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# Forest Insect and Disease Conditions

Prince George Forest Region  
1985

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Government  
of Canada

Gouvernement  
du Canada

Canadian  
Forestry  
Service

Service  
canadien des  
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## INTRODUCTION

This report summarizes the findings of the Forest Insect and Disease Survey field studies in the Prince George Forest Region in 1985. Forest pest conditions are described with emphasis given to those capable of sudden damaging outbreaks. Most of the information was gathered through:

1. the monitoring of over 100 permanent sample stations strategically located in forest stands throughout the Region;
2. the monitoring of already known or recently reported infestations and disease problems;
3. annual aerial surveys during which major pest problems were mapped with reference to severity and volume loss;
4. the finding of pest problems during travels through the Region;
5. special projects designed to gain information for research.

## SUMMARY

Spruce beetle mortality declined dramatically to 78 200 m<sup>3</sup> over 4 000 ha due primarily to logging and host depletion.

Two-year-cycle spruce budworm lightly defoliated white spruce and alpine fir over 280 ha in Everett Creek, and 300 ha on the west side of the Bowron River. Eastern spruce budworm caused light defoliation over an undetermined vast area between Fort Nelson and the Northwest Territories. Engraver beetles killed the tops of approximately 4 000 white spruce, mainly in the Torpy River drainage in the second year of infestation. Four white spruce stands were found to contain high incidence of a root disease, Inonotus (Polyporus) tomentosus. Spruce weevil caused terminal mortality of young spruce between Hungary Creek and Doré River, southeast of Prince George.

Mountain pine beetle mortality decreased within the Region to 11 760 m<sup>3</sup> from 97 100 m<sup>3</sup> in 1984, particularly along Canoe Reach, but increased near the Cariboo border south of Vanderhoof. At the Red Rock Seed Orchard, lodgepole pine in provenance trials were severely infected by Lophodermella needle disease and red band needle disease but infections were slightly less severe than in 1984. Elsewhere in the Region, infections by both diseases were greatly reduced. Recent quarantine restrictions in Europe prompted surveys for the pinewood nematode. None were found in eight samples of lodgepole pine from within the Region. In cooperation with Svenska Cellulose, the B.C. Ministry of Forests (BCMF) and the University of B.C. (UBC), the Canadian Forestry Service - Forest Insect and Disease Survey (CFS-FIDS) surveyed 10 potential lodgepole pine planting sites in four geographical locations within the Region, for existing and potential pest problems. Swedish lodgepole pine two

generations removed from B.C. native stock will be outplanted on recommended sites to test their response to the local environment and their resistance to native pests.

Recent alpine fir mortality caused by western balsam bark beetle declined slightly to 5 240 trees, located primarily in the northern Prince George and Mackenzie Timber Supply Areas (TSAs). Tip blight of alpine fir was prevalent in stands in the McLeod Lake-Carp Lake area for the third consecutive year.

Douglas-fir mortality caused by the Douglas-fir beetle totalled 213 trees in 1985. Mortality declined in the ongoing Blackwater River and Averil Lake infestations, but a new infestation was found in Dawson Creek along Canoe Arm.

Conifer sawflies lightly defoliated western hemlock over 500 ha in the Doré River.

Black army cutworm killed approximately 3 000 lodgepole pine seedlings near Indianpoint Creek in the only significant infestation recorded in the Region in 1985. Herbaceous defoliation was reported from recent burns in the Weedon Lake area and from Kiwa Creek near Tête Jaune Cache.

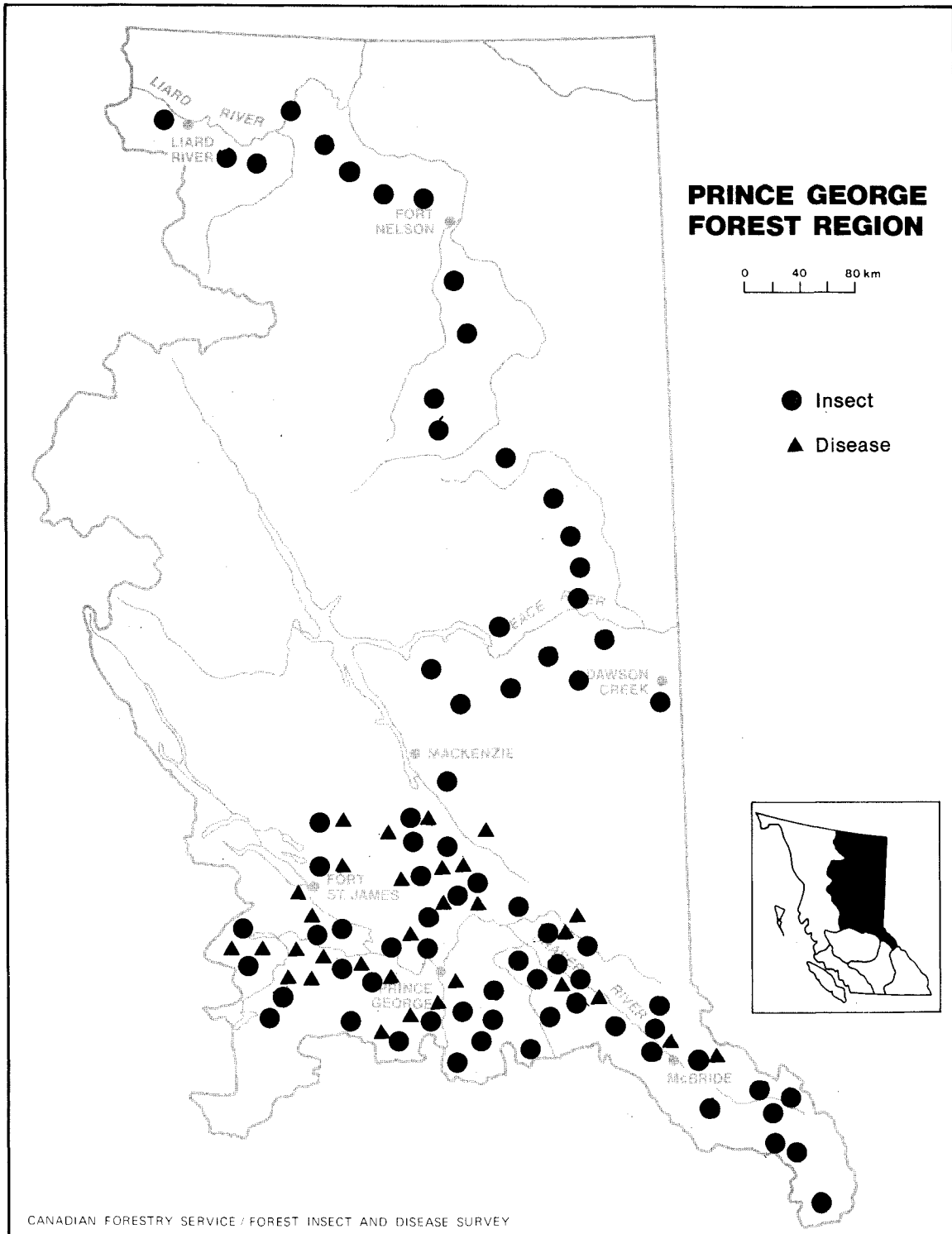
Forest tent caterpillar defoliation of aspen increased between Fort St. John and Dawson Creek to cover over 57 000 ha. The Salmon River infestation collapsed this year following two successive years of defoliation. For the third consecutive year birch leafminer severely defoliated white birch between Tête Jaune Cache and Grant Brook in the Yellowhead Pass, and moderately defoliated birch between Valemount and Albreda. Approximately one ha of white birch in the city of Prince George was severely defoliated by the ambermarked birch leafminer in the first recorded finding of this insect west of the Rocky Mountains. Thirty-nine gypsy moth pheromone traps were placed in 31 locations throughout the Region. No adult males were trapped.

Eleven 10-30 m diameter circular patches containing 30-150 red-topped lodgepole pine found in the Region in 1985 were thought to have been caused by lightning. There were no associated insects or pathogens. As part of the Acid Rain National Early Warning System (ARNEWS), a long term study plot was established in an immature white spruce-alpine fir stand near Averil Lake in cooperation with Northwood Pulp and Timber. Tree growth, tissue chemistry and soil chemistry will be closely monitored within the plot for the next 25 years. Foliar and soil samples taken from the site are currently undergoing analysis.

