

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

1914 ~ 1981



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HISTORY OF POPULATION FLUCTUATIONS  
AND INFESTATIONS OF IMPORTANT  
FOREST INSECTS IN THE  
PRINCE RUPERT  
FOREST REGION

BY

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## INTRODUCTION

This report constitutes a history of some important forest insects in the Prince Rupert Forest Region since 1914. It serves to:

1. Designate the species of insects which have caused damage in the past and are presumably capable of causing damage in the future.
2. Record the pattern of population fluctuations.
3. Designate areas that appear to have chronic problems.
4. Point out the possibility of damage in different areas by insects, including species not known to have caused damage in the Prince Rupert Forest Region in the past.

Widespread sampling of insect populations began in the southern portion of the Province in 1946 and in the Prince Rupert Region in 1949, with the expansion of the Forest Insect and Disease Survey. Before 1946, surveillance was mainly confined to industrialized areas; therefore, reports of infestations in remote areas were sporadic. Observations have gradually improved due to expanded road systems and through the use of aircraft for surveillance of forest problems.

Until the early years of the Second World War, limited development in the Prince Rupert Region restricted commercial exploitation of the forests. Most of the logging and manufacturing was done by tie-hackers, part-time farmers and small independent loggers. Hundreds of small operations were scattered throughout the accessible forests. Daily and annual cuts were small and used locally. After the Second World War, with increased markets and better machinery, virgin forests were made accessible and losses from insect outbreaks were less acceptable. As second-growth timber in logged valleys becomes semi-mature, it may become more susceptible to insect attack.

The Prince Rupert Region encompasses 30.6 million ha. Of this 11.6 million ha are productive forest land. The volume of the timber on this land has been broken down into seven species groups as shown in Table I.

Table I

### Volume of Mature Timber

Species Type	Volume (m <sup>3</sup> )
Hemlock	901 680 000
Cedar & Fir	428 090 000
Spruce	345 220 000
Balsam	381 300 000
Lodgepole Pine	371 230 000
Deciduous	39 158 386
Other	669 552

Total: 2 467 300 000

Spruce beetle is a major pest in the Prince Rupert Region. Major outbreaks have occurred over extensive areas of mature and overmature white spruce stands since the 1940's. Spruce beetle, Dendroctonus rufipennis, is present in small numbers in windthrown trees and fresh stumps under normal conditions. Beetle populations are usually kept at low levels by natural control factors, such as woodpeckers and insect parasites. Outbreaks occur when the beetle outruns its natural controls. Preference is shown for trees of larger diameter.

Mountain pine beetle, Dendroctonus ponderosae, is a chronic problem in the interior portion of the Region. The mountain pine beetle infests mature pine forests often decimating them over extensive areas. During periods of low population levels there is a tendency for the beetles to select weaker, less vigorous trees for attack, but no such selection is evident during epidemic conditions.

The balsam bark beetle, Dryocoetes confusus, combined with a lesion causing disease, Ceratocystis dryocoetidis, has been recorded as a pest since 1949, killing large volumes of alpine fir throughout the host range in the Prince Rupert Region.

The blackheaded budworm, Acleris gloverana, has defoliated large areas of western hemlock, true fir and spruce in the Region. Outbreaks occur about once each decade and last up to four years. Little tree mortality has occurred directly as a result of these infestations, although some increment growth loss results from such defoliation.

The saddleback looper, Ectropis crepuscularia, caused extensive defoliation of western hemlock and alpine fir near Kitimat in 1960. Prior to this outbreak the pest was not considered a serious defoliator.

The two-year-cycle spruce budworm, Choristoneura biennis, has caused severe defoliation in the central portion of the Region. Near Kitimat a one-year-cycle budworm, C. orae caused extensive defoliation of amabilis fir and western hemlock.

The green-striped forest looper, Melanolophia imitata, a common defoliator of conifers in British Columbia, was not considered a serious pest until 1963. During that year severe defoliation and tree mortality was encountered on the Queen Charlotte Islands.

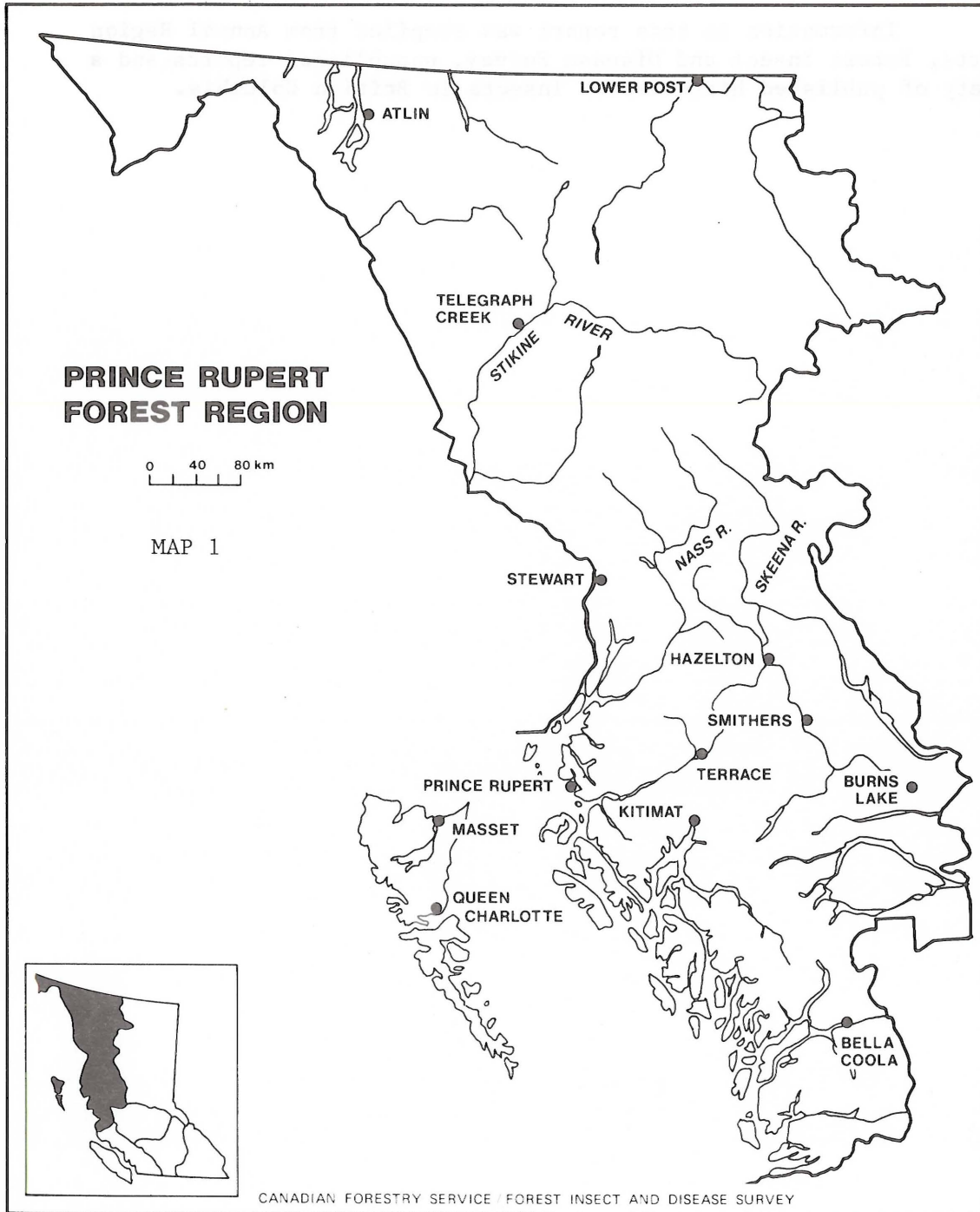
The black army cutworm, Actebia fennica, caused severe damage to over 750 ha of planted conifer stock during 1973 in the interior portion of the Region. This pest prior to 1973 had been known only as an agricultural pest.

Spruce aphids usually occur at endemic population levels in the Region. However, large populations of Adelges cooleyi in the central interior area in planted Douglas-fir and white spruce plantations caused moderate to severe damage to these tree species. The coastal provenance

Douglas-fir in the Nelson River area was destroyed. On the coast, Elatobium abietinum has been reported in large numbers since 1976. This aphid is a serious pest of ornamental spruce. Mortality has been reported in Sitka spruce on the Queen Charlotte Islands.

Information in this report was compiled from Annual Region Reports, Forest Insect and Disease Survey, unpublished reports and a variety of published histories of insects in British Columbia.







SPRUCE PESTS

Spruce beetle, Dendroctonus rufipennis

The spruce beetle is one of British Columbia's most damaging pests. Major outbreaks have occurred over extensive areas of mature and overmature white spruce stands in the Prince Rupert Region since the 1940's. The life cycle of the beetle is usually 2 years but may last 1 or 3. Control of the spruce beetle can be achieved by practising sanitary logging methods, quick removal of decked logs and logging of blowdown or infested stands.

