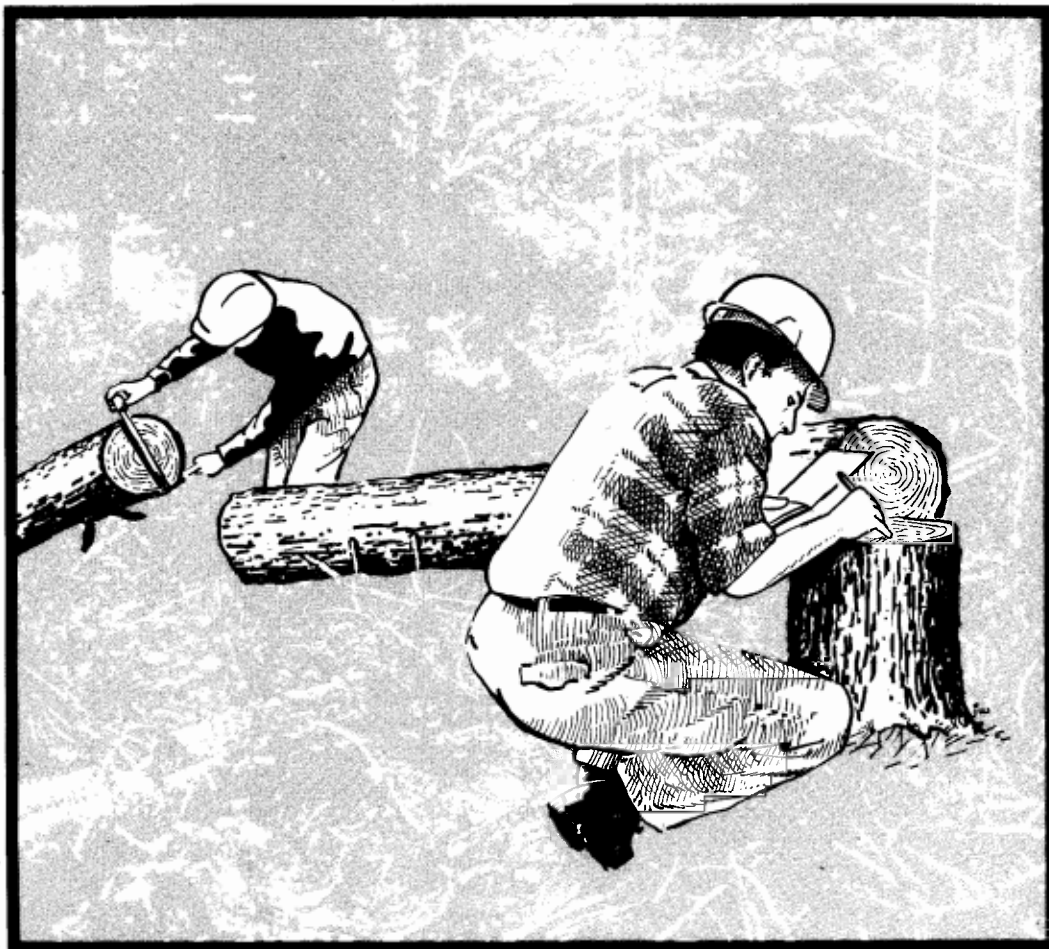




Forest Insect and Disease Conditions

Cariboo Forest Region
1982

R.J. Andrews



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TABLE OF CONTENTS

	Page
SUMMARY	1
PINE PESTS	5
Mountain pine beetle	5
Dwarf Mistletoe	12
Lodgepole pine terminal weevil ...	12
Pine needle cast	12
Pine stem rust	12
SPRUCE PESTS	12
Spruce beetle	12
Two-year-cycle spruce budworm	15
DOUGLAS-FIR PESTS	15
Douglas-fir beetle	15
Western spruce budworm	17
Douglas-fir tussock moth	18
ALPINE FIR PESTS	18
Western balsam bark beetle	18
PESTS OF NATURAL AND MANAGED SECOND GROWTH STANDS AND PLANTATIONS	19
Dwarf mistletoe	19
Armillaria root rot	19
White Stalactiform blister rust ..	19
Western gall rust	19
Foliage disease	20
CONE AND SEED PESTS	23
DECIDUOUS PESTS	25
Forest tent caterpillar	25

SUMMARY

This report outlines forest insect and disease conditions in the Cariboo Forest Region in 1982, and attempts to forecast pest populations with emphasis on pests capable of sudden damaging outbreaks. Pests are listed by host in order of importance.

Mountain pine beetle killed an estimated 50 million trees over 222 000 hectares with an estimated volume loss of 13,600,000 m³. Severe infection by lodgepole pine dwarf mistletoe was common on understory regeneration and mature trees in mountain pine beetle killed stands near Tatla Lake. From 2 to 14% of the leaders of regeneration lodgepole pine in 8 stands west of the Fraser River to Anahim were infested by a pine terminal weevil. A pine needle cast infected from 20 to 90% of the older needles of regeneration lodgepole pine throughout the Region.

Spruce beetle-killed trees were recorded over 10 800 hectares, an estimated volume loss of 584,000 m³. Spruce weevil infested up to 14% of spruce regeneration near Mitchell Bay along Quesnel Lake. Two-year-cycle spruce budworm populations were low in spruce-alpine fir forests east of Quesnel and Horsefly and little defoliation was observed.

Alpine fir mortality caused by balsam bark beetle increased to 5,770 trees primarily south of Chilko and Tatlayoko lakes.

The number of Douglas-fir beetle-killed trees remained stable at 1,400 trees in 1982. Western spruce budworm lightly defoliated 2 800 hectares of Douglas-fir in the Clinton area and near Hart Ridge and Loon Lake. Douglas-fir tussock moth severely defoliated Douglas-fir over 500 hectares south of Clinton in Scottie and Loon creeks and lightly defoliated trees on less than 10 hectares along Hart Ridge.

Western forest tent caterpillar severely defoliated 490 hectares of trembling aspen near Bonaparte and Bridge lakes and north of Black Creek east of Horsefly.

Cone and seed pests lightly infested heavy Douglas-fir cone crops and moderately infested a heavy white spruce cone crop at 24 sample locations.

The Forest Insect and Disease Survey program extended from May 18 to August 26. A total of 165 samples contained 125 forest insect collections, 90% of which were positive, and 40 disease collections, all submitted to Pacific Forest Research Centre by the Regional Survey Technician and personnel from industry and other forestry agencies. Locations where one or more insect or disease samples were collected are shown on Map 1.

Forty-eight hours of fixed wing flying were supplied by the B.C. Ministry of Forests, in August, to map bark beetle and defoliator infestations; the areas flown during aerial surveys are shown on Map 2.

