Forest Insect and Disease Conditions in Canada 1993

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Forest Insect and Disease Conditions in Canada 1993

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INTRODUCTION

The Forest Insect and Disease Survey (FIDS) is a nationally coordinated program operating out of the six Canadian Forest Service (CFS) establishments. The FIDS Technology Development Project is based at the Petawawa National Forestry Institute and there is increasing integration with the forest protection group of the Forest Pest Management Institute. The FIDS provides an annual overview of insects, diseases, abiotic effects and the state of the health of forests to forest managers, quarantine agencies, researchers, educators, and the public.

The significant changes now being made to FIDS are outlined in its new strategy covering the period 1993-1998. This strategy defines the role and responsibilities of FIDS in relation to other federal and provincial agencies and provides guidance for FIDS program development and activities over the next five years. One trend is the increasing role played by provincial and industrial agencies in forest health surveys. The FIDS recognizes the need to maintain the capacity to carry out national surveys, prepare national reports and implement federal mandates. In the future FIDS will enhance its involvement in the development of forest health surveys and examine new ways in which to address issues concerning the health of forest ecosystems.

In 1993 the FIDS published a 5-year strategy, committing the CFS to monitor the health of Canada's forests.

The FIDS will assess and monitor forest health in Canada by generating national information, conducting the necessary research and development, enhancing national and international partnerships, and transferring the associated knowledge and technology to the user. These functions are based on the past, current and projected requisites for the sustainable development of forests.

The Ontario FIDS has shifted emphasis from the northern Ontario field program to the development of hazard rating systems for spruce budworm, jack pine budworm and Scleroderris canker.

Forest Insect and Disease Conditions in Canada 1993 is the fourteenth in a series of national annual reports of the FIDS which date back to 1936. The survey provides quantitative and interpretive data on damage and depletion caused by forest pests in cooperation with those responsible for improving forest inventory and economic data in Canada. The initiative requires the development of methodologies and procedures before complete and accurate data can be made available. As forest management intensifies and the older, unmanaged forests are gradually replaced by new, intensively managed forests, novel pest problems and impacts will arise and require increased attention. Accordingly, regional and national reporting will continue to be modified to reflect the changing activities of the FIDS. This report is a synthesis of the results of FIDS operations conducted from the regional establishments.

Pests of national significance are described in Chapter 1, while those of particular significance in one or two regions are described in Chapter 2. Certain FIDS monitoring initiatives, as well as various other types of tree damage and abiotic declines are outlined in Chapter 3. In recent years FIDS has also reported on surveys of forest health and on pest conditions at nurseries, seed orchards and young stands, as these aspects of forest management have become increasingly important. These are described in Chapter 4.

The status of many other pests is presented in tables by region in the Appendix. Although they usually do not have spectacular effects, they are important because of their potential for expansion, their possible role as vectors and indicators of other problems, and because of quarantine considerations. More detailed information on these and other pests and conditions can be obtained from regional forestry centres of the Canadian Forest Service.

Table 1. Estimates of Areas with Moderate to Severe Defoliation and Beetle-killed Trees in 1993 for Selected Major Pests (thousands of ha).

Province or Territory	Eastern Spruce Budworm	Jack Pine Budworm	Hemlock Looper	Forest Tent Caterpillar[1]	Mountain Pine Beetle
Newfoundland and Labrador	0.0	–	4.4	0.0	
Nova Scotia	0.0	–	0.0	0.0	
New Brunswick	0.0	–	0.0	196.0	
Prince Edward Island	33.8	–	0.0	0.0	
Quebec	0.4	0.2	0.4	39.9	
Ontario	8 991.2	282.2	–	656.3	
Manitoba	13.8	0.0	–	3.6	
Saskatchewan	22.6	0.0	–	375.8	–
Alberta	46.5	0.0	–	19.0	0.0
British Columbia	170.0[2]	–	46.4[3]	86.0	49.5[4]
Northwest Territories	53.6	–	–	0.0	–
Yukon	–	–	–	–	–
TOTAL	**9 331.9**	**282.4**	**51.2**	**1 376.6**	**49.5**

[1]Includes defoliation by forest tent caterpillar in New Brunswick, Quebec, Manitoba; large aspen tortrix in Saskatchewan, and the forest tent caterpillar and aspen leafroller in Alberta.

[2]An additional 2 150 ha of moderate and severe defoliation by the western spruce budworm (*Choristoneura occidentalis* Free.), and light and moderate defoliation on 107 000 ha by the two–year cycle budworm (*C. biennis* Free.).

