

Forest Insect and Disease Conditions

Cariboo Forest Region
1991

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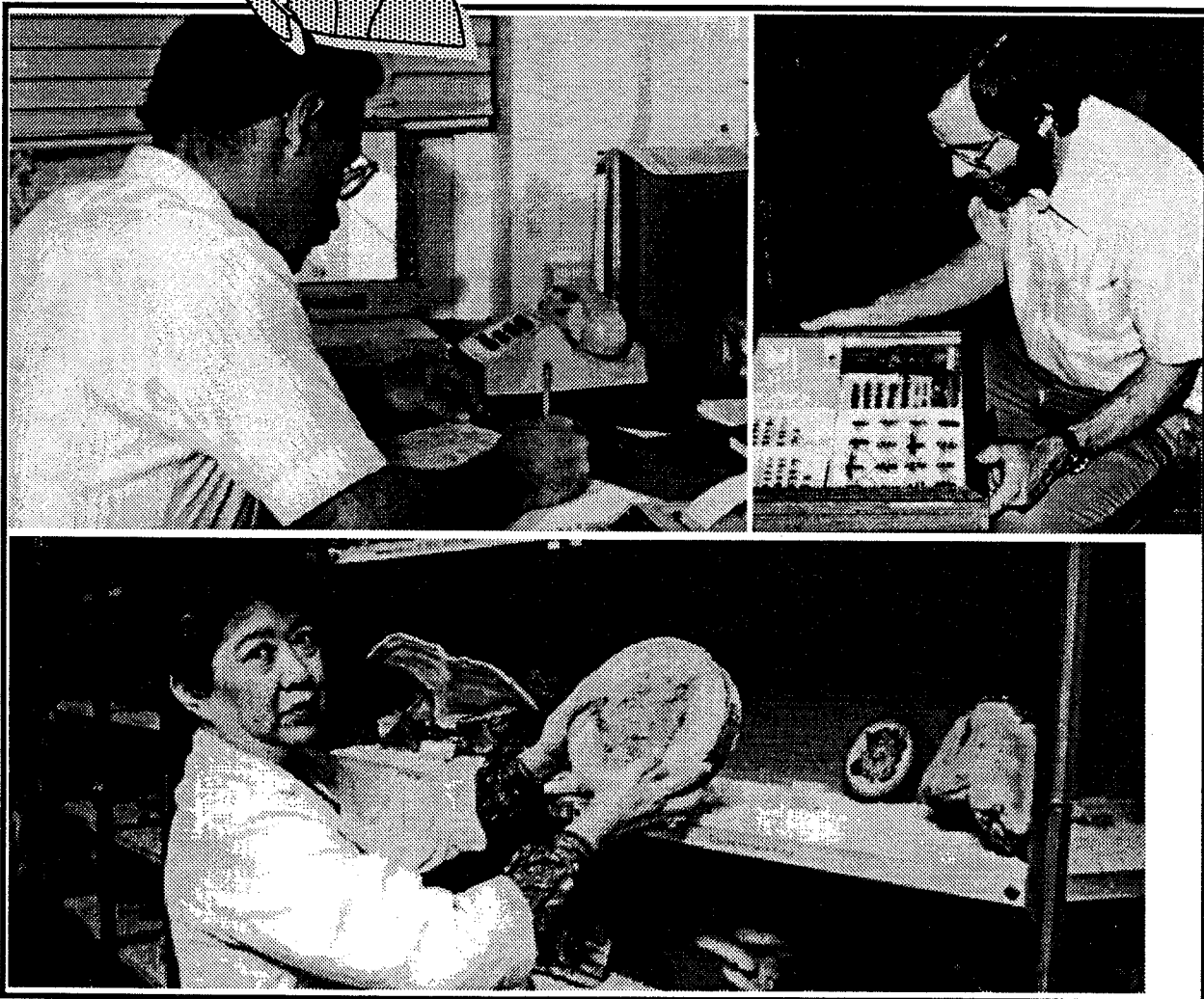


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INTRODUCTION

This report outlines the status of forest pests recorded by the Forest Insect and Disease Survey (FIDS) in the Cariboo Forest Region in 1991, and attempts to forecast some of their trends. Pests are discussed by host, generally in order of their importance.

The Forest Insect and Disease Survey is a nation-wide network working within Forestry Canada. It is responsible for producing an overview of forest pest conditions and their implications; maintaining records and surveys to support quarantines; supporting forestry research; providing advice on pest conditions; developing and testing survey techniques, and conducting related biological studies. The cooperation of provincial, industrial and municipal agencies is essential for the effective fulfillment of these mandates and is gratefully acknowledged.

The 1991 field season was contained within the period from May 27 to October 21, during which there were 290 insect and disease samples and other pest data collected by FIDS personnel. Pest damage was mapped and photographed during 32.1 hours of fixed-wing aerial survey and 9 hours of survey by helicopter (**Map 1**). The British Columbia Forest Service (BCFS) supplied 26 hours of fixed wing time and all the helicopter time; Forestry Canada supplied the remainder. Additional information was obtained from an aerial survey contracted by the BCFS.

In this report, defoliation ratings are defined as follows:

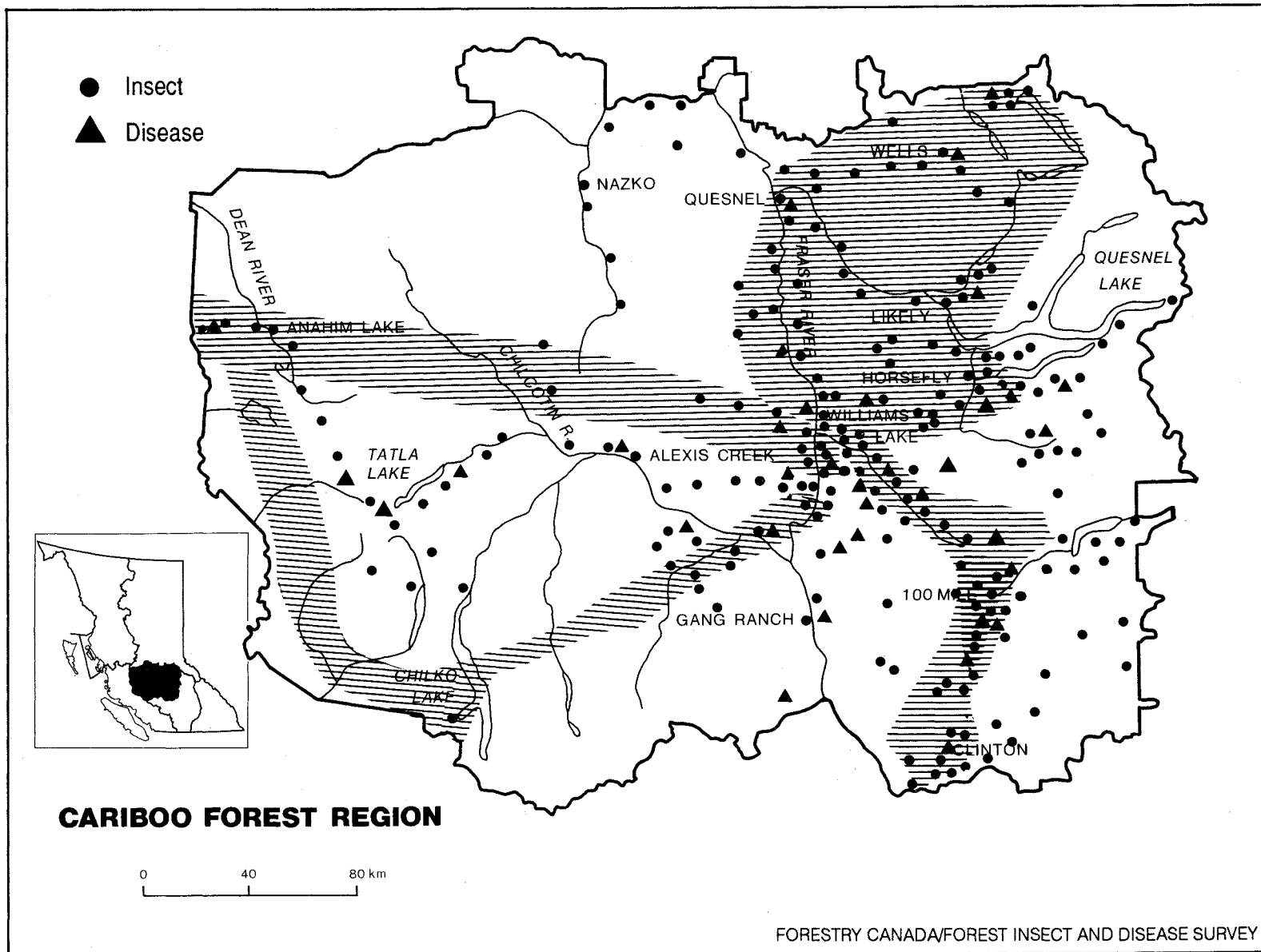
- Light : discolored foliage barely visible from the air, some branch tip and upper crown defoliation
- Moderate : pronounced discoloration, noticeably thin foliage, top third of many trees severely defoliated, some completely stripped
- Severe : bare branch tips and completely defoliated tops, most trees sustaining more than 50% total defoliation

The Forest Insect and Disease Survey has conducted an annual pest survey in the Cariboo Forest Region since the late 1930s and from an established field headquarters at Williams Lake since 1954. Inquiries can be directed to FIDS in the Cariboo Region at this address:

Forestry Canada
Forest Insect and Disease Survey
Sidcum Sub., Comp. 33,
Williams Lake, B.C.
V2G 2V4, Ph. 392-6067

The field station is closed from October to April; however, FIDS staff including the ranger, may be reached anytime at:

Forestry Canada
Pacific Forestry Centre
506 West Burnside Rd.
Victoria, B.C.
V8Z 1M5 Ph.363-0716



Map 1. Location where one or more forest insect and disease samples were collected and areas covered by aerial surveys to map bark beetle and defoliator infestations in 1991 (large scale maps available on request).