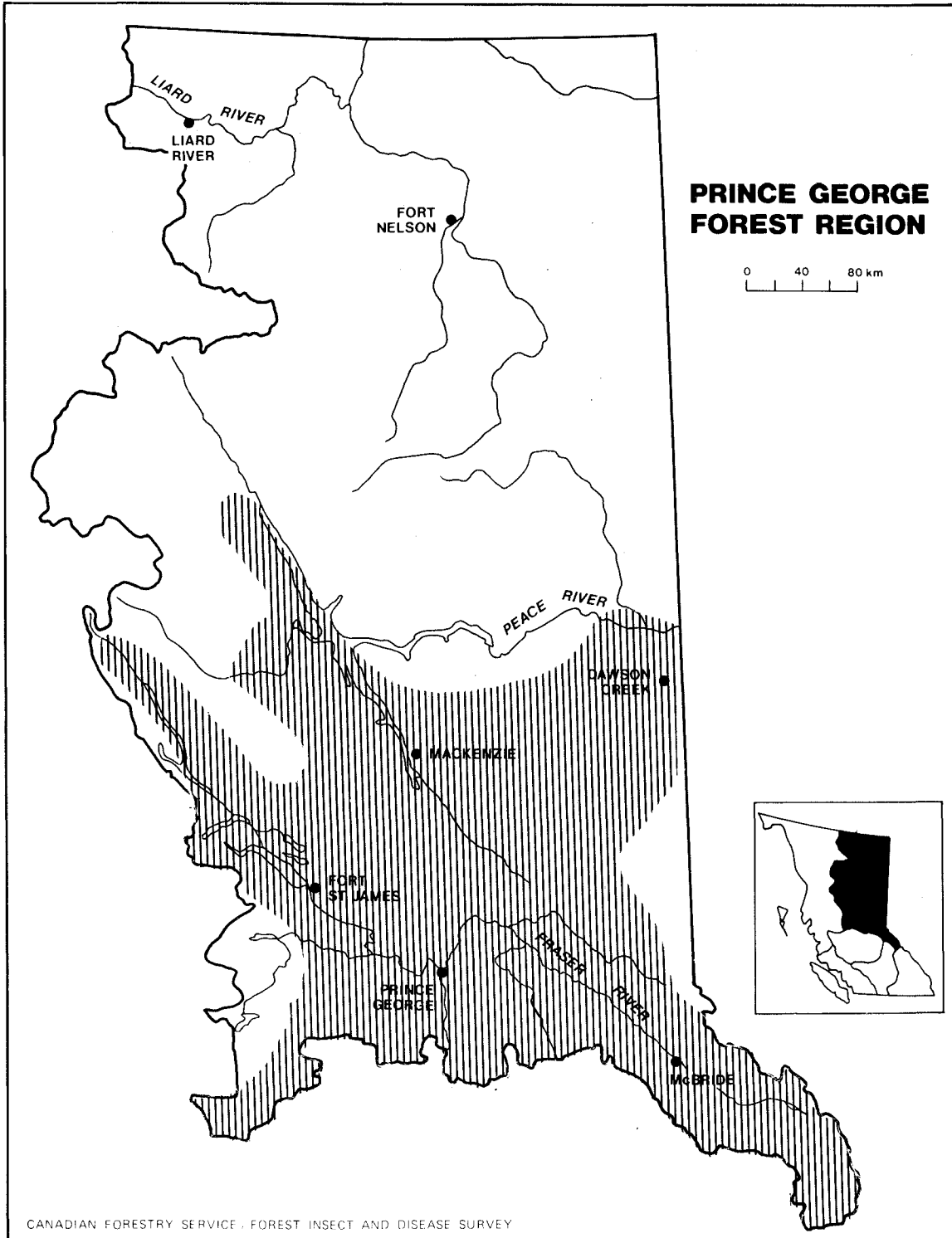
Additional special FIDS surveys included pests of Provincial Parks and pests of young stands.

The FIDS field season extended from May 27 until September 29, during which time 180 insect and 60 disease collections were made at various locations throughout the Region (Map 1).

The B.C. Ministry of Forests provided 38 hours of fixed wing and 6 hours of helicopter time for aerial surveys in the 1985 season. Northwood Pulp and Timber provided an additional two hours of helicopter time. The area covered by aerial surveys is shown in Map 2.



Map 1. Locations where one or more forest insect and disease samples were collected in 1985.



Map 2. Areas covered by aerial surveys to map bark beetle and defoliator infestations, 1985.



SPRUCE PESTS**Spruce beetle, Dendroctonus rufipennis**

Mortality of white spruce from attacks by spruce beetle declined for the third consecutive year to 78 200 m<sup>3</sup> over 4 000 ha from 525 900 m<sup>3</sup> over 25 470 ha in 1984 (Table 1, Map 3). Most notable were declines in the McGregor, Bowron and Goat river drainages.

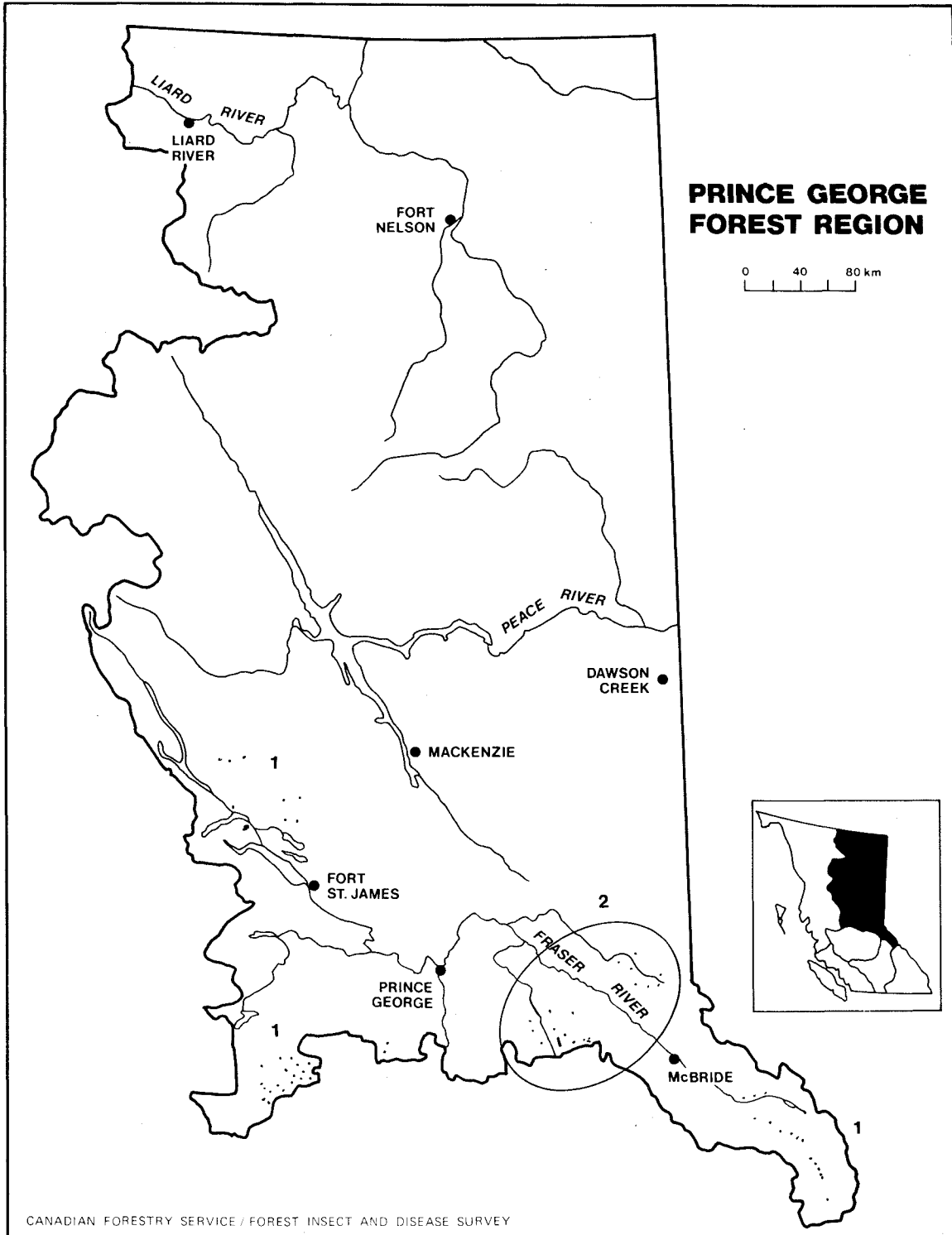
Table 1. Location, area, volume and severity of white spruce recently killed by spruce beetle, Prince George Forest Region, 1985.

