	No records in reports.
1970	Severe defoliation at 9 locations including: McBride, 1 000 ha; Vanderhoof, 400 ha; Stuart - Pinchi lakes, 2 ha; and Fort St. James, 1 600 ha.
1971	McBride area, 2 000 ha defoliated; Fraser L - Vanderhoof - Nechako - Stuart R area, 6 800 ha.
1972	Population declined with moderate defoliation from Fort Fraser to Prince George, Prince George to Ahbau and at McBride.
1973	Population collapsed as forest tent caterpillar increased to severe in same areas.
1974	Low population; 5 km of light defoliation along Hwy 97 near Groundbirch.
1975	Low populations.
1976	Moderate to severe defoliation of trembling aspen on more than 160 ha near Dawson Creek and Fort St. John. Twig dieback on 25% of the trees in some areas.
1977	Low populations, no defoliation recorded.
1978	Patches of severe defoliation in stands east of Fort St. John. The pupae were parasitized and diseased.
1979	Severe defoliation along the Alaska Highway near Kledo Cr. and light defoliation near Ft. St. John and along the bench lands above the Peace River near Dawson Creek.
1980	Light defoliation over 27 300 ha and moderate defoliation over 11 500 ha in the Vanderhoof area; along Fraser, Stuart and Tezzeran lakes. Defoliation was widespread east of Chetwynd along the bench lands above the Peace River to Fort St. John and near Dawson Creek. Patches of light defoliation were recorded along the Alaska Highway from Trutch to Ft. Nelson; west to Kledo Creek and along the Liard River near the B.C.-Yukon border.

Year	Remarks
1981	Outbreak continued; light to severe defoliation on 50-200 ha patches from Trutch to Muncho Lake, Liard River to Fireside, and in the Chetwynd-Fort St. John and Vanderhoof-Fraser Lake areas. Parasitism in pupae and larvae was 75% at Liard River.
1982	Defoliation was greatly reduced; 20 ha patches of light defoliation from Chetwynd to Muncho Lake. Parasitism, (75%), in 1981 attributed to collapse.

Bruce spanworm, Operophtera bruceata

The bruce spanworm is a leaf roller and defoliator of deciduous trees and has attacked trembling aspen throughout its host range in the Region. The most extensive infestations have occurred in the Peace River area and usually remained at epidemic levels for up to five years.

Year	Remarks
1956	No record in reports.
1957	Moderate to severe defoliation of tA from Pine Pass to Pouce Coupe and north to km 152, Alaska Hwy.
1958	Moderate to severe defoliation of tA from Pine Pass to Beatton R. with small scattered infestations as far north as Fort Nelson. Severe defoliation occurred at Little Prairie, East Pine, Hudson Hope, Dawson Creek, and Fort St. John.
1959	Severe defoliation west of Dawson Creek on tA, bCo and W; less defoliation north of Dawson Creek.
1960	Pine Pass infestation collapsed. Larvae were collected in small numbers from Al and W in Fraser L. and Fort St. James areas.
1961-64	Low populations.
1965	Increase N.E. of Pine Pass.
1966	Widespread defoliation N.E. of Pine Pass.
1967	High populations in Peace R Valley with the highest populations near Fort St. John.
1968-69	High populations in Peace R. region.
1970-77	Decrease in populations.
1978	Moderate defoliation between Dawson Creek and km 184 Alaska Highway.
1979	Severe defoliation of tA in the Dawson Creek - Fort St. John area and north along the Alaska Highway to km 175.
1980-82	Population collapsed in 1980 and remained low through to 1982.

Aspen leaf miner, Phyllocnistis populiella

Since first recorded in B.C. near Bowron L in 1939, it has been common throughout the range of trembling aspen in the Prince George Region. During large aspen tortrix and forest tent caterpillar outbreaks, aspen leaf miner populations tend to decline and remain at endemic levels. Trembling aspen stands throughout most of British Columbia and Yukon Territory were infested from 1955 to 1965.

Year	Remarks
1952-54	Severely infested tA for 208 kms along the Liard R Valley in 1952 and from lower Liard R crossing to Fireside in 1953 and 1954.
1955-56	Infestation continued from Lower Liard crossing to Fireside, and along Muskwa R Valley west of Fort Nelson to 64 kms, Alaska Hwy..
1957-58	Common within host range west and north of Prince George and scattered in the northern regions of the Region with some light damage.
1959	Common throughout the Region but declined.
1960-61	Decreased in the northern areas but increased west and south of Prince George.
1962	Decreased throughout the Region.
1963-65	Further annual decrease throughout the Region.
1966	Population at low levels except along Yukon border, where a high population existed.
1967	Increased throughout most of Region to moderate population levels and high along Yukon border.
1968	Moderate populations at McBride and Valemount. Light to moderate from Endako to Hart Hwy., and high along Yukon border.
1969	Moderate at Valemount; heavy at Aleza L and McBride.
1970	Moderate to severe at McBride and Valemount.
1971-76	Low populations.

Year	Remarks
1977	High population between Tete Jaune Cache and Mt. Robson Park, causing up to 100% discoloration of tA.
1978	Damage continued from Valemount to McNaughton Lake, in the Albreda area, from McBride to Tete Jaune Cache and near the Fort Nelson airport.
1979-82	No recorded damage.

HOST TREE ABBREVIATIONS

Abbreviations	Common Name
eS	Engelmann spruce
wS	White spruce
bS	Black spruce
sS	Sitka spruce
alF	Alpine fir
gF	Grand fir
aF	Amabilis fir
dF	Douglas-fir
wL	Western larch
aL	Alpine larch
tL	Tamarack
wC	Western red cedar
yC	Yellow cedar
roJ	Rocky Mt. juniper
wH	Western hemlock
mH	Mountain hemlock
lP	Lodgepole pine
sP	Shore pine
pP	Ponderosa pine
wwP	Western white pine
wbP	Whitebark pine
tA	Trembling aspen
bPO	Balsam poplar
bCo	Black cottonwood
Al	Alder general
B	Birch general
M	Maple general
W	Willow general
gO	Garry oak