SUMMARY

The following report summarizes the forest pest conditions in Cariboo Forest Region, based on the summer survey conducted by FIDS.

The area of Douglas-fir killed by Douglas-fir beetle declined slightly to 1780 ha from 2020 ha last year. More than 2000 separate infestations were widespread in the Williams Lake area, with the most severe damage in the DND Block at Riske Creek and some drainages along the Fraser River. The early flight which occurred around April 16 in most parts of the region, averaged 9% current attack, down slightly from 13% in 1990 and 29% in 1989. The highest new attack was near patches of 1991 blowdown at widely scattered locations. A contributing factor to the increase in the DND block was the absence of population control.

Spruce beetle continued at a low level in Bowron Provincial Park, where about half of the trees examined in spring and fall surveys were infested with an average of one gallery per 900 cm². About 50% of the lethal trap trees felled along Isaac Lake, were lightly attacked as well, with no live brood. The number of infestations outside the park in the Barkerville and Willow River areas, also was reduced from last year.

Mountain pine beetle decreased in the Chilko Lake area; however 117 new infestations were mapped east of Highway 97 from Quesnel to 100 Mile House in mixed lodgepole pine and Douglas-fir stands. The rate of current attack was high.

Immature two-year-cycle spruce budworm lightly defoliated new tips of mature spruce and alpine fir stands over 3200 ha mainly in the Barkerville-Willow River area, along the north arm of Quesnel Lake and at Grain Creek. Under-growing immature alpine fir were severely defoliated in some areas.

Western hemlock and western red cedar were lightly and moderately defoliated by western hemlock looper in 25 separate patches in the Quesnel Lake area over 5700 ha, up from only 20 ha last year on the Lynx Peninsula. Defoliation on Lynx Peninsula expanded to the east arm of Quesnel Lake from Hen Ingram Lake to Wells Gray Provincial Park on the eastern boundary of the region.

Rusty tussock moth populations increased slightly along the north and east arms of Quesnel Lake causing light to severe defoliation of all seedlings and deciduous shrubs, especially thimbleberry in logged areas. Rusty tussock moth populations, when associated with western hemlock looper, averaged 95 larvae per standard three-tree beating sample.

In the eastern part of the region, forest tent caterpillar populations increased, causing moderate and severe defoliation of poplar over 15 000 ha. The damage occurred in 155 separate patches from Bridge Lake north to Canim Lake, between Quesnel and Horsefly lakes, from Horsefly to Williams Lake, and south-east of Quesnel along the Quesnel River.

Climatic damage caused by late spring frost occurred throughout the Cariboo region. Patches of tree mortality occurred mainly in Douglas-fir. Bud mortality in Douglas-fir and Englemann spruce was common throughout the region. Younger trees were most severely damaged, however trees 15 m high also had 10-100% of buds killed.

Animals, mainly squirrels, bear and voles, debarked immature and semi-mature lodgepole pine at widespread locations throughout the region. Voles destroyed 42% of recently planted seedlings over about 3 ha near Leeches Lake, west of Williams Lake.

Damage to groups of roadside conifers from salt spray and seepage continued throughout the southern part of the region at moderate levels similar to last year.

Infection of new and year-old pine foliage by needle disease fungi, continued at high levels similar to last year. Ponderosa pine was again severely infected by Elytroderma needle disease throughout the host range near Clinton, and Loon Lake. Lodgepole pine was also severely infected by Elytroderma deformans over a large area similar to last year mainly near Clinton and Alexis Creek. Infection of lodgepole pine by pine needle cast fungi was widespread throughout the region for the third consecutive year.

In 27 young stands 15 years old or younger treated under FRDA 1, the most commonly recorded damage was caused by late frost, pine and spruce terminal weevils, pine needle blights and mammals. There was no reported damage to seedlings by black army cutworm this year.

Forest tent caterpillar moderately to severely defoliated mainly trembling aspen over about 15 000 ha in the eastern portion of the region for the fifth consecutive year, up from 4760 ha last year.

There were no adult male gypsy moths caught in 27 sticky traps placed in 21 Provincial parks, campgrounds and highway rest areas in the region.

Surveys for acid rain at a permanent plot east of Quesnel found no evidence of damage attributable to acid rain.

DOUGLAS-FIR PESTS

Douglas-fir beetle
Dendroctonus pseudotsugae

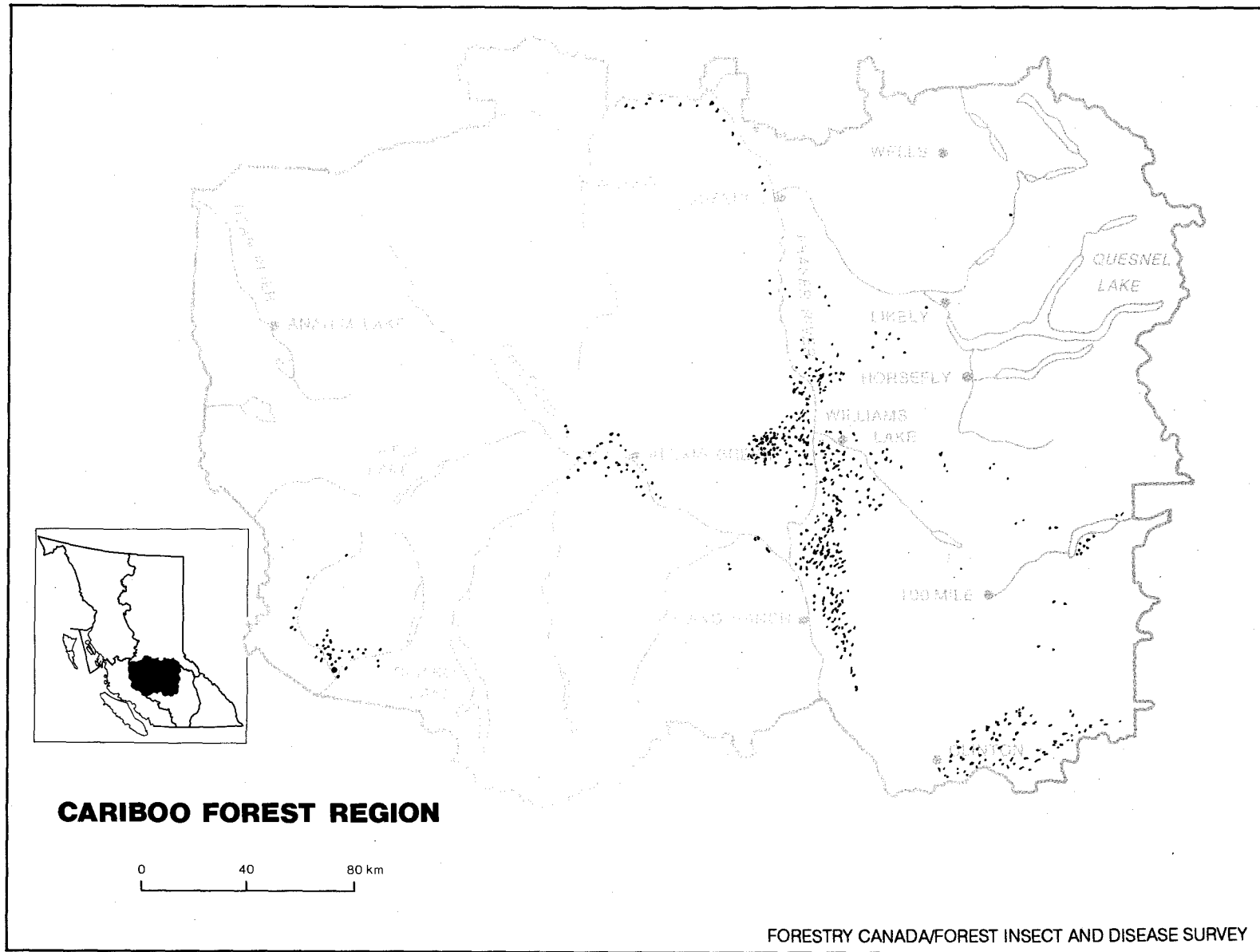
The Douglas-fir beetle epidemic continued throughout the region, but with signs of a reduction in intensity. Mature and overmature Douglas-fir were killed over 1780 ha down slightly from 2020 ha last year. There were 2030 patches containing 3-200 recently killed trees, only 110 less than 1990 (Map 2, Table 1). Infestations recorded last year expanded and new ones were recorded from the Blackwater River north of Quesnel, south to Williams Lake and Clinton including stands east of Williams Lake to Horsely, and west to Alexis Creek. Salvage and control logging were effective, where undertaken, in reducing the number of infestations and the population potential of this important bark beetle.

Table 1. Douglas-fir beetle infestations and trends, Cariboo Forest Region, 1991.

TSA and Location	Biogeoclimatic zones	1991		1990	
		Area (ha)	Number of patches	Area (ha)	Number of patches
<u>QUESNEL TSA</u> Blackwater-Quesnel	SBSK1, SBSK2	32	45	100	100
<u>WILLIAMS LAKE TSA</u> Williams Lake, Horsely, Chilcotin	IDF, SBS	1460	1580	1195	1360
<u>100 MILE HOUSE TSA</u> Bonaparte R.,	IDF, SBS	290	405	725	590
Total		1782	2030	2020	2050

QUESNEL TSA

About 45 patches were mapped over 32 ha, down from 100 infestations over 100 ha in 1990. Infestations occurred mainly along the Blackwater River from the Euehiniko River junction to the Fraser River and along the Fraser River to Quesnel. These represent only 2% of the Douglas-fir epidemic in the Cariboo Forest Region.