Location and Supply Block	Area (ha)	Volume (m <sup>3</sup> )	Severity
<u>Prince George TSA</u>			
Bowron-Willow	G	440	light <sup>1</sup>
		1 090	moderate
McGregor	H	1 960	light
		510	moderate
Totals	4 000	78 200	

<sup>1</sup>light - 0-5% mortality; moderate - 6-30% mortality

Areas of recent light and moderate mortality of mature white spruce in the upper McGregor drainage and in Bastille and Revolution creeks covered 1 000 and 500 ha, respectively. Near Kitchi and Einar creeks, an additional 1-5% of the trees over 900 ha were killed. Within the same general area over 6 000 ha of previously killed trees were recorded as grey, with 50%+ of the timber dead standing for more than two years. In Walker Creek no recent tree mortality was seen but 40% of the timber over an area in excess of 1 000 ha was killed prior to 1983. No red trees were seen in the Torpy River Valley where numerous small infestations were mapped in 1984. Further south in the Bowron River drainage, host depletion due to logging, previous infestations and losses due to the 1985 Pink Fire have dramatically reduced beetle populations and available timber. Recent tree mortality was seen over only 1 500 ha in 13 scattered infestations, down significantly from nearly 9 000 ha of infestation in 1984. Most notable were attacks in: Hagen Creek, 560 ha; Indianpoint Creek, 310 ha; Slim Creek, 180 ha, and Fly Creek, 25 ha. Dome Creek, which drains directly into the Fraser River, contained an additional 120 ha of light mortality.

Assessments of beetle populations were made in June near the confluence of Hagen Creek and the Bowron River, in a stand severely attacked in 1983 and due to release a brood in May, 1985. No current (1985) attack, however, was seen in the surrounding trees, many of which were 60+ cm dbh. Woodpeckers which commonly feed on spruce beetle larvae had completely stripped the bark from mid-crown to root collar of all 1983-attacked trees, and virtually no brood survived. Woodpecker



Map 3. Areas of recent tree mortality detected during aerial and ground surveys, 1985.  
 1. Mountain pine beetle  
 2. Spruce beetle

populations have increased since the beetle infestation began in the late 1970's and, with the dramatic decline in beetle populations, have been forced to feed within fewer and smaller areas. No red trees were seen in the Parsnip River drainage where a few scattered attacks were recorded in the Missinka River Valley in 1984. A total of 300 trap trees, 75% of which were lethal (monosodium methanearsonate (MSMA)), were dropped in this area by the B.C. Ministry of Forests crews in stands suspected of, or confirmed to contain, beetle populations. Most of these trap trees remained largely unattacked by spruce beetles, indicating little more than endemic populations.

In the Fort St. James area two small groups totalling 23 recently killed trees were seen near Sidney Creek, north of Trembleur Lake, and a few currently attacked trees were found at the west end of Cunningham Lake. No signs of infestation were seen in the Tarnezell Triangle or near Butterfield Creek, both areas where mortality was recently recorded.

No recent mortality was mapped in the McBride TSA in 1985. A ground assessment was made near the headwaters of the Goat River in September, in an area recorded as moderately infested in 1984. Of the over 100 trees examined for retained brood, only one was found to contain a few beetles. No current attacks were seen.

No active spruce beetle infestations were detected in either the Mackenzie or Peace TSAs.

The recent spruce beetle infestation which began in blowdown in the Bowron Valley in 1976 has almost collapsed throughout the Region in 1985 (Figure 1). Improved pest management techniques and logging practices have been developed over the past ten years and, if employed, will guard against such outbreaks occurring in the future. A recent relaxation of utilization standards and reduced waste surveys, however, has resulted in increased amounts of logging debris being left on-site, including some large diameter material attractive to spruce beetle. Adding to this hazard, aerial surveys in September disclosed large patches totalling at least 250 ha of recent blowdown in the Narrow and Tumuch lakes areas, and in the upper Everett Creek area, with more reported from Mt. George, the Naver area and in the McGregor River drainage. As the blowdown occurred in late summer, it remained uninfested in 1985 but will be susceptible to attack in the spring of 1986. If these conditions are not quickly addressed, beetle populations could increase dramatically and the infestation cycle begin again. The situation will be closely monitored in the spring of 1986.

#### **Two-year-cycle spruce budworm, Choristoneura biennis**

Early instar feeding by spruce budworm destroyed buds and current foliage of white spruce and alpine fir over a total of 580 ha in the Bowron River valley and in Everett Creek. More than 50% of the current growth was consumed in two infested areas covering 120 and 180 ha respectively, on the west side of the Bowron River near Km 100 of the Bowron Coal road. These two infestations were seen for the first time in September 1985. Negligible bud damage occurred across the River at Km 59

Figure 1.

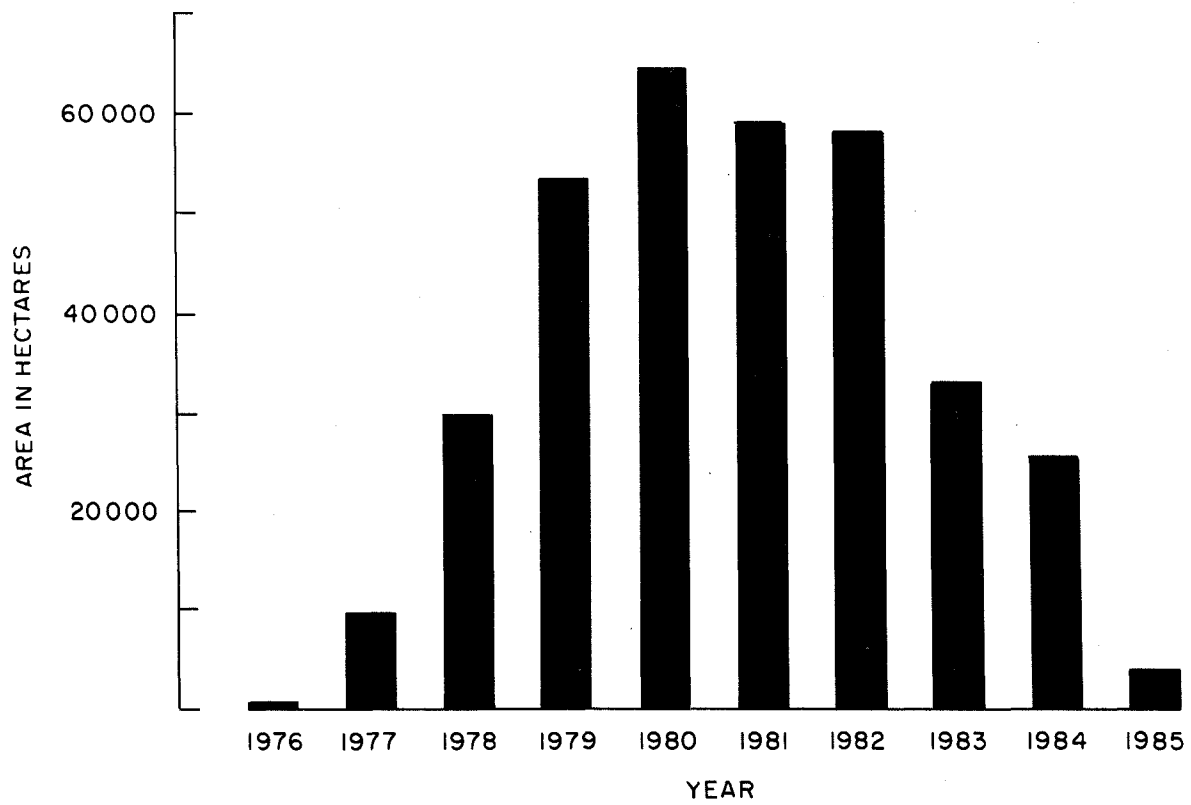


Fig. 1. Area infested by spruce beetle, *Dendroctonus rufipennis* 1976-1985 Prince George Forest Region 1985.

of the Bowron Forest Road, where high budworm populations have been monitored for the past two years. The remaining 280 ha of infested timber was seen in three similar sized patches in upper Everett Creek and tributaries, where an average of 10% of the buds were destroyed. This infestation was first investigated in 1984, when 31% of the larvae were infected by nuclear polyhedrosis virus (NPV) and a fungus, Beauveria bassiana. Most of the remaining buds of alpine fir were infested by an aphid, Mindarus abietinus, with no apparent detrimental effect. Three-tree beatings on July 3 yielded 85 second and third instar larvae, compared with 150 larvae in 1984. No overwintering fourth instar larvae were found during a close examination of the bole, branches and foliage in both Bowron and Everett infestations. In over 35 years of investigation, no overwintering C. biennis larvae have been found in this stage.

