FOREST INSECT AND DISEASE CONDITIONS IN ALBERTA, SASKATCHEWAN, MANITOBA, AND THE NORTHWEST TERRITORIES IN 1991

H.F. Cerezke and H.S. Gates

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ABSTRACT

Forest pest conditions in Alberta, Saskatchewan, Manitoba, and the Northwest Territories during 1991 are summarized. Major pests are discussed, and additional noteworthy insects, diseases, and tree damage agents are reported in a table. An updating of surveys for acid rain symptoms in permanently established ARNEWS (Acid Rain National Early Warning System) plots and pest damage incidence in young coniferous stands are also reported.

RÉSUMÉ

Le présent rapport résume l'état des populations de ravageurs et des maladies des arbres en Alberta, en Saskatchewan, au Manitoba et dans les Territoires du Nord–Ouest en 1990 et donne certaines prévisions des niveaux d'infestation pour 1991. II examine des ravageurs d'importance et fait état, sous forme de tableau, de la situation d'autres insectes, de maladies et d'agents nuisibles dignes de mention. II présente également une mise à jour sur les relevés des symptômes des pluies acides observés dans les placettes permanentes du DNARPA (Dispositif national d'alerte rapide pour les pluies acides) ainsi que des dégâts causés par les ravageurs dans les jaunes peuplements de conifères.

CONTENTS

APPENDIX

FIGURES

TABLES

NOTE

The exclusion of certain manufactured products does not necessarily imply disapproval nor does the mention of other products necessarily imply endorsement by Forestry Canada.

INTRODUCTION

The Forest Insect and Disease Survey (FIDS) unit at the Northern Forestry Centre (NoFC) of Forestry Canada has conducted general surveys annually since 1948 to detect and monitor important forest insects and diseases and other tree-damaging agents in Forestry Canada's Northwest Region (Alberta, Saskatchewan, Manitoba, Northwest Territories, and Rocky Mountain national parks) (Fig. 1). The surveys have included aerially mapped pest infestations (with rated forest injury levels) and various ground plot observations for the purposes of pest collection and identification, measurement of damage intensity, updating of host tree records, and descriptions of applied control projects. The conduct and assessment of many of the annual surveys would not be complete without the close cooperation and contributions of numerous federal, provincial, and industrial client agencies.

The results of the surveys are summarized to provide an annual regional pest status report and to contribute to an annual review of national forest pest conditions. The collections of insect and disease specimens made during the surveys are maintained at NoFC; they provide continuity for the historical records of both a permanent insect collection and a herbarium, and for the national FIDSINFOBASE (the Forest Insect and Disease Survey Information system). The collections also contribute information to support plant quarantine and special forest surveys and research projects. Two national surveys in which FIDS staff participate are the gathering of tree-damage-related information to develop pest depletion loss estimates, and a program of acid rain detection and monitoring, under the umbrella of ARNEWS (Acid Rain National Early Warning System).

This regional report summarizes the status of major forest insect and disease pest conditions and other tree-damaging agents within the three prairie provinces and the Northwest Territories in 1991. Also reported are results from special surveys, such

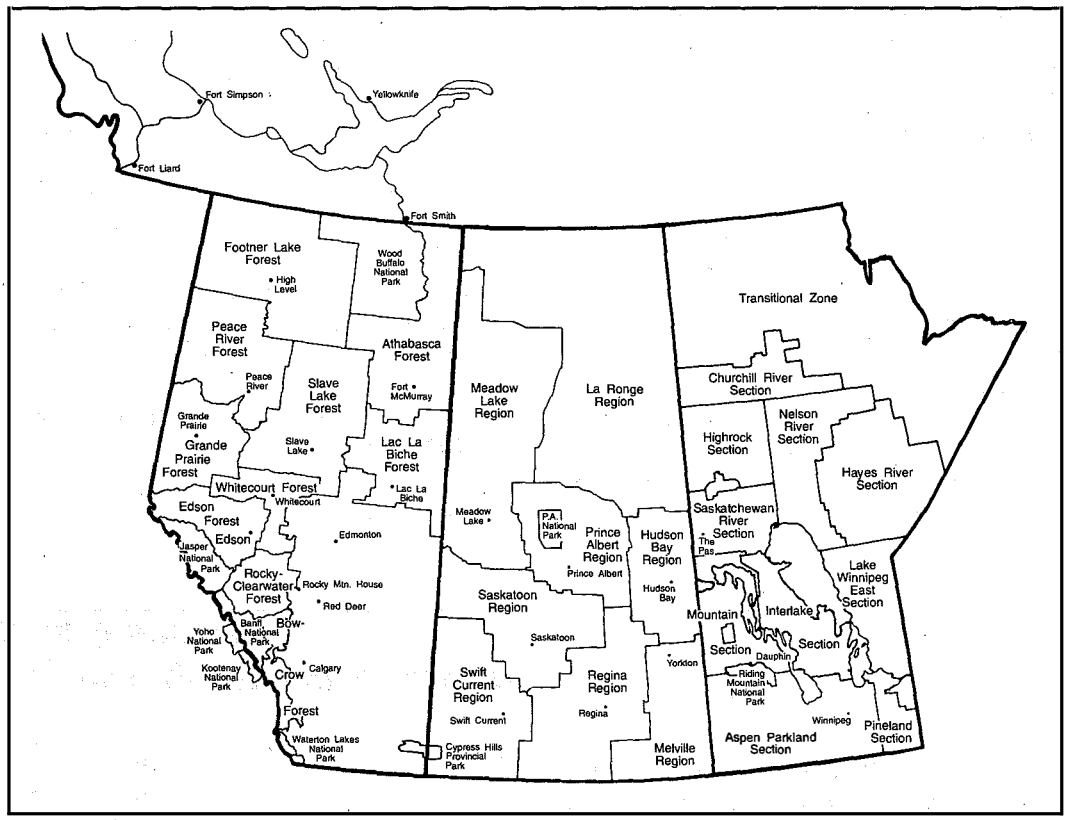

Figure 1. Forest districts and regional boundaries of the three prairie provinces and the Northwest Territories.

as those conducted in nurseries, seed orchards, and plantations, and in permanent sample plots (PSPs). Other tree-damaging agents that affect shelterbelts, and shade and ornamental trees in urban and high-use areas are summarized in tabular form.

Information for this report is based on field observations and collections compiled in 1991, from May to late October, by the following FIDS ranger staff within the identified jurisdictions:

- Mike Grandmaison: Manitoba
- Gary Still: Saskatchewan (retired June 30, 1991)
- Craig Tidsbury: Northern Alberta (retired June 30, 1991)
- Howard Gates: Alberta, Northwest Territories, Rocky Mountain national parks, and Saskatchewan (ARNEWS plot monitoring)
- Colin Myrholm: Alberta

Various regional client agencies have provided information for inclusion in this report and assistance in the conduct of field surveys; their contributions are hereby acknowledged with appreciation. Thanks are expressed to the following people, and to their associated departments, for the sharing of pest-related information.

- Hideji Ono, Sunil Ranasinghe, Michael Michaelian, Ken McCrae, Don Law, Tom Archibald, Al Hovan, Art Evans, Kurt Frederick, Howard Herman: Alberta Forestry, Lands and Wildlife, Alberta Forest Service
- Bruce Walter, Gordon Frey, Garry Carter: Saskatchewan Parks and Renewable Resources
- Keith Knowles, Richard Westwood: Manitoba Natural Resources
- Bob Larson, Mark Vieweg, Chris Carlisle: Northwest Territories Renewable Resources
- Tom Trott: Alberta Recreation and Parks
- Greg Curniski: Weyerhaeuser Canada Ltd., Saskatchewan Division
- Hiro Koga: Agriculture Canada, Food Production and Inspection Branch
- John McIntosh: Environment Canada, Canadian Parks Service
- Leo Unger, Allan Van Sickle: Forestry Canada, Pacific and Yukon Region

At the Northern Forestry Centre, other contributors to this report were:

- Herb Cerezke, Head of FIDS; Entomologist
- Jim Emond, Senior FIDS Ranger (retired April 30, 1991)
- Yasu Hiratsuka, Mycologist; disease diagnostics
- David Langor, Entomologist; insect collection maintenance and diagnostics
- Ken Mallett, Pathologist; disease diagnostics
- Paul Maruyama, Mycology Technician; disease diagnostics
- Jan Volney, Project Leader for Forest Insect and Disease Survey and Management Systems; Entomologist
- Daryl Williams, Entomology Technician and FIDS Ranger
- Andu Yohannes, Entomology Technician

SPRUCE BUDWORM
Choristoneura fumiferana (Clem.)

In the Northwest Region, spruce budworm infestations increased in size and intensity in most previously affected areas in northern Alberta and the Northwest Territories in 1991, but some infestations occurred in new locations (Fig. 2). The infestations covered a composite area of 317 000 ha in 1991, compared to 260 540 ha in 1990. The 1991 figure reflects overall increases in infestation in Alberta, Manitoba, and the Northwest Territories; a small reduction occurred in Saskatchewan (Table 1).

