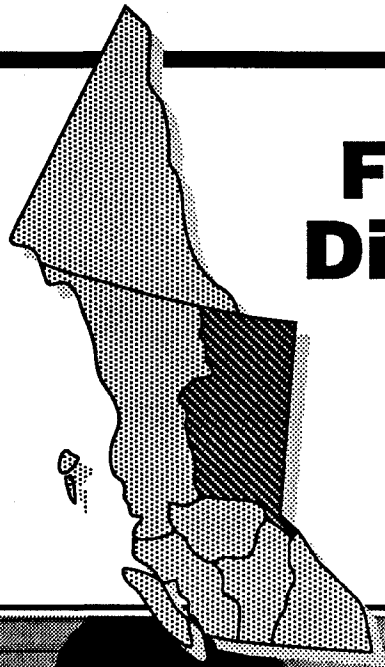
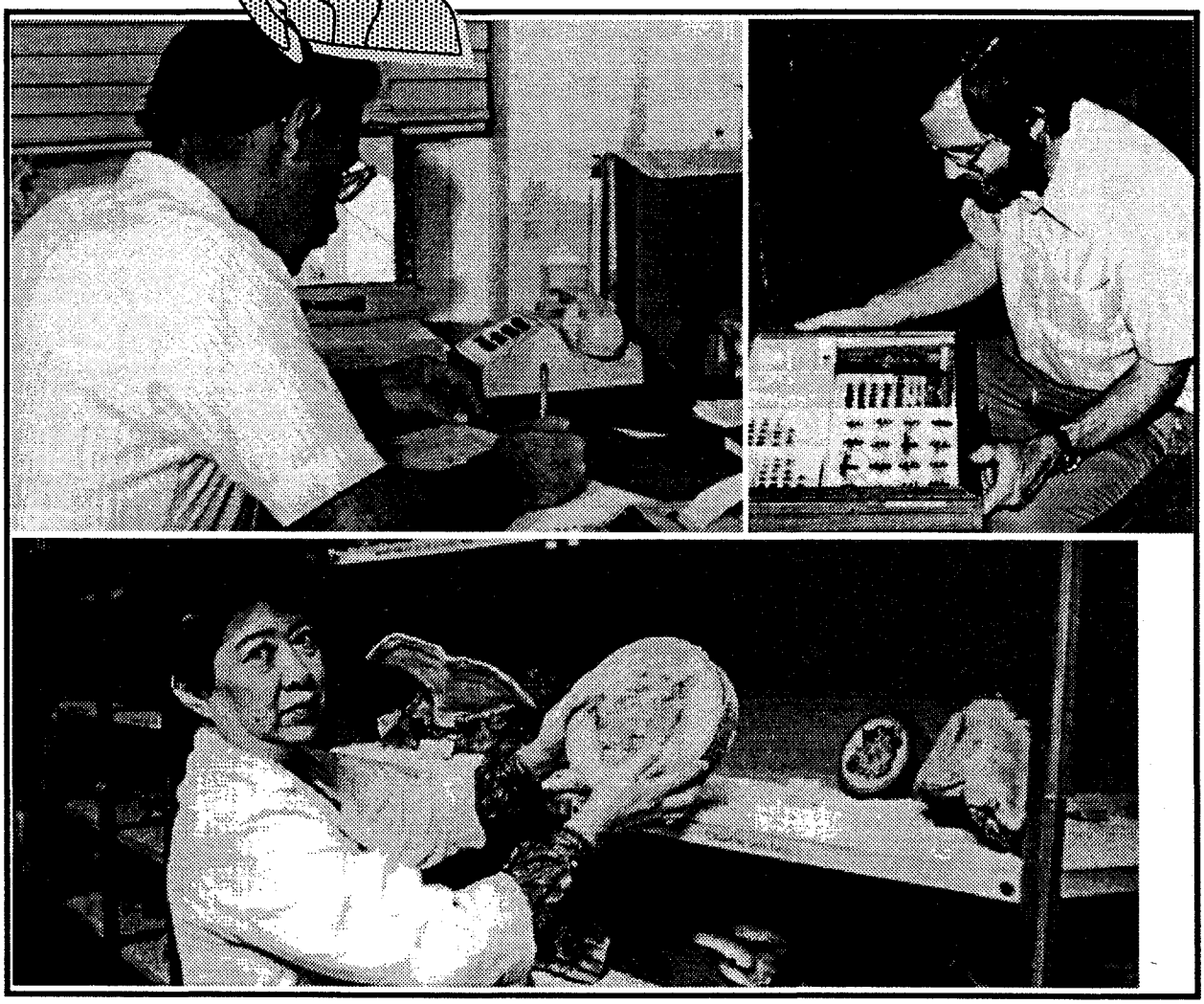


Forest Insect and Disease Conditions

Prince George Forest Region 1991

N. Humphreys & R. Ferris



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APPENDICES

The following appendices are available upon request from:

Forest Insect and Disease Survey
Forestry Canada
506 West Burnside Road
Victoria, B.C.
V8Z 1M5

I. Maps of major bark beetle and defoliator infestations compiled during aerial surveys of the Prince George Region, 1991.

II. Summary of pest problems in provincial parks within the Prince George Region, 1991.

III. A summary of the joint Canada-Sweden lodgepole pine trials in the Pacific Region.

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 1991. 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 54 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 28 to October 17 during which over 150 insect and 110 disease collections were sent to the Pacific Forestry Centre (PFC) for identification or confirmation (**Map 1**). Some of these were added to the extensive permanent collections in the PFC Insectary and Herbarium.

The B.C. Forest Service provided approximately 29 hours of fixed-wing and 8 hours of helicopter time, for aerial and aerially accessed ground surveys during the 1991 season (**Map 1**). 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 - 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

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 cooperators. All area figures are generated by the GIS. Further copies of digitized maps are available by request through FIDS.

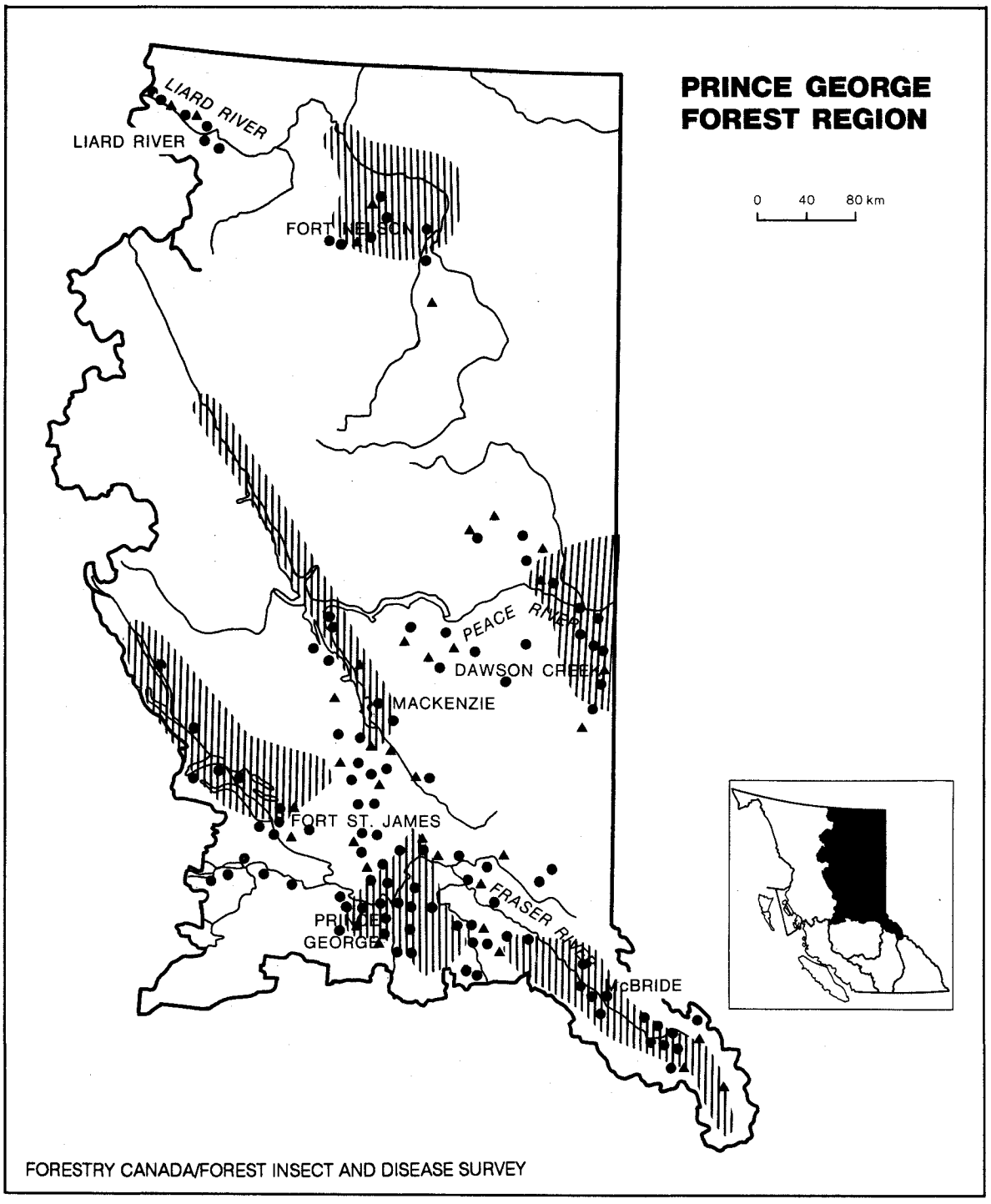
During the field season, correspondence and inquiries with respect to forest pest problems in the Prince George Forest Region can be directed to the Forest Insect and Disease Survey (FIDS) Technicians at:

Forest Insect and Disease Survey, Phone: 963-7238
Forestry Canada
R.R. 8, Site 25, Compartment 8, 963-7394
Prince George, B.C. V2N 4M6

During the remainder of the year, the technicians are based at:

Pacific Forestry Centre, Forestry Canada
506 West Burnside Road, Victoria, B.C. V8Z 1M5 Phone: 363-0600

The Forest Insect and Disease Survey is a nation-wide network within Forestry Canada with the responsibility of: producing an overview of forest pest conditions and their implications; maintaining records and surveys to support quarantines and facilitate predictions; supporting forestry research with records, insect collections, and herbaria; providing advice on forest insect and disease conditions; and developing and testing survey techniques and conducting related biological studies. Surveys are carried out in both British Columbia and the Yukon, collectively termed the Pacific Region.



Map 1. Location where one or more forest insect and disease samples were collected and areas covered by aerial surveys to map bark beetle and defoliator infestations in 1991.

SUMMARY

The area of **spruce beetle** killed trees increased for the third consecutive year with cumulative mortality of approximately 942 000 m^3 over almost 44 000 ha, from southeast of Prince George to north of Mackenzie. Over 30 000 ha was recorded in the Mackenzie Forest District. **Eastern spruce budworm** defoliation of spruce and fir declined in the Fort Nelson district by 40% to 245 400 ha. Defoliation by mature **two-year-cycle spruce budworm** more than doubled to almost 23 000 ha in the Fort St. James and Mackenzie district.

