FOREST INSECT AND DISEASE CONDITIONS IN ALBERTA, SASKATCHEWAN, MANITOBA, AND THE NORTHWEST TERRITORIES IN 1987

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ABSTRACT

Forest pest conditions in Alberta, Saskatchewan, Manitoba, and the Northwest Territories during 1987 are summarized, and some predictions of infestation status are given for 1988. Eight major pests are discussed, and additional noteworthy insects, diseases, and other tree damage agents are reported in a table. Results of surveys for acid rain symptoms, pests and damage incidence in nurseries and plantations, and climatic injury to trees are also reported.

RESUME

Les auteurs présentent un résumé de la situation relative aux insectes et aux maladies observés dans les forêts de l'Alberta, de la Saskatchewan, du Manitoba et des Territoires du Nord-Ouest en 1987 en plus de formules certaines prévisions pour 1988. Huit ravageurs importants sont examinés, et les données sur d'autres insectes, maladies et agents de destruction des arbres dignes de mention sont présentées dans un tableau. Des détails sont également donnés sur les résultats de relevés portant sur les symptômes reliés aux pluies acides, sur les agents nuisibles et l'incidence des dommages dans les pépinières et les plantations ainsi que sur les dégâts d'origine climatique subis par les arbres.

CONTENTS

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

This report summarizes forest insect and disease conditions in Alberta, Saskatchewan, Manitoba, and the Northwest Territories in 1987 and provides some predictions of infestation levels for 1988. Within the region, survey detection, monitoring, and recording functions were conducted by Forest Insect and Disease Survey (FIDS) staff at the Northern Forestry Centre (NoFC), Forestry Canada (then the Canadian Forestry Service), in cooperation with personnel from provincial parks, major cities, and forest industries in the region, and the following major federal and provincial agencies:

Agriculture Canada
Alberta Agriculture
Alberta Forestry, Lands and Wildlife
Indian and Northern Affairs Canada
Manitoba Agriculture
Manitoba Natural Resources
Parks Canada
Saskatchewan Agriculture
Saskatchewan Parks, Recreation and Culture

In addition, much of the annual planning and review of regional survey requirements is accomplished through discussions with representatives acting on behalf of many of the above agencies. The cooperation and contributions provided by these agencies are gratefully acknowledged.

Appreciation is also extended to FIDS staff at Forestry Canada headquarters in Ottawa for overall coordination, to FIDS staff in the adjacent provinces of British Columbia and Ontario for additional information along provincial boundaries, and to Forestry Canada staff of the FIDS Technology Development Project at the Petawawa National Forestry Institute for FIDS data management and training services.

In 1984–85 the federal government entered into forestry development agreements with the provinces of Manitoba, Saskatchewan, and Alberta. Provision was made under each agreement to support insect and disease survey services; these services have enhanced the FIDS program in each province. We acknowledge the contributions provided by those directly involved under these agreements, namely Peter Amirault (Edmonton), Marilyn Daoust-Savoie (Winnipeg), and Jan Volney (Edmonton).

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The following descriptions of pests are arranged more or less according to national and regional importance. Comments on other noteworthy insects, diseases, and other tree-damaging agents appear on pages 18–25.

SPRUCE BUDWORM
Choristoneura fumiferana (Clem.)

The areas of moderate-to-severe spruce budworm infestation decreased in Manitoba and the Northwest Territories but increased in Saskatchewan and Alberta in 1987 (Fig. 1). These infestations were scattered over an area of 55 530 ha compared to 66 208 ha in 1986 (Table 1). An additional 12 290 ha of light-to-moderately defoliated stands occurred in northwestern Alberta and the Northwest Territories. Small-scale control operations were conducted against the spruce budworm using the biological insecticide *Bacillus thuringiensis*. Areas treated were high-value sites in Big Knife Provincial Park, near Millet and Morningside, Alberta, and at Dorothy and Falcon lakes in Whiteshell Provincial Park, Manitoba.

Manitoba: A decline in areas defoliated by the spruce budworm occurred for the second consecutive year in 1987. Moderate-to-severe defoliation of white spruce and balsam fir was mapped over 15 540 ha compared to 34 318 ha in 1986, a reduction of 55%. Nearly all areas infested occurred in the southeastern part of the province, with the highest populations and largest increase in defoliated areas in Whiteshell Provincial Park. The total areas of moderate-to-severe defoliation in 1987 by provincial forest sections[1] were as follows:

Pineland	259 ha
Lake Winnipeg East	14 504 ha
Interlake	777 ha
Total	15 540 ha

[1] Forest sections are administrative units of the Manitoba Department of Natural Resources.

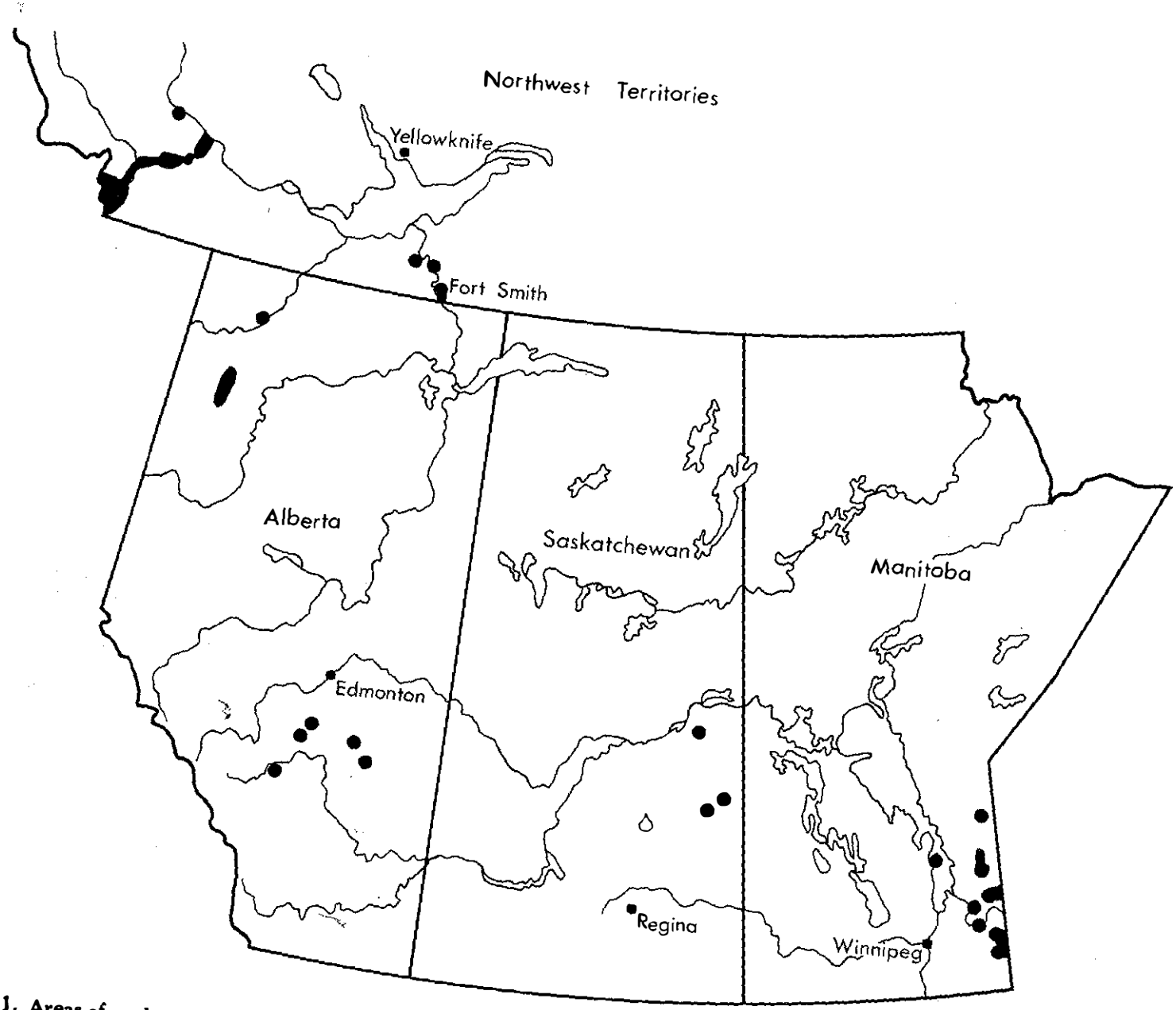

Figure 1. Areas of moderate-to-severe defoliation by the spruce budworm in 1987.