In the Bowron River infestation, the severity of damage this year indicates a strong potential for moderate to severe defoliation as larvae mature in the early summer of 1986. In the Everett Creek infestation, trace to light defoliation is expected in 1986.

#### **Eastern spruce budworm, Choristoneura fumiferana**

A new infestation was recorded at the junction of the Fort Liard and Fort Simpson highways and along the Nelson River west of the bridge. During an aerial survey in late June, defoliation was seen to be limited to new growth in the mid and upper crowns. This defoliation was only a fraction of a major infestation later reported by BCMF personnel. Light defoliation, limited primarily to valley bottoms, stretched from the Fort Nelson River valley just north of Fort Nelson to the Northwest Territories border; a southern extension of a previously reported infestation in the Territories.

No defoliation was seen along the Alaska Highway from Km 790 to 863, an area moderately and severely defoliated in 1984. Three-tree beatings yielded from one-three early instar larvae.

To gain a better understanding of the distribution of northern Choristoneura species, pheromone traps were set at various locations in the north part of the Region. Two species, C. fumiferana and C. orae are distinguished by their response to different pheromones (Table 2). Trap results show that though C. fumiferana was the prevalent species in these stands in 1985, C. orae was also present. Numbers of each species fluctuate from year to year, and since we need to gain information on the long term population structure, this trapping program will be repeated annually.

Table 2. Location and number of adult male Choristoneura spp. caught in pheromone traps, Prince George Forest Region, 1985.

Location	Pheromone	No. of traps	Avg. no. moths/trap	Species
Pine Pass	A <sup>1</sup>	4 <sup>2</sup>	2.2	<u>C. orae</u>
	B	5	11.8	<u>C. fumiferana</u>
Moberly Lake	A	5	7.8	<u>C. orae</u>
	B	5	15.2	<u>C. fumiferana</u>
Km 514 Alaska Highway	A	5	2.2	<u>C. orae</u>
	B	5	53.4	<u>C. fumiferana</u>

<sup>1</sup>A - aldehyde formulation

<sup>2</sup>B - acetate formulation  
one trap not recovered

#### **Northern spruce engraver, Ips perturbatus**

The upper crowns of an estimated 4 000 mature white spruce were attacked by Ips perturbatus in 1985 compared with 3 000 in 1984 when it was first reported. Attacks were patchy and scattered, extending for approximately 25 km mainly along the southwest side of the Torpy and West Torpy rivers in the Prince George TSA. Infested patches were small, containing between five and twenty trees and were located primarily on flat ground and lower northeast facing slopes. In addition to the new attacks, most of those trees top-killed in 1984 were reattacked further down the boles. Additional attacks totalling approximately 500 trees were seen singly or in groups of two-five trees near the McGregor, Parsnip and Bowron rivers, Slim Creek, Tumuch Lake and north of Prince George, adjacent to Hwy 97 as far as McLeod Lake.

Approximately 50% of the attacked trees examined this year were initially attacked in 1984 and re-attacked in 1985. Attacks were highly concentrated on the bole and larger branches. Some attacked trees (10%) examined in the Torpy River drainage were also attacked by spruce beetle, probably in response to stress placed on the tree by 1984 engraver beetle attacks. Trees attacked in the spring of this year quickly turned red and by fall when aerial surveys were conducted, most needles had dropped and 1985 attack was indistinguishable from 1984 attack. The only foliage retained was the partially flushed current growth whose development had been arrested almost immediately following attack. In contrast, spruce beetle-attacked trees usually remain green for more than one year following attack and often retain their needles for two years. This quick deterioration could be explained by one or a combination of factors such as:

1. the very high density of attacks quickly cutting off moisture flow.

2. a higher rate of moisture loss from the more open upper crowns.
3. the abnormally hot and dry summer of 1985.

In order to predict the behaviour of a normally secondary agent such as the northern engraver beetle, the question of what predisposed the trees to attack must be addressed. With respect to the current infestation, which is as yet in only its second year, this question remains unanswered. A number of possible explanations have been put forward and in the summer and fall of 1985, some of these were examined. At one site near the West Torpy bridge an Inonotus (Polyporus) tomentosus root rot survey showed no obvious relationship between infection and beetle attacks. Every one of the ten trees examined whether attacked or not was to some degree infected with the pathogen (Table 3).

Table 3. Inonotus (Polyporus) tomentosus root rot survey in a mature white spruce stand in the Torpy River infested by the northern engraver beetle, Ips perturbatus, Prince George Forest Region, 1985.

Tree #	<u>Ips</u> attack	dbh	Incidence of infection by	
			<u>I. tomentosus</u>	
1	yes	65	4/5	3 roots stained <sup>1</sup> , 1 root rotted
2	no	35	1/1	root stained
3	yes	60	2/2	roots rotted
4	no	70	2/2	roots rotted
5	no	70	2/2	roots rotted
6	yes	50	1/1	root stained
7	yes	65	2/2	roots stained
8	no	45	1/2	roots stained
9	no	50	2/2	roots stained
10	no	45	2/2	one root stained, one root rotted

<sup>1</sup> root staining indicates incipient stage of infection

In a second attacked stand 9 km southeast of the West Torpy bridge, increment cores were taken at dbh from five attacked and five unattacked trees. Sample trees ranged in age from 105 to 181 years and dbh's ranged from 47 to 87 cm. Radial growth was not measurably different between attacked and unattacked trees and therefore no abnormal stress which would predispose them to attack by the northern engraver beetles was indicated.

Ips perturbatus is known to attack the tops of trees previously attacked by the spruce beetle (Furniss and Carolyn, 1977) as well as windthrown trees, decked logs and slash. It is reasonable to conclude therefore, that in the past nine years while spruce beetle killed millions of mature spruce in the Bowron and McGregor drainages, engraver beetle populations increased to fill the niche provided by the tops of

so many dying trees. Though there was some past spruce beetle mortality in the Torpy River, the vast majority of killed trees were well removed from this area, so there is no clear evidence of a relationship between the two species in this infestation.

The present danger of spruce beetle populations rebuilding in Ips-attacked trees is significant, particularly in light of the added hazard caused by large areas of late summer blowdown.

Further investigative work is planned for the spring of 1986, to study the attack behaviour of the engraver beetle and of its parasites and predators.

#### **Tommentosus root rot, Inonotus (Polyporus) tomentosus**

All three white spruce stands sampled for I. tomentosus in 1985 were severely infected (Table 4).

Table 4. Location and percent of white spruce infected by Inonotus root rot in three stands in the Prince George Forest Region, 1985.

Location	No. trees sampled	Stand maturity	% infected
Robson River	10	semi-mature	70
Stephanie Creek	12	mature	83
Torpy River	10	mature	100

The Torpy River stand was the most uniformly infected and contained the largest trees, averaging 60+ cm dbh. Four of the ten trees examined had recently been attacked by the northern engraver beetle, Ips perturbatus, but there is as yet no evidence that attacks were linked to stresses caused by root rot. Both of the other stands were less severely infected but higher than the average (67%) found in eleven stands in 1984.

Inonotus root rot has been found in every semi-mature and mature white spruce stand examined within the Prince George Region. The disease has long been associated with blowdown and outright tree mortality, but its importance in limiting growth and longevity are not yet understood.

Younger spruce stands will be examined in 1986 in an attempt to determine the stage at which root rot enters and begins to impact upon the stands.

#### **Spruce weevil, Pissodes strobi**

Following a trend established over the past two years, spruce weevil activity remained low throughout most of the Region in 1985. However, 20% of sapling sized-white spruce were recently attacked in a spaced mixed white spruce and alpine fir plantation adjacent to Highway 16 East, near Hungary Creek. New attacks were also common in roadside



white spruce regeneration further to the southeast to West Twin Creek. Examination of infested leaders from the plantation and roadside regeneration in September revealed evidence of a successful brood and a high percentage of adult emergence. For this reason, populations are expected to increase in this area in 1986.

#### **Allegheny spruce beetle, Dendroctonus punctatus**

The butt of a single mature white spruce near Munroe Lake in the Mackenzie TSA was found to be infested with D. punctatus, the most southerly recorded collection of this beetle in British Columbia in 25 years. The beetle is more common in the Yukon and in the eastern United States. The Allegheny spruce beetle is not an economically important forest pest, attacking only single stressed or recently killed trees.

