

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

1913 ~ 1982



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AND INFESTATIONS OF IMPORTANT
FOREST INSECTS IN THE
CARIBOO FOREST REGION
1913 - 1982

BY

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TABLE OF CONTENTS

	<u>PAGE</u>
INTRODUCTION	3
MAP 1 - CARIBOO FOREST REGION	5
<u>PINE PESTS</u>	
Mountain pine beetle	6
Lodgepole pine terminal weevil	11
<u>SPRUCE PESTS</u>	
Spruce beetle	12
Two-year-cycle spruce budworm	15
Spruce weevil	18
<u>DOUGLAS-FIR PESTS</u>	
Douglas-fir beetle	19
Western spruce budworm	23
Douglas-fir tussock moth	24
<u>ALPINE FIR PESTS</u>	
Western balsam bark beetle	25
<u>WESTERN HEMLOCK PESTS</u>	
Western blackheaded budworm	27
<u>MULTIPLE HOST PESTS</u>	
Black army cutworm	28
<u>DECIDUOUS TREE PESTS</u>	
Forest tent caterpillar	29
Fall webworm	31
<u>APPENDIX I - Host Tree Abbreviations</u>	32

Introduction

This report constitutes a history of some important forest insects in the Cariboo Forest Region since 1913. Information was compiled from Kamloops and Prince George Annual District Reports of the Forest Insect and Disease Survey to 1972, and from the Cariboo Regional reports from 1973. Information was also compiled from unpublished reports and a variety of published histories of insects in British Columbia.

The Cariboo Region encompasses 8.7 million ha; of this 6.5 million ha are productive forest land. Tree species in the Region are: lodgepole pine, on 65% of the area; white spruce, 11%; Douglas-fir 17%; alpine fir 3% and western red cedar 1%. Western hemlock, white pine and ponderosa pine are minor species comprising less than 1% and deciduous species approximately 3%. Volume of mature timber is as follows:

lodgepole pine	293 795 820 m ³
white spruce	150 843 747 m ³
Douglas-fir	88 100 719 m ³
alpine fir	25 088 404 m ³
western red cedar	24 122 467 m ³
western hemlock	6 400 261 m ³
white and ponderosa pine	1 982 057 m ³
deciduous spp.	3 179 484 m ³
Total	593 512 959 m ³

Bark beetles have been the major cause of volume loss in the Cariboo Region. The mountain pine beetle is the most serious pest of the mature pines in western Canada. Unlike spruce and Douglas-fir beetles, the mountain pine beetle does not attack and buildup in windthrown trees and slash but attacks healthy pines. Large areas of mature pine in the Region have been killed in the current outbreak which started in 1974.

Douglas-fir beetle occurs throughout mature and overmature Douglas-fir stands in the Interior. Normally the beetle prefers to attack logs, windfalls, slash, and injured or weakened trees. Frequently, however, it infests single trees but more often groups of up to a hundred trees. Areas of chronic beetle attack in the Region are around Williams Lake, the Narcosli Creek valley and the plateau between 100 Mile House and the Fraser River.

The spruce beetle is the most destructive pest of mature spruce. Populations breed in windthrown trees and logging slash and when epidemic, living trees are attacked resulting in tree mortality. Outbreaks have occurred periodically in the eastern portion of the Region in the Horsefly and Quesnel districts where much of the Regional spruce stands occur.

Western balsam bark beetle, in association with a woodstaining pathogen, kills alpine fir extensively in British Columbia. Tree mortality has been recorded annually throughout the host range.

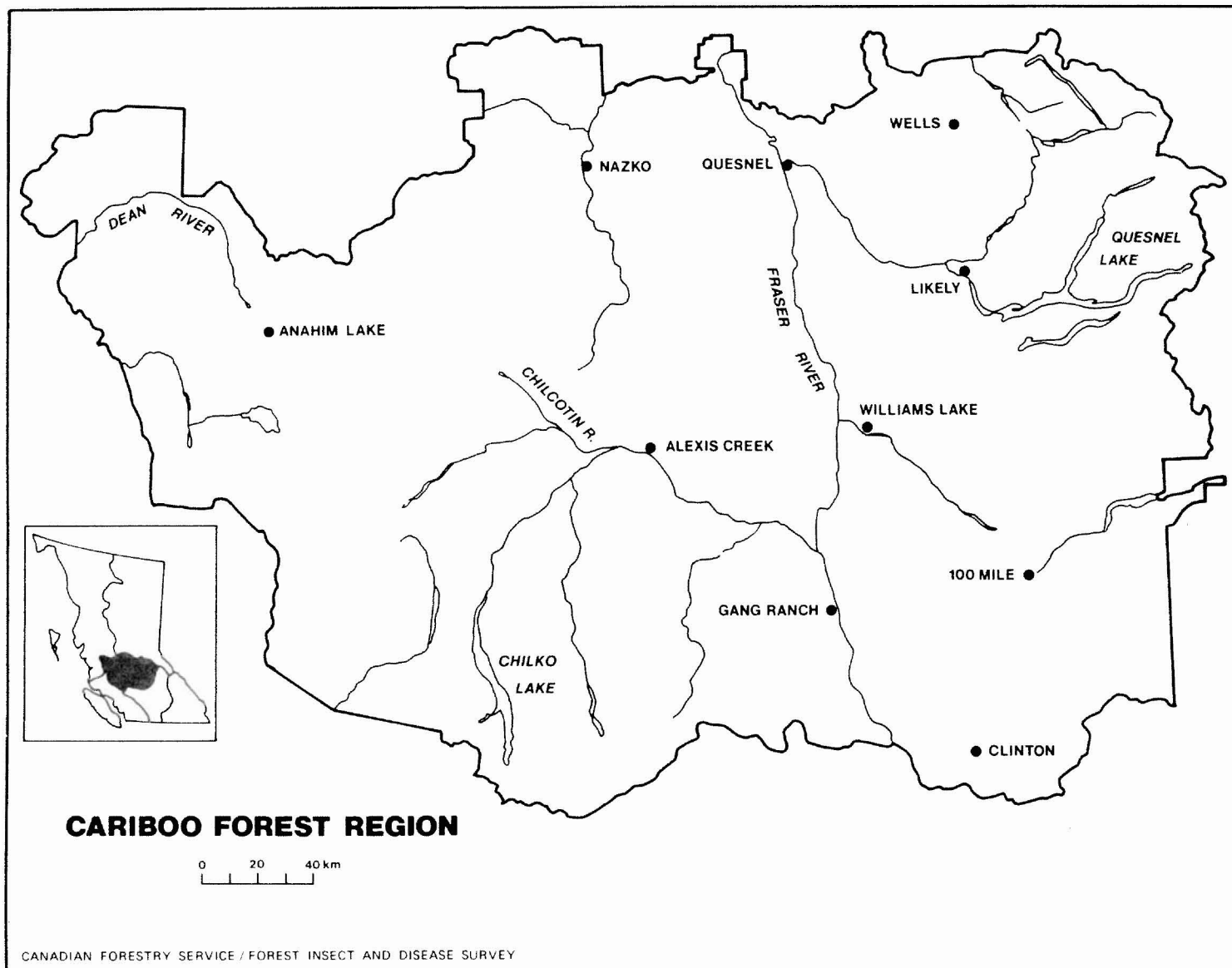
Defoliators have also seriously damaged conifer forests in the Region. The two-year-cycle spruce budworm, a subalpine species, has frequently defoliated alpine fir and spruce stands. Periodic outbreaks reported since 1913 occurred from Hendrix Lake north to the Regional boundary.