Map 2. Areas of recent Douglas-fir mortality caused by Douglas-fir beetle, detected during aerial and ground surveys, 1991 (large scale maps available on request).

WILLIAMS LAKE TSA

The largest portion (82%), of the epidemic occurred in the **Williams Lake TSA** where 1580 infestations totalled 1460 ha, up from 1195 over 1360 ha last year. Infestations occurred mainly in the Interior Douglas-fir biogeoclimatic zone, (IDF), and the dry southern subzone of the Sub boreal spruce zone, (SBS). Recently killed trees were mapped in 215 separate patches over 380 ha in the DND block near Riske Creek, up from 205 infestations totalling 260 ha last year. Infestations continued at the same level from Sheep Creek to Marguerite along the Fraser River and east from Williams Lake to Horsefly. Decreases in tree mortality occurred from Tyhee Lake south-east to 150 Mile House and west to Chimney Lake. Infestations also decreased along the Chilcotin River from Big Creek to Hanceville to 15 patches of 0.5 to 3 ha from 90 in 1991. Infestations continued in the Alexis Creek area and west along the Chilko River. The number of recently killed trees mapped along Homathko River and Mosley Creek increased from 20 patches over 25 ha to 90 patches over 130 ha this year. Another increase occurred from Alkali Lake south to Dog Creek where more than 200 trees were mapped, up from 80 last year.

100 MILE HOUSE TSA

The epidemic decreased in intensity and area in **100 Mile House TSA** where 406 patches were located over 290 ha, down from 590 infestations over 725 ha in 1991. Infestations continued at nearly the same level west of La La Hache and along the Bonaparte River where the same number of patches were mapped over a 50% larger area. There were larger but fewer infestations along Canoe Creek west of Clinton. Infestations continued along Bonaparte Lake, however there was a decrease in the Clinton area including Kelly Lake, Loon Lake and Loon Creek.

FORECASTS

To assess the Douglas-fir beetle population and potential for 1992, 18 fixed-radius plots 0.24 ha in size, were examined in representative infestations throughout the epidemic (Table 2,3). The average current attack was 9% of the stems per ha, (range 0-36%) down from 13% in 1990. The number of recently killed, red trees, averaged 9% (range 2-17%) down from 11% last year. Not all plots contained current attack and the range was much larger this year, indicating that the population was reduced from previous years, when all plots contained current attack.

Table 2. Status of Douglas-fir beetle populations in cruise plots in the Cariboo Forest Region, 1991.

TSA and Location	Percent of stems/ha				
	Current ¹	Partial	Red	Grey	Healthy
<u>WILLIAMS LAKE TSA</u>					
DND/Drummond L.(E)	3	10	11	26	50
/Drummond L.(NE)	36	4	2	0	58
/Callanan L.(E)	5	0	5	6	84
/Callanan L.(N)	6	0	14	11	69
/Callanan L.(SE)	30	0	10	13	47
/Peavine Meadow	30	0	4	24	42
/Drummond L.(N)	2	3	6	23	66
//B' Road	29	1	4	0	66
Williams Lake	6	0	17	10	67
Chimney Cr.	2	1	5	9	83
Meldrum Cr.	3	0	6	5	86
Pablo Cr.	4	0	10	6	80
Soda Cr.	1	7	11	2	79
Hawks Cr.	3	6	6	7	78
Dog Cr.	2	1	7	3	87
Springhouse	0	0	13	19	69
Mayfield L. Rd.	0	1	7	3	89
<u>100 MILE HOUSE TSA</u>					
Bonaparte R.	6	0	14	12	68
Average	9	2	9	10	70

¹ Current=trees attacked in 1991; red=trees attacked in 1990; grey=trees killed prior to 1990. Only trees 20 cm DBH and greater were recorded.

Table 3. Volume of Douglas-fir in Douglas-fir beetle cruise plots in the Cariboo Forest Region, 1991.

TSA and Location	Volume (m ³) per hectare				
	Current ¹	Partial	Red	Grey	Healthy
<u>WILLIAMS LAKE TSA</u>					
DND/Drummond L.(E)	12	13	24	95	81
/Drummond L.(NE)	160	17	10	0	70
/Callanan L.(E)	7	0	40	65	212
/Callanan L.(N)	13	0	57	89	141
/Callanan L.(SE)	97	0	45	85	54
/Peavine Meadow	93	0	16	117	88
/Drummond L.(N)	7	8	22	142	163
//B' Road	164	2	28	0	59

(Cont'd)

Table 3. (Cont'd)

TSA and Location	Volume (m ³) per hectare				
	Current ¹	Partial	Red	Grey	Healthy
Williams Lake	23	0	64	22	115
Chimney Cr.	2	3	16	46	148
Meldrum Cr.	7	0	25	15	139
Pablo Cr.	7	0	28	6	156
Soda Cr.	12	19	140	13	258
Hawks Cr.	12	17	21	27	179
Dog Cr.	2	3	27	32	135
Springhouse	0	0	76	102	76
Mayfield L. Rd.	0	3	47	39	285
<u>100 MILE HOUSE TSA</u>					
Bonaparte R.	11	0	43	30	83
Average	35	11	40	51	136

¹ Current=trees attacked in 1991; red=trees attacked in 1990; grey=trees killed prior to 1990. Only trees 20 cm DBH and greater were recorded.

The Douglas-fir beetle broods in trees attacked in 1991 were healthy, averaging 20 larvae, pupae and adults per 900 cm² of bark surface. This was up from 1990 when 14 healthy individuals were counted and down from 1989 when 25 were counted, indicating the natural variation in populations only, not a trend.

The highest rate of current attack was in the DND Block north of Riske Creek where an average 17% (range 2-36%) of the trees on the plots were infested, up from 11% (range 2-19%) last year. Elsewhere in the region, current attack averaged 3% (range 0-6%) down from 14% (range 4-21%) in 1990. The lack of any control action in the DND Block has resulted in the increase of beetle numbers and spread to nearby mature Douglas-fir. Control action, including trap trees and salvage logging, has been successful in the remainder of the region except for a few notable exceptions where the trap trees were neglected. At these locations there will be an expansion of infestations since a population build-up was promoted and the rate of current attack could be higher than the regional average 3% this year.

Douglas-fir beetle will continue to be a major pest of mature and overmature Douglas-fir in Cariboo Region. Complete elimination of the pest is not possible. Infestations in the DND block will expand until the susceptible old growth Douglas-fir is depleted, unless control actions are undertaken. There will be a continued decrease in infestations throughout the remainder of the region due mainly to weather conditions that have increased the resistance of Douglas-fir to attack and other factors including trap trees and salvage logging which will reduce the size of the population.

Western spruce budworm
Choristoneura occidentalis

Low populations of western spruce budworm continued in 1991. Larval collections in standard three-tree beating samples increased slightly to an average 17 from <1 last year. This was the third consecutive year of low populations since infestations were last recorded in the region in 1988.

The increase was centered around Clinton, particularly west of Clinton at Cavanaugh Creek, where trace defoliation occurred and beating samples averaged 150 larvae, up from 25 last year. Elsewhere in the region, the average number of budworm larvae per three-tree beating sample increased to 3 from <1 last year.

FORECAST

An average 18 male moths per trap were caught in five pheromone-baited MultipherR traps, set out in a population monitoring plot at Bridge Lake, up from six last year. Fractionally more than one larva were collected in three branch tip beating samples on each of 25 trees at the plot, similar to last year. These results could indicate the early stages of an increasing budworm population. Trapping will continue as part of a province-wide study to improve the detection of rising western spruce budworm populations by comparing numbers of larvae and adults to subsequent defoliation levels.

Egg mass samples at Cavanaugh Creek west of Clinton indicate moderate defoliation¹ in 1992. There were 104 egg masses counted per 10 m² of foliage, up from 23 in 1990. Western spruce budworm populations increased and defoliation was mapped nearby, south of Clinton in the Kamloops Forest Region. In other Douglas-fir stands throughout the region the budworm populations will remain low.

Conifer-poplar rust
Melampsora occidentalis
M. medusae

The current growth of all ages of Douglas-fir was infected by the aecial stage of these rusts over a widespread area west of Alexis Creek and in a localized 2 ha infection near Three Mile Lake south of Clinton. At each location nearly all of the current years' growth, on all the trees, was infected. This resulted in significant premature needle loss on the trees. Last year, mainly young Douglas-fir were affected in the eastern portion of the region.

Conifer-aspen rust, M. medusae, is the more damaging of these rusts and has been shown to cause serious growth loss of aspen; however, the damage on Douglas-fir is not usually serious.