Table 1. Summary of moderate-to-severe defoliation by the spruce budworm sketch-mapped from aerial surveys in 1986 and 1987

Area	Area of defoliation[a] (ha)		
	1986	1987	Change
Manitoba	34 318	15 540	−18 778
Saskatchewan	18 500	31 600	+13 100
Alberta	390	5 790	+5 400
Northwest Territories	13 000	2 600	−10 400
Total	66 208	55 530	−10 678

[a] Areas of light-to-moderate defoliation in northwestern Alberta and the Northwest Territories were 3690 and 8600 ha.

Egg-mass samples from several locations, taken by Forestry Canada and the Manitoba Department of Natural Resources, and the large numbers of trapped moths indicate that defoliation may occur in southeastern Manitoba in 1988 (Table 2). Spruce budworm moth-captures in pheromone-baited traps in 1987 indicate declining trends, compared to 1986, at 12 of 13 sites monitored (Table 3).

Saskatchewan: Moderate-to-severe defoliation of white spruce and balsam fir occurred in the Red Earth and Porcupine Hills areas in the east-central part of the province; damaged stands covered an area of 31 600 ha, an increase of about 170% over last year. Severe defoliation within some of these areas has been continuous since 1982 and 1983.

In the Porcupine Hills infestations south of Hudson Bay, moderate-to-severe defoliation of white spruce stands extended over 16 600 ha between Reserve and Usherville, westward to Big Valley Lake, and eastward to White and Decorby lakes. Additional areas of light defoliation occurred between Eagle Lake and Piwei River and between Swallow and Parr Hill lakes.

In the Red Earth infestations, the total area of moderate-to-severe defoliation was 15 000 ha, which is somewhat higher than last year. Extensions of the boundaries occurred northwest of the Carrot River and south of Highway 55. Timber harvesting is in progress in both infested areas to salvage budworm damaged trees.

Egg-mass density estimates and male moth captures in pheromone-baited traps at six locations indicate that a general decline to light or moderate levels may occur in 1988 in at least five of the six locations (Table 2).

Alberta: Small infestations causing moderate-to-severe defoliation occurred again in Big Knife Provincial Park (100 ha), near Castor (200 ha), near Morningside along Bigstone Creek (50 ha), and near Red Lodge Provincial Park (10 ha). Additional areas of light defoliation occurred in Edmonton along the North Saskatchewan River (100 ha), near Millet (250 ha), and in Red Lodge Provincial Park (30 ha).

In northwestern Alberta a new outbreak causing moderate-to-severe defoliation over 5400 ha occurred along the Chinchaga River, west of High Level. An additional area of 3690 ha of light defoliation occurred within the same vicinity (Fig. 1), while light-to-moderate defoliation of about 100 ha occurred along the Steen River in Township 120, Range 21. The infestations along the Chinchaga River were aerial sketch-mapped by the Alberta Forest Service (AFS), and detailed ground monitoring for egg masses, second instar larval (L2) populations, and defoliation estimates were done under the Canada-Alberta Forest Resource Development Agreement[2].

Egg-mass density counts at several locations in the Footner Lake Forest indicate that moderate-to-severe defoliation will occur in 1988 in the Chinchaga River outbreak area, and light defoliation will occur at Steen River.

Northwest Territories: The spruce budworm infestation along the Liard River continued in generally the same white spruce stands as reported in 1986, extending

[2] Amirault, P.A.; Gates, H.; Niederleitner, S. 1988. Spruce budworm in the Footner Lake Forest—1987. Can. For. Serv., North. For. Cent., Edmonton, Alberta. Unpubl. Rep.

Table 2. Number of spruce budworm moths captured in pheromone traps, percent defoliation, and egg-mass counts in 1987, and predicted defoliation for 1988

Location	No. moths per trap	Percent defoliation	Avg. no. egg masses per 10 m² foliage	Predicted defoliation for 1988[a]
MANITOBA				
Birds Hill Prov. Park	128	10	0 (5)[b]	Nil
Spruce Woods Prov. For.	293	7	25 (5)	Light-to-moderate
Duck Mt. Prov. Park	1	4	0 (—[c])	Nil
Red Deer River	9	1	0 (0)	Nil
Riding Mt. Natl. Park	2	5	0 (0)	Nil
Northwest Angle Prov. For.	136	3	0 (—)	Nil
Whiteshell Prov. Park	1326	31	200 (115)	Severe
Wanipigow	456	46	75 (272)	Moderate
Hecla Island Prov. Park	65	14	6 (11)	Light
Lake St. George	9	8	2 (0)	Light
Rocky Lake	9	10	0 (—)	Nil
Simonhouse	1	13	0 (0)	Nil
Pisew Falls	1	16	0 (0)	Nil
SASKATCHEWAN				
Red Earth	236	70	79 (—)	Moderate
Duck Mt. Prov. Park	9	—	0 (0)	Nil
Parr Hill Lake	301	30	14 (28)	Light
Tall Pines (south)	364	70	48 (106)	Light-to-moderate
Tall Pines (McBride Rd.)	83	5	9 (—)	Light
Porcupine Hills	—	60	46 (—)	Light-to-moderate
ALBERTA				
Thickwood Hills	0	—	5 (—)	Light
Fort McKay	0	—	0 (—)	Nil
Steen River	13	—	13 (—)	Light
Chinchaga River	74	—	195 (—)	Moderate-to-severe
Hatch Lake	2	—	4 (—)	Light
Senex Creek	0	—	0 (—)	Nil
Freeman River	11	0	0 (—)	Nil
Little Smoky River	0	0	0 (—)	Nil
Fox Creek	0	0	0 (—)	Nil
Nordegg	3	0	0 (—)	Nil
Clearwater River (western Alberta)	2	0	0 (—)	Nil
House River	0	—	0 (—)	Nil
Moonshine Lake Prov. Park	0	—	0 (—)	Nil

[a] Based upon egg mass density.
[b] Values in brackets are for 1986.
[c] Indicates no collections made.

Table 3. Summary of spruce budworm moth catches in pheromone-baited traps in Manitoba during 1985, 1986, and 1987

Plot location	Avg. no. moths captured per trap[a]		
	1985	1986	1987
Birds Hill Prov. Park	2	279	128
Spruce Woods Prov. Forest	60	435	293
Duck Mt. Prov. Park	1	13	1
Red Deer River	25	16	9
Riding Mountain Natl. Park	2	52	2
Northwest Angle Prov. Park	—[b]	103	136
Whiteshell Prov. Park	335	3517	1326
Wanipigow	97	1585	456
Wallace Lake	26	375	—
Hecla Island Prov. Park	9	239	65
Lake St. George	1	77	9
Rocky Lake	5	66	9
Simonhouse	0	8	1
Pisew Falls	—	8	1

[a] Values are average numbers of moths caught in three traps at each location.
[b] Indicates no collections made.

from the B.C. border north to the confluence of the Liard and Mackenzie rivers, and west along the south side of the river to the confluence of the Martin River. A slight expansion of the area of outbreak occurred west of Fort Simpson, all of which was classed as light-to-moderate defoliation in 1987 compared to a moderate-to-severe rating in 1986. Scattered pockets of moderate-to-severe defoliation occurred along the Kotaneelee River and south of Fort Simpson, however. The combined total area mapped with noticeable defoliation was 11 200 ha.

In the outbreak along the Slave River, the overall area affected increased slightly over that reported in 1986, while the defoliation level declined to light-to-moderate and extended over about 2000 ha on Long Island and along the adjacent east side of the Slave River. At other areas along the Slave River, near Hook Lake, and 10 km north of the mouth of the Salt River, light-to-moderate defoliation extended over an estimated 600 ha. An infestation first reported on Salt Mountain in 1985 apparently collapsed in 1987.

JACK PINE BUDWORM
Choristoneura pinus pinus Free.

Infestations of the jack pine budworm in Manitoba and Saskatchewan virtually collapsed in 1987. Moderate-to-severe defoliation occurred over a total mapped area of only 2670 ha compared to the 308 390 ha mapped in 1986. The infestation in Alberta remained much the same as in 1986 at about 70 ha of light-to-moderate defoliation.

Manitoba: The current outbreak of the jack pine budworm, first reported in 1982, collapsed in 1987 in all areas except for about 100 ha of moderately to severely defoliated jack pine stands. These stands were near Brereton and West Hawk lakes in Whiteshell Provincial Park (Fig. 2). In contrast, 132 000 ha were defoliated in Manitoba in 1986.

