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ANNUAL REGION REPORT
FOREST INSECT AND DISEASE SURVEY
BRITISH COLUMBIA, 1978
PART III, PRINCE GEORGE FOREST REGION

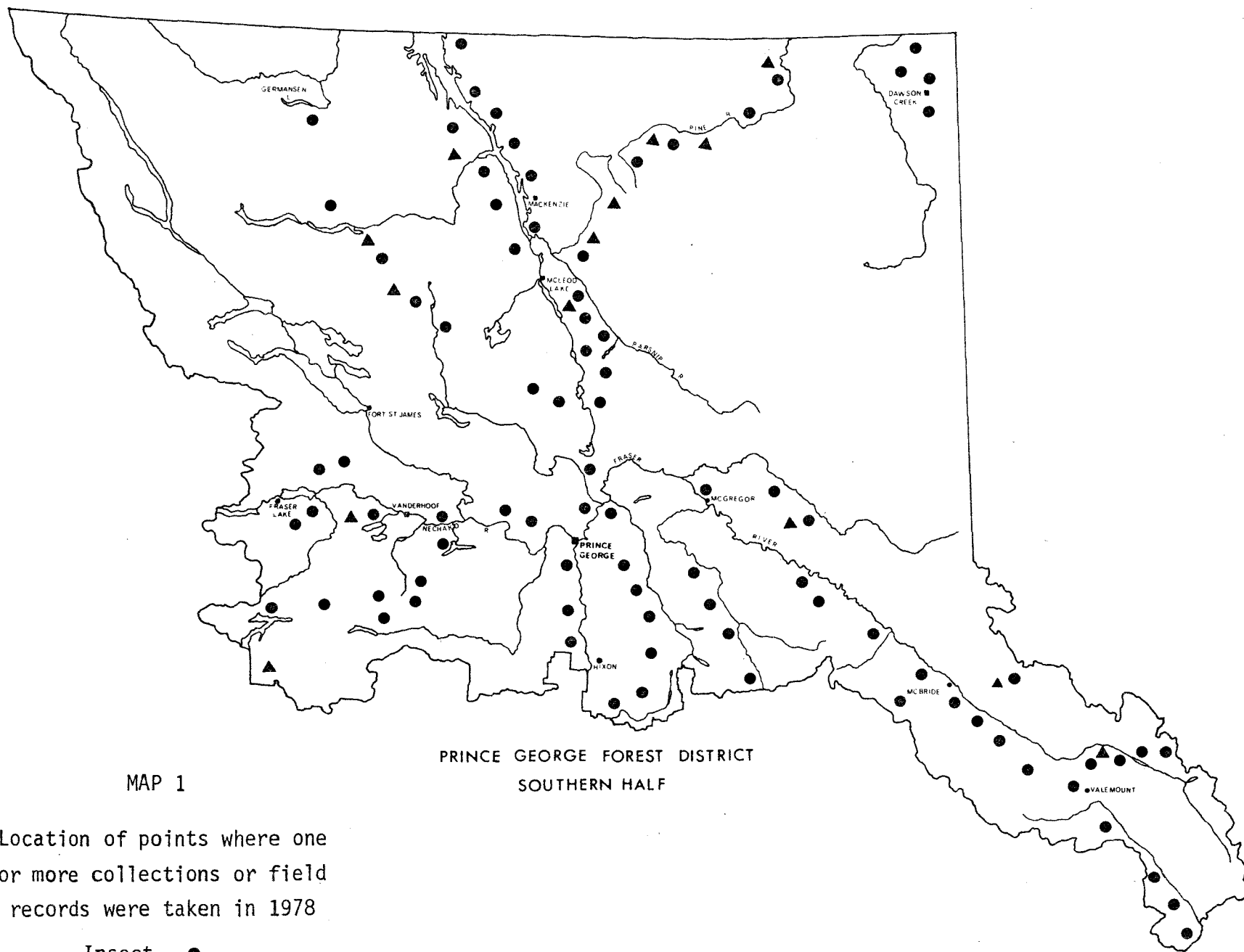
by
L.S. Unger and R.L. Fiddick^{1/}

Pacific Forest Research Centre
Canadian Forestry Service
Victoria, British Columbia

FILE REPORT
Environment Canada
December, 1978

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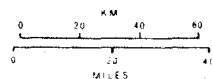
MAP 1