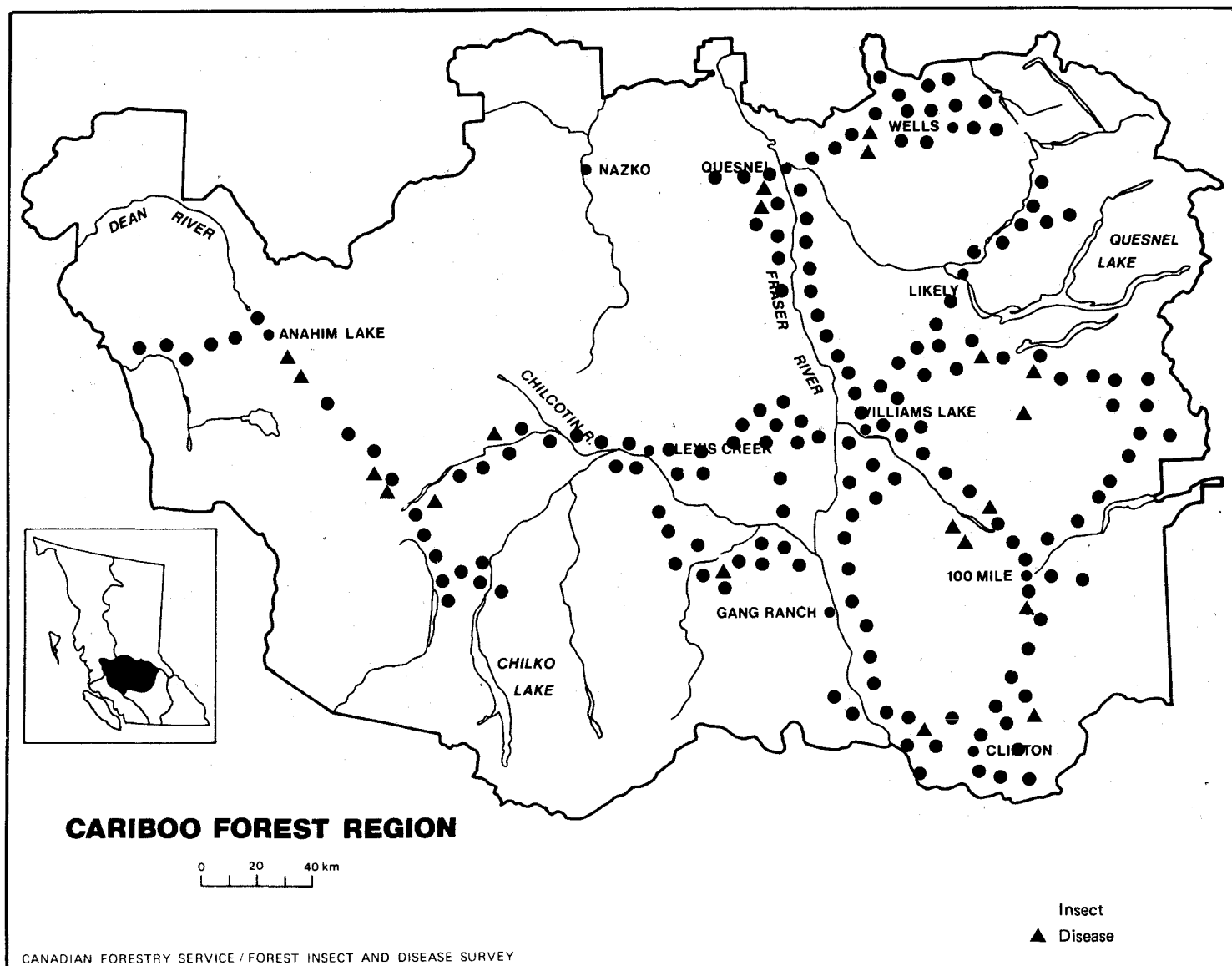
Special surveys, partially funded by B.C. Ministry of Forests, were conducted to appraise bark beetle and defoliator infestations from September 20 to October 6.

Fifteen hours were used throughout the summer in liaison with forest agencies and parks in relation to pest problems and cooperative surveys.

Two special collections of 150 tussock moth larvae were sent to the Biological Control unit at PFRC, Victoria, and one collection of 200 western spruce budworm to Forest Pest Management Institute for possible insect disease determination.

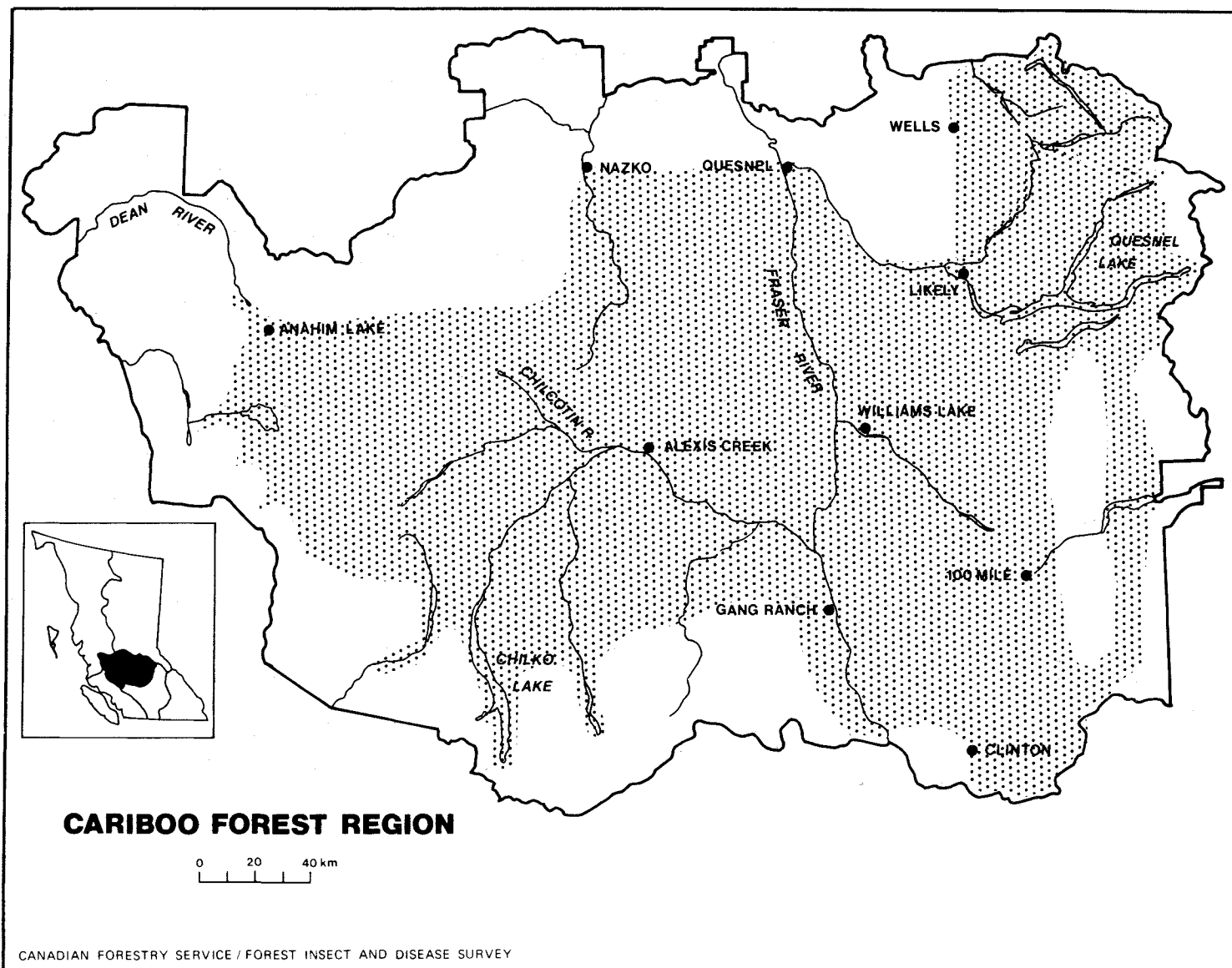
Ten provincial parks were examined for pest problems or incidence of unsafe trees.