Egg-mass samples collected at 20 locations in Manitoba indicate that no defoliation will likely occur in 1988 at 14 of the locations and only light defoliation will occur at the other 6 locations (Table 4). No control measures of jack pine budworm were undertaken in the province in 1987.

The Manitoba Department of Natural Resources conducted a survey of jack pine budworm damaged pine stands near Thompson in 1986 and 1987[3]. Mature jack pine stands in the area had been severely defoliated in 1984 and 1985; subsequently 17.5% of the trees were dead or declining, and potential volume loss was estimated

[3] Knowles, K.; Warner; S. 1987. Jack pine budworm damage appraisal survey, Thompson area. Man. Dep. Nat. Resour., For. Branch., Winnipeg, Man. Unpubl. Rep. 87-4.

Figure 2. Areas of moderate-to-severe defoliation by the jack pine budworm in 1987.

Table 4. Results of the 1987 jack pine budworm egg-mass surveys in Manitoba and 1988 forecast

Location	Avg. no. egg masses per 10 m² foliage		Predicted defoliation for 1988
Spruce Woods Prov. For. (MDNR)[a]	0.1	(5.2)[b]	Light
Kettle Hills (For. Can.)[c]	0	(3.1)	Nil
Porcupine Prov. For. (For. Can.)	0	—[d]	Nil
Sandilands (For. Can.)	0.1	(0)	Light
Agassiz Prov. For. (For. Can.)	0	(0)	Nil
Belair Prov. For. (MDNR)	0	(0.5)	Nil
Pointe du Bois (For. Can.)	0	(3.2)	Nil
Rennie (For. Can.)	6.9	(143)	Light
Ingolf (For. Can.)	7.6	—	Light
Wallace Lake (MDNR)	0.5	—	Light
Manigotagan (For. Can.)	0	(3.3)	Nil
St. Martins (MDNR)	0	—	Nil
Devils Lake (MDNR)	0	(2.5)	Nil
Wicked Point (MDNR)	0	—	Nil
The Pas (MDNR)	0	—	Nil
Moose Lake (MDNR)	0	(0.7)	Nil
Reed Lake (MDNR)	0	—	Nil
Kississing Lake (MDNR)	0	(1.4)	Nil
Lynn Lake (MDNR)	0	—	Nil
Thompson (MDNR)	0	—	Nil

[a] Foliage data collected by Manitoba Department of Natural Resources (MDNR), based on six 60-cm branch tip samples per location; light defoliation = < 2 egg masses per branch.
[b] Values in brackets are for 1986.
[c] Foliage data collected by Forestry Canada based on 10, 45-cm branch tip samples per location; light defoliation = 1–25 egg masses per 10 m² foliage.
[d] Indicates no collections made.

at 15.5%. Further decline of the stands is expected to continue in 1988, when additional damage surveys will be done.

Saskatchewan: Moderate-to-severe defoliation of jack pine forests occurred over an estimated 2500 ha in 1987 compared to the 176 000 ha reported in 1986. Most of the infestations were in pine stands scattered along Highway 106 between Torch River and White Gull Creek in east-central Saskatchewan (1000 ha) and in the Nisbet Provincial Forest (1500 ha), mostly south and southwest of Prince Albert (Fig. 2).

Jack pine budworm egg-mass samples collected at nine locations indicate that light or light-to-moderate defoliation will likely occur at three of the locations in 1988 (Table 5).

Alberta: Light-to-moderate defoliation occurred over a total area of 70 ha near Tawatinaw and Clyde in central Alberta, all in the same stand locations as reported in 1986 (Fig. 2). No egg-mass data were obtained to predict infestations for 1988.

ASPEN DEFOLIATORS
Forest tent caterpillar (*Malacosoma disstria* Hbn.) and the large aspen tortrix (*Choristoneura conflictana* (Wlk.))

The total land area in which areas of trembling aspen stands were defoliated in 1987, primarily by the forest tent caterpillar, amounted to an estimated 7 865 103 in the three prairie provinces (Fig. 3, Table 6). This represents an almost 60% increase over 1986. Most of the increase occurred in Alberta, while a decrease of 74% was noted in Manitoba. Because a large portion (about 80%) of the outbreak occurs within the agricultural zone where aspen stands are often

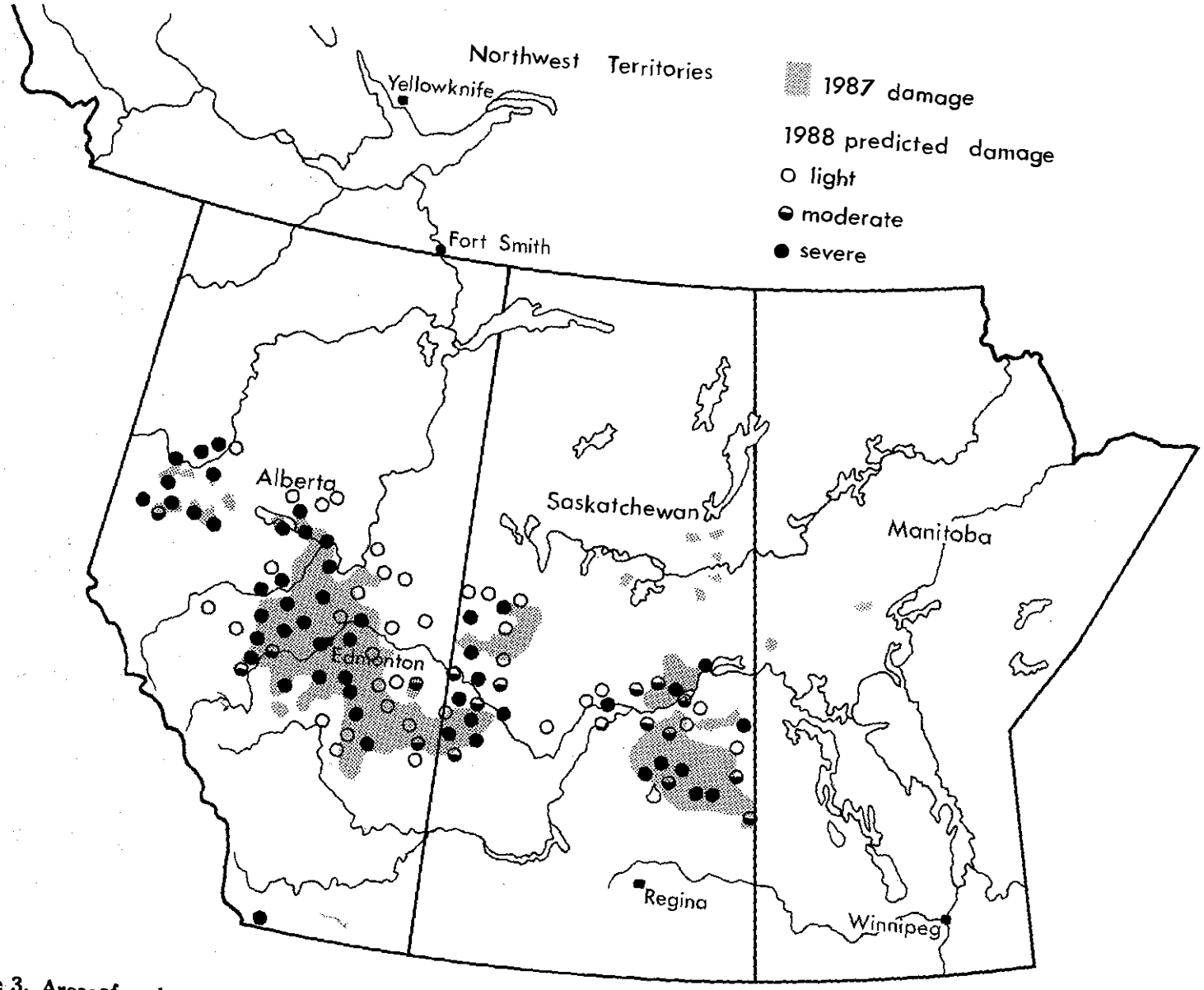

Figure 3. Areas of moderate-to-severe defoliation of trembling aspen in 1987 primarily by the forest tent caterpillar, and 1988 damage level prediction.