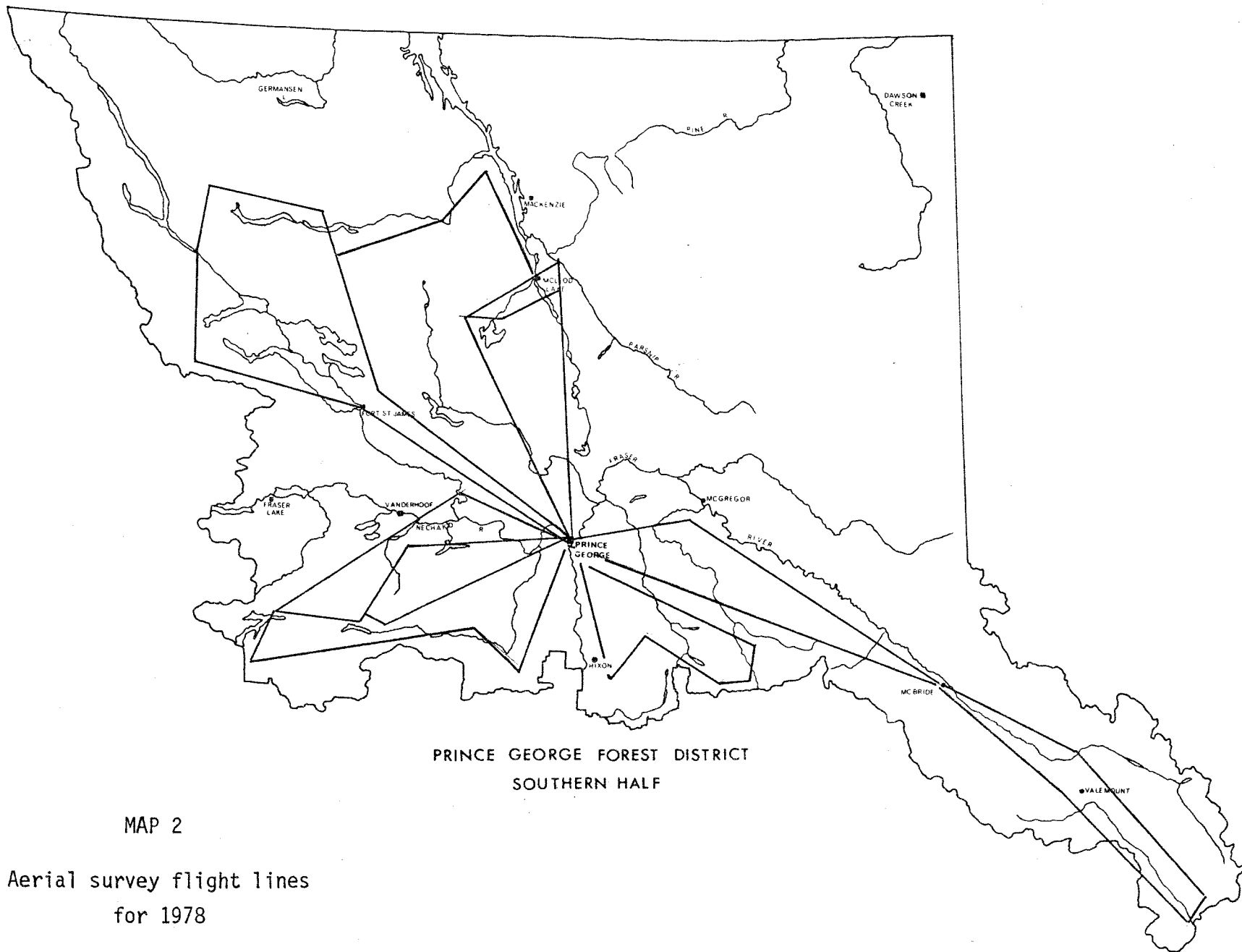
PRINCE GEORGE FOREST DISTRICT
SOUTHERN HALF

Location of points where one
or more collections or field
records were taken in 1978