Spruce weevil continued to kill young spruce leaders throughout the southern half of the region; an infestation found north of Mackenzie is the most northerly population yet found in the central interior. Increased populations of the **northern spruce engraver beetle** killed tops of scattered mature white spruce, mostly northeast of Prince George.

Lodgepole pine mortality due to 1990 **mountain pine beetle attacks** increased to 267 000 m^3 over approximately 9300 ha. The majority of the mortality was in the Fort St. James Forest District with over 9000 ha recorded. Surveys of log decks for woodborers were initiated this year as part of an experimental **pinewood nematode** pasteurization program in conjunction with COFI and FORINTEK. **Stem rusts** were the major cause of mortality of young lodgepole pine stands throughout the region. **Root collar weevil,** stem rusts, secondary insects and microfungi were common at four lodgepole pine plantations established in 1986 in a joint **Canada-Sweden project.** A new species of **pine feeding budworm** was monitored through the use of pheromone traps north of Prince George. **Gouty pitch midge** infested young plantation lodgepole pine throughout the region causing twisted and deformed shoots.

The recorded area containing high elevation mature alpine fir killed by **balsam bark beetle** mostly north of Prince George increased to 6900 ha, due to increased aerial surveys. **Fir-fireweed rust** was recorded in 70% of the young stands where alpine fir was a major component. **Douglas-fir beetle** populations increased by 100% killing trees over 1540 ha.

No **acid rain** symptoms were recorded at a long term study plot near Averil Lake in this the sixth year of monitoring. Surveys of 54 young stands at widespread locations found a variety of diseases and insects; the most common were **stem rusts, root** and **terminal weevils, adelgids** and **environmental damage. Black army cutworm** populations remained at endemic levels causing trace defoliation of herbaceous material at two locations. Pheromone trap results indicate static populations for 1992. **Mammal damage** was recorded at several locations throughout the region, but tree mortality was minimal.

Forest tent caterpillar populations decreased by more than half throughout the region defoliating trembling aspen over 92 000 ha. **Large aspen tortrix** populations increased for the third consecutive year and defoliated trembling aspen over more than 18 000 ha, mainly in the northern half of the region. No adult male **gypsy moths** were trapped in 50 pheromone-baited traps placed in provincial parks, rest areas or private campgrounds. Infections caused by **poplar shoot blights** were widespread in the northern half of the region.

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

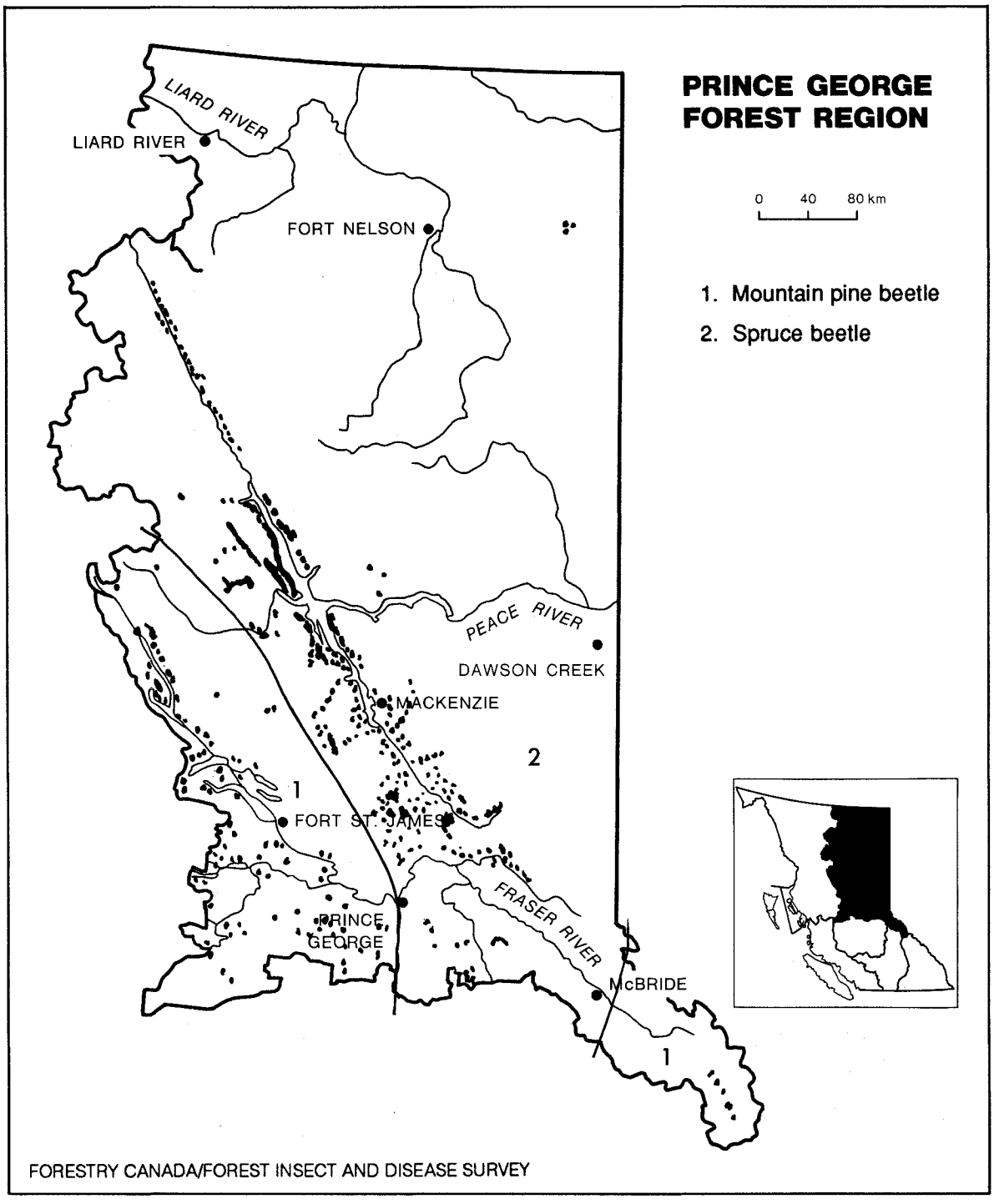
Mortality caused by the spruce beetle populations increased for the third consecutive year; cumulative (2+ years) mortality of approximately 942 000 m^3 over 43 900 ha (Table 1, Map 2) was mapped, by the B.C. Forest Service, from the Stony Lake area on the southern edge of the Prince George Region to Kotcho Lake east of Fort Nelson. This is more than three times the 296 530 m^3 killed over 11 160 in 1990. All of the infestations mapped during aerial surveys were in the Prince George, Mackenzie, and Fort Nelson Timber Supply Areas (TSA's). Infestations ranged in size from single trees to several hundred hectares.

Ground surveys from late June through to mid September found current attack in trap trees, blowdown and standing green trees from the Summit Lake area north of Prince George to the Manson River area, northwest of Mackenzie and in the Silver Sands Creek area, west of Chetwynd. Additionally, current attack in blowdown was recorded in the Carbon and Table creeks areas southwest of Hudson Hope.

Table 1. Timber supply area (TSA), cumulative area and volume of white spruce recently killed by spruce beetle, Prince George Forest Region, 1990 - 91.

TSA	Area (ha)		Volume (m^3)	
	1991	1990	**1991**	1990
Prince George	**10 630**	3850	**274 000**	54 865
Mackenzie	**32 400**	7310	**655 000**	241 665
Fort Nelson	**870**	*	**12 180**	*
Dawson Creek	*	*	*	*
Regional total	**43 900**	11 160	**941 000**	296 530

* No figures available



Map 2. Areas of lodgepole pine recently killed by mountain pine beetle and white spruce killed by spruce beetle, determined by the BCFS aerial and ground surveys in 1991.

Prince George TSA

Spruce beetle infestations increased almost four-fold in the Prince George TSA to 11 155 ha in over 700 individual infestations. Light mortality was recorded over 7315, moderate over 2510 and severe over 1330 ha. An estimated 98% of the attacked trees were within the Prince George Forest District boundaries.

The largest infestations were recorded along the Parsnip River, the McGregor River between the Fraser River and Herrick Creek, and in the Wichcika, Seebach and Averil Creek drainages. Scattered areas of .25 to several hundred hectares of light to severe mortality were mapped in the area bordered by Summit, Davie, Carp and McCleod Lakes. Infestations were also scattered along drainages in the northwest of the district including Hominka, Table and Anzac rivers, and as far north as Colbourne Creek. In the southern portion of the district approximately 500 ha of light to moderate mortality occurred between Stony Lake and the district boundary.

The only infestations recorded outside the Prince George district in the Prince George TSA were in the Fort St. James district. One area of light mortality covering 55 ha was noted between Mt. Copley and Kazchek Lake, just north of Trembleur Lake, and three infestations over 150 hectares along Rainbow Creek just south of the east end of Chuchi Lake.

Spruce beetle broods were assessed by FIDS in October of 1991 at two locations, 368 and 357 km along the west side of Weedon Lake. At km 368 the **'R'**[1] value determined was **6.6** indicating an increasing population. A total of 91 larvae, 21 callow adults and 32 mature adults were recorded from ten trees. The mature adults will probably fly early next spring. The mature and callow adults are probably in a one year cycle and the larvae a two year cycle. The **'Tc'** or current trend ratio between the number of current attacked trees this year and the number last year was **2.4**; a result of **1.4+** indicates increasing populations. The average DBH of attacked trees in this area is 53 cm, range 48-58 cm.

Surveys at the second location at 357 km Weedon Lake road failed to locate any currently attacked trees suitable for "R" value sampling. Two probe lines were followed in the infestation, only strip attacks, pitchouts and attacks in the lower bole from root collar to 1m in height were found. Grey large diameter spruce with no broods were common in the southern section of the infestation, but no suitable current attack that could be sampled was found. Broods examined near the root collar consisted mainly of mature larvae and callow adults. Only a portion of the area was surveyed, so currently attacked trees could be present or even prevalent in other areas. Based on this limited survey it is expected that the spruce beetle population at this location is static and will remain so for the next few years due to lack of beetle broods and small diameter spruce trees.

---

[1] 'R' value = an average population trend derived from the number of insects relative to the number of parent galleries originating within a representative bark sample.

0.7	decreasing
0.7-1.3	static
1.4	increasing

Mackenzie TSA

The largest expansion of spruce beetle attack occurred in this TSA, a more than four-fold increase to 32 400 ha. Infestations were mapped 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 largest concentration of infestations was 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. Further south, major infestations were mapped along Manson River and scattered infestations were noted in the area bordered by Nation Bay, Blackwater Creek and Williston Lake. To the east recent mortality was recorded between Peace Reach and Mt. Ludington. In the south, attacked trees were visible in the Phillip Creek and Lakes area and widely scattered around the Municipality of Mackenzie.

