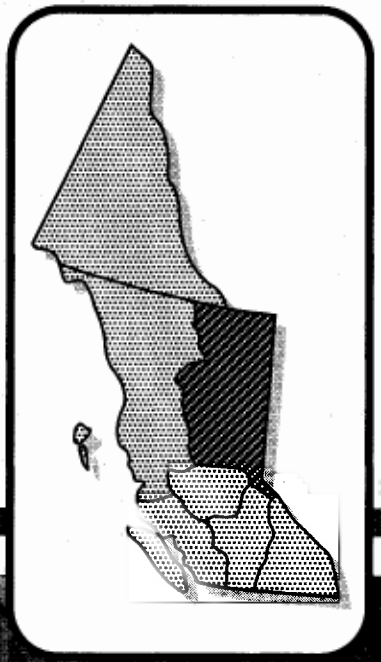
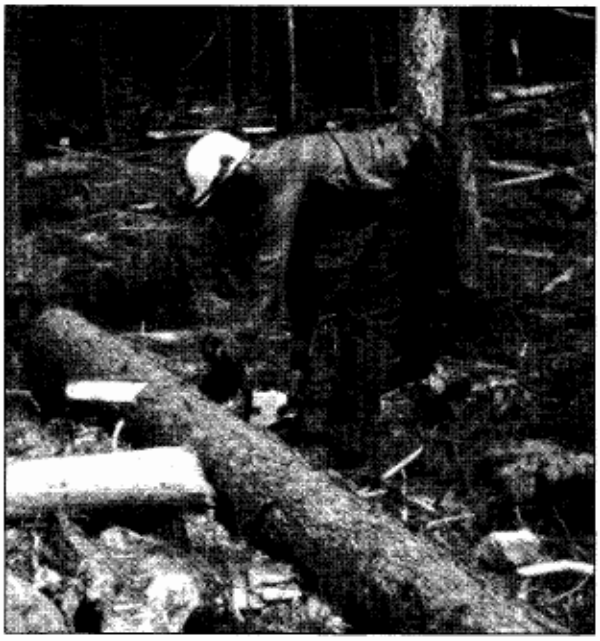
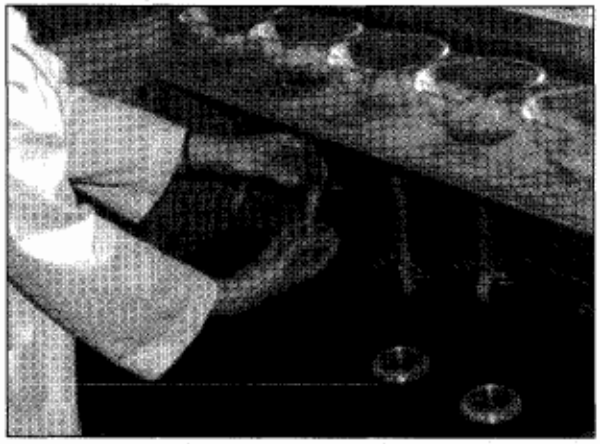


Forest Insect and Disease Conditions

Prince George Region • 1992

Nick Humphreys and Bob Ferris





Forestry Canada Forêts Canada

Canada

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Foreward

Forest Insect and Disease Survey (FIDS) is a nation-wide network within Forestry Canada with the responsibility of: (1) producing an overview of forest pest conditions and their implications, including predictions where possible; (2) maintaining records and surveys to support quarantines; (3) supporting forestry research with field studies, records and Herbarium and Insectary collections; (4) providing advice and extension on forest insect and disease conditions; (5) developing and testing survey techniques; (6) and conducting related biological and impact studies.

Correspondence and inquiries with respect to forest pest problems, and requests for publications can be directed to:

Pacific Forestry Centre
Forestry Canada
506 West Burnside Road
Victoria, B.C. V8Z 1M5
Ph. 363-0600
from: October to May

Forest Insect and Disease Survey
Forestry Canada
R.R. 8, Site 25, Compartment 8,
Prince George, B.C. V2N 4M6
Ph. 963-7238 or 963-7394
from: June to September

During aerial surveys, bark beetle and defoliator damage has been quantified within damage classes and reference to these classes appear intermittently throughout the report:

Bark beetle mortality classes:

light - 10% or less of stand recently killed
moderate - 11-29% of stand recently killed
severe - 30%+ of stand recently killed

Aerial survey defoliation classes:

Light - discoloured foliage barely visible from the air; some branch and upper crown defoliation

Moderate - pronounced discolouration; noticeably thin foliage; top third of many trees severely defoliated; some completely stripped

Severe - bare branch tips and completely defoliated tops; more than 50% of most trees defoliated

Final copies of infestation maps produced during aerial surveys are digitized into the FIDS in-house geographical information system (GIS). Computer-generated copies of these maps are sent to various co-operators and are available by request through FIDS.

Introduction

This report summarizes the findings of two Forest Insect and Disease Survey (FIDS) technicians during summer and fall field studies in the Prince George Forest Region in 1992. Forest pest conditions are listed by host in order of importance with emphasis given to those capable of sudden damaging outbreaks. Most of the information was gathered through the surveying of 49 young stands throughout the region; the monitoring of already known or recently reported infestations or disease problems; the detection of pest problems during travels through the region; annual aerial surveys during which major pest problems were mapped with reference to area and severity; and special projects designed to gain information for ongoing research.

The FIDS field season extended from May 25 to October 1 during which over 160 insect and disease collections were sent to the Pacific Forestry Centre (PFC) for identification or confirmation (**Figure 1**). Some of these were added to the extensive permanent collections in the PFC Insectary and Herbarium.

The B.C. Forest Service provided approximately 36 hours of fixed-wing and 20 hours of helicopter time, for aerial and aerially accessed ground surveys during the 1992 season (**Figure 1**).

Summary of Pest Conditions

The area of **spruce beetle** killed trees increased for the fourth consecutive year with cumulative mortality of almost 2 000 000 m^3 over more than 100 000 ha, from southeast of Prince George to north of Fort Nelson. Over 90 000 ha were recorded in the Mackenzie and Dawson Creek Forest Districts. **Eastern spruce budworm** defoliation of spruce and fir declined in the Fort Nelson Forest District by 46% to 139 000 ha. This is the second consecutive year of decline. Defoliation by mature **two-year-cycle spruce budworm** increased twelve-fold to 104 000 ha in the Prince George, McBride, Fort St. James and Mackenzie Forest Districts.

Spruce weevil continued to kill young spruce leaders throughout the southern half of the region. Infested leaders found north of Fort St. John are part of the most northerly population found in the central interior. The **northern spruce engraver** beetle continued to kill tops of scattered mature white spruce, mostly northeast of Prince George.

Lodgepole pine mortality due to 1991 **mountain pine beetle attacks** increased slightly to 293 000 m^3 over a decreased area of 8430 ha. The majority of the mortality was in the Fort St. James Forest District with over 8000 ha recorded. **Pine needle cast** was widespread in the southern half of the region defoliating lodgepole pine over several hundred hectares.

The recorded area containing high elevation mature alpine fir killed by **balsam bark beetle** mostly in the Fort St. James Forest District increased to 40 000 ha.

Tree mortality due to attacks by the **Douglas-fir beetle** was mapped over more than 3400 ha.

New surveys in 1992 were conducted to obtain a exemption of western hemlock from a ban on non-kiln dried exports to Europe due to the **pinewood nematode**. **Environmental damage** and **stem rusts** were common at four lodgepole pine plantations established in 1986 in a joint **Canada-Sweden project**. The **Acid Rain National Early Warning System (ARNEWS)** was expanded in the Prince George Forest Region this year with the addition of 3 new plots. Another plot was established in the Prince George Forest District at Willow River Demonstration Forest, and one each in the Dawson Creek and Fort St. John Forest Districts. Surveys of 49 young stands at widespread locations found a variety of diseases and insects. The most common of these were **stem rusts**, **adelgids**, and **environmental damage**.

Defoliation of mature to overmature western hemlock and western redcedar by the **western hemlock looper** increased to over 28 000 ha up from 200 ha in 1991. More than 60% of the defoliation occurred in the Prince George Forest District with the remainder in the McBride Forest District. Feeding by **rusty tussock moth** larvae

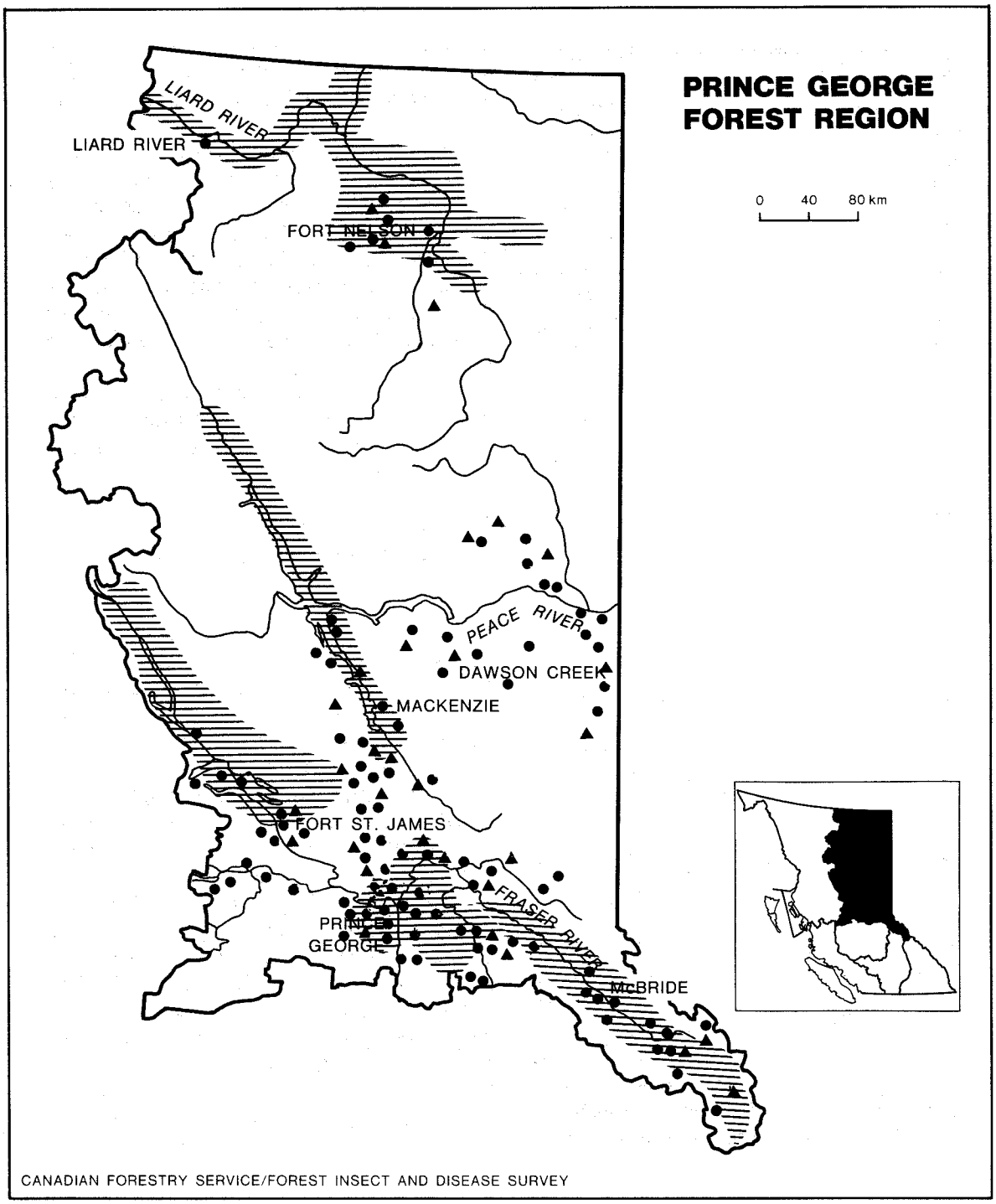

Figure 1. Location where one or more forest insect and disease samples were collected and areas covered by aerial surveys to map bark beetle and defoliator infestations in 1992.

defoliated conifers and deciduous trees and shrubs over more than 13 000 ha in the Prince George Forest District. The first time that an infestation of rusty tussock moth has been reported causing defoliation in the Prince George Forest Region. **Black army cutworm** populations were identified as causing trace defoliation of spruce plantations at several locations in the Robson Valley. Pheromone trap results indicate increasing populations for 1993.