Insect ●

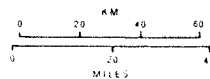
Disease ▲

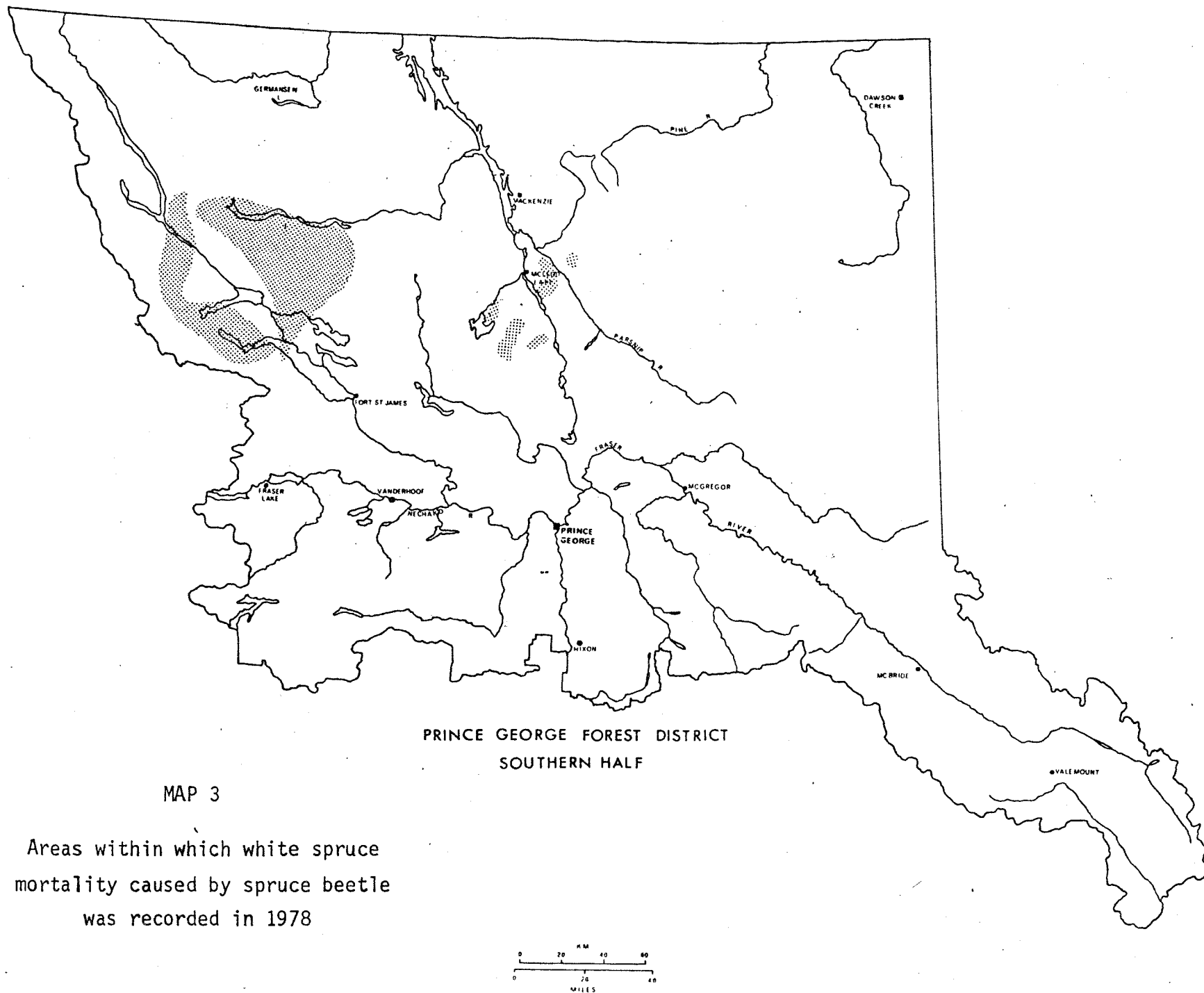




MAP 2

Aerial survey flight lines
for 1978





Introduction

This file report outlines the status of forest insect and disease conditions in the Prince George Forest Region for 1978, emphasizing pests capable of sudden damaging outbreaks.

Regular field work in the Region commenced on June 1 and terminated on September 23, broken by a return to Victoria between August 25 and September 10. Flying time provided by the British Columbia Forest Service amounted to 19 hours fixed wing and 7 hours helicopter. A total of 287 insect and 26 disease collections were taken in 1978. Collection localities are shown on Map 1. Aerial flight lines are shown on Map 2.

Collections containing defoliating larvae increased to 81% from 79% in 1977. Defoliation of white spruce and alpine fir by the two-year-cycle spruce budworm increased at Holmes River and Bowron River. Larch sawfly again defoliated much of the tamarack in the Bednesti-Tatuk lakes area. Black army cutworm damaged seedlings at Chuchi Lake. There was a decline in defoliation by the forest tent caterpillar in the McBride-Tete Jaune Cache area. Defoliation of western hemlock by sawfly decreased to only minor significance near Purden Lake. Spruce beetle has killed much of the mature white spruce in the Carp-Hodda lakes and Stuart-Trembleur-Nation lakes areas but 1978 attacks were light. Mountain pine beetle continued to kill western white and lodgepole pine around McNaughton Lake and in the Fort St. James area.

Needle casts of lodgepole pine were widespread in the western part of the Region. Much of the same general area had a shoot and foliage blight damaging trembling aspen. A true-fir shoot blight and the fir-fireweed rust caused alpine fir foliage loss in the MacLeod Lake-MacKenzie area.

Details on individual insects and disease problems appear in subsequent sections.