[3]Defoliation by the western hemlock looper (*Lambdina fiscellaria lugubrosa* [Hulst]).

[4]Areas where beetle–killed trees occurred.

The FIDS in British Columbia hosted a delegation from the Anhui Forest Biological Control Centre of the People's Republic of China for 10 days during which FIDS sampling methods, aerial surveys and geographic information systems (GIS) were the main topics discussed.

Efforts toward collecting and reporting information in quantitative terms are emphasized, but it is not possible to express all observations quantitatively. Throughout this report the terms severe, moderate, light and trace are used to describe the level of defoliation and, in some cases, other injury or insect population levels. Unless otherwise stated, the extent of defoliation, injury or population level is defined as follows: trace, up to 5%; light, 6 to 29%; moderate, 30 to 69%; and severe, 70 to 100% defoliation.

We have used current nomenclature and authorship, where possible, to designate pest species. Because the taxonomy of some species changes occasionally and old names persist, we have tried to balance clear communication to our audience with respect for the taxonomic revision.

In 1993, several insect populations declined in area of forest affected, although their importance in depleting the forest resource remains significant. Populations of spruce budworm continued to decline in most of Canada (Table 1). Areas of moderate and severe defoliation remained high in Ontario and increases in Prince Edward Island and British Columbia kept defoliation levels at over nine million ha. The area defoliated by the jack pine budworm increased substantially in Ontario but caused essentially no defoliation elsewhere. The area defoliated by the forest tent caterpillar declined greatly in Ontario, Manitoba and British Columbia, and increased in New Brunswick and Saskatchewan. The overall area defoliated, however, was less than one-tenth the 1992 levels. In short, 1993 appeared to be a typical year with both small and large changes in the patterns of damage to our forests.

The FIDS has published a set of multilingual brochures describing our activities.

Finally, the FIDS would like to acknowledge the field and laboratory staffs of the regional establishments, officers of provincial and federal governments and agencies, the forest industry, and private individuals. The Ministère des forêts du Québec, Service de la protection contre les insectes et les maladies (SPIM) continues to provide most of the information from Quebec. The Quebec Region of CFS continues to conduct surveys for forest health monitoring and other special surveys. Finally, we thank those who provided us with comments and suggestions on previous reports.

J. Peter Hall

Coordinator
Forest Insect and Disease Survey

CHAPTER 1
Major Insect Pests

This chapter describes insect pests which have a wide distribution and impact across the country. Nine insect pests are discussed: spruce budworm, western spruce budworm, two-year-cycle budworm, jack pine budworm, hemlock looper, forest tent caterpillar, gypsy moth, spruce beetle, and mountain pine beetle. Insects and diseases which have a more local or regional impact are discussed in Chapter 2.

Spruce Budworm

Choristoneura fumiferana (Clem.)

Spruce budworm continues to have a major impact on forests although its intensity has declined slightly during the past few years. The area of moderate to severe defoliation remains high, largely because of the continuing infestation in Ontario (Table 2). The areas sprayed to control the insect, however, remain a miniscule proportion of the area defoliated (Table 3). In 1993, spraying was done only in New Brunswick, Saskatchewan and Alberta, plus a few hectares of plantations in Ontario.

NEWFOUNDLAND AND LABRADOR

In 1992, moderate and severe defoliation in the Codroy Valley in southwestern Newfoundland occurred on 1 900 ha, light defoliation on 700 ha. This infestation collapsed in 1993 and no new areas of defoliation were detected.

Pheromone traps were placed at 50 permanent sample locations throughout the Island. The total number of moths captured decreased about sevenfold to 259 in 1993. The average catch in 1993 was 5 moths per location, as compared to 38 in 1992. In western Newfoundland the mean number of moths per location was 4.7, in central Newfoundland 8.1, and in eastern Newfoundland near zero.

The Newfoundland Department of Forestry and Agriculture did not conduct an operational control program against spruce budworm in 1993.

Overwintering populations were sampled in conjunction with the hemlock looper and blackheaded budworm egg sampling from mid- to late October. No defoliation by spruce budworm was forecast for 1994.

Table 2. Area of Moderate to Severe Defoliation by Province and Territory, and Area Sprayed to Control the Spruce Budworm in 1993.