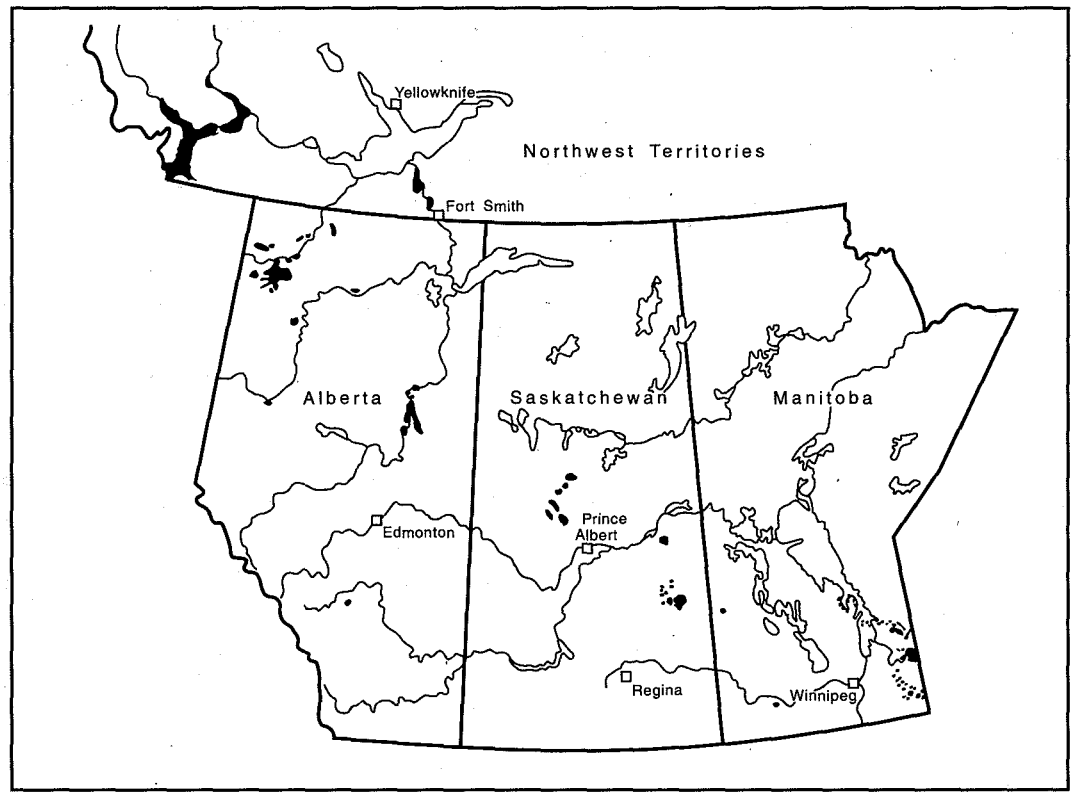

Figure 2. Areas of moderate-to-severe defoliation caused by the spruce budworm in 1991.

In 1991 aerial spraying programs for spruce budworm control and foliage protection were carried out only in Alberta, using the biological insecticide, *Bacillus thuringiensis* var. *kurstaki* (*Bt*) (Table 2). One of the treated areas (about 1941 ha) had been established in 1990 as the site of a cooperative research study by the Alberta Forest Service and Forestry Canada. The study was expanded in 1991 to evaluate *Bt* spray efficacy tests in northern white spruce forests.

In Alberta, moderate-to-severe defoliation occurred on a few hectares of white spruce west of Bowden, while light defoliation occurred in a small area in nearby Red Lodge Provincial Park. About 200 ha of white spruce in the Cypress Hills Provincial Park was lightly defoliated. No control action was taken in either of these provincial parks. Light defoliation occurred on white spruce in Big Knife Provincial Park and an aerial spray application of *Bt* was applied for budworm suppression.

Table 1. Summary of spruce budworm defoliation in the Northwest Region, sketch-mapped from aerial and ground surveys in 1990 and 1991

Location	Area of defoliation (ha) 1990	1991	Change (%)
Alberta	109 150	141 000	+29
Saskatchewan	18 780	15 600	–17
Manitoba	18 985	30 500	+61
Northwest Territories	113 625	130 000	+14
Total	260 540	317 100	+22

Table 2. Summary of spruce budworm infestation areas treated in commercial forests in Alberta in 1991 with aerial applications of *Bacillus thuringiensis* var. *kurstaki* (*Bt*)

Forest district/site	Area treated (ha)	Host tree species	*Bt* product	Application rate (BIU[a]/ha)
Operational				
Footner Lake	20 920	White spruce	Dipel 132	30[b]
Grande Prairie	910	White spruce	Dipel 132	30[b]
Lac La Biche	4 830	White spruce–balsam fir	Foray 48B	30[b]
Experimental				
Peace River (Hawk Hills)				
Site 1	417	White spruce	Dipel 132	25[b]
Site 2	104	White spruce	Dipel 176	50[b]
Site 3	47	White spruce	Dipel 176	50[b]
Site 4	470	White spruce	Dipel 176	50[c]
Site 5	903	White spruce	Dipel 132	30[b]
Footner Lake (Chinchaga River)				
Site 6	140	White spruce	Foray 48B	50[c]
Site 7	164	White spruce	Foray 75B	50[c]

[a] BIU = Billion International Units.

[b] Indicates two applications at the same rate, 5–7 days apart.

[c] Indicates one application.

Major infestations continued in five provincial forest districts: Footner Lake, Peace River, Grande Prairie, Lac La Biche, and Athabasca; the composite total was 141 000 ha of moderate-to-severe defoliation (Fig. 2), representing an increase of about 29% over the totals reported in 1990 (Table 1). The largest of the infestations covered about 120 000 ha in the Footner Lake Forest District; the affected area has increased in size annually since 1987 when it was first reported, and some top kill is now evident in some of the oldest portions of the outbreak area. Several large new outlying areas of infestation were mapped by the Alberta Forest Service this year, including areas in the northwestern, eastern, and southern portions of the main outbreak area west of Zama Lake, along the Zama and Amber rivers, as well as near Meander River, along the Steen and Yates rivers, and near John D'or Prairie. About 20 920 ha were treated aerially with *Bt* to suppress budworm populations in the main outbreak areas.

In the Peace River Forest District, about 2600 ha of infestation were mapped this year near Hawk Hills (about 1000 ha reported in 1990); most of this area was moderately-to-severely defoliated. About 1941 ha were treated aerially with *Bt* applications as part of an experimental spray program (Table 2).

The oldest known infestation in the province, probably 7–8 years old, continued in the Grande Prairie Forest District near Eaglesham, where up to 40% tree mortality is now occurring in the worst affected white spruce stands. Most of this infestation, about 910 ha, was treated aerially with *Bt* in 1991.

In the Lac La Biche Forest District, about 14 000 ha of moderate-to-severe defoliation were mapped, and about 1500 ha were mapped in the adjacent Athabasca Forest District, an increase from the 11 800-ha total in the two districts in 1990. About 4830 ha of the Lac La Biche infestation was treated aerially with *Bt*.

Table 2 provides a summary of the operational and experimental spray block treatments conducted by the Alberta Forest Service in 1991. In the operational spray blocks, Dipel 132 (30 Billion International Units [BIU]/ha) was used over all areas except those of the Lac La Biche Forest District, where Foray 48B (30 BIU/ha) was applied. Various *Bt* products were used in the experimental trials conducted at the Hawk Hills and Chinchaga River sites (Table 2). The results of the *Bt*

applications are summarized in unpublished provincial reports.[1]

Assessments of the surviving populations of spruce budworm in the Footner Lake and Lac La Biche infestation areas were conducted by the Alberta Forest Service. These assessments are based on second instar larval density counts collected from mid-crown branches in late August, 1991, and expressed as numbers of larvae per 10 m^2 of foliage (Table 3). The results suggest that moderate-to-severe defoliation (from 35 to 90%) will likely occur in most unsprayed areas in 1992, while low populations causing light-to-moderate defoliation (<35%) can be expected in all *Bt*-treated areas (Table 3). Post-spray larval population assessment in the Grande Prairie Forest District suggests that in 1992 low populations and light defoliation will likely occur in the *Bt*-sprayed areas there as well.

The Alberta Forest Service also deployed 81 pheromone-baited sticky traps at 27 locations in five forest districts and in Cypress Hills Provincial Park. Male moths were captured in all five districts and indicate current spruce budworm population levels and distribution. Moderate population levels are predicted for the Footner Lake, Lac La Biche, and Peace River forests districts and in the Cypress Hills Provincial Park. Low population levels are probable in the Grande Prairie and Bow–Crow forest districts.

In **Saskatchewan,** aerial surveys to map spruce budworm areas of defoliation were conducted by Saskatchewan Parks and Renewable Resources and by Weyerhaeuser Canada Ltd. An estimated 15 600 ha of white spruce–balsam fir forests were moderately-to-severely defoliated in four general locations: Big River (7000 ha), Red Earth (3000 ha), Tall Pines (3000 ha), and Eagle Lake (2600 ha). This represents a 17% reduction from 1990, and was due in part to the on-going salvage logging of budworm-damaged timber in the Red Earth, Tall Pines, and Eagle Lake infestations. Portions of these infestations have persisted since 1982.