Two-year-cycle spruce budworm, Choristoneura biennis

The numbers of C. biennis larvae in three-tree beating samples increased to 12.5 in 1978 from 1.3 in 1976. The most significant increases occurred in the Bowron River drainage.

Drainage Division	No. of samples taken during larval period			% samples containing larvae			Avg. no. larvae per positive sample		
	1976	1977	1978	1976	1977	1978	1976	1977	1978
359	76	55	74	20	16	9	1.3	4.0	12.5

Defoliation of white spruce and alpine fir occurred only on the current year's growth. Aerial mapping was done during mid-August but by then most of the damaged foliage had been washed off by rain. As a result the figures and ratings in Table 1 may be conservative.

Table 1. Areas of Choristoneura biennis defoliation, Prince George Region, 1978

<u>Location</u>	Hectares defoliated	
	<u>light</u>	<u>moderate</u>
Holmes R	3000	
Red Pass	400	
Indian L	180	
Bowron R	560	640
(south of Wendle Cr)		
Wendle L		240
Haggen Cr - Pinkerton Mtn	2 400	2 400

Table 2. *Choristoneura* spp. larvae in 3-tree beating samples from white spruce and alpine fir, and adults in pheromone traps, Prince George Forest Region, 1978.

Location	No. larvae per 3-tree sample			Time in field 1978	Range of moths per trap 1978	Avg. no. moths per trap		
	1976	1977	1978			1976	1977	1978
Km 26 Naver Rd	1	0	0	July 6-Aug 18	26-45	77	3	35
George Cr	0	0	0	"	28-41	41	3	33
Hay L	1	0	0	"	31-47	34	2	40
Willow R (Hwy 16)	0	0	0	"	30-49	27	1	37
Crystal L	0	0	0	July 5-Aug 16	7-25	24	1	16
Davie L	0	0	1	"	7-14	2	1	9
Tudyah L	0	0	0	"	3-14	2	3	8
Pine Pass	0	0	0	"	17-38	11	18	24
Beaver Cr	0	0	0	"	36-49	11	4	43
Link Cr	0	0	0	"	5-20	39	10	11
Tumuch Rd	2	4	38	July 12-Aug 21	49-86	-	-	71
Holmes R	-	-	13	July 13-Aug 24	48-70	-	-	59

Two fifty-cm branch samples were taken from the mid-crown of 10 co-dominate trees in the Bowron River infestation for egg counts. The average number of egg masses per 10 m^2 was 808 which indicates a high population is developing. Some defoliation may occur next year but increased feeding will occur in 1980 when the larvae from this year's eggs are in the late larval stage.

Traps, baited with a synthetic (pheromone) sex attractant, again showed that a budworm population exists even in areas where no larvae were found in beating samples (Table 2). The traps used in 1978 consisted of a 2-litre size milk carton $9 \frac{7}{8}$ inches in length with the ends removed, cut along one side and refolded to form a triangular cage of about 722 cm^2 with the inside coated with bird tanglefoot.

One-year-cycle spruce budworm, Choristoneura fumiferana

The spruce budworm population in the Liard-Smith rivers area dropped to a low level in 1978. Very few larvae were found and no defoliation is expected for 1979.

Spruce beetle, Dendroctonus rufipennis

Spruce beetle was responsible for the death of a large number of mature white spruce trees in the Fort St. James and Summit Lake Ranger districts. Most of the mortality is due to attacks between 1975 and 1977. Many of these trees were partially attacked one year and re-attacked the following year. This trend continued in 1978 but at a much reduced rate. Dead spruce trees were evident during fall aerial surveys in 1977, but beginning this spring large areas of discolored spruce showed up and due to the dry, warm weather new areas of discolored dead trees continued showing up through the summer (Map 3). When cruise strips were run this fall it was evident that more trees were beetle-killed but had not yet lost their green foliage.

The cruise strips, run during mid-September, indicated a light current attack except for strip #1 at Boomerang Lake (Table 3). This strip was run through an area of moderate to heavy tree mortality caused by beetle attacks between 1975 and 1977. In areas which had only small numbers of 1975-76 beetle killed trees, the majority of both the 1977 and 1978 attacks were pitched out.

Table 3. Status of White spruce trees on cruise strips, Prince George Forest Region, 1978

<u>Location</u>	<u>Healthy</u>	<u>Current</u> ^{1/}	<u>Red</u> ^{2/}	<u>Gray</u> ^{3/}
Chuchi L	92%	4%	1%	3%
Boomerang L #1	43	22	10	25
" #2	93	2	0	5
" #3	98	0	0	2

^{1/} 1978 attack including partials

^{2/} 1976 and 1977 attack

^{3/} 1975 or previous attack

Brood development in the cruised areas at Chuchi Lake and Boomerang Lake indicated that 77% and 75% respectively will take two years to complete their life cycle. A similar situation exists in the high elevation windfall areas along the Bowron River where 80% will require two years. In lower elevation windfall near McGregor only 25% will require a two year development period.