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Year	Remarks
1914	"Reports of extensive (spruce) bark beetle injury to spruce farther up the coast and on Queen Charlotte Islands. It is possible that this beetle is the primary cause of damage but investigation was not possible". J.M. Swaine.
1927	Morrison Arm of Babine Lake, 47 square km, probably from 1922-27.
1947	An infestation of 4 ha was reported near Burns Lake.
1949	6.5 ha of spruce beetle reported near Palling.  777 square km reported in Upper Nass River Valley. Damage symptoms indicate population had been active for the past 4-5 years.
1950	No new attacks near Palling.
1954	Approximately 142 m <sup>3</sup> of spruce salvaged in small infestation near Rose Lake.
1958	A localized outbreak of spruce beetle resulted in the killing of 595 m <sup>3</sup> white spruce on a 13 ha site, 6.5 km south of Smithers.
1959	Tree mortality continued south of Smithers. Volume totalled 958 m <sup>3</sup> , an increase of 363 m <sup>3</sup> over 1958. Spruce stands from Cedarvale to Kitwanga Lake suffered heavy mortality from bark beetles. Tree mortality in some localities was up to 90% of the stands.
1960-1961	No reports of damage.

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Year	Remarks
1962	Severe infestation occurred on 89 ha of forest with 25 465 m <sup>3</sup> volume loss through beetle attack near east end of Taltapin Lake. Mature spruce were also attacked near Suskwa Trail, opposite McKendrick Island, opposite Old Fort Village, opposite Bear Island, Wright Bay, Fort Babine, Smithers Landing road, Topley Landing, Shoulder Mountain north end of Chapman Lake, and at John Brown Creek near Moricetown.
1963	68 826 ha total attack, 18 219 ha of severe attack throughout the Region from Henrietta Creek to Kitwanga. A large proportion of attacks occurred in Ootsa Lake, Francois Lake, Babine Lake, the Telkwa River Valley, the Morice Access Road and the Bulkley River Valley.
1964	Beetle attack over 93 036 ha; estimated 1 857 624 m <sup>3</sup> of white spruce killed in Buck Creek - Goosly Lake - Parrott Lake region, the Bulkley River Valley west of Moricetown and Hazelton, and the Kispiox - Sweetin River areas.
1965	Light attacks occurred at Burdick Creek, Parrott, Goosly, Helene and Binta lakes. Surveys indicate a reduced population to near normal levels.
1966-1972	Bark beetle populations remained low. A few trees attacked at Chapman and north Babine lakes in 1968.
1973	Spruce beetles were present in low numbers in white spruce near the Stewart-Cassiar Highway where recent right of way felling had taken place. Medium to high populations have been encountered in nearby Alaska for the past two years.
1974-76	Beetle populations remained low with a small infestation along Cranberry River.
1977	Spruce beetle infestations increased to 2 280 ha from 100 ha in 1976. The main area of attack was 2 200 ha near Smithers Landing. Minor infestations were reported in the Morice River drainage and S. of Telkwa.
1978	Spruce beetle infestations in the Prince Rupert Region were recorded over 16 800 ha in the Prince Rupert Region. The majority of this occurred in the region of Babine Lake, Old Fort Mtn., Morrison Lake, Smithers Landing and in the southwestern portion of the Morice River.

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Year	Remarks
1979	Beetle infestations decreased from 16 800 ha in 1978 to 11 170 ha in 1979. Houston, Telkwa, Nilkitkwa Lake, and Fleming Creek were the areas which contained a large portion of the beetle population. Extensive areas of attack also occurred near Old Fort, Wilkinson Bay on Babine Lake, Tachek Creek, Chapman Lake, and Reisetser Creek.
1980	Spruce beetle infestations increased slightly to 12 700 ha in 1980. The largest of 133 infestations covered 1 800 ha at Eutsuk Lake in Tweedsmuir Park and 1 700 ha in the Tagetochlain Lake and Hautete Creek areas. Mature spruce were also attacked in the Pimpernel Creek, Houston Tommy Creek, and McDonnel Lake, regions.
1981	Infestations were distributed over 6 200 ha with an estimated volume loss of 160 000 m <sup>3</sup> . In the Morice T.S.A. the spruce beetle killed an estimated 63 400 m <sup>3</sup> over 2 060 ha. The areas were in the Morice R., Poplar L., Parrott L., Walcott, and in the Hautete Cr. area. In the Bulkley T.S.A. 5 600 m <sup>3</sup> of wood was killed. Infestations continued in the McDonnel Lake, Trout Creek, Reister Creek and the Goathorn - Coffin Lakes areas. 41 000 m <sup>3</sup> of timber has been killed over 1 300 ha in the Lakes T.S.A. between Ootsa Lake and Tetachuck Lake. Patches of less than 5 ha were evident near Kitwanga Lake, extending over 100 ha. Beetles destroyed 11 000 m <sup>3</sup> over 1 500 ha along the Bell-Irving River. Infestations continued in the Eutsuk and Sigutlat areas and destroyed an estimated 37 000 m <sup>3</sup> of spruce on 1 100 ha.

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Spruce budworm, Choristoneura biennis

The principal hosts of the two-year-cycle budworm are alpine fir, Engelmann spruce and white spruce. Extensive areas of white spruce and alpine fir have been defoliated in the region west of the Bulkley River Valley to Babine Lake, Kispiox River Valley, Nass River and along Highway 37 from the second crossing of the Bell-Irving River south to Meziadin.

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Year	Remarks
1949	Small numbers of larvae collected near Babine and Pinkut lakes.
1950	Estimated 912 square km of defoliation north of Burns Lake in the southeastern section of Babine Forest Reserve. Up to 75% defoliation of spruce and alpine fir overstory.
1952	Medium population evident throughout Babine Lake area. Defoliation not as extensive as in 1950.
1954	Infestation in Babine Lake area showed signs of subsiding. Defoliation lighter on mature trees than in 1952, and severe on regeneration trees.
1956	Severe infestation on some 2 590 square km between Babine Lake and Cronin Mine road, and from Mt. Horetzky south to Tochcha Lake. Large moth flight in Babine Lake area.
1958	Infestation which encircles northern half of Babine Lake continued to cause severe damage. Aerial mapping of infestation shows 3 370 square km of defoliation.
1960	Light to severe defoliation extended from west of Bulkley River to Babine Lake and from Taltapin Lake in the south to about 64 km north of Nilkitkwa.
1962	The two-year-cycle budworm infestation in spruce and alpine fir stands has declined. Light defoliation recorded at northern end of Babine Lake from Old Fort to Nilkitkwa Lake. Medium defoliation at Chapman Lake and light at eastern end of Taltapin Lake.
1964	Infestation near Babine Lake continued to decline.
1966	Few budworm larvae found in Babine Lake area.

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Year	Remarks
1967-1978	Low populations.
1979	Light defoliation of new growth of alpine fir on 100 ha at Skunsnat Creek in the Kispiox River Valley. 63% of the collections were positive, containing an average of two budworms.
1980	Up to 90% defoliation of the current years foliage of mature alpine fir and white spruce along Highway 37 from the second crossing of the Bell-Irving River south to Meziadin Lake. Light defoliation also occurred at Skunsnat Creek in the Kispiox River Valley.
1981	A total of 39 000 ha of light to moderately defoliated spruce and alpine fir stands were mapped during aerial surveys in 1981. The major area of defoliation (37 570 ha) was between Vandyke and Bowser Lake, with moderate defoliation on 17 400 ha between Vandyke and Meziadin Lake and light defoliation over the remainder of the area. Lightly defoliated stands were recorded over 4 060 ha along the Babine River between Shedin and Thomlinson creeks, and also in the Kispiox River valley where 350 ha near Footsore Lake were visible from the air.

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The spruce aphid, Elatobium abietinum

The spruce aphid feeds almost exclusively on spruce, but has been recorded on pine and Douglas-fir. Mortality of spruce has been attributed to this aphid on the Queen Charlotte Islands and in the Prince Rupert and Port Edwards areas. The aphid is a serious pest of ornamental spruce. Populations are at their highest during late winter and early spring and practically disappear in summer. The spruce aphid feeds on old needles, sucking the sap from the needles. Epidemics in the forest are usually short term. Chemical control to be effective must be applied in March and April.

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Year	Remarks
1961	A severe and extensive outbreak of this aphid occurred on the Queen Charlotte Islands and along the coastal portion of the mainland section of the Region. Many of the mature spruce in Sandspit and Queen Charlotte City areas had lost all their old growth. Equally severe attacks were found as far south as Tanu Island and as far north as Masset. Although the aphid feeds mainly on the old growth, a considerable percentage of 1961 growth was also lost as a result of these attacks. Attacks occurred on all size trees in all types of stands.
1962.	Infestations decreased in intensity on the Queen Charlotte Islands and in the Prince Rupert area. Defoliation was light to moderate. The infestation extends as far south as Jedway on Moresby Island.
1963	The green spruce aphid infestation, although light on the mainland was prevalent throughout most of the Queen Charlotte Islands. Mature trees were severely defoliated and many around Sandspit and Queen Charlotte City have only short new twigs containing any needles.
1964-1965	Attack was very light.
1967	Spruce aphid caused discoloration and loss of 20% to 60% of the old foliage on about 20% of the Sitka spruce in the wooded areas around the north-east part of Prince Rupert. Lighter damage by this insect occurred on scattered trees on the Queen Charlotte Islands in the Sandspit-Alliford Bay and Skidegate-Tlell areas.