The one-year-cycle western spruce budworm does not have a lengthy history of damage in the Cariboo Region, but has defoliated Douglas-fir and caused light tree mortality near Clinton and along the Fraser River near Big Bar Creek.

The western blackheaded budworm occurs less frequently in the Region but is capable of causing severe defoliation in wet belt areas. The Douglas-fir tussock moth, an important pest of Douglas-fir, is capable of sudden outbreaks with tree mortality as occurred in 1981 near Clinton.

Some insects, though of minor importance, are recorded because they have a potential to cause damage and are common in samples from forest hosts.

Cariboo Forest Region



PINE PESTS

Mountain pine beetle, Dendroctonus ponderosae

Mountain pine beetle is a primary killer of mature forests and during epidemics, of younger overstocked stands. Complete development takes one year.

Year	Remarks
1936	Small infestation along Cariboo highway north of Clinton. Major outbreak in Tatla Lake area west of Chilcotin River. 60% to 90% of lodgepole pine destroyed over area 161 km long by 40 to 64 km wide.
1948	Tree mortality in Bella Coola River valley, extending for many kilometers into Tweedsmuir Provincial Park.
1949	Tweedsmuir Park infestation between Stuie and Atnarko reported moving east and west along Atnarko River.
1951	Infestation continued in Stuie-Atnarko area.
1953	Infestation continued in Atnarko River area. Four ha of beetle killed lodgepole pine 14 km west of Puntchesakut Lake.
1954	Infestation near Puntchesakut Lake decreased to 8 trees. Infestation near Atnarko River spread into younger stands in lower part of valley.
1955	Small scattered groups of mature lodgepole pine killed in Narcosli Creek area.
1956	Infestation in Atnarko River area continued. Near Bowron Lake, 70% of trees in 60% pine stand were killed along lower slopes of Two Sisters Mountain.
1958	Atnarko River infestation declined. 25 trees killed near Joes Lake south of Springhouse.
1961	Scattered ponderosa pine infestations in the Clinton area, near Hayes Creek, Douglas Lake and east of 70 Mile House along Fly Creek.
1963	Ponderosa pine infestations continued near Clinton. An estimated 840 m ³ of lodgepole pine killed in Narcosli Creek valley.

Year	Remarks
1964	10 000 recently killed trees counted in Cariboo area, highest numbers at Bull Mountain, 5 000 and Tyee Lake 5 000; 10 ha infested at Cuisson Creek.
1965	10 000 trees at Bull Mountain-Williams Lake, 1 000 trees near Cuisson Lake, 2 000 over 121 ha south of Quesnel and 1 000 over 323 ha northwest of Alexandria.
1966	10 000 recently killed trees at Bull Mountain, Tyee, and Cuisson lakes and Williams Lake.
1967	10 000 trees at Bull Mountain, 475 at Cuisson Lake, 1 000 along Tingley Creek, 600 near Narcosli Creek and 120 near Eveline Creek.
1968	East of Williams Lake, 20 000 recently killed pine trees; Bull Mountain, 10 000.
1969	Infestation at Bull Mountain collapsed; highest numbers of recently killed lodgepole pine were 500 east of Williams Lake, and 2,000 near Cariboo Lake.
1970	Thirty trees killed near Cuisson Lake.
1971	Few recently killed pines recorded.
1972	Generally low populations in Region except near north end of Cariboo Lake where 720 recently killed lodgepole pine were counted.
1973	Populations remained at low levels.
1974	Counts of recently killed trees increased to 9 700 in the Region; Klinaklini River, 3 650 trees; Cariboo Lake, 1 500; Bald Mountain, 1 150; Cariboo Lake - Ditch Creek 700; Tyee Lake, 700; Little River, 400; Beaveridge Lake, 250; Little Lake, 200 and Tinmuskat Creek 200.
1975	Infestations expanded 6 fold to 140 000 trees over 14 900 ha. Aerial surveys disclosed recently killed trees as follows: West Chilcotin, 74 500 trees; East Chilcotin, 18 450; Williams Lake, 14 600; Tyee Lake, 6 700; Cariboo Lake, 6 200; Dog Creek - Jesmond, 6 905. Additional areas with from 100 - 600 recently killed lodgepole pine were scattered throughout the region.