Forest tent caterpillars continued to defoliate stands dominated by trembling aspen, however, the area decreased to less than 21 000 ha down from 92 000 ha last year. **Large aspen tortrix** populations increased for the fourth consecutive year and defoliated trembling aspen over more than 24 000 ha, mainly in the northern half of the region. No adult male **gypsy moths** were trapped in 55 pheromone-baited traps placed in provincial parks, rest areas and private campgrounds. Infections caused by **poplar shoot blights** caused over 1600 ha of defoliation on trembling aspen near Valemount. Widespread willow mortality caused by the **poplar-and-willow borer** was noted throughout the Prince George Forest Region south of Mackenzie.

A table summarizing other **noteworthy pests** is included in this report. Several **new host records** were confirmed from collections submitted to the Pacific Forestry Centre; their occurrences are noted under the appropriate host.

Spruce Pests

Spruce beetle

Dendroctonus rufipennis

British Columbia Forest Service aerial and ground surveys indicate that spruce beetle caused mortality increased for the fourth consecutive year to over 105 000 ha (**Table 1**). Almost 90 000 ha were mapped by the Forest Service in the Mackenzie and Dawson Creek Forest Districts (**Figure 2**). Increases in spruce beetle caused mortality were recorded in all forest districts in the region except Vanderhoof. Timber loss has been estimated at over 2 000 000 m^3 of recently killed white spruce. This is more than double the estimated volume loss for 1991. Infestations ranged in size from single trees to several thousand hectares.

Forest Service and forest industry personnel found varying levels of currently attacked trees throughout the infested areas in all districts. If broods remain healthy throughout the winter of 1992-93, continued spruce mortality can be expected in 1993 and 1994. The life cycle of the beetle broods were a mixture of 1, 2, and 3 years, with two-year-cycle the most common.

Dawson Creek TSA

Increased aerial surveys by the Forest Service, mapped the largest recorded expansion of spruce beetle infestations in this TSA. Areas not previously mapped for spruce beetle were flown this year resulting in a dramatic increase in the area of infestation.

The total area of infestations will be reduced as ground survey data is analyzed later in the year. Extensive spruce beetle probes were undertaken by Forest Service contractors in the summer and fall of 1992. The information from the probes will eliminate some areas that were aerially mapped previously but for which no beetle attack was found during ground surveys. A corresponding decrease will also occur in the volume figures calculated on the original area figures.

The largest areas of infestation, some several thousand hectares in size, were mapped between the Rocky Mountains and the foothills south of the western arm of Williston Lake and north of the Hart Highway. The more than 40 000 ha were noted in the following drainages; Eleven Mile, Carbon, McNairn, Doonan, Silver Sands, Little Boulder, Big Boulder and Fisher creeks. Infestations were also mapped south of the Hart Highway along the eastern slopes of the Murray Range in the Mountain Creek and Burnt River drainages south to Windfall and Wolverine creeks to Hook Lake.

Fort Nelson TSA

In only the second year of recorded infestation, spruce beetle attacks increased to

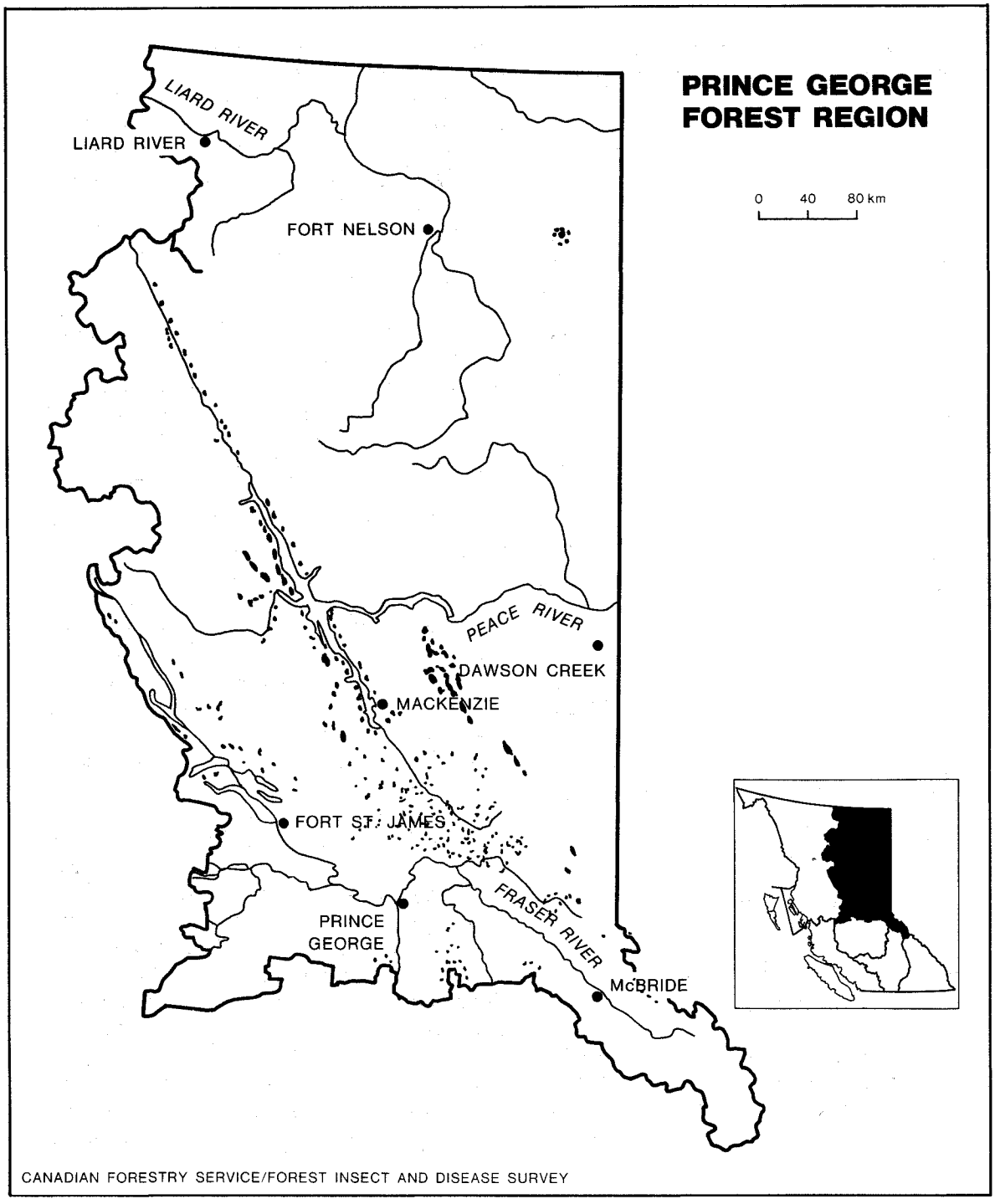

Figure 2. Areas of white spruce killed by spruce beetle determined by aerial and ground surveys in 1992.

Table 1. Timber supply area (TSA), cumulative area and volume of white spruce recently killed by spruce beetle, Prince George Forest Region, 1991 - 92.

TSA	Area (ha)		Volume (m^3)	
	1992	1991	**1992**	1991
Dawson Creek	**49 900**	*	**690 000**	*
Fort Nelson	**5 900**	870	**82 000**	12 180
Fort St. John	*	*	*	*
Mackenzie	**40 000**	32 400	**1 230 000**	655 000
McBride	**40**	*	**600**	*
Prince George	**9620**	10 600	**247 000**	274 000
Regional totals	**105 460**	43 870	**2 249 600**	941 180

* No figures available

over 5900 ha. Light spruce mortality was widely scattered over an area bordered by Kotcho Lake, Kotcho River, Shekillie River, and Datchin Creek. No ground surveys were carried out due to the inaccessibility of the sites.

Fort St. John

Reports of the spruce beetle attacks in the eastern portion of the TSA have not yet been confirmed

Mackenzie TSA

Spruce beetle attacks on white spruce increased in the Mackenzie TSA to over 40 000 ha from 32 000 in 1991. Major increases were recorded in the Clearwater River drainage northeast of Mackenzie and in the Ross Factor Creek area south of Ingenika arm. Infestations were mapped again from Mischinsinlika Creek in the south to Fox Lake in the north, and east from the junction of the Ominicetla Creek and Omineca River to the Nabeshe River.

The same recalculation of area figures from additional ground survey data that are taking place in the Dawson Creek TSA will apply in the Mackenzie TSA. As beetle probe data becomes available, non-infested polygons will be eliminated from aerial survey maps.

A large portion of the spruce beetle infestations occurred in mixed white spruce and alpine fir stands in the Phillips, Blackwater, and Chunamen creek drainages along the eastside of Williston Lake south of Omineca Arm. Infestations continued near the northeast end of Williston Lake along the Ospika, Finaly, and Messilinka Rivers, between Mt. Ross and Omineca Arm, and between Collins Bay and Tobin Lake on the westside of the lake.

Due to the large areas of infestation, healthy broods and susceptible timber, spruce beetle caused mortality will continue in this TSA for the next several years.

McBride TSA

Only 40 ha of spruce beetle attack were mapped in this TSA. Most of this attack occurred along the Holmes River and the northeastern arm of the headwaters of Small

Creek. Ground surveys are continuing in other areas of the TSA to confirm suspected locations of beetle attack.

Prince George TSA

The area of spruce beetle infested white spruce remained relatively constant in the Prince George TSA at 9720 ha in 1992. Light mortality was recorded over 6040, moderate over 2550, and severe over 1130 ha. Mortality in the Prince George Forest District decreased to 7170 ha but increased in the Fort St. James Forest District to 2550 ha.

The largest infestations in the Prince George Forest District were recorded in the McGregor River and Herrick Creek drainages along Goodson, Jarvis, Framstead, Muller, James, Fontonika, Otter, and Wichcika creeks drainages. Scattered patches of 10 to over 100 ha were noted along the West Torpy, Seebach, and Olsson creeks. In the northern portion of the district, widely scattered attacks were noted over a large area bordered by McLeod, Carp, and Weedon lakes. Infestations were also mapped in the southerly areas of the district. Moderate to severe attacks were noted at Grizzly, Lodi, Hay, May, and Stony lakes. Several infestations of severe attack were located along Haggen and Stephanie creeks.

The area of spruce beetle infestations in the Fort St. James Forest District increased from several hundred hectares to over 2500 ha in 1992. The main concentration of beetle killed trees occurred along the north shore of Tchentlo Lake and between Tchentlo and Chuchi lakes. Scattered attacks were noted in the Sidney Creek area north of Trembleur Lake and around Otterson Lake. In the western portion of the district infestations were recorded along the south shore of Takla Lake between Bivouac and Macdougal creeks.

General

The B.C. Forest Service has proposed accelerated logging in both standing infested timber and areas of infested blowdown, along with follow up trap tree programs as well as removal of existing trap trees. This will occur over the next few years in order to control beetle populations and thus reduce subsequent mortality.

Forest insect and Disease Survey will continue to monitor spruce beetle populations in both standing and windthrown trees next year.

Eastern spruce budworm

Choristoneura fumiferana

Eastern spruce budworm populations decreased for the second consecutive year, in this the ninth year of the current outbreak (**Figure 3**). The area of recorded defoliation in the Fort Nelson and Fort St. John Forests Districts declined by 46% to 139 000 ha of light defoliation in mainly white spruce stands (**Figure 4**). Aerial surveys recorded defoliation over 245 000 ha in 1991 down from the almost 400 000 ha mapped in 1990. Severe defoliation was last reported in 1990 when over 28 000 ha were observed during aerial surveys.

Damage was mapped in many of the same areas as in 1991 and expanded into the Fort St. John Forest District where 6500 ha of light defoliation was recorded. Defoliation was mapped from Fort Nelson to the Northwest Territories, west to the Coal River area and near Liard Hot Springs. The largest area of defoliation was along the Fort Nelson river between Klua Creek and the Snake River. The infestation extends down the Fort Nelson and Fontas rivers into the Fort St. John Forest District.

Spruce and fir foliage were examined for egg masses in order to predict budworm populations for 1993. Through cooperation with the B.C. Forest Service, egg mass samples were obtained from white spruce at four locations; Clark Lake, Liard River, and two at the Snake River. The number of egg masses per $10m^2$ of foliage averaged 290, range (110-470). In 1991, the number of egg masses averaged 230 per $10m^2$ of foliage down from 400 egg masses in 1990 (**Table 2**).

The numbers in Table 2 cannot be used for accurate predictive purposes as the egg mass sampling method was calibrated for western spruce budworm, *C. occidentalis*, rather than eastern spruce budworm. However, the trend suggests a decreasing population causing only

Table 2. The average number of egg masses on white spruce and alpine fir by year and the amount of defoliation the following year, in the Fort Nelson Forest District 1988-92.