In early August of this year a cooperative investigation by FIDS and BCFS surveyed infested stands in the Chunamen, Phillips, Trapping and Mischinsinlika creek drainages. The surveys confirmed the presence of current attack in or adjacent to the majority of the 27 sites surveyed. Most sites, selected from 1990 aerial survey maps contained mature susceptible spruce or were adjacent to recently infested stands. The incidence of new attacks was generally light and moderate but occasionally, as in locations in the Chunamen creek area, exceeded 25% of the standing timber.

Throughout the TSA attacks were generally limited to pockets within or adjacent to previously infested stands and were more prevalent in the northern than southern areas. Periodic scattered windthrow on cutblock boundaries and within mature stands throughout the 1980s had contributed significantly to the population increases. Some of the 1989 attacks, commonly associated with old 'grays' (1985 and/or 1987 attacks), had been strip or partial attacks. This had resulted in little or no color change until this year, when broods emerged and in many cases re-attacked the same 1989-attacked trees. Also because of high soil moisture and rich sites as of August, 1991, many attacked trees had not changed colour.

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.

Dawson Creek TSA

Ground surveys in the Dawson Creek TSA found active spruce beetle populations in three locations.

At Silver Sands Creek, between Pine Pass and Chetwynd, current attack, including larvae, pupae, callow adults and exit holes were found in standing white spruce. Only scattered light attacks were reported with insufficient trees to determine 'R' values. High stumps left from winter logging in combination with recent blowdown are probably responsible for the build up of spruce beetle populations in this area. Near Carbon and Table Creeks trees baited by Canadian Forest Products are being used to draw populations from areas of recent blowdown with varied success. No adult beetles were absorbed by 20 baited trees at Table Creek and only 15 of 30 baited trees at Carbon Creek

attracted light populations. These areas will be baited again in 1992. Populations appear to be low in the district and efforts to reduce and contain populations should be successful.

Fort Nelson TSA

For the first time spruce beetle attack was recorded over 875 ha near Kotcho Lake east of Fort Nelson. The BCFS mapped 6 areas of light mortality during summer aerial surveys. No ground surveys were carried out due to the inaccessibility of the sites. Very light widely scattered attacks were also found in the Fort Nelson area. Logging of the infested areas is planned for the winter of 1991-92.

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

Spruce budworm populations in the Fort Nelson area decreased for the first time in three years, in this the eighth consecutive year of the current outbreak (Figure 1). The area of recorded ~~primarily~~ defoliation declined by 40% to 245 000 ha in mainly white spruce stands (Map 3). The area affected, as delineated by defoliation classes was: severe - none; moderate - 24 000 ha; light - 221 000 ha. Aerial surveys recorded defoliation over 398 000 ha in 1990 this was more than triple the 124 000 ha recorded in 1989, and more than ten times the 36 000 ha recorded in 1988. Last year was only the second year that severe defoliation, over 28 000 ha, was observed during aerial surveys in this area.

Damage was recorded over similar areas as in 1990, from Fort Nelson to the Northwest Territories border and west to the Coal River area, but was less severe and more scattered. Most moderate defoliation occurred near Liard Hot Springs and the largest area of damage was along the Fort Nelson River between Klua and Cridland Creeks.

Last year top kill and possible whole tree mortality in mature stands was reported in locations that had suffered repeated severe defoliation, particularly along the Liard River near the Northwest Territories border. Top kill was again noted in these areas in 1991 and also in the Kledo and Steamboat Creek areas, along the Muskwa River and near the Fort Nelson River Bridge, but no whole tree mortality of mature trees was noted. Scattered mortality of understory trees is beginning to occur in the Kledo and Steamboat creeks areas.

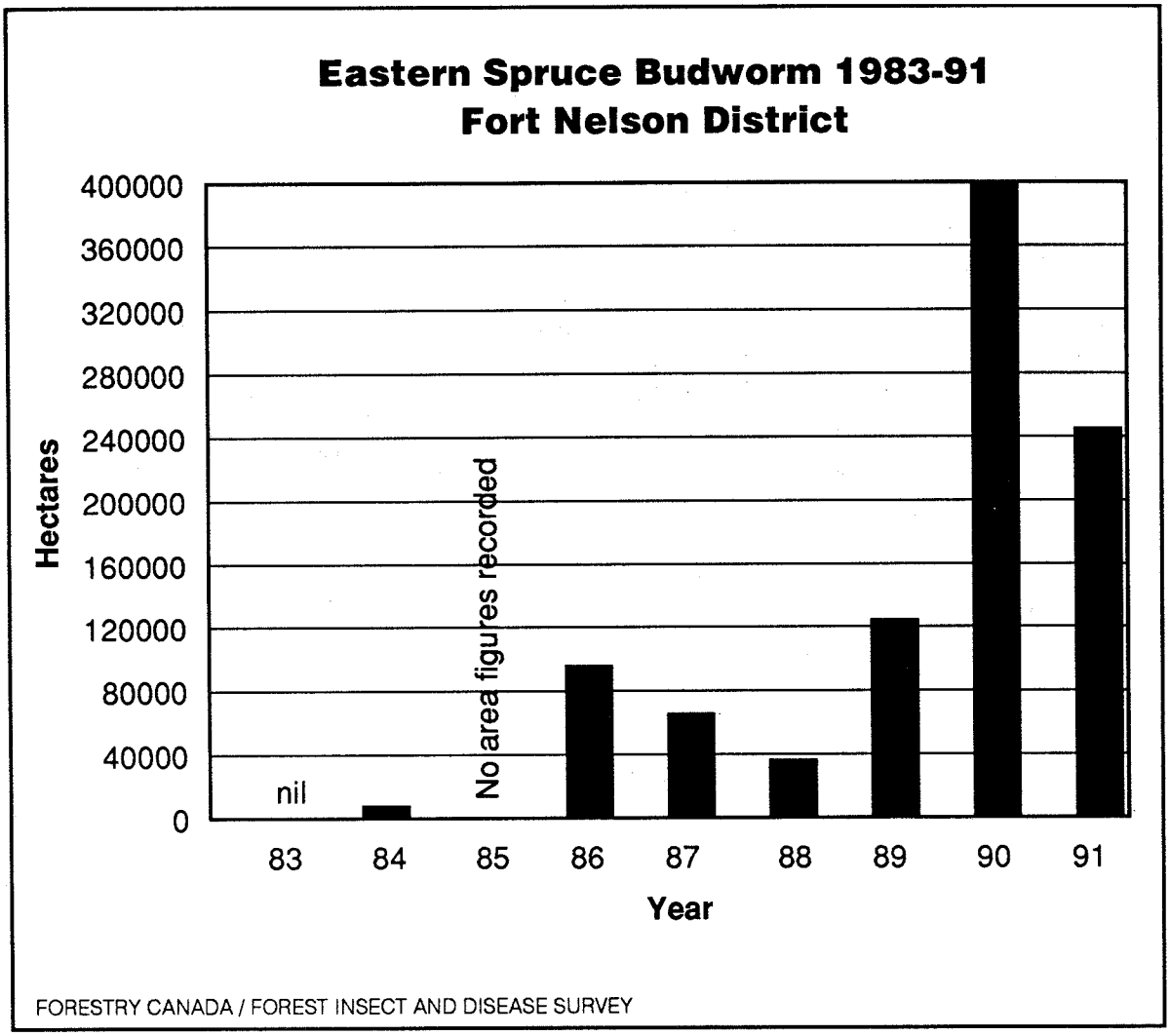
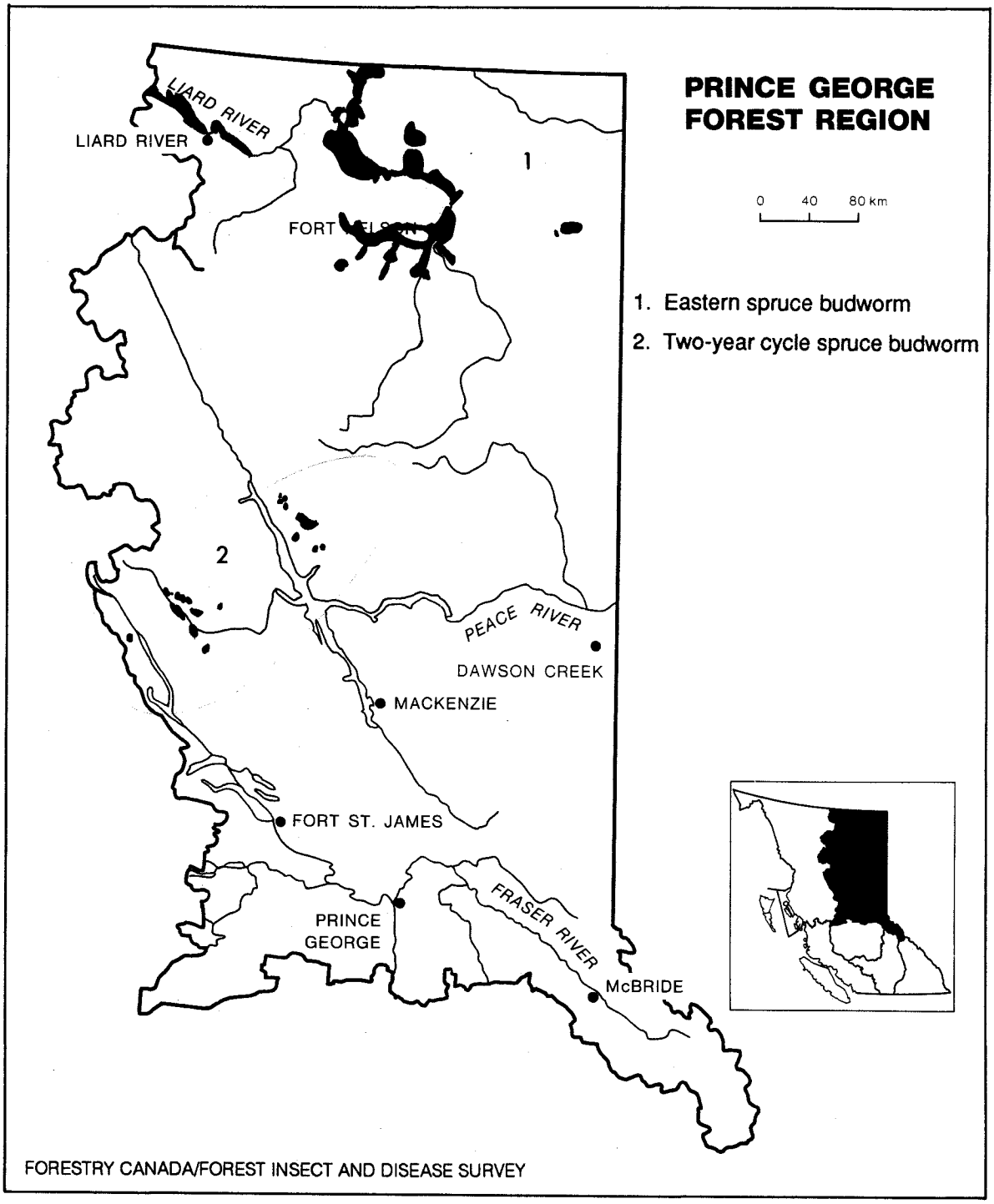

Eastern Spruce Budworm 1983-91
Fort Nelson District
Hectares
400000
360000
320000
280000
240000
200000
160000
120000
80000
40000
0
nil
No area figures recorded
83
84
85
86
87
88
89
90
91
Year
FORESTRY CANADA / FOREST INSECT AND DISEASE SURVEY

Figure 1.