Province or Territory	Defoliation (thousand ha)	Area Sprayed (thousand ha)
Newfoundland and Labrador	0.0	0.0
Nova Scotia	0.0	0.0
New Brunswick	0.0	134.7
Prince Edward Island	33.8	0.0
Quebec	0.4	0.0
Ontario	8 991.2	0.3[1]
Manitoba	13.8	0.0
Saskatchewan	22.6	34.0
Alberta	46.5	8.7
Northwest Territories	53.6	0.0
British Columbia	170.0	0.0
Yukon	–	–
TOTAL	**9 331.9**	**177.7**

[1]Control by *Bt* on plantations.

MARITIMES

Information about the spruce budworm is summarized from: the New Brunswick Department of Natural Resources and Energy (NBDNRE), Forest Protection Ltd., J.D. Irving Ltd., the Nova Scotia Department of Natural Resources (NSDNR), and the Forest Insect and Disease Survey (FIDS). The cooperation of all organizations is acknowledged. More detailed information is available from the various agencies.

As a result of fenitrothion and Bt treatments, no defoliation was observed in New Brunswick. Similarly, Nova Scotia forests suffered no defoliation for the seventh consecutive year. Prince Edward Island reported moderate to severe defoliation over 33 800 ha, a slight increase over 1992.

Table 3. Area of Moderate to Severe Defoliation and Area Sprayed to Control the Spruce Budworm since 1983.

Year	Defoliation (million ha)	Area Sprayed (million ha)
1983	23.8	3.1
1984	16.8	2.0
1985	20.2	1.5
1986	12.3	0.8
1987	8.4	0.9
1988	6.3	0.7
1989	7.7	0.8
1990	8.5	1.1
1991	10.2	0.5
1992	10.1	0.3
1993	9.3	0.2

New Brunswick

Defoliation - For the first time in 45 years, no defoliation of balsam fir or spruce was observed in New Brunswick. Localized areas of defoliation were observed during surveys in north-central New Brunswick and ranged from trace to moderate. Most defoliation was in Northumberland and Restigouche counties.

Foliage protection against spruce budworm in New Brunswick was done on 134 720 ha in 1993: 100 000 ha by Forest Protection Ltd. and 34 720 ha by Forest Patrol Ltd., a subsidiary company of J.D. Irving Ltd.

Forest Protection Ltd. treated 36% of their area with fenitrothion and 57% with *Bacillus thuringiensis* (*Bt*) Most of this area was treated twice. The remaining 7% was sprayed with fenitrothion, followed by an application of *Bt*. Forest Patrol Ltd. treated 87% of their area with fenitrothion and 13% with *Bt*; 85% of the total area was sprayed twice.

Surveys of overwintering larvae (L_2 surveys) conducted by NBDNRE identified only six “pockets” of moderate infestation in the province, five of these in north-central New Brunswick.

Nova Scotia

Defoliation - For the seventh consecutive year, no defoliation of balsam fir or spruce was observed in Nova Scotia in 1993. Larvae were difficult to find during ground sampling and their presence was recorded only at seven locations in the central and eastern parts of the province. Light trap catches were very low. Catches in nine pheromone traps were reduced by 75% from the already low levels observed in 1992. The highest pheromone catch, (50 moths), was in Inverness County.

Control - No operational-scale controls were done for the spruce budworm in 1993.

Forecast - Surveys of overwintering larvae (L_2 survey) conducted by NSDNR indicated that spruce budworm populations would remain low in 1994. Overwintering populations were negligible or low at 97% of the locations sampled and moderate at only 3%. The moderate populations were found in northern Antigonish County.

Prince Edward Island

Defoliation, mostly of white spruce and to a lesser extent balsam fir, occurred over 42 800 ha in 1993; 33 800 ha were in the severe and moderate categories. This is an increase of 1 800 ha from 1992.

Defoliation was patchy and ranged from trace to severe, with the majority in the moderate category. Defoliation occurred mainly in southern Kings and southeastern Queens counties. Elsewhere, defoliation was at trace or light levels, and there were fewer damaged stands than in 1992.

Control - No operational control measures were done in 1993.

Forecast - L_2 surveys conducted by FIDS indicated that significant defoliation would occur in 1994 in southeastern Prince Edward Island.

QUEBEC

The spruce budworm infestation in eastern Quebec continued to decline in 1993, and the population increase observed in recent years in the western part of the province did not result in significant new pockets of defoliation. For the first time in 20 years, no defoliation was observed in aerial surveys of the Lower St.Lawrence, Gaspé-Magdalen Islands or North Shore regions. A total area of only 477 ha was infested in 1993, down from 46 278 ha in 1992 (Table 4).