Year

Remarks

1976

Estimated number of killed trees decreased to 85 000, however, area of pine killed increased to 15 800 ha, as follows:

Chilko PSYU	52 920 trees;	6 970 ha.
Stum " "	8 350 " ;	1 860 ha.
Narcosli "	350 " ;	60 ha.
SSA	25 " ;	5 ha.
Quesnel Lake	2 475 " ;	1 730 ha.
Williams Lake	8 625 " ;	1 540 ha.
Big Bar	10 315 " ;	3 390 ha.
Tweedsmuir Park	1 500 " ;	260 ha.

TOTAL	84 560	15 812
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1977

Infestations continue; 46 000 trees over 17 500 ha.

Chilko PSYU	33 070 trees;	12 897 m ³ ;	12 220 ha
Stum	4 275 " ;	2 650 m ³ ;	1 390 "
Narcosli	10 " ;	6 m ³ ;	10 "
Special Sale Area	100 " ;	18 m ³ ;	30 "
Quesnel Lake	1 000 " ;	730 m ³ ;	540 "
Williams Lake	1 100 " ;	748 m ³ ;	1 280 "
Big Bar	5 910 " ;	4 081 m ³ ;	1 860 "
Tweedsmuir Park	500 : ;	130 m ³ ;	250 "

46 000	21 260	17 500
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1978

Infestations increased to 863 470 trees killed over 31 240 ha

Chilko PSYU	830 400 trees;	328 856 m ³ ;	20 500 ha
Stum	12 100 " ;	7 502 " ;	4 470 "
SSA	40 " ;	25 " ;	20 "
Quesnel Lake	6 300 " ;	4 600 " ;	1 500 "
Williams Lake	5 700 " ;	3 875 " ;	1 090 "
Big Bar	8 800 " ;	5 984 " ;	3 580 "
Tweedsmuir Park	130 " ;	50 " ;	60 "

863 470	350 892 m ³	31 220
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Year	Remarks
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1979 Decrease in number of recently killed trees to 72 985.

Chilko	45 535 trees;	17 758 m ³
Stum	6 035 " ;	3 741 "
SSA	1 475 " ;	914 "
Quesnel L.	8 330 " ;	6 080 "
Williams L	6 930 " ;	4 712 "
Big Bar	4 680 " ;	3 182 "
	72 985	36 377

1980 The number of trees killed over the large area infested precluded counting of trees and in 1980, an estimate of the number of trees killed was derived from cruising at 18 locations and sketchmapping the area during aerial survey.

Mountain pine beetle killed an estimated five million trees or an estimated 2 650 000 m³ over 63 900 ha.

<u>TSA</u>	<u>Supply Blk.</u>	<u>Area infested (ha)</u>
Williams Lake	Cariboo	3 602
	Skelton	645
	Springhouse	4 990
	Palmer Lake	479
	Gaspard	5 090
	Chezacut	2 940
	Tatla	18 405
	Anahim	6 755
	Chilcotin	2 905
Quesnel	East Narcosli	145
100 Mile House	Meadow, Loon, Holden	6 160
	TOTAL	63 909

Year	Remarks		
1981	Area of recently killed pine continued to expand.		
	<u>TSA</u>	<u>Supply Blk.</u>	<u>Area infested (ha)</u>
	Williams Lake	Anahim	11 860
		Tatla	21 276
		Chilcotin	3 450
		Kloakut	2 660
		Chezacut	2 740
		Springhouse	5 770
		Gaspard	10 409
		Churn	4 096
		Palmer Lake	320
		Cariboo	4 660
	100 Mile House	Loon	180
		Meadow	4 940
		Holden	90
	TOTAL		72 450
	Area of pine killed prior to 1979:		
	<u>TSA</u>	<u>Supply blk.</u>	<u>Area infested (ha)</u>
	Williams Lake	Tatla-Anahim	35 900
1982	Increased to 222 000 ha; 13.6 million m ³ killed. Largest increases in Williams Lake TSA.		
	Williams Lake TSA	213 400 ha;	13 999 000 m ³
	Quesnel TSA	165 ha;	6 685 m ³
	100 Mile TSA	4 270 ha;	164 200 m ³
	Bowron Provincial Park	285 ha;	11 525 m ³
	Tweedsmuir "	2 560 ha;	163 840 m ³
	DND Military Block	1 150 ha;	47 230 m ³
		221 830	13 592 480

Lodgepole pine terminal weevil, Pissodes terminalis

The preferred host of this weevil is lodgepole pine, but it does attack western white pine and occasionally ponderosa pine. It is common in the Cariboo Region.

Year	Remarks
1962	Roadside trees attacked along Alexis Creek, Dean River and at Tatla Junction.
1963	10% of trees at Big Bar Lake and Dean River infested.
1964	30% of reproduction in old burn infested, at Big Creek.
1965	Infested leaders at Horse Lake, Young Lake, 70 Mile House, Big Bar Lake, Jesmond, Mile 104 Cariboo Highway, Gustafsen and Fletcher lakes.
1966	29% of leaders attacked at Tatla Lake.
1967-1971	Low numbers throughout Region.
1972	Scattered attacks on regeneration lodgepole pine along roads and in clearings in Cariboo and Chilcotin areas.
1973	Attack common on 10-30 foot trees in old burns or along roadsides throughout Chilcotin area. Most noticeable areas of damage were along Bella Coola Highway between Tatla Lake and Anahim.
1979	Immature lodgepole pine attacked throughout the Region. 100 trees at each of 8 locations were: 30-36% infested along Alex Graham Mountain road, 26% along Tatlayoko Lake road; 10% Eagle Lake; 2% Bosk Lake; 10-12% in Slough Creek and 6% near Swift River.
1980	1 to 9% of terminal leaders infested in four of sixteen natural stands.
1981-82	Scattered light attack recorded.

SPRUCE PESTS

Spruce beetle, Dendroctonus rufipennis

In British Columbia the spruce beetle usually has a 2-year life cycle. Some populations or parts thereof may mature in one to three years depending on geographical location, elevation and variations in the mean temperature of the spring and summer months.