Map 3. Areas where current defoliation of white spruce by eastern spruce budworm and two-year cycle spruce budworm was detected during aerial surveys in 1991.

Spruce and fir foliage were examined for egg masses in order to predict budworm populations for 1992. Through cooperation with the B.C. Forest Service, egg mass samples were obtained from three locations; Liard River, and two at Snake River. Only very limited samples were obtained again this year, making predictions very difficult and probably invalid. A total of 20 branch samples from 10 trees is the minimum number required in sampling for western spruce budworm, the 6 samples from 3 trees at each location collected for eastern spruce budworm is to small of a sample for accurate predictive purposes. The number of egg masses per 10 m^2 of foliage averaged 230 from the three locations down from the over 400 egg masses in 1990. In the case of western spruce budworm and regulation sized sample these numbers would indicate severe defoliation for 1992, it appears unlikely that this will happen with the eastern spruce budworm in the Fort Nelson area. Last years prediction of severe defoliation at 400 egg masses proved to be false, the even lower numbers this year probably indicate continued light defoliation for 1992. In 1989, only the second time that severe defoliation was recorded in the area, over 1000 egg masses per 10 m^2 were recorded.

FIDS technicians will continue to monitor budworm populations as part of continuing surveys.

Two-year-cycle spruce budworm
Choristoneura biennis

Defoliaton of spruce-balsam stands in the Prince George Forest Region by mature **2-year-cycle budworm** increased to almost 23 000 ha from 8600 ha in 1990 (Map 3). Immature "on-cycle" populations lightly defoliated stands over 260 ha near McBride.

Last year, an even year, is considered to be the major feeding or "on-cycle" year of this budworm, so the majority of feeding noted this year, an odd year, was done by what is termed "off-cycle" mature two-year-cycle budworm.

Defoliation by mature "off-cycle" populations was mostly light over 15 000 ha, along the Omineca River between Duckling and Ominicetla Creeks and at Ankwill Creek in the Fort St. James Forest District (Map 3). In the Ospika River and nearby Davis River drainages, north of Mackenzie, light defoliation occurred over approximately 8000 ha. No defoliation was noted in this area last year but defoliation over 11 000 ha was mapped for the first time here in 1989. Reports of defoliation north of the Ospika River drainage were not confirmed due to limited aerial surveys in the area.

Complete defoliation of understory trees, noted at several locations, will likely cause growth loss and some top-kill. Continued defoliation over several years could result in tree mortality. Feeding on mature trees was mostly restricted to the top three metres; some top-kill may become apparent in the future.

Although identity of the species has not been positively confirmed, taxonomic study of adult budworms reared at the Pacific Forestry Centre from larvae collected in the Ospika Valley have shown that this is not the **eastern spruce budworm**, Choristoneura fumiferana. This narrows the identification to two species, of which the **two-year-cycle spruce budworm**, Choristoneura biennis, is the most likely candidate. Hopefully collections made this year of budworm

pupae and pheromone trapped adults will be able to confirm species identification.

The number of immature "on-cycle" 2-vear spruce budworm, Choristoneura biennis, larvae in new buds of alpine fir and white spruce in the Bowron and Willow river drainages have declined overall. An average of 12% of the buds were infested by early instar larvae at six locations in 1991, compared with 31% in 1989. However populations are still sufficiently high to cause significant defoliation in 1992 when they mature (Table 2).

Table 2. Location, percent buds infested by two-year-cycle spruce budworm and predicted defoliation, Prince George TSA, Prince George Forest Region, 1991.

Location	% buds infested[1] spring 1991	Predicted defoliation, summer 1992
Stephen Lake	21	moderate
Rond Creek	17	moderate
68 km Bowron-Coal Road	10	light
76 km Bowron-Coal Road	6	light
12 km Tumuch Road	6	light
Everett Creek	11	light
Average	**12**	**light**

[1] 1-15 light; 16-30 moderate; 31+ severe.

Defoliation has been recorded periodically in this area since 1914, with 800 000 ha defoliated in 1962. Up to 10% top-kill can occur with extended severe defoliation but mortality is usually limited to understory trees. The most significant problem caused by the budworm is increment loss. Damage appraisal plots established near Babine Lake in 1961 showed a 76% increment loss due to severe budworm defoliation.

Control has been limited to disease, parasitism and weather. Chemical control programs have not been used against the two-year-cycle spruce budworm in British Columbia. Natural population controls normally include diseases, parasites, predators and weather.

In an on going calibration study designed to correlate population levels with subsequent defoliation, pheromone traps were hung and special 25 tree beatings were conducted at two locations. Five non-sticky pheromone-baited traps placed at 76 km on the Bowron Road and 12 km on the Tumuch Road, caught an average of <1 and 7 adult males respectively. No larvae were collected in beating samples at the Bowron Road or Tumuch Lake site. Further study is needed and will be ongoing over the next several years before any correlations can be made between population densities and potential defoliation.

FIDS will continue to monitor two-year-cycle spruce budworm populations in historically active and newly reported areas in 1992.

Spruce weevil
Pissodes strobi

Spruce weevil populations were again active in scattered white spruce stands throughout the Region in 1991. Current attack averaged 4% (range 2-6%) in four young stands from the Red Rock Seed Orchard south of Prince George, to Nation River west of Mackenzie. The stands ranged in age from 8-15 years. Aside from these surveyed stands weevil attacks were widespread and often more severe in young stands throughout the southern half of the region. For the second consecutive year spruce weevil was found to be infesting lodgepole pine, 2% of the stems in a stand east of Fort St. James and 4% of the stems in a stand along the Nation River. Although this is not a new host record, attacks in lodgepole pine are rare.

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 due to a successful leader clipping program.

Northern spruce engraver beetle
Ips perturbatus

Populations of this engraver beetle increased in the Prince George Region in 1991. Scattered single standing white spruce were top killed over large areas east of Summit Lake in the Prince George district and west of Takla Lake in the Fort St. James district. The top third of the infested trees were killed in the Averil, Olsson, Ankwill and Kwanika Cr. drainages and along the Torpy River.

Although this pest is normally a secondary bark beetle, the attacks on living trees were not unexpected as population build-ups were noted last year. The large broods developed because of the abundance of suitable host material consisting of both windfall and non-lethal spruce beetle trap trees which were widespread in the region in 1990. Trap trees which were felled partially in the open, to facilitate removal, provided an excellent source of host material. The engraver beetles emerged as adults in late summer and overwintered in the duff, before attacking the tops of the standing timber in the spring of this year.

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, following 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 1991.

PINE PESTS

Mountain pine beetle
Dendroctonus ponderosae

Recorded lodgepole pine mortality due to attacks by the mountain pine beetle increased to some 267 000 m^3 over more than 9 300 ha (Table 3, Map 2), up from 206 000 m^3 over 7900 ha in 1990 and 97 910 m^3 over 2800 ha in 1989.

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. Mortality increased slightly in the Prince George and Mcbride districts but remained static in Vanderhoof district.

Table 3. Timber supply area (TSA), forest district, area and volume of lodgepole pine recently killed by mountain pine beetle, Prince George Region, 1991.

TSA and Forest District	Area (ha)	Volume (m^3)
PRINCE GEORGE TSA		
Fort St. James District	8915	263 000
Prince George District	165	3000
Vanderhoof District	10	125
TSA TOTAL	**9090**	266 125
MCBRIDE TSA		
McBride District	220	10 000
TSA TOTAL	**220**	10 000
REGIONAL TOTAL	**9310**	276 125

Fort St. James District

The area of recently killed lodgepole pine increased to over 8900 ha from 7750 ha 1990, 2800 ha in 1989, and 3400 ha in 1988. Light mortality was mapped over 4500 ha, moderate over 2400 ha and severe over 2000 ha. The majority of this increase was mapped along the north shore of Trembleur Lake, along the north shore of the Northwest arm of Takla Lake, and northwest of Lovell cove on the west side of the lake. Mortality remained approximately constant within Tree Farm Licence (TFL) 42, and in the Takla Landing area along Takla Lake.

Mortality in TFL 42 was mainly centered in the area between Tarnezell Lake, Trembleur Lake and the Tachie River. Outside the TFL beetle activity was recorded along Butterfield Creek near the western edge of the TFL and scattered infestations were also mapped along the north side of Trembleur Lake. Beetle killed trees were recorded: on the north shore of Whitefish Lake; west of Cunningham Lake; along both sides of the Middle River from Baptiste Creek to Bivouac Creek; north of Takla Narrows to Dominion Point; and in the Ankwill Creek area on the west side of Takla Lake. On the east side of the lake increased scattered mortality was mapped from south of Tliti Creek to Bulkley House and new large areas of beetle attacked trees were seen around Lovell Cove. Increased mortality was also mapped in the Patcha Creek area, north of Bear Lake and the Birdflat and Minaret creeks area along the Sustut River. Some mortality was also recorded along the Skeena River from the Sustut River to near the Slamgeesh River. New areas of attack were recorded on the north and south shores of Chuchi Lake near the east end of the lake and along the Omineca River just west of Carruthers Creek.

Population Trends

During spring brood assessments, 'R'[2] values were obtained from two sites on the Nancut Reserve(0.6 and 0.7), northwest Stuart Lake(0.0), TFL 42(6.9) and Chuchi Lake(6.2). The first three areas had been pheromone baited and treated with MSMA and the low values obtained verified the effectiveness of the treatments. However at TFL 42 - Blk 1 and at Chuchi Lake expanding populations were predicted with 'R' values of 6.9 and 6.2 respectively. At both locations large healthy broods of mainly mature larvae were recorded.

Fall cruising at TFL 42 found two very different results at two adjacent blocks near Tanizul Lake. The same area, CP 107-Blk 1 that yielded an 'R' value of 6.9 was cruised in September and no current attack was recorded. In the 10 prism plots surveyed 66% of the trees were healthy, 14% red (attacked in 1990), 13% gray (attacked in 1989 or earlier), and 7% partial attacks. The 'R' value at this time was **0.0** due to the lack of currently attacked trees. The **Tc**, a ratio of currently attacked trees this year compared to current attack the

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[2] 'R' value = an average population trend derived from the number of insects relative to the number of parent galleries originating within a representative bark sample.

2.5	decreasing
2.6-4.0	static
4.1+	increasing

previous was also 0.0, indicating a decreasing population. The 7% partial attacks are probably not enough to keep the infestation expanding in this area. The reason for the lack of current attack at this location is not clear and an unusual occurrence given the high spring 'R' value. Strong prevailing winds at the time of flight resulting in dispersal of the population is the most probable explanation.

Data from a cruise strip at a nearby stand, CP 104-Blk 23A, gave a different picture with an 'R' value of 7.4 and a Tc of 1.6, both indicating an increasing populations. In this stand 13% of the trees were currently attacked, 8% red, 12% gray, 3% partial and 64% healthy. An average of only 23 cm dbh for the healthy trees indicates that future expansion in the stand will be limited. Historical observation has shown that beetle survival is enhanced by larger diameter trees.