In the Big River lease area of Weyerhaeuser Canada Ltd., two infestations are now entering their fourth (Taggart Lake) and fifth (Pancake Lake) consecutive years, 16% tree mortality of mixed balsam fir and white spruce was reported this year in the Pancake Lake area. Some new expansion of the infested areas occurred, and there is the potential for this to continue in 1992. Weyerhaeuser Canada Ltd. has undertaken some salvage harvesting, and the company is attempting to limit the spread of the spruce budworm in other areas by containment (i.e., making use of adjacent nonhost tree species and swamp areas).

Assessment surveys of the infestations, based on egg-mass samples and defoliation estimates, were undertaken by Weyerhaeuser Canada Ltd., but the results are not yet available. In addition, Saskatchewan Parks and Renewable Resources deployed 120 pheromone-baited sticky traps throughout budworm-susceptible areas, and an additional 180 traps were distributed within the Weyerhaeuser Canada Ltd. lease area. The moth capture data are being used to define management strategies for 1992. Some aerial spray treatments with *Bt* may be considered in 1992.

In **Manitoba,** spruce budworm caused moderate-to-severe defoliation over an estimated 30 000 ha of white spruce–balsam fir forests in southeastern Manitoba (an increase of about 58% over 1990). The affected areas were located within the Abitibi-Price Forest Management Licence (F.M.L.), and in the Nopiming, Whiteshell, and Hecla provincial parks (Fig. 2). A new infestation caused about 200 ha of light-to-moderate defoliation in the Duck Mountain Provincial Forest.

The decision not to conduct a 1991 aerial spray program for budworm suppression was based on low egg mass densities in 1990 and low larval counts in early 1991.

Spruce budworm pheromone traps were placed at 13 fixed sampling locations (3 traps per location) for the seventh consecutive year to record trends in the numbers of male moths trapped. Mid-crown foliage samples were also collected from the same locations for the estimation of egg-mass densities and prediction of defoliation levels in 1992. Based on these results, moderate and severe defoliation levels are predicted for the baiting locations in the Spruce Woods Provincial Forest, Whiteshell

[1] Personal communication, 1991, from H. Ono, Manager, Insects and Disease Programs, Alberta Forestry, Lands and Wildlife, Edmonton, Alberta.

Table 3. Results of surveys for spruce budworm defoliation, egg-mass densities, and second instar larval densities in 1991, and expected defoliation levels in 1992 for Alberta and Manitoba

Location	Avg defoliation 1991 (%)	Avg number of egg masses/10 m^2 of foliage	Avg number of moths/trap *or* avg L2[a]/10 m^2 of foliage	Expected defoliation for 1992[b]
Alberta				
Footner Lake Forest District				
Untreated areas	–[c]	–	464[d]	Moderate-severe
Bt-treated areas	–	–	115[d]	Light
Lac La Biche Forest District				
Untreated areas	–	–	419[d]	Moderate-severe
Bt-treated	–	–	47[d]	Light
Manitoba				
Birds Hill Provincial Park	13	10 (11)[e]	98[f]	Light
Spruce Woods Provincial Forest	13	76 (76)	290[f]	Moderate
Red Deer River	<1	0 (0)	25[f]	Nil
Duck Mountain Provincial Park	2	0 (0)	5[f]	Nil
Riding Mountain National Park	1	0 (0)	13[f]	Nil
Northwest Angle Provincial Forest	2	4 (0)	29[f]	Light
Whiteshell Provincial Park	30	279 (218)	455[f]	Severe
Wanipigow	30	138 (77)	197[f]	Moderate
Hecla Provincial Park	5	4 (36)	38[f]	Light
Lake St. George	2	0 (0)	32[f]	Nil
Rocky Lake	8	30 (12)	44[f]	Light-moderate
Simonhouse	2	0 (0)	18[f]	Nil
Pisew Falls	3	0 (0)	6[f]	Nil

[a] L2 = second instar larvae.

[b] Based on egg-mass densities where Light = <25% defoliation (1–15 egg masses), Moderate = 26–50% defoliation (50–100 egg masses), and Severe = >50% defoliation (200+ egg masses). The predicted defoliation levels for 1992 apply only to the immediate sites of trap deployment.

[c] No data available.

[d] Indicates average numbers of L2 larvae, estimated over all sample sites. Data collected by the Alberta Forest Service.

[e] Values in brackets are for 1990.

[f] Indicates average number of moths per trap.

Provincial Park, and near Wanipigow Lake in 1992 (Table 3).

Manitoba Natural Resources has initiated a detailed study in the Abitibi-Price F.M.L. to estimate wood volume losses due to repeated spruce budworm defoliations. In some areas of the F.M.L., volume reductions caused by budworm feeding injury may have accumulated since the early 1980s.

In the **Northwest Territories**, there was an estimated 14% expansion of the outbreak in 1991, as well as some increase in its severity: an estimated 130 000 ha was affected, compared to the 113 625 ha reported in 1990. In most of the infestations, moderate-to-severe defoliation occurred over many of the same areas as in the previous year. The main infestation extended along the Liard River between the British Columbia border and Fort Simpson, and along the Mackenzie River between Fort Simpson and Fort Norman. An additional infestation was adjacent to the Slave River between Fort Smith and Great Slave Lake (Fig. 2), with some areas only lightly defoliated. The infestations are expected to continue in 1992.

ASPEN DEFOLIATORS
Forest tent caterpillar, *Malacosoma disstria* Hbn.
Large aspen tortrix, *Choristoneura conflictana* (Wlk.)
Bruce spanworm, *Operophtera bruceata* (Hulst)

In **Alberta**, where no infestations are known to have been sprayed this year, there was a further decline in forest tent caterpillar population levels in 1991, and in the size of defoliated areas of aspen stands (Fig. 3). The largest area of infestation occurred northeast of Edmonton, between Smoky Lake and Bonnyville, and covered an estimated composite land area of 646 000 ha; however, because this area includes a large block of agricultural land, the actual area of aspen forest was estimated as 129 200 ha, or 20% of the total (Table 4).

Other smaller areas of aspen forests with moderate-to-severe defoliation occurred in Elk Island National Park, between Edmonton and Tofield, and in small scattered pockets along the Peace River valley—adjacent to the town of Peace River and extending westward to Grimshaw. Another defoliated area, also believed to be caused by the forest tent caterpillar, consisted of about 2000 ha and was located about 50 km northeast of Grande Prairie.

Egg-band surveys to predict levels of defoliation by the forest tent caterpillar in 1992 were made at 60 locations across central Alberta, extending from Peace River to Lloydminster (Fig. 4). Only one of the locations (Kehiwin Lake) is predicted to be moderately defoliated, while 22 locations, all in east-central Alberta, are expected to be lightly defoliated in 1992.

The large aspen tortrix caused mostly light defoliation in 1991, with some scattered

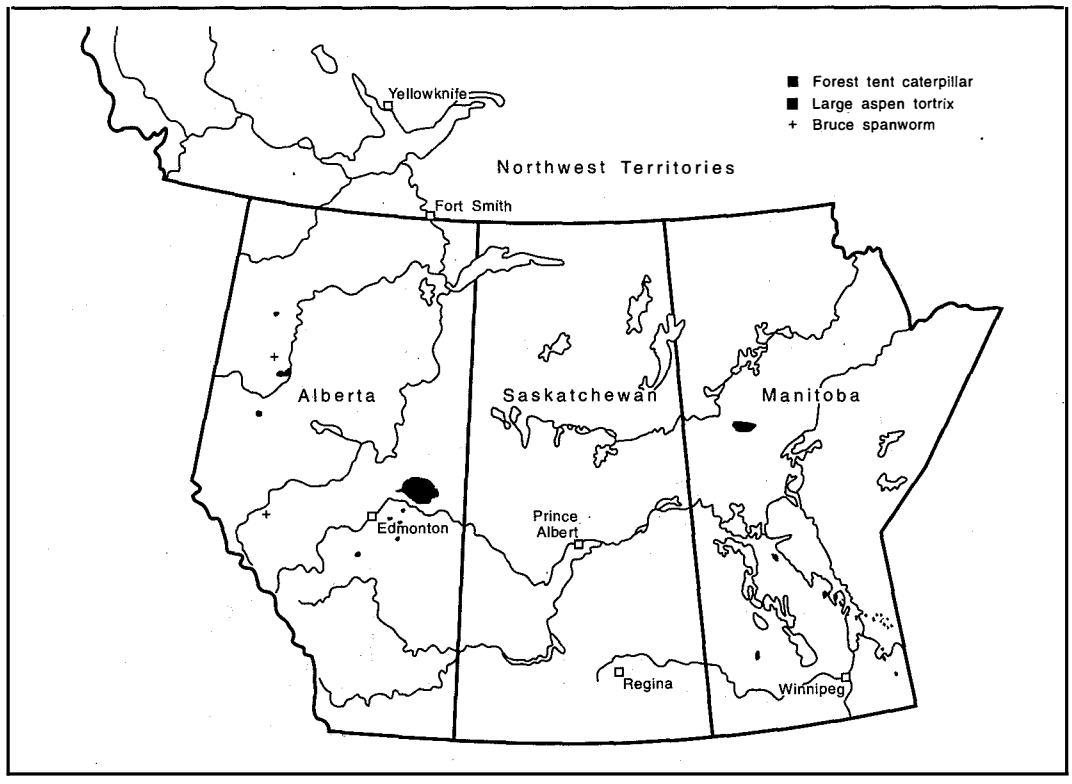

Figure 3. Areas of moderate-to-severe defoliation caused by the forest tent caterpillar, large aspen tortrix, and Bruce spanworm in 1991.