Year	Remarks																		
1932	Occasional standing attacked spruce trees near Stanley in a spruce budworm infested area.																		
1933	Standing attacked trees in spruce budworm infestation south of Jack of Clubs Lake.																		
1962	100 mature spruce heavily infested near Hush Lake and 15 miles east of Quesnel in areas surrounded by wind felled trees. Populations in one year cycle.																		
1963	Heavy attack near Hush and Kenny lakes in Cottonwood PSYU, moderate attack near Wingdam and light attack eastward to Trigillus Creek. Heavy attack near Willow River area in Big Valley PSYU.																		
<table><tr><th><u>Location</u></th><th><u>Area (ha)</u></th><th><u>Volume(m³)</u></th></tr><tr><td>Cottonwood PSYU</td><td>3 652</td><td>247 436</td></tr><tr><td>Big Valley</td><td>6 512</td><td>239 680</td></tr><tr><td>TFL 5</td><td>792</td><td>60 060</td></tr><tr><td>Quesnel SSA</td><td>1 098</td><td>46 928</td></tr><tr><td>Total</td><td>12 054</td><td>594 104</td></tr></table>		<u>Location</u>	<u>Area (ha)</u>	<u>Volume(m³)</u>	Cottonwood PSYU	3 652	247 436	Big Valley	6 512	239 680	TFL 5	792	60 060	Quesnel SSA	1 098	46 928	Total	12 054	594 104
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1964	Tree mortality decreased but infestations continued in Cottonwood, Big Valley PSYUs and TFL 5.																		
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1965	Infestations continue but reduced tree mortality in Cottonwood Big Valley PSYUs and TFL 5.															
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	Beetle attack in 15 of 24 windfelled trees near 20 mile, Horsefly River Road. Bark samples showed 1 to .25 attacks per sq. ft. Light attack on few standing trees nearby.															
1966	Approximately 375 m ³ of timber killed over 24 ha in Big Valley area.															
1968	Few attacked trees in Cottonwood area.															
1969	Aerial surveys showed heavier 1968 infestations in Cottonwood River area than was indicated by ground surveys. Resurgence of this pest followed the warm dry 1967 summer and abundant local windfall. Severe infestations showed in the Quesnel and Cariboo lakes area (cruise strip disclosed 80% tree mortality at Weaver Creek and 40% at Spanish Mountain). This infestation covered 12 726 ha.															
1970	Infestation expanded to 26 260 ha in the Quesnel and Cariboo lakes area. This increase was due mostly to late color change of 1968 - attacked trees not counted in the 1969 aerial surveys. Populations of beetles in all areas were greatly reduced by an extremely cold 1968-69 winter.															
1971	In the Quesnel Lake area, infestations declined to 80.8 ha at Blackbear Creek, 40 at Spanish Lake, 242 at Abbot Creek and 40 at Tasse Lake. Total volume of spruce killed during the infestation was estimated at 1 019 520 m ³ .															
1974	Trace population near Quesnel Lake.															
1975	Low populations in windthrow trees in Bowron Lake area.															
1976	1 400 ha of spruce blowdown in Bowron Lake Provincial Park. 53% of blowdown attacked but only 36% contained established broods.															

Year	Remarks																								
1977	Brood development in blowdown in 2-year cycle. Further attack of blowdown and standing trees predicted for 1978.																								
1978	No standing white spruce beetle attack observed. Beetle populations in 1975 windthrow remained low.																								
1980	Spruce beetle killed trees over an estimated 100 ha near Kruger Lake, Indian Lake, Big Valley, Towkuh and Two Bit creeks in Willow and Bowron drainages.																								
1981	Over 13 000 ha of beetle killed spruce in Quesnel, Horsefly and 100 Mile Districts																								
	<table><tr><td>Bowron Lake Park</td><td>345 806 m³;</td><td>6 202 ha</td></tr><tr><td>Quesnel TSA</td><td>302 419 m³;</td><td>4 770 ha</td></tr><tr><td>Horsefly TSA</td><td>38 112 m³;</td><td>852 ha</td></tr><tr><td>100 Mile TSA</td><td>137 242 m³;</td><td>1 226 ha</td></tr><tr><td></td><td>823 579</td><td>13 050 ha</td></tr></table>	Bowron Lake Park	345 806 m ³ ;	6 202 ha	Quesnel TSA	302 419 m ³ ;	4 770 ha	Horsefly TSA	38 112 m ³ ;	852 ha	100 Mile TSA	137 242 m ³ ;	1 226 ha		823 579	13 050 ha									
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1982	10 885 ha infested with volume loss of 583 700 m ³ .																								
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Two-year-cycle spruce budworm, Choristoneura biennis

In the Cariboo Region eggs of this pest are laid in even-numbered years and the larvae overwinter in the second instar. In odd numbered years they develop to the fourth instar and again overwinter. The following year they feed on both new and old needles and complete their 2-year life-cycle.

Year	Remarks
1913-14	Severe infestation near Barkerville reported on white spruce and alpine fir, high percentage of young trees were not expected to survive. No further reports after 1914; assume infestation collapsed in 1915.
1921-25	Outbreak reported in the Barkerville area; increased in 1923 and epidemic in 1924.
1926	Infestation began at Wingdam and increased in severity toward Barkerville and Richfield. Defoliation of alpine fir and white spruce was equally severe. Estimated 3 100 sq km of severe defoliation.
1928	Defoliation in the Barkerville area continued.
1929	Barkerville; the outbreak near Barkerville was more or less active since 1921, if not longer, and extended over 1 554 sq km, mostly from 930-1 200 metres elevation. Mature alpine fir and white spruce were mostly affected. Outbreak reached a peak in 1924. For the greater part of the area little serious damage resulted. However, on the south side of Lightning Creek and in the vicinity of Jack of Clubs Lake, there was a large number of recently killed alpine fir which had been attacked by <u>Dryocoetes confusus</u> . Weather conditions were adverse in 1929.
1930	More defoliation than expected.
1932	Still epidemic, but declining populations.
1938	Outbreak reported at Barkerville. Fire season reported as severe.