Barring an unusually severe winter mountain pine beetle populations are expected to continue increasing especially in the more northern areas of the district, where large continuous forests of mature pine exist. The control of the beetle through the use of attractants and MSMA applications and cut and burn operations will be more difficult in these isolated inaccessible areas.

Prince George Forest District

Lodgepole pine mortality was mapped over approximately 165 ha in 1991, a slight increase from the 125 ha recorded in 1990 and 80 ha in 1989, but still down from 255 ha in 1988. An estimated 150 ha of light and 15 ha of severe attack in scattered pockets of .25 to 1.0 ha, were noted south of Prince George City. Southeast of the city mortality was again mapped along Taspai Creek and south of Purden Lake, with new areas noted at Stephanie Creek; southwest of Prince George red trees were mapped at Baldy Hughes, and along Gregg and Blackwater Creeks. The largest single area of infestation was located northeast of Prince George at Hansard Lake.

Pheromone baited trees were used by the B.C. Forest Service to attract mountain pine beetle in preparation for some MSMA injection, single-tree disposal and logging operations. These management options, along with good road access are proving successful in combating beetle populations in the district.

McBride Forest District

The area of recently killed lodgepole pine covered 225 ha with 140 ha of severe and 85 ha of light mortality. No figures are available for 1990 but it can be assumed by the number of grey trees noted during aerial surveys that mortality has increased slightly from 1990. The majority of the dead trees 210 ha were mapped along McNaughton Lake from House to Blackman Creeks on the east side and from Deer to Howard Creeks on the west side.

Two infestations totaling 15 ha were noted near McBride along the Dore River and at Fleet Creek.

In the Mt. Robson corridor area, the B.C. Parks plans to dispose of a total of 104 trees during the winter of 1991-92: 55 at Shale Hill within Mt. Robson Provincial Park; and 49 at Swiftcurrent Creek just west of the park boundary. A total of 88 baits were set out this year, 28 at Swift Current Creek, and 60 at four locations in the Shale Hill area. In 1990, Forest Service

probe lines located 97 currently attacked trees at Shale Hill and 105 at Swiftcurrent Creek. These trees were felled and burned before May to reduce the 1991 beetle flight in the area. This vigorous program to control beetle attacks in the park seems to be successful. There is still concern that mountain pine beetle could spread from the Robson Corridor through the Yellowhead Pass into Jasper National Park and Alberta.

Logging, along with pheromone baiting and single tree disposal is used to combat beetle populations in this district.

Vanderhoof Forest District

Mountain pine beetle populations in this district remained static with only 10 ha of severe attack noted. Attacked trees were recorded from south of Natalkuz Lake to the southern shore of Francois Lake. A vigorous disposal program of over 400 infested trees in 1990 including pheromone baiting followed up by MSMA treatments, logging and single-tree disposal has helped control beetle infestations.

Pinewood Nematode
Bursaphelenchus xylophilus

A total of six dry land sorts were surveyed in the Region for the presence of woodborer-infested logs, woodborers are thought to be the main vector of the pinewood nematode. Infested logs were detected at two sites in Prince George and one in Fort Nelson with less than 5% of the logs infested at all sites. The sampling was part of an experimental pinewood nematode pasteurization program in conjunction with COFI and FORINTEK. None of the infested logs from Prince George were used in the experimental heat treatment process to control the nematode, but 24 logs were selected at a site near Squamish, north of Vancouver.

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 the Yukon Territory with only individual, predisposed trees affected at a few widely distributed locations.

Pine stem rusts and cankers
Cronartium spp., *Endocronartium harknessii*, *Atropellis piniphila*

Pine stem rusts and cankers continue to be the most serious pests of young lodgepole pine stands throughout the Region. Young stand surveys (see Multiple Host Pests) found **stalactiform** *C. coleosporioides*, **sweet-fern**, *C. comptoniae* and **comandra**, *C. comandrae*, blister rusts, in 29% of the 2 to 20 year-old stands surveyed, affecting an average of 8% (range 2-17%) of stems. An average of 6% had stem cankers, (2% dead, 4% dying), and 2% branch cankers.

Western gall rust, *E. harknessii* was found in 61% of lodgepole pine stands surveyed, affecting 7% (range 1-33%) of the trees. Stem galls were recorded on 5% of the trees and branch galls on 3%. Galls on branches or stems, often kill all growth above the gall through girdling or render the tree susceptible to breakage by snow or wind. Additionally, secondary insects often

attack the stem immediately above the galls, further weakening the trees. Atropellis-caused cankers, A. piniphila were found in 11% of the stands affecting an average 2% (range 1-16%) of the trees.

Various management techniques including the planting of alternate species, overstocking areas where rusts are common, and spacing infected stands are available to forest managers. FIDS will continue to monitor and report on the presence of these important young stand pests in 1991.

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 June to October 1991. The results of the survey in the fifth plot near Whitehorse are summarized in the 1991 FIDS Yukon report. 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 10 remains basically healthy with few pest problems. The most damaging pest found in the stand was **western gall rust**, Endocronartium harknessii, infecting 4% of the lodgepole pine trees. All of the stem galls were at the root collar and difficult to detect. Mortality will probably result over the next several years from these infections. The **gouty pitch midge**, Cecidomyia piniinopis, deformed and twisted between 1-10%, average 6%, of the new shoots on 16% of the trees. Severe attacks by this pest retard tree growth and repeated attacks sometimes kill trees. No evidence of further mortality caused by **Warren's root collar weevil**, Hylobius warreni was found. Approximately 1% of the lodgepole and Scots pine was attacked and killed in 1990. The only other problem noted was chlorotic 1990 foliage on both the Scots and lodgepole pine, possibly caused by a nutrient deficiency or winter damage. Approximately 10% of the one-year-old foliage was affected on 30-40% of the trees.

Mackenzie, Nation Bay

The plot examination on July 5 found healthy trees accounting for 73, 67 and 53% of the lodgepole pine, Scots pine and Siberian larch respectively. **Western gall rust**, infected 10% of the lodgepole and 4% of the Scots pine. **Stalactiform blister rust**, Cronartium coleosporioides, was found as stem cankers on 12% of the lodgepole pine. Mortality can be expected from both diseases. **Warren's root collar weevil**, killed 3% of the lodgepole pine in 1991, no current mortality was observed in the Scots pine. **Northern pitch moth**, Petrova albicapitana, infested 2% of the lodgepole pine, resulting in weakened tops susceptible to breakage from snow and wind. About 45% of the Siberian larch were extensively damaged by winter winds/snow/ice causing multiple tops and bushy form. Irregular, but not necessarily abnormal bark formations were noted on 24% of the Scots pine. Bark splitting and light resin flow was noted on some larger diameter saplings.

Fort Nelson, Liard Highway

Several pest problems were found at the Fort Nelson plot which was examined on July 14. **Winter damage** affected 20, 80 and 90% of the Siberian larch, lodgepole pine and Norway spruce respectively, causing multiple tops on 20% of the larch and spruce. Dead foliage, 1-10%, of the needles, due to winter damage was also noted on all conifers. **Eastern spruce budworm,** Choristoneura fumiferana, consumed approximately 1% the foliage on 100% of the larch and spruce. **Western gall rust,** formed branch galls on 1% of the lodgepole pine. Pitch nodules resulting from **northern pitch twig moth,** attacks were recorded on 2% of the pine.

Fort St. John, Halfway River

The Fort St. John plot examined on July 7, had only minor pest problems. **Winter damage** again was the most destructive agent causing multiple tops on 40% of the Siberian larch and 5% of the lodgepole pine. **Western gall rust,** formed galls on 1% of the stems and branches on 4% of the pine.

A pine-feeding budworm Choristoneura n. sp.

The current known distribution of this budworm is from Woodpecker to Carswell along Highway 97 in north-central British Columbia with concentrations near Bear and McLeod Lakes. Since 1989 the Pacific Forestry Centre has been isolating and identifying the pheromone of an previously undescribed species of Choristoneura that feeds on lodgepole pine. This research is currently being compiled as a scientific publication. Although this insect feeds mainly on staminate cones and pollen it also feeds on the needles. Growth ring analysis has found no signs of radial reduction which commonly results from outbreaks of other budworm species. A similar species in eastern Canada, the **jackpine budworm,** Choristoneura pinus, has caused widespread defoliation. More details will be reported on the identification of this budworm and its potential damage as they are discovered.

Gouty pitch midge Cecidomyia piniinopis

Lodgepole pine infested by this midge was recorded in 13% of the 54 young stands surveyed throughout the region. An average 18% of the trees were attacked, range 1-50%. Twisted and deformed lateral and terminal shoots were the symptoms noted though very little shoot mortality was evident. Its principal host is ponderosae pine and it is common in young open growing plantations on the current years growth. Severe repeated attacks can kill trees.

Continued surveys will determine if populations of this midge increase to levels where they be become damaging to lodgepole pine in the Prince George Region.

ALPINE FIR PESTS

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

Balsam bark beetle killed alpine fir over approximately 6900 ha mostly in the northern portion of the region. The increase is almost double the 3900 ha recorded in 1989, the last year that accurate area figures were available.

The majority of the mortality occurred in the Fort St. James district with light mortality mapped over 4200 ha. North of Takla Lake more than 1700 ha were recorded along both sides of Bear Lake and between Forester Lake and Katsberg Creek. The rest of the attacked trees were scattered in smaller infestations along the southside of Chuchi Lake and along Takla Lake from Middle River to just south of Lovell Cove and north of the northwest arm of the Lake.

In the Mackenzie district almost 2400 ha of light to moderate mortality were mapped by the BCFS, an estimated 960 ha were bordered by Nation Bay, Manson Arm and Mt. Bisson. The remaining areas were scattered around Boulder, Phillips and Wasi Lakes, along Ole and Lorimer Creeks, at the mouth of the Omineca River and near the junction of the Ominica and Osilinka Rivers.

In the McBride district almost 300 ha of scattered severe mortality in over 60 infestations were noted along the Goat, Morkill and Dore Rivers and near Hugh Allan Creek on the eastside of McNaughton Lake.

Balsam bark beetle is a chronic problem in most districts in this region, and populations fluctuate little from year to year. The increase this year is largely because of increased aerial surveys, rather than an abrupt increase in beetle populations. Mortality in 1992 is expected to continue at levels similar to 1991.

Fir-fireweed rust
Pucciniastrum epilobi

This rust was widespread in young alpine fir stands throughout the region. Current foliage was infected in 11 of 16 young stands surveyed with alpine fir as a component of the stand, and in 100% of the stands where alpine fir was a 10%+ component. Complete defoliation of the current years needles was noted on up to 75% of the trees at several sites.

Generally the rust if found on young trees (5-10yrs) and on lower branches of older trees because the different spore states require conditions of high humidity in which to germinate and grow. However a severe outbreak was noted on older trees along the 200 road off the Teardrop main east of Ft. St. James. Approximately 90% of the 5-25 year old fir with up to 100% of the new needles infected some 10+ meters above ground level.