### **PINE PESTS**

#### **Mountain pine beetle, Dendroctonus ponderosae**

Lodgepole and western white<sup>3</sup> pine mortality in the Prince George Region declined overall to 11 760 m<sup>3</sup> over 630 ha in 1985 from 97 100 m<sup>3</sup> over 2 800 ha in 1984 (Map 3). Notable increases in mortality, however, occurred: in the Prince George TSA, near the Cariboo border south of Vanderhoof, 5 000 trees; north of Fort St. James, near Chuius Mt., 100 trees; and in the McBride TSA, three small infestations in and adjacent to Mt. Robson Provincial Park, 110 trees. Major declines in mortality occurred on the east side of Canoe Arm in the McBride TSA, near Bulldog, Hugh Allan and Ptarmigan creeks, where only 150 ha of 10% mortality occurred in 1985 compared with 1 380 ha of 30% mortality in 1984.

In the Prince George TSA in the infestation south of Vanderhoof, 5 000 trees were killed in over 1 000 separate sites, concentrated between Tsacha Lake and Kluskoil Lake, a tenfold increase over 1984. Scattered small patches numbering between one and five trees were also mapped further east near Tsayakwacha Lake and to the north in the Jerryboy Hills. The infestations were a result of beetle populations moving north from the Fraser Plateau in the Cariboo Region where attacks were far more concentrated. Vanderhoof BCMF crews are attempting this winter to cut and burn infested trees. Roads are being built to access timber that will almost inevitably become infested in the next few years as beetle populations continue to move north.

North of Fort St. James near the Tachie River, a major infestation active since 1982, declined to 125 from 200 ha of recent mortality. Access into the infestation has not yet been completed and if the infestation continues unabated it could expand significantly over the next few years. A notable new infestation containing 100 recently killed trees occurred on the east side of Chuius Mt. Small (1-20 trees) scattered infestations occurred along Takla, Indata and Tchentlo lakes, and the Middle River. An infestation mapped in 1984 on the north shore of Inzana Lake was logged in the winter, but 16 red-attacked trees seen during aerial surveys in 1985 provided a potential for renewed outbreaks in the area.

In the Blackwater River area only 14 small groups containing from 1 to 5 red trees were mapped by aerial survey. Current attacks detected by BCMF probe crews, however, were slightly increased over 1984. Attacks in 1985 were more successful than in the previous year, with second and third instar larvae in long (up to 70 cm) galleries in September, whereas in 1984 most beetles were killed by severe cold before galleries were completed.

East of the Fraser River beetle populations have also been slowly moving north from longstanding infestations in the Cariboo Region. Fifteen beetle-killed trees were found near Stephanie Creek during ground surveys in June. Attacks were initially successful but all parent galleries were less than 10 cm long and contained no progeny. The trees were probably killed by the Ceratocystis sp. fungus carried by the attacking beetles. Future infestations in this area will be limited by the scarcity of lodgepole pine type.

On the east side of Canoe Arm in the McBride TSA, where the majority of the Regional mountain pine beetle mortality has occurred since 1977, only 150 ha of up to 10% mortality occurred in 1985, compared with 1 380 ha of up to 30% mortality in 1984. Cut and burn operations in the winter of 1984-85 removed many spot attacks between McBride and the south end of Canoe Arm. As a direct result of this program, no red trees were seen in the area between Tête Jaune Cache and McBride in 1985. Three new small infestations were found east of Tête Jaune Cache, adjacent to and within Mt. Robson Provincial Park. These infestations are particularly important, not only because they threaten timber within the Provincial Park, they also threaten to cross into Alberta through the Yellowhead Pass. From west to east the infestations occurred: on the east side of Mt. Chamberlin, 20 trees; on the east side of Swiftcurrent Creek, 50 trees; within the Park eight km east of the Mt. Robson viewpoint, 40 trees. At Swiftcurrent Creek less than 10% of the brood had survived the 1984-85 winter and in early July surviving larvae averaged only third instar, well behind normal development for that date. One tree however, contained eggs and first instar larvae from a recent attack, indicating a split in the synchrony of development within the population. By September, the forty 1984-attacked trees in Mt. Robson Park released brood enough to successfully attack a similar number of adjacent trees. Attacks were very late however, and parent galleries were incomplete. Historically, populations which fall behind their normal cycle to this degree either succumb in the egg or early instar larval stage due to winter cold, or revert to a longer cycle by overwintering as adults and completing brood production in the spring. These populations will be re-evaluated early in the spring of 1986 and full tree disposal, if necessary, will be carried out then.

Timely salvage logging effectively eliminated an active infestation in Swift Creek. Examinations of felled infested trees in early June found 80% ultimate instar larvae and 20% pupae. Hauling was completed within days of the examination and logs were milled immediately so the risk of spreading the infestation through log transport was minimal.

Almost all major mountain pine beetle hazard areas in the McBride and Prince George TSAs are being sanitized over the winter by BCMF cut and burn crews. Attack densities in 1986 will depend upon the success of these programs. Concurrently, logging plans are being adjusted to prioritize removal of high risk stands. In the Cariboo border areas, beetles are expected to continue their northeasterly advance, but with the two successive severe winters (1984-85 and 1985-86) having killed more than 90% of the beetle progeny, valuable time has been gained. By building accesses and planning advance strategies, losses to the beetle in future years can be minimized.

**Pine needle diseases: Red band needle disease, Scirrhia (Dothistroma)  
pini  
Lodgepole pine needle cast, Lophodermella concolor**

At the Red Rock Seed Orchard, where lodgepole pine family provenances were severely infected by red band needle disease in 1984, comparably high levels of infection were seen this year. Between 2 and 50% (avg. 15%) of year-old and older needles were infected on all trees in each of 30 provenances (Table 5).

The main difference this year lay in the prevalence of lodgepole pine needle cast infections which was hardly detected in 1984, but accounted for approximately 50% of all needle loss in the Seed Orchard in 1985.

Less than 1% of the trees in examined lodgepole pine stands elsewhere in the Region exhibited symptoms of either disease, following a downward trend established in 1984.

Table 5. The severity and trends of needle cast diseases at the Red Rock Seed Orchard, Prince George Forest Region, 1985.

Provenance number	Location	<u>S. pini/L. concolor</u> infections	
		% needles	trend (compared with 1984)
14	Wentworth Cr.	10	no change
15	Esperon Lake	10	decrease
16	Lime L/O	20	decrease
20	Collins Lake	5	no change
23	Udy Creek	10	decrease
24	Finlay Forks	15	increase
26	Tower Lake	10-40	increase
27	Pink Mountain	15	no change
28	Tetsa Lake	20	no change
30	Lower Post	20	increase
32	Carmacks (Yukon)	20	decrease
33	Ethel Lake (Yukon)	15	decrease
35	Atlin	40	increase
36	Kinaskan	5	no change
38	Jackfish Creek	5	no change
39	Redwillow River	5	decrease
40	McLeod Lake	5	no change
41	Rock Creek	50	increase
43	Bisson Lake	10	no change
44	Marl Creek	20	no change
47	Sawdust Creek	30	decrease
56	Elk Valley	15	decrease
59	Anahim Lake	35	increase
64	Wendle Park	5	no change
65	Lynx Lake	15	increase
66	Stone Mountain	25	increase
67	Hinton (Alberta)	5	decrease
68	Kananaskis (Alberta)	30	no change
70	Flathead	20	no change
72	Larch Hills	5	decrease

#### **Lodgepole pine terminal weevil, Pissodes terminalis**

Terminal weevil damage in young lodgepole pine was common in the Region for the first time since 1979. Along the Blackwater road south of Baldy Hughes the terminals on 40% of the natural regeneration were killed by the weevil. For approximately two km along the 400 road, south of the junction with the Bobtail access, up to 50% of the pine in a large 15-year-old natural stand were infested. Much lighter damage occurred east of Highway 97 where approximately 1% of the terminals were infested in two pine plantations at Km 9 and Km 15 along the Naver access road.

### **Pinewood nematode, Bursaphelenchus xylophilus**

Over the past year, 80 samples of sapwood from lodgepole pine and other coniferous species from throughout B.C. (8 samples from the Prince George Region) have been examined for the presence of this potentially damaging nematode but, to date, it has not been found.

The pinewood nematode is a serious forest pest in Japan where it has caused extensive mortality. Pinewood nematodes have been found in eastern Canada and the United States but damage has been restricted to highly stressed trees or exotic species. Nevertheless, its presence in North America has resulted in quarantine restrictions on the importation of wood products by some European countries.