Table 4. Summary of moderate-to-severe defoliation of trembling aspen by the forest tent caterpillar and large aspen tortrix in the prairie provinces in 1991

Province	Area of defoliation (ha) 1990	Area of defoliation (ha) 1991	Change (%)
Alberta	609 272[a]	129 200[a]	-79
Saskatchewan	260 922[a]	–[b]	–
Manitoba	15 178[c]	58 082[c]	+283
	15 540[d]	12 691[d]	-18

[a] Estimated as 20% of the total land area mapped.

[b] Areas of aspen defoliation were not mapped in 1991.

[c] Estimated area of defoliation by forest tent caterpillar.

[d] Estimated area of defoliation by large aspen tortrix.

moderate-to-severe patches of defoliation between Hawk Hills and Twin Lakes. Patches of light-to-severe defoliation were also noted near Camrose and Bentley.

Defoliation caused by the Bruce spanworm in 1991 was noted at two locations, both with small patches of moderate-to-severe defoliation. The first location was about 20 km south of Manning, and the second between Edson and Hinton, near Obed.

In **Saskatchewan**, while some aspen defoliation was noted, no areas were mapped this year, nor were there any ground surveys made to determine causal organisms.

Areas of aspen forests defoliated by the forest tent caterpillar and the large aspen tortrix increased in **Manitoba** in 1991 to a total of 70 773 ha, of which 12 691 ha of defoliation were attributed solely to the large aspen tortrix. This total, substantially higher than in 1990, is due to expansion of the forest tent caterpillar (Table 4). Aspen forest defoliation in Manitoba is

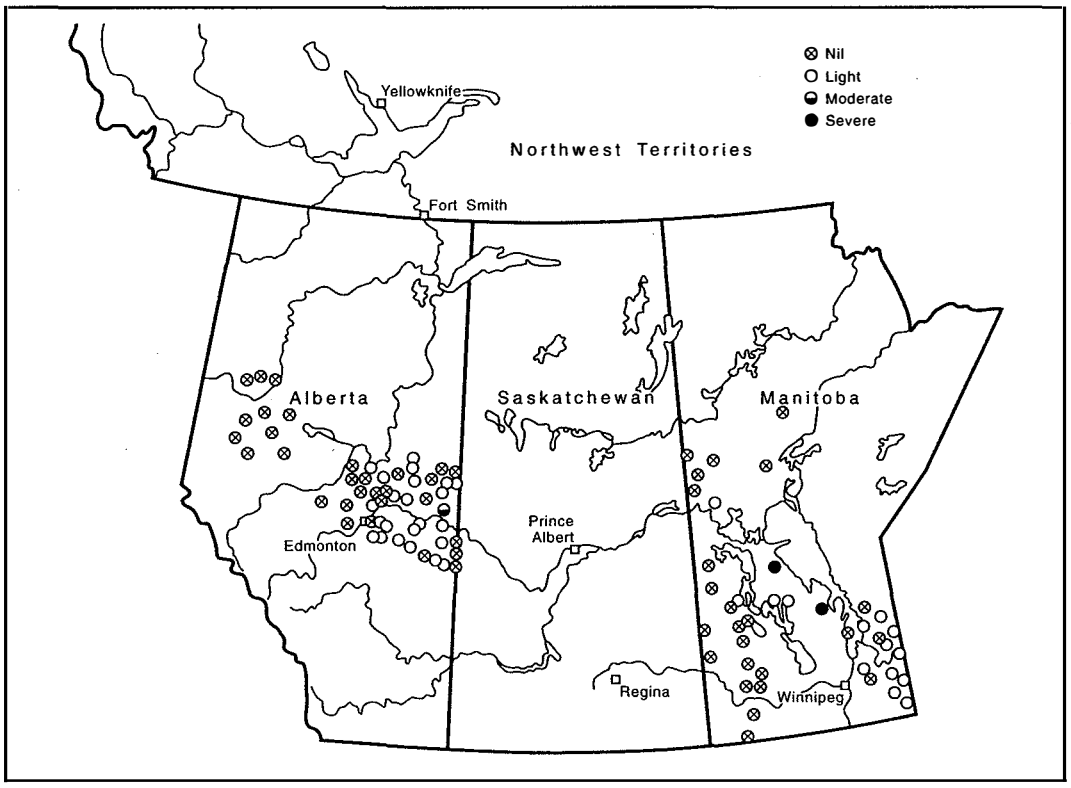

Figure 4. Predicted 1992 defoliation of aspen by the forest tent caterpillar, based on egg-band surveys.

summarized by forest section in Table 5 (see Figure 1 for locations). No suppression of populations by aerial spray applications was undertaken by the province.

Egg-band counts were made at 40 locations in Manitoba to predict the 1992 level of defoliation by the forest tent caterpillar (Fig. 4). Light defoliation is predicted for several of the sites, and severe defoliation at Centre Three Rivers and at Lake St. George.

The large aspen tortrix was present in north-central and northwestern Manitoba as well as in the Duck Mountain area, but the area of defoliation declined for the second consecutive year. No infestations of Bruce spanworm were reported in Manitoba.

No defoliation of aspen forests was reported in the **Northwest Territories** in 1991.

Table 5. Areas of aspen forests defoliated mostly by the forest tent caterpillar and large aspen tortrix in Manitoba in 1991, summarized by forest section areas and provincial forest management units

Forest section[a]	Management units	Defoliated area (ha)
Mountain	15[b]	5 180
Pineland	23	65
Lake Winnipeg East	30	1 166
	31	3 432
Interlake	40	17 742
	41	33 605
	46	2 072
Highrock	66[b]	4 403
Nelson River	83[b]	518
	89[b]	2 590

[a] Forest section areas of Manitoba are shown in Figure 1.

[b] Areas defoliated by the large aspen tortrix.

MOUNTAIN PINE BEETLE *Dendroctonus ponderosae* Hopk.

Infestations of the mountain pine beetle (MPB) were present in many of the same locations in **Alberta** as reported in 1990. Current endemic populations exist in southwestern Alberta, mostly within a few kilometres north and south of the Crowsnest Pass corridor, and in Cypress Hills Provincial Park in southeastern Alberta. Other areas are of concern because of the potential risk of MPB spreading eastward into Alberta from adjacent infestations in **British Columbia**. Known infestations in British Columbia that may contribute to this eastward spread exist in the Nelson Forest District, between Elkford and the United States border, in areas south of Banff National Park, in Kootenay and Yoho national parks, and in an area between Jasper National Park and Valemount, British Columbia.

In 1991, the Canadian Parks Service provided an aircraft and assisted in aerial surveys over Banff, Kootenay, and Yoho national parks to sketch-map established infestations in the latter two parks. A FIDS staff member from the Pacific Forestry Centre, Victoria, British Columbia assisted in this survey. The aerial survey included the Bow River valley corridor between Banff and Lake Louise, but did not include the southern portion of the park. No tree mortality attributable to MPB was observed in the park.