Table 5. Results of the 1987 jack pine budworm egg-mass surveys in Saskatchewan and 1988 forecast

Location	Avg. no. egg masses per 10 m² foliage[a]		Predicted defoliation for 1988
Dechambault Lake	0	(51)[b]	Nil
Jan Lake	0	(22)	Nil
Johnson Lake	0	(27)	Nil
Nipiwin Prov. Park	0	(133)	Nil
Smeaton	9	—[c]	Light
Fort à la Corne Prov. For.	0	(5)	Nil
Nisbet Prov. For. (Satellite Rd. Jct. and Hwy 3)	0	—	Nil
Nisbet Prov. For. (4 km W of Satellite Rd. and Hwy 3)	42	—	Light-to-moderate
Nisbet Prov. For. (Crutwell Rd. Jct. and Hwy 3)	28	—	Light

[a] Egg-mass counts on 10, 45-cm branch tips at each location are used to calculate numbers per 10 m² foliage.
[b] Values in brackets are for 1986.
[c] Indicates no collections made.

Table 6. Summary of moderate-to-severe defoliation in 1987 caused mainly by the forest tent caterpillar

Province	Area mapped (ha)	Estimated aspen defoliation (ha)
Manitoba	4 403	4 403
Saskatchewan	1 250 000	250 000[a]
Alberta	6 610 700	1 322 140[a]
Total	7 865 103	1 576 543

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

small and dispersed, the actual stand areas estimated to be defoliated are given in Table 6. The large aspen tortrix caused significant defoliation in several forested areas in central Saskatchewan.

In **Manitoba**, moderate-to-severe defoliation of aspen stands by the forest tent caterpillar was reported at two locations: near Rocky Lake (3108 ha) in the Saskatchewan River Forest Section and near Wabowden (1295 ha) in the Nelson River Forest Section (Fig. 3, Table 6). This was the third consecutive year of decline. No egg-band surveys were undertaken in the province to predict population change for 1988.

The early aspen leafroller (*Pseudexentera oregonana* Wlsm.) caused noticeable feeding damage of aspen generally throughout Manitoba but caused moderate-to-severe foliage damage near Pine Falls, Lake Francis, Gypsumville, and in Spruce Woods Provincial Forest. Low populations of the large aspen tortrix were noted near Lake Francis, Gypsumville, and in Duck Mountain Provincial Park.

In **Saskatchewan**, the total composite land area of aspen and other associated broadleaf trees defoliated was estimated at 1 250 000 ha, a slight decrease from the 1 772 590 ha reported in 1986 (Table 6). Although a larger portion of defoliated aspen stands occurred within the agricultural zone in 1986, there were new infestations in the forested areas in 1987; these increased the actual area of defoliated aspen from 177 160 ha in 1986 to about 250 000 ha in 1987. Moderate-to-severe defoliation occurred in 11 infestation areas (Fig. 3) and was caused mostly by the forest tent caterpillar throughout the agricultural zone. In the forested zone of pure aspen and mixed aspen stands, the large aspen tortrix was a common and important defoliator contributing to the defoliated stands and was the main defoliator between Reserve and Lady Lake in the Porcupine Provincial

Forest and north of Macdowall in the Nisbet Provincial Forest.

Four infestations were mapped in western Saskatchewan: three in the Meadow Lake area, and one between North Battleford and the Alberta border. The largest infestation, in eastern Saskatchewan, extended between Melfort and Big Quill Lake eastward almost to the Manitoba border. Three infestations, one near Lac la Ronge and the others between Lac la Ronge and the Manitoba border, were observed from the air only, and therefore the defoliator species is uncertain.

Egg-band surveys conducted in late 1987 at 73 locations in the outbreak area suggested that the forest tent caterpillar will again cause significant defoliation in 1988 (Fig. 3). Moderate and severe defoliation levels can be expected in at least 50% of the locations sampled, and some increase in the total area defoliated will occur.

In **Alberta**, the total composite land area of aspen stands moderately to severely defoliated increased to 6 610 700 ha in 1987, compared to 4 949 570 ha in 1986, a 34% increase. As in Saskatchewan, most of the defoliated stands (about 80%) were distributed throughout the agricultural zone, although infestations in 1987 expanded in five forest districts—Slave Lake, Peace River, Grande Prairie, Edson, and Whitecourt (Fig. 3). In all areas of the outbreak, the forest tent caterpillar appeared to be the dominant defoliator species. The main area of outbreak extended broadly from Lesser Slave Lake southeastward through Edmonton to the Saskatchewan border and northwestward into the Peace River and Grande Prairie districts. Two isolated patches of defoliation occurred, one in the eastern part of Waterton Lakes National Park and the other in the Buffalo Head Hills in northern Alberta.

Above-average temperatures during much of April and early May allowed development of aspen foliage and tent caterpillar egg hatch to commence early, in late April. Young larvae were observed feeding during the first week of May throughout much of the outbreak area in Saskatchewan and Alberta; however, a late spring snowfall on May 18 and 19, centered in central and east-central Alberta, and freezing temperatures, mostly between −5 and −9°C on May 20–21, caused top kill of some aspen clones and variable amounts of larval mortality. The larvae were in the fourth and fifth instars at the time of the storm. Patches of top-killed aspen extended throughout central Alberta and into west-central Saskatchewan.

Egg-band surveys to predict 1988 defoliation levels were conducted at 87 locations. Moderate and severe defoliation is expected to occur in central and western Alberta, and light and moderate defoliation is expected in eastern Alberta.

DWARF MISTLETOES
Arceuthobium americanum Nutt. ex Engelm. on jack and lodgepole pines and *A. pusillum* Pk. on white and black spruces

In **Manitoba**, surveys, research, and operational sanitation control programs were conducted with funding provided under the Canada–Manitoba Forest Renewal Agreement. A total of 4000 km² of infected stands of jack pine were surveyed by aircraft near Grand Rapids. The area was flown over in early 1987 when there was maximum contrast of the dwarf mistletoe witches' brooms against the background of snow cover. Areas of infection were identified on forest cover type maps using an audiotape event recorder with subsequent ground truthing. Stands of jack pine were also identified for subsequent sanitation treatment and salvage harvest. Some 60 sampling plots were established to monitor the characteristics of dwarf mistletoe infection in jack pine stands. Additional research studies are aimed at examining dwarf mistletoe pollen retention and dispersal and seed germination. Studies of the effects of the parasite on jack pine were also undertaken to help improve pest management strategies.

Under the operational program, post-harvest sanitation cuttings were carried out on cutover areas including 130 ha of jack pine at Mitchell Lake, 650 ha at Talbot Lake, and 135 ha in the Belair area. An additional 30 ha of black spruce infected with *A. pusillum* in the Belair area were also treated.

In **Saskatchewan** and **Alherta** only minor programs of survey and stand treatments were undertaken in 1987.

DUTCH ELM DISEASE
Ceratocystis ulmi (Buis.) C. Moreau

In **Manitoba**, Dutch elm disease (DED) surveys were conducted primarily by the Manitoba Department of Natural Resources, except in Riding Mountain National Park, where surveys were done by Parks Canada. Within the southern part of the province the distribution of DED remained much the same as in 1986, although the incidence of infected trees continued to increase in wild stands of elm. Incidence of infected trees remained comparatively low in the urban areas, where control

programs were maintained. In Winnipeg, less than 1% of the elm population was infected, and in Brandon it was less than 2%. Most infected trees occurred along river valleys where control measures are less effective. Elsewhere in the province about 77 municipalities reported diseased elms, about the same number as in the previous year.

Increases in diseased elms were reported in southern Manitoba, especially along the Red and Assiniboine rivers around Winnipeg, along the Assiniboine to Portage la Prairie, and west of Brandon to St. Lazare. Scattered pockets of diseased trees occurred along smaller drainages in south-central Manitoba in areas near Winkler, Altona, Morden, and Carman. Extensive infections also occurred along the Souris River from southwest of Brandon to the United States border.

During the period from November 1, 1986 to October 31, 1987, provincial sanitation crews removed about 9000 elm trees. An additional 2550 decadent elms near Brandon and 1081 in Winnipeg were removed.

In Riding Mountain National Park, DED-infected trees increased along the eastern escarpment of the park. No control action was taken here.

In **Saskatchewan**, intensive surveys for DED and its bark beetle vectors were conducted by the Department of Parks, Recreation and Culture with cooperation from Saskatchewan Agriculture, Agriculture Canada (Prairie Farm Rehabilitation Administration), city park departments, and FIDS. No DED-infected trees were found in 1987; however, the spot where it is most likely to first appear is in southeastern Saskatchewan, from infestations along the Assiniboine River west of St. Lazare, Manitoba.