Gypsy moth pheromone baited traps set out at Lac La Hache, Canim and Green lakes provincial parks to monitor this pest were negative.



Map 1

Locations where one or more forest insect or disease samples were collected, 1982



PINE PESTS

Mountain pine beetle, Dendroctonus ponderosae

Aerial surveys showed a dramatic increase in areas of mountain pine beetle infestations in Cariboo Region (Map 1) to 222 000 hectares, with an estimated volume loss of 13,600,000 m³ (Table 1) compared with 73 000 hectares and 2,140,000 m³ in 1981. The increases result from the increased incidence of 1981 beetle attacks, improved recording methods, increased flying time and the employment of a flight grid system, similar to that used by the B.C. Ministry of Forests

The largest increases of beetle killed pine were mainly in the Williams Lake Timber Supply Area (TSA). However, there were some Supply Blocks (SB) in Williams Lake and in 100 Mile TSA's that stabilized or decreased in outbreak area.

Williams Lake TSA: Anahim SB, increased to 45 630 ha in 1982 from 11 860 in 1981; increased area of attack near Charlotte Lake and along Dean River. Increased area of attack along Klinikleena River to height of land south and west in previous attacked stands (Upper Klinikleena River not surveyed in 1981).

Tatla SB; increased to 72 840 ha in 1982 from 21 276 ha in 1981, increased in area and attack intensity north of Tatla Lake including upper Chilanko River and Chantslar Lake areas. Increased area and intensity south of Tatla Lake from Sapeye-Horn lakes east to Cochin, Choelquoit, Brittany and Bidwell lakes. (Area near Horn and Bluff lakes not surveyed in 1981.)

Chilcotin SB; increased to 19 760 ha in 1982 from 3 454 ha in 1981, increased attack in 1982 in Middle Lake area and south along Morley River drainage to Homathko River. Increased attack along both sides of Tatlayoko Lake particularly near the south end. Increased attack near Tsuniah, Konni, Vedan and Elkin lakes area. (Morley drainage not surveyed in 1981.)

Kloakut SB; increased to 28 590 ha in 1982 from 2 660 ha in 1981, increased patchy attack on both sides of Chilko River from Bidwell Lake to Chilcotin River and Alexis Creek and in the Big Creek drainage.

Chezacut SB; increased to 20 175 ha in 1982 from 2 740 ha in 1981, increased area and intensity of attack near Puntzi Lake and Mountain area to Chilcotin River extending northward in patches to Punkutlaenkut Creek.

Palmer Lake SB; increased to 3 650 ha in 1982 from 323 ha in 1981, increased patchy attack north of Alexis Creek extending north to Stum, Palmer, Tanilkut lakes and near Aneko Creek.

Churn SB: decreased slightly to 3 700 ha in 1982 from 4 100 ha in 1981, infestation becoming stable in area mapped.

Gaspard SB; remained stable in area with 10 400 ha mapped in 1982 and 1981.

Springhouse SB; reduced to 4 970 ha in 1982 from 5 750 ha in 1981; decrease probably from intense logging of infested stands.

Cariboo SB; reduced area of recently killed trees along northwest side of Cariboo Lake, however, continued patchy attack along southeast side of the Lake and along Cariboo and Little rivers.

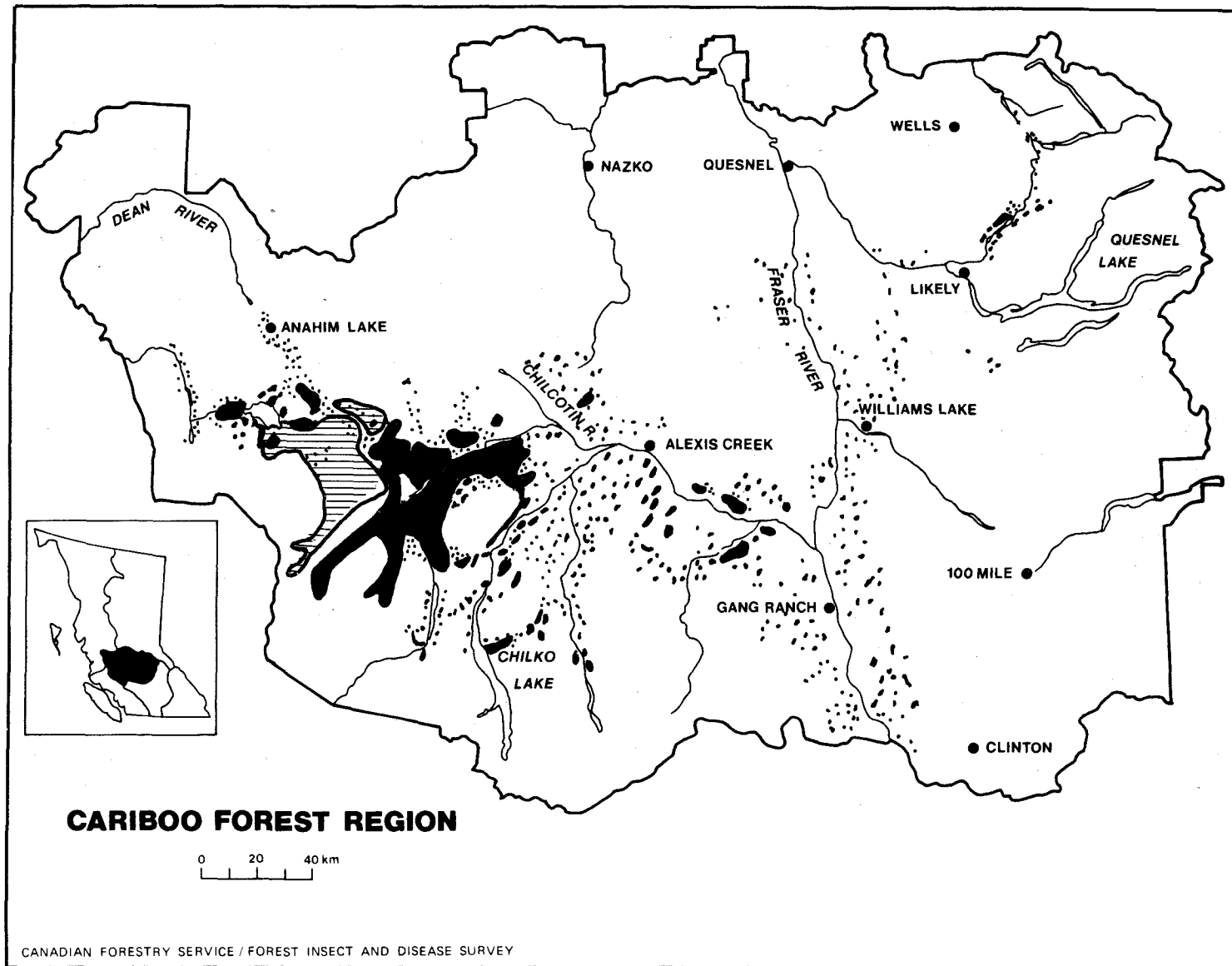
100 Mile TSA: Loon, Meadow and Holden SB; decreased in area probably from intense logging of infestations in Jesmond, Dog Creek areas.