Year	Average #egg masses per $10m^2$ of foliage	Defoliation the following year Area(ha)			
		Light	Moderate	Severe	**Total**
1988	unknown	41 380	71 070	11 290	**123 740**
1989	1000+	172 285	197 470	28 400	**398 155**
1990	400+	221 000	24 000	-	**245 000**
1991	230	132 000	_	_	**132 000**
1992	290		_	_	_

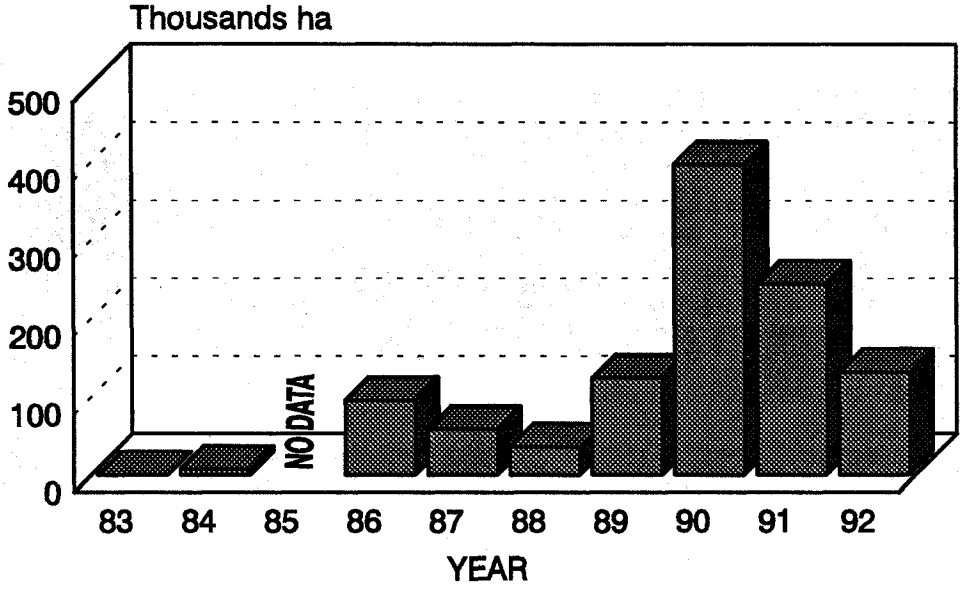

Figure 3. Eastern spruce budworm defoliation (ha) in spruce/balsam stands.

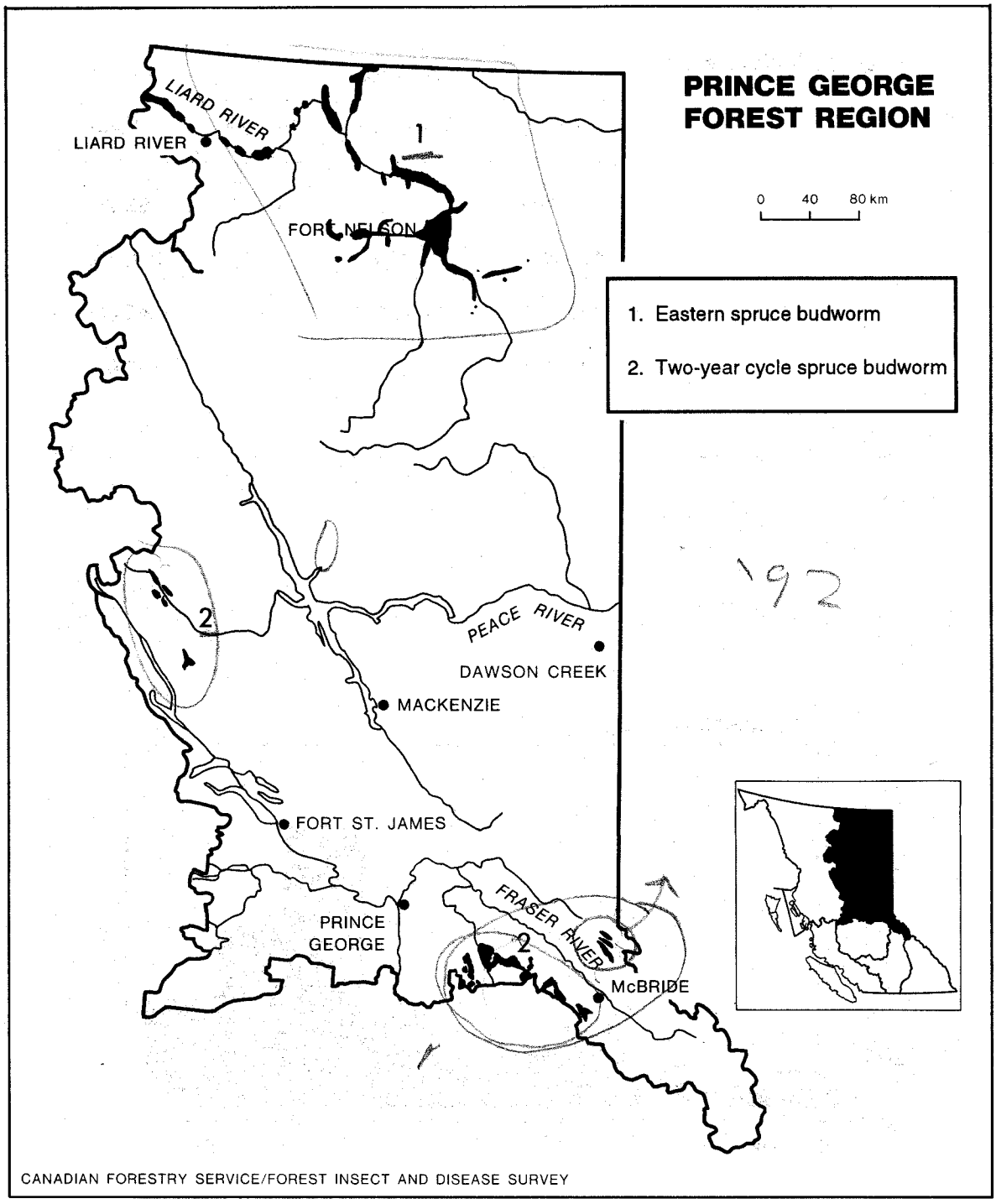

Figure 4. Areas where current defoliation of spruce/balsam stands by eastern spruce budworm and two-year cycle spruce budworm was detected during aerial surveys in 1992.

light defoliation for 1993. Only light defoliation over a reduced area was recorded in 1991 after 400 egg masses were collected the previous year. Populations continued to decline in 1992 after an average 230 egg masses were found.

Two-year-cycle spruce budworm

Choristoneura biennis

Defoliaton of spruce-balsam stands in the Prince George Forest Region by mature **two-year-cycle budworm** increased to 104 000 ha from 23 000 ha in 1991 (**Figure 4**). The Prince George, McBride, and Fort St. James Forest Districts had 58 000, 33 000, and 13 000 ha of defoliation respectively. Budworm defoliation was also noted in the Mackenzie Forest District and was estimated to include approximately 5000 ha. However, no budworm feeding was mapped from the air or included in the total area figure.

In the Prince George Forest District over 42 000 ha of damage occurred in 42 infestations along the Bowron, Slim, Everett, and Dome rivers. The remaining damage from feeding (almost 16 000 ha) was noted in 18 infestations in the Hagen, Dominion, and Littlefield creek drainages and around Crescent, Stoney and Slender lakes. The most severe defoliation was also in the Prince George Forest District with 3600 ha of moderate defoliation mapped along the west side of the Bowron River just east of Narrow Lake.

Budworm defoliation in the McBride Forest District was evenly distributed between two general areas. Over 17 000 ha of budworm feeding was mapped in 16 infestations along the Dore and Milk rivers and in the Betty Wendle, North Star, and Macleod creek drainages. The other area consisted of almost 16 000 ha in 10 infestations along the Morkill, Cushing, and Forgetmenot rivers.

Defoliation was recorded over approximately 13 000 ha in 14 infestations in the Fort St. James District. Most of the feeding was mapped along the Omineca River between Old Hogen and the Axlegold range. Two other areas were attacked near the west end of Tchentlo Lake and along the Falls River.

In the Mackenzie Forest District budworm feeding was reported but not mapped in the Ospika and Omineca river drainages and along Davis Creek. Estimates of actual defoliated area were given as approximately 5000 ha.

The defoliation in the Ft. St. James and Mackenzie Forest Districts was somewhat unexpected as over 23 000 ha was defoliated in 1991 by the mature larvae in the same area. This year, an even year, is considered to be the major feeding or "on-cycle" year of this budworm south of latitude 54°30'. The budworm feeding mapped in the Ft. St. James and noted in the Mackenzie Forest Districts is classified as "off-cycle." The mature larval feeding for these areas should occur next year, an odd year. The immature larval feeding may have become more visible this year due to the lack of precipitation this summer causing damaged needles to turn red more readily.

Forestry Canada completed a survey of infested buds in June of this year. The counts indicated increasing populations and defoliation in the Prince George and Quesnel Forest Districts. The survey of infested buds is possibly the most accurate sampling method for predicting populations and damage. Egg samples have been collected in the past for predictive purposes but no definite population trend has been determined from these samples (**Table 3**). Egg mass sampling has proven effective in predicting western spruce budworm population fluctuations. The biology of *C. biennis* may preclude predictions of population fluctuations through egg sampling. Forestry Canada will continue to monitor populations through infested bud counts, larval sampling, and aerial surveys.

The impact of defoliation should be insignificant this year as over 100 000 ha of the damage was classified as light, with feeding restricted almost exclusively to the top 3 metres on mature trees. Growth loss in the stands with moderate feeding along the Bowron River will be the main impact. However, occasional scattered top kill, branch, and some understory tree mortality is possible. The visual impact of a red hillside may lead to speculation that the damage is greater than it actually is. Previous studies indicate that incremental growth can be reduced by over 75% when severe defoliation has occurred. When severe defoliation occurs for several successive years, the added stress

Table 3. Year and number of sites where eggs were collected, average number of eggs per $10m^2$ of foliage and area(ha) of defoliation 2 years later.

Year	# Sites eggs collected	Average # egg masses/$10m^2$ of foliage	Area of Defoliation(ha)[1] 2 years later
1984	6	180	15 700
1986	6	258	17 500
1988	5	562	8 610
1990	none	unknown	90 000
1992	7	200	-

[1] Area only includes defoliation by the mature "on-cycle" two-year-budworm.

could predispose the large diameter spruce to beetle attack.

Spruce weevil
Pissodes strobi

Spruce weevil attacks were again observed in scattered white spruce stands throughout the region in 1992. However, infested stands were not surveyed so data on percentage of current attack is not available. Weevil attacks were widespread and often more severe in young stands throughout the southern half of the region.

An annual monitoring program of selected spruce weevil infested stands is to begin in 1993. Stands with varying levels of attack and in different biogeoclimatic zones will be surveyed for current attack on an annual basis. This monitoring program is designed to recognize any trend in fluctuations of weevil populations and aid in the development of management strategies.

Multiple tops, loss of the current leader, and corresponding radial growth loss are the results of spruce weevil attacks. Repeated attacks can severely retard height growth and alter the form of the tree, reducing its end product value, through crooks and defects in the logs. Leader clipping in conjunction with biological control such as parasite releases are management options that can reduce spruce weevil populations. Red Rock Seed Orchard reduced current attack levels to 2% in 1991 and 1990, from 40% in 1989 using a leader clipping program.

Northern spruce engraver beetle
Ips perturbatus

Populations of this engraver beetle continued to kill the tops of white spruce mostly in the Prince George Forest District. Scattered single standing white spruce were top killed throughout the Averil Creek, Olsson Creek, and the Torpy, McGregor, and Parsnip river drainages. The dead tops caused by the beetle were often found next to dead and dying spruce beetle infested trees.

Although this pest is normally a secondary bark beetle, the attacks on living trees is not unusual. Large broods develop because of an abundance of suitable host material. Windfall and non-lethal spruce beetle trap trees that were felled partially in the open to facilitate removal, provided an excellent source of host material. The period from time-of-attack to emergence can take as little as six weeks. The engraver beetles

emerge as adults in late summer and overwinter in the duff, before attacking the tops of the standing timber in the spring.

The last major outbreak of this insect was in the Torpy River area from 1984 to 1986, when the tops of several thousand white spruce were attacked. This outbreak followed population increases in spruce killed during the last spruce beetle outbreak. Populations declined in 1987 and few attacks by this pest have been noted until this year.

FIDS will continue to monitor and report on the presence of this pest in 1993.

Pine Pests

Mountain pine beetle

Dendroctonus ponderosae

The area of recorded lodgepole pine mortality due to attacks by the mountain pine beetle decreased to 8430 ha after three consecutive years of increase (**Table 4**).