Endemic populations of the native elm bark beetle (*Hylurgopinus rufipes* (Eichoff)) were present in elm stands in several locations of the province (Pandila 1987). Eight adults of the smaller European elm bark beetle (*Scolytus multistriatus* (Marsh.)) were captured in pheromone-baited traps in Regina in 1987 but were not associated with any DED infected trees.

In **Alberta**, detection surveys for DED and its bark beetle vectors were conducted jointly by Alberta Agriculture and FIDS in southern Alberta. Pheromone-baited traps and elm trap logs were placed in 16 locations. No bark beetle adults were captured nor was there any evidence of DED in 1987.

ARMILLARIA ROOT ROT
Armillaria ostoyae (Romag.) Herink and several other biological species

Across the region, infections of Armillaria root rot caused mortality to red, jack, and lodgepole pines and to white spruce and balsam fir. Most of the mortality occurred in young, naturally regenerated stands and in plantations.

In **Manitoba**, Armillaria root rot continued to cause mortality in some red pine plantations in the eastern and southeastern part of the province, affecting plantations 5-50 years old. In five study plots monitored by the Manitoba Department of Natural Resources, mortality attributed to Armillaria root rot was 39, 34, 18, 14, and 18% accumulated up to 1987. The stands were 11-14 years old. Infections by Armillaria root rot also occurred in young jack pine stands in all three prairie provinces.

In **Alberta**, infections of Armillaria root rot caused considerable mortality to alpine fir regeneration near Boundary Bay and along the Cameron Lake and Red Rock Canyon roads in Waterton Lakes National Park. At the Boundary Bay site, mature lodgepole pine had been killed by the mountain pine beetle (*Dendroctonus ponderosae* Hopk.) in about 1982, and these trees are now believed to be the source of the inoculum infecting the alpine fir.

An infection center in a mixed aspen—white spruce—lodgepole pine stand at the east gate of Banff National Park, first noted in 1965, continued to increase in size, causing mortality to both pine and spruce. Lodgepole pine mortality caused by Armillaria root rot also occurred at several locations in Jasper National Park.

There was abundant production of sporophores (mushrooms) across the region during the fall of 1987. Collections of sporophores, diploid isolates, and haploid cultures were made. These specimens will be used in the identification and distribution of the different biological species of the fungus.

BARK BEETLES
Mountain pine beetle *Dendroctonus ponderosae* Hopk. and the spruce beetle *D. rufipennis* Kby.

Infestations of the mountain pine beetle remained at endemic levels in southwestern **Alberta** and

Saskatchewan and in the Rocky Mountain national parks, except in Kootenay and Yoho parks (Fig. 4). Estimated numbers of recently killed lodgepole pine are shown in Table 7 for the five Rocky Mountain national parks.

Table 7. Number of lodgepole pine trees recently killed by the mountain pine beetle in the Rocky Mountain national parks, surveyed in 1987

National park	Estimated new tree mortality 1986	1987
Banff	10	25
Kootenay	5500	3870
Yoho	130	105
Waterton Lakes	55	220
Jasper	0	0

An examination of 22 infested lodgepole pine at three locations in Kootenay National Park in early May indicated good survival of the overwintering larval population and some adults (about 3.7%). This suggested that populations were still expanding and that a small but early flight of adult beetles could be expected. Parasitism, caused mostly by the fly, *Medetera aldrichii* Wheeler, resulted in 5–10% mortality of larvae.

In Banff National Park, all of the infested trees were near the south end of the park adjacent to the Spray River. Examination of broods in a few trees indicated a low percentage of egg hatch, low survival of larvae, and no evidence of live adults, probably due to the high elevation.

Mountain pine beetle infestations in Kootenay National Park occurred in about 150 patches of varying size extending mainly between Daer and Pitt creeks and along the Kootenay River valley to the south end of the park. Several large patches occurred within 2–4 km of Radium, and three new spot infestations were noted north of Highway 93 and east of Sinclair Pass.

In Yoho National Park, most infestation patches occurred in the same locations as last year and in groups of one to five trees. A slight expansion in numbers of dead trees occurred near Field in five patches of 35 trees.

Nearly all of the newly killed pine in Waterton Lakes National Park occurred as single trees scattered on northern slopes of Chief Mountain and along Cameron Lake and Red Rock Canyon roads.

Elsewhere in the region, semiochemical lures were used as part of the detection survey and control strategy for the mountain pine beetle in the Cypress Hills, Kananaskis area, and southern Bow-Crow Forest of Alberta. In the Saskatchewan portion of the Cypress Hills, 300 lures were distributed by Saskatchewan Parks, Recreation and Culture staff, and only five fresh attacks on three baited trees were observed. A total of 37 recently killed pine trees were mapped but none had been attacked by the mountain pine beetle. In the Alberta portion of the Cypress Hills where 200 lures were deployed by provincial park staff, 43 fresh attacks occurred on 20 baited trees; none of the attacks were successful. No new or recent beetle-killed trees were observed; however, about 90 recently killed trees observed from aerial surveys were believed to be mainly the result of porcupine feeding.

In southwestern Alberta, the Alberta Forest Service conducted two aerial surveys and deployed 150 semiochemical lures at 20 sites in the Kananaskis area and at 30 sites in the Crowsnest Pass area. Only a few recently killed lodgepole and limber pine were observed near Blairmore during the aerial survey. Of the 150 baited trees, 82 had fresh attacks, and an additional 36 adjacent trees were attacked. Fifty of the attacked trees were in the Kananskis area alone. Of the 118 attacked trees in the two areas, 47 were cut and burned, and the remainder were treated by removal of individual galleries. The infestations in 1987 were slightly higher than had been reported in 1986.

Populations of the spruce beetle remained low in all areas of the region in 1987. Light populations were detected in a mature spruce stand 50 km north of Manning, Alberta. In the Grande Prairie Forest District, spruce beetle surveys were conducted in Moonshine Lake Provincial Park, Two Lakes Recreation Area, and along the Kakwa River. Endemic populations causing occasional tree mortality occurred at the latter two sites.

LARCH SAWFLY
Pristiphora erichsonii (Htg.)

In the **Northwest Territories**, the larch sawfly caused moderate-to-severe defoliation in tamarack stands in the Martin and Ebbutt hills, near Sibbeston Lake, and in the Nahanni Butte area. Similar defoliation occurred along the Liard Highway from southwest of its junction