¹ 1-50 egg masses/10 m² of foliage = light defoliation
51-150 egg masses/10 m² of foliage = moderate defoliation
151+ egg masses/10 m² of foliage = severe defoliation

PINE PESTS

Mountain pine beetle
Dendroctonus ponderosae

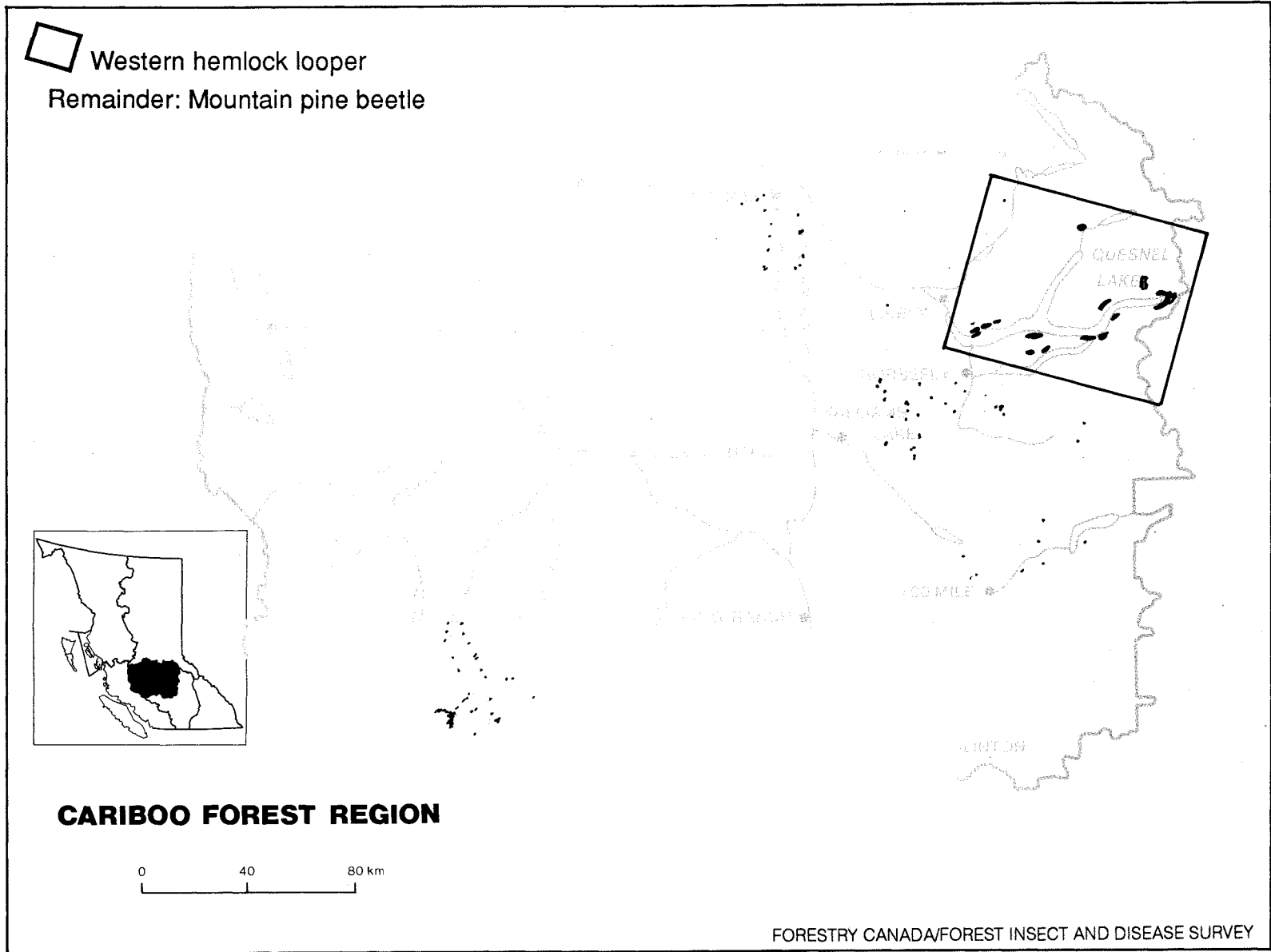
Lodgepole pine, recently killed by mountain pine beetle, were mapped over 350 ha in 295 separate infestations in 1991, up from 315 ha in 155 separate patches last year (Map 3, Table 4). The existing infestations in the Chilko Lake area decreased to 170 infestations over 215 ha; however, new small 0.5-4 ha infestations were mapped over 135 ha from near Quesnel south to Clinton.

Table 4. Mountain pine beetle infestations, Cariboo Forest Region, 1992

TSA and location	1991		1990	
	Area (ha)	Number of Infestations	Area (ha)	Number of Infestations
<u>WILLIAMS LAKE</u>				
Chilko L.-	220	175	315	155
Taseko L.				
Horsefly	45	65	0	0
<u>QUESNEL TSA</u>				
Blackwater R.	5	5	0	0
Narcosli Cr.-	20	30	0	0
Quesnel R.				
<u>100 MILE HOUSE TSA</u>				
Canim L.	60	20	0	0
Total	350	295	315	155

WILLIAMS LAKE TSA

In Williams Lake TSA small infestations, 0.5-2 ha, were mapped over about 100 ha on both sides of Chilko Lake similar to 1990. Little change occurred in the large infestations that have persisted at the head of Franklyn Arm since 1987. There were about 25 small infestations from the Yohetta Lake area east to Fishem Lake near Chilko Lake, where only five were found last year. Infestations along Edmond Creek at the south end of Chilko Lake decreased again to only 11 infestations over 40 ha from 13 over 60 ha last year. Noteworthy increases occurred at other locations in the region. In the eastern part of the Williams Lake TSA between Horsefly and Williams Lake, there were 67 small infestations over 42 ha where none were mapped in 1990.



Map 3. Areas of recent tree mortality and defoliation detected during aerial and ground surveys, 1991 (large scale maps available on request).

QUESNEL TSA

In the northern part of the region, 35 new infestations were located at widespread locations in **Quesnel TSA** over 25 ha. Most of the patches were small (0.25 ha) except for a single infestation of about 5 ha south of Dragon Mountain near Quesnel.

100 MILE HOUSE TSA

In **100 Mile House TSA**, new infestations were found at 20 locations in the Canim Lake and Lac La Hache areas over 60 ha, in 20 separate small, 0.5-30 ha patches.

As in other years, the BCFS used pheromones to bait trees near or in small infestations to contain the beetle flight, and allow control of the population by single tree disposal. In 1991, 1559 baits were set out at 40 locations in the Quesnel, Chilcotin, Horsefly and 100 Mile House BCFS districts. These methods can be effective to control expansion of infestations especially when used along with control/salvage logging.

FORECAST

Surveys of infestations showed substantial current attack at some of the locations. Three areas examined had an average 64 currently attacked pine and 25 red, over areas ranging from 0.5 ha to 40 ha. Prism cruises at Meiss Creek near Rose Lake and Cosmosky Creek near Crooked Lake in October, averaged 11% current attack (1991 attack); 31% red (1990 attack); 9% grey (attacked before 1990) and 49% healthy.

The largest infestations, at Franklyn Arm and Edmond Creek, are expected to continue to decline next year, due to host depletion. The new infestations in the eastern part of the Williams Lake and 100 Mile House TSAs have increased dramatically in the last year and will increase again in 1992 based on the rate of current attack and the brood potential. Apart from the ongoing infestations at Chilko Lake, mountain pine beetle populations have been low and have shown no inclination to increase until this year. This increase could be an indication of the onset of rising populations region-wide. Control measures, if applied to the infestations, should be effective in reducing the rate of population increase and the resulting damage.

Pinewood nematode Bursaphelenchus xylophilus

Pinewood nematode studies continued for the ninth consecutive year in the Cariboo Region. Nematodes have been collected from five trees, six chip piles (of which four were in Cariboo Forest Region) and from one woodborer adult, in 12 years of sampling in British Columbia. Pinewood nematode remains extremely rare in the forests of British Columbia.

Log storage yards were examined for woodborers at five major mills in the Williams Lake area. Only one mill had woodborer infested logs in the log decks,

which were located for possible future sampling in a kiln drying project at Forintek Canada Corp. The logs were not used in the study; however pinewood nematode sampling will continue in Cariboo Region in 1992 to support the anti-quarantine work by government agencies and industry in British Columbia.

Pine needle diseases
Elytroderma deformans
Lophodermella concolor
L. montivaga

Brooming and needle loss of ponderosa pine caused by E. deformans, decreased in chronically infected areas near Loon Lake, Clinton and west to Kelly Lake. Infection of 60% of the ponderosa pine declined to 15% of foliage mainly in brooms which averaged 5 per tree, from 40% foliage discoloration on 80% of the trees last year.

Infection of lodgepole pine, by E. deformans increased from Williams Lake south to Clinton and west to Alexis Creek. Damage was widespread from 100 Mile House to Chasm where 40% of the foliage was infected on all trees. West of 100 Mile House at Snag Lake all the pine foliage over 20 ha was 40% infected, causing severe defoliation. Similar damage occurred from Alexis Creek west to Redstone in 5-20 ha pockets.

In British Columbia, Elytroderma needle disease is the most important foliar disease of ponderosa pine. The consequences of infection in ponderosa pine, the most common host, can be severe causing mortality of weakened trees and branches, especially in dense, overstocked stands. However, damage is usually light in lodgepole pine stands, depending on the severity of infection and the condition of the trees.

The infection of year-old needles of lodgepole pine by L. concolor and L. montivaga increased for the second consecutive year mainly in the south-central and western parts of the region. Mainly small trees and the lower crown of larger trees had 10-60% of the foliage infected in 1/6-1/2 ha patches near Young, Watch and Camden lakes. The most severe damage occurred in small sheltered patches along Enterprise Creek south of Williams Lake, where up to 60% of the foliage was infected.

In the Chilcotin, where infection was recorded last year, all trees had 30% of foliage infected in 1/2 ha patches over a widespread area near Puntzi Mountain and Anahim Lake. West of there in the Homathko River Valley, the limited pine type was 50% infected with an average 30% of the foliage affected. Lodgepole pine were all infected in 1/4 ha patches south of 100 Mile House to the highway 24 junction on highway 97 and east for 4 kms.

Severe infections in successive years will cause loss of the foliage resulting in growth loss up to 30%. The infected trees then appear tufted since only the current foliage is left. Infection will continue if suitable moist weather conditions occur next spring.