No doubt a major cause of the outbreak was a liberal amount of windfall throughout the mature and overmature spruce stands in which the beetle population built up during 1974 and 1975. The major attack year appears to have been 1976 with decreasing attacks during 1977 and 1978. A further decrease in standing tree attacks is expected in 1979.

Salvage logging was being directed into some of the most heavily attacked areas. A high beetle population persisted in some areas and a modified trap tree program, planned for areas which are to be logged within a year, involves felling trees along right-of-ways and at landing sites in early spring. These logs would be removed during the following summer and winter.

Several isolated patches of beetle-killed trees were found at Tatalkuz Lake, Ahbau Lake and Swift River during aerial surveys but no ground checks were made except at Holmes River where the main 1978 flight appeared to have attacked windfall.

In the Bowron-Everett-Willow rivers area there was still an abundant beetle population in the windfall, but no 1978 standing tree attacks were found. The number of attacks on windfall ranged between 8 and 16 per $.09 \text{ m}^2$.

Table 4 shows the areas that were mapped during aerial surveys in the second week of August.

Table 4. Areas of Spruce beetle-killed white spruce,
Prince George Forest Region, 1978

<u>Location</u>	Area in hectares		
	<u>light</u>	<u>moderate</u>	<u>heavy</u>
Fort St. James R.D.			
Sakeniche R	380		
Macdougall Cr	60		
Grassham L		280	
Whitefish L	200		
McKelvey L	160		
Cunningham L	60		
Butterfield Cr	380		
Trembleur L		80	280
Grostete Cr			800
Hatdudatehl Cr		160	
Inzana L		380	
Kloch L		1 880	
Chuchi L	<u>1 600</u>	<u>1 600</u>	<u> </u>
TOTALS	2 840	4 380	1 080
Summit Lake R.D.			
Carp-Weedon lks	15 200	3 800	1 380
McLeod-Hodda lks	5 400	2 800	800
Reynolds Cr	<u>480</u>	<u> </u>	<u> </u>
TOTALS	21 080	6 600	2 180
GRAND TOTAL		38 160	

Mountain pine beetle, Dendroctonus ponderosae

There was a general decrease in the number of lodgepole and white pine "red tops" caused by the 1977 beetle attacks. No fall brood examinations were made but beetle activity is expected to continue in 1979, due to the dry warm weather which persisted from the beetle flight period until mid-August.

Two new areas of red-topped trees were found between Nevin and Horsey creeks near McBride and along the Nation River near Williston Lake. No ground checks were made at either location due to inaccessibility but they were assumed to be caused by mountain pine beetle. Table 5 shows locations and numbers of pine trees killed by mountain pine beetle attack in 1977.

Table 5. Number of lodgepole and white pine trees killed by mountain pine beetle counted or estimated from aerial surveys, Prince George Forest Region, 1978

<u>Location</u>	<u>Year of attack</u> <u>1977</u>
Valemount R.D.	
Ptarmigan Cr	395
Ptarmigan to Hugh Allen Cr	115
Hugh Allen to Dist boundary	295
West side of McNaughton L opposite Bulldog Cr	110
Windfall to Howard crs	70
South of Howard Cr	460
Swift R	200
Fort St. James R.D.	
Cunningham L	30
Stuart L	30
Tezzeron L	25
Kazcheck L	75
Tsayta L	25
Mackenzie R.D.	
Nation R	50
McBride R.D.	
Nevin to Horsey crs	125

Douglas-fir beetle, Dendroctonus pseudotsugae

A few small patches of 5-10 Douglas-fir trees have been killed by Douglas-fir beetle along Castle Creek near McBride. A few trees have been killed each year over the last four to five years.

Dryocoetes - Ceratocystis complex

Mortality of alpine-fir caused by this insect-disease complex was present over at least 800 ha. Moderate mortality has occurred over 250 ha at Pine Pass and over 250 ha in the Everett Creek valley. More scattered mortality is evident at Kuyakuz Mt, 200 ha and at Limestone Ridge, 100 ha. In Mount Robson Provincial Park 100 trees were killed between Moose Lake and Grant Brook as a result of the 1977 attacks. In addition some scattered mortality is present in most alpine fir stands.

Pine root weevil, Hylobius warreni

Pine root weevil continues as a minor pest of young lodgepole pine in the southern portion of the district from Tete Jaune Cache west to Kenny Dam. Scattered individual or small groups of pine were being killed in both natural regeneration and planted stock. None were found in plantations from container stock.