Again over ninety percent of beetle caused mortality occurred in areas, mostly inaccessible, of chronic infestation in the Fort St. James Forest District in the Prince George TSA (**Figure 5**). The actual area of attack decreased from 8900 ha to 8100 ha but the timber volume of trees killed increased slightly to 272 000 m^3, (**Figure 6**), due to increased severity of attack. The same situation occurred in the McBride Forest District with a decrease in area to 150 ha but an increase in tree volume killed, 11 000 m3. Mortality increased slightly in the Prince George Forest District to 180 ha and remained static in the Vanderhoof Forest District with no recorded tree mortality.

Fort St. James Forest District

The area of recently killed lodgepole pine decreased to over 8100 ha from 8900 ha in 1991, 7750 ha in 1990, and 2800 ha in 1989. Light mortality was mapped over 2900 ha, moderate over 3000 ha, and severe over 2200 ha. The majority of dead trees were mapped in the same areas as last year. The major areas of decrease were along the north shore of Trembleur Lake and along the north shore of the Northwest arm of Takla Lake. Increases in area were noted northwest of Lovell Cove on the west side of Takla lake and along Bear Lake and the Sustut River. Mortality continued at approximately the same levels within Tree Farm Licence (TFL) 42.

Prince George Forest District

Lodgepole pine mortality has increased for the third consecutive year in the Prince George Forest District with 180 ha recorded, up from 165 ha in 1991, 125 ha in 1990, and 80 ha in 1989, but down from 255 ha in 1988. An estimated 25 ha of moderate attack in scattered pockets of approximately 0.25 ha were noted along the Chilako and Blackwater rivers southwest of Prince George city and in the Wannsa and Vama Vama creek drainages northeast of the city. Larger infestations of up to 50 ha were noted at Herring and James creeks and along the Willow River just north of Spey Creek and southeast of the junction of Walker Creek and the Fraser River.

McBride Forest District

The area of recently killed lodgepole pine covered over 150 ha of severe mortality. Although the area of infestation decreased, the volume increased slightly to 11 000 m^3 (**Table 4**). The majority of the dead trees in 11 infestations were mapped along the eastside of McNaughton Lake from Bulldog to Hugh Allen creeks. Scattered light attack was noted in five infestations along Castle Creek southeast of McBride.

In the Mt. Robson corridor area, B.C. Parks plans to dispose of 100 trees during the fall of 1992. The 100 trees included 74 baited trees and 26 periphery trees that were also attacked. One hundred and four trees were disposed of last year in Robson Park.

Vanderhoof Forest District

Mountain pine beetle populations remained static with only scattered single tree attacks noted. Attacked trees were recorded from south of Natalkuz Lake to the southern shore of Francois Lake.

Pheromone baited trees continued to be used by the Forest Service to attract mountain

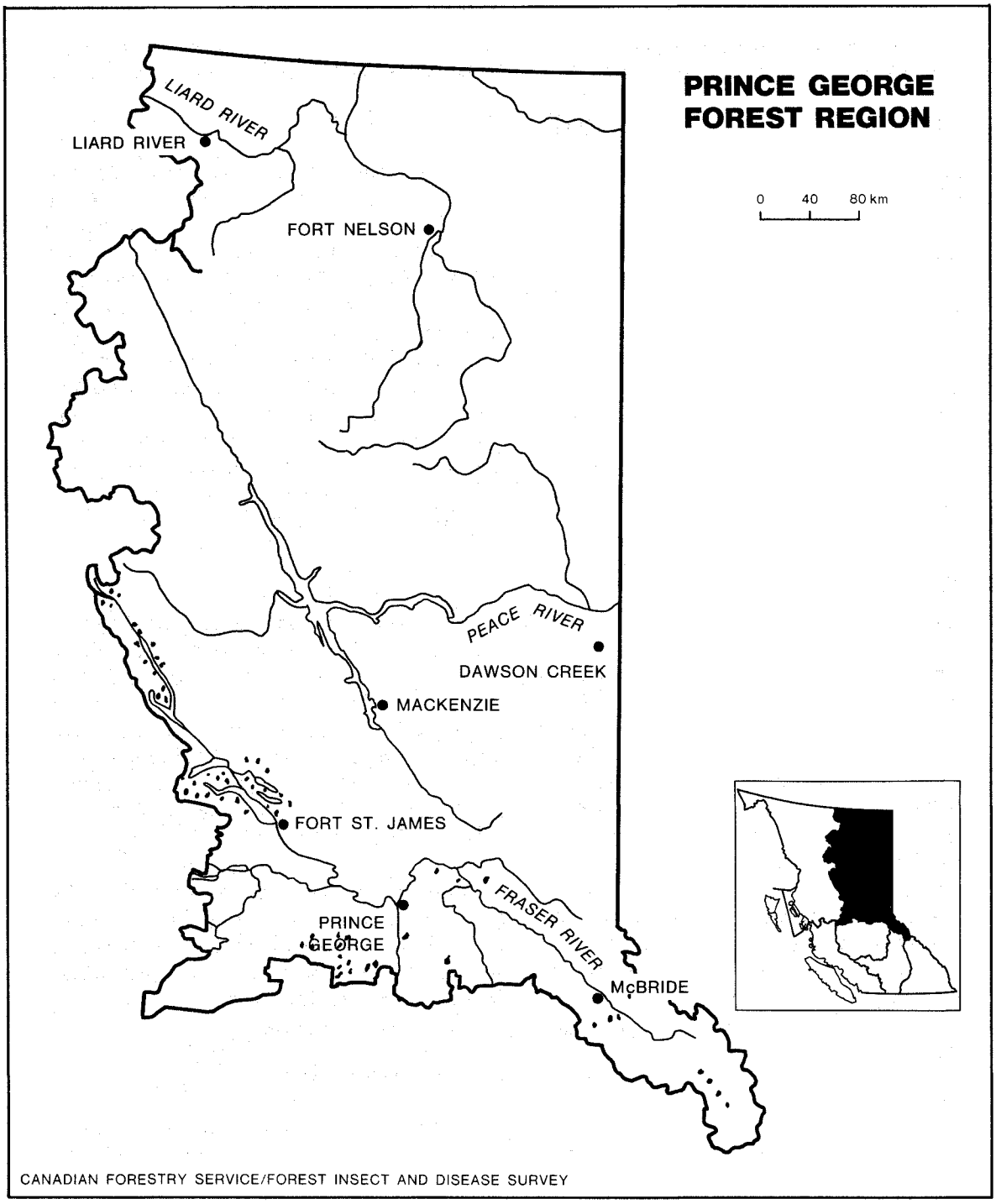

Figure 5. Areas of lodgepole pine killed by mountain pine beetle determined by aerial and ground surveys in 1992.

Table 4. Timber supply area (TSA), forest district, area and volume of lodgepole pine recently killed by mountain pine beetle 1991-92, Prince George Region, 1992.

TSA and forest district	Area (ha)		Volume (m^3)	
	1991	**1992**	1991	**1992**
Prince George TSA				
Fort St. James	8915	**8100**	263 000	**272 000**
Prince George	165	**180**	3 000	**10 000**
Vanderhoof	10	**0**	125	**0**
TSA TOTAL	9090	**8280**	266 125	**282 000**
Mcbride TSA				
McBride	220	**150**	10 000	**11 000**
TSA Total	220	**150**	10 000	**11 000**
Regional Total	9310	**8430**	276 125	**293 000**

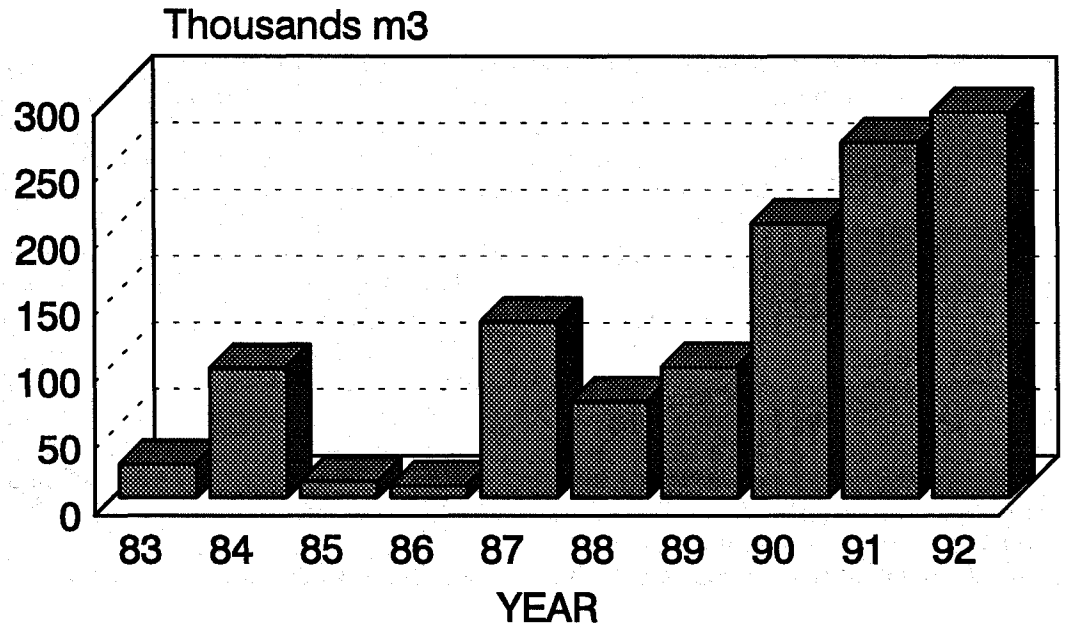

Figure 6. Lodgepole pine volume loss (m^3) caused by mountain pine beetle.

pine beetle in preparation for some MSMA injection, single-tree disposal, and logging operations.

Pine Needle Cast
Lophodermella spp.

Discolouration and premature casting of lodgepole pine needles caused by pine needle cast infections were widespread in the southern half of the region.

Approximately 10% of the older needles on 40% of the immature pine were infected over 350 ha around 37 km of the Bowron road. Over 100 ha of young pine were infected at both the Pack River east of Mackenzie and along Archie road near McGregor. Up to 80% of the foliage was killed on 80% of the trees. Premature casting of 50% of the foliage on over 90% of the trees was noted in the Red Rock Seed Orchard.

This needle cast does not kill large trees or significantly affect their health unless heavy and repeated infections occur in successive years. Extensive, long-term defoliation affects growth and shape of trees.

Alpine Fir Pests

Western balsam bark beetle-fungus complex
Dryocoetes confusus, Ceratocystis dryocoetidis

Balsam bark beetle caused tree mortality increased over fivefold, killing alpine fir over approximately 40 000 ha.

The majority of the mortality again occurred in the Fort St. James Forest District with light mortality mapped over 35 000 ha. Almost half the area was mapped in 15 infestations along the east side of the Bates Range east of Takla Lake and the Driftwood River. A total of 11 000 ha in 54 infestations was scattered over a wide area along Silver and West Kwanika creeks, the Nation River and Lakes and throughout the Mitchell Range. In the northern portion of the district over 4700 ha were mapped in 64 infestations along Bear Lake and the Sustut and Skeena rivers. The remaining approximately 2300 ha of mortality was recorded over 21 infestations in the Trembleur and Inzana lakes area.

In the Mackenzie Forest District mortality was reported over a wide area. However, no actual area figures are available due to lack of aerial mapping. The Forest Service estimates that the infestations have expanded beyond the almost 2400 ha of light to moderate mortality mapped last year but have remained in approximately the same geographic areas.

In the McBride Forest District more than 1200 ha of mortality, in 13 infestations were recorded up from the only 300 ha in 1991. The largest area of expansion, over 1000 ha, was along the south side of Moose Lake just outside Robson Park.

Balsam bark beetle is a chronic problem in most districts in this region, and populations usually fluctuate little from year to year. The balsam bark beetle appears to be at the height of its population cycle with increased populations and mortality noted province wide.

FIDS will continue to monitor this pest in 1993.

Douglas-fir Pest

Douglas-fir beetle
Dendroctonus pseudotsugae

Mortality due to attacks by the Douglas-fir bark beetle more than doubled to over 3425 ha in 1992, compared to 1500 ha in 1991, 800 ha in 1990, and 115 ha in 1989 (**Figure 7**). Almost half the damage, 1400 ha, was recorded in the McBride Forest District more than twice the estimated 600 ha in 1991. Infestation expansions also occurred in the Prince George Forest District where over 1125 ha were recorded up from 720 ha in 1991 and in the Ft. St. James Forest District which increased from 225 ha to over 900 ha.