Fireweed and other **Epilobium spp.** are the alternate host for this rust, which can sometimes be confused with the Fir-blueberry rust **Pucciniastrum goeppertianum**. Growth loss can result during a severe outbreak when enough needles are killed to prevent photosynthetic activity during part of the growing

season. Since weather (dry, windy weather to disseminate the various spore types, followed by warm, humid weather for germination) seldom favors the build-up of epidemic rust conditions, the needle rusts of true firs rarely warrant chemical or silvicultural controls.

DOUGLAS-FIR PEST

Douglas-fir beetle
Dendroctonus pseudotsugae

Mortality due to attacks by the Douglas-fir bark beetle almost doubled to over 1500 ha in 1991, compared to 800 ha in 1990 and 115 ha in 1989. A large part of the damage, 720 ha, was again recorded in the Prince George Forest District by BCFS personnel, down from an estimated 800 ha in 1990. The remainder of the mortality was noted in the Fort St. James and McBride Districts where 225 and 600 ha respectively, were mapped by FIDS. Douglas-fir beetle mortality was noted by the BCFS in these districts in 1990 but no actual area figures were available.

Prince George District

Mortality occurred in over 250 small, scattered infestations of mostly light mortality in the district. The mortality was concentrated southeast of Prince George along Slim and Taspai Creeks and around Pinkerton Lake; southwest of the city along the Blackwater Creek and north to Telegraph Trail; north of the Fraser and Salmon Rivers around Summit Lake; in the Averil and Caine Creek drainages and north to Kerry Mountain and along the west side of McLeod Lake.

Fort St. James District

In the Fort St. James district recently killed trees were again mapped along the southside of Tezzeron Lake around Pinchi Mountain; scattered patches were noted north of Pinchi Lake just west of Hyman Creek; north of Stuart Lake from Mt. Hope to Tachie and also on the Islands in Stuart Lake.

McBride District

The largest increase in beetle-caused Douglas-fir mortality occurred in this district with over 600 ha of mostly moderate mortality recorded, area figures are not available for 1990. All of the red trees were noted along McNaughton Lake. Patches of mortality of up 20 ha were noted along the east side of the Lake from south of Packsaddle Creek in the north to Dawson Creek in the south; and along the west side of the Lake from Mt. Thompson to Foster Creek. Several areas of attack were grouped at the mouth of Hugh Allan Creek and around Windfall, Goatlick and Ptarmigan Creeks.

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

MULTIPLE HOST PESTS

Western hemlock looper
Lambdina fiscellaria lugubrosa

For the first time since 1983 western hemlock looper defoliation has been recorded in the Prince George Region. Severe defoliation, up to 100%, of mature western hemlock and western red cedar was reported by the BCFS over approximately 200 ha southeast of McBride along Hankins Creek. This infestation occurred in the ICHj biogeoclimatic zone partially up slope from the valley floor. Understory Douglas-fir was also completely defoliated along with undergrown herbaceous plants.

This infestation coincides with other western hemlock looper population build-ups in the province; with a total area of defoliation exceeding 50 000 ha province wide. Although cedar-hemlock stands in the Region have been severely defoliated during past infestations only limited tree mortality was recorded, but extensive mortality has been documentated in some coastal infestations.

Historically infestations have been recorded in the ICH biogeoclimatic zones in the Valemount and McBride areas and to a lesser extent in the SBSj1 zone just east of Prince George. These areas will be surveyed in 1992 to determine the spread and severity of the current infestation. Outbreaks usually last about 3 years, and are generally brought under control by starvation, predators, disease and weather.

Acid Rain National Early Warning System (ARNEWS)

The Acid Rain Early Warning System (ARNEWS) plot, located near Averil Lake, northeast of Prince George, was surveyed twice in 1991. No acid rain damage was recorded.

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 detailed analysis of foliage, soils, growth rates, foliar retention, and general stand condition done every five years, was completed in the 15 plots in British Columbia last year. No significant changes in soil or foliar chemical content, have been detected yet. Annual monitoring will continue at this plot and fourteen others in British Columbia in 1992. Several additional plots could be established in Prince George next year.

Pests of Young Stands

A total of 54 planted and natural stands between one and twenty years old were surveyed for pest problems in 1991. The most frequently occurring pests are summarized in Table 4.

The most damaging pests encountered were the Cronartium stem rusts, C. coleosporioides, C. comptoniae and C. comandrae. These rusts were found in 11 of the 38 lodgepole pine stands surveyed throughout the region causing significant damage. Dead and dying (stem cankers) trees made up 95% of the infected trees, branch cankers were noted on the remainder.

Table 4. Summary of pests of young stands, Prince George Forest Region, 1991

Host/pest	No. stands affected	% of trees affected[1] Average	Range	Severity[2] index
Lodgepole pine - 3377 trees in 38 stands, 2776 trees were pest free				
Gouty pitch midge	5	18	1 - 39	3
Lodgepole terminal weevil	2	2	2	4
Northern pitch twig moth	4	2	1 - 3	3
Warrens root collar weevil	16	3	1 - 9	4
Atropellis canker	4	2	1 - 16	5 - 6
Blister rusts	11	8	2 - 17	5 - 6
Western gall rust	24	7	1 - 33	5 - 6
Mammal damage	21	13	1 - 100	3 - 5
Climatic	9	10	2 - 32	2 - 6
Mechanical	2	6	4 - 9	4
White spruce - 1814 trees in 43 stands, 1169 trees were pest free				
Adelgids	24	34	4 - 100	2
Eastern spruce budworm	1	3	3	3
2-year spruce budworm	2	11	10 - 16	3
White pine weevil	2	4	2 - 6	4
Mammal	4	21	14 - 33	3

(Cont'd)

Table 4. (Cont'd)

Host/pest	No. stands affected	% of trees affected[1] Average	Range	Severity[2] index
White spruce (Cont'd)				
Climatic	24	24	6 - 100	2 - 4
Herbicide	2	16	12 - 25	3
Alpine fir - 359 trees in 24 stands; 170 trees were pest free				
2-year spruce budworm	3	35	15 - 100	3
Warrens root collar weevil	1	36	-	6
Fir-fireweed rust	16	68	10 - 100	3
Climatic	5	40	9 - 100	2 - 4
Herbicide	2	50	31 - 64	3 - 4
Mechanical	2	41	26 - 38	3
Western red cedar - 230 trees in 5 stands; 135 trees pest free				
Cedar leaf blight	3	26	2 - 50	3
Climatic	2	30	21 - 37	2
Mechanical	1	10	-	3
Western hemlock - 37 trees in 3 stands; 33 trees were pest free				
Climatic	1	15	-	3
Trembling aspen - 145 trees in 7 stands; 106 trees were pest free				

[1] Percent 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

As further emphasis is placed on intensive management, interest in pests of young stands and their impact will grow. FIDS will continue to monitor young stands in the Prince George Region in 1992.

Black army cutworm
Actebia fennica

Black army cutworm populations decreased in 1991. Light feeding was noted on white spruce over 2 ha at George Creek and moderate feeding of herbaceous material over 20 ha at the same location. Moderate feeding of herbaceous material was also noted over 20 ha at a site near Hambone Lake where 770 moths were caught in pheromone traps in 1990.

A total of 13 multipher pheromone traps were placed at 9 one-year-old prescribed burns from south of Hixon to Weedon Lake. Only 10 traps survived to be used for the calibration of moth numbers, 3 having being destroyed by vandals. An average of 138 (range 24-320) adults were trapped (Table 5) a decrease from the average of 220 (range 0-770) adults caught in 1990. None of these figures shows potential for significant damage (Map 4) in 1992 (600+ moths/trap indicates a potential for significant damage).

Table 5. Location and number of adult male black army cutworm caught in pheromone-baited Prince George Forest Region, 1991.

Company/Location	No. of traps	No. of adults[1]	Remarks
Pas			
Weedon Lake (149 km 100 RD)	1	320	no defoliation predicted
(152 km 100 RD)	1	40	no defoliation predicted
Lakeland Mills			
Salmon River (238 km)	2	24, 90	no defoliation predicted
Northwood			
Tsadelsa Rd	1	112	no defoliation predicted
East Seebach	1	118	no defoliation predicted
Horn Creek	2	176, 185	no defoliation predicted
Haydn Creek	2	121, 191	no defoliation predicted
Huble Creek		-	trap damaged

(Cont'd)

Table 5 (Cont'd)

Company/Location	No. of traps	No. of adults[1]	Remarks
Carrier			
Mt. George	-	-	trap damaged
CFP			
18 km Strathnavor	-	-	trap damaged
Average		**138**	

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

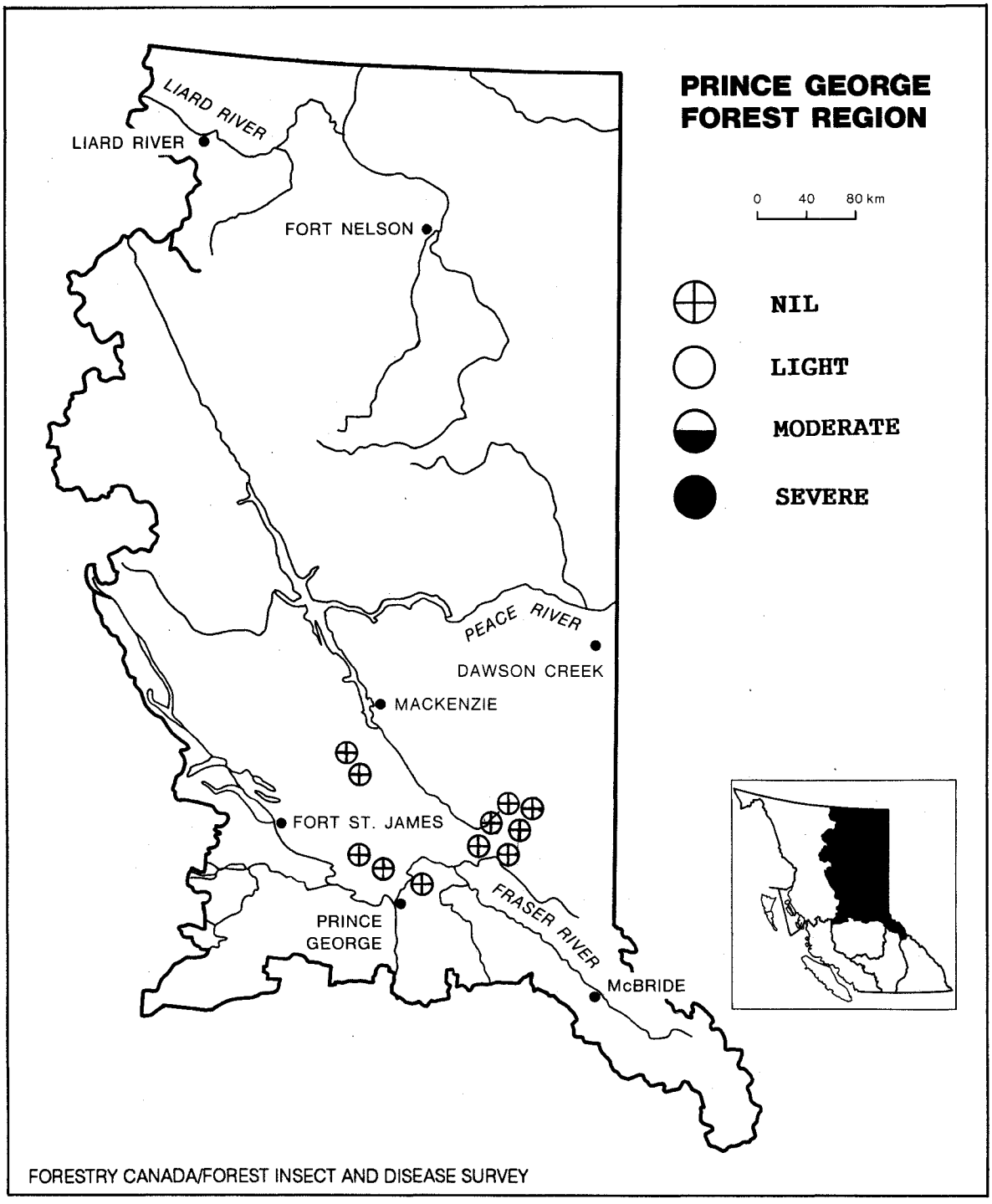
350	no defoliation of vegetation or seedlings expected
350-600	defoliation of vegetation is common with occasional seedling damage
600+	high risk of vegetation and seedling defoliation

Recent burns and any reported cutworm outbreaks will be monitored in 1992.