TABLE 1. Location, area and volume of lodgepole pine recently killed by mountain pine beetle, determined by aerial surveys, Cariboo Forest Region, 1982.

Location, TSA and Supply Blocks	Area (ha)			Volume (m ³)			1/
	Light	Moderate	Severe	Light	Moderate	Severe	
<u>QUESNEL TSA</u>							
Junction SB		65			2,625		
Narcosli East SB	5			205			
S.S.A.	95			3,855			
Subtotal	100	65		4,060	2,625		
<u>100 MILE TSA</u>							
Holden SB	1 300	2 580	230	52,500	105,780	9,450	
Loon SB	40	120		1,550	4,920		
Subtotal	1 340	2 700	230	54,050	100,700	9,450	
<u>WILLIAMS LAKE TSA</u>							
Moffat	100			4,390			
Skelton	65	5		2,580	160		
Cariboo	700	900	1 920	59,900	75,160	160,900	
Kloakut	2 000	7 150	19 440	126,720	450,750	1,243,900	
Tatla	1 200	7 720	63 920	77,820	494,470	4,090,620	
Chezacut	875	2 000	17 300	56,000	131,070	1,106,820	
Anahim	900	2 900	41 830	56,600	185,600	2,676,990	
Chilcotin	1 000	2 950	15 810	66,820	188,420	1,011,970	
Churn	650	2 500	520	26,240	102,750	21,160	
Gaspard	1 260	4 400	4 740	51,860	179,740	194,180	
Springhouse	1 780	3 000	190	72,940	124,800	7,880	
Palmer Lake	400	1 800	1 480	16,150	73,480	60,352	
Subtotal	10 930	35 325	167 150	618,020	2,006,400	10,574,772	
<u>BOWRON LAKE PROV. PARK</u>	25	130	130	1,025	5,250	5,250	
<u>TWEEDSMUIR PROV. PARK</u>	640	1 920		40,960	122,880		
<u>MILITARY BLOCK DND</u>	380	770		15,740	31,490		
Subtotal	1 045	2 820	130	57,725	159,620	5,250	
TOTAL	222 000 ha			13,603,000 m ³			

*A more detailed breakdown of infested areas is shown in Appendix 1.

1/ Light - 1 - 6% of stems infested
 Moderate - 6 - 30% stems infested
 Severe - 31+% stems infested



Map 3

Mountain Pine Beetle

Areas of recently killed lodgepole pine, as determined from aerial surveys, 1982

Larval broods in 1981-attacked trees were examined in June to determine the 1981-82 overwintering mortality and brood viability (Figure 1, Appendix 3). From 25 trees at each of 8 locations, two 15 cm² bark samples were removed at dbh from the north and south sides of the tree and from these samples, numbers of larvae, pupae, teneral adults and entrance holes were counted. Average numbers were calculated for the 25 trees and the "R" values computed for each area sampled (Table 2).

TABLE 2. Results of brood examination for overwintering mortality in 1981 mountain pine beetle killed trees, Cariboo Forest Region, 1982.

Location	"R" Values	Percent mortality	1982 population prediction
Hanceville	3.3	29	Static
Big Creek	0.75	88	Decreasing
Mons Lake	10.4	15	Increasing
Puntzi Mountain	10.0	13	Increasing
Tatla Lake	0.0	99	Decreasing
Tatlayoko Lake	0.0	100	Decreasing
Cochin Lake	13.0	13	Increasing
10 Mile south of Nimpo	0.0	100	Decreasing

R - $\frac{\text{avg. no. progeny sample}}{\text{avg. no. of entrance holes}}$

Interpretation: 0 to 2.5 - population decreasing
2.6 to 4.0 - population static
4.1+ - population increasing

With three exceptions the results indicated a general population decrease from 1981 levels and was verified from cruising in September. However, it was noted at the five locations where decreased populations were indicated, healthy larvae were abundant between dbh and ground level which indicated a continuing attack potential.

Cruise strips were established at 17 locations throughout the Region in October to assess the number and status of beetle-killed lodgepole pine (Table 3).

TABLE 3. Number and status of pine trees examined in plots established on cruise lines in mountain pine beetle infested stands, Cariboo Forest Region, 1982.

Location	Healthy	1982 attack	1982 partial	1981 attack	Previous partial	Grey
Little River	16	27	0	41	4	12
Wild Goose L. #1	97	0	0	0	0	3
Wild Goose L. #2	29	0	0	41	0	31
W. of Palmer L. Rd.	61	6	1	17	4	11
Mons L.	27	9	0	43	8	12
Jamieson Meadows	70	3	0	18	0	9
Puntzi Mtn.	30	44	4	11	5	6
Pyper L.	84	10	0	3	0	3
Tatla L.	35	15	1	22	12	14
Chilko R.	73	1	0	23	0	3
Tsuniah L. Rd.	51	42	7	0	0	0
2 mi. E. of Cochin L.	31	51	0	14	3	0
Dean R. crossing	98	0	0	0	0	2
*Vert L.	29	1	0	5	0	65
*Tatla L. gravel pit	29	1	1	27	16	26
*4 mi. Tatlayoko L. Rd.	29	2	0	21	0	48
McClinchy R.	\$.6	0	27	0	24

*Permanent strips; individual trees numbered with paint and monitored annually since 1979.

Based on the criteria that 1-5% of stems attacked will result in light tree mortality, 6 - 30% moderate and 31+% severe, Puntzi Mtn., Tsuniah Lake road east of Chilko River and Cochin Lake areas will show severe tree mortality in 1983. Moderate tree mortality will occur in the Little River area northeast of Cariboo Lake, west of Palmer Lake road along the Hanceville Flats, Mons Lake area and near Pyper and Tatla lakes. Light tree mortality or a decrease in stems attacked may be expected north of Clearwater Lake to Anahim and south of Williams Lake to Jesmond.

Four permanent cruise strips established in 1979 to determine long term stand impact and foliage color change annually, were assessed in late 1982 (Figure 1). From a total of 141 stems that were attacked in 1979 and 1980, 28% retained red foliage for one year after attack, 66% for two years and 6% for three years. Of 249 stems recorded as current or partial attack and monitored for two or more years following the attack, 24% survived the attack by "pitching-out" the attacking beetles.

Factors including site, elevation and climate contribute to variations in tree resistance and needle retention. These factors must be considered when interpreting results of stand examinations.