Fort St. James Forest District

Volume loss due to Douglas-fir beetle attacks was estimated at 29 000 m^3 in 28

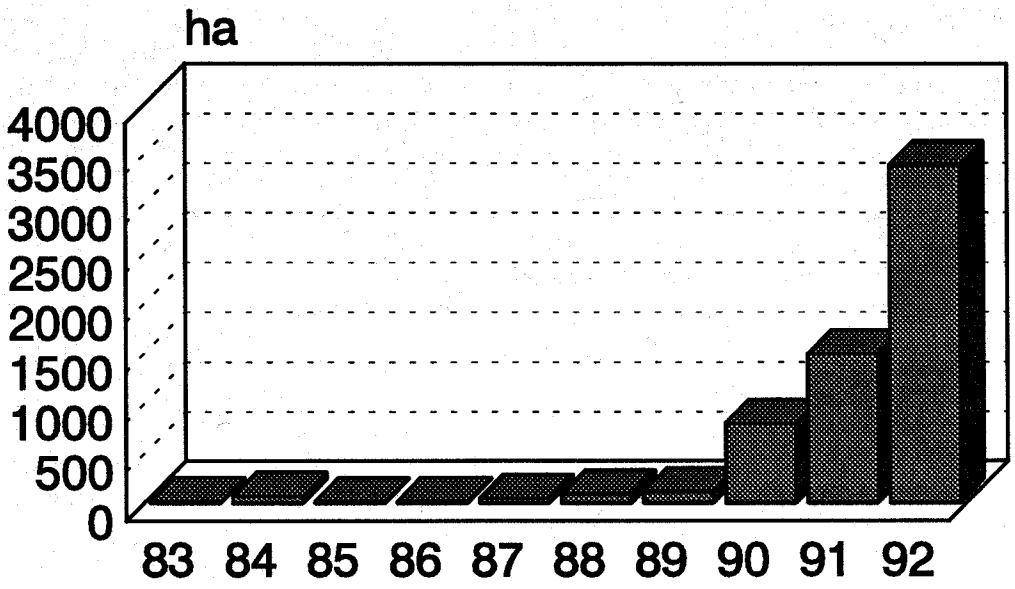

Figure 7. Douglas-fir beetle caused mortality (ha) in mature Douglas-fir stands.

infestations. Infestations expanded in basically the same areas as last year with mortality mapped along the west side of Stuart Lake from just north of Fort St. James to Tachie, between Pinchi and Tezzeron lakes, along the east side of Tachie River, and scattered around the north shore of Trembleur Lake to Tchentsut Mtn. and throughout TFL 42.

Prince George Forest District

Mortality was widespread causing an estimated volume loss of 21 000 m^3 in over 200 infestations. The main areas of mortality were: 300 ha of light and severe attack in 6 infestations along the northside of the **McGregor River** between Gleason and Hendrick creeks; 200 ha of light attack on the south facing slope of the Slim Creek drainage east of Everett Creek; 150 ha of severe attack in 5 infestations south of **Mackenzie Creek** east of the junction of the Torpy and Fraser rivers; 150 ha of light attack in 8 infestations along the south facing slope of the **Torpy River** drainage between Don and Goodson creeks; and 100 ha of light attack at both **Purden Lake** and **Giscome Canyon**.

McBride Forest District

Beetle-caused Douglas-fir mortality was estimated at 19 000 m^3 in 33 mostly light infestations along McNaughton Lake. Infestations occurred along the east side of the lake from Packsaddle Creek in the north to Dawson Creek in the south with the main areas of attack between Mt. Blackman and Dawson Creek. Scattered patches of attack were also noted along the west side of the lake at Foster, Windfall, and Grouse creeks and near the northwest base of Mt. Thompson. New areas of mortality were recorded along the Raush River.

The B.C. Forest Service continues to use trap trees, pheromone traps and logging of selected sites to combat this pest.

Special Directed Surveys

Pinewood Nematode
Bursaphelenchus xylophilus

New surveys in 1992 were conducted to obtain data to support an exemption of western

hemlock from a ban on non-kiln-dried exports to Europe.

Freshly cut logs from healthy standing cedar (5), hemlock (25), and lodgepole pine (25) were placed at a mill site near Prince George. This site had active woodborer populations in the lodgepole pine log decks. The log bolts were on site from May until September, the flight period of adult woodborers. These logs were measured, peeled and assessed for woodborers at Pacific Forestry Centre. Chips were extracted to determine the presence of nematodes.

Only one of the four lodgepole pine logs attacked by *Monochamus* spp. contained the **pinewood nematode**, *Bursaphelenchus xylophilus*. The *Monochamus* spp. woodborer is believed to be the vector of the pinewood nematode.

The western hemlock log bolts were lightly attacked by flatheaded woodborers, Buprestidae but not by *Monochamus* spp. Ten percent of the western hemlock logs contained other nematodes but no pinewood nematode.

The western redcedar has not yet been assessed for woodborer attack or processed for pinewood nematode.

In addition, over 100 hemlock logs were examined at a dry land sort in the McBride Forest District. Six percent of these logs were attacked by flatheaded borers, but none by *Monochamus* spp.

Based on nearly 2000 samples from trees, logs, boards, and potential vectors collected from throughout British Columbia since 1980, this nematode remains extremely low in forests in British Columbia and Yukon Territory. Only individual, predisposed trees have been affected at a few widely-distributed locations.

Joint Canada-Sweden lodgepole pine trials

The four existing lodgepole pine trial sites established in 1986 in the Prince George Forest Region were examined by FIDS during the course of regular surveys from May to September 1992. The following is a summary of conditions found during the surveys.

Fort St. James, Teardrop Road

The Fort St. James plot, which was examined on June 8, 1992 has several varied pest problems, mostly at low levels. The most damaging pest found in the stand was **western gall rust**, *Endocronartium harknessii*, infecting 14% of the lodgepole pine trees. Stem cankers were noted on 6% of the trees and branch cankers on 8%. **Winter winds/snow/ ice** deformed or killed lodgepole pine tops on 8% of the trees. **Northern pitch twig moth**, *Petrova albicapitana*, infested stems and the **fir coneworm**, *Dioryctria abietivorella*, attacked terminal shoots on 1% of the lodgepole pine stems. No evidence of further mortality caused by **Warren's root collar weevil,** *Hylobius warreni,* was found. Approximately 1% of the lodgepole and Scots pine were attacked and killed in 1990. The average 1992 lodgepole pine terminal growth was 40 cm (range 25-55 cm).

An estimated 87% of the Scots pine were **healthy**, the chlorotic needles on the remaining 13% can be attributed to the **abiotic factors** of nutrient deficiency or winter kill. The average 1992 terminal growth was 35 cm (range 20-60 cm).

Needle wilt probably caused by **winter winds** or **frost** was evident on 10% of the Siberian larch. The average 1992 terminal growth was 30 cm (range 20-50 cm).

Mackenzie, Nation Bay

The plot examination on June 3, 1992 determined that lodgepole pine, Scots pine, and Siberian larch accounted for 63, 71, and 40% of the healthy trees respectively. **Western gall rust,** *E. harknessii*, infected 24% of the lodgepole pine with galls noted on 9% of the stems. **Comandra blister rust**, *Cronartium comandrae,* was evident on the lower stems of 8% of the lodgepole pine. **Stalactiform blister rust,** *Cronartium coleosporioides,* was found as stem cankers on 2% of the lodgepole pine. **Northern pitch twig moth**, *Petrova albicapitana*, infested 1% of the lodgepole pine, resulting in weakened tops susceptible to breakage from snow and wind. No mortality by **Warren's root collar weevil**, *Hylobius warreni*, was noted in 1992. An estimated 3% of

the lodgepole and Scots pine were killed by the weevil in 1991. The Siberian larch and Scots pine were extensively damaged by **winter winds/ snow/ice** causing broken stems and poor form on 40% and 29% of the trees respectively.

Fort Nelson, Liard Highway

Few pest problems were found at the Fort Nelson plot, which was examined on July 14, 1992. **Winter damage** caused multiple tops on 15% of the Siberian larch and on 20% of both the lodgepole pine and Norway spruce. No **eastern spruce budworm**, *Choristoneura fumiferana*, feeding was noted in 1992. **Western gall rust**, *E. harknessii*, formed branch galls on 1% of the lodgepole pine. Pitch nodules resulting from **northern pitch twig moth**, *P. albicapitana*, attacks were recorded on 2% of the pine.

Fort St. John, Halfway River

The Fort St. John plot, which was examined on July 8, 1992, again had only minor pest problems. **Winter damage** caused multiple tops on 20% of the Siberian larch and 5% of the lodgepole pine. The reduction in multiple tops from 1991 on the Siberian larch was due to the lateral leaders starting to show dominance. **Western gall rust**, *E. harknessii* formed branch galls on 2% of the lodgepole pine. **Spruce weevil**, *Pissodes strobi* was found in leaders on 1% of the white spruce.

Whitehorse, Yukon, Takhini Reserve

Pest conditions in the 6-year-old lodgepole pine trials in the Takhini Forest Reserve were evaluated by FIDS during the annual Yukon survey.

Survival in the replicates of lodgepole pine was again fairly uniform. Of the 14 randomly selected replicates that were examined, an average cumulative mortality of 11% was found (i.e., 57 of the 64 original seedlings were alive). These results were strongly influenced by one replicate in which 33 of the 64 trees had died likely from a combination of **frost** and **rodent** feeding. With data from this plot removed, average mortality dropped to 8%.

Cumulative mortality in the Siberian larch averaged 18%, 4% less than reported last year. Following the severe dieback caused by frost in the winter of 1990-91, some of the affected trees produced adventitious shoots from near the root collar and showed renewed signs of life this year.

Surviving seedlings of both species appeared more vigorous in 1992 following a relatively mild winter and a collapse of the **hare** population that had been feeding within the plantation.

Acid Rain National Early Warning System (ARNEWS)

The Acid Rain Early Warning System (ARNEWS) was expanded in the Prince George Forest Region this year with the addition of three new plots. One plot was established in the Prince George Forest District at Willow River Demonstration Forest, and one each in the Dawson Creek and Fort St. John Forest Districts. The plots at Willow River and Fort St. John were in lodgepole pine types and the one at Dawson Creek was in a mainly aspen stand.

These plots are part of a national system to gather baseline data on the effects of acid rain. The data will be used to quantify changes to forest trees, ground vegetation, and soils that might result from acidification of precipitation, or other atmospheric pollutants. A five-year detailed analysis of foliage, soils, growth rates, foliar retention, and general stand condition was completed in 15 plots in British Columbia in 1990. No significant changes in soil or foliar chemical content, have been detected.

Monitoring will continue at the Prince George plots and at twenty-three others in British Columbia in 1993.

Pests of Young Stands

A total of 49 planted and natural stands between 1 and 20 years old were surveyed for pest problems in 1992. The most frequently occurring pests are summarized in (**Table 5**).

The most damaging pests encountered were the stem and branch rusts, *Cronartium coleosporioides, C. comptoniae, C. comandrae*

Table 5. Summary of pests of young stands, Prince George Forest Region, 1992

Host/pest	No. stands affected	Trees affected %[1] Average	Range	Severity index[2]
Lodgepole pine - 2381 trees in 38 stands, 1892 trees were pest free				
Lodgepole terminal weevil	1	3	3	3
Ips	1	2	2	6
Northern pitch twig moth	1	1	1	2
Atropellis canker	3	2	1 - 3	4 - 5
Blister rusts	7	20	2 - 30	6
Needle casts	8	45	8 - 100	3
Western gall rust	17	20	1 - 30	3 - 5
Mammal damage	6	10	1 - 22	3 - 5
Abiotic	11	7	1 - 32	4 - 6
Climatic	12	10	2 - 22	2 - 5
Mechanical	2	3	2 - 4	4
Poor form	9	14	1 - 100	4
White spruce - 1812 trees in 39 stands, 1206 trees were pest free				
Adelgids	8	55	8 - 95	3
Pineus	12	52	1 - 100	3
Spruce weevil	2	4	2 - 6	4
Large spore spruce-Labrador tea rust	1	9	9	3
Moose	1	1	1	2
Abiotic	1	2	2	5
Drought	2	9	1 - 16	2
Frost	10	20	1 - 100	3
Ice/Snow	5	40	3 - 78	3 - 4
Mechanical	2	6	5 - 7	4
Poor form	8	13	1 - 13	3 - 4
Alpine fir - 276 trees in 18 stands; 202 trees were pest free				
Fir-fireweed rust	5	25	2 - 70	3
Abiotic	2	28	28	2
Browse	5	30	8 - 40	3
Frost	1	64	64	3
Poor form	2	16	15 - 17	4
Mechanical	2	50	100	3
Western redcedar - 38 trees in 1 stand; 0 trees pest free				
Ice/Snow	1	100	100	4
Western hemlock - 2 trees in 2 stands; 2 trees were pest free				
Trembling aspen - 423 trees in 14 stands; 346 trees were pest free				
Defoliator	3	90	82 - 100	3
Leaf blight	2	56	50 - 62	2
Abiotic	1	7	7	3

[1] % of trees affected includes only trees from stands in which the pest occurred.