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Year	Remarks
1968	Infestations persisted on sapling and pole-sized Sitka spruce in the Prince Rupert area and at several localized areas on the Queen Charlotte Islands. In the Prince Rupert area there was up to 90% defoliation of the old foliage of shade trees in the parks and private residences. On the Queen Charlottes, aphids were active on fringe trees in the Skidegate-Tlell area and at Queen Charlotte City and Sandspit.
1969	Infestations have collapsed probably due to the severe winter of 1968-69.
1970	Spruce aphids appeared on Sitka spruce in the old infestation areas around Prince Rupert and Port Edward after a year's absence. Damage was much lighter than in 1968, and was confined to open-growing and border trees along roadways and shorelines. Approximately 30% of the old foliage of Sitka spruce trees along the exposed coastline south of Safety Cove, Calvert Island, and Bella Coola were infested by the green spruce aphid.
1971-1973	Not reported.
1974	Green spruce aphid defoliated shoreline Sitka spruce from Sandspit to Alliford Bay on Moresby Island, along Skidegate Inlet between Queen Charlotte City and Skidegate Mission, Tlell to Port Clements and near Juskatla. Single and scattered groups of trees were 50-80% defoliated.
1975-1976	Not reported.
1977	The spruce aphid caused severe discoloration and needle drop of shoreline Sitka spruce on the Queen Charlotte Islands and on the adjacent mainland in the Prince Rupert area. Some light needle drop occurred farther inland on the Queen Charlotte Islands.
1978	Population collapsed.
1979	Spruce aphids have caused moderate discoloration and needle drop of shoreline Sitka spruce on the Queen Charlotte Islands. Foliage browning was particularly evident between Sandspit and Alliford Bay and on Graham Island at Queen Charlotte City.

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Year	Remarks
1980	Defoliation of shoreline Sitka spruce occurred intermittently from Tlell south to Queen Charlotte City and between Alliford Bay and Sandspit. Cumulative defoliation since 1976 has resulted in some minor tree mortality, a few dead tops, and some trees with thinned foliage.
1981	Moderate to severe defoliation of coastal Sitka spruce was recorded on 5 020 ha. Feeding was most evident on open growing mature spruce along much of the east, north and to a lesser extent the west coastline of the Queen Charlotte Islands, and from the mouth of the Skeena River north to Portland Canal. There was 5 to 10% mortality on 320 ha between Queen Charlotte City, Tlell and at Gray Bay.



A seedling weevil, Steremnius carinatus

Damage by this pest in the Prince Rupert Region has been mainly confined to the Queen Charlotte Islands. The adults feed on many kinds of plant material, mostly dead. The larvae develop in the phloem of slash and in the roots of dead conifers. The adults cause damage by girdling 1- and 2-year old seedlings at the ground line, Douglas-fir and Sitka spruce are preferred.

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Year	Remarks
1961	Recognized as a pest on the Queen Charlotte Islands.
1962	Attacked and girdled up to 75% of planted seedlings over 80 ha south of Juskatla Inlet.
1963	This weevil is still prevalent in the Queen Charlotte Islands, although attacks were not as severe as in 1962. At Deena River, west of Alliford Bay on Moresby Island, 25 seedlings were girdled on one quarter hectare. A Company Forester at Juskatla examined seedlings and found up to 23% attacked and 12% dead with weevil injury in one area.
1964-1970	Not reported.
1971	Inspection of 250 container-planted trees near Juskatla that were planted in 1969, showed 40% of the seedlings had been attacked by this weevil and 25% mortality had occurred.
1972-1980	Not reported.
1981	This seedling weevil killed up to 50% of the Sitka spruce seedlings, planted during the late winter, 1981, near Alliford Bay and South Bay on northern Moresby Island. In three of four plantations examined, on the Island 20, 30, and 50% of the seedlings were killed respectively, with the highest incidence adjacent to landings and spruce stumps in which the weevils had been feeding.

Spruce weevil, Pissodes strobi

The weevil attacks and kills the year-old leader; consequently, the current year's growth dies as well. The first gross evidence of damage occurs when the new shoot begins to wilt and droop, usually in July. The needles eventually discolour, turn red, and drop by fall or the following spring. Damage results in multiple and crooked stems, loss of height growth and general bushiness. The spruce weevil has become more economically important with the advent of extensive reforestation. It has caused widespread damage to regeneration and pole-sized white, black and Sitka spruce throughout the mainland portion of the Prince Rupert Region.

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Year	Remarks
1949	Light damage in lower Skeena Valley. Moderate to severe damage near Terrace and Remo.
1951	Damage recorded at Terrace, Topley, Burns Lake, Morice River, Cedarvale and Kitsequecla River.
1952	Morice River and Babine Lake area, 10 to 50% of white spruce regeneration leaders infested.
1953	Population declined in most areas.
1955	Damage common in most open growing areas.
1956	27% of open growing, spruce regeneration infested near Sheraton Station.
1957	Damage found near Hazelton, Forestdale and Savory.
1960	Continued attacks at Ginlulach Creek, Terrace, Cedarvale, Skeena Crossing, Kitwanga and points between.
1961	Attacks were general throughout the range of Sitka spruce except on the Queen Charlotte Islands. In Kitimat River Valley about 15% of the trees over 1 meter high were attacked.
1963	40% of Sitka spruce regeneration attacked in Bella Coola River Valley. Damage common in Meziadin River Valley.
1964	Damage light in the Bella Coola and Telkwa River valleys and Buck Flats.

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Year	Remarks
1965	Attacked Sitka spruce common in Bella Coola and Kitimat River valleys. White spruce damage occurred at Telkwa, Kispiox valleys and Buck Flats.
1966	Sitka spruce leader damage common near Bella Coola.
1968	White spruce leader damage ranged from 1-13% at Telkwa and Morice rivers.
1969	27 localities sampled for attack intensity of weevils. Stands near Exstew, Salvus, Driftwood Creek, and Morice - West Forest Development Road were heavily infested (11-20%). Those at Shames, Priestly, Rose Lake, Jonas and Byman creeks were moderately infested.
1970	Average of 28% of trees had current leader damage at Morice River, Buck Flats, Byman Creek, Topley Landing and Chapman Lake.
1971-1975	Not reported.
1976	<u>Pissodes strobi</u> was common on white and Sitka spruce along both sides of Highway No. 16, between Prince Rupert and Burns Lake.
1977	New attacks were noted along the 60 km of highway between Smithers and Hazelton. A new attack area also occurred at Glacier Creek where 8% of the trees in the plot were attacked.
1978	Spruce weevil continued to cause minor damage throughout the Region. Attacked spruce were common at Houston, Smithers, Moricetown, Alice Creek and on the Kalum Lake road.
1979	Not reported.
1980	Spruce weevil infested 50 (6%) of 800, 9-year-old Sitka spruce planted on 6 ha near Kseadan Camp along the Nass River.
1981	Spruce weevil continued to cause leader damage throughout the Kitimat-Terrace-Prince Rupert area. Damage to leaders ranged from 14% at Nelson Creek to 30% at Onion Lake. Other areas were Andesite Creek, Kitimat River and Exchamsiks River.

Cooley spruce gall aphid, Adelges cooleyi

The Cooley spruce gall aphid is the most prevalent of the Phylloxerids that cause cone-shaped galls in the west. These galls are only of importance on seedlings and saplings because they kill the tips of branches and tend to stunt and deform trees. The hosts of the gall aphid include all spruce species and the alternate host Douglas-fir. The distribution of Adelges cooleyi in the Prince Rupert Region is restricted to the areas where Douglas-fir and spruce occur together.

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Year	Remarks
1960	The aphid has been detected in only a few localities on the mainland section of the Region to date. Attacks on individual Douglas-fir and Sitka spruce were found in the vicinity of Terrace.
1961	A few light attacks were observed in 1961 in a Douglas-fir plantation in the Kitsumkalum Valley and also on young white spruce at Seeley Lake.
1962-1965	Not reported.
1966	Light infestation found in Bella Coola Valley.
1967	<u>Adelges cooleyi</u> infestation occurred in Smithers, Telkwa and the Bella Coola Valley areas. Light damage.
1968	At Nelson River, aphids again caused severe gall formation on lateral branch tips of Sitka spruce over several hundred hectares of plantations. Trees suffering the severest damage were under 1 metre high. Attacks were common on white spruce regeneration in the Ootsa Lake and Morice Lake areas.
1969	Infestations were common in the Nelson River area north of Terrace. Light to moderate damage in Sitka spruce plantation.
1970	Cooley spruce gall aphid damage occurred in Sitka spruce plantations at Nelson River, Erlandsen Creek and Beaver River Flats. Aphids have been present in these plantations since 1960 when one small transplant Douglas-fir was severely infested. Heavy spruce gall aphid attacks in plantations at Nelson River have stunted and deformed some of the spruce trees. Douglas-fir trees of coastal provenance were more severely infested by <u>A. cooleyi</u> than Douglas-fir from the Interior.