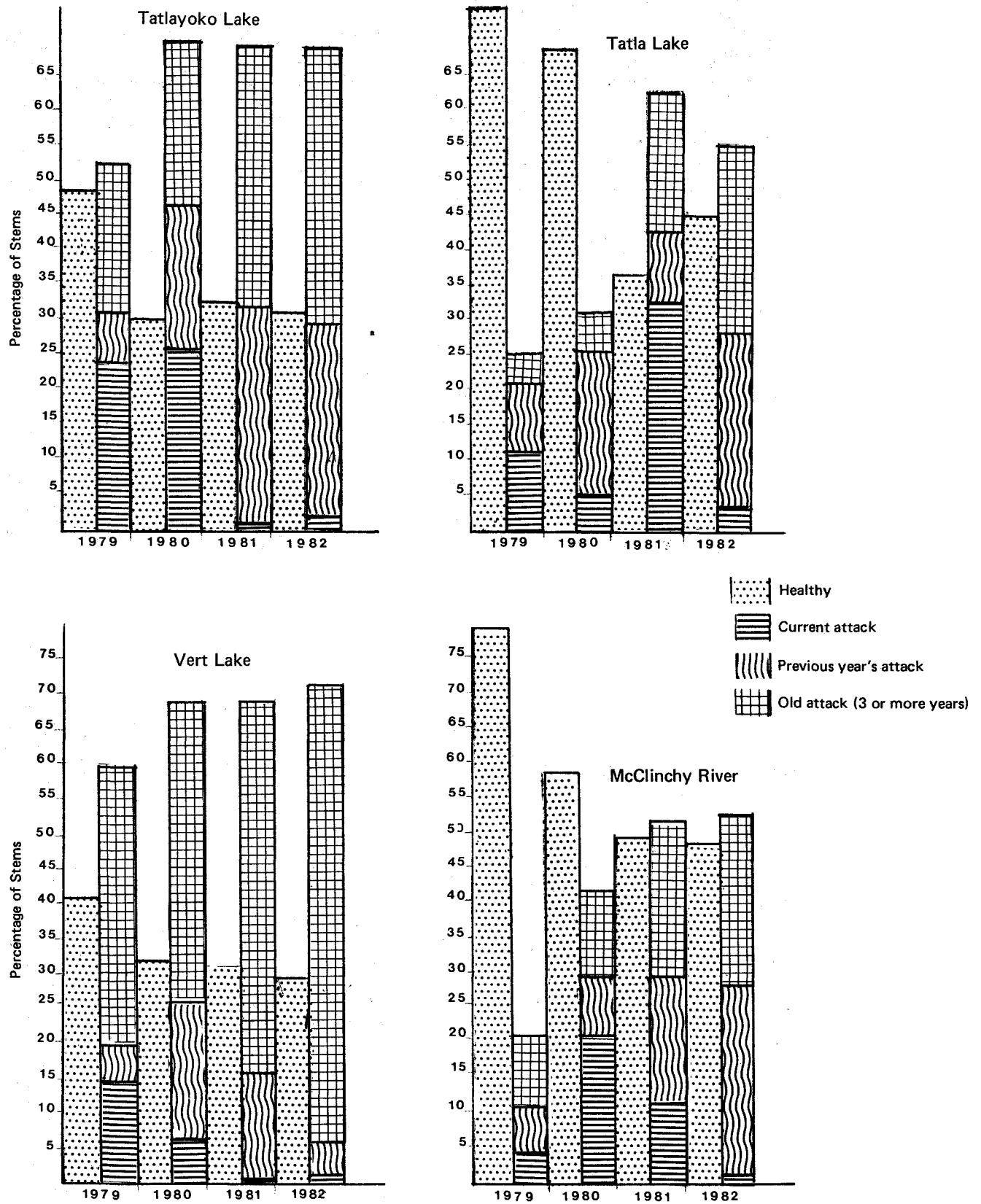


Fig. 1. Percentage of lodgepole pine infested by mountain pine beetle at four localities, Cariboo Forest Region, 1979 to 1982.

Dwarf mistletoe, Arceuthobium americanum

An average of 15% of the regeneration and 41% of the overstory lodgepole pine were infected by dwarf mistletoe in 8 stands examined between Chilanko Forks and Clearwater Lake during a special survey to assess the degree of infection of natural regeneration and mature trees.

Results showed that infection levels were directly related to the age of the regeneration (Appendix 2).

Lodgepole pine terminal weevil, Pissodes terminalis

Lodgepole pine terminal weevil lightly damaged an average of 7% of 2,800 trees in nine stands examined west of Williams Lake. The highest incidence was near Raven Lake (14%) and the lowest (2%) near Anahim.

A pine needle cast, Lophodermella concolor

For the second consecutive year the previous year's foliage of regeneration pine was severely infected over a widespread area between Clinton and Quesnel. Near Big Creek the disease infected up to 90% of the 1 to 3 metre regeneration lodgepole pine over 5 hectares resulting in premature needle loss.

Pine stem rust, Cronartium coleosporoides

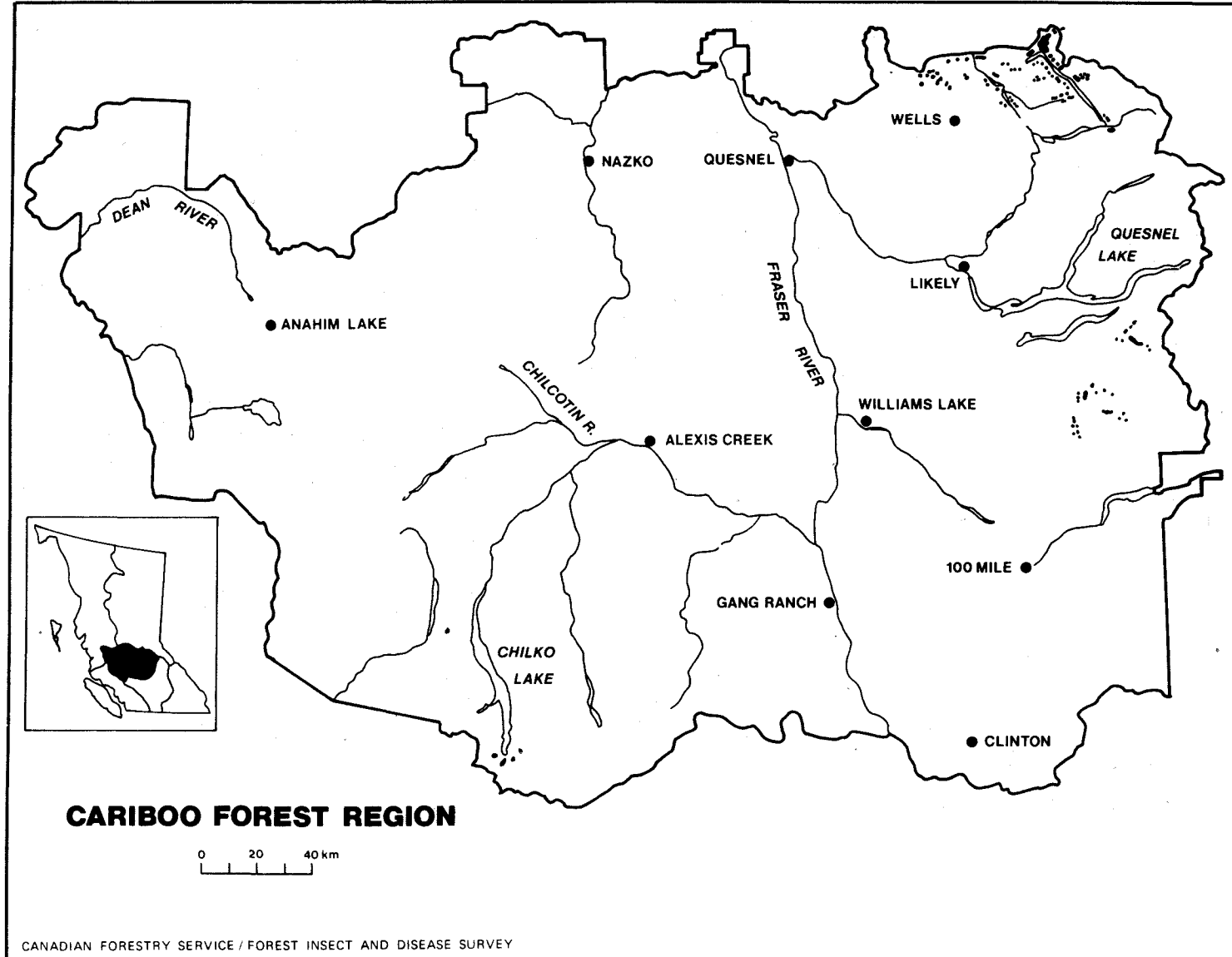
Stem cankers on lodgepole pine regeneration were common on mainly roadside trees at five locations between 70 Mile House and Horsefly. Infection intensities ranged from 20 to 50% which results in significant increment loss, degrade and occasional tree mortality.