In the Outaouais region, infested areas declined by 20% from 1992 levels. They continue to be located southwest of the Basse-Lièvre management unit. Since 1992, there have been slight changes in the location of the infestations, no significant damage at several pockets where the insect caused slight damage last year, and the appearance of a few new pockets of defoliation near existing ones. Damage continued to be severe near Sainte-Cécile-de-Masham, it intensified in a pocket northwest of Aylmer (from moderate in 1992 to severe in 1993) and it was less severe north of Wakefield (from moderate in 1992 to light in 1993). The ground surveys conducted also confirm that defoliation continued to be light in the other parts of the region.

For the most part, very little spruce budworm damage was observed in the Lower St. Lawrence, Gaspé-Magdalen Islands and North Shore regions. In addition, the high overwintering larvae (L_2) populations that had been detected in the fall of 1992 on the Magdalen Islands did not cause the anticipated damage. Defoliation was generally light, with the exception of one site near the municipality of Fatima, where damage was moderate.

Forecast - The results of the L_2 survey indicate that spruce budworm populations continue to increase in the Outaouais region. Although damage remains generally light throughout the region, a few new isolated pockets of moderate to severe defoliation are forecast for 1994. Most visible defoliation in 1994 will occur within an area bordered by the municipalities of Gatineau, Fort-Coulonge and Kazabazua.

Spruce budworm populations also continue to increase on the north shore of the St.Lawrence, from the Outaouais to the Quebec City region. Nonetheless, population levels continue to be low and damage will be insignificant. In the Quebec City, Saguenay-Lac-Saint-Jean, Chaudière-Appalachian, Eastern Townships, Montérégie and Abitibi-Témiscamingue regions, the overwintering larvae survey did not reveal significant variations in the abundance of populations forecast for 1994 as compared to those of 1993. The populations will remain low, as in 1993.

In 1994, spruce budworm populations will continue to decline in the Lower St.Lawrence, Gaspé-Magdalen Islands and North Shore regions. The L_2 population levels were low or nonexistent throughout the three regions, except in the Magdalen Islands, where surveys are forecasting large populations for 1994.

ONTARIO

Defoliation - In 1993, the total area of moderate to severe defoliation was 8 991 177 ha, a reduction of 604 585 ha from 1992. Most of the defoliation occurred in a

Table 4. Area (ha) of Quebec Affected by the Spruce Budworm in 1993.

Administrative Region	Defoliation			Total
	Light	Moderate	Severe	
Outaouais	103 (231)[1]	172 (270)	202 (96)	477 (597)
Lower St. Lawrence	0 (3 808)	0 (116)	0 (126)	0 (4 050)
Gaspé-Magdalen Islands	0 (20 084)	0 (15 017)	0 (3 538)	0 (38 639)
North Shore	0 (1 422)	0 (1 229)	0 (341)	0 (2 992)
TOTAL	**103** (25 545)	**172** (16 632)	**202** (4 101)	**477** (46 278)

[1] ( ) = Area affected in 1992.