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Year	Remarks
1971	In the Nelson River area the severely infested coastal provenance Douglas-fir were destroyed to lessen severity of attack on the adjacent Sitka spruce. A smaller area of Interior provenance Douglas-fir planted within a mile of the control-cut was left standing. Only a trace of gall aphid was found infesting these trees although white spruce adjacent to the plantation was moderately infested.
1972-1975	Not reported.
1976	<u>Adelges cooleyi</u> infested Douglas-fir planted on a large burn near Perow about 6 years ago. These Douglas-fir trees are out of their range on a pine-spruce site, providing the insect with the perfect alternate host situation.
1977-1980	Not reported.
1981	Adjacent to a 12 year old Douglas-fir plantation in the Perow Burn, the shoots on two branches from each of 25 white spruce trees were examined for galls. An average of 48% of the shoots were infested.

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Spruce budmoth, Zeiraphera spp.

Seven species of Zeiraphera feed upon western conifers, these are closely related, similarly appearing native species. The taxonomic confusion of the past led to many confusing survey records. Confusion persists regarding the species on spruce and true fir. The biology of the western budmoth is not recorded in detail. Z. canadensis and two other species of budmoth feed on Sitka spruce and the habits of these three species are believed very similar. Each young larva enters an opening bud and feeds on the new needles. As the twigs elongate, the partially eaten needles die and cause the trees to appear reddish brown early in the season.

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Year	Remarks
1951	Common in small numbers on white spruce and balsam in the Interior section of the Region.
1952	Late instar larvae damaged Sitka spruce in mid-June at Remo Flats, Exchamsiks River and Salvus Slough.
1953	Larvae attacked the tips of Sitka spruce throughout the Region. Twenty per cent of spruce tips were affected. The growth of the trees was not seriously affected.
1954	Populations declined. Only small numbers of larvae collected.
1955-1960	Low populations.
1961	From 70-80% of lateral buds of Sitka spruce attacked near Douglas Channel. Severe damage in Queen Charlotte Islands with terminal and lateral attack. Heaviest attacks on young reproduction Sitka spruce near Sandspit and Skidegate Lake. Heavy attack on Sitka spruce in Kitimat - Minette Bay area.
1962	Continued severe feeding at Douglas Channel; up to 70% and 80% buds infested. Damage on Queen Charlotte Islands determined as combination of <u>Zeiraphera</u> sp., <u>Epinotia</u> sp. and <u>Rhabdophaga</u> sp., continuing.
1963	Damage decreased slightly near Douglas Channel.
1964	Douglas Channel, 60% of tips infested. Queen Charlotte Islands, up to 32% of tips infested resulting from combination of attack. In eastern portion of Region, increase in numbers of larvae and damage apparent.

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Year	Remarks
1965	Populations declined throughout Region.
1966-1974	Low populations.
1975-1976	Spruce budmoth was common and caused light to moderate damage on Sitka spruce in the western portion of the Region. At Deena Creek on Moresby Island Sitka spruce had terminal and lateral bud damage. Dead tips were also common along the Skeena River between Terrace and Kitwanga.
1977	Infestations continued along Deena Creek on Moresby Island. Elsewhere populations were low.
1978-1979	Budmoths continued to cause deformed tops and laterals on 54 ha of pre-commercially thinned Sitka spruce at Spur 90 - Deena Creek on Moresby Island.
1980	Tip damage to laterals and leaders of Sitka spruce regeneration was greatly reduced at Deena Creek on Moresby Island. Based on historical data which indicates a five year damage period, spruce tip moth populations should continue to subside in 1981.
1981	Not reported.

Spruce sawflies, Pikonema spp.

There are two species of spruce sawflies in the Region on Sitka and white spruce. Pikonema alaskensis and Pikonema dimmockii. The greenheaded spruce sawfly, P. dimmockii commonly occurs with the yellowheaded spruce sawfly, P. alaskensis, but is considerably less damaging. The yellowheaded spruce sawfly damages and sometimes kills open-growing spruce. The larvae feed first on the new needles and then on the old.

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Year	Remarks
1957	Two collections, each containing one <u>P. alaskensis</u> larvae were made this year.
1958	Four collections of <u>P. alaskensis</u> averaged 1.5 larvae and four single larva were collected.
1959	The spruce sawflies, <u>Pikonema alaskensis</u> and <u>Pikonema dimmockii</u> increased in occurrence and numbers during 1959. Thirty-four collections averaged 5.0 larvae.
1960	The highest populations occurred at three locations in the southern portion of the Region. In Khutz Inlet near Butedale 140 larvae were collected on Sitka spruce. At Camp Point on Grenville Channel 147 were found on western hemlock and in Douglas Channel 158 were collected on Sitka spruce. This is a definite increase in the sawfly population from previous years. The sawflies were also common in the coastal portion of the Region.
1961	Spruce sawflies were commonly found in collections throughout the Region but no large numbers were found in any one sample.
1962	Eighteen spruce collections containing <u>P. dimmockii</u> averaged 27 larvae each and 12 collections containing <u>P. alaskensis</u> averaged 1.7 larvae.
1963	Sawflies continued to show up in small numbers. Eight collections averaged 1.7 <u>P. dimmockii</u> larvae and two collections contained four <u>P. alaskensis</u> .
1964-1966	Sawflies were common throughout the Region in moderate numbers.



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Year	Remarks
1967	A localized infestation of yellow-headed spruce sawfly occurred in a .5 ha plantation of white spruce in the vicinity of Nelson River north of Terrace. Larvae caused 10 to 90% defoliation of current foliage on about 50% of the saplings and some defoliation of old foliage on two saplings. This plantation of white spruce is more than 50 miles from the natural range of native white spruce and is completely surrounded by a Douglas-fir plantation. There has never been more than an endemic population of this insect recorded in the Region prior to this.
1968	Sitka spruce collections contained an average of 3.3 larvae per sample. A small infestation of sawflies continued in the Nelson River area in an exotic plantation of white spruce.
1969	Widespread at low levels. Continued defoliation occurred at Nelson River.
1970-1971	The Nelson River infestation subsided.
1972	Larvae were prevalent in collections made in the Houston and Bella Coola areas and also on the Queen Charlotte Islands.
1973-1978	Not reported.
1979	Sawfly larvae were found throughout the Region but there was no defoliation evident.
1980	Conifer sawflies defoliated up to 10% of the old growth of understory western hemlock between Burdick and Hazelton creeks. Elsewhere sawfly larvae were common in low numbers.
1981	Not reported.

PINE PESTS

Mountain pine beetle, Dendroctonus ponderosae

The main host of the mountain pine beetle in the Prince Rupert Region is lodgepole pine. Mountain pine beetle infestations are spotty at first; later if conditions are suitable, they will spread and coalesce to form large areas of attacked trees. The history of attack in the Rupert Region is persistent and fairly widespread. The main areas of infestations have occurred in the northern Babine Lake, Bella Coola Valley, Houston, Hazelton, Nass River, Harold-Price Creek, Kispiox River and Suskwa River regions. Lighter infestations have been recorded in Tweedsmuir Park.

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Year	Remarks
1949	Small infestation reported at Topley Landing.
1951	Infestation reported for 9 km along valley from Mosher Creek to Atnarko in Bella Coola region.
1953	An outbreak along higher slopes and ridges adjoining Babine Lake; east slope of lake between Fulton River and Bear Island. Near Morrison Lake 50% kill over 26 square km area.
1954	No damage reported.
1955	Numerous scattered groups of red-tops near Stule. New areas of attack along eastern slopes of Babine Lake from and including Morrison Lake south to a position northeast of Pierre Creek mouth.
1956	Morrison Lake along east shore of Babine Lake to a point opposite Pierre Creek. West side of Babine Lake opposite Bear Island. Volume calculated at 3 500 cu m.
1957	Slight decline of infestation along eastern shore of Babine Lake.
1958	Infestation in Bella Coola has declined. Surveys in the Babine Lake area indicated 257 000 cu m of lodgepole pine had been killed by this beetle in the past five years.

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Year	Remarks
1959	An additional 67 500 cu m pine killed by bark beetles. Total kill in Prince Rupert Region by mountain pine beetle from 1953 to 1959 was 324 700 cu m.
1960-1961	No damage reported.
1962	5,065 red trees counted in eastern portion of Region.
1963	An estimated 56 000 cu m of lodgepole pine killed from 1960-1963 in Kitwanga area. Increased attack near Wright Bay and Hagan Arm on Babine Lake. Estimated volume 7 940 cu m.
1964	Reduced attack.
1965	850 red-tops counted between Burdick Creek and Kitwanga River. Population decreased near Wright Bay and Hagan Arm.
1966	A few recently attacked trees near Wright Bay.
1967-1968	Low population.
1969	Scattered attack over (100 ha) north of Hazelton.
1970-1971	Approximately 1,200 red-topped lodgepole pine trees counted near Weegett and Burdick creeks.
1972	General increase in all known infestations as well as new attacks in the same general areas. New attacks at Harold-Price Creek, in the Kispiox River Valley and in the Kitwanga River Valley.
1973	An expansion of all infestations with new attacks east of Houston, in the Kitsequecla River Valley, near Kitwancool and near Kwun and Sharpe creeks in the Bulkley River Valley.
1974	An estimated 1 316 ha of lodgepole pine stands were infected in 1974, with a total of 17,100 trees. Main areas of infestations occurred near Suskwa River, Harold-Price Creek, Kispiox River, Kitwanga River and Hazelton.
1975	In 1975 there were in excess of 17,000 lodgepole pine killed on 2 040 ha at 48 locations extending from Ritchie to Babine Lake. Kitwanga, Hazelton, Smithers, Houston and Burns Lake were the general areas of infestations.