Year	Remarks										
1939	Non-flight year, but outbreak continued in the Barkerville area from just west of Beaver Pass Creek to Cunningham Creek and from Meridian Mountain south of Barkerville northward for approximately 29 km (light defoliation); moderate defoliation occurred from Cunningham Creek on the west and is 14 km wide in a north and south direction; severe defoliation along Antler Creek, 1.8 km wide and 14 km long.										
1940	Widespread light defoliation in the vicinity of Barkerville. Severe defoliation southeast of Barkerville (Cunningham-Antler Creeks).										
1943	Outbreak near Barkerville continued.										
1946	Light defoliation in Barkerville-Richfield area between 930-1200 metres elevation.										
1952	Light defoliation near Wells and Bowron lakes.										
1954	Severe defoliation from Wells to Wingdam, light defoliation near Barkerville.										
1956	A general decrease in population.										
1960	Light defoliation in the Swift River Valley and moderate to severe defoliation along Cottonwood River.										
1962	Light defoliation along Cottonwood River.										
1964	Sovereign Creek, 15 sq km of moderate defoliation; Tregillus Creek, 31 sq km of light defoliation and east of Abbau Lake, 20 sq km of light defoliation.										
1972	No defoliation observed but population increase noted.										
1974	Defoliation over 40 000 ha: <table> <tr> <td>Hendrix-Bosk-Gotchin-McNeil lakes</td><td>8 500 ha</td></tr> <tr> <td>McKay-Horsefly river</td><td>13 000 ha</td></tr> <tr> <td>Little River</td><td>32 000 ha</td></tr> <tr> <td>Cunningham Creek</td><td>6 000 ha</td></tr> <tr> <td>Bowron Lake Park</td><td>9 700 ha</td></tr> </table>	Hendrix-Bosk-Gotchin-McNeil lakes	8 500 ha	McKay-Horsefly river	13 000 ha	Little River	32 000 ha	Cunningham Creek	6 000 ha	Bowron Lake Park	9 700 ha
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Bowron Lake Park	9 700 ha										
1975	"Off" year but some open growing small trees were 100% defoliated and understory trees lost 20-80% of current years foliage near Horsefly and McKay rivers.										

Year	Remarks												
1976	Light to moderate defoliation over 27 000 ha from Hendrix Creek to Bowron lakes.												
1977	Moderate to high population of presumably early instar larvae caused light defoliation of alpine fir along McKay River and in the Hendrix Lake area.												
1978	Defoliation from Hendrix Creek to Bowron Lake Park but generally lighter than in 1976. Severe defoliation over 3 800 ha in McKay River Valley. Light defoliation over 3 000 ha from Hendrix Lake to Bosk Lake, 575 ha northwest of Crooked Lake, 2 300 ha along Mathew River, 3 070 ha in Bowron Lake Park and 2 350 ha in the Grain Creek valley.												
1979	More severe than normal defoliation in "off" year throughout eastern portion of the Region. 50% defoliation of 1979 growth of alpine fir and spruce.												
	<table> <tr> <td>Hendrix Lake-Horsefly River</td><td>2 500 ha</td></tr> <tr> <td>Cariboo Lake and River</td><td>1 100 ha</td></tr> <tr> <td>Bowron Lake Park</td><td>17 000 ha</td></tr> <tr> <td>Big Valley Creek</td><td>3 300 ha</td></tr> <tr> <td>Grain Creek Valley</td><td>300 ha</td></tr> <tr> <td>Total</td><td>24 200 ha</td></tr> </table>	Hendrix Lake-Horsefly River	2 500 ha	Cariboo Lake and River	1 100 ha	Bowron Lake Park	17 000 ha	Big Valley Creek	3 300 ha	Grain Creek Valley	300 ha	Total	24 200 ha
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Grain Creek Valley	300 ha												
Total	24 200 ha												
1980	231 000 ha of alpine fir and spruce defoliated between Hendrix Lake and Bowron Lake Park. Damage generally light but patches of severe defoliation at headwaters of Horsefly, McKay, Mathew and Little rivers. Larval parasitism and disease reported in infestation areas for first time. There was also a decrease in the number of egg masses which indicates a possible decreased population in 1981.												
1981	A few mined buds in McKay River area, otherwise low populations throughout 1980 infestation area.												
1982	200 ha of trace defoliation of current growth near Willow River; no defoliation in stands defoliated in 1980.												

Spruce weevil Pissodes strobi

Preferred hosts are spruces but it also attacks lodgepole pine. This insect is common along roadsides or in other open sites such as plantations.

Year	Remarks
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1957	15 trees infested at Big Lake; 40% of 54 trees examined were infested at Horsefly Lake.
1958-62	Not reported
1963	8% of examined reproduction Engelmann spruce attacked in Horsefly Bay area.
1964	10% of examined reproduction Engelmann spruce attacked in Horsefly Bay area.
1965-76	Sporadic minor attacks.
1977-81	No damage reported.
1982	48% of 3 m high trees in 1968 plantation near Quesnel Lake area attacked: 8% in 1982, 30% prior to 1982.

DOUGLAS FIR PESTS

Douglas-fir beetle, Dendroctonus pseudotsugae

The Douglas-fir beetle has a one-year life-cycle with two broods per generation. Although there is considerable overlapping in the emergence and attack periods of the two broods, there are definite spring and summer flights producing one brood each.