Mammal damage

The amount and severity of damage to conifers by **squirrels, bears and voles** increased significantly this year throughout the region for the second consecutive year, mainly in lodgepole pine (Table 5). Tree mortality, reduced growth and branch mortality were the types of damage encountered.

Partial or complete stem girdling of 1-2 m high trees occurred in a 2 ha patch at 170 km Chezacut Road. Roadside surveys of nine stands revealed 1-30 dead branches per tree in 0.25 to 0.5 ha patches in pine 2-12 m high. Many of the branches killed were also infected with lodgepole pine dwarf mistletoe, Arceuthobium americanum, which attracts squirrels. The frequency and intensity of the squirrel damage was noteworthy and also occurred in stands not infested with mistletoe.

Table 5. Summary of lodgepole pine stands damaged by squirrels, Cariboo Forest Region, 1991.

Location and TSA	Area of damage	Number of damaged branches per tree	Height of trees
<u>WILLIAMS LAKE</u>			
Chezacut Road	1/4 ha patches	2-25	3-10 m
Cuisson Lake	1/2 ha patches	1-25	5-10 m
Alexis Creek- Riske Creek	1/6 ha patches	1-20	5-10 m
Joes L. Rd.	1/3 ha patches	3-30	2-10 m
Enterprise Rd	1/6 ha patches	1-8	2-12 m
Anahim-Tatla	1/4 ha patches	4-30	3-12 m
<u>100 MILE HOUSE</u>			
Forest Grove- 100 Mile House	1/5 ha patches	1-10	3-12 m
Lac La Hache	1/4 ha patches	3-30	3-10 m
70 Mile House- 100 Mile House	1/6 ha patches	1-8	3-12 m

Bears girdled and killed 2% of 12 year-old, 6-m high lodgepole pine over 20 ha at Little River near Cariboo Lake. There was no damage there last year, however from conversation with local residents the bear population seemed to be higher in 1991.

Increased populations of **voles** severely damaged or destroyed 42% of lodgepole pine seedlings planted over 10 ha in an open grassy stand of pine and Douglas-fir at Leeches Lake west of Williams Lake. This was the first record of seedling damage by voles in the area in recent years.

Damage caused by the squirrels will not have a lasting effect on the trees except for some growth loss and branch mortality. However, the bear and vole damage is more serious and if it continues next year at the same intensity, stocking in those areas will be reduced. Actions may be required to reduce pest populations or change planting treatments and schedules.

SPRUCE PESTS

**Spruce beetle
Dendroctonus rufipennis**

Mature Engelmann spruce were killed over 65 ha in 40 separate infestations in 1991, similar to the 84 ha in 44 infestations last year (Table 6). Five new infestations were reported and previously infested stands remained infested; however, there was no obvious expansion. Recently killed trees were mapped in the eastern part of **Quesnel TSA** along Cariboo, Mitchell and Matthew rivers, near Kruger and Bowron lakes and west at Towkuh, Big Valley, Rebman, Beaverpass and Alice creeks. In **Williams Lake TSA**, recently killed spruce were reported near Horsefly River and near Chilko Lake at Edmond Creek.

Table 6. Location, area and number of Engelmann spruce recently killed by spruce beetle, Cariboo Region, 1990-91.

Location and TSA	1991		1990	
	No. of infestations	Area (ha)	No. of infestations	Area (ha)
<u>QUESNEL TSA</u>				
Mitchell R.	1	3	2	12
Matthew R.	5	5	11	20
Bowron L.	1	2	1	5
Kruger L.	4	6	7	10
Towkuh Cr.	1	2	1	2
Big Valley Cr.	2	4	2	3
Rebman Cr.	9	18	13	20
Alice Cr.	4	5	3	6
Cariboo R.	3	3	4	6
Beaverpass	5	2	0	0
Ghost L.	1	2	0	0
<u>WILLIAMS LAKE TSA</u>				
Horsefly R.	1	1	0	0
Cosmosky Cr.	1	2	0	0
Edmond Cr.	2	10	0	0
Total	40	65	44	84

Previous infestations in the Cariboo Region began with large-scale blowdown and usually followed the same pattern; the population increased in the windfall, many beetles completing their life cycles in one year which concentrated the numbers of emerging beetles and resulted in more successful attacks in standing green trees. Weather conditions caused widespread moisture stress contributing to further increases in populations. Forest Insect and Disease Survey records show that three major spruce beetle epidemics have occurred in the Cariboo Region since 1962. Infestations developed in 1962-65 near Big Valley Creek and Cottonwood River; from 1969-70 near Cottonwood River and Cariboo Lake and from 1980-86, in Bowron Provincial Park and at other scattered locations near the park. The largest infestation, from 1969-70, peaked at 26 260 ha in 1970.

FORECAST

A survey of the blowdown at Isaac Lake in Bowron Provincial Park was conducted September 24-30 for the second consecutive year, in cooperation with British Columbia Parks and British Columbia Forest Service. The survey was carried out to determine the status of spruce beetle, Dendroctonus rufipennis, in the blowdown and predict its' trend next year (Table 7).

Table 7. Summary of spruce beetle cruises in blowdown at Isaac Lake in Bowron Provincial Park, Cariboo Forest Region, 1991.

Location	No. of logs attacked		Total no. of logs examined		Average no. of progeny ¹ per m ² of bark	
	1991	1990	1991	1990	1991	1990
Wolverine Bay	27	12	58	68	142	262
Nigoo Cr.	27	33	96	47	118	432
Peever Cr.	8	9	50	51	72	93
Peever Pt.	21	7	49	30	137	121
Isaac R.	4	10	85	31	12	170
South Shore	10	12	34	66	129	258
Total:	97	83	372	293		

¹ Progeny includes larvae, pupae and adults.

The 10 m wide strip cruises recorded all standing and blowdown trees on transects through the middle and around the edges of the patches of windfall. Spruce blowdown was sampled every 100 m along the line recording attack category and progeny information. At the six locations cruised, 13% of the 882, 1990 windthrown trees, were attacked, down from 29% in 1990. Approximately 24% of 37, 1991 windthrown trees were attacked. The population consisted of 73% larvae, 8% pupae and 19% adults. Last year the proportions were similar; 67%

larvae, 11% pupae, 17% adults and 5% eggs. Data showed an average 10.3 beetle attacks per m² of bark surface, similar to 12 per m² last year. The mean "R"² value was 2.4, indicating a rising population in the trees attacked.

The 1992 spruce beetle flight will be small since most of the small population is two-year cycle (maturing in 1993) in Bowron Park and nearby areas. Unless more blowdown occurs, the small numbers of beetles emerging this year will have little susceptible spruce to attack since the 1990 blowdown is too dry to be attractive. There will be no large infestations beginning near the blowdown in Bowron Provincial Park.

Managers must put priority on blowdown salvage for spruce beetle population control in any mature spruce stand. Mature spruce types in the eastern portion of the region, where the 1990 windfall occurred, are subject to the highest hazard.

Two-year-cycle spruce budworm Choristoneura biennis

Immature two-year-cycle spruce budworm, lightly defoliated the current growth and new branch tips of spruce and alpine fir stands over 3250 ha in 43 separate infestations from Barkerville south to Quesnel Lake in **Quesnel** and **Williams Lake TSA's** (Map 4, Table 8). In 1990, forests were lightly and moderately defoliated over 13 840 ha by mature larvae, throughout the same area infested this year. In 1989, immature larvae lightly defoliated 2800 ha in 15 infestations, mainly in the 100 Mile House TSA from Crooked Lake to Mahood Lake.