SPRUCE PESTS

Spruce beetle, Dendroctonus rufipennis

Spruce beetle attacked stands were mainly in the Bowron Lake Provincial Park (5 000 ha) and in the Quesnel TSA; Bowron Unregulated (1 660 ha), Bowron SB (2 000 ha) and in Big Valley SB (710 ha). However, scattered groups of trees were attacked in the Upper Horsefly SB (1 070 ha), Junction SB (25 ha), Cariboo SB (220 ha), and Chilcotin SB (70 ha) of the Williams Lake TSA and in Canim SB (64 ha) of the 100 Mile TSA (Table 4).

In the northern portion of Tweedsmuir Provincial Park adjacent to Anahim SB, between 15 and 65% spruce mortality was recorded in the Sigutlat, Tetachuck and Chelaslie lake areas and has been reported in detail in the 1982 Prince Rupert Region Annual Report.



Map 4

Areas of recently killed spruce, as determined from aerial surveys, 1982

TABLE 4. Location, area and volume of spruce beetle infested mature white spruce as determined by ground and aerial surveys, Cariboo Forest Region, 1982.

Location by TSA and Supply Block	Area (ha)			Volume (m ³)		
	Light	Moderate	Severe	Light	Moderate	Severe
<u>BOWRON LAKE PROV. PARK</u>	2 970	2 050		77,270	215,040	
<u>QUESNEL TSA</u>						
Bowron Unreg.	1 470	190		38,650	20,160	
Bowron SB	1 090	960		28,560	100,800	
Big Valley SB	450	260		11,760	26,880	
Subtotal	3 010	1 410		18,970	147,840	
<u>WILLIAM LAKE TSA</u>						
Upper Horsefly SB	170	640	260	3,490	10,640	42,560
Junction SB	25			520		
Cariboo SB	220			4,630		
Chilcotin SB	70			1,430		
Subtotal	480	640	260	10,070	10,640	42,560
<u>100 MILE TSA</u>						
Canim SB	64			1,330		
TOTAL			10 900			582,400

The incidence of one-year-cycle brood development was rare in standing attacked trees and was limited to a low occurrence in blowdown along logging perimeters. Standing 1980-attacked trees examined in May along Big Creek, east of Crescent Lake and west of Towkuh Creek contained averages of 8, 7 and 5 adults respectively per 15 x 30 cm ($\frac{1}{2}$ sq.ft.) bark sample. These results indicated a continuing infestation but a lower attack intensity than in 1980.

Four cruise lines were run to determine the incidence of 1982 attack and tree condition in the Bowron and Willow drainages. East of Crescent Lake two lines were run parallel and two at right angles to logging boundaries from two to fifty metres respectively into the stands (Table 5).

TABLE 5. Status of mature white spruce trees examined in or adjacent to spruce beetle outbreak areas, Cariboo Forest Region, 1982.

Location	Percent stems			
	Healthy	Current	Partial	Grey
Crescent L. #1	65	20	0	15
Crescent L. #2	4	73	8	15
East of Ketchum Cr.	32	22	8	35
West of Ketchum Cr.	10	57	4	29

The intensity of 1982 beetle attack was unexpectedly severe in the upper Bowron and Willow river drainages and is presumed to have been greatly influenced by a large beetle flight originating from outbreak areas to the north in the Prince George Region. Susceptible spruce stands in proximity to the Regional boundary therefore are most likely to be attacked and killed in 1983 with mortality decreasing further from the Regional boundary.

Two-year cycle spruce budworm, Choristoneura biennis

Trace defoliation of the current foliage of alpine fir and white spruce understory occurred over less than 2 ha, two miles west of 2400 road near the Willow River. From Barkerville south to Hendrix Lake, where severe defoliation occurred over 231 000 ha in 1980, populations were low and no defoliation was observed.

Fifteen traps baited with 96% trans-11-tetra-decenal 4% cis-11-tetradecenal pheromone in three concentrations by weight (0.1%, 0.01%, 0.001%) were located near Hendrix Lake to determine the adult population status. A total of 470 moths were caught; an average of 71 in 5 traps of 0.1%, 37 at 0.01% and 5 at 0.001%. Although population densities cannot as yet fully be predicted they do indicate a continuing population in the area with the potential for trace to light defoliation in 1984, but none in 1983, the normal "off" flight year.

DOUGLAS-FIR PESTS

Douglas-fir beetle, Dendroctonus pseudotsugae

Fourteen hundred Douglas-fir trees were killed by Douglas-fir beetle in 1982, little changed from 1981. Concentration of recently killed trees were recorded from Dog Creek and Empire Valley along the Fraser River Valley north to the Military Block near Alexis Creek and to Alexandria.

TABLE 6. Location by TSA and Supply Block and number of Douglas-fir trees killed by Douglas-fir beetle, Cariboo Forest Region, 1982.

TSA and Supply Block		No. of recently killed trees
<u>WILLIAMS LAKE TSA</u>		
Springhouse	S.B.	505
Palmer Lake	S.B.	5
Gaspard	S.B.	100
Kloakut	S.B.	100
Skelton	S.B.	60
Cariboo	S.B.	5
Churn	S.B.	115
Subtotal		890
<u>100 MILE TSA</u>		
Bonaparte	S.B.	90
Meadow	S.B.	155
Loon	S.B.	90
Subtotal		335
<u>QUESNEL TSA</u>		
S.S.A		10
Military Block		165
Subtotal		175
TOTAL		1,400

Increased numbers of killed trees were noted along Empire Valley (Churn SB), Chimney Lake (Springhouse SB) and the Military Block. Decreased counts were most notable along Bonaparte River (90 trees in 1982 from 400 trees in 1981).