Sampling will continue in 1986 in a continued effort to establish whether this nematode occurs in B.C.

### **Canada-Sweden lodgepole pine planting trials**

In cooperation with a Canada-Sweden interagency project, CFS-FIDS surveyed and evaluated 10 sites at 4 locations within the Region proposed for planting second generation Swedish lodgepole pine, in an experiment to test the trees' susceptibility to local pathogens. The seed, produced in the seed orchard of Svenska Cellulose, a major Swedish forest company, was germinated at the Balco forest nursery near Kamloops in 1985, to be outplanted in the spring of 1986. Sites at Fort St. James, Mackenzie, Fort St. John and Fort Nelson were evaluated for the frequency of pests in the surrounding timber and on-site brush competition. Pathogens potentially damaging to lodgepole pine occurred at varying levels on most sites and included lodgepole pine dwarf mistletoe, Arceuthobium americanum, near Mackenzie and Fort St. James, and western gall rust, Endocronartium harknessii, near Mackenzie and Fort St. John. Some sites near Mackenzie were unsuitable for planting because of heavy competition from naturally regenerated lodgepole pine and a site near Fort Nelson was unsuitable because of a lack of pines in the surrounding type. A report summarizing the findings was submitted to the interagency group for final site selection.

### **ALPINE FIR PESTS**

#### **Western balsam bark beetle complex, Dryocoetes confusus Ceratocystis dryocoetidis**

This bark beetle and its associated fungus continue to kill mature alpine fir throughout the Region. In 1985, a total of 5 240 red trees were seen from the air over an area of 4 600 ha, slightly less than in 1984. Most of the mortality was seen north of Mackenzie along Williston Lake, and north of Fort St. James near Takla Lake. Small scattered attacks were also seen in high elevation stands in the Bowron Valley.

**A tip blight of alpine fir, Delphinella sp.**

Needle blight was less severe but more widespread in the Region in 1985. In the McLeod Lake-Carp Lake area where severe tip infections occurred in 1984, only small pockets of tip kill were seen. Isolated trees were strikingly discolored in the area between Davie Lake and Weedon Lake, where up to 70% of the growing tips were killed. In the Doré River Valley, an area chronically infected by tip blight, 100% of the understory trees lost 20% of the buds. Near Dome Creek, 80% of the new foliage in all understory trees and 40% of the lower crowns of larger trees were infected. Near Pass Lake, 30% of the tips were infected on 20% of the alpine fir.

This disease can cause some growth loss but, unless repeated for two or more years, trees quickly regain full vigor.

**Balsam twig aphid, Mindarus abietinus**

The current year's growth of young alpine fir was infested by balsam twig aphid in many locations throughout the Region, including the Willow River, Bowron River and Everett Creek. Though the infestation appeared severe with an average of 70% of twigs infested, damage overall was negligible with some needle drop and needle and twig stunting.

**DOUGLAS-FIR PESTS**

**Douglas-fir beetle, Dendroctonus pseudotsugae**

The incidence of recent Douglas-fir beetle attacks in the mature and overmature Douglas-fir in the Blackwater River area in the Prince George TSA, declined to 63 trees from 384 in 1984. The decline was due in large part to an ongoing trap tree program. A total of 470 non-lethal and 87 lethal (MSMA) trap trees were employed in beetle control in 1985. Experiments with lethal trap trees, unsuccessful in 1984, were repeated in 1985 with 1/3, 1/2 and 3/4-strength in separate trees, but no significant mortality of adults or brood was found. All trap trees were removed and milled.

On the east side of Averil Lake on TFL 29, Douglas-fir beetle killed 80 trees. During the last five years, over 500 trees have been killed in this stand.

Two small infestations of 10 and 20 trees, respectively, were seen on the east side of Indianpoint Creek at approximately 1 200 m elevation.

No recent attacks were seen in an infestation area just east of the confluence of the Torpy River and Goodson Creek.

In the McBride TSA, 30 recently killed Douglas-fir were recorded near the mouth of Dawson Creek on the east side of Canoe Arm.

### Douglas-fir tussock moth, Orgyia pseudotsugata

To better understand the distribution of the Douglas-fir tussock moth, a pheromone trapping program was undertaken throughout the host range in 1985. In the Prince George Region, the trap site was located five km north of Hixon. Though no Douglas-fir tussock moth were caught, the five traps caught 78 adult male pine tussock moth, Dasychira grisefacta, which are commonly found in the Region on Douglas-fir, western hemlock and white spruce but rarely cause any noteworthy damage.

### WESTERN HEMLOCK PESTS

#### Conifer sawfly, Neodiprion sp.

Trace to light defoliation of western hemlock occurred over an area in excess of 500 ha in the Doré River Valley near McBride, the first recorded damage by this insect since 1978. A three-tree beating within the infestation yielded 519 larvae, while beatings in the Goat River and Hungary Creek plots yielded 64 and 62 larvae, respectively, similar to numbers recorded in the previous two years.

Feeding by this insect is limited to older needles, resulting in some growth loss but little mortality. No signs of disease or parasitism were seen and populations are expected to increase in 1986.

### DECIDUOUS TREE PESTS

#### Forest tent caterpillar, Malacosoma disstria

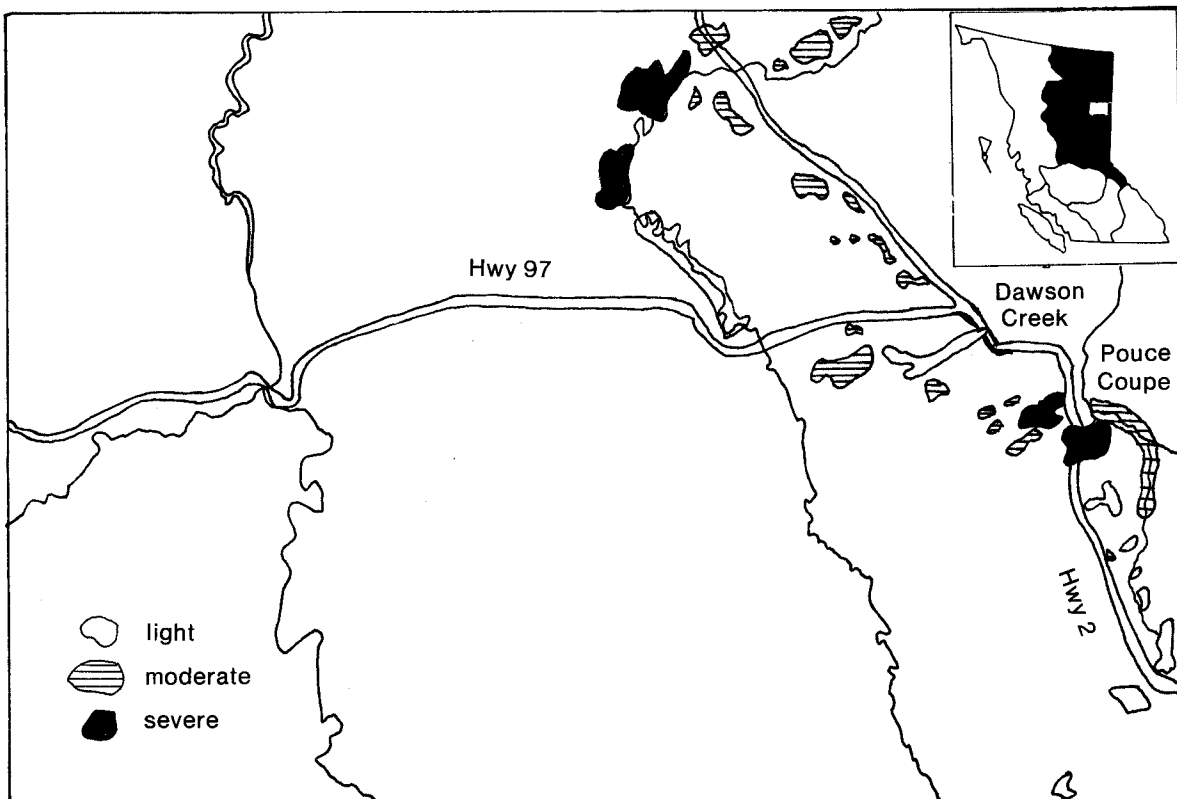
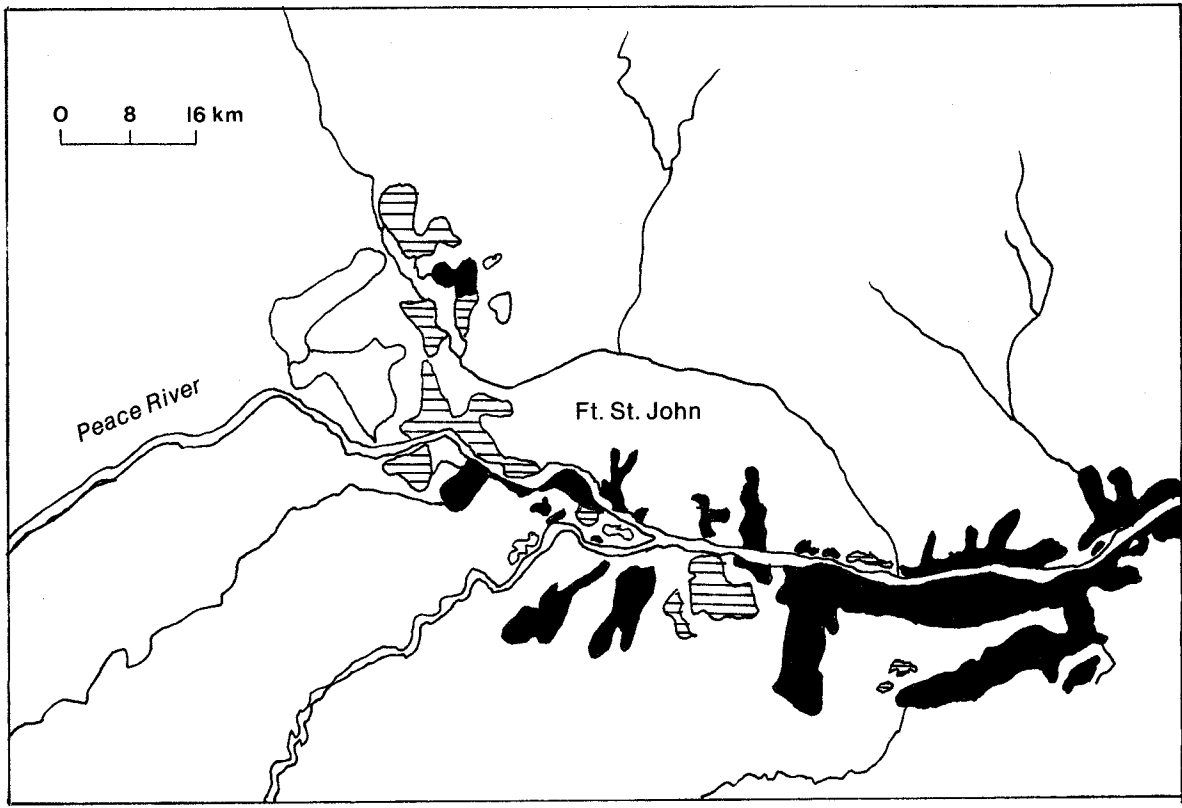
Defoliation of trembling aspen between Pouce Coupé and Fort St. John covered 56 390 ha in 1985 (12 140 light, 15 000 moderate and 29 250 severe<sup>1</sup>), a threefold increase since 1984 (Map 4).