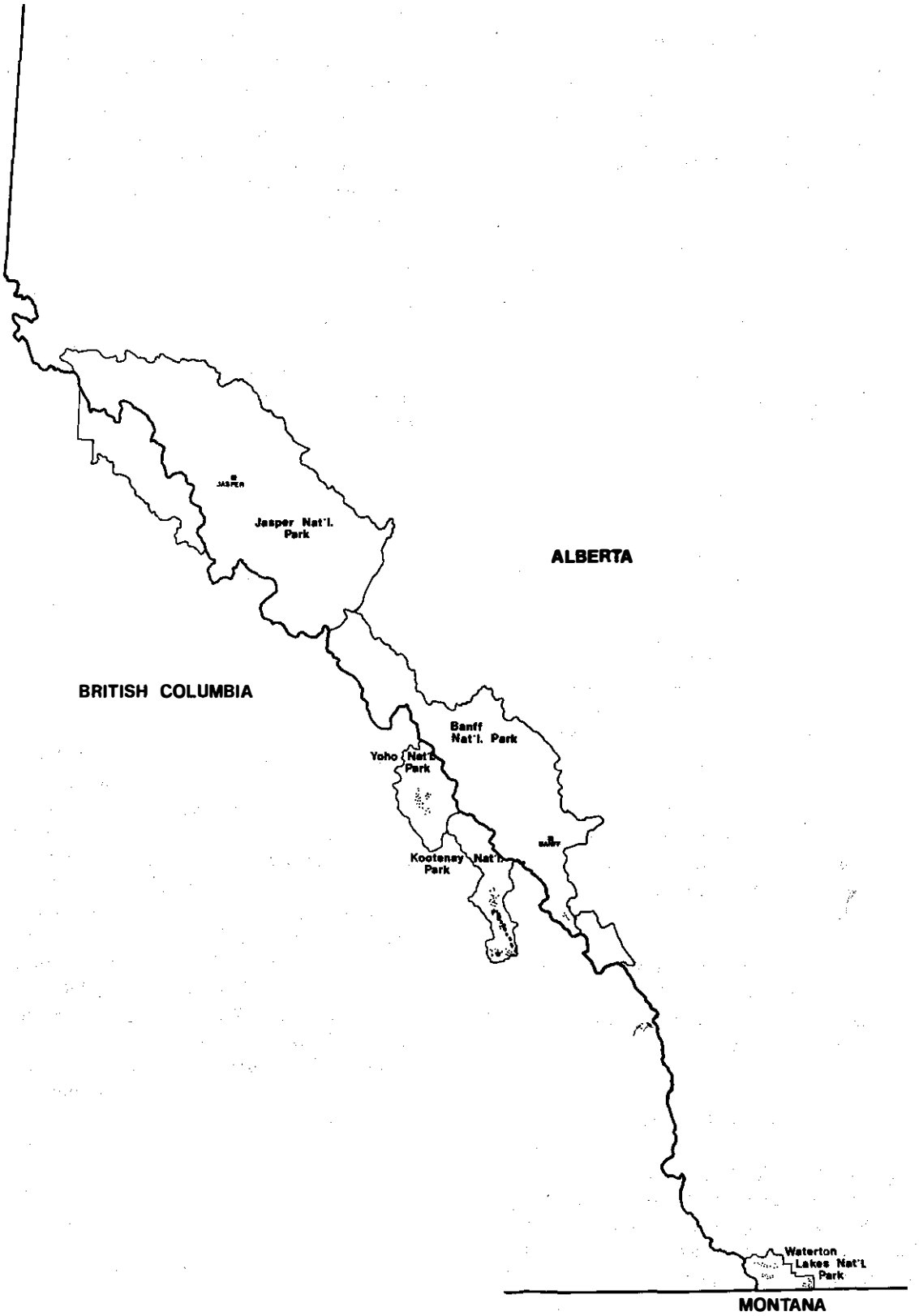

Figure 4. Areas of mountain pine beetle infestations in the Rocky Mountain national parks in 1987.

with Highway 1 to the Blackstone River. Light-to-moderate defoliation extended from Blackstone River to Fort Liard, along the Mackenzie Highway between Hay River and the Alberta border, and in a small area near Fort Providence. Light defoliation also occurred between Fort Liard and the British Columbia border, between the Redknife River and Camsell Bend, and between Hay River and Fort Smith.

In **Alberta**, light defoliation occurred on Siberian larch in Edmonton and Red Deer, and some defoliation was noted near Rocky Mountain House, east of Wabamun Lake, and near Obed Lake.

Low populations of the larch sawfly were observed in **Saskatchewan** north of Prince Albert and in **Manitoba** near Zhoda.

NURSERY PESTS

In **Manitoba**, personnel with the Department of Natural Resources submitted samples of spruce and jack pine seeds, soil, and conifer seedlings to the Pacific Forestry Centre and Manitoba Agriculture for identification of potential disease organisms. Specimens were submitted from the Pineland and Clearwater nurseries. *Pythium* and *Fusarium* species, known for causing potential damping-off and root rot diseases, were found in soil samples along with many saprophytic nematodes. Various storage molds were present on pine and spruce seedlings, but were all saprophytic. Seed contaminants identified on seeds of white and black spruce and jack pine included the following species of fungi: *Alternaria*, *Chaetomium*, *Melanospora*, *Papulaspora*, *Trichoderma*, and *Trichothecium*.

No disease or insect problems were identified in nurseries in **Saskatchewan**. In **Alberta**, nonpathogenic damage resulting from heat exposure caused damage to spruce and pine container-grown seedlings.

PLANTATION PESTS

A committee with representatives from the three prairie provinces and Forestry Canada was established in early 1987 to develop a standardized field survey method suitable for conducting pest surveys in high-value conifer stands within the region. The method provides a means to systematically sample and quantitatively assess plantations and naturally regenerated areas for incidence of tree mortality, stem deformities, and reduced growth. Plantations sampled and reported in 1987 included seven in Manitoba, two in Saskatchewan, and fifteen in Alberta. They provided a trial run to test out the survey method and provided an indication of some important pest problems, which are summarized in Table 8. A more detailed description of the methodology and results of surveys conducted in Alberta and Manitoba are reported elsewhere[4].

In **Manitoba**, the most important factors causing mortality included Armillaria root rot, pine root-collar weevils (*Hylobius* spp.), and western gall rust (*Endocronartium harknessii* (J.P. Moore) Y. Hirat.). In **Saskatchewan**, Armillaria root rot was also present but at a lower incidence level in the plantations sampled. Damage by Armillaria root rot was often associated with "J"-root formation, indicating an interaction with improper planting procedures. In **Alberta**, tree mortality resulted from Armillaria root rot (up to 14.3% incidence), comandra blister rust (*Cronartium comandrae* Pk.), Warren's root-collar weevil (*Hylobius warreni* Wood), and western gall rust.

CLIMATIC INJURY

Above average temperatures occurred during much of April and early May 1987 throughout the central prairies region. This allowed the early flushing of trembling aspen leaves and hatching of forest tent caterpillar eggs, both of which occurred during the last week of April. Early instar larvae were observed feeding on aspen leaves in stands extending from Edmonton to Prince Albert, and south at least to Stettler and Lacombe, Alberta. Development of larvae was rapid during the first 18 days of May. A late spring snowfall of up to 20 cm occurred on May 18 and 19, centered in central and east-central Alberta. It was accompanied by freezing minimum temperatures, mostly between −5 and −9°C, on May 19–21 (Table 9). The weather station at Bellis, northeast of Edmonton, reported a minimum temperature of −12°C.

Following the frost period (Table 9), many aspen clones throughout central Alberta, south to the U.S. border, and in west-central Saskatchewan showed frost kill in the upper crowns. Other tree species severely

[4] Amirault, P.A.; Niederleitner, S. 1987. Pest surveys in young stands, Alberta—1987. Can. For. Serv., North. For. Cent., Edmonton, Alberta. Unpubl. Rep.
Beaubien, Y. 1988. Manitoba plantation pest survey—1987. Manitoba Dep. Nat. Resour., For. Branch, Winnipeg, Manitoba. Unpubl. Rep. 88-6.

Table 8. Summary of important insects, diseases, and noninfectious agents causing mortality, growth loss, and stem and branch deformity in pine plantations in the three prairie provinces in 1987

Causal agent	Manitoba		Saskatchewan		Alberta	
	Host	Proportion affected	Host	Proportion affected	Host	Proportion affected
Animal damage	Jack pine Red pine	7/7	Jack pine	2/2	Lodgepole pine	4/15
Armillaria root rot (*Armillaria* sp.)	Jack pine	1/7	Jack pine	1/2	Lodgepole pine	2/15
Comandra blister rust (*Cronartium comandrae*)	—[a]	—	—	—	Lodgepole pine	—
Improper planting	Jack pine Red pine	6/7	Jack pine	1/2	Lodgepole pine	2/15
Jack pine budworm (*Choristoneura pinus*)	Jack pine	2/7	Jack pine	1/2	Lodgepole pine	—
Jack pine resin midge (*Cecidomyia resinicola*)	—	—	Jack pine	1/2	—	—
Jack pine shootborer (*Rhyacionia granti*)	Jack pine	2/7	Jack pine	1/2	—	—
Lodgepole terminal weevil (*Pissodes terminalis*)	Jack pine	2/7	Jack pine	2/2	Lodgepole pine	—
Northern pitch twig moth (*Petrova albicapitana*)	Jack pine	3/7	Jack pine	2/2	Lodgepole pine	11/15
Pine needle cast (*Lophodermella* sp.)	Jack pine Red pine	3/7	—	—	—	—
Pine needle scale (*Phenacaspis pinifoliae*)	Red pine	1/7	—	—	—	—
Pine rootcollar weevils (*Hylobius* spp.)	Jack pine Red pine	2/7	—	—	Lodgepole pine	4/15
Redheaded jack pine sawfly (*Neodiprion virginianus* complex)	—	—	Jack pine	1/2	—	—
Western gall rust (*Endocronartium harknessii*)	Jack pine	3/7	Jack pine	2/2	Lodgepole pine	1/15
White pine weevil (*Pissodes strobi*)	Jack pine	3/7	—	—	—	—

[a] Indicates no trees affected.