In a B.C. Ministry of Forests trap tree program 174 groups of Douglas-fir trees were felled at six locations. Ten randomly chosen trees from 10 of the 125 groups of trees felled in the Military Block were sampled to determine the number of beetles attracted to the felled trees. Samples of 15 x 15 cm ($\frac{1}{2}$ sq. ft.) bark were removed from the top, mid and butt sections of each tree and the number of beetle progeny totalled. An average of 7 larvae, 1 pupae and 6 teneral adults were recorded which indicated an endemic population. While some samples were negative, maximums of 53 teneral adults and 150 larvae were recorded in two samples.

In the Empire Valley the incidence of 1982 attack increased at Mile 3 along the Black Dome Mountain road in a localized 1 ha area where twelve 1981 and fifty-six 1982 attacked trees were recorded. Bark samples at dbh from 10 of the 1982 attacked trees revealed that 70% of the beetles had been pitched out. Brood counts in three trees averaged 3 larvae and 2 teneral adults per sample which indicated low endemic levels. Therefore, based on the high incidence of pitch out and low brood numbers, populations and tree mortality are expected to decrease in 1983.

Western spruce budworm, Choristoneura occidentalis

Western spruce budworm defoliated an estimated 2 800 ha of Douglas-fir forest in 1982, a 44% decline from 5 040 ha in 1981.

Douglas-fir buds were examined in May at four locations defoliated in 1981 to determine the 1982 population and estimate potential defoliation. Near Big Bar Lake road and Highway 97 north of Clinton, 23% of the buds were infested, along Bonaparte River south of Ilahee Meadows, 21%; north of Hart Ridge, 6%, and along south Hart Ridge, 17%. Based on the results of previous studies, which showed that 20% of the buds infested would result in defoliation of the current foliage, defoliation was expected to increase in 1982 north of Clinton and decrease south and east of Clinton. However, three tree beating samples at four locations contained 150 to 300 larvae and moderate defoliation resulted.

Defoliation along Big Bar Lake road and near Ilahee Meadows was light to moderate and light defoliation extended along the north ridge near Loon Lake and patches along Loon Creek, southwest of the lake to the south facing slopes of Hart Ridge.

Fifteen traps (5 per concentration) baited with pheromones at three concentrations by weight (0.1%, 0.01%, 0.001%) were located along Hart Ridge near Clinton, to determine adult male budworm flight densities. A total of 1,146 moths were caught with averages of 92 at 0.1%, 72 at 0.01%, and 66 at 0.001% which indicates continued populations and defoliation in 1983 which is indicated also from egg mass samples.

Two branches from the mid crown of each of ten trees were collected at four locations near Clinton to determine the number of egg masses present, and to predict population trends and damage potential in 1983 (Table 7). The number of egg masses per 10 m² of foliage indicated that severe defoliation may be expected in 1983 along Bonaparte River near Ilahee Meadows (180), along Big Bar Lake road near the junction with Highway 97 (358) and along Hart Ridge (429).

TABLE 7. Number of egg masses per 10 m² of foliage and predicted defoliation by western spruce budworm in 1983, Cariboo Forest Region, 1982.

Location	Number of egg masses per 10 m ² of foliage <u>1/</u>	Predicted Defoliation for 1983
Hart Ridge	429	Severe
Loon Lake	163	Severe
Ilahee Meadows	180	Severe
Big Bar Lake Road	358	Severe

1/

Categories: Light - 1 - 50 egg masses per 10 m² of foliage
 Moderate - 51-150 " " " " " "
 Severe - 151+ " " " " " "

Douglas-fir tussock moth, Orgyia pseudotsugata

An estimated 500 ha of Douglas-fir were severely defoliated by tussock moth south of Clinton near the Regional border. Defoliation occurred primarily in regeneration and pole-sized Douglas-fir along the lower slopes of Scottie and Loon creeks and in patches of less than one hectare along the lower slopes of Hart Ridge, Maiden Creek and on both sides of Highway 97 north to Three Mile Lake.

The number of larvae from random Douglas-fir collections ranged from 100 to 250 along the lower slopes of Scottie, Loon and Maiden creeks and Hart Ridge. Two special collections from the area were virus free, indicating a healthy population.

A sequential egg sampling survey was undertaken at three locations between Scottie Creek and Three Mile Lake. Evaluations were made on the basis of the average number of egg masses on three branches from each of one or more trees. Results based on an average of 7 or more egg masses per tree indicate that severe defoliation will occur from Scottie Creek north to Three Mile Lake where over 7 egg masses per tree were recorded.

ALPINE FIR PESTS

Western balsam bark beetle, Drycoetes confusus

A total of 5,600 recently killed alpine fir trees were counted during aerial surveys, an increase from 1981, along Franklin Arm, Farrow, Chesni, Edmond, Ottarasko and Notetuko creeks near the south end of

Tatlayoko and Chilko lakes. Near the southeast corner of Bowron Lake Provincial Park, 170 alpine fir were counted along Betty Wendell Creek, Isaac and Lanezi lakes and along upper Cariboo River.

PESTS OF NATURAL AND MANAGED SECOND GROWTH STANDS AND PLANTATIONS

Twenty managed stands, fourteen spaced and six plantations, were examined in the Region in 1982 to identify and assess pest problems (Table 8) and were host to a broad range of significant insects and diseases which have a significant impact on the growth and development of young stands.

Dwarf mistletoe, Arceuthobium americanum

Although the disease severely affects lodgepole pine stands (Figure 3, Appendix 3) at widespread locations in the Region, a juvenile spaced plot near Helena Lake, administered by B.C. Ministry of Forests showed that scattered residuals were only lightly infected. Pre-examination and marking of mistletoe infected residuals prior to implementation of a spacing program in regeneration stands would ensure improved and potentially complete removal of infected stems.

Armillaria root rot, Armillaria mellea

Ten infection centres were located in a thinned natural Douglas-fir stand (+ 20 years) over 16 ha near Niquidet Lake east of Horsefly. Near each infection centre 1 to 3 fading trees were recorded which indicated a permanent and continuous area of infection which represents significant annual and accrued volume loss and potential future second growth problems.

A routine pre-examination of the areas proposed for thinning programs may have eliminated this and other similarly infected stands as a project area. Management of this stand and other similar stands require a decision on whether there will be an investment return with further treatment which would not be recommended. ^{1/}

White stalactiform blister rust, Cronartium coleosporoides
Western gall rust, Endocronartium harknessii

Between 1 and 5% of the lodgepole pine were infected by white stalactiform rust near Raven Lake (5%), Cottonwood River (1%) and near Niquidet Lake (1%) (Figure 5, Appendix 3).

^{1/} Armillaria Root Disease, A Guide to Disease Diagnosis, Development and Management in British Columbia. D.J. Morrison, July, 1981. BC-X-203, Pacific Forest Research Centre.

The number of lodgepole pine stands infected by western gall rust are widespread throughout the range in the Region and it is commonly found in natural regeneration stands. In 6 plots the incidence of infection averaged 6% (range 1-24%) and an estimated 90% of the galls were on branches.

No method of biological or chemical control have been established for pine stem rusts but surveys for hyperparasites of rusts, as potential control, continue. Silviculture methods currently in use include:

- (a) eradication of secondary hosts (stalactiform rust) from within an infested stand for some distance around by hand grubbing;
- (b) removal of infected trees, especially trees with trunk infection, during thinning and stand improvement operations;
- (c) pruning of infected branches to reduce chance of trunk infections.