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Year	Remarks
1976	Mtn. Pine beetle infestations continue to increase with an estimated 18,000 beetle killed lodgepole pine in the District. Areas with continuing problems are Smithers-Houston, Harold-Price Creek, Suskwa River, Kispiox River, west of Hazelton and north of Kitwanga.
1977	There were 11,000 red-topped trees in the Region a reduction from the 18,000 of 1976. The only areas in the eastern portion of the District with continued infestations were at Cunningham Lake and Donald Landing. Beetles continued to kill trees along the Bulkley River between Smithers and Hazelton, and along the Suskwa and Kispiox River Valleys. The western portion (Hazelton and Kitwanga) still have large beetle problems. The third area of concern is in Tweedsmuir Park near the junction of the Dean and Takia rivers.
1978	23,000 dead lodgepole pine trees were mapped in 1978, twice as many as in 1977. The eastern portion of the Region experienced continued beetle damage at Cunningham Lake, Donald Landing and along Pierre Creek. In the western section of the Region beetles continued to kill trees along the Bulkley River, Smithers and Hazelton, the Kispiox River Valley and along the Skeena River from Hazelton to Doreen and north up the Kitwanga River as far as Vandyke Island in the Nass River.
1979	Infestations of mountain pine beetle on lodgepole pine were mapped on 4 800 hectares in 1979. Nearly 30,000 trees were killed, an increase of 30% over the 23,000 killed in 1978. General areas of infestations were along the Skeena River from Doreen to Hazelton, Kispiox River Valley, Harold-Price Creek, Suskwa River, north of Kitwanga, Bulkley River Valley and Babine Lake East.
1980	Aerial surveys of mountain pine beetle infestations revealed nearly 50,000 lodgepole pine trees killed on 13 200 hectares in 1980. This is a 67% increase over the 30,000 trees mapped on 4 800 hectares in 1979. The largest of 115 infestations in the Region continued in the Harold Price Creek area and significant infestations near Skeena River from Doreen to Hazelton, Kitwanga north to Nass River, Kispiox River, Suskwa River Valley, Bulkley River Valley and Babine Lake.

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Year	Remarks
1981	An estimated 190,000 mature lodgepole pine were killed over 5 700 ha. In the Bulkley TSA, 103,000 trees were recently killed on 1 730 ha, most of which was in the Harold Price Creek area. The 56,000 trees killed over 1 930 ha in the Kispiox TSA and TFL 1 were mainly scattered in 5 to 20 ha patches along the Kispiox River, east along the Suskwa River and southwest along the Skeena River. In the Morice and Lakes TSA's infestations continue primarily on south facing slopes along Babine Lake where 6 400 trees were killed on 180 ha. Beetles killed an estimated 23,000 trees over 900 ha in Tweedsmuir Park from Atnarko River to the southern border and in the Dean River area.

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ABIES PESTS

Alpine fir mortality caused by the Dryocoetes-Ceratocystis complex

Balsam mortality has been reported mainly in conjunction with spruce beetle attack in the Prince Rupert Forest Region. Unlike other tree species attacked by bark beetles, alpine fir retains red foliage up to five years instead of three, giving the impression from aerial observation of continuing attack. The number of beetle-killed trees recorded, vary annually due to limited aerial coverage rather than biological cycle.

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Year	Remarks
1949	Heavy alpine fir mortality in Upper Nass River Valley in conjunction with spruce beetle mortality, also severe mortality near Eutsuk Lake.
1962	Large numbers of red-tops and dead alpine fir along Babine Lake from Smithers Landing to McKendrick Island; 1,500 red-topped trees counted in Suskwa River Valley and 250 in Whitesail Lake area.
1963	Aerial surveys disclosed extensive balsam mortality in Babine, Nilkitkwa, Skeena, Suskwa, and Shelagyote River drainages. "Almost every stand of balsam in the District has been affected to some extent."
1964	Infestations over 161 950 ha in past 10 years; heavy mortality. Figures provided by the B.C. Forest Service show 560 000 cu m of dead alpine fir in a 5 265 ha infestation in Kispiox-Sweetin River areas. Further mortality expected but on a reduced scale.
1965	Several extensions in known range were observed. Current mortality was noted near Mill Creek west of Kitwanga and extensive damage extended along the Bell-Irving River.
1966	No sign of current balsam mortality in Bell-Irving River Valley. Current mortality slightly reduced in eastern portion of Region. Light to moderate mortality recorded at Chapman Lake, Nadina Lake, Cronin Mine Road and southwest of Old Fort.
1967	Reduced population. Red-topped alpine fir trees were observed in a high elevation stand at Swordgrass Lake, on the Kispiox Forest Development Road.

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Year	Remarks
1968	Beetle-killed alpine fir seen occasionally during aerial survey along Bell-Irving River Valley north of Meziadin Lake to Oweege Lake. Small patches of light to moderate attack along Sustut River Valley for a distance of 17 km.
1969	More than 1,100 dead alpine fir counted along Smithers Landing Road, between Ganokwa Creek and Cronin Mine Road. Numerous red-tops observed in Sustut River Valley.
1970-1971	Some alpine fir mortality evident in eastern portion of Region but has declined from previous year. Up to 15% mortality noted along the Morice River, north arm of Babine Lake and south of Gunanoot Lake.
1972	Moderate to severe mortality in McKendrick Creek and Telkwa River.
1973	Aerial surveys of McKendrick Creek and Telkwa River show 2,000 red-topped trees.
1974-1976	An estimated 5,200 dead alpine fir trees were detected during aerial surveys in the Region. McKendrick Pass, Dome Mountain, Hudson Bay Mountain, McCrea Mountain near Topley and Pendleton Bay accounted for 4,000 of these trees. The remaining 1 200 ha were spread throughout the Region.
1977	2,700 red-topped alpine fir were mapped in scattered patches near Smithers in addition to 5 900 ha in McKendrick Pass. Aerial surveys were not completed in 1977; therefore, comparisons of total tree mortality for the Region with earlier years are invalid.
1978	An estimated 8,300 red-topped alpine fir in scattered patches were mapped near Smithers, in addition to the 5 900 ha in the McKendrick Pass area, a chronic problem area with continuous alpine fir mortality.
1979	An estimated 7,000 dead alpine fir were mapped in scattered patches. Locations of killed trees were; McKendrick Pass, Dome Mountain, Morice River and Telkwa River.

Year	Remarks
1980	An estimated 8,000 alpine fir were killed in high elevation stands in the Region. Some of the more noteworthy infestation areas were; McKendrick Pass, Houston Creek, Eutsuk Lake, Dome Mtn., Nanika River and McDonnell Lake.
1981	This beetle killed an estimated 20,000 overmature alpine fir on 2 450 ha, primarily in the McKendrick Pass, Dome Mountain, in the Telkwa River drainage and in the White Pass area. Of the 30-40 beetle killed trees examined the average age was 266 years and twenty percent of the trees examined were infected by the heart rots, <u>Fomes pini</u> and <u>Echinodontium tinctorium</u> .



Spruce budworm, Choristoneura orae

This one-year-cycle spruce budworm is found in north coast stands, particularly around Kitimat and Prince Rupert on Sitka spruce, amabilis fir and low elevation western hemlock.

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Year	Remarks
1960	Severe defoliation of current year's foliage on amabilis fir from Terrace to Kitimat.
1961	Outbreak continued in Kitimat area. Defoliation extended from Bish Creek on Kitimat Arm to Lakelse Lake.
1962	Severe defoliation of amabilis fir on west side of Kitimat River and Kitimat Arm from Little Wedeene River to Jesse Lake.
1963	Severe defoliation of amabilis fir in Kitimat area for fourth consecutive year. Defoliation extended from Wedeene River Valley south along Kitimat River and Arm to Bish Creek. From 75 to 98% current year's foliage lost.
1964	1-year cycle budworm infestation near Kitimat declined to lowest level in 5 years.
1969	In conjunction with saddleback looper, spruce budworm caused moderate to severe defoliation of amabilis fir in Kitimat River area.
1970-1971	Caused no visible defoliation of amabilis fir.
1972-1973	Populations remain light.
1974	Trace levels at Kitimat
1975	Low populations near Bell-Irving River and trace levels at Kitimat.
1976-1979	Low populations.
1980	Light defoliation of amabilis fir was evident in the Kitimat Valley for the first time since 1969. Up to 50% defoliated in the upper crowns of overmature amabilis fir in leave blocks at Onion Lake and Hirsch Creek.
1981	Very few larvae were found and no defoliation was evident this year, probably because the majority of the larval population were in a second diapause thus maturing in a two year cycle.