Table 9. Minimum daily temperatures (°C) recorded at selected weather stations during May 1987 in central Manitoba, Saskatchewan, and Alberta

Station location	Date in May 1987				
	18	19	20	21	22
MANITOBA					
Thompson A	4.5	0.6	−7.7	−10.2	3.2
The Pas A	4.1	8.1	−0.5	−4.9	1.0
Swan River	−0.5	8.0	5.0	−2.0	0.0
Dauphin A	−1.2	8.5	3.0	−3.5	−5.3
Brandon A	5.6	8.7	2.9	−0.2	−2.7
SASKATCHEWAN					
Hudson Bay A	1.3	7.6	−1.9	−4.8	0.6
Prince Albert A	6.5	4.9	0.8	−5.1	6.2
Saskatoon SRC	6.0	4.5	−1.0	−5.0	7.0
Meadow Lake A	5.2	0.0	−1.1	−5.1	3.6
ALBERTA					
Grande Prairie A	3.7	−0.2	0.6	0.0	0.4
Slave Lake A	2.8	1.0	−4.4	−0.5	4.8
Athabasca LD	−3.0	−4.0	−4.0	−3.0	−1.0
Bellis	3.5	−2.5	−12.0	−5.5	1.0
Wainwright Heath	5.0	−0.5	−5.5	−3.5	4.0
Edmonton International A	4.6	−5.0	−8.6	−0.5	2.0
Stettler North	5.0	−1.5	−6.0	−4.0	−1.0
Red Deer A	1.7	−1.5	−4.1	0.1	0.8

affected were green ash and native white spruce. Frost-injured leaves and buds of green ash were observed throughout central Alberta, eastward through Lloydminster and Prince Albert, and also in the Outlook and Yorkton areas of Saskatchewan. The injury delayed leaf flushing until mid to late June, but trees were not killed.

Frost-kill of the current year's formed shoots was almost universal in much of central Alberta on native white spruce, and some black spruce was also affected. Frost damage was also reported on young, 3–4 m tall lodgepole pine trees growing at the Pine Ridge Forest Nursery near Smoky Lake, Alberta. The damage appeared as a crook in the current leader growth and some loss of current year male and female flowers.

The generally warm and dry conditions during the spring of 1987 also resulted in drought injury to a variety of ornamental and shelterbelt-planted tree and shrub species in the Big River, Prince Albert, Shellbrook, and North Battleford areas of Saskatchewan. The drought injury on planted spruce caused advanced seasonal needle drop and appeared to enhance spruce spider mite (*Oligonychus ununguis* (Jac.)) infestations.

ACID RAIN MONITORING

The Acid Rain National Early Warning System (ARNEWS) was established in 1984 as a national program to accurately detect early signs of acid rain damage to forests. Twelve permanent sampling plots, five in Alberta, three in Saskatchewan, and four in Manitoba, have now been established as part of a nationwide network of permanent plots to detect and monitor changes in forest soil, minor vegetation, and trees. Base-line data have been collected on tree growth, the present concentrations of foliar and soil elements, foliar and tree conditions, tree-damaging insect fauna, and fungal disease organisms and their general level of

abundance and damage. All ARNEWS plots were visited twice in 1987, once in June and again in late August, and were monitored for insect and disease damage. Increment core measurements of major sample trees were completed, and all basic plot data were sent to the Petawawa National Forestry Institute at Chalk River, Ontario, for computer input and summary.

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OTHER INSECTS, DISEASES, AND DAMAGE AGENTS

Insect, disease, or damage agent	Host	Location	Remarks
Aphids, open-feeding Several species	Coniferous and deciduous hosts	Alberta Saskatchewan Manitoba	Populations were prominent and common on forest regeneration, plantations, and urban trees and shrubs.
Aspen blotchminer *Lithocolletis tremuloidiella* Braun	Aspen	Alberta Saskatchewan Manitoba	Common occurrence in many areas.
Aspen and poplar leaf and twig blight *Venturia macularis* (Fr.) E. Müller & Arx *Venturia populina* (Vuill.) Fabric.	Aspen Poplar	Alberta Saskatchewan NWT	Common on regeneration in the two provinces and along the Nyarling River, NWT.
Atropellis canker *Atropellis piniphila* (Weir) Lohman & Cash	Lodgepole pine	Alberta Saskatchewan	Infections noted in Kananaskis Country, Waterton Lakes National Park, between Nordegg and the Red Deer River, Alberta, and in Cypress Hills.
Birch leaf miners *Fenusa pusilla* (Lepeletier) *Profenusa thomsoni* (Konow)	Birch species	Prairie provinces	Moderate-to-severe infestations in most urban areas; high infestations noted in many native stands, likely due mostly to *P. thomsoni*.
Black-knot of cherry *Apiosporina morbosa* (Schw.) Arx	Choke cherry Mayday Pin cherry	Alberta Saskatchewan	Common in many areas.
Boxelder twig borer *Proteoteras willingana* (Kft.)	Manitoba maple	Alberta Saskatchewan	Commonly observed in many areas.
Bronze birch borer *Agrilus anxius* Gory	Birch species	Alberta Saskatchewan Manitoba	Associated with birch dieback mostly in urban areas. Specific reports from Devon and Lethbridge, Alberta and from Regina, Saskatchewan.

Other insects, diseases, and damage agents, continued

Insect, disease, or damage agent	Host	Location	Remarks
Bruce spanworm *Operophtera bruceata* (Hulst)	Aspen	Alberta Saskatchewan	Low populations observed in Cypress Hills and in Alberta between Calgary and Turner Valley and west of Stettler.
Chemical injury Herbicides, road salts, soil sterilants	Several species	Alberta Saskatchewan	Several inquiries and diagnoses made; most were road salt injury to conifers and soil sterilant injury to various species.
Clearwing moth *Synanthedon* sp.	Pine Spruce	British Columbia Alberta Saskatchewan	Girdling injury and resinosis common on many urban plantings. Branch and stem girdling observed in Redstreak Campground in Kootenay National Park and at several locations in Banff National Park.
Cottonwood leafmining beetle *Zeugophora scutellaris* Suffr.	Poplar	Alberta Saskatchewan	Light and moderate injury observed at several locations in southern Alberta, at Big River and Prince Albert nurseries, and in Saskatoon.
Cytospora canker *Cytospora chrysosperma* (Pers.) Fr.	Mountain-ash Poplar	Alberta Saskatchewan Manitoba	Some increased incidence noted, probably resulting from late spring frost injuries in late May.
Douglas-fir beetle *Dendroctonus pseudotsugae* Hopk.	Douglas-fir	British Columbia Alberta	Low populations near Annette and Patricia lakes in Jasper National Park and in Redstreak Campground in Kootenay National Park.

Continued on next page

Other insects, diseases, and damage agents, continued

Insect, disease, or damage agent	Host	Location	Remarks
Early aspen leafroller *Pseudexentera oregonana* Wlsm.	Aspen	Alberta Saskatchewan Manitoba	Light and moderate leaf injury reported in many areas: Pine Falls, Gypsumville, Lake Francis, and Spruce Woods Provincial Forest, Manitoba. Also south of Calgary, near Valleyview, Alberta, and near Prince Albert and Yorkton, Saskatchewan.
Eastern blackheaded budworm *Acleris variana* (Fern.)	Spruce	Alberta Saskatchewan Manitoba	Light and moderate defoliation reported at several locations.
Fall cankerworm *Alsophila pometaria* (Harr.)	Elm Green ash Manitoba maple	Alberta Saskatchewan Manitoba	Caused light-to-severe defoliation at several locations in Saskatchewan and Manitoba; light defoliation in southern Alberta.
Fire blight *Erwinia amylovora* (Burr.) Winsl. et al.	Apple Cotoneaster Mountain-ash Plum	Alberta Saskatchewan	Fewer incidences of infection were reported compared to previous years.
Frost injury	Many species	Alberta Saskatchewan Manitoba NWT	Various degrees of injury reported regionwide on many species.
Gray willow leaf beetle *Tricholochmaea decora* (Say)	Willow species	British Columbia Alberta Saskatchewan	Patches of moderate-to-severe skeletization injury in Kootenay, Banff, Jasper, and Prince Albert national parks; also near Athabasca, Rochester, Sylvan Lake, and Eckville, Alberta.
Greenheaded spruce sawfly *Pikonema dimmockii* (Cress.)	Spruce	Manitoba	Low populations observed near Powerview and Moose Lake.
Honeysuckle aphid *Hyadaphis tataricae* (Aizen.)	Honeysuckle	Alberta Saskatchewan Manitoba	Common on urban and rural plantings, causing rosetting and brooming of terminal shoots.