[2] Severity index:

1. pest free
2. minor damage, minimal impact
3. significant loss of current growth potential
4. net volume loss or loss of significant long-term growth potential
5. life-threatening or severely deforming
6. recently dead

and *Endocronartium harknessii*. The *Cronartium* spp. rusts were found causing significant damage in 7 and *Endocronartium* sp. in 17 of the 38 lodgepole pine stands surveyed throughout the region . Abiotic damage in 11 pine stands also caused significant damage.

Multiple Host Pests

Western hemlock looper
Lambdina fiscellaria lugubrosa

Defoliation of mature to overmature western hemlock and western redcedar by the western hemlock looper increased to over 28 000 ha in 77 infestations, up from 200 ha in 1991. More than 60% of the defoliation occurred in the Prince George Forest District with the remainder in the McBride Forest District (**Figure 8**). Eighty percent of the area was severely defoliated, with the loss of most or all foliage on more than 50% of the trees. The remainder of the feeding was moderate with approximately one third of the crown defoliated, and light, with defoliation limited mainly to upper crowns. The last recorded western hemlock looper infestation in the Prince George Forest Region was 1983, when 845 ha were attacked in the same biogeoclimatic zone.

In the Prince George District the area of defoliation covered approximately 17 500 ha in 53 infestations in the southeastern portion of the district in the ICHvk2 biogeoclimatic subzone. Feeding was noted as far west as Purden Lake and east to the district boundary. Defoliated trees were readily visible on mainly crown land from various locations on the Prince George-McBride highway. The largest infestation occurred along the Torpy River drainage, with Dome, Slim, and Ptarmigan creek drainages also heavily infested. The northern limit of the infestation was in the McGregor River drainage.

Defoliation in the McBride TSA was recorded over 11 500 ha in 24 infestations from Ptarmigan Creek at the western boundary to the McBride-Golden district boundary in the southeast. The majority of the defoliation, 6500 ha, occurred in the ICHwk3 biogeoclimatic subzone between Ptarmigan and Snowshoe Creeks. The remaining 4000 ha of mostly severe defoliation of mixed stands occurred in the ICHmm biogeoclimatic subzone along both sides of McNaughton Lake from Grouse Creek south to the forest district boundary. In 1991, the McBride Forest District had the only recorded western hemlock looper defoliation in the Prince George Forest Region, 200 ha at Hankins Creek. This infestation has doubled its size.

Forecast

Forestry Canada's, three-tree beating samples at Dome, Ptarmigan and Hungary creeks averaged 275 larvae/beating (range 250-325), indicating large populations in these areas. Mass collections of over 400 larvae and pupae were reared at the Pacific Forestry Centre to determine levels of parasites and disease. Less than 2% of the larvae and 11% of the pupae were parasitized and no evidence of disease was found in either population. These levels of parasitism are considered very low and will have little impact on the looper populations.

Samples of lichen were taken this fall from five representative areas within the outbreak to determine the number and viability of overwintering eggs to help forecast damage trends in 1993 (**Table 6**). Two separate samples were collected and processed from each site, the egg counts were then averaged for each location.

The results of fall egg mass sampling indicate that moderate to severe defoliation will occur over at least the same area in 1993 as this year with possible expansion in area. Parasitism of eggs is very low and an estimated 30% parasitism of eggs is needed to affect the population. Expansion of the infestation will probably be limited to the mature stands in the ICH biogeoclimatic zone. Populations of western hemlock looper often collapse after only one year, the last recorded infestation in the Prince George Forest Region collapsed after only two years.

Impact

Nine damage appraisal plots have been established to help determine the impact of the looper, three at both Walker Creek and Catfish Creek and three at La Salle Lake (**Table 7**).

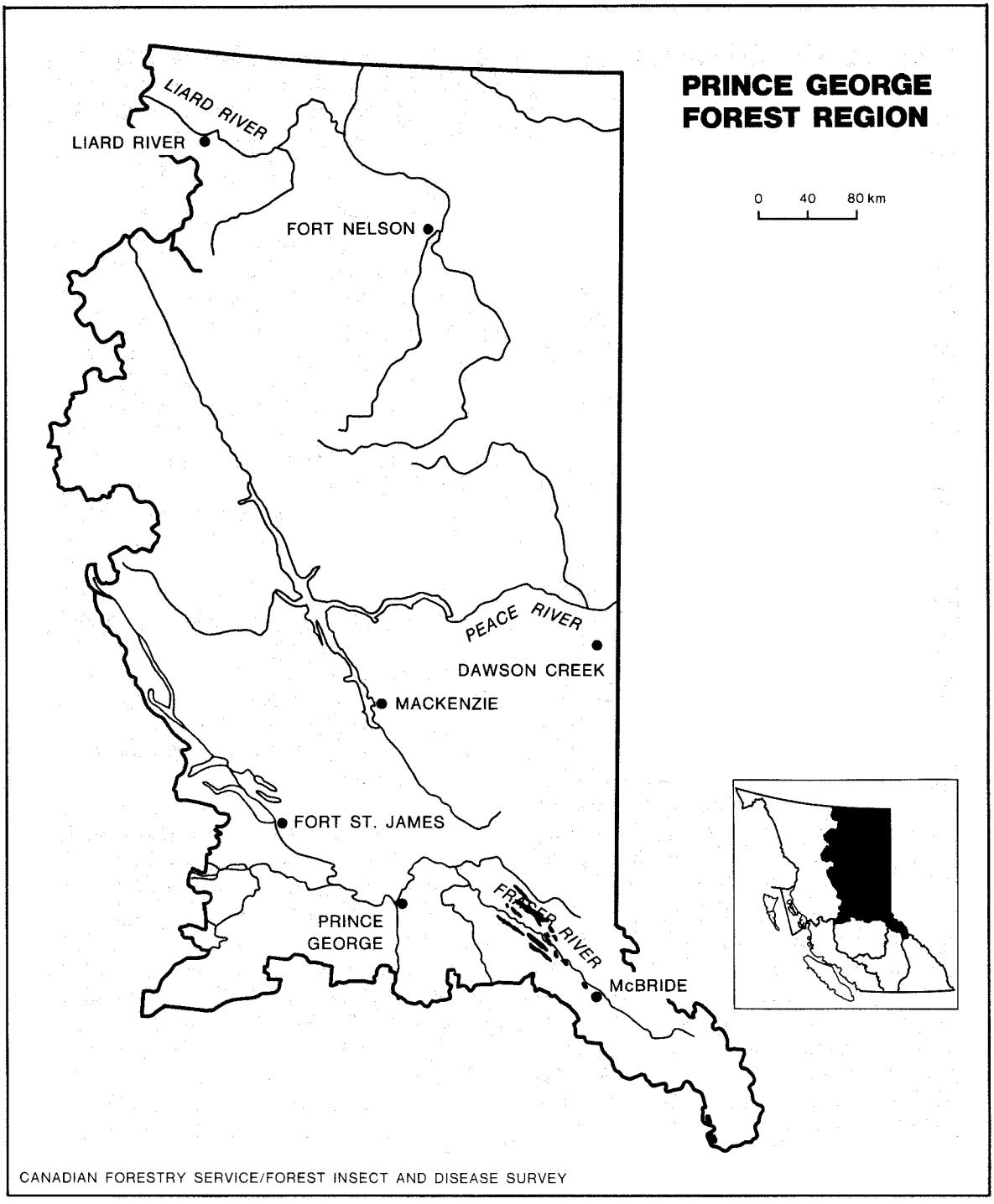

Figure 8. Areas of western hemlock and western red cedar defoliated by western hemlock looper determined by aerial surveys in 1992.

Table 6. Location, average number, and status of western hemlock looper eggs and predicted defoliation for 1993, Prince George Forest Region 1992.

Location	Avg. no. eggs per 100 g lichen				Predicted 1993[1]
	Healthy	Parasitized	Infertile	Old	defoliation
Catfish Creek	**37**	1(3%)	1	3	moderate
Hankins Creek	**47**	2(4%)	0	4	moderate
Walker Creek	**140**	6(4%)	7	6	severe
LaSalle Lake	**166**	5(3%)	7	12	severe
Torpy River	**269**	9(3%)	6	14	severe

[1] light - 5-26 eggs; moderate - 27-60 eggs; severe - 61+ eggs

Table 7. Location, number of trees by species, and percentage of trees with over 90 percent defoliation in the impact plots, Prince George Forest Region, 1992.

Location	No. of trees				Percent trees with 90%+ defoliation			
	wH	wrC	wS	alF[1]	wH	wrC	wS	alF
La Salle Lake	31	25	5	1	100	8	0	0
Walker Creek	50	24	0	0	86	54	0	0
Catfish Creek	30	46	5	0	50	2	0	0
TOTAL	**111**	**95**	**10**	**1**	**80**	**17**	**0**	**0**

[1] wH : western hemlock
wrC : western red cedar
wS : white spruce
alF : alpine fir

The impact plots were established in early August but defoliation estimates were not made until September when all feeding had ceased. Accessibility was a important consideration for selecting plots. Also the degree of defoliation, was important, so plots were placed in areas having the most severe defoliation to enable a worst case scenario to be predicted.

During past infestations, up to 50% of the trees that had been 90%+ defoliated died, though mortality may not have occurred until 3 years after the infestation subsided. Using this factor for the current infestation, up to 40% of the western hemlock will probably succumb due to defoliation or to attack by secondary bark beetles.

> "During the period following the outbreak, in four species observed, (western hemlock, Sitka spruce, Douglas-fir and alpine-fir), all trees of larger diameter, except Douglas-fir, suffered higher percent mortality for all defoliation classes. Large overmature trees would be expected to die, but the survival of small, weak, suppressed trees was not expected. Kinghorn (1954) surmises that the difference was probably due to the incidence of secondary bark-mining insects. The cambium of large, open growing trees that are exposed to higher temperatures tends to dry out more readily. Those trees then become more susceptible to successful beetle attack, thus the higher mortality in all defoliation classes for large-diameter trees. This was borne out by field observations which indicated heavier secondary beetle attacks in larger-diameter trees.
>
> The exception to this, Douglas-fir, which had better recovery in larger trees, may be due to the fact that these trees had not yet reached physiological maturity, and because the trees were tall and more open growing, competition was negligible. Also, the crowns were large and well developed and as a result, recovery was extraordinary. Douglas-fir in closer-growing stands whose crowns were generally not above the overall canopy height were much more susceptible to Douglas-fir beetle attack." [1]

These plots along with larval and pupal populations will be monitored again next year by FIDS/Forestry Canada.

Rusty tussock moth

Orgyia antiqua badia

Feeding by rusty tussock moth larvae defoliated conifers, deciduous trees, and shrubs over more than 13 000 ha in the Prince George Forest District in 1992. This is the first time that an infestation of rusty tussock moth has been reported causing defoliation in the Prince George Forest Region.

Light defoliation over more than 11 000 ha of white spruce, alpine fir, lodgepole pine, Sitka alder and various herbaceous shrubs was noted in the headwaters of Wichcika, East Seebach, Seebach, Olsson and Angusmac creek drainages. Over 1600 ha of moderate defoliation was recorded around Mt. Averil. All defoliation occurred in the SBSf biogeoclimatic subzone.

Complete defoliation of the current year's foliage was common on all age classes of white spruce throughout the infestation area. Occasional top-stripping of up to 2 metres was noted on single understory trees. Impact on the damaged trees should be limited to growth loss and occasional top-kill.

Outbreaks have occurred in small infestations of several hundred hectares in the southern regions of the province in the past. Last year in the Cariboo Forest Region, spruce plantations along the north arm of Quesnel Lake were defoliated by the rusty tussock moth. An estimated 98% of the larvae collected for parasite and disease rearing from the Quesnel Lake area were killed by a virus, the usual control agent of this pest.

The current area of infestation in the Prince George Forest District is the largest ever reported in the province. Limited historical information on the rusty tussock moth makes population predictions for 1993 difficult. The small number of egg masses collected in 1992 probably indicates that 1992 will be the only year of notable defoliation.

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[1] Western Hemlock Looper In British Columbia; R. Turnquist 1991

Forestry Canada will continue to monitor this pest in 1993.

Black army cutworm
Actebia fennica

Black army cutworm populations continued to cause light defoliation of recent plantations in the Prince George Forest Region in 1992. Light feeding of spruce plantations was noted at several locations in the Robson Valley by local forest industry and Forest Service personnel.