HEMLOCK PESTS

Western hemlock looper, Lambdina fiscellaria lugubrosa

The western hemlock looper is periodically destructive in coastal forests of British Columbia.

Outbreaks develop in forests in which the preferred host, western hemlock, predominates. Associated Sitka spruce, fir, and Douglas-fir are also readily fed upon and understory shrubs may be defoliated. Heaviest losses of timber have occurred in extensive old-growth hemlock stands. The first feeding on the needles takes place in May, June and the early part of July. From July to October the feeding of larvae causes a heavily infested forest to turn yellowish red then brown.

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Year	Remarks
1958	The hemlock looper showed a slight increase in numbers in 1958 compared with 1957. The first collection to contain this insect was made in early June and the last in early July.
1959	The hemlock looper remained at a low level. Collections containing this insect were more widespread and for the first time the survey recorded two occurrences of the hemlock looper on the Queen Charlotte Islands. One collection at Crescent Point, Logan Inlet, contained two larvae and another collection on the Peel Inlet road contained one larvae. Both collections were made from hemlock in mid July.
1960	The hemlock looper decreased considerably from 1958 and 1959. Only 11 larvae were collected in five samples from western hemlock in various sections of the Region.
1961	Populations of this looper continued at a low level in the mainland section of the region in 1961. A total of five collections averaged 1.2 larvae each. No larvae were found in the Queen Charlotte Islands.
1962-1965	Hemlock looper populations remained low for the third consecutive year. Only four per cent of the collections made during the larval period contained larvae.
1966	The hemlock looper populations increased slightly in the Terrace-Kitimat area and Skeena and Nass River valleys. A total of 21 positive collections contained 36 larvae compared to 9 collections containing 14 larvae in 1965.

Year	Remarks
1967	There was a marked increase in the western hemlock looper populations at lower elevations in the Bella Coola Valley. One sample 2 miles east of Bella Coola contained 51 larvae.
1968-1981	Populations remained at low levels.

Blackheaded budworm, Acleris gloverana

The history of blackheaded budworm in the Prince Rupert Region has been of periodic outbreaks lasting from one to four years. When conditions favor a high population of the blackheaded budworm, the larvae cause extensive defoliation of hemlock, spruce, and several species of fir. Trees of all ages may be killed, top-killed, or severely weakened. The first recorded outbreak occurred in 1931 on the Queen Charlotte Islands from Masset to Lyall Island. Since this time infestations have been recorded from Portland Canal south to Bella Coola, Calvert Island north to Douglas Channel, Ootsa Lake, Morice River, Babine Lake, Bell-Irving River and the Telkwa River.

Minor infestations have occurred throughout the Rupert Region.

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Year	Remarks
1931	Severe infestation on hemlock from Masset Inlet to Lyall Island. Medium-heavy infestation along South Bentinck Arm.
1943	Severe defoliation of hemlock at Masset Inlet. Large moth flight observed at Darwin Sound on Moresby Island.
1944	Severe infestation on pole and reproduction hemlock near Masset Inlet.
1945-1948	No reports or observations made.
1949	Small numbers of larvae found in coastal areas.
1951	Two lightly defoliated areas at Ootsa and Pearl lakes; slight increase in collections generally.
1952	Larvae widely distributed in East Prince Rupert. Defoliation ranged from 10 to 75%. Severe hemlock defoliation at Kaien Island, Copper Bay on Moresby Island, Holum Lake, and Cedar River.
1953	Severe defoliation, Portland Canal, Observatory Inlet, Alice Arm, Queen Charlotte Islands, Kitsumkallum Lake and Lower Skeena Valley at higher elevations.
1954	Infestations continued but populations decreased on mainland; remained high on Queen Charlotte Islands from Masset and Alliford Bay to Skidegate Lake and Tasu Harbour.

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Year	Remarks
1955	Infestation continued on Queen Charlotte Island although population declined. Population collapsed on mainland section around Prince Rupert. High population at Ocean Falls, Nascall Bay, Bella Coola. Defoliation light at Labouchere Channel and South Bentinck Arm.
1956	Scattered light to moderate defoliation of hemlock near Labouchere Channel, Elcho Harbour and Bentinck Arm. Population near Bella Coola and on the Queen Charlotte Islands subsided.
1957	Slight increase in population on Moresby Island. At South Bay, 16 out of 25 trees had dead tops.
1958	Low population at Naden Harbour, Masset Sound and Moresby Island.
1959	Population increased to high from Skidegate Inlet to Jedway on Moresby Island.
1960	Populations on Queen Charlotte Islands decreased significantly. Larvae abundant from Grenville Channel to Observatory Inlet; defoliation light.
1961	Populations increased in Kitimat River Valleys; decreased to low levels on Queen Charlotte Islands, and along the south mainland coast.
1962	Increased population at Zymoetz River and Dean Channel. Defoliation minimal.
1963	Population decreased at Zymoetz River and Dean Channel.
1964	Larvae common in collections throughout Buck Creek - Morice River areas. Defoliation minimal.
1965	Larvae common in Southbank area (Francois Lake).
1966	Larvae common in Morice Forest on alpine fir and white spruce.
1967	Light defoliation of alpine fir and white spruce near Morice River access road.
1968	Light infestation along Morice River access road continues.

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Year	Remarks
1969	5% of current year's shoots of alpine fir and white spruce infested at Nilkitkwa Lake, Doris Lake and south of McKendrick Island.
1970-1971	Populations remained light.
1972	Ground surveys in July revealed low to high larval populations at Peel Inlet and Burnaby Island in the Queen Charlotte Islands and in localized stands from Calvert Island north to Douglas Channel on the mainland coast. Defoliation light.
1973	Blackheaded budworm reached epidemic proportions over much of the southern coastal stands, in localized stands on the Queen Charlottes and in three areas of the interior forests. Hectares of defoliation mapped were as follows: 108 500 ha along mainland coast from Ocean Falls to Hirsch and Dahl creeks north of Kitimat; 4 000 ha on Queen Charlotte Islands, (Lyell Island, Burnaby Island, Tasu Sound, Jedway, Deena River) and 1 200 ha of alpine fir in the interior portion of the Region (Ft. Babine Rd., Morice River access road, Andrew Bay area).
1974	In 1974, defoliation was sporadic south of Ocean Falls but increased in intensity and extent between Ocean Falls and Kitimat and expanded into areas north of Kitimat to the Bell-Irving River near Stewart. During 1974, there was lighter defoliation on the southern islands and heavy defoliation at Deena Creek, light defoliation north of Queen Charlotte City and Port Clements, moderate defoliation near Eden Lake and severe defoliation on Kwaikans Island in Masset Inlet. Light to medium populations persisted at Babine and Nadina lakes, and epidemic numbers of larvae were collected at Ganokwa Creek, Hudson Bay Mountain and Byman Creek.  Over 127 000 ha of defoliation, caused by blackheaded budworm feeding, were mapped on western hemlock, alpine fir and white spruce in the Prince Rupert Region.
1975	During 1975, populations declined substantially throughout the coastal zone except near Port Clements, where samples yielded up to 400 larvae per collection and light defoliation was evident. In the interior of the Region, populations remained moderate to high. Severe defoliation of new growth on alpine fir and spruce occurred near the Bell-Irving River, Telkwa River, and along the Fort Babine Road.

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Year	Remarks
1976	Populations in the Region were at their lowest level in 6 years. The incidence of larvae collected in beating samples was very low, except along the Bell-Irving River where three samples from alpine-fir averaged 50 larvae, a decrease from 400 per sample in 1975.
1977	Low population levels in the Region, only 7% of beating samples contained larvae. Highest populations were found at mile 18, Nilkitkwa road and Oweege Creek and Highway 37.
1978	The budworm remained at low population levels, only 6% of beating samples containing larvae. Highest populations were found on alpine fir at Chapman Lake. Some light defoliation of the current years growth of alpine fir and white spruce occurred for the third consecutive year along the Bell-Irving River at Glacier and Oweege Creeks and the second crossing of Bell-Irving River.
1979	Populations in the Region were up slightly from 1978. 12% of all beating samples contained larvae. Highest numbers were found on alpine fir along Babine Lake opposite Fort Babine.
1980	Low populations 13% of all beating samples containing an average of 5 larvae. Defoliation occurred for a half km along the Morice FDR and at Byman Creek. There was minor feeding on alpine fir and white spruce at Morice River and Chapman, Morice and Pinkut lakes.
1981	Alpine and white spruce were lightly defoliated by the budworm over 400 ha near Byman Creek, on 150 ha near km 57 of the West Morice FDR and on 120 ha at Rainbow Lake, near Francois Lake.

Saddleback looper, Ectropis crepuscularia

The saddleback looper commonly occurs with the hemlock looper and blackheaded budworm. Western hemlock is the preferred host. Douglas-fir, western red cedar, true firs, spruce, alder, willow and poplar are other principal hosts. Deciduous and ground cover is defoliated before heavy feeding becomes apparent on overstory trees. Until 1960, saddleback looper was not regarded as a dangerous forest defoliator.