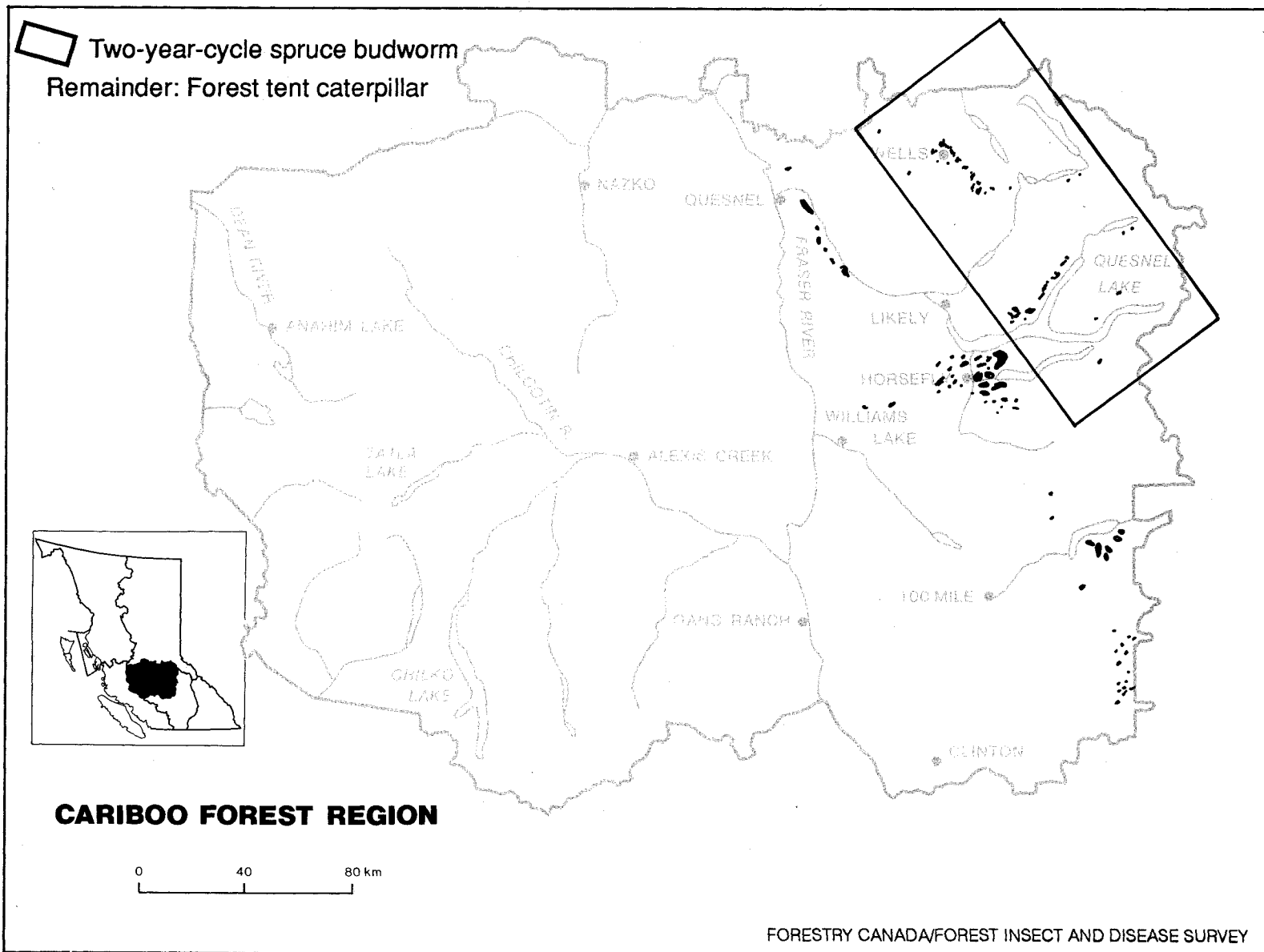
QUESNEL TSA

Light defoliation occurred over 820 ha in areas infested last year at Pundata and Lightning creeks and near Barkerville and Wells. New defoliation was mapped in areas not infested last year but with a history of damage by two-year budworm, over 250 ha at Cunningham Creek and near Cariboo River. The only defoliation mapped in Bowron Provincial Park was over 60 ha in an area infested in 1990, south of Lanezi Lake.

WILLIAMS LAKE TSA

Stands were lightly defoliated over 1100 ha at Grain Creek near Quesnel Lake, the first time since 1988. New small patches from 75-170 ha were mapped near Mitchell Lake and Horsefly River and over 700 ha in the chronic area on the north side of the north arm of Quesnel Lake. Nearly 70% of the regional defoliation occurred in Quesnel TSA in the northern portion of the region, the opposite of 1989 when 73% of the defoliation was mapped in the 100 Mile House TSA farther south.

² "R" values: decreasing = 0.7; static = 0.8-1.3; increasing = 1.4+.



Map 4. Areas of defoliation, detected during aerial and ground surveys, 1991 (large scale maps available on request).

Table 8. Location and area of spruce and alpine fir defoliated by two-year-cycle spruce budworm, as determined from aerial and ground surveys, Cariboo Forest Region, 1991.

TSA and location	Area of light defoliation (ha)	No. of infestations
<u>QUESNEL TSA</u>		
Pundata Cr.	80	1
Lightning Cr.	30	1
Barkerville	710	20
Cariboo R.	30	1
Cunningham Cr.	220	4
<u>Bowron Provincial Park</u>		
Lanezi Cr.	60	1
TSA Subtotal	1130	28
<u>WILLIAMS LAKE TSA</u>		
Grain Cr.	1100	5
Quesnel L.(north arm)	700	5
Mitchell L.	75	2
Lynx Cr.	70	1
Horsefly R.	170	2
TSA Subtotal	2115	15
GRAND TOTAL	3245	43

FORECASTS

Five pheromone-baited traps at each of two locations, caught an average of one moth per trap at Bowron Lake and one per trap at Wells, down from 221 and 312 respectively, in 1990. This was expected since 1991 was a "non-feeding" year of the two-year-cycle spruce budworm, during which the population remains in 1-3rd larval instars. Non-feeding is a relative term meaning the amount of feeding is very small compared to that which can occur in the final year of the life cycle when larvae are large.

An average 4.1 early instar larvae were collected per 45-cm branch tip beating sample at the plots, up from the 1.3 late instar larvae collected last year. This indicates a small population to overwinter and feed next spring. As part of a province-wide study, the data from these plots will be used to equate

level of damage to the relative size of the budworm population, as measured by larval and adult sampling.

To predict defoliation of alpine fir and spruce stands for 1992, 100 buds were examined at each of eight locations throughout the infestation in May (Table 9).

Table 9. Percent buds infested by immature two-year-cycle spruce budworm and predicted defoliation 1992, Cariboo Forest Region, 1991.

TSA and location	Percent of buds infested (May)	Predicted ¹ defoliation 1992
<u>QUESNEL TSA</u>		
Pundata Cr.	23	Light
Four Mile L.	55	Moderate
Barkerville	5	Trace
Pleasant Valley Cr.	43	Moderate
Antler Cr.	21	Light
Willow R. (upper)	21	Light
Average	28	

¹ Percent buds infested in first year of life cycle = percent defoliation following year. 1-25% = light; 26-45 = moderate; 46+ = severe (FIDS Report 84-1).

The major results of successive years of budworm infestations in Engelmann spruce and alpine fir stands are top-kill, branch dieback and loss of annual increment. When severe defoliation occurs for several successive years, the added stress could help predispose the large diameter spruce to beetle attack.

Population predictions covering a two year period are subject to many alleviating factors which can affect the course of the infestation. Based on an average 28% of buds infested in May, 1991, and the high number of small larvae per branch tip beating sample, the infestation is expected to continue next year at much the same rate as in 1990.

Spruce weevil Pissodes strobi

An average 13% of immature Engelmann spruce in cut blocks were attacked by spruce weevil in 1991, mainly in the eastern part of the region. This is a slight increase from 9% in 1990.

East of Horsefly along MacKay River, 12% of terminals were attacked; near Quesnel Lake on the Plato Island Road 20% of regeneration Engelmann spruce were infested; east of Mitchell Bay on Quesnel Lake 15% of leaders were killed and 5% of spruce had tops killed at Raft Creek at the west end of Quesnel Lake.

British Columbia Forest Service, regional plant health personnel, surveyed 14 young stands in three biogeoclimatic zones in the eastern part of the region in 1991 (Table 10). The rate of current attacked averaged 9.7% (range 1.4-35.6%) in intensive strip surveys run through cut blocks.

Table 10. Summary of BCFS surveys for spruce weevil attack, Cariboo Forest Region, 1991

Location and Biogeoclimatic Zone	Percent of trees attacked (current and older)
<u>ICHe</u>	
Bootjack L. #2	7.7
Bassett Cr.	31.0
Moorehouse Cr.	8.8
Hazeltine Cr.	1.4
Trio L.	35.6
<u>IChh</u>	
Bootjack L. #1	13.3
Spanish L. #1	2.0
Poquette L.	7.7
Spanish L. #2	10.6
Spanish L. #3	2.9
Bootjack L. #3	1.7
<u>SBS</u>	
Wolverine L.	3.3
Victoria Cr.	3.9
Lightning Cr.	6.0

One method of weevil control currently being evaluated is the clipped leader/parasite release system developed by J.W.E. Harris. Infested leaders are pruned off and placed in onsite cages which allows emerging parasites to escape while containing emerging weevil adults. This is still the most effective method of spruce weevil control. There are several criteria that should be followed for this method to be effective (pers. commun. J.W.E. Harris):

- 1) select a plantation that is isolated from other infested stands by approximately 1-2 kilometers;
- 2) clip all old and currently infested leaders;
- 3) take enough of the leader to ensure all of the progeny are removed;

- 4) treat the plantation again the following year to ensure all the weevils were collected;
- 5) maintain quality control of work performed.

This serious pest of Engelmann spruce in the Cariboo Region causes loss of height growth and poor form, which can result in suppression of growth potential.

ALPINE FIR PESTS

Western balsam bark beetle Dryocoetes confusus

There were 860 ha containing 5300 m³ of recently killed, mature alpine fir mapped in 75 high elevation spruce and alpine fir stands in the region this year, down from 550 ha in 25 separate infestations last year.

The most severe damage was over 630 ha in 50 patches from 10-100 ha, along the east side of Chilko Lake from Stikelan Point to Edmond Creek and on the south side of Franklyn Arm. Noteworthy damage also occurred at 16 locations over 150 ha in 1-30 ha patches from Dorothy Lake to Taseko Lake and south along Taseko Lake to Falls River. Other areas of noteworthy severe tree mortality included 30 ha north of Quesnel Lake; 15 ha along Betty Wendle Creek in Bowron Provincial Park and 40 ha in the MacKay River drainage.

Western balsam bark beetle is a chronic pest of high-elevation spruce-balsam stands throughout British Columbia and infestations and tree mortality are expected to continue next year, based on historical trends. Change from previous years is sometimes reflected more by the current patterns of aerial survey rather than a biological change in the population. The number of trees killed fluctuates slightly from year to year, generally continuing until the mature fir component is depleted.

WESTERN HEMLOCK PESTS

Western hemlock looper Lambdina f. lugubrosa

Mature western hemlock and western red cedar were lightly defoliated over 5000 ha and moderately defoliated over 700 ha by western hemlock looper in Williams Lake TSA near Quesnel Lake (Map 3), up from only 20 ha at Lynx Peninsula in 1990. This was the first recurrence of high populations since 1984 when 5000 ha of forest were defoliated in the same area.