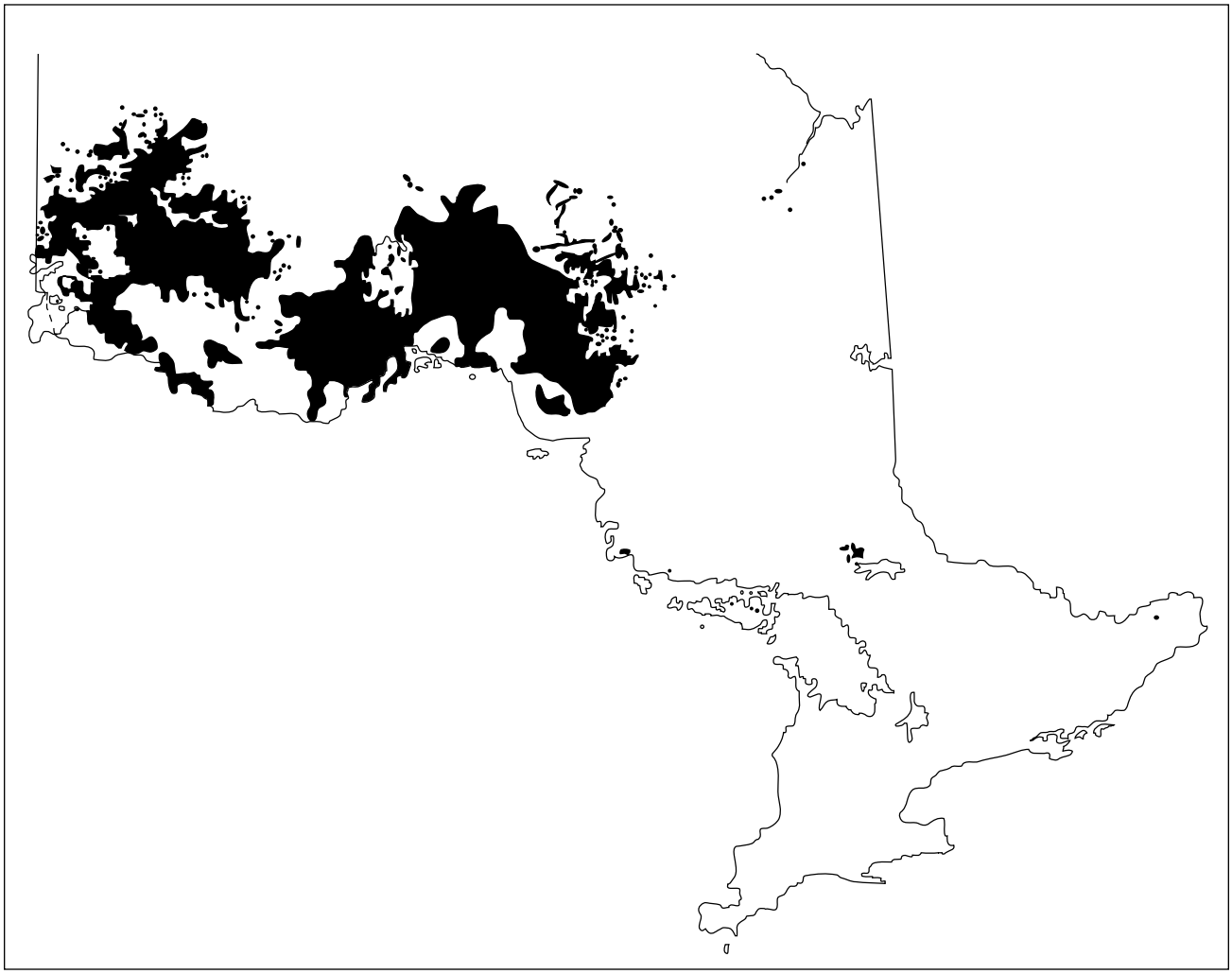

Figure 1. Area of Moderate to Severe Defoliation by the Spruce Budworm in Ontario, 1993.

large infestation stretching from the Manitoba border eastward to north-central Ontario, with small, outlying infested areas along the northern rivers (Figure 1). Declines in area infested occurred in the western part of the outbreak from Kenora to Thunder Bay, and on the eastern side of the outbreak in north-central Ontario. There were increases in infested areas in northern Ontario and near Sault Ste. Marie. The area of defoliation declined slightly in Algonquin Park. Small pockets of defoliation occurred at white spruce plantations in eastern Ontario and near Lake Simcoe.

Spruce budworm infested 8.99 million ha of Ontario's forests: the 27th consecutive year at outbreak levels.

Damage - Aerial surveys showed an increase in the area of budworm-caused mortality of balsam fir and white spruce (Figure 2). Mortality occurred on 5 032 925 ha, an increase from 3 943 442 ha in 1992. Most of the increase occurred in the eastern part of the main outbreak, but there were also sizable increases in the areas surrounding the north part of Lake of the Woods and in the north-central Fort Frances District.

Control - The Ontario Ministry of Natural Resources (OMNR) aerially sprayed four white spruce plantations in the vicinity of Tyrol Lake, totaling 291 ha in June 1993. The treatment was a single application of Foray 48B at 30 BIU/ha (neat) by helicopter.