Hemlock sawfly, Neodiprion spp.

After three consecutive years of defoliation of western hemlock east of Prince George, the sawfly population declined sharply from an average of 656 larvae per 3-tree beating sample in 1977 to 290 in 1978, within the area of 1977 defoliation. A few areas still maintained a fairly high larval count, they were: Purden Lake - 1400; Sugarbowl Mtn - 565; Bowron Rd Km 31 - 285; Ptarmigan Cr - 330. In these areas defoliation was confined to individual understory trees. In areas of heavy 1977 defoliation the trees had recovered but foliage was very thin.

A population persisted in all hemlock stands sampled with only 4 negative samples out of 19 and an average of 168 larvae in the positive samples compared to 246 in 1977.

Current defoliation was not severe enough to be visible during aerial survey in mid-August.

Neodiprion spp. on other hosts were only minor. Douglas-fir was the most consistent host with 37% of the trees sampled yielding an average of 3.4 larvae per sample.

Larch sawfly, Pristiphora erichsonii

The larch sawfly infestation continued in the Bednesti-Tatuk lakes area. No sampling was done in the Peace River and Monkman area for sawfly. In the Liard River area no defoliation was present. Beating samples at Tamarack Lake yielded 69 larvae. Duff samples, .09 m², taken during early September yielded an average of 34 cocoons compared to 50 in 1977, indicating a slight decline in population may be expected.

During aerial surveys a wide spread area of defoliation was mapped in a band running south west from Bednesti Lake to Tatuk Lake. Since tamarack grows primarily in relatively small clumps in moist swampy locations, determining the number of hectares defoliated is difficult but is estimated to be 2 500 ha of moderate to severe defoliation.

Forest tent caterpillar, Malacosoma disstria

The tent caterpillar infestation in the McBride area almost disappeared after causing extensive defoliation of trembling aspen in 1977. The area dropped to 2 100 ha of light defoliation from 30 400 ha of moderate defoliation in 1977.

The main area of defoliation was on the southwest facing slope from McBride to Horsey Creek and a few small patches south to Tete Jaune Cache.

Epirrita spp.

This was the most common defoliating insect collected in beating samples. It was present in 28% of the samples and averaged 2.1 larvae per positive sample, ranging up to 11 per sample. The areas most consistently yielding Epirrita larvae were in the 2-year-cycle spruce budworm areas along the Tumuch Road and Holmes River.

Western hemlock looper, Lambdina fiscellaria lugubrosa

Populations increased slightly in the Dome Creek to Goat River area. On samples from western hemlock, the main host, 11% were positive with an average of 3.5 larvae.

Leaf blotch miner, Lyonetia saliciella

Light mining of willow and birch foliage was caused by this insect in the Willow River, Hart Highway and Fraser Lake areas.

Birch leaf skeletonizer, Bucculatrix canadensisella

The damage to birch foliage in the McNaughton Lake-Tete Jaune Cache-Mt. Robson area decreased in 1978. Never-the-less, light discoloration of birch foliage was evident from McBride east to Moose Lake and light to moderate along McNaughton Lake.

Aspen leaf miner, Phyllocnistis populiella

The main area of mined aspen foliage in 1977 was in the Tete Jaune Cache-Mt. Robson area. The damage here has decreased but has increased in the Valemount to McNaughton Lake and Valemount to Albreda area. Light leaf mining was also noted along the Fraser River valley between McBride and Tete Jaune Cache. At Fort Nelson airport up to 100% of the foliage was infested on some trees.

Geometrids on trembling aspen

Patches of trembling aspen were moderately defoliated by bruce spanworm, Opheroptera bruceata between Dawson Creek and Mile 115 of the Alaska Highway. Though Choristoneura conflictana, large aspen tortrix, and an unidentified geometrid were present in collections, Bruce spanworm was the major species causing defoliation. At the time of collection in mid-June a large portion of the population had already pupated. Of a mixed sample of geometrids sent to the Forest Pest Management Institute, one-quarter were infected with Thelohania sp. a microsporidia.

Large aspen tortrix, Choristoneura conflictana

Only a few small patches of trembling aspen were defoliated by the large aspen tortrix in the area east of Fort St. John. A mass collection sent in to the Forest Pest Management Institute indicated the presence of several fungi and nuclear polyhedral virus.

Cone insects

The 1978 white spruce cone crop was very poor and, as a result, few cones were collected. A spiral spruce cone borer (Hylemya anthracina), was present in 90% of the cones and a spruce seedworm, Laspeyresia youngana, was present in 50% of the cones. Several cone midges were present in low numbers as well.