After two years of defoliation peaking in 1984 at 5 420 ha, an infestation in the Salmon Valley collapsed in 1985, due primarily to infection by NPV.

Most of the increases in the Peace River resulted from an expansion of areas infested in 1984. There were, however, newly defoliated areas south of Dawson Creek along the Pouce Coupé and Tupper rivers as far south as Peavine Lake.

<sup>1</sup>Aerial survey defoliation classes:

- Light : Discolored foliage barely visible from the air; some branch 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 more than 50% defoliated.



Map 4. Areas of trembling aspen defoliated by forest tent caterpillar, Prince George Region, 1985.



Understory mortality was prevalent over 1 000+ ha in patches this year along the Peace River near Taylor. Most dead trees failed to refoliate in early summer following the second consecutive year of severe defoliation. Aspen in the understory are less vigorous than overstory trees, which are more fully exposed to the light.

Egg mass surveys at three locations within the infested area indicate that defoliation will continue in most areas in 1986 (Table 6).

Table 6. Forest tent caterpillar egg mass survey results and predicted defoliation in 1986, Prince George Forest Region, 1985.

Location	Total no. of new egg masses	Avg. no. egg bands/tree	Predicted 1986 defoliation
Fort St. John	13	2.5	light-moderate
Taylor	77	3.4	moderate
Pouce Coupé	125	4.3	severe

Based on historical infestation patterns and egg mass survey results, 1986 defoliation is expected to be most severe in the southern extent of the infested area, where populations have been epidemic for only one year. Further north, declines are expected in areas where populations have been epidemic for up to three years.

#### **Birch leafminer, Lyonetia saliciella**

For the third consecutive year, patches of white birch in the McBride TSA were defoliated by the leafminer. The most severe damage in 1985 was seen along the Yellowhead Highway between Tête Jaune Cache and Grant Brook. All age classes of birch were at least partially defoliated, and in some stands near Swiftcurrent Creek, 90% of the leaves were skeletonized, primarily along leaf margins. Lesser damage occurred between Valemount and Albreda, where up to 80% of the leaves were skeletonized on 30% of the trees. This insect has historically had little long term effect on the health and vigor of the trees.

#### **Ambermarked birch leafminer, Profenusa thomsoni**

This small introduced sawfly which was first recorded in the eastern United States and has never before been found west of the Rockies, was found in 1985 mining the leaves of white birch in the city of Prince George. All young birch in a mixed birch-aspen stand over an area of approximately one hectare were infested and up to 80% of the leaves were mined. Trees should recover fully in 1986 unless the infestation continues. Successive years of severe defoliation would cause concern, based on information from records of infestations in Alberta, where continuous moderate-severe infestations over several years have resulted in the removal of ornamental birches from the urban environment.

**Poplar and willow borer, Cryptorhynchus lapathi**

Two mature trembling aspen near the Willow River crossing on Highway 16 East were killed by mass attacks by this wood boring weevil. Damage caused by this insect is sporadic and significant outbreaks are rare.

**Pacific willow leaf beetle, Pyrrhalta decora carbo**

This small leafmining beetle was found defoliating roadside willows in scattered infestations between Stoner and Strathnaver and north of Prince George to the Salmon River. Within infested areas, all willows were attacked and an average of 60% of the leaves were mined. Mined leaves turned brown in July and early August.

Infestations of this insect are common in B.C. but the damage is considered minor.

**Gypsy moth, Lymantria dispar**

As part of a cooperative interagency quarantine related survey, a total of 39 gypsy moth traps were placed in 31 separate sites, in Provincial parks, rest areas and campgrounds throughout the Region in 1985. No adult males were trapped in the Prince George Region but moths were trapped on Vancouver Island, the lower mainland and near Cache Creek.

**MULTIPLE HOST PESTS****Black army cutworm, Actebia fennica**

More than 3 000 lodgepole pine seedlings over an area of approximately 2 ha were destroyed by black army cutworm feeding near Indian-point Creek in the Bowron Valley. Herbaceous plants such as fireweed and false hellebore over an additional 500 ha were completely consumed but freshly planted lodgepole pine and white spruce seedlings were only minimally damaged. High cutworm populations were reported at Kiwa Creek in the McBride TSA, but no seedling damage occurred. Sets of five sex attractant sticky traps were placed at recently burned sites in the Region, three in the Bowron Valley and five in the vicinity of Weedon Lake (Table 7). Six sets were placed in prescribed burns and two within the Pink wild fire near Haggan Creek. All areas are scheduled to be replanted in the next few years. Meanwhile, over 8 000 ha of slashburns and wildfires in the Bowron Valley have greatly increased potential for high black army cutworm populations in 1986.

Table 7. Numbers of adult male black army cutworm caught in sex attractant sticky traps, Prince George Forest Region, 1985.

Area & Location	No. of traps	Avg. no. moths/trap
<u>Bowron</u>		
Km 63 Bowron Road	5	28.8
Narrow Rd. 1.6 km from Bowron Rd.	5	2.6
Km 15 Haggen Rd.	5	19
<u>Weedon</u>		
CP 102 The Pas	4 <sup>1</sup>	5.4
4750 off 100 road	5	12.2
4752 off 100 road	5	8.2
4753 off 100 road	5	19.2
Merton Lake	5	3.4

<sup>1</sup> one trap not found

Insufficient data yet exist to allow population predictions to be made on the basis of numbers trapped. Areas such as Km 63 Bowron Road, which was planted with white spruce in the spring of 1985, will be closely monitored in the spring of 1986 and the pheromone trapping program will continue.