Moderate defoliation was mapped over 250 ha on Lynx Peninsula at the west end of Quesnel Lake. New areas of light defoliation over 850 ha occurred

adjacent to Lynx Peninsula on the north shore of Quesnel Lake. Light defoliation was recorded over 500 ha along Niagara Creek; over 300 ha west of Niagara Creek at Lynx Creek; in several patches over 860 ha between Quesnel and Horsefly lakes and over 1050 ha from Bouldery Creek west to the end of Horsefly Lake. Overmature and mature western hemlock and western red cedar were lightly defoliated over 1400 ha and moderately defoliated over 390 ha at the east end of Quesnel Lake from Killdog Creek east to Stranger Lake and the Cariboo Forest Region boundary.

Standard three-tree beating collections in the Quesnel-Horsefly lakes area averaged 64 larvae (range 1-160) on western hemlock; 7, (range 1-18) on Douglas-fir and 19, (range 3-110) on western red cedar. Significant numbers of sawfly, *Neodiprion* spp., saddleback looper, *Ectropis crepuscularia*, and rusty tussock moth, *Orgyia a. badia*, larvae collected along with western hemlock looper, were responsible for a small percentage of the defoliation.

PARASITISM

The rate of parasitism of western hemlock looper by hymenopteran and dipteran parasites averaged 6%, as determined from rearings of three collections of 4-6 instar larvae from representative locations within the infestation. Larval rearing results showed negligible parasitism of sawflies and 2% parasitism of saddleback looper by dipteran parasites. Rusty tussock moth larvae were not parasitized, however 98% of the larvae were infected with a viral disease. This high incidence of infection by virus should result in much reduced populations of rusty tussock moth in the Quesnel Lake area next year.

HISTORY

The last infestation, occurred in 1984, and was similar to the current infestation. The same general area was infested; 5700 ha in 1991 and 5000 ha in 1984. Parasitism by hymenopteran and dipteran insects averaged 6% in 1991 and 12% in 1984. The number of eggs per 100 grams of lichen averaged 37 at three locations in 1991 and 47 in 1984 at one location.

In 1985 the infestation subsided, however there were four patches totalling 640 ha of mature western hemlock and western red cedar that did not refoliate, resulting in 25% mortality.

FORECAST

Egg collections from each of 10 trees at three locations in October contained an average 37 healthy eggs per 100 grams of lichen (old mans' beard) indicating light to severe defoliation³ in 1991 (Table 11).

³ 5-26 healthy eggs per 100 grams of lichen = light defoliation
27-59 " " " " " " " = moderate defoliation
60+ " " " " " " " = severe defoliation

Table 11. Predicted defoliation by western hemlock looper based on egg surveys in 1991, Cariboo Forest Region.

TSA and location	No. of eggs/100 grams of air dried lichen				Predicted defoliation 1992
	Healthy	Parasitized	Infertile	Old	
Bouldery Creek-1	35	8	<1	7	Moderate
Bouldery Creek-2	4	0	0	3	Light
Lynx Peninsula	71	13	1	24	Severe
Average	37	7	<0	11	

Based on the low rate of parasitism and the high number of egg masses found, the infestation could expand in 1992 with more severe defoliation likely in the Quesnel Lake area.

PESTS OF YOUNG STANDS

To assess pest damage, 27 young, managed stands funded under FRDA 1, were examined in the region this year in the 12th consecutive year of young stand study. Natural and planted regeneration up to 25 years old were sampled using fixed radius plots, (radius range 3.99-5.64 m) on transects through the plantations, recording a minimum of 10 plots and 7 trees per plot (Table 12).

Lodgepole pine, Douglas-fir and Engelmann spruce were the main host components of the 10 biogeoclimatic zones sampled. The majority of the plots (34%) were in the IDfb2 zone, 15% in IDfb2 and ESSfh, 11% in ICHe2 and 25% in six other zones.

The most common and severe damage found in the young stands surveyed was **climatic damage** caused by a late spring frost in the early months of 1991, mainly in Douglas-fir stands. This resulted in an average 22% bud mortality (range 5-80%) through the range of Douglas-fir with the most severe located west of Lac La Hache (see Multiple Hosts).

Squirrels and cattle damaged mainly lodgepole pine in five stands, causing branch and tree mortality of all ages of trees throughout the region. The most severe damage occurred along the Chezacut Road northwest of Alexis Creek where 96% of 1-2 m high pine were girdled or killed.

Spruce weevil killed an average of 15% of the terminals of young, 2-6 m high spruce in 60% of stands examined in the eastern part of the region from Quesnel Lake south to Mahood Lake. This weevil is a common and important pest

of Engelmann spruce and can cause loss of dominance of the most preferred crop trees in the stand. An average of 73% of the trees were infested by **Cooley spruce gall adelgid** in 80% of stands examined from Cottonwood south to Horsefly River.

Table 12. Summary of pests of young stands surveys, Cariboo Forest Region, 1991.

Host and Pest	Severity Index ¹	No. of stands affected	Percent of trees affected
<u>Lodgepole pine</u> - 1619 trees in 18 stands, one pest free, major species in 13.			
Mammals ²	5	5	32%
Warrens' root collar weevil	5	2	1%
Climatic (snow)	5	2	7%
Lodgepole terminal weevil	4	3	2%
Dwarf mistletoe	4	1	2%
Pine needle cast	3	2	3%
Western gall rust	3	2	11%
.....			
<u>Douglas-fir</u> - 1102 trees in 17 stands, one pest free, major species in 9.			
Climatic (frost)	3	13	49%
Cooley spruce gall adelgid	3	1	70%
A twig beetle	3	2	37%
Conifer-poplar rust	3	2	31%
.....			
<u>Engelmann spruce</u> - 391 trees in 6 stands, none pest free, major species in 5.			
Spruce weevil	4	3	15%
Cooley spruce gall adelgid	3	4	73%
Two-year cycle budworm	3	1	100%
.....			
<u>Western red cedar</u> - 45 trees in 2 stands, none pest free, major species in none			
Climatic (frost)	3	2	25%
.....			
Totals	3157 trees in 27 stands, none pest free		

¹ Severity index: 1. Pest free
 2. Negligible damage
 3. Loss of current growth potential
 4. Loss of long term growth potential and volume
 5. Life threatening
 6. Mortality

² Mammals includes squirrels, bear, cattle and voles.

Forest regeneration and young stands are becoming more important in terms of forest management and will continue to demand more FIDS resources. The surveys of young stands will continue next year in Cariboo Region.

MULTIPLE HOSTS PESTS

Blowdown

Only single, widespread trees were blown down in 1991 in the region and the widespread blowdown that occurred in 1990 was logged and utilized where possible throughout the region. There was some build-up of Douglas-fir beetle populations in the IDF zone and low numbers of *Ips* spp. in lodgepole pine blowdown; however, the damage to adjacent stands was negligible.

The blowdown cruise at Isaac Lake was designed to look at the spruce beetle population in the windfall. Nearly half of the stand component was spruce and approximately half of that was blown down. There was a total 206 m³ of wood per ha (all species) in the stands, both standing and fallen. There was a total 107 m³ per ha of spruce of which 49 m³ per ha was blowdown.

The populations remain low, average 13% of the 1990 windfalls attacked with 10.3 spruce beetle attacks per m² of bark surface, compared to 29% of the trees and 12 attacks per m² last year (see spruce beetle section).

In 1990, 40% of the windfalls contained cerambycid woodborers, which affected 2.8% of the phloem area; 27% contained engraver beetles, *Ips* spp., which affected 3% of the phloem; and 29% were infested by ambrosia beetles, *Trypodendron lineatum*, which affected less than 1% of the phloem. The galleries of these insects accelerated the drying of the windfall.⁴

The windfall examined in September was too dry to be suitable for spruce beetle attack in the spring of 1992.

There will be spruce beetles emerging from 1990 blowdown in the spring of 1992 upon completion of their two-year life cycle. However the population remains small and infestations are not expected.

Black army cutworm Actebia fennica

There were no reports of cutworm populations or damage to seedlings in the region, for the second consecutive year.

⁴ Schmid, J.M. and R.H. Frye, USDA For. Serv., Gen. Tech. Rep. RM-49. Dec. 1977

Cutworm infestations have historically occurred in the wetter parts of the region in spruce-alpine fir forest types particularly in the Cariboo-Horsefly lakes area.

FORECAST

Pheromone-baited Multipher^R traps were placed at two recently burned cutblocks in the Horsefly River area. Two of the four traps were mauled by bears and the other two caught 62 and 7 male moths. The low numbers of moths indicate small populations and the low probability of damage in 1992.

Climatic damage

Mainly young Douglas-fir and some Engelmann spruce were damaged by spring frost, combined with flooding in some areas, throughout the range Douglas-fir in Cariboo Forest Region, and in spruce forests east of Williams Lake. Similar damage occurred in 1989 in the same areas. The damage ranged from 5% bud mortality at some locations to whole tree mortality at others. The tree mortality was mapped over 250 ha in 60 patches from 1/5-1 ha, mainly in the 100 Mile House TSA west of Lac La Hache near Helena Lake. There were an average 135 dead Douglas-fir 2-20 m high, per location.

Young trees were the most severely damaged with 10-100% of the buds killed on most of the trees. Therefore some of these trees lost a complete year's growth. A small number (35%) of the affected buds flushed, however the resulting growth was late and deformed. There was further partial recovery in July when some trees flushed. The bud mortality and late flush gave the trees a "tufted" appearance.

Secondary insects and diseases may cause further deformation of the trees affected and some branch dieback may occur; however, whole tree mortality of the bud-killed trees is unlikely.

Salt damage

Damage to Douglas-fir and lodgepole pine continued at the same level this year as in 1990. Trees with obvious salt damage were located in 46 patches of 5-40 trees from Williams Lake to Quesnel along Highway 97; 34 patches from Williams Lake to Bella Coola along Highway 20; 15 spots from 100 Mile House east to Horse Lake along a secondary paved road and in 57 patches south from Williams Lake to Clinton along Highway 97. The damage to the roadside trees was similar at all locations, varying from 2-10 dead branches per tree to 100% defoliation of the whole tree often resulting in mortality.