Black Army Cutworm, Actebia fennica

An outbreak of black army cutworm was reported in the spring of 1978 at Chuchi Lake, 70 miles north of Fort St. James. By late June the larvae had completely denuded seedlings and shrubs over 12 hectares. Since the general area was to be a major planting site for 1979, an attempt was made to predict cutworm activity. Fifteen pheromone-baited traps were placed on nearby cutblocks intended for planting in 1979. As indicated in Table 6, very few moths were caught.

Table 6. Black Army Cutworm Moths in Pheromone Traps,
Prince George Forest Region, 1978

Cutblock Location	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
I-1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
I-2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
K-1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	1
H-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H-2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
L-2	3	0	0	1	0	0	0	5	4	0	0	0	0	3	7

As the pheromone traps attract only the male cutworm moths, two light traps were set up at two locations that had a known cutworm population. The contents of these traps provided a clue for the apparent collapse of the population. Ichneumon creperus, a parasitic wasp of cutworm pupae was more abundant in the traps than the cutworms. The assistance of BCFS personnel from Ft. St. James, in weekly checking the traps, was much appreciated. Table 7 shows the numbers of moths caught in the light traps.

Table 7. Black Army Cutworm Moths in Light Traps

	<u>Cutblock D-1</u>			<u>Cutblock F-1</u>	
	male	female	unsexed	male	female
July 31	-	-	6	0	0
Aug. 1	0	0		3	0
Aug. 3	2	3		0	0
Aug. 8	1	0		0	0
Aug. 15	2	4		*	*
Aug. 22	0	0		0	0
Aug. 29	0	0		0	0
Sept. 5	0	0		*	*

* Contents unidentifiable

Porcupine damage, Erethizon dorsatum nigrescens

Porcupines continued to kill young lodgepole pine at Chuchi Lake. Several hundred scattered young lodgepole pine were killed along the ridge between Williston Lake and Dastaiga Creek. At the head of the Holmes River scattered patches of 10-15 lodgepole pines had been killed. At Kiwa Creek 30 young lodgepole pine trees were killed by porcupine.

A gall-forming hymenoptera

Buds of young lodgepole pine in the research section of the Red Rock Nursery were infested by an unidentified hymenoptera. The buds were not killed but developed galls which would result in weak points for several years. The two-year old stands had 50% of the trees infested and up to 50% intensity on some trees. In addition to the general damage, there was a 10% incidence of infested terminals.

Table 8. Other insects of current minor significance

Insect	Host	Locality	Remarks
<u>Acleris gloverana</u> blackheaded budworm	wS, alF D, wH	General	Defoliator, endemic.
<u>Edtropis crepuscularia</u> saddleback looper	wH, wS alF, wC	Hungary Cr to Dove R	Defoliator, 50% of collections positive, avg of 4 larvae.
<u>Eupithecia</u> sp.	wS, alF wH	McGregor, Summit Lk, Barney Cr	Defoliator, 36% of collections positive, Avg of 1.1 larvae.
<u>Nyctobia limitaria</u> Green balsam looper	alF, wS	Purden Lk, McGregor, Barney Cr	Defoliator, 61% of collections positive, avg 2.7 larvae.
<u>Nymphalis antiopa</u> mourningcloak butterfly	W	McBride	Defoliator, light on ornamentals.
<u>Pikonema</u> spp. Spruce sawfly	wS	General South Pr George	Defoliator, 56% of collections positive, avg 2.8 larvae.
<u>Pissodes strobi</u> Spruce weevil	wS	Hixon, McGregor	Terminal borer, light damage.
<u>Pissodes terminalis</u> lodgepole terminal weevil	IP	Sinkut Mtn, Uslika	Terminal borer, light damage.
<u>Semiothisa</u> sp A looper	wS, D, IP	Cluculz L, Bobtail L	Defoliator, 80% of collection positive, avg 3.6 larvae.
<u>Tipula</u> sp. Crane fly	IP	Red Rock Nursery	Several roots girdled.
<u>Zeiraphera</u> sp. Spruce bud moth	wS	McGregor	Defoliator, 67% of collection positive, avg 2.2 larvae.

FOREST DISEASE CONDITIONS

Lodgepole pine Dwarf mistletoe, Arceuthobium americanum

Mistletoe is a perennial problem in much of the lodgepole stands in Mackenzie, Ft. St. James, Vanderhoof and Prince George Ranger regions. Current methods of clear-cut logging eliminate most of the problems of reinfection of the regeneration especially when effort is made to kill all residuals from the stand at the time of logging.