Other insects, diseases, and damage agents, continued

Insect, disease, or damage agent	Host	Location	Remarks
Hypoxylon canker *Hypoxylon mammatum* (Wahl.) J.H. Miller	Aspen	Alberta Saskatchewan Manitoba	Infection incidence is common especially across central part of region.
Jack pine sawfly *Neodiprion virginianus* complex	Jack pine	Alberta Saskatckewan	Colonies of larvae observed in plantations near Chip Lake, Alberta, and near Macdowall, Saskatchewan.
Leaf beetles *Chrysomela* spp.	Aspen Poplar	British Columbia Alberta Saskatchewan	Skeletizing and defoliation injury noted in Banff, Kootenay, Jasper, Waterton Lakes, and Prince Albert national parks.
Leaf miner *Lyonetia* sp.	Willow	Alberta Saskatchewan NWT	Mostly light mining injury at several locations in central Saskatchewan including Prince Albert National Park. Also northern Alberta and southern NWT.
Leaf rust *Melampsora medusae* Thuem.	Aspen Poplar	Alberta	Infections were common in Rocky Mountain national parks and less common along the Alberta foothills.
Lodgepole needleminer *Coleotechnites starki* (Free.)	Lodgepole pine	Alberta	Moderate-to-severe mining between Saskatchewan Crossing and Weeping Wall, Banff National Park, covering 52 km^2. Light injury on Mt. Norquay near Banff.
Lodgepole pine beetle *Dendroctonus murrayanae* Hopk.	Jack pine Lodgepole pine	Alberta	Observed at several locations in Jasper and Banff national parks; often associated with fire-killed or dying pine.

Continued on next page

Other insects, diseases, and damage agents, continued

Insect, disease, or damage agent	Host	Location	Remarks
Lodgepole terminal weevil *Pissodes terminalis* Hopping	Jack pine Lodgepole pine	Alberta Saskatchewan	Incidence common in young stands including nurseries and plantations. Light incidence near Saskatchewan Crossing, Banff National Park.
Nelson's juniper rust *Gymnosporangium nelsonii* Arth.	Juniper Saskatoon	Regionwide	Infections common in Redstreak Campground in Kootenay National Park and near Field in Yoho National Park.
Northern pitch twig moth *Petrova albicapitana* (Busck)	Jack pine Lodgepole pine	Alberta Saskatchewan Manitoba NWT	Common in naturally and artificially regenerated areas.
Pine needle casts *Davisomycella ampla* (Davis) Darker *Elytroderma deformans* (Weir) Darker *Lophodermella concolor* (Dearn.) Darker	Jack pine Lodgepole pine	Alberta Manitoba	Low incidence of infection of *E. deformans* and *L. concolor* along the Alberta foothills and in Rocky Mountain national parks. *D. ampla* caused light damage in plantation near Marchand, Manitoba.
Pine needle scale *Chionaspis pinifoliae* (Fitch)	Pine White spruce	Alberta Saskatchewan Manitoba	Infestations were common in many regeneration sites, including some plantations near Mortlach and Border, Saskatchewan.
Poplar borer *Saperda calcarata* Say	Aspen Poplar	Alberta Manitoba NWT	Common in many mature and semi-mature aspen stands in central and southern parts of the provinces. Common incidence in poplar stands growing along some river drainages in NWT.
Poplar serpentine miner *Phylocnistis populiella* Cham.	Aspen	Alberta Saskatchewan Manitoba NWT	Low incidence reported in many areas of the region.

Other insects, diseases, and damage agents, continued

Insect, disease, or damage agent	Host	Location	Remarks
Porcupine	Apple Lodgepole pine Scots pine	British Columbia Alberta NWT	Top kill resulting from girdling common at several locations in Banff, Jasper, Yoho, and Kootenay national parks. Damage to Scots pine in Edmonton. Several patches of damaged trees in the South Nahanni and Kotaneelee river valleys, NWT.
Prairie tent caterpillar *Malacosoma californicum lutescens* (N.& D.)	Choke cherry Poplar	Alberta Manitoba	Moderate and severe defoliation noted at several locations in Alberta; moderate injury on choke cherry in Spruce Woods Provincial Forest in Manitoba.
Red belt	Lodgepole pine	Alberta	Light-to-severe injury in the foothills area south of Grande Prairie.
Septoria canker *Mycosphaerella populicola* G.E. Thompson (anam. *Septoria populicola* Pk.) *Septoria caraganae* Karst.	Caragana Poplar	Alberta Saskatchewan	High incidence of infection on hybrid poplar in central Alberta; low incidence in Prince Albert Provincial Nursery in Saskatchewan. *S. caraganae* caused light-to-moderate injury to a caragana shelterbelt near Prince Albert.
Shot-hole of cherry *Coccomyces hiemalis* Higgins	Choke cherry	Alberta Saskatchewan	Infection and "shot-holes" were common, especially on urban plantings.
Silverleaf *Chondrostereum purpureum* (Pers.: Fr.) Pouzar)	Apple Cotoneaster Mountain-ash Plum	Alberta	Common infections on mature trees in several urban areas.
Snowshoe hare	Jack pine	NWT	Scattered patches of tree girdling in Yellowknife Forest District.

Continued on next page

Other insects, diseases, and damage agents, continued

Insect, disease, or damage agent	Host	Location	Remarks
Spittlebug *Aphrophora* sp.	Jack pine	Manitoba	Low-to-high populations in young stands in southeastern Manitoba.
Spruce bud midge *Rhabdophaga swainei* Felt	White spruce	Alberta Saskatchewan NWT	Common in forested areas of the provinces and near Chan Lake and Edzo, NWT.
Spruce gall aphids *Adelges* spp. *Pineus* spp.	Douglas-fir Pine Spruce	British Columbia Alberta Saskatchewan	Common where host trees occur.
Spruce needle cast *Lirula macrospora* (Htg.) Darker	White spruce	Alberta	Several infections reported from Alberta foothills.
Spruce needle rust *Chrysomyxa ledicola* Lagh.	White spruce	British Columbia Alberta Saskatchewan	Light and moderate infection incidence in Rocky Mountain national parks. Low infection in central Saskatchewan.
Spruce spider mite *Oligonychus ununguis* (Jac.)	Cedar Juniper Spruce	Regionwide	Common pest of planted trees in urban areas and farm shelterbelts, especially in mature trees.
Squirrel	Jack pine Lodgepole pine	British Columbia Alberta Manitoba NWT	Tip and branch mortality common in Jasper, Banff, Kootenay, and Waterton Lakes national parks. Light damage near Jenpeg, Manitoba, and near Fort Smith and Trout River, NWT.
Stalactiform blister rust *Cronartium coleosporioides* Arth.	Lodgepole pine	Alberta	Infections and injury common at Saskatchewan Crossing in Banff National Park and near Athabasca Falls in Jasper National Park.

Other insects, diseases, and damage agents, continued

Insect, disease, or damage agent	Host	Location	Remarks
Two-year-cycle spruce budworm *Choristoneura biennis* Free.	Alpine fir Engelmann spruce	British Columbia Alberta	Low and moderate budworm populations at Numa Creek in Kootenay National Park, near Emerald Lake in Yoho National Park, and at Saskatchewan Crossing in Banff National Park.
Ugly-nest caterpillar *Archips cerasivorana* (Fitch)	Choke cherry	Alberta Saskatchewan	Common in central and southern Alberta and near Macdowall, Saskatchewan.
Western ash bark beetle *Hylesinus californicus* (Swaine)	Green ash	Alberta Saskatchewan	Commonly reported causing tree injury in Medicine Hat, Lethbridge, Strathmore, and Calgary areas in Alberta and in Saskatoon, Swift Current, and Regina areas in Saskatchewan.
Western gall rust *Endocronartium harknessii* (J.P. Moore) Y. Hirat.	Jack pine Lodgepole pine Scots pine	Alberta Saskatchewan Manitoba NWT	Branch and stem infections common in many young stands regionwide. Infections noted on Scots pine near Rockglen, south of Regina, Saskatchewan.
White pine weevil *Pissodes strobi* (Peck)	Colorado spruce White spruce Jack pine	Alberta Saskatchewan Manitoba	Important pest species causing 2 or more years of top kill in plantations and other high-value stands. Common in Rocky Mountain national parks.
Yellow-headed spruce sawfly *Pikonema alaskensis* (Roh.)	Colorado spruce White spruce	Regionwide	Common defoliator pest of young planted spruce in urban areas, plantations, shelterbelts, and nurseries. Chronic infestations in some areas.
Yellow witches' broom *Chrysomyxa arctostaphyli* Diet.	White spruce	Regionwide	Common disease in many semi-mature and mature stands.