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Year	Remarks
1960	Severe outbreak occurred at Kitimat on 5 260 ha on the west side of Kitimat River, up to 500 m elevation. Defoliation of hemlock was severe; coniferous understory also severely defoliated.
1961	4 220 ha of infested timber sprayed at Kitimat in June and July. Estimated 90% of larvae killed. Area of infestation was slightly over 6 425 ha. There was 100% mortality of suppressed and intermediate crown class hemlock and alpine fir over large areas. Mortality of dominant and codominant trees was lighter except for local pockets. Losses reached 4,000 bd ft per ha.
1962	The outbreak on hemlock subsided.
1963	Population at low levels at Kitimat.
1966	A few larvae collected at the fringe of the previous infestation at Kitimat.
1969	Defoliation from Wedeene River south to Emsley Cove. Severest damage south of Kitimat where 50% of overstory trees were defoliated. Severest defoliation occurred on hemlock and amabilis fir. Diseased larvae were found in August, and by September, the population was greatly reduced. Moderate numbers of larvae collected near Eden Lake on Graham Island.
1970-1971	Populations near Kitimat were low. Near Eden Lake, on Graham Island, beating samples from western red cedar and western hemlock averaged 95 and 75 larvae, respectively, as they did in 1969.



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Year	Remarks
1972-1973	Populations remain light.
1974-1978	No damage reported.
1979	Saddleback looper which caused no visible defoliation were found in 20 samples of western hemlock and Sitka spruce. The average number of larvae per beating sample was 3.2. The most significant was on the Queen Charlotte Islands at Rennell Sound. No larvae were obtained in the vicinity of Kitimat, site of the former infestation.
1980	Populations of saddleback loopers on western hemlock, Sitka spruce and western red cedar, increased significantly on the Queen Charlotte Islands, but there was no defoliation. The average number of larvae per positive sample increased to 12 in 1980. The highest populations occurred along Dolomite Narrows and at Rennell Sound.
1981	Populations remain low.

Green-striped forest looper, Melanolophia imitata

Green striped forest loopers are general feeders on conifers, but prefer hemlock, cedar, Douglas-fir and occasional feeders of broad-leaved trees and shrubs. This looper is an economic feeder; fairly high populations can occur before defoliation is noticeable. The green-striped forest looper had no history of severe defoliation and it was not considered a destructive forest pest until 1960. This pest is present throughout the Region in small numbers. The Queen Charlotte Islands is the only area that has experienced tree mortality due to green-striped forest loopers.

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Year	Remarks
1959-1961	Low populations. Average number of larvae per positive sample was 2.8.
1962	The occurrence and abundance of green-striped forest looper increased slightly in all areas, with an average number of larvae per sample of 6.3.
1963	There was a marked increase in populations of the green-striped-forest looper on Graham Island, and an above normal number of larvae in the Kitimat area. The largest collection, 180 larvae, was made just west of Tlell. The outbreak extended over 16 400 ha of hemlock-cedar-lodgepole pine-spruce stands on Graham Island; defoliation of hemlock and cedar was severe on 14 170 ha. Lodgepole pine and spruce were not defoliated.
1964	The infestation declined throughout most of Graham Island and in the Kitimat area. The infestation spread to the west side of Masset Sound in 1964, causing light to moderate defoliation on over 2 430 hectares.
1965	Populations increased slightly on the south coast. Looper populations on the Queen Charlotte Islands declined to a very low level in 1965.
1966	Populations remained at a low level in 1966.
1967	Populations increased in distribution and numbers compared to 1966. Throughout the Region, 67 positive samples contained 367 larvae.
1968	Populations increased slightly near Kitimat, elsewhere a decrease was noted.

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Year	Remarks
1969	There was an increase in the number of collections containing larvae but the number of larvae per collection remained about the same. On the Queen Charlotte Islands there was an increase in the abundance and distribution of larvae.
1970-1978	Low populations.
1979	The incidence of larvae in beating samples from western hemlock increased significantly in 1979, especially along coastal portions of the Region. The highest population was found near Belowe Lake on Grenville Channel.
1980	Larval populations on western hemlock and western red cedar increased for the second consecutive year especially along the coastal portions of the Region, no defoliation occurred.
1981	Larval populations of this looper decreased from 40% positive three tree beating samples to 10% in 1981.

MULTIPLE HOST PESTS

Black army cutworm, Actebia fennica

The black army cutworm feeds on the foliage of many herbs and shrubs. Occasionally it damages coniferous plantings on new burns devoid of vegetation. The cutworm has one generation per year and feeding occurs in the spring. The outbreaks of this cutworm in conifer seedling plantations have been mainly restricted to the eastern portion of the Prince Rupert Region.

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Year	Remarks
1964	Infestation occurred on 20 ha each in the Southbank and Houston areas. These infestations caused severe damage and some mortality.
1965-1972	Not reported.
1973	There was severe damage to widely scattered 80-150 ha blocks of newly planted lodgepole pine and white spruce seedlings at Quick, Goosly Lake, Tagetochlain Lake and Andrew Bay.
1974	Light feeding on herbaceous plants was noted at Chapman Lake, Lano Creek, Knockholt, Andrew Bay and Burdick Creek in the Interior and near Onion Lake in the coastal forest.
1975	Low populations
1976	Black army cutworm were detected in small numbers, feeding on scattered patches of fireweed and other broadleaved vegetation on the higher ridges within an 800 ha 1974 burn, along the north side of Fulton Lake.
1977-1981	Not reported.

Grey spruce looper, Caripeta divista

The grey spruce looper is a solitary feeder upon western hemlock, Douglas-fir, true firs, spruce, larch, western red cedar and pine. In British Columbia there is one generation annually. The eggs are laid in June. Larvae are present until mid-October.

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Year	Remarks
1961	An outbreak of this looper occurred in the Zymoetz River area. Light defoliation extended from the valley bottom up the hillside to 460 m elevation and in all stands along the south side of the river as far east as the junction of the Zymoetz and Kitnayakwa rivers and south along the Clore River to a point midway between Moraine and Elf creeks. Young understory hemlock and alpine fir had lost up to 40% of their current growth.
1962	In 1962 the population had declined considerably. Beating samples contained up to 200 larvae. No defoliation was noticeable.
1963	The localized outbreak of this looper in the Zymoetz River Valley has collapsed. Early in the summer, when the larvae were in the early instars, collections contained up to 40 larvae. At a later date, when they were nearing the last instar, very few larvae could be found.
1964-1981	Populations remained at low levels.

Yellow-lined forest looper, Nyctobia limitaria

This looper is common in British Columbia. It is usually a solitary feeder on foliage of many conifers, especially true firs, spruce, hemlock, Douglas-fir, and larch. It is rated a potential forest pest though no destructive outbreaks are recorded. Larvae are most often associated with other looper and tortricid outbreaks.

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Year	Remarks
1957	Three scattered collections containing this species averaged 1.6 larvae each.
1958	This looper continued to occur in the odd collection this year.
1959	The yellow-lined forest looper increased in numbers. Twenty-two collections on hemlock, alpine fir, and Sitka spruce, averaged 3.0 larvae per three-tree beating sample.
1960	Widely scattered collections throughout the Region increased slightly. Thirty-six collections on hemlock, Sitka spruce, and amabilis fir averaged 3.6 larvae each.
1961-1965	Populations remained low.
1966-1968	Populations increased to the extent that larvae were common in beating samples in all areas of the Region.
1969-1971	Not reported.
1972	Moresby Island and the Douglas Channel area showed that 40% of the 59 collections were positive containing an average of 2.7 larvae.
1973-1981	Not reported.

Sawflies, Neodiprion spp.

Of all the sawflies, the Neodiprion spp. are of greatest concern to western foresters. These sawflies attack trees of all ages. They feed on old foliage which weakens the trees, teamed with insects that feed on new foliage they become a real threat. Sawfly populations fluctuate greatly throughout the Prince Rupert Region.