In Kootenay National Park, most of the 1991 infestations reported in previous years remained in the same locations in the southern half of the park (Fig. 5). There was, however, evidence of some spread north of Kootenay Crossing toward Mount Wardle, and northeastward for 8–10 km along the Vermilion River. A single patch of about 40 recently killed lodgepole pine (attacked in 1990) occurred within 1 km of Hector Gorge viewpoint. Three other infestations, each resulting in four or five dead trees, were distributed eastward from Hector Gorge viewpoint. There was no MPB brood survival at one of the sites. Numerous other small, scattered infestations (each with from one to five trees) occurred between Kootenay Crossing and the mouth of the Dolly Varden Creek. Elsewhere, the main infestation areas, with an estimated 10 000 recently killed trees, were located on the east side of the Kootenay River between Daer and Pitts creeks. Numerous similar patches, each consisting of 30 to 300 recently killed trees were scattered from

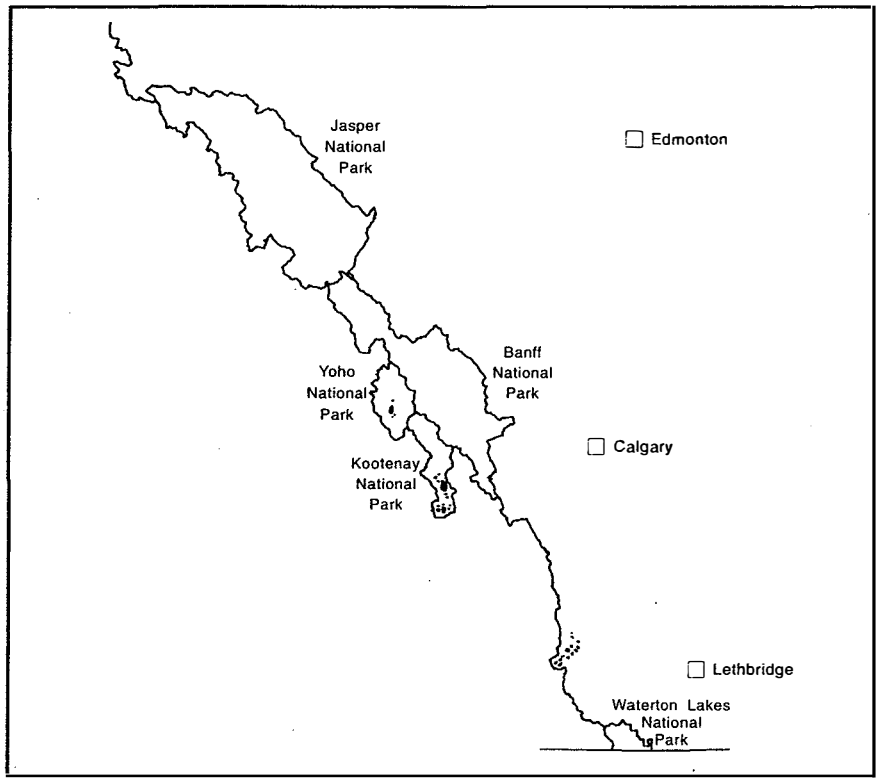

Figure 5. Areas of mountain pine beetle infestation in the Rocky Mountain national parks and southwestern Alberta in 1991.

south of Pitts Creek to the southern end of the park (for an estimated total of 2000 dead trees).

Other major infestations, with a total of about 4000 recently killed trees, occurred from Radium Hot Springs eastward to the Kootenay River, and especially along Kimpton Creek valley. In total, there was an estimated 15 000 to 20 000 recently killed lodgepole pine in the park, representing a 20–30% increase over 1990.

In Yoho National Park, there were several small, scattered patches (one to three trees) of tree mortality between Emerald Lake and the mouth of the Ottertail River, totaling less than 50 recently killed trees. The largest infestation of about 130 trees occurred adjacent to Field. A single MPB-killed tree was also found at Wapta Lake, within 4–5 km of Banff National Park; there was evidence that this tree was attacked in 1989 and successful broods of MPB were produced in 1990.

Ground surveys were made in Jasper National Park, but no tree mortality was attributed to MPB. A lodgepole pine, recently killed near Jasper Park Lodge, was attributed to the pine engraver (*Ips pini* [Say]), probably as a result of the population buildup of this species in adjacent recent blowdowns.

The Alberta Forest Service deployed semiochemical[2] tree baits for MPB at 19 sites in the southern Bow–Crow Forest District and at two sites on the east side of Spray Reservoir.[3] The baited sites in the southern Bow–Crow Forest District extended over a 60-km area along the Alberta–British Columbia border, from Byron Creek northward along the Oldman River, including three sites in the Porcupine Hills. Mountain pine beetle attacks occurred at 18 of the sites, but the attacks were most abundant at five sites between Coleman and the British Columbia border. A total of 40 trees (baited and adjacent unbaited) were attacked at these five sites, three of which had live larvae present. Dead larvae were found at a number of other sites; the early-winter larval mortality in 1991 was believed to be due to the minimum temperatures of -26°C recorded in October. All trees with brood present were either debarked or cut down and burned. It is anticipated that the program of semiochemical tree baiting will continue in 1992. At the two sites on the east side of the Spray Reservoir, MPB adults attacked all six baited trees. The attacks were hand-treated by removal of the bark around each egg gallery.

[2] Semiochemicals are compounds involved in the chemical interaction between organisms. They are message-bearing or behavior-modifying chemicals such as pheromones, allelochemicals, and kairomones produced by organisms or plants.

[3] Personal communication, 1991, from H. Ono, Manager, Insects and Diseases Programs, Alberta Forestry, Lands and Wildlife, Edmonton, Alberta.

Semiochemical tree baits were again deployed in the Cypress Hills of Alberta and **Saskatchewan,** by Alberta Recreation and Parks (201 baits at 67 locations on the Alberta side) and by Saskatchewan Parks and Renewable Resources (100 baits at 50 locations throughout the central and western blocks). No MPB attacks were found on the Saskatchewan side of the provincial border, but 18 attacks on 14 trees at 12 of the bait locations were recorded on the Alberta side. All galleries were destroyed and there appeared to be no successful brood development. The tree bait results suggest that an endemic population is surviving in weakened and dying trees. Aerial surveys conducted by Alberta Recreation and Parks indicated two recently killed trees, but MPB was not implicated. On the Saskatchewan side, the death of one tree was attributed to the pine engraver. A similar surveillance program is planned for 1992.

SPRUCE BEETLE
Dendroctonus rufipennis (Kirby)

In **Alberta,** the Alberta Forest Service conducted an aerial survey to monitor the spruce beetle over mature white spruce forests in the Footner Lake Forest District. This survey included ground examinations along the Chinchaga River and on Watt Mountain to examine possible spruce beetle infestations. Some tree mortality, attributed in part to the spruce beetle, occurred on Watt Mountain, while some 1990 and 1991 attacks were common in recent blowdown and on some live standing trees along the Chinchaga River. Semiochemical tree baits for the spruce beetle were deployed in a stand slated for 1991–92 harvesting at one of the sites near the Chinchaga River. Over half of the baited trees sustained heavy spruce beetle attacks, which suggests that populations are relatively high. Population buildup in this area is probably due to recent blowdown, residual slash in adjacent logged-over areas, and stressed trees weakened by several years of spruce budworm defoliation.

A high population of spruce beetle exists in a mature white spruce forest in the Peace River Forest District, 50 km north of Manning. Mortality of live standing trees was noted in the area during 1990 and 1991, and can be attributed in part to a storm that damaged trees in late May 1989. Trees that had broken tops became infested by the spruce beetle in 1989 and 1990, and the result was a substantial population buildup in 1991. Semiochemical baits, which have been deployed in this location annually since 1987, reflected an increasing population trend. A portion of the stand was scheduled for harvest in 1991–92.

A small area of recent white spruce mortality, probably due to spruce beetle, was noted in the Grande Prairie Forest District, near Two Lakes.

WOOD BORERS
Whitespotted sawyer, *Monochamus scutellatus* (Say)
Northern spruce borer, *Tetropium cinnamopterum parvulum Casey*

A number of client requests were received in **Alberta** and **Saskatchewan** in 1991 regarding problems related to wood borer species. Many of these problems were investigated on site.

In **Alberta,** a mature white spruce stand was examined along the Chinchaga River in an attempt to identify the source of a high population of the northern spruce borer that had caused considerable degrade of sawlog material at a mill in High Level. The source of the population could not be identified.

Three other mill sites, near Fort Assiniboine, in Blue Ridge, and near Grande Prairie, were visited to identify and confirm wood borer species in decked white spruce logs. A sawyer beetle,

probably the whitespotted sawyer, was confirmed at all three sites as the main wood borer species. Most of the problem resulted from logs being held over a second summer after harvesting, allowing sawyer beetle larvae to establish extensive tunnels in the wood. A similar problem involving sawyer beetle infestations in winter-cut white spruce and jack pine was identified in sawlog material at Fort McMurray and in **Saskatchewan**, at Kamsack.

Twelve client calls were concerned with the export of lumber to European markets and the restrictions and risks related to infection by the pinewood nematode (*Bursaphelenchus xylophilus* [Steiner & Buhrer] Nickle) and its main vectors, the *Monochamus* species.

In southeastern **Manitoba**, high populations of the whitespotted sawyer beetle that were reported had probably built up in forests killed by fire in 1989, as well as in trees killed recently by the spruce budworm. The mortality of standing trees around the periphery of recent clearcuts on the Abitibi-Price F.M.L. was attributed to accumulated feeding injury by the adult sawyer beetle. Some of the losses due to the wood borer were minimized by salvage harvesting. Similar tree injury due to sawyer beetles was reported in northwestern Manitoba.

DUTCH ELM DISEASE
Ophiostoma ulmi (Buis.) Nannf.

In **Alberta**, surveys to detect the incidence of Dutch elm disease (DED) were conducted by the staff of Alberta Agriculture. There were no reports of the disease in the province.