A total of 15 multipher pheromone traps were placed at 10 one-year-old prescribed burns and 14 traps at 2 wild fires from south of Hixon to Weedon Lake. Only 24 traps survived to be used for the calibration of moth numbers, 5 were found on the ground. An average of 347 (range 18-750) adults were trapped (**Table 8**) an increase from the average of 138 (range 24-320) adults caught in 1991. Potential for seedling damage exists at three sites (Figure 9) with the level of moth catches in 11 traps high enough to indicate risk of defoliation.

Recent burns and any reported cutworm outbreaks will be monitored in 1993 (**Figure 9**).

Deciduous Tree Pests

Forest tent caterpillar
Malacosoma disstria

The area of mainly trembling aspen defoliated by the forest tent caterpillar decreased to less than 21 000 ha (**Figure 10**), down from the 92 000 ha recorded last year.

Tent caterpillar populations in the Prince George Forest District decreased for the second consecutive year after five years of increase (**Figure 11**). An estimated 11 600 ha of trembling aspen were defoliated in the district down from 83 000 in 1991. The largest area of decrease was again in the Salmon and Willow river drainages where recorded defoliation declined by over 25 000 ha to 2450 ha in 1992.

The tent caterpillar populations collapsed in the Peace River area in 1992. For the first time in eight years no defoliation of trembling aspen was recorded in this area. Feeding by the caterpillar was mapped over almost 5000 ha in 1991.

The decline in tent caterpillar populations can be attributed primarily to infection by viral disease, nuclear polyhedrosis virus, a fungal pathogen, *Entomophthora* sp. and parasitism. Both these diseases were isolated from mass collections made in 1991. The mortality rate of five larval mass collections submitted in 1991 averaged 75%; 43% from disease, 20% from parasitism, and 12% unknown causes. These diseases have contributed to the collapse of various lepidopteran infestations throughout British Columbia, and are the probable cause of the decline of tent caterpillar populations in the Prince George Forest Region.

In the McBride Forest District the area of feeding increased for the second consecutive year by approximately 50% to 9700 ha of mostly severe defoliation. Feeding was recorded from south of Tete Jaune to the Monroe Creek drainage northwest of McBride. The majority of the increase was near locations where feeding was noted in 1991. Large moth flights were noted in the McBride area during June and July of this year indicating continued defoliation for 1993. Newly defoliated areas were mapped along the south side of the Fraser River near Castle Creek and south of Tete Jaune.

The population fluctuations recorded in 1992 matched those predicted last year. The number of egg masses found in the Prince George Forest District declined to 2 from an average of 17 and in the Peace River area to less than 1 from an average 2 in 1990. Increases were noted in the McBride area where an average of 12 new egg masses were collected, up from less than 1 in 1990.

The number of egg masses found during the **1992** fall surveys in the Prince George Forest District actually increased this year due to high egg counts at Trapping Lake (**Table 9**). Egg mass counts for 1991 declined to an average 2 per 10 cm dbh tree from 17 in 1990, in 1992 the average count was 3.5, because of the 10 egg masses per 11 cm dbh tree at Trapping Lake. Excluding Trapping Lake, the average would be less than 2 egg masses per

Table 8. Location and number of adult male black army cutworm caught by pheromone-baited traps, Prince George Forest Region, 1992.

Location	No. of traps	No. of adults[1]	Remarks
Weedon Lake (127 km 100 RD)	1	**250**	no defoliation predicted
(132 km 100 RD)	1	**300**	no defoliation predicted
(5042 km 100 RD)	1	**375**	possible defoliation
(348 km 100 RD)	1	**275**	no defoliation predicted
(360 km 100 RD)	1	**170**	no defoliation predicted
Cashwell	1	**200**	no defoliation predicted
Merton Lake	1	**150**	no defoliation predicted
Bowron River & Highway 16 Junction	2	**28, 38**	no defoliation predicted
Junction Beaver & Bear Roads	2	**18, 45**	no defoliation predicted
Tumuch RD (6 km)	1	**195**	no defoliation predicted
Eagle Fire (Willow River)	7	**350, 350, 550**	possible defoliation
		600, 620, 640, 740	probable defoliation
Stoner Fire (Stoney Lake)	5	**250, 300**	no defoliation predicted
		600, 600 700	probable defoliation
Average		**347**	

[1] Levels of moth catches that indicate risk of defoliation

350	no defoliation of vegetation or seedlings expected
350-600	defoliation of vegetation is common with occasional seedling damage
600+	high risk of vegetation and seedling defoliation

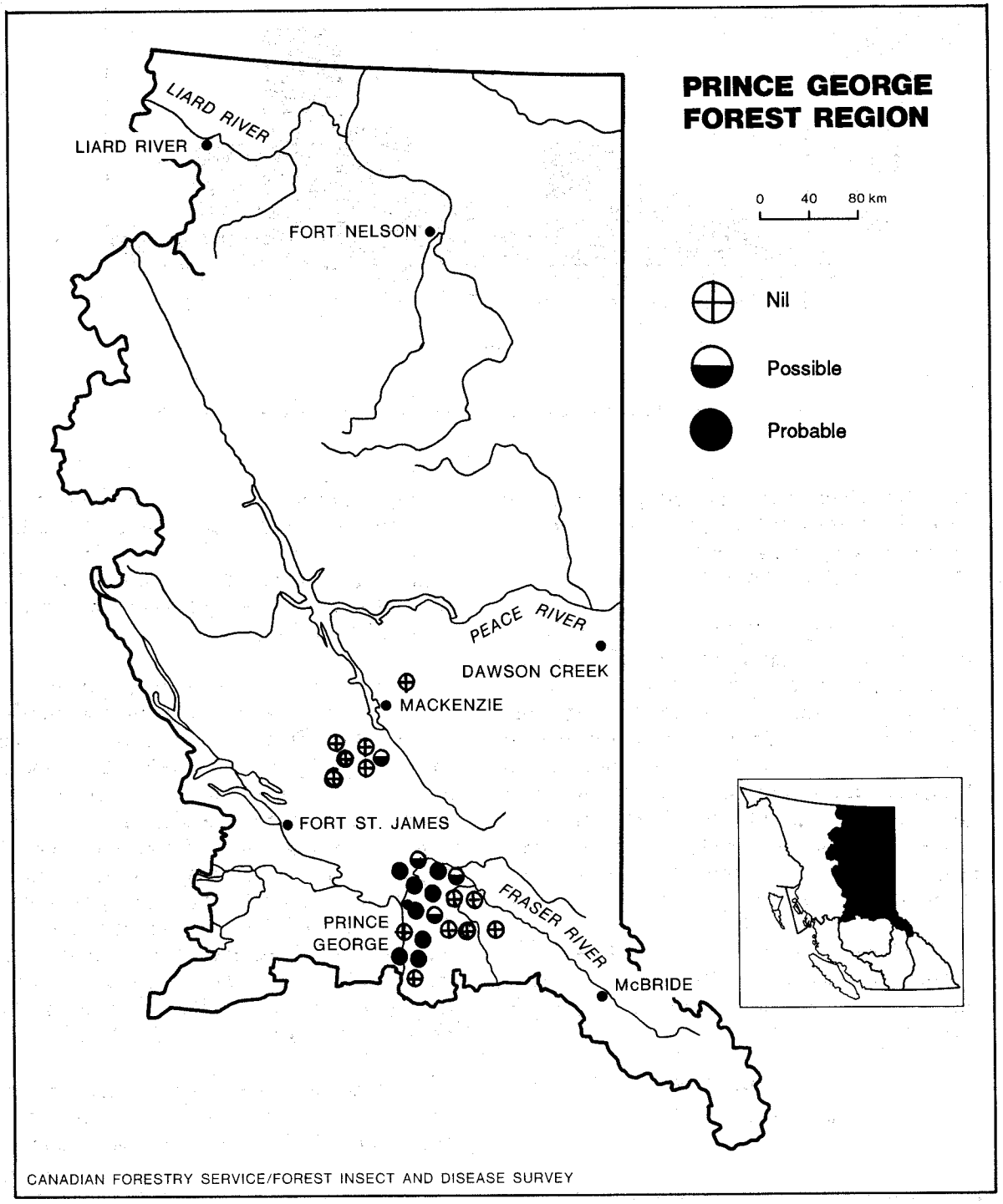

Figure 9. Forecast of 1993 defoliation by black army cutworm in the Prince George Forest Region, based on pheromone trap surveys.

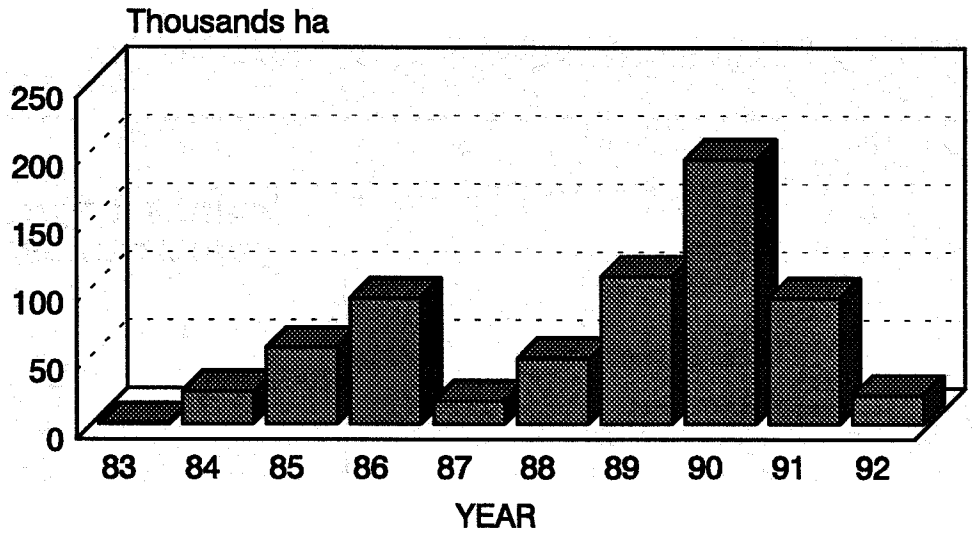

Figure 10. Forest tent caterpillar defoliation (ha) in trembling aspen stands.

tree. Population increases were pronounced in the McBride Forest District where the average number of egg masses increased from 10 in 1991 to 19 in 1992 (**Figure 12**).

In areas around Prince George where defoliation has occurred for 3-5 years, top and branch dieback is evident although no whole tree mortality has been recorded. Continued defoliation leads to growth loss and increased susceptibility to attacks by other insects and diseases. As well as damaging trees, forest tent caterpillars can be a nuisance to homeowners, campers, and picnickers because of its tendency to migrate in large numbers during the larval stage.

FIDS will continue to monitor forest tent caterpillar populations in 1993 and a pest report will be issued after early season sampling is completed.

Large aspen tortrix

Choristoneura conflictana

Large aspen tortrix populations increased for the fourth consecutive year, defoliating trembling aspen over more than 24 000 ha compared with 18 000 ha in 1991. All recorded defoliation, mostly light and moderate, occurred in 89 infestations in the Mackenzie Forest District (**Figure 11**). The majority of the damage, almost 20 000 ha, occurred along the east and west sides of Williston Lake from Mackenzie north to Finlay Reach. The remaining 4900 ha of moderate feeding was mapped along the Finlay River from Fort Ware south to Williston Lake.

The unsightly red-brown patches of defoliated aspen were easily visible from the town of Mackenzie and from various locations on local logging roads. Feeding by the tortrix will result in severe reduction in radial growth and may cause branch and twig mortality. This is the fourth successive year of feeding by the large aspen tortrix in this area which is probably weakening the trees and predisposing them to attack by insects and disease, especially Armillaria root disease and certain aspen cankers. The aspen ecological reserves along the east side of Williston Lake could be threatened by continued tortrix defoliation.

No predictive sampling was done due to the remoteness of the infestations. Historically, large aspen tortrix populations have collapsed after 2-3 years of defoliation due to parasitism, disease, or climatic conditions. FIDS will continue to monitor this pest in 1993.

Table 9. TSA, location, dbh, number of new and old egg masses of forest tent caterpillar, and predicted 1993 defoliation, Prince George Forest Region, 1992.