Year	Remarks
1946	Horsefly Lake 10% beetle kill over 808 ha.
1949	Small outbreak reported south of Likely
1950	Scattered, recently killed trees noted along the Fraser River from Cottonwood to Blackwater rivers. Indications were that attacks had occurred in this area for a number of years.
1951	A few recently killed trees noted along the Fraser River from Quesnel to Hixon.
1952	Populations increased in the Quesnel District west of the Fraser River; patches of up to 16 ha.
1953	An estimated 1 000 recently killed trees on the east side of the Fraser River north of Cottonwood Canyon. Scattered attacks occurred on both sides of the Fraser from Narcosli Creek to Alexandria and for 32 km north of Williams Lake.
1954	Moderate to heavy attacks from Lac La Hache north to Soda Creek. Numbers of recently killed trees increased south of Quesnel on the west side of the Fraser River but decreased on the east side.
1955	Increased to 6 000 recently killed trees near Narcosli Creek and 400 in the vicinity of Marguerite. Active infestations occurred near 100 Mile House, Lac La Hache, Timothy Lake, Canim Lake road, and from Williams Lake to Macalister.
1956	Increased to 10 600 recently killed trees in the Narcosli valley and scattered groups around Macalister and Marguerite. Total of 6 200 recently killed trees from Williams Lake to 100 Mile House; the main areas being Macalister to Williams Lake, 1 600; San Jose to Lac La Hache, 4 500; 100 Mile House, 2 200. April studies showed up to 64% beetle mortality due to severe winter.

Year	Remarks
1957	Infestation intensity increased in the winter-damaged stands near Williams Lake. Highest concentrations of recently killed trees were near Williams Lake, 1 000 trees; Lac La Hache, 2 600, and at 100 Mile House, 1 150. At Lazaroff Lake an estimated 16 800 m ³ of beetle killed Douglas-fir timber was salvaged.
1958	An estimated 13 000 dead trees around Lac La Hache and Williams Lake. At Lazaroff Lake, 6 000 recently killed trees.
1959	Continuing infestations in the Cariboo, small groups of recently killed trees scattered along the Fraser River.
1960	Largest infestation at Joes Lake-Springhouse, 4 600 trees, and Riske Creek 1 500. Narcosli Creek-Buck Ridge infestations increased to 1 250 recently killed trees. Overwintering beetle mortality was 22% at Lac La Hache, 40% at 100 Mile House and 32% near Williams Lake.
1961	14 000 recently killed trees in the Cariboo. Unusually dry conditions caused many currently-attacked trees to drop their needles by August.
1962	1 700 recently killed trees in the Chilcotin River area.
1963	Highest counts of 37 000 recently killed trees were in the Chilcotin River area, southwest of Williams Lake and northwest of Clinton. Increase also south of Quesnel and along the Fraser River; Whiteslanding Creek, 580; Cottonwood Canyon, 230; Narcosli Creek, 580; Twan Creek, 100 and Tingley Creek, 260. Total volume of timber killed in the Quesnel area was 6 874 m ³ .
1964	29 600 recently killed trees recorded in the Cariboo and Chilcotin; decrease in the Quesnel area; largest infestation in the Narcosli Creek valley where an estimated 1 300 trees were killed.
1965	26 000 recently killed trees were recorded in the Cariboo and Chilcotin areas; tree mortality caused by beetles remained the same in Narcosli Creek area.

Year	Remarks																												
1966	Marked decrease; highest concentrations from Clinton to Dog Creek and in Chilcotin River Valley (5 000 trees).																												
1967	Further decrease; largest numbers 2 900 in the Williams Lake-Lac La Hache and Gaspard-Chum creeks areas.																												
1968	Largest numbers of recently killed trees were in the 1966 spring frost damaged stands in the Lac La Hache-Williams Lake area. There were 1 000 recently killed trees from Lillooet along the Fraser River, northeast of Williams Lake and west to Alexis Creek.																												
1969	10 000 recently killed trees along the Plateau from Williams Lake south to Dog Creek. Overwintering beetle mortality apparently was high.																												
1970-71	Negligible populations.																												
1972	Small groups of 5 to 10 recently killed Douglas-fir trees noted throughout Cariboo-Chilcotin areas. In Gang Ranch-Dog Creek-Gaspard Creek areas there were 470 trees counted.																												
1973	Locations of highest concentration of beetle-killed trees were: <table><tr><td>San Jose River</td><td>500 trees</td></tr><tr><td>Meldrum-Buckskin Cr</td><td>400 "</td></tr><tr><td>Hawks Creek Valley</td><td>300 "</td></tr><tr><td>McLeese Lake</td><td>200 "</td></tr><tr><td>Williams Lake River</td><td>200 "</td></tr><tr><td>Gaspard Creek</td><td>100 "</td></tr></table>	San Jose River	500 trees	Meldrum-Buckskin Cr	400 "	Hawks Creek Valley	300 "	McLeese Lake	200 "	Williams Lake River	200 "	Gaspard Creek	100 "																
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1974	Counts of recently killed trees increased to 7 500 <table><tr><td>Dog Creek</td><td>830</td><td>McLeese Lake</td><td>250</td></tr><tr><td>San Jose River</td><td>825</td><td>Gulatch Creek</td><td>200</td></tr><tr><td>Buckskin Lake & Cr.</td><td>720</td><td>Chimney Lake</td><td>200</td></tr><tr><td>Meldrum Cr.to Fraser River</td><td>670</td><td>Opp.Buckskin Cr</td><td>200</td></tr><tr><td>Hawks Creek Valley</td><td>680</td><td>Yorston Lake</td><td>200</td></tr><tr><td>Gaspard Creek</td><td>310</td><td>Duchworth Cr</td><td>200</td></tr><tr><td>Williams Lake River</td><td>275</td><td>Alexis Cr</td><td>200</td></tr></table>	Dog Creek	830	McLeese Lake	250	San Jose River	825	Gulatch Creek	200	Buckskin Lake & Cr.	720	Chimney Lake	200	Meldrum Cr.to Fraser River	670	Opp.Buckskin Cr	200	Hawks Creek Valley	680	Yorston Lake	200	Gaspard Creek	310	Duchworth Cr	200	Williams Lake River	275	Alexis Cr	200
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Year	Remarks																								
1975	Numbers of recently killed trees decreased to 4 700 <table><tr><td>Hawks Creek Valley</td><td>800</td><td>Lees Corner-Anahim</td><td>300</td></tr><tr><td>San Jose River-Jones Cr</td><td>600</td><td>Dog Cr-China Gulch</td><td>300</td></tr><tr><td>Meldrum Cr-Buckskin L.</td><td>600</td><td>Gaspard Cr-Churn L.</td><td>300</td></tr><tr><td>Chimney-Felker lakes</td><td>500</td><td>Chilko Lake</td><td>200</td></tr><tr><td>Williams Lake River</td><td>400</td><td>McLeese Lake</td><td>100</td></tr><tr><td>Macalister</td><td>400</td><td></td><td></td></tr></table>	Hawks Creek Valley	800	Lees Corner-Anahim	300	San Jose River-Jones Cr	600	Dog Cr-China Gulch	300	Meldrum Cr-Buckskin L.	600	Gaspard Cr-Churn L.	300	Chimney-Felker lakes	500	Chilko Lake	200	Williams Lake River	400	McLeese Lake	100	Macalister	400		
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Macalister	400																								
1976	Numbers of recently killed trees decreased to 250 <table><tr><td>Soda Creek and southward</td><td>150</td></tr><tr><td>McLeese Lake</td><td>30</td></tr><tr><td>Williams Lake to Dog Creek</td><td>60</td></tr><tr><td>Gang Ranch-Alexis Creek</td><td>10</td></tr></table>	Soda Creek and southward	150	McLeese Lake	30	Williams Lake to Dog Creek	60	Gang Ranch-Alexis Creek	10																
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1977	600 recently killed trees counted; 350 near mill site on north side of Williams Lake.																								
1978	A total of 160 beetle killed trees near Beaver Creek, McLeese Lake, Soda Creek, Dog Creek and Gaspard Creek.																								
1979	500 beetle killed trees at: Meldrum Creek 56, Desertus Creek 20, Websters Creek 10, Narcosli Creek 55, Alexandria I.R. 20, Cuisson Lake 25, McLeese Lake 20, Soda Creek 10, Canoe Creek 180, Big Bar 70, Stock Valley 10, and Hotnarko River 30.																								
1980	Small groups of 2 to 10 recently killed trees recorded near Soda Creek, McLeese Lake, Meldrum Creek, Springhouse, Dog Creek, Big Creek, Clinton and Hart Ridge.																								
1981	Recently killed trees in widespread areas: Higginbottom-Grinder Crs. 185, Dog Creek 400, Gaspard Creek 60 and Word Creek 70. Williams Lake to McLeese Lake 185, Military Block 100, Bonaparte River-Clinton 400.																								
1982	1 400 trees killed; Dog Creek and Empire Valley along Fraser River to Alexis Creek and Alexandria <table><tr><td>Williams Lake TSA</td><td>890 trees killed</td></tr><tr><td>100 Mile</td><td>" 335 "</td></tr><tr><td>Quesnel</td><td>" 175 "</td></tr></table>	Williams Lake TSA	890 trees killed	100 Mile	" 335 "	Quesnel	" 175 "																		
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Western spruce budworm, Choristoneura occidentalis