In **Saskatchewan**, 92 DED-infected elm trees were identified and removed in 1990 from one location south of Estevan, and an additional 3000 high-hazard trees were identified for subsequent removal. In 1991, aerial and ground surveys conducted by Saskatchewan Parks and Renewable Resources were expanded, and this resulted in the identification of several new infestations (Fig. 6). Many newly DED-infected trees were identified along the Souris River, along major creeks in southeastern Saskatchewan to the United States border, and along Pipestone Creek and the Qu'Appelle River. Two DED-infected trees were confirmed near Spy Hill in southeastern Saskatchewan. Three other large areas of infected trees were discovered along the Carrot River valley, near the Manitoba border west of The Pas, and along the Saskatchewan River Old Channel west to Cumberland House, where diseased and dead elms extended for about 30, 8, and 30 km, respectively. It was speculated that DED may have invaded these locations as early as 1987.

Two additional locations of DED were confirmed: one along Wascana Creek, 8 km west of Regina (125 infected elms), and the other in the town of Shaunavon (3 infected elms).

Staff of Saskatchewan Parks and Renewable Resources, in cooperation with staff of urban parks and the Prairie Farm Rehabilitation Administration, distributed over 100 pheromone-baited traps attractive to the smaller European elm bark beetle (*Scolytus multistriatus* [Marsham]), a vector of DED; however, all of the infections in Saskatchewan were probably vectored by the native elm bark beetle (*Hylurgopinus rufipes* [Eichhoff]), because it is native to Canada and its distribution coincides with that of the native elm. Other strategies initiated by Saskatchewan Parks and Renewable Resources to combat the spread of DED and control it included the preparation of DED displays, production of media advertisements for public awareness, placement of highway signs to discourage transportation of infected wood, presentation of field workshops, and preparation of DED brochures.

In **Manitoba**, DED surveys were undertaken, on a cost-shared basis, between Manitoba Natural Resources and various communities in the province, as well as municipalities surrounding the city of Winnipeg. The cost-shared program included sanitation pruning, basal spraying with insecticide to reduce beetle vector populations, and replacement plantings. The "Elm Guard Program" was established, with a volunteer group assisting in the detection of DED-infected elms.

In the provincial survey, 9500 elm trees were marked for removal, of which 700 were DED-infected. In Winnipeg a total of 5843 trees were slated for removal, 1096 of which were confirmed as positive for DED. The infection rate in both Winnipeg and Brandon remained at about 2%.

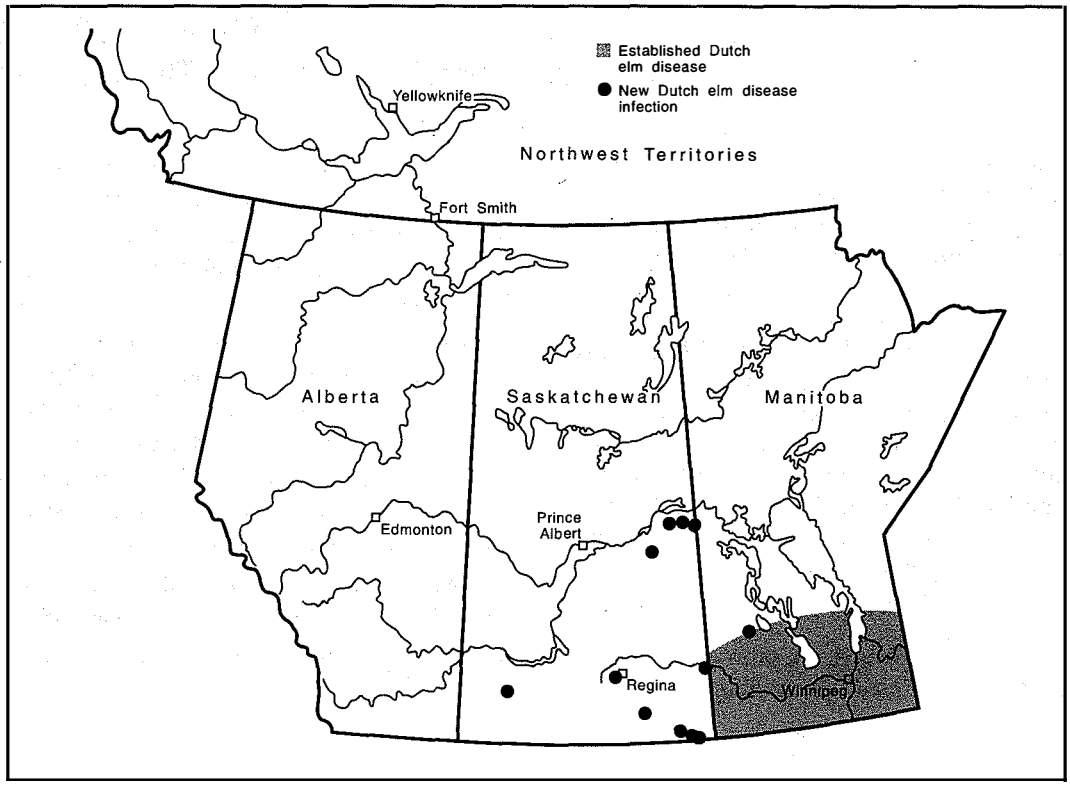

Figure 6. Established areas of Dutch elm disease in Manitoba in 1991, and new infections identified in Saskatchewan and Manitoba in 1991.

Dutch elm disease is now firmly established in most of southern Manitoba, including such urban centers as Brandon, Portage La Prairie, Morden, Winkler, Dauphin, Steinbach, and Selkirk; many of these urban centers experienced increases in 1991 in DED-infected trees. It is also found in Riding Mountain National Park along the Wilson, Vermilion, and Ochre rivers, and along the Red, Assiniboine, Boyne, and Souris rivers. Figure 6 indicates the general area of known DED infections in Manitoba, including one new infection at Valley River, north of Dauphin.

GYPSY MOTH
Lymantria dispar L.

There was an increase in 1991 in the number of male gypsy moths captured in pheromone-baited traps placed at various locations in the three prairie provinces by Agriculture Canada.[4] Five single gypsy moth captures were recorded in **Manitoba**, at Caddy Lake in Whiteshell Provincial Park, near Sidney and Austin, and in and near Portage La Prairie. In 1990 only one male moth had been captured in Whiteshell Provincial Park. In addition, four captured gypsy moths were confirmed in 1991 in **Saskatchewan** and **Alberta**: one in Moose Jaw, two in Calgary and one in Drumheller. Intensive surveys to detect egg masses at each of these locations are planned for the early spring of 1992 by Agriculture Canada.

[4] Personal communication, 1991, from H. Koga, Agriculture Canada, Food Production and Inspection Branch, Edmonton, Alberta.

PINE NEEDLE CAST
Lophodermella concolor (Dearn.) Darker

Pine needle cast, a virulent fungal disease caused by *L. concolor*, was reported to be causing foliage discoloration of lodgepole pine over extensive areas along the foothills of southwestern **Alberta**. Areas most severely affected in 1991 extended from north of Rocky Mountain House southward to Waterton Lakes National Park, and included portions of the Porcupine Hills. Other areas of lodgepole pine less severely affected occurred in Banff National Park near Lake Minnewanka and Saskatchewan River Crossing, and in Jasper National Park. A needle cast disease, *Lophodermella arcuata* (Darker) Darker was also identified on limber pine in the Porcupine Hills.

Some mortality of lodgepole pine was noted in young stands that had been thinned and fertilized near Sundre, Alberta; the mortality was attributed in part to *L. concolor* infections during the previous two or more years. While *L. concolor* is not known to cause the direct mortality of lodgepole pine, it is suspected of causing significant increment loss, and has the potential to cause mortality if infection persists for several consecutive years. This disease was reported to be common at a number of locations in western Alberta in 1987 and 1988; in 1990 it was found throughout central and southern Alberta, where it caused infections on shelterbelt and ornamental pines, as well as in forested areas throughout the Alberta foothills. Over the years, *L. concolor* has consistently been the most important of the needle cast diseases on lodgepole pine.

PESTS AND DAMAGE CONDITIONS IN YOUNG STANDS

In 1991 a number of young, high-value, coniferous stands, including seed orchards and genetic improvement plantations, were surveyed for insects, diseases, and other damage agents. These are summarized by province in Table 6.

Table 6. Summary of important insects, diseases, and other agents causing injury to young, high-value, coniferous stands in Alberta and Manitoba in 1991

Damage agent	Province(s)	Tree species	Remarks
Animal browse (probably snowshoe hare and ungulates)	Manitoba	Jack pine Red pine White spruce Black spruce	Light browse injury in several plantations in the Nelson River, Lake Winnipeg East, and Pineland forest sections, and in the Turtle Mountains.
Armillaria root rot *Armillaria* spp.	Manitoba	Jack pine	Mortality of scattered, individual trees in several plantations in the Lake Winnipeg East and Pineland forest sections.
Comandra blister rust *Cronartium comandrae* Pk.	Alberta	Lodgepole pine	Low incidence of tree mortality in the Huallen Seed Orchard, near Grande Prairie.