#### **Hornworm, *Hyles galli intermedia***

The larvae of this insect are often very conspicuous on recent burns and in plantations because of their large size and often high numbers feeding on fireweed. In 1984-85 these insects were common throughout the central and eastern portions of the Region from McLeod Lake to Kinbasket Lake. In Kiwa Creek near Tête Jaune Cache, larvae consumed all herbaceous material on a 200 ha plantation and caused minor damage to some newly planted spruce seedlings. A sample of 161 pupae were retrieved from 4 m<sup>2</sup> of duff on the site. These are undergoing cold treatment in preparation for rearing in the early spring of 1986 to determine levels of parasitism. This site will be closely monitored in 1986 in case even higher populations inhabit the site and cause damage to seedlings.

Hornworm larvae were also found in mid-September in Haggen Creek feeding upon fireweed which had sprouted following the Pink Fire in July.

No seedling damage has as yet been attributed to this insect and it is not generally considered to be a significant forest pest.

## ANIMAL DAMAGE

### **Porcupines**

Porcupine feeding damage primarily to the stems of immature and mature lodgepole pine, has been increasing annually throughout the Region. In the Prince George TSA, areas of recent pine mortality of one or more hectares were seen in the low hills just east of McLeod Lake and north of Takla Lake adjacent to the Driftwood River. Scattered patches of mortality were also seen in the Blackwater River area as far east as Strathcona Park. In the McBride TSA, a total of 100 ha of scattered mortality was seen near the northeast end of Canoe Arm and further south near Baker Creek. In the Mackenzie TSA scattered individual young pine were killed on the west side of Williston Lake near Eklund Creek.

Observations and reports from local foresters indicate that porcupine populations have increased steadily in recent years, especially in 1982 and 1983, when winters were uncharacteristically mild and winter porcupine mortality was very low. The severe cold of the 1985 winter may help to reduce porcupine populations and restore their damage to normal levels.

## ENVIRONMENTAL DAMAGE

### **Frost damage**

Two periods of unseasonably cold weather in November 1984 and June 1985 caused severe and widespread tissue damage to a range of species of young trees throughout the southern portion of the Region.

At the Red Rock Seed Orchard 50% of the lodgepole pine in the bulk lodgepole pine provenances were flagged with one or more dead branches over an area in excess of 2 ha. Lakeland Mills reported mortality of many Douglas-fir and white spruce seedlings near Pilot Mountain as a result of the November frost. Surviving seedlings in the same area lost buds and new growth to the June frost. East of Ahbau Lake near the Cariboo boundary an average of 30% of white spruce and 10% of alpine fir growing tips were killed (up to 60% in smaller trees). Full recovery, however, is expected.

### **Lightning damage**

In the past two years, lightning strikes have been isolated as the probable cause of 12 scattered patches of lodgepole pine mortality, the first ever reports of this type of mortality in the Region. Patches of dead trees ranged in size from 10 to 50 meters in diameter and contained from 30 to 150 trees. In 1984, one group of red trees was found 20 km southwest of Prince George, and in 1985 an additional eleven were seen, five in the Blackwater River area, another five south of Vanderhoof, and one near Philip Creek south of Mackenzie. Stands which discolored in the spring of 1985 were probably struck by lightning in the summer of 1984.

Characteristics which identified this type of mortality included:

1. circular-shaped plots with sharply delineated boundary;
2. inside the circle trees were all uniformly red;
3. no evidence of insect, disease or animal damage;
4. all affected stands were fully stocked or overstocked.

Ordinarily when lightning strikes a tree, the charge is grounded and quickly dissipated. When soil moisture is at low levels, however, the path of least resistance is through living tissue. In tightly grouped stands of lodgepole pine where root grafts are common, the charge readily passes from tree to tree, radiating outward from the initial strike. In its passage through the root systems the charge is thought to damage the delicate feeder roots preventing trees from absorbing moisture and nutrients from the soil. At the centre of a killed stand near Punchaw Lake, one tree exhibited some charring of the bark about midway along the bole. Roots from this area were submitted to the Pacific Forestry Centre for examination but no external signs of fine root damage were seen.

This phenomenon will be further examined if repeated in 1986.

#### **Acid Rain National Early Warning System (ARNEWS)**

In 1984 a national program was instituted to closely monitor forest conditions with respect to airborne pollutants. Though acid rain is not known to be a problem in the Prince George Region, there is a need to collect baseline data representing the normal forest condition so that changes can be detected and monitored over time.

In the summer of 1985, with the cooperation of Northwood Pulp and Timber, a long term ARNEWS research plot was established in a young white spruce-alpine fir stand near Averil Lake. This plot is one of nine established province-wide. At regular intervals over at least the next 25 years, samples of the soil, and tree and undergrowth foliage will be analyzed in order to detect changes in chemical composition that could signal future problems. Samples taken from the plot in the fall of 1985 are currently being analyzed.

#### **Blowdown**

During aerial surveys in September, numerous areas of blowdown in spruce-alpine fir types totalling over 250 ha were seen near Tumuch Lake, Everett Creek and Narrow Lake. Additional patches of undetermined size were later reported near George and Naver creeks and in the McGregor River drainage. All of this damage resulted from a single late summer windstorm.

The timber types affected being predominantly white spruce, the blowdown has created a significant hazard, especially in inaccessible sites, that the spruce beetle will attack and successfully breed in this material. Most historical spruce beetle outbreaks began in windthrown timber. Fortunately, the storm occurred after the 1985 beetle flight and none of the timber examined in September was attacked. Attacks by spruce beetle and secondary insects will likely occur in May and June of 1986.

Accessible sites will be closely monitored in the spring of 1986.

#### PESTS OF YOUNG STANDS

As part of a new emphasis toward gaining information on the impact of forest pests on second growth stands, FIDS has implemented a new program of young stand surveys. A survey technique involving the location of fixed radius plots at fixed intervals, was used in 1985 because it offers more precise information than previously used methods. Most commonly seen in young pine stands this year were the western gall rust, Endocronartium harknessii, and stem rust, Cronartium coleosporioides. Young white spruce and alpine fir sustained significant damage by early winter and late spring frosts. Results of these surveys are summarized in Table 8.

Table 8. Pests of young stands in the Prince George Forest Region, 1985.

Location	% Species <sup>1</sup> Composition	Age	Treatment	No. plots	Avg. no. trees/plot	No. trees/ha	Pests	% of type infested/infected
Chief Lake	1P 95.5	12	natural regen. 3 plots spaced 4 plots unspaced	10	spaced 12 unspaced 149	spaced 1900 unspaced 22000	<u>Cronartium coleosporioides</u>	4.6
							Cecidomyiidae (gall midge)	0.5
	alF 4.4						<u>Pissodes terminalis</u>	0.2
	wS .1						frost damage	100% alF avg. 30% new growth
							frost damage	100% wS avg. 50% new growth
Km 29 Moldowan Rd.	1P 75	8	natural regen.	12	11.25	1700	<u>C. coleosporioides</u>	12
	alF 25						Cecidomyiidae	14
							<u>Endocronartium harknessii</u>	2
							frost damage	65% alF avg. 30% new growth
Willow R.	wS 94	10	planted	15	13.4	2680	<u>Adelges cooleyi</u>	15
	Df 3							
	alF 2							
Km 9 Naver Rd.	1P 1	9	planted	16	10.6	2125	<u>E. harknessii</u>	25
	1P 74							Cecidomyiidae
							<u>Petrova</u> sp.	9.5
							needle cast	3.5
							<u>P. terminalis</u>	4
Km 15 Naver Rd.	wS 26	9	planted	16			<u>Pineus</u> sp. gall aphid	4.5
	wS 55	14	planted	7	22	2230	<u>A. cooleyi</u>	39
	1P 45						<u>E. harknessii</u>	44
							rodent feeding	23
							Cecidomyiidae	9
							<u>P. terminalis</u> (old)	6
							<u>C. coleosporioides</u>	3
							<u>Petrova</u> sp.	3
North Fraser (LeGault Rd.)	1P 55	10	planted (1P)	no plots			<u>E. harknessii</u>	4
		2	interplanted (Df) est.				Cecidomyiidae	4
	alF 21						<u>Hylobius warreni</u>	2
	Df 15							
	wS 9						<u>A. cooleyi</u> (wS)	10

<sup>1</sup>1P = lodgepole pine; alF = alpine fir; wS = white spruce; Df = Douglas fir.

Canada