TSA and location	Avg. dbh (cm)	Avg. no. egg masses/tree new	old	Predicted defoliation 1992	Ratio of new to old egg masses	Population status
PRINCE GEORGE						
Trapping Lk	11	**10**	5	severe	2:1	increasing
Fyfe	11	**2**	3	light	2:3	declining
Airport (Prince George)	11	**<1**	2	nil	1:2	declining
Crysdale	11	**1**	1	nil	1:1	static
AVERAGE	**11**	**3**	**3**	**light**	**1:1**	**static**
MCBRIDE						
Dunster	10	**22**	6	severe	4:1	increasing
Haile Creek	10	**19**	8	severe	2:1	increasing
Holiday Creek	10	**18**	7	severe	3:1	increasing
Croydon	11	**15**	6	severe	2:1	increasing
AVERAGE	**10**	**19**	**7**	**severe**	**3:1**	**increasing**

Gypsy moth
Lymantria dispar

No adult male gypsy moths were caught in 55 pheromone-baited traps placed by FIDS throughout the Prince George Forest Region as part of a continuing interagency monitoring program. The traps were placed at provincial parks, highway rest areas, and private campgrounds. A program of trapping and egg mass surveys is carried out by Forestry Canada and the B.C. Forest Service in co-operation with Agriculture Canada to detect the establishment of this potentially serious pest.

Poplar shoot blights
Venturia macularis, V. populina

Poplar shoot blight caused severe defoliation of trembling aspen over 1600 ha near Valemount. Blackened foliage on semi-mature aspen was noted between Packsaddle and Hogan creeks on the eastside of McNaughton Lake. The band of discoloured trees was readily visible between 1200 and 2000 m elevation. The trees had refoliated by early August.

Poplar shoot blight was observed again on scattered groups of trembling aspen, balsam poplar and black cottonwood along the Alaska Highway from the Charlie Lake area north to

Fort Nelson. Understory and younger trees continued to be the most severely affected.

Trembling aspen was infected by *V. macularis* while balsam poplar and black cottonwood were infected by *V. populina*. These diseases cause blackening, wilting, and subsequent mortality of young shoots and foliage. Little long term damage has been recorded in mature trees, however, young trees can be disfigured and growth can be severely affected in areas with consecutive years of severe infections. These diseases could have serious impacts on young trees in areas where aspen or cottonwood are being intensively managed.

FIDS will continue to monitor and report on the presence of these and other aspen diseases in 1993.

Poplar-and-willow Borer

Cryptorhynchus lapathi

Widespread willow mortality caused by the poplar-and-willow borer was noted throughout the Prince George Forest Region south of Mackenzie. Dead, dying, and partially killed willow were seen in forest stands, roadside stands, and on private property from June to September. The weevil populations are at their highest levels ever recorded in the Prince George Forest Region.

The stems of the willow become honeycombed with larval tunnels causing "breakover." Most plants are not killed outright. Rather multi-stemmed willow clumps result as old stems are killed and new ones sprout. The most damage is done by larvae. However, the adults also feed on young, succulent bark of shoots, branches, and the main stem.

This weevil was introduced to North America from Europe in the late 1800's. It was previously thought that the borer occurred primarily south of 52° north latitude but recently populations have become established as far north as 56°.

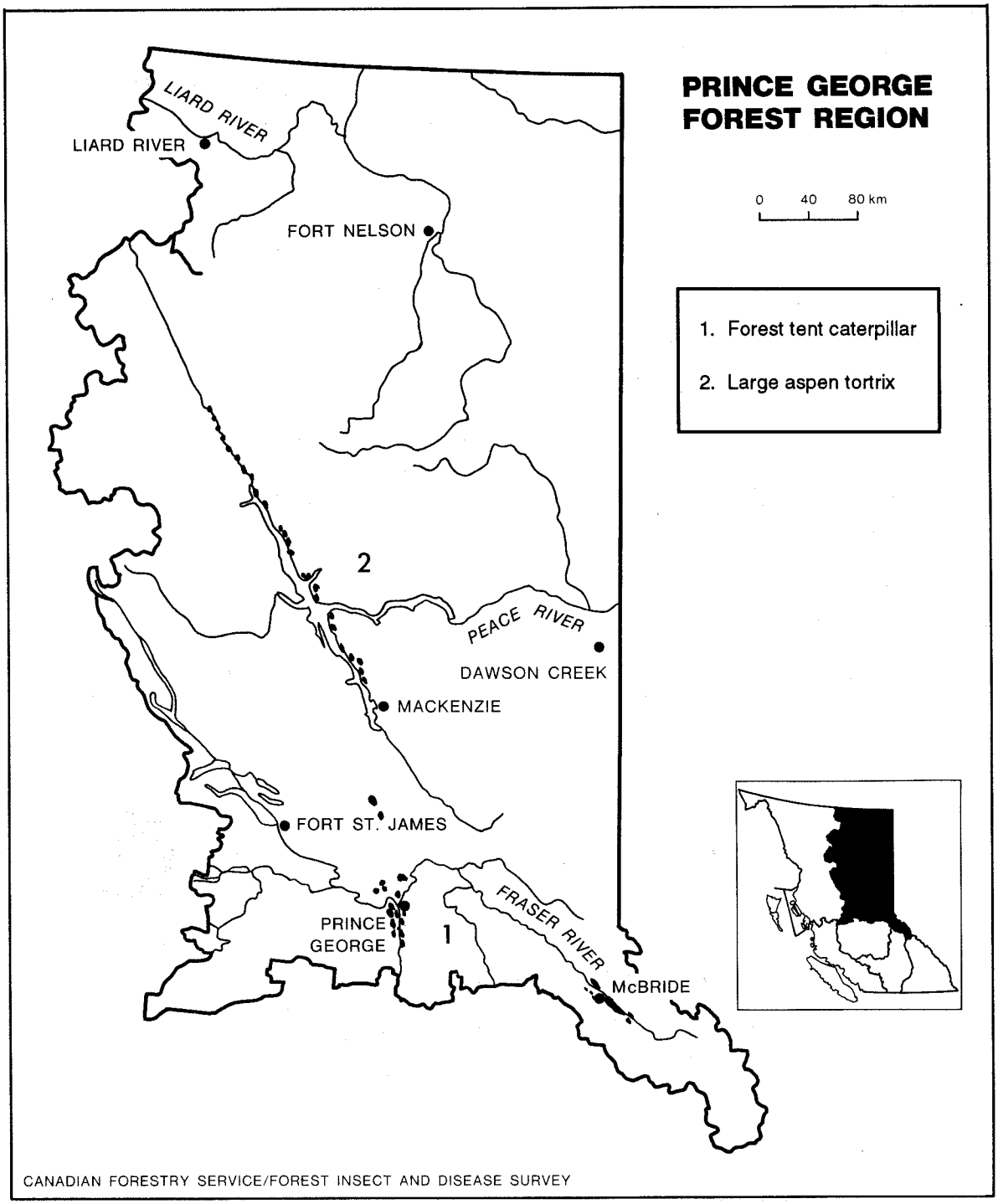

Figure 11. Areas where current defoliation of deciduous trees by forest tent caterpillar and large aspen tortrix was detected during aerial surveys in 1992.

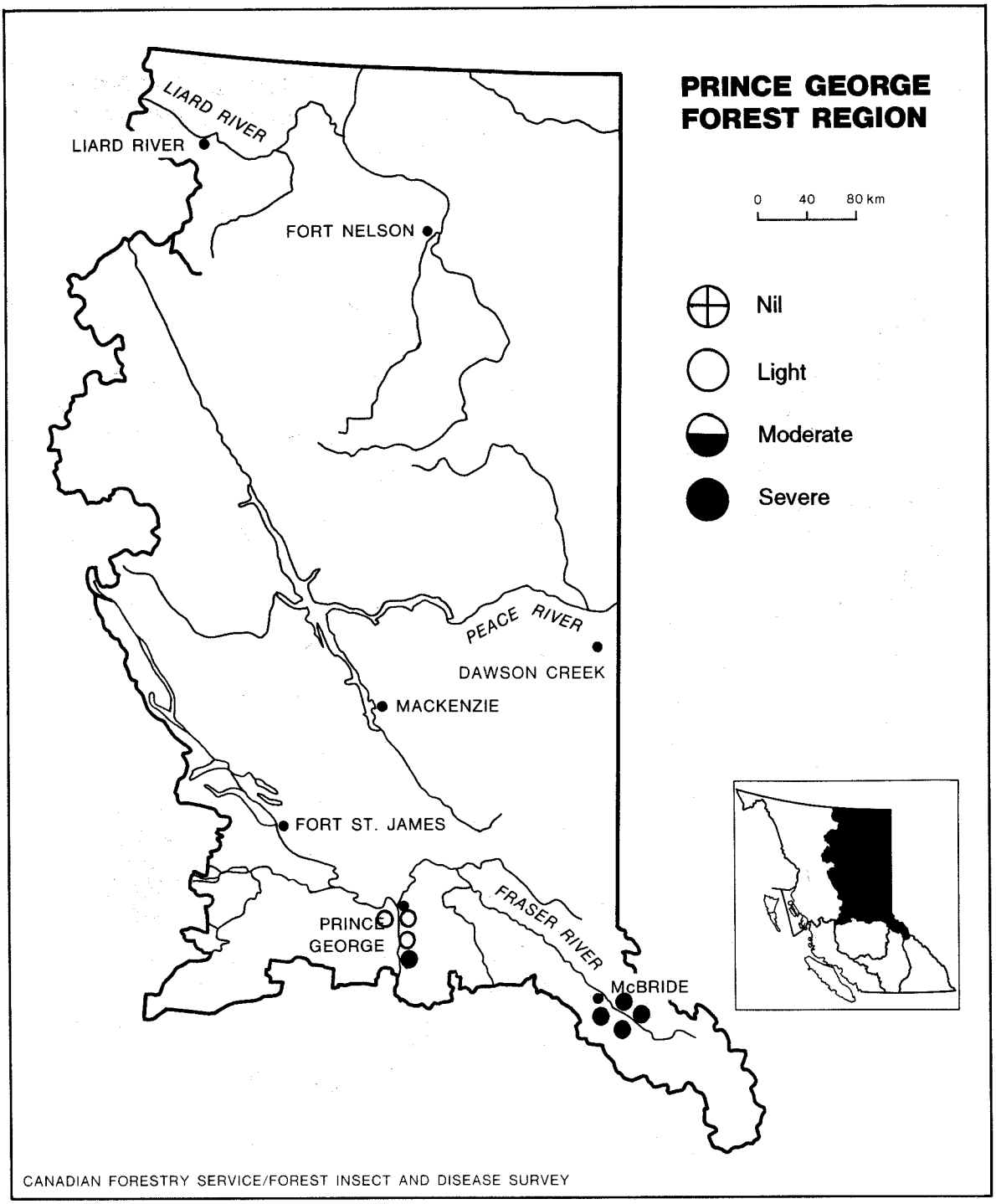

Figure 12. Forecast of 1993 defoliation by forest tent caterpillar in the Prince George Forest Region, based on egg mass surveys.

Table 10. Other noteworthy and minor pests

Host and pest	Location	Remarks
White spruce		
A bark beetle *Dryocoetes affaber*	Jarvis Creek, Ant Lake, Blackwater Creek	found in blowdown and trap trees
A coneworm *Hylemya anthracina*	Vama Vama Creek	infesting cones
Cooley spruce gall adelgid *Adelges cooleyi*	Prince George Forest Region	common and widespread
Fir coneworm *Dioryctria abietivorella*	Vama Vama Creek	infesting cones
Spruce engraver beetle *Scolytus piceae*	Jarvis Creek	found in blowdown
Lodgepole Pine		
Atropellis canker *Atropellis piniphila*	Willow River	found at ARNEWS plot
Pine engraver beetle *Ips pini*	Boomerang Lake, Kloch Lake	found in blowdown and mountain pine beetle attacked trees
Red ring rot *Fomes pini*	Caine Creek	found in butts of windthrown trees
Elm		
Elm leafminer *Agromyza aristata*	Prince George	sixth consecutive year of damage, 25% of the foliage on all of the ornamental elms in the 'Miller Creek addition' were mined

Host and pest	Location	Remarks
Trembling Aspen		
Aspen leafroller *Pseudexentera oregonana*	Fort St. John, Wonowon, Dawson Creek	associated with other aspen defoliators
Aspen twoleaf tier *Enargia decolor*	Pouce Coupe, Wonowon, Charlie Lake, Mackenzie	associated with other aspen defoliators
Aspen webworm *Tetralophia apostella*	Prince George, Vanderhoof	An early fall solitary defoliator. Found in forest tent caterpillar damaged stands
Bruce spanworm *Operophtera bruceata*	Fort St. John, Dawson Creek	associated with forest tent caterpillar
Hypoxylon canker *Hypoxylon novemexicanum*	Dawson Creek	found in 50 year old stand
Poplar canker *Valsa sordida*	Pouce Coupe Hoodoo Lakes	common in the stand
Willow		
A heart rot *Haploporus odorus*	Fort Nelson	found on living willow
Fir-willow rust *Melampsora abietiarea capraearum*	Fort St. James	common throughout this
Pacific willow leaf beetle *Pyrrhalta decora carbo*	Pouce coupe to Liard River area	common for third year, causing patchy light defoliation