Winter damage

Winter winds caused foliage mortality on several conifer species throughout the Prince George Region. West of Fort Neslon at Muncho Lake, Steamboat Mountain, and along the Alaska highway near the Liard Bridge an average 25% of the foliage was killed on 60% of the mature lodgepole pine over several hundred hectares. Approximately 30% of the foliage turned red on over 50% of the mature pine between Silver Sands and Little Boulder Creeks in the Pine Pass area east of Mackenzie. Further east towards Chetwynd scattered groups of pine with mostly red foliage were also noted. East of the Bowron River from 5-34 km of the Tumuch Road desiccated foliage was evident on all age class hemlock over more than 1000 ha. Defoliation ranged from 10 to 70% on more than 50% of the trees.

Multiple tops and growth loss can result from this damage, possible infection by secondary organisms could produce more significant defects. Environmental damage in young stands is covered in the Pests Of Young Stands section.



Map 4. Forecast of 1992 defoliation by the black army cutworm in the Prince George Forest Region, based on pheromone trap surveys.

Mammal damage

Mammal damage including rodents chewing on rust cankers, hares feeding on young stems, moose and deer browse on young trees, and porcupine damage on all age classes of trees was recorded, mainly in the southern half of the region.

Debarking of lodgepole pine stems by hares and/or squirrels was the most significant mammal caused damage. Complete or partial girdling of stems was noted in 29% of the lodgepole pine stands affecting an average 6% (range <1-14%) of the trees. Mortality was noted in <5% of the trees. In some stands spacing has provided hares with a favorable habitat and has resulted in population increases with proportionate increases in the incidences of feeding damage.

Light browse damage caused by ungulates (moose and deer) was recorded in 13% of young lodgepole pine stands and 3% of the alpine fir stands surveyed in the Region. Severe feeding usually causes multiple tops and poor form.

DECIDUOUS TREE PESTS

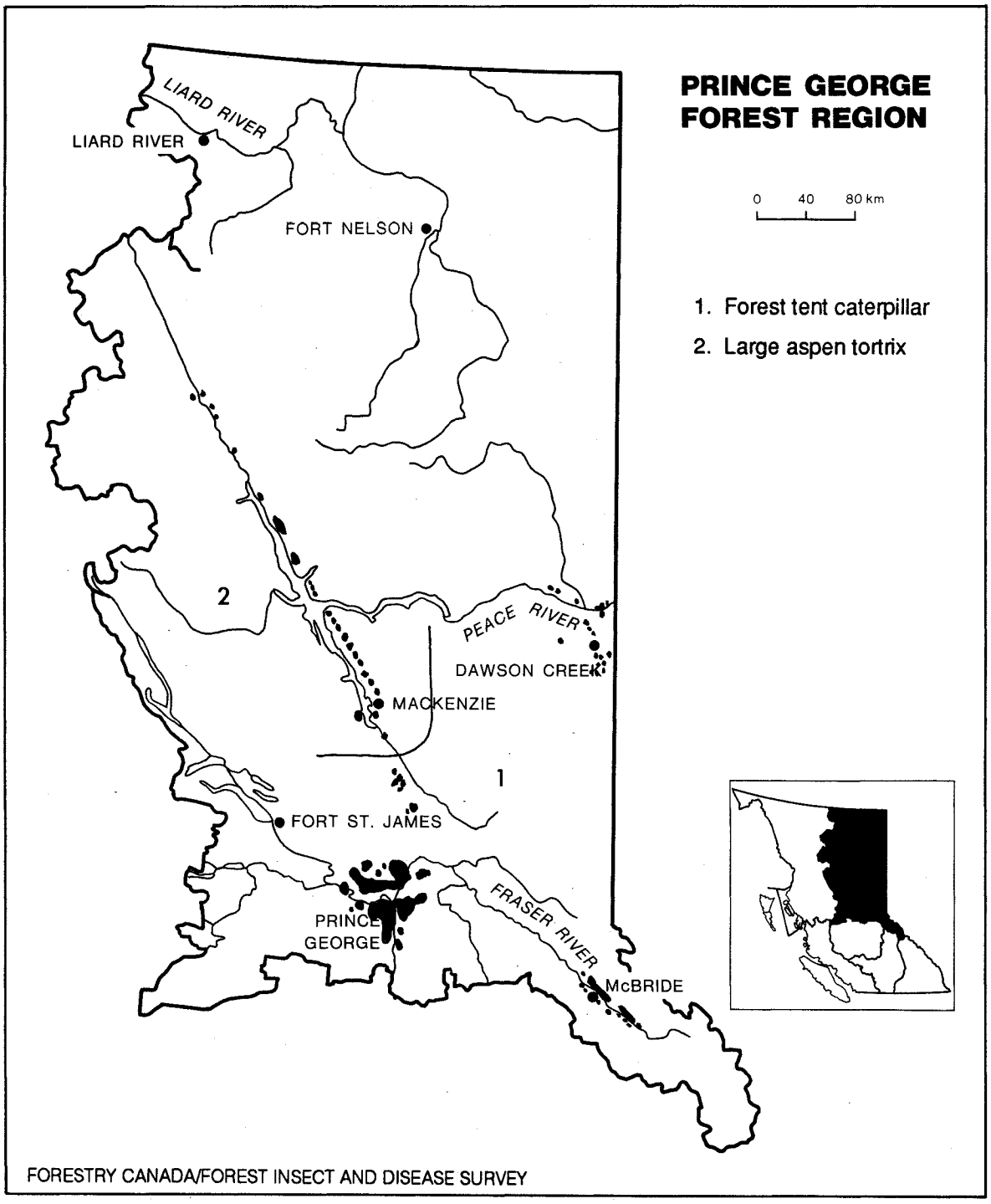
Forest tent caterpillar
Malacosoma disstria

The area of mainly trembling aspen defoliated by the forest tent caterpillar decreased to more than 92 000 ha (Map 5), less than half the 194 000 ha recorded last year.

Tent caterpillar populations in the Prince George Forest District decreased after five consecutive years of increase (Figure 2). An estimated 83 000 ha of trembling aspen were defoliated in the district; an almost 50% decrease from 1990. The only area of increase was along the south end of McLeod Lake up 60% to 8000 ha in 1991. The largest area of decrease was in the Salmon and Willow River drainages where recorded defoliation declined by 65% to 28 000 ha in 1991.

In the McBride Forest District the area and intensity of feeding increased by 45% to 6500 ha of severe defoliation. Newly defoliated areas were mapped along the north and south sides of the Fraser River between Horsey and Holliday Creeks and along the Fraser River northwest of McBride. The intensity of defoliation was mostly severe in areas that were lightly to moderately defoliated in 1990.

Aspen defoliation in the Peace River area decreased by more than 85% to cover 4800 ha. This is the eighth consecutive year that defoliation has been recorded in the Peace River area. Light defoliation occurred in scattered pockets near Taylor, Shearer Dale, Farmington and Pouce Coupe.



Map 5. Areas where current defoliation of deciduous trees by forest tent caterpillar and large aspen tortrix was detected during aerial surveys in 1991.

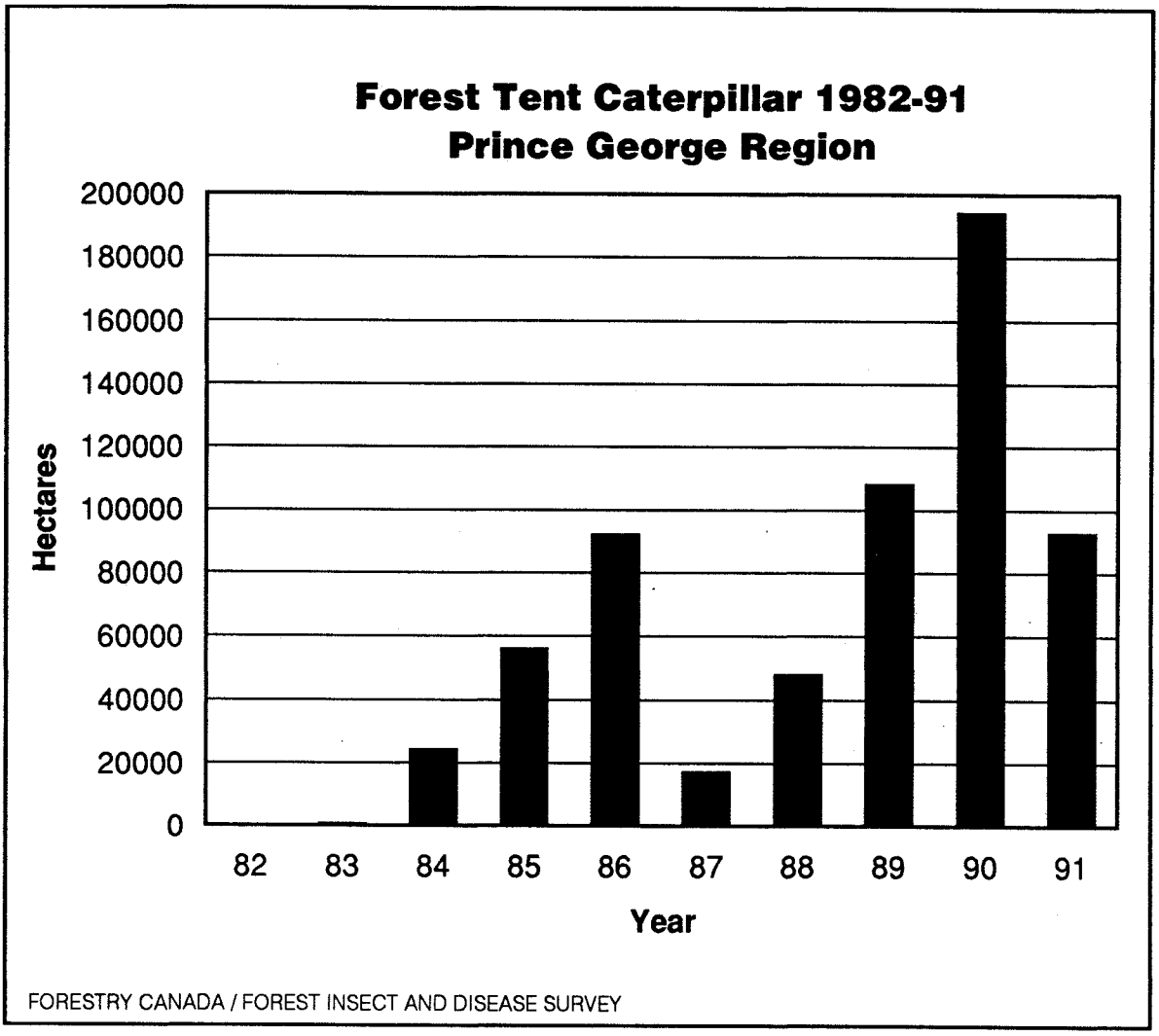

Forest Tent Caterpillar 1982-91
Prince George Region
Hectares
200000
180000
160000
140000
120000
100000
80000
60000
40000
20000
0
82
83
84
85
86
87
88
89
90
91
Year
FORESTRY CANADA / FOREST INSECT AND DISEASE SURVEY