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Year	Remarks
1960	<p>Fourty-four collections averaging 20.1 larvae were made on Sitka spruce. The highest populations occurred in Khutz Inlet near Butedale and in Douglas Channel near Cho Point.</p> <p>On western hemlock 44 collections average 19.6 larvae with the highest populations at Camp Point on Grenville Channel.</p> <p>Six collections on miscellaneous hosts averaged 3.1 larvae.</p>
1961	<p>Sawfly larvae were common and widespread in collections made on hemlock, spruce and balsam in the West Prince Rupert Region in 1961. They were more common in collections made in the Queen Charlotte Islands than in the mainland section of the Region. A small localized outbreak of <u>Neodiprion</u> was discovered on lodgepole pine between Port Clements and Tlell on Graham Island. Some young pines lost from 10 to 15 per cent of their current growth.</p>
1962	<p>The number of sawfly larvae found in 1962 increased considerably over that of the previous year. Three hundred and thirty-one larvae were collected from western hemlock on the east side of Johnson Channel near Ocean Falls. A total of 37 collections made on western hemlock averaged 26.1 larvae per sample. One mile north of Bish Creek on Douglas Channel, 287 larvae were found on Sitka spruce. Twenty-two collections from Sitka spruce averaged 19.5 larvae.</p>
1963	<p>Larvae of this genus of sawfly were common in the western portion of the Prince Rupert Region. The largest number approximately 600, was taken just west of Tlell.</p>

Year	Remarks
1964	Sawfly populations decreased in numbers considerably from 1963. The average number of larvae for the Region was 8.7/collection.
1965-1966	Common in the region but at low levels.
1967	Small infestation at Williams Creek.
1968	Populations of conifer sawflies increased throughout the Region, but remained low except at the head of Dean Channel where a moderate population of over 200 larvae per sample was found.
1969	Neodiprion spp. was widespread and found in 24% of beating samples. One collection from hemlock at Snootle Creek near Bella Coola produced over 1 000 larvae.
1970-1974	Widespread low levels.
1975	A Pine Sawfly defoliated shore pine on 92 000 ha on Banks, Pitt, McCauley and Porcher islands south of Prince Rupert.
1976	Pine Sawfly infestations on shore pine on the outer islands south of Prince Rupert are continuing and apparently moving northward. Only the current year's foliage (1976) remains on the shore pines.
1977	The infestation of sawflies on shore pine on the outer islands south of Prince Rupert appears to have collapsed south of Porcher Island. No new defoliation was noted, but heavy tree mortality resulting from 2 years of severe defoliation was evident along Grenville Channel on Pitt Island between Kxngeal Inlet and Rippon Point, a distance of approximately 30 km.
1978	Moderate to heavy defoliation of overmature western hemlock and some alpine fir occurred along the Skeena River south of Carrigan Creek (1 000 ha) and in the Kisplox River Valley near Ironside Creek (300 ha).
1979	Hemlock sawflies were common in collections throughout the Region. Two large patches of moderate to severe defoliation of overmature western hemlock and alpine fir occurred on 940 ha along the Skeena River south of Carrigan Creek and on 780 ha in the Kisplox River Valley near Ironside Creek.



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Year	Remarks
1980	Conifer sawflies defoliated up to 10% of the old growth of understory western hemlock between Burdick and Hazelton creeks. Elsewhere sawfly larvae were common in low numbers.
1981	A pine sawfly caused ten percent defoliation on lodgepole pine at Onion Lake, where 120 larvae were collected from a three-tree beating sample. The numbers of larvae collected from other conifers were low, with the highest, 75 larvae, collected from Sitka spruce at Emsley Cove south of Kitimat.

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DECIDUOUS TREE PESTS

Alder sawfly, Hemichroa crocea

Periodically it is abundant (in Prince Rupert Region) on Alnus rubra stripping the foliage from extensive stands. There are two generations per year. Feeding starts from the underside giving the leaf a characteristic riddled appearance. Feeding continues on a leaf until only the coarser midrib remains. Severe infestations of this sawfly on alder occurred on the Queen Charlotte Islands for 20-odd years prior to 1962.

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Year	Remarks
1945	Severe defoliation on the Queen Charlotte Islands. Most alder trees were completely defoliated from Port Clements to Queen Charlotte City.
1946	Present throughout Queen Charlotte Islands causing severe defoliation of alder in all areas.
1948	Alder sawfly was found in large numbers on willow near Prince Rupert. Queen Charlotte infestation continued.
1949	Light defoliation near Stewart and Lakelse Lake. Infestation in Queen Charlotte Islands declining.
1951	Light defoliation in Lakelse Lake area.
1952	Up to 50% defoliation at Skidegate Inlet, Masset Inlet, Skidegate Lake and Cumshewa Inlet.
1953	Distribution and intensity of the red alder sawfly declined. Tree mortality was more apparent than in previous years.
1954	No defoliation noted in Queen Charlotte Islands.
1957	Light to severe defoliation along the Nass River between Grenville and Aiyansh. 95% defoliation occurred in scattered patches at Skidegate, Charlotte City, Lawn Point, Alliford Bay and Sandspit.
1961	Severe defoliation on north end of Louise Island between Mathers Creek and Carmichael Passage. Defoliation noted also on south shore of Cumshewa Inlet in Queen Charlotte Islands.
1962	Light defoliation at Alliford Bay.

Year	Remarks
1963-1977	No reports of infestation after 1962.
1978	Light damage over several hectares on Kwaikans Island and for 1 km along the shore of Rennell Sound on the Queen Charlotte Islands.
1979	Young red alder trees were almost completely defoliated over 3 ha on Kwaikans Island in Masset Inlet, Queen Charlotte Islands. Moderate to severe defoliation occurred on roadside alder between Skidegate Mission and Miller Creek.
1980	Roadside alders near Skidgate Mission were lightly defoliated for the third consecutive year, but damage was much reduced from previous years.
1981	Not reported.

Forest tent caterpillar, Malacosoma disstria

The hosts of the forest tent caterpillar are poplar, birch, willow, alder and other deciduous trees and shrubs. This has been a chronic pest of poplar in the Babine Lake, Bulkley and Skeena River area since 1946. Infestations occur every 5-7 years, lasting 3 or 4 years. During epidemics poplars over wide areas may be 100% defoliated.

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Year	Remarks
1946	Completely defoliated poplar, birch, willow, alder and shrubbery over 200 ha adjacent to Hazelton - Smithers highway, 19 km from Hazelton.
1947	Poplar and willow completely defoliated for 26 miles from Moricetown to Skeena Crossing.
1949	Up to 100% defoliation in Morice, Bulkley and Skeena River valleys.
1954	50% defoliation of willow and poplar species adjacent to Kasiko River.
1959	Severe defoliation near Kitwanga, Telkwa and Kispiox River, also severe defoliation on east side of Bulkley River.
1960	Severe defoliation between Hazelton and Kitwanga in Skeena River Valley.
1961	Infestation increased in area. Severe defoliation on both sides of Skeena River from Cedarvale to Smithers. Egg counts indicate continuing infestation.
1962	Severe defoliation from Cedarvale in Skeena River Valley to Utsun Creek in Bulkley River Valley, also in the Kitwanga River Valley to Kitwanga Lake.
1963	Light to moderate defoliation from Cedarvale to Hazelton. Outbreak in Bulkley River Valley spread eastward with severe defoliation around Smithers and Telkwa and on both sides of the valley to Houston.
1964	Severe defoliation occurred on aspen in Bulkley River Valley from Telkwa to 8 km east of Houston. Patches of defoliation occurred from Telkwa to Smithers and along the Skeena River from Cedarvale to Hazelton.

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Year	Remarks
1965	Infestation in Bulkley River Valley subsided.
1969	Severe defoliation of cottonwood and other deciduous trees around Terrace and West along Skeena River to Kitwanga, also on islands in the Nass River between Aiyansh and Grenville.
1970	Approximately 240 ha of trembling aspen defoliated in the Aiyansh area. Egg sampling indicated a high population in 1971.
1971	Population declined. Moderate defoliation along Skeena and Nass rivers caused by western tent caterpillar.
1972	Damage by the western tent caterpillar decreased in the Terrace area and was not detected in the lower Nass River Valley. Individual shrubs and poplars in Terrace were partially defoliated, but overall defoliation was light.
1973	Light endemic populations.
1974	Numerous small groups of poplar infestations near Kitimat.
1975-1980	Not reported.
1981	Light defoliation of deciduous trees occurred on 22 ha near Meziadin Lake.

Insects of minor significance

<u>Insect</u>	<u>Host</u>	<u>Remarks</u>
<u>Cecidomyia</u> sp. A pine midge	lodgepole pine	Moderate to severe damage from Terrace to Hazelton, Beam Stream road, Kalum River Block and near Kitwancool. Up to 40% tops killed in 1972. Populations decreased in 1973.
<u>Chrysomela</u> <u>scripta</u> A leaf beetle	willow	Caused extensive defoliation of willow and cottonwood in the Nelson River area in 1968.
<u>Hylobius</u> <u>warreni</u> Root weevil	lodgepole pine	Root collar weevil caused mortality of scattered exposed saplings in the Bulkley Valley, Burns and Ootsa lakes in 1971. In 1980 this weevil killed up to 5% of seedling size to 15 year old lodgepole pine in small scattered groups of 2 to 5 trees at the Perow Burn, Nilkitkwa Lake and in several plantations along the Nass Road near Kiteen River.
<u>Neophasia</u> <u>menapia</u> Pine butterfly	Douglas-fir	Defoliator. Large flights of butterflies observed. No significant defoliation recorded.
<u>Phyllocnistis</u> <u>populiella</u> Aspen leaf miner	trembling aspen	Large populations from Terrace to Burns Lake from 1961 to 1970 and from Smithers to Hazelton in 1976.
<u>Pleroneura</u> <u>borealis</u>	amabilis fir	Common in the western portion of the District. Up to 20% of the tops were infested, 1971-72, between Terrace-Kitimat.
<u>Pseudohylesinus</u> <u>grandis</u> A fir bark beetle	amabilis fir	Secondary bark beetle. Present at Kitimat following saddleback looper infestation - 1961.

APPENDIX I. HOST TREE ABBREVIATIONS

<u>Abbreviations</u>	<u>Common Name</u>
eS	Engelmann spruce
wS	White spruce
bS	Black spruce
sS	Sitka spruce
a1F	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
1P	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