The western spruce budworm is a defoliator of Douglas-fir. Prior to 1972, budworm defoliation in the Cariboo Region was not recorded. However, since then, populations have been recorded annually causing light to severe defoliation.

Year	Remarks
1972	Light defoliation of regeneration Douglas-fir in Stuie area in extreme west location of Region.
1973	Light defoliation near Stuie
1974	Light defoliation near Kelly Lake near Clinton. Light population near Stuie but no defoliation.
1975	Light defoliation in small patches on Beckers Prairie near Riske Creek and at Kelly Lake near Clinton.
1976	Light defoliation near Kelly Lake. Small populations occurred in Douglas-fir stands throughout the southern portion of the Region.
1977	Infestations at Maiden Creek, Hart Ridge Scottie Creek, Loon Lake, Bonaparte River, north side of Clinton and along west side of Fraser River opposite Big Bar Creek. Defoliation was moderate to severe along Maiden Creek causing extensive top stripping.
1978	Populations declined and there was less defoliation and top-kill at Maiden Creek, Hart Ridge, Loon Lake, Scottie Creek and Big Bar Creek.
1979	Increased populations causing moderate to severe defoliation of Douglas-fir stands along Hart Ridge. Light defoliation near Loon Lake, Maiden Creek, Scottie Creek and Big Bar Creek.
1980	Defoliation over 10 600 ha: severe over 3 500 ha, moderate over 3 300 and light over 3 800; extending from Hart Ridge near Clinton and adjacent Highway 97 area along the ridge north and south of Maiden Creek, along Loon Lake and Scottie Creek.
1981	Decline; light defoliation over 5 000 ha along Hart Ridge, Loon Lake, Maiden and Scottie Creeks.
1982	Decline; 2 800 ha of light to moderate defoliation in Hart Ridge, Loon Lake and Big Bar Lake road areas.

Douglas-fir tussock moth, Orgyia pseudotsugata

An occasional important pest of Douglas-fir in the Clinton area capable of sudden outbreaks which usually result in some tree mortality.

Year	Remarks
1948	South of Clinton 1 600 ha of Douglas-fir were infested resulting in high tree mortality
1981	Sudden increase of population and light defoliation in the Maiden Creek, Loon Lake, Scottie Creek area except one severely defoliated patch approximately 1 ha, near Scottie Creek. Larvae began to show symptoms of nuclear polyhedral virus. By September larvae had spun cocoons but 80% did not pupate. Egg mass counts were low indicating a light population for 1982.
1982	500 ha severely defoliated south of Clinton near the Regional border. Up to 250 virus free larvae per three tree beating sample.

ALPINE FIR PESTS

Western balsam bark beetle, Drycoetes - Ceratocystis complex

The western balsam bark beetle, Drycoetes confusus in association with a blue stain fungus, Ceratocystis dryocoetidis, has killed large volumes of alpine fir but early reports of damage were sketchy.