Table 6. Continued

Damage agent	Province(s)	Tree species	Remarks
Diplodia canker *Diplodia pinea* (Desm.) Kickx	Manitoba	Red pine	Numerous dead and dying trees in the Pineland Forest Section.
Eastern pine shootborer *Eucosma gloriola* Heinrich	Manitoba	Jack pine	Shoot kill common in plantations in the Pineland Forest Section.
Frost injury	Alberta	White spruce	Planted spruce (up to 3 m tall) in a plantation in the Footner Lake Forest District dying from basal stem canker and resin bleeding symptoms believed to be due to frost injury.
Jack pine sawfly *Neodiprion maurus* Rohwer	Manitoba	Jack pine	Light-to-moderate defoliation in plantations in the Pineland Forest Section.
Northern pitch twig moth *Petrova albicapitana* (Busck)	Alberta	Lodgepole pine Jack pine Scots pine	Occasional pitch blisters on plantation-grown trees at the Pine Ridge Forest Nursery, near Smoky Lake. A 14.9% incidence of blisters on lodgepole pine in the Huallen Seed Orchard, near Grande Prairie.
Pitch mass borer *Synanthedon pini* (Kellicott)	Alberta Manitoba	Lodgepole pine Jack pine	A *Synanthedon* sp. found in the Pine Ridge Forest Nursery in Alberta. Low incidence of injury in the Pineland Forest Section in Manitoba.
Rodent girdling (mouse)	Alberta	Siberian larch	Girdling of the lower stem caused a low incidence of tree mortality in a plantation, and in Footner Lake Forest District.
Root collar weevils *Hylobius radicis* Buchanan *H. warreni* Wood	Alberta Manitoba	Lodgepole pine Scots pine	Considerable tree mortality in the Pineland Forest Section, Manitoba, due to *H. radicis*. Up to 5% mortality in genetic plantations in the Grande Prairie Forest District, Alberta, due to *H. warreni*.
Root deformation	Alberta Manitoba	Lodgepole pine Jack pine	J-root and club or deformed root condition (generally associated with container-grown seedlings or poor planting technique) in the Grande Prairie Forest District, Alberta, and in several plantations in the Pineland Forest Section, Manitoba.

Table 6. Concluded

Damage agent	Province(s)	Tree species	Remarks
Spruce cone rust *Chrysomyxa pirolata* Wint.	Alberta	White spruce	Moderate incidence of infected cones on genetically selected, planted trees at the Pine Ridge Forest Nursery, near Smoky Lake.
Western gall rust *Endocronartium harknessii* (J.P. Moore) Y. Hiratsuka	Alberta Manitoba	Lodgepole pine Jack pine	Main stem and branch gall infections in plantations in the the Grande Prairie Forest District, Alberta, and in the Lake Winnipeg East and Pineland forest sections, Manitoba.
White pine weevil *Pissodes strobi* (Peck)	Alberta	White spruce Lodgepole pine	Moderate incidence of top kill to white spruce grown in a seed orchard at the Pine Ridge Forest Nursery, near Smoky Lake, and in a plantation of white spruce in the Footner Lake Forest District. Single lodgepole pine at the Pine Ridge Forest Nursery also attacked by *P. strobi*.
Yellow-bellied sapsucker *Sphyrapicus varius varius* (L.)	Alberta Manitoba	Lodgepole pine Jack pine	Girdling-type injury at the Pine Ridge Forest Nursery, Alberta, and in a plantation in the Pineland Forest Section, Manitoba.
Yellowheaded spruce sawfly *Pikonema alaskensis* (Rohwer)	Alberta Manitoba	White spruce	Light-to-severe defoliation levels in spruce genetic plantings at the Pine Ridge Forest Nursery, Alberta, and in a plantation in the Pineland Forest Section, Manitoba.

ACID RAIN MONITORING

The Acid Rain National Early Warning System (ARNEWS) was established in 1984 to detect early signs of acid rain injury to forests. Twelve permanent sampling-plots were established in the Northwest Region: five in Alberta, three in Saskatchewan, and four in Manitoba. One of the plots (Plot 804), identified as Suwannee River, Manitoba, was destroyed by fire and a replacement plot (Plot 813) was established near Leaf Rapids, Manitoba, in 1990. The ARNEWS plots in the Northwest Region are part of a permanent nationwide network of plots where changes in soil, minor vegetation, tree condition, tree growth, and insect and disease incidence are detected and monitored.

In 1991, all of the 12 regional plots were visited once. All plots were assessed for pest damage and acid rain symptoms and Forms 4, 7, and 8 or 9 (Magasi 1988) were completed. Radial growth increment cores that had been collected in 1990

were measured, and this growth increment data and the forms completed in 1991 were submitted to the Petawawa National Forestry Institute for analysis.

No injury attributable to acid rain symptoms was identified in any of the plots in 1991.

As part of a new national proposal for biomonitoring, under the Green Plan, to increase the network of ARNEWS plots, six new plot locations were selected in the Northwest Region. Four new plots were established in aspen–spruce sites, two in **Alberta**, (one each in the Slave Lake and Footner Lake forest districts), and two in the **Northwest Territories**. A fifth plot was established in a jack pine site in **Saskatchewan**, near Shellbrook. The sixth plot will be established in the spring of 1992 in a jack pine forest in **Manitoba**, near Flin Flon.

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APPENDIX

NOTEWORTHY INSECTS, DISEASES, AND OTHER DAMAGE AGENTS

Insect, disease, or damage agent	Host	Location	Remarks
American aspen beetle *Gonioctena americana* (Schaeffer)	Aspen	Manitoba	Moderate populations near Gypsumville.
Armillaria root rot *Armillaria ostoyae* (Romag.) Herink	Aspen Pine spp. Spruce	Alberta Saskatchewan Manitoba NWT	Infection centers found throughout most of the region. Up to 25% tree mortality in planted and natural red pine regeneration in Manitoba in 1991.
Aspen leaf beetle *Chrysomela crotchi* Brown	Aspen	Alberta Manitoba	Low populations and light skeletonizing injury in the Smoky Lake–Bonnyville area, Alberta, and at Homebrook, Manitoba.
Aspen leafroller *Pseudexentera oregonana* (Walsingham)	Aspen	Manitoba	Moderate-to-severe defoliation near Gypsumville.
Aspen twoleaf tier *Enargia decolor* (Walker)	Aspen	Manitoba	Very light defoliation at West Hawk Lake in Whiteshell Provincial Park.
Atropellis canker *Atropellis piniphila* (Weir) Lohman & Cash	Pine	Alberta Saskatchewan	Stands with moderate-to-severe infections in Waterton Lakes National Park, in the Cypress Hills Provincial parks in Alberta and Saskatchewan, and along the foothills northward to Jasper National Park.
Balsam fir mortality	Balsam fir	Alberta Saskatchewan Manitoba	Patches of single and multiple tree mortality in the Slave Lake, Lac La Biche, and Athabasca forest districts in Alberta, within the Weyerhaeuser Canada Ltd. lease area in Saskatchewan, and in eastern Manitoba. Mortality within stands and at stand margins of all sizes, on dry-to-moist sites. No single causal agent identified.

NOTEWORTHY INSECTS, DISEASES, AND OTHER DAMAGE AGENTS, continued

Insect, disease, or damage agent	Host	Location	Remarks
Birch leaf miners *Fenusa pusilla* (Lep.) *Profenusa thompsoni* (Konow)	Birch	Alberta	Light-to-severe leaf mining throughout most of central and northern Alberta, with moderate-to-severe infestations near Slave Lake.
Birch skeletonizer *Bucculatrix canadensisella* Chambers	Birch	Alberta	Moderate-to-severe skeletonizing along the Wapiti River south of Grande Prairie, and in the Swan Hills.
Black knot of cherry *Apiosporina morbosa* (Schw.) Arx	May Day Choke cherry	Alberta Saskatchewan Manitoba	Common in native stands of choke cherry throughout the region, and on some urban plantings of both hosts.
Blotch miner of aspen *Phyllonorycter* nr. *salicifoliella* (Chambers)	Aspen	Manitoba	Extensive leaf mining injury in the Dauphin–Swan River area.
Blowdown	Several species	Alberta Saskatchewan	About 450 ha of forested area blowdown due to severe storms within the Weyerhaeuser Canada Ltd. lease area in Saskatchewan. Another area of blowdown, of unknown acreage, between Valleyview and Grande Prairie.
Bronze birch borer *Agrilus anxius* Gory	Birch	Manitoba	Top die-back of birch at scattered locations in southern Manitoba.
Cankerworms *Alsophila pometaria* (Harris) *Paleacrita vernata* (Peck)	Elm Manitoba maple Green ash	Alberta Saskatchewan	Moderate infestations in southern areas of both provinces, and as far north as Edmonton and Saskatoon.
Chemicals	All species	Alberta Saskatchewan	Misuse of soil sterilants, and herbicides in urban and rural areas contributed to mortality of ornamental trees and shrubs. Deicing salt applied to roadways also killed roadside native- grown conifers.