Figure 2.

The number of new egg masses found during 1991 fall surveys in the Prince George TSA declined for the second consecutive year to average 2 (range 1-7) per 10 cm dbh tree (Table 6, Map 6) from 17 in 1990 and 38 in 1989. In the Peace River area, egg masses also decreased to <1 from an average of 2 in 1990. Increases were only noted east of McBride where an average of 12 new egg masses were collected from two locations up from <1 in 1990.

Table 6. TSA, location, dbh, number of new and old egg masses of forest tent caterpillar and predicted 1992 defoliation, Prince George Forest Region, 1991.

TSA and location	Avg. dbh (cm)	Avg. no. egg masses/tree		Predicted defoliation 1992	Ratio of new:old egg masses	Population Status
		new	old			
PRINCE GEORGE						
42 mile Creek north	9	**2**	5	light	1:2	declining
42 mile Creek south	12	**1**	4	nil	1:4	declining
Eaglet Lake	12	**1**	9	nil	1:9	declining
Ruby Lake	10	**1**	3	nil	1:3	declining
Cranbrook Hill	10	**1**	20	nil	1:20	declining
Northern University	11	**5**	14	light	1:3	declining
Ness Lake	12	**2**	6	light	1:3	declining
Hart Highlands	11	**7**	21	moderate	1:3	declining
Haldi Road	9	**2**	10	light	1:5	declining
Tabor Lake	10	**<1**	3	nil	1:3	declining
Trapping Lake	11	**2**	2	light	1:3	static
AVERAGE	**10**	**2**	**9**	**light**	**1:4**	**declining**

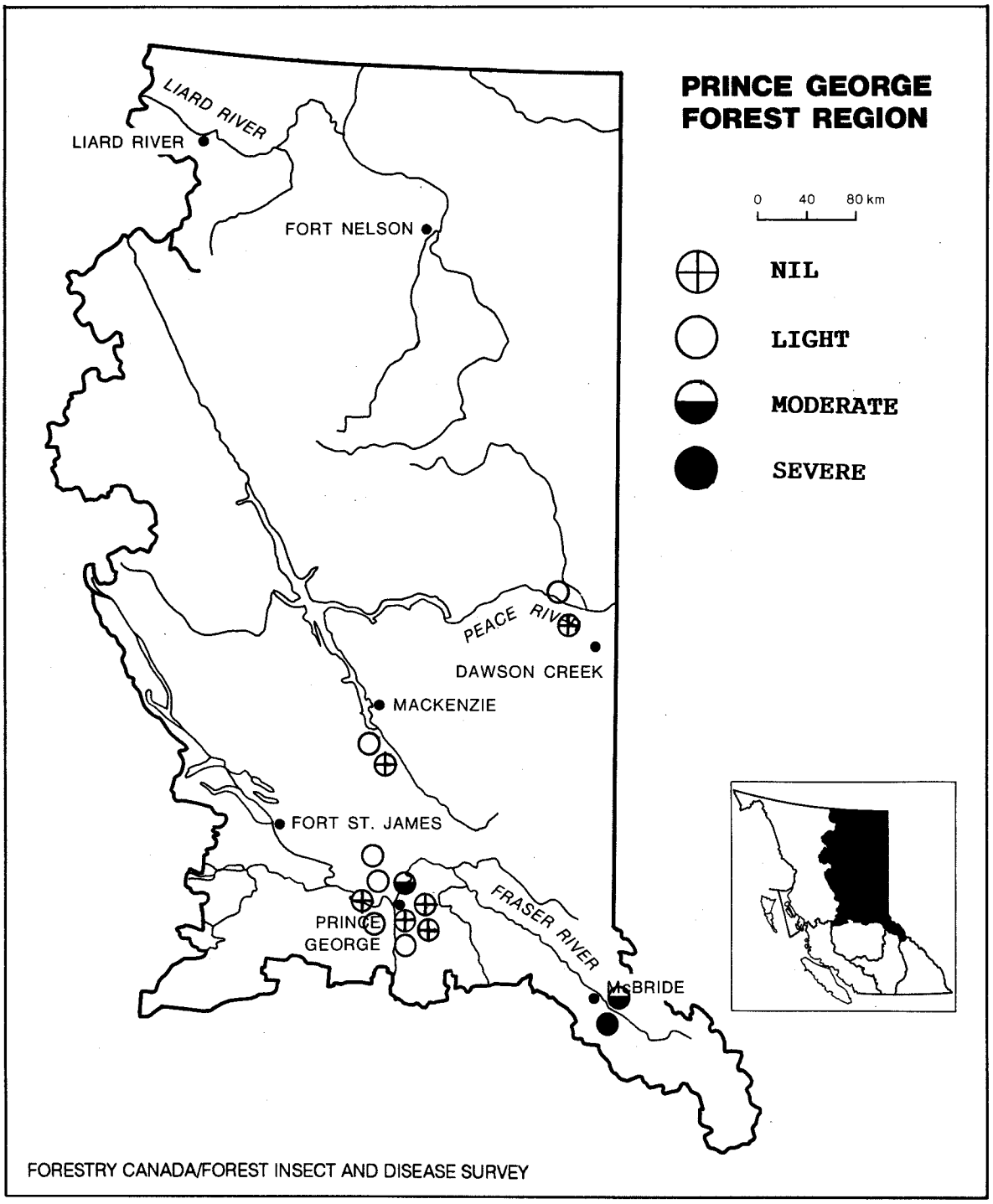
(Cont'd)

Table 6 (Cont'd)

TSA and location	Avg. dbh (cm)	Avg. no. egg masses/tree new	old	Predicted defoliation 1992	Ratio of new:old egg masses	Population Status
DAWSON CREEK						
South bank, Peace R., near Taylor	9	1	1	nil	1:1	static
6.5 km S of Farmington	12	0	1	nil	0:1	declining
AVERAGE	**10**	**<1**	**1**	**light**	**1:1**	**declining**
MCBRIDE						
Dunster	10	16	4	severe	4:1	increasing
Nevin Creek	10	6	4	moderate	3:2	increasing
AVERAGE	**10**	**11**	**4**	**severe**	**3:1**	**increasing**

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 region.

FIDS will continue to monitor forest tent caterpillar populations in 1992 and a pest report will be issued after early season sampling is completed.



Map 6. Forecast of 1992 defoliation by forest tent caterpillar in the Prince George Forest Region, based on egg mass surveys.

Large aspen tortrix
Choristoneura conflictana

Large aspen tortrix populations increased for the third consecutive year, with 45 infestations defoliating trembling aspen over more than 18 000 ha compared with 7365 ha in 1990. All recorded defoliation, mostly moderate and severe, occurred in the Mackenzie Forest District (Map 5). The majority of the damage, 93%, occurred along the east and west sides of Williston Lake from Mackenzie north to Finlay Reach. The remaining 1200 ha of light feeding was mapped along the Finlay River from Fort Ware south to Williston Lake.

Very little tree mortality has been directly attributed to the large aspen tortrix; however, two or more successive years of moderate to severe defoliation by the tortrix will result in reduced radial growth and may cause branch and twig mortality.

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 1992.

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 cooperation with Agriculture Canada to detect the establishment of this potentially serious pest.

Poplar shoot blights
Venturia macularis, V. populina

Poplar shoot blight was again common on trembling aspen, balsam poplar and black cottonwood along the Alaska Highway from the Charlie Lake area north of Fort. St. John, to the Coal River area near the Yukon border. 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 1992.

OTHER NOTEWORTHY PESTS

Table 7. Other noteworthy pests

Host and Pest	Location	Remarks
White Spruce		
Gall aphids Adelgid spp. Pineus spp.	Prince George Region	common and widespread
Eastern blackheaded budworm, Acleris variana	Liard River	low numbers associated with eastern spruce budworm
Whitespotted sawyer Monochamus scutellatus	Ft. Nelson	common in log decks
Lodgepole Pine		
A needle cast fungus Lophodermella concolor	Red Rock Seed Orchard, West and Horse Creeks, Endako, Ft. St. James	up to 50% foliage infected on 90% trees
Pine-aster rust Coleosporium asterum	Salmon River, Chuchinka Creek	light infections on trees in young stands
Pine engraver beetle Ips tridens	Slim Creek Klua Lake	found in blowdown and mountain pine beetle attacked trees these areas
Elm		
Elm leafminer Agromyza aristata	Prince George	sixth consecutive year of damage, 20% of the foliage on all the ornamental elms in the 'Miller Creek Addition' were mined
Trembling Aspen		
A solitary leafroller Epinotia criddleana	Dawson Creek	associated with other aspen defoliators
Aspen leafroller Pseudexentera oregonana	Fort St. John, Wonowon, Dawson Creek	associated with other aspen defoliators

(Cont'd)

Table 7 (Cont'd)

Host and Pest	Location	Remarks
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
Conifer-aspen rust *Melampsora medusae*	Mackenzie	common throughout this area
Speckled green fruitworm *Orthosia hibisci*	Pouce Coupe	associated with other aspen defoliators
Willow		
Fir-willow rust *Melampsora abieti-capraearum*	Fort St. James	common throughout this area
Pacific willow leaf beetle *Pyrrhalta decora carbo*	Pouce coupe to Liard River area	common for second year, causing patchy moderate to severe defoliation
Poplar and willow borer *Cryptorhynchus lapathi*	Host range	common throughout the region, causing mortality and multiple tops
Birch		
Birch leaf miners and skeletonizers	Prince George	widespread light damage on mostly ornamentals