Year	Remarks
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1923	More or less epidemic since 1922; a few alpine fir were attacked in the spruce budworm infestation near Stanley and south of Jack of Clubs Lake.
1929	From 25-50% of the alpine-fir killed over 15 sq km near Stanley and Jack of Clubs Lake. Trees weakened by repeated attacks of spruce budworm.
1930	Stanley-Wells area: 50% of trees in a 26 sq km area killed since 1925.
1931	Approximately 75% of alpine fir along the south side of Lightning Creek area dead.
1933	Decline occurred, due probably to heavy blowdown in area in 1932 and absorption of existing populations.
1969	599 recently killed trees near Quesnel Lake.
1970-71	Scattered groups of 50-100 trees around Quesnel Lake.
1972	Largest group of dead trees near Bonaparte Lake, 300; Isaac Lake, 140; Hendrix Creek, 130 and Spanish Lake 110.
1974	Recently killed trees at Moffat Lake, 500; Sovereign Creek, 400 and Buster Lake, 200.
1975	Increased incidence of tree mortality: Moffat Lake, 400; Molybdenite Creek, 300; Tisdall Lake, 200; Hen Ingram, Lake 200; Swift River, 100; and Spanish Lake, 50.
1976	Numbers of recently killed alpine fir trees decreased to 160: Mathew River, 60; Sovereign Creek, 50; Swift River, 30; Antler Creek, 20.
1977	750 recently killed alpine-fir at Big Timothy Mountain, Mathew River, Ghost Lake, Cariboo River, Swift and Dean rivers.

Year	Remarks
1978	Increased populations. Segutlat Lake, 220; Klinaklini River, 220; Tatlayoko Lake, 170; Franklin Arm-Chilko Lake, 550; and Matthew River, 150.
1979	Decreased to 100 trees along west side of Tatlayoko Lake.
1980	Further decrease to scattered single trees.
1981	Increased occurrence of recently killed alpine fir east of Highway 97: Clinton Creek, 2 small groups of trees; West of Bowers Lake near Windy Mountain, 9 groups and near Timothy Mountain, 4 small and 1 large group of trees.
1982	5 600 trees killed; increased south end of Tatlayoko and Chilko lakes and south east corner of Bowron Lake Provincial Park.

WESTERN HEMLOCK PESTS

Western blackheaded budworm Acleris gloverana

An important pest of western hemlock in the interior wet belt areas. The insect also feeds on Douglas-fir, spruce, alpine fir and occasionally on lodgepole pine.

Year	Remarks
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1967	18 900 ha of western hemlock along Quesnel and Mitchell lakes suffered from moderate to severe defoliation.
1968	Infestations in Quesnel Lake area collapsed.
1973	60% defoliation of current year's growth of alpine fir between Wingdam and Beaver House Pass.
1974-1982	No records of visible defoliation.

MULTIPLE HOST PESTS

Black army cutworm, Actebia fennica

Black army cutworms normally feed on ground cover but where this is lacking it will consume seedling foliage as in plantation areas.

There has been one outbreak recorded in the Cariboo Region in 1980 in the Jack Fire area, six miles south of Cottonwood House. Douglas-fir seedlings over approximately 10 ha were from 50 to 100% defoliated. Defoliation was limited to ridgetops where herbaceous ground cover was sparse.

Year

Remarks

1981-82 No recorded defoliation; active in other Regions.

DECIDUOUS TREE PESTS

Forest tent caterpillar, Malacosoma disstria

Major infestations of this pest have occurred on trembling aspen; they also occur on other deciduous hosts.

Year	Remarks
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1937	Severe outbreak between Williams Lake and Quesnel.
1941	Outbreak areas: 100 Mile House, Soda Creek, Beaver Valley, Fraser River, Horsefly, Forest Grove. Severest defoliation at Lac La Hache and in Beaver Valley.
1942-43	Outbreaks continued in the Cariboo; larvae were so numerous on railway tracks between Lone Butte and Horsefly that a train was delayed for 2 hours.
1949	40 ha of aspen, birch, willow, alder 90% defoliated near Moose Heights. Parasitism was high and there was evidence of disease.
1950	Moose Heights infestation collapsed.
1951	Sharp increase in localized infestations, large overwintering population; severe defoliation in Cottonwood Canyon and near Ten Mile Lake.
1952	Severe defoliation of aspen in vicinity of Beaver Creek north to Cottonwood River; moderate to severe defoliation west side of Fraser River from Quesnel north for 14 km and 19 km west of Bouchie Lake.
1953	Increased; Quesnel infestation expanded north along the Fraser River for 128 km. Starvation from overcrowding occurred in the Quesnel area, also polyhedral disease noted in some larvae.
1954	Infestations near Soda Creek, Williams Lake, Horsefly, east of Lac La Hache and 50 sq km along Horsefly Lake. Severe defoliation also occurred along the Fraser River from Macalister to Prince George.
1955	All infestations collapsed.

Year	Remarks
1972	Defoliated 60-80% of trembling aspen over 3 749 ha. Severe defoliation around Heyden Creek and Dragon Lake, 80% over 2 068 ha; 60% defoliation over 1 034 ha south of Cottonwood River and over 646 ha between Bouchie Lake and Moose Heights.
1973	Defoliation over 70 700 ha from Australian to Greening and 32 km along Wells-Barkerville road, 24 km along Blackwater, and 9 km along Nazko road.
1974-82	No recorded defoliation.

Fall webworm, Hyphantria cunea

Almost any deciduous tree or shrub will be attacked by this defoliator but the most common hosts are chokecherry, willow, trembling aspen, black cottonwood and rose. This insect, with its unsightly tents, is common in the southern portion of the Region and is not uncommon as far north as Williams Lake. No tree mortality has been attributed to this pest but it is a nuisance to home owners.

APPENDIX I. HOST TREE ABBREVIATIONS

<u>Abbreviations</u>	<u>Common Name</u>
eS	Engelmann spruce
wS	White spruce
bS	Black spruce
sS	Sitka spruce
alF	Alpine fir
gF	Grand fir
aF	Amabilis fir
D	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
O	Oak general