There are a few areas where intermediate utilization logging was practical in the 1960's. This left behind a number of infected residuals. Several of these stands were examined south of Vanderhoof in the Bobtail Lake-Corkscrew Creek areas. Mistletoe was not a problem in the residuals in any of these areas. Brooms were present on some of the trees but the majority were physiological stimulation brooms as a result of the opened stand. Regeneration checked was almost totally free of infection except along the edges of patches of mature trees with heavy mistletoe infection.

One area of severe mistletoe infection near Cleswuncut Lake had 50% of the mistletoe shoots infected with Wallrothiella arceuthobii, a dwarf mistletoe hyper-parasite.

Fir-fireweed rust, Pucciniastrum epilobii

This fir blight was prevalent on alpine fir along McLeod Lake and up to Pine Pass and in the Mackenzie-Williston Lake area. Intensity averaged 10-15% of the current year's foliage along the Hart Highway and 30% in the Williston Lake area and along the Parsnip River road south of the Hart Highway.

A True Fir Shoot Blight, Delphinella abietis

This blight was present on alpine fir throughout the southern part of the district. Only scattered infection occurred in the Canoe, MacGregor and Bowron rivers drainage. Incidence along the Hart Highway from MacLeod Lake to Pine Pass and in the Mackenzie area averaged 15% of the current foliage. D. abietis combined with Pucciniastrum epilobii killed between 20-50% of the current years foliage of alpine fir in this area.

Lodgepole pine needle blight, Scirrhia pini

Discolored lodgepole pine was prominent in much of the south west part of the Prince George Region. Moderate to severe incidence of infested lodgepole pine was present along Willison Lake, in the Bear Lake area, north of Ft. St. James in the Nation, Omineca and Mesilinka rivers area, and much of the area south and west of Vanderhoof. Near Hixon areas of infection were patchy though frequently severe with up to 80% of the old foliage lost on 90% of the trees. Discoloration was severe enough to be visible from the air at the south end of Chuchi Lake in the Nataalkuz-Tsacha lakes area, and along the Omineca River near Germansen Landing.

Flooding

Immature lodgepole pines were killed in patches on about 480 ha in the Laidman, Johnny-Majuba lakes area. Samples were checked for pathogens but only Ceratocystis sp., a secondary disease, was found. Though no water was present in the area when checked in mid-August, the areas are subject to spring flooding. However this does not appear to be the only factor causing mortality.

The mortality has occurred over the past 3 years.

Red Ring Pot, Fomes pini

This is one of the most common wood destroying fungi in the district. In several cases it appears to be closely related to bark beetle activity. At Castle Creek trees infected with Fomes pini were attacked by Douglas-fir beetle, Dendroctonus pseudotsugae. At Chuchi Lake major attacks by spruce beetle, Dendroctonus rufipennis, were in and around Fomes pini foci.

A spruce needle rust, Chrysomya ledi

Near Eulatazella Lake some 50% of the white spruce on 50 ha had from 15 to 20% of the 1978 foliage infected. Further light infection was general in the same area.

Aspen leaf and shoot blight, Venturia macularis

Discoloration and early drop of aspen foliage occurred as a result of infection by V. macularis in all aspen stands in the southern part of the Region. The most extensive area of moderate to severe damage was from Fraser Lake to Endako. The Manson-Omineca rivers and Williston Lake areas had only light infection this year but was very severely infected last year. Generally patchy areas of light to moderate infection were present between Vanderhoof, Prince George and Summit Lake. East of Prince George there was light foliage damage in the McBride-Tete Jaune Cache-Valemount area.

Table 9. Disease of current minor significance

<u>Disease</u>	<u>Host</u>	<u>Locality</u>	<u>Remarks</u>
<u>Armillaria mellea</u> Shoestring root rot	IP, bS	White Landings Cr Esker L	.5 ha dead & dying trees in each area.
<u>Chrysomxa woroninii</u> Spruce shoot rust	wS	Alaska Hwy	Light incidence.
<u>Elytroderma deformans</u> A lodgepole pine needle cast.	IP	Norman Lk Yardley Lk	1-3% of IP infected.
<u>Ganoderma applanatum</u>	wS, aIF	Haggen Cr	Several dead trees.
<u>Lirula punctata</u>	aIF	Link Cr	Needle blight; up to 50% of foliage on some trees.
<u>Melampsora medusae</u>	D	Cluculz, Punchaw lks	Needle blight; 5 to 50% of current foliage avg 15% infected.
<u>Phomopsis lokoyae</u>	D	Punchaw L Blackwater	Tip dieback of regeneration 70% incidence, 7% terminal kill.
<u>Rhabdocline</u> spp.	D	Cluculz, Punchaw lks Valemount	Needlecast, 75% incidence, 25% of needles infected.