Foliage diseases

Pine needle cast	<u>Lophodermella concolor</u>
Fir-fireweed rust	<u>Pucciniastrum epilobii</u>
Fir-aspen rust	<u>Coleosporium asterum</u>

Foliage diseases are greatly influenced by weather conditions and severe infections are generally shortlived and cause premature needle loss but rarely any permanent damage to larger regeneration and pole-sized trees. However, when 2-10 year old stock are severely infected for more than two years, the impact is significant and permanent damage is more likely to occur; in such cases control measures may be considered.

A pine needle cast, Lophodermella concolor, (Figure 4, Appendix 3), severely infected lodgepole pine regeneration in the Region for the past two years which has resulted in the premature loss of older needles in stands south of Farwell Canyon, along Gaspard Creek road and in scattered islands of natural regeneration from Clinton to Horsefly.

Fir-fireweed rust, Pucciniastrum epilobii, caused a trace of premature needle loss on natural regeneration alpine fir in a Douglas-fir, lodgepole pine plantation near Niquidet Lake.

Western pine-aster rust, Coleosporium asterum, caused a trace of premature needle loss to lodgepole pine plantations near Raven Lake and Cottonwood River.

Near McKay River, east of Horsefly, in a natural spruce-balsam stand type, two plantations were examined, one was planted to Douglas-fir with natural white spruce regeneration, the second planted to white spruce.

In the Douglas-fir plantation 75% of the white spruce had from 25 to 50% branch tip mortality caused by cooley spruce gall aphid, Adelges cooleyii. The white spruce plantation showed less than 5% branch tip mortality on less than 10% of the seedlings.

The occurrence of cooley spruce gall aphid is common throughout the Region, however, when Douglas-fir is introduced to a natural spruce growing area, which is not recommended, increased damage causing premature needle loss and yellowing of Douglas-fir foliage and gall formation on spruce branches will occur causing slower growth rate.

Spruce weevil, Pissodes strobii, caused little damage to spruce in the Region in 1982, however in a stand planted in 1968 along Quesnel Lake near Tabors Road up to 48% of the 1 to 3 metre high trees were infested; 18% currently and 30% prior to 1982.

A successful control measure being used more often is clipping and burning of infested tips twice yearly during the early growing years and has effectively reduced the incidence of attack to less than 1% in some Coastal plantations.

Foliage symptoms, indicative of advanced Warrens collar weevil Hylobius warreni feeding, were evident at low levels in a juvenile spaced stand near Raven Lake (2% of stems infested) and two planted areas near Cottonwood River (2%) and near Niquidet Lake (6%). Based on the premise that foliage symptoms indicate advanced feeding (2 or more years), there is likely twice as many green trees infested than is indicated by these percentages and further surveys are required in 1983.

Damage caused by the northern pitch nodule maker, Petrova albicapitana is common on regeneration and pole-sized lodgepole pine throughout the Region. In a pine plantation (+ 15 years) near Cottonwood River, 17% of 100 trees examined revealed 1 to 5 attacks on branches per tree.

Damage to regeneration trees by this pest is superficial when restricted to branches (Figure 2, Appendix 3). Advanced feeding over two years at bases of leaders sometimes results in leader mortality and may initiate malformation of the stem.

A pine needle miner, Coleotechnites sp., caused restricted damage to terminal foliage at two juvenile spaced areas of lodgepole pine near Raven Lake (9% of stems examined) and near Canoe Lake (50%). Damage impact was minimal.

There was no rodent damage observed in the 19 managed stands examined.

TABLE 8. Percentage of trees damaged by pests in managed stands and plantations, Cariboo Forest Region, 1982

[illegible]

CONE AND SEED PESTS

Heavy ^{1/} Douglas-fir and white spruce cone crops were common in the Cariboo Region in 1982. Cones were sampled in 23 stands (Table 9), 13 in Douglas-fir stands and 10 in white spruce stands. Less than 50% of the Douglas-fir were infested by a variety of pests such as a Douglas-fir cone moth, Barbara colfaxiana, a fir cone worm, Dioroctria abietivorella, Douglas-fir scale midge, Contarinia washingtonensis, a Douglas-fir seed chalcid, Megastigmus spermotrophus. More than 50% of the spruce cones were infested at 5 of the 10 locations by a spruce seedworm, Cydia youngana, a spiral spruce cone borer, Hylemya anthracina, a spruce seed chalcid, Megastigmus piceae, spruce seed midge, Mayetiola carpophagus and spruce cone rust, Chrysomyxa pirolata and considered unsuitable for cone collections.

^{1/} Cone crop rating:

None	- No cones on trees
Very light	- Few cones on less than 25% of trees
Light	- Few cones on more than 25% of trees
Medium	- Many cones on 25-50% of trees
Heavy	- Many cones on more than 50% of tree

TABLE 9. Percentage of Douglas-fir and white spruce cones infested at 23 locations, Cariboo Forest Region, 1982.

Location	Fir cone moth	Fir cone worm	Fir scale midge	Fir seed Chalcid		Area Suitable for Collecting
<u>DOUGLAS-FIR CONES</u>						
Big Lake	-	-	-	20		Yes
George Lake	10	10	10	-		Yes
Canoe Lake	45	5	-	-		Yes
108 Mile House	20	5	5	-		Yes
Williams Lake			-			Yes
Blue Lake	-	-	10			Yes
Marguerite		5	5	-		Yes
Moffat Lake	-	10	10	-		Yes
Gaspard Creek	5	-	10	10		Yes
Farwell Canyon	35	30	-	10		Yes
Bull Canyon	-	-	5	-		Yes
Tatlayoko Lake	15	-	5	5		Yes
Likely-Horsefly Jct.	15	5		5		Yes
<u>WHITE SPRUCE CONES</u>						
Location	Spruce seed worm	Spruce cone maggot	Spruce seed chalcid	Spruce seed midge	Cone Rust	Area Suitable for Collecting
Anaheim	15	65	10	30	-	No
Heckman Pass	15	65	10	30	-	No
Spokin Lake	15	55	-	-	-	Yes
Beaver Valley	40	75	-	-	-	No
Moffat Creek	15	15	-	-	-	Yes
Meadow Lake	5	-	-	-	-	Yes
Gaspard Creek	40	-	-	-	-	Yes
Baker Creek		60	-	-	-	No
Wild Goose Lake	-	15	-	-	-	Yes
Wells (3100 Rd)	40	80	-	-	10	No

*Based on examination of 20 cones/location

1 - 49% infested - not suitable for collecting

50%+ infested - suitable for collecting

DECIDUOUS PESTS

Forest tent caterpillar, Malacosoma disstria

The forest tent caterpillar severely^{1/} defoliated trembling aspen over 490 ha at three locations: near Bonaparte Lake patches of severe defoliation over 50 ha; near Bridge Lake, five patches of moderate defoliation over 120 ha and along Black Creek east of Horsefly, one large patch of severe defoliation over 320 ha.

This pest has not been reported in the Cariboo Region since 1973 when over 70 000 ha were defoliated in the Quesnel District.

Although the number of egg masses were not evaluated, defoliation will likely persist and possibly expand in 1983 based on previous outbreak patterns.

^{1/} Light - 1 - 33% defoliation
Moderate - 34-66% defoliation
Severe - 67+% defoliation

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