The damage occurred when salt spray from snowploughs contacted the needles of roadside trees and the saline run-off permeated the soil supporting the trees. The damage was most severe on the lower parts of the roads and on hills and corners where large amounts of salt were applied. Trees weakened by salt become attractive to secondary beetles and Douglas-fir beetle.

Damage will probably occur again next year, since there is no economical alternative to salt application for ice control on interior highways.

Acid rain monitoring

There was no evidence of change in the condition of plant growth at the acid rain monitoring plot at Cottonwood, east of Quesnel. Examination of the plot includes: assessment of the marked trees recording tree condition and damage if evident; inspection of the ground cover in the three subplots; photography and foliage evaluation of other tagged trees and periodic chemical evaluation of foliage from trees near the plot.

There was light discoloration of older foliage recorded on the off plot trees, damage mimicking acid rain symptoms, however the cause was identified as an abiotic condition called "winter flecking".

Two Engelmann spruce trees have died since the plot was established in 1986. They were not killed by acid rain or any related factor. Brown cubical rot, Polyporus spp., was isolated from the dead trees, however it may not have been the cause of mortality.

Monitoring of the plot will continue because of concerns about potential acid rain and the long-range transport of air pollutants.

DECIDUOUS TREE PESTS

Forest tent caterpillar Malacosoma disstria

Forest tent caterpillar populations increased dramatically, as predicted, causing 15 000 ha of light to severe aspen defoliation east of Highway 97 from Bridge Lake to Quesnel in 155 separate infestations, up from 4760 ha in 1990 (Map 4).

100 MILE TSA

Infestations in the Bridge Lake area in 1990 were forecast to decline and most did, however new infestations began nearby. Infestations were mapped from Young Lake north to Bridge Lake where 750 ha of aspen were severely and 80 ha moderately defoliated compared to 1560 ha of light to severe in 1990. Infestations increased slightly south of Canim Lake to 400 ha light, 160 ha moderate and 850 ha severe, from 1380 ha light and moderate last year.

WILLIAMS LAKE TSA

Infestations expanded nearly ten-fold resulting in 7500 ha severe and 3300 ha moderate defoliation from 1250 ha of severe defoliation in 1990. Patches of aspen 4-1800 ha in area, were defoliated in late May in all directions from Horsefly, with the largest mapped east along the Horsefly River

near Horsefly and north to Horsefly Lake. Moderate defoliation of aspen clones totalling 270 ha in nine separate infestations were also located north of Horsefly to Likely and west along the Quesnel River.

QUESNEL TSA

Along the Quesnel River from Beaver Creek north to Quesnel, there were 21 patches of moderately defoliated aspen mapped over 980 ha and 800 ha light. There was none found in 1990. Small poplar and willow shrubs, 1-3 m high, were 40% defoliated over about 10 ha north of Barkerville in the Williams Creek Valley.

FORECASTS

To help predict the trend of the tent caterpillar population, egg masses were assessed on each of three trees at seven representative infestations (Table 13). The surveys indicate that four of the locations will be severely defoliated and three will be moderately defoliated in 1992.

Table 13. Predicted defoliation of trembling aspen by forest tent caterpillar in 1992, Cariboo Forest Region, based on egg mass surveys in 1991.

Location and TSA	Average number of egg masses/tree		Avg. dbh (cm)	Predicted ¹ defol. 1992	Defoliation 1991
	New	Old			
<u>WILLIAMS LAKE TSA</u>					
Beaver Valley	6	1	13	moderate	severe
Horsefly Lake	49	4	12	severe	severe
Black Creek	29	6	13	severe	moderate
Meiss Creek	1	3	11	light	severe
<u>100 MILE HOUSE TSA</u>					
Bridge Lake	3	6	13	light	severe
Canim Lake	5	25	14	moderate	moderate
<u>QUESNEL TSA</u>					
Quesnel R.	1	3	13	light	moderate

¹ A 10-cm dbh tree would be 100% defoliated with 11+ egg masses.

Several successive years of severe defoliation has been shown to cause tree mortality of trembling aspen. However the most common adverse effects of forest tent caterpillar defoliation are usually growth reduction, branch and top dieback and a great nuisance to the public since many of the stands affected are on private and recreational property.

The rate of parasitism, by mainly Dipterous parasites, averaged 34% (range 10-50%) in collections of late instar larvae taken at four representative locations throughout the infestation. Infection of larvae by mainly viral diseases averaged 6% at Meiss Creek and Bridge Lake. At newer infestations along Horsefly River and Horsefly Lake, where diseases have not had time to increase, collections were negative.

It appears from the egg mass sampling that the potential exists for continuation of the outbreak. Past records in FIDS files indicate outbreaks have characteristically lasted 2-4 years. This means that the southern portion of the infestation near Bridge Lake will decline and the Horsefly-Quesnel infestations will probably continue next year. The relatively high rate of parasitism (average 34%) will probably reduce the damage caused by forest tent caterpillar, mainly near Horsefly and Bridge lakes. Some of the localized infestations in those areas will decline while new ones could spring up in the Likely area. Cool temperatures at the time of egg hatch reduces populations so early spring temperatures are critical.

Gypsy moth
Lymantria dispar

There were no adult male gypsy moths caught in 27 pheromone-baited sticky traps placed in 21 forest recreation areas, parks and highway rest areas in the region in 1991 (Table 14).

In British Columbia 72 adult male gypsy moths were trapped at 17 locations this year, down from 121 at 16 locations in 1990. Moths were caught in the lower mainland and at scattered sites from Victoria to Courtenay on Vancouver Island. Eleven of the 72 males have been identified as the Asian strain of gypsy moth. Living up to its' common name, the Asian gypsy moth hitch-hiked on freighters last docked at ports in Asia. This is the first known capture of this strain in North America.

Table 14. Gypsy moth trapping program, Cariboo Forest Region, 1991.

TSA and Location	Number of sticky traps per site	Number of male moths caught
<u>QUESNEL TSA</u>		
Australian Cr. Rest area	1	0
Barkerville Provincial park	3	0
Bowron Provincial park	1	0
Cottonwood (Historic)	1	0
Ten Mile Lake Provincial park	1	0
<u>WILLIAMS LAKE TSA</u>		
Bull Canyon Provincial park	1	0
Horsefly Lake Provincial park	1	0
McLeese Lake Rest area	1	0
Riske Creek DND	1	0

(Cont'd)

Table 14. (Cont'd)

TSA and Location		Number of sticky traps per site	Number of male moths caught
<u>100 MILE HOUSE TSA</u>			
Bridge Lake	Provincial park	1	0
Canim Lake	Provincial park	1	0
Chasm	Provincial park	1	0
Downing	Provincial park	1	0
Green Lake	Provincial park	3	0
Kokanee Bay	Private park	1	0
Lac la Hache	Provincial park	2	0
Loon Lake	Provincial park	1	0
Mahood Lake	Provincial park	1	0
Ruth Lake	Provincial park	1	0
<u>BELLA COOLA</u>			
Bella Coola Airport		1	0
Tweedsmuir Park	Provincial park	2	0
Total		27	

The continuing gypsy moth survey is a cooperative project with Agriculture Canada (Plant Health), Forestry Canada and the British Columbia Forest Service, to monitor the spread of this important defoliator of deciduous trees. The survey will continue and possibly intensify in 1992 in Cariboo Forest Region.

OTHER PESTS OF MINOR SIGNIFICANCE

Collections and observations of other potentially damaging pests, currently of minor significance, are listed by importance in Table 15.

Table 15. Pests of minor significance in the Cariboo Forest Region, 1991.

Host/Pest	Location	Damage	Status ¹
<u>Coniferous Hosts</u>			
LOGEPOLE PINE			
.....			
A confer weevil <u>Magdalis</u> sp.		Populations much reduced from 1990, no damage located.	D
Brown cubical rot <u>Fomitopsis pinicola</u>	McLeese L.	60% of the 20 m high trees were infected over 5 ha. Normally a pest of dead trees.	S
Lodgepole pine dwarf mistletoe <u>Arceuthobium americanum</u>	Blackdome Mtn.	1-4 brooms per tree in 14 m high lodgepole pine at 2000 m elevation; 2% dead tops over 50 ha.	I
Pine terminal weevil <u>Pissodes terminalis</u>	Nimpo L. Pigeon Cr. Chezacut Rd. Green L.	Averaged 4% of terminals attacked in trees 2-4 m high. Averaged 2% in 1990 at other locations.	I
AMABILIS FIR			
.....			
Branch gall fungi <u>Caliciopsis pseudotsugae</u> <u>Tympanis laricina</u>	Homathko R.	New host records for these diseases, confirmation planned for 1992.	S
ALPINE FIR			
.....			
Fir-fireweed rust <u>Pucciniastrum epilobii</u>	Hendrix L.	80-100% of the trees had 20-100% of current growth infected for the second consecutive year. Trees damaged were 0.5-1 m high.	I

(Cont'd)

Table 15. (Cont'd)

Host/Pest	Location	Damage	Status ¹
<u>DECIDUOUS PESTS</u>			
POPLAR			
.....			
Birch-aspen leafroller <u>Epinotia solandriana</u>	Quesnel Kersley	1/4-40 ha patches of all age aspen were 50-80% defoliated for the third consecutive year. No serious damage was evident.	I
Northern tent caterpillar <u>Malacosoma californicum</u> <u>pluviale</u>	Cariboo L.	Population collapsed due to natural factors such as weather, diseases and parasites.	D

¹ I = Increasing; D = Decreasing; S = Static