NOTEWORTHY INSECTS, DISEASES, AND OTHER DAMAGE AGENTS, continued

Insect, disease, or damage agent	Host	Location	Remarks
Deodar weevil *Pissodes nemorensis* Germ.	Pine	Alberta	Several collections from pine regeneration, in Jasper National Park, and on a plantation-grown spruce near Meadow River.
Douglas-fir beetle *Dendroctonus pseudotsugae* Hopkins	Douglas-fir	Alberta	About 50 Douglas-fir trees killed by the Douglas-fir beetle near Jasper Park Lodge and Jasper townsite.
Drought	Aspen	Alberta	Browning of foliage on aspen clones after mid-July in the Grande Prairie to Valleyview areas.
Dwarf mistletoe *Arceuthobium americanum* Nutt. ex Engelm.	Pine	Alberta Saskatchewan Manitoba	Important cause of degrade and mortality in commercial pine stands in the region. An intensive survey of jack pine stands, completed by MNR, indicated substantial volume losses due to dwarf mistletoe.
Eastern pine shootborer *Eucosma gloriola* Heinrich	Jack pine	Manitoba	Increased incidence in plantations and natural regeneration of jack pine.
False tinder conk *Phellinus tremulae* (Bond.) Bond. & Boriss.	Aspen	Alberta Saskatchewan	Common in aspen throughout the region.
Fire blight *Erwinia amylovora* (Burr.) Winsl. et al.	Mountain-ash Wild plum	Manitoba	Fairly heavy infections in the Town of Stonewall.
Frost damage	Aspen Birch	Saskatchewan	Defoliation of both species over several hundred hectares, resulting from severe August frost, near Bainbridge Junction on Highway 9.
Fusarium root rot *Fusarium* spp.	Pine Spruce	Alberta Saskatchewan Manitoba	Incidence of Fusarium root rot becoming more common in both bare-root and container-grown stock produced in Northwest Region nurseries.

NOTEWORTHY INSECTS, DISEASES, AND OTHER DAMAGE AGENTS, continued

Insect, disease, or damage agent	Host	Location	Remarks
Gall mite on elm *Aceria ulmi* (Garman)	Elm	Manitoba	Galls on elm leaves common at many locations.
Gray willow leaf beetle *Tricholochmæa decora* (Say)	Willow	Alberta Saskatchewan	Light-to-moderate defoliation throughout most of the northern and central parts of both provinces. More severe defoliation along many watercourses.
Hail damage	Pine	Alberta	Moderate hail damage to an estimated 200 ha of timber in the Edson area.
Hypoxylon canker *Hypoxylon mammatum* (Wahl.) J.H. Miller	Aspen	Alberta Saskatchewan Manitoba	Common in aspen stands throughout the central part of the region.
Larch sawfly *Pristiphora erichsonii* (Hartig)	Larch	NWT	Scattered light infestations in the Fort Smith and Fort Simpson areas.
Leaf spot of poplar *Marssonina balsamiferae* Y. Hirat.	Poplar	Manitoba	Common in the area between Dauphin and Swan River.
Leaf rust of aspen *Melampsora medusae* Thuem.	Aspen	Manitoba	Light rust injury in Duck Mountain Provincial Park.
Leucostoma canker of spruce *Leucostoma kunzei* (Fr.) Munk ex Kern	White spruce	Manitoba	Branch and stem cankers on shelterbelt-grown spruce in southern Manitoba.
Lodgepole terminal weevil *Pissodes terminalis* Hopping	Jack pine Lodgepole pine	Alberta	Incidence of top kill at 0.1–4.0% in west-central Alberta.
Northern lodgepole needleminer *Coleotechnites starki* (Freeman)	Pine	Alberta	An increase in needle browning (compared to the 1990 level) at Saskatchewan River Crossing and north to the Weeping Wall in Banff National Park. Some light needle mining in Cypress Hills Provincial Park.
Oak lace bug *Corythuca arcuata* (Say)	Bur oak	Manitoba	Mottling of the leaves common in the Grand Beach area.

NOTEWORTHY INSECTS, DISEASES, AND OTHER DAMAGE AGENTS, continued

Insect, disease, or damage agent	Host	Location	Remarks
Pine needle scale *Chionaspis pinifolia* (Fitch)	Pine Spruce	Manitoba	Infestations common in many shelterbelts.
Poplar borer *Saperda calcarata* Say	Aspen	Alberta Saskatchewan	Common in residual trees along fence lines, and around the margins of clearings in agricultural areas.
Red belt	Pine	Alberta NWT	Significant red belt injury near Athabasca and Sunwapta falls, in Jasper National Park, in numerous patches in Nahanni National Park, NWT (on Yohin Ridge and throughout the canyon on south-facing slopes) and on the west slope of Pointed Mountain, NWT.
Red turpentine beetle *Dendroctonus valens* LeConte	Red pine	Manitoba	Infestations common in weakened and dying trees in the Sandilands area.
Spearmarked black moth *Rheumaptera hastata* (Linnaeus)	Birch	Manitoba	Moderate-to-severe defoliation near Leaf Rapids.
Speckled green fruitworm *Orthosia hibisci* (Guenée)	Aspen	Manitoba	Light defoliation near Gypsumville.
Spruce bud midge *Rhabdophaga swainei* Felt	Spruce	Alberta	Incidence of bud damage common in native stands, plantations, and ornamentals throughout the province.
Spruce cone rust *Chrysomyxa pirolata* Wint.	Spruce	Alberta	Up to 50% loss of white spruce cones in cone collections made in the Lac La Biche and Athabasca forest districts.
Spruce gall aphid *Adelges lariciatus* (Patch)	Spruce	Alberta	Moderate-to-severe infestations on ornamentals and open-grown trees in most of north-central Alberta.
Spruce needle rust *Chrysomyxa ledicola* Lagh.	Spruce	Alberta	Light-to-moderate rust infections on trees north of Mariana Lake in the Athabasca Forest District, a decline from 1990.

NOTEWORTHY INSECTS, DISEASES, AND OTHER DAMAGE AGENTS, continued

Insect, disease, or damage agent	Host	Location	Remarks
Spruce spider mite *Oligonychus ununguis* (Jacobi)	Spruce Pine Douglas-fir	Alberta Manitoba	Infestations not as severe as in previous years in Alberta but common in Manitoba.
Squirrel damage	Pine	Alberta NWT	Red branch tips (flagging), resulting from cone clipping, on trees in the Rocky Mountain national parks in Alberta, and in Wood Buffalo Park near Fort Smith, NWT.
Stalactiform blister rust *Cronartium coleosporioides* Arth.	Pine	Alberta	Common in Jasper National Park and near Saskatchewan River Crossing in Banff National Park.
Tussock moth on aspen *Dasychira vagans* (Barnes & McDunnough)	Aspen	Manitoba	Light defoliation near Gypsumville.
Twig blight *Venturia macularis* (Fr.) E. Müller & Arx *Venturia populina* (Vuill.) Fabric.	Aspen Poplar	Alberta	Level of incidence moderate-to-severe in patches throughout central and southern Alberta.
Verticillium wilt *Verticillium albo-atrum* Reinke & Berth.	Elm	Alberta	One infected elm found in the City of Edmonton.
Warren rootcollar weevil *Hylobius warreni* Wood	Pine	Alberta	Common problem in plantations in the Swan and Virginia hills areas; also found in plantations in the Nose Mountain area southwest of Grande Prairie.
Weevil on elm *Magdalis armicollis* (Say)	Elm	Saskatchewan	Breeds under the bark of recently dead or dying elms. Adult weevils reared from branches collected at the University of Saskatchewan, Saskatoon. Up to 10% of the campus trees apparently affected.
Western gall rust *Endocronartium harknessii* (J.P. Moore) Y. Hiratsuka	Pine	Alberta Saskatchewan Manitoba	Common in pine stands throughout most of the province.

NOTEWORTHY INSECTS, DISEASES, AND OTHER DAMAGE AGENTS, concluded

Insect, disease, or damage agent	Host	Location	Remarks
Western ash bark beetle *Hylesinus californicus* (Swaine)	Ash	Alberta	A continuing pest of ornamental ash grown in urban centers, such as Calgary and Lethbridge.
White pine weevil *Pissodes strobi* (Peck)	Pine Spruce	Alberta Saskatchewan Manitoba	Common problem throughout the region, particularly in plantations and in some regeneration areas.
Winter storm damage	All species	Alberta Saskatchewan	Severe damage in the form of bent trees and broken stems and branches in the Lloydminster area, resulting from sub-zero temperatures and heavy snow in late April and early May.
Yellow-bellied sapsucker *Sphyrapicus varius varius* L.	Many species	Alberta Saskatchewan Manitoba NWT	Incidence of stem injury becoming more common on ornamental trees throughout the region.
Yellowheaded spruce sawfly *Pikonema alaskensis* (Rohwer)	Spruce	Alberta	General decline in defoliation incidence in the central and northern parts of the province. Damage still severe in the urban centres of Lethbridge and Medicine Hat, and in the Cypress Hills Provincial Park. Some damage to commercially grown Christmas trees reported by the Alberta Forest Service.
Yellow witches' broom *Chrysomyxa arctostaphyli* Diet.	Spruce	Alberta	Common on mature spruce throughout the province.