Monitoring - Egg-mass sampling was carried out at 560 locations to forecast populations in 1994. A comparison of 330 locations sampled in 1992 and 1993 showed an

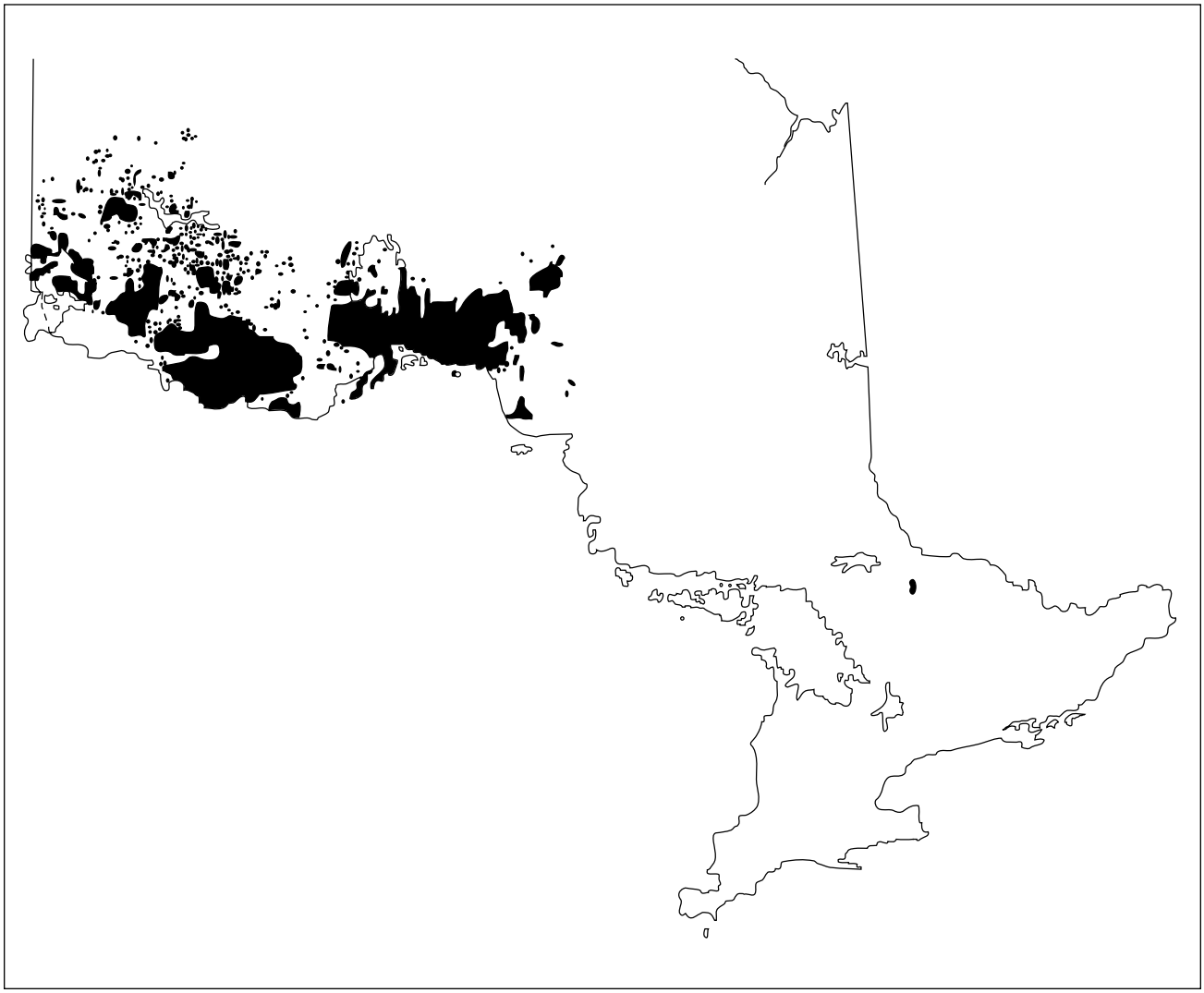

Figure 2. Area of Tree Mortality Caused by the Spruce Budworm in Ontario, 1993.

overall decrease of 36% in egg-mass densities, the fourth consecutive year of overall decline. However, egg-mass densities remain high enough that moderate to severe defoliation will probably persist in 1994 in most of the areas infested in 1993. Some reduction in the area of moderate to severe defoliation may occur in the northern part of the outbreak. Little or no change is expected in the eastern part of the main outbreak or in central and southern Ontario.

NORTHWEST

Manitoba

Defoliation - Spruce budworm infestations surveyed by the Manitoba Department of Natural Resources occurred over 15 051 ha of white spruce and spruce-balsam fir forests. In the defoliated areas 1 287 ha were classed as light and from light to moderate, and 13 764 ha as moderate to severe. The largest affected areas, which have persisted since 1979, were within the Forest Management Licence of Abitibi-Price and included areas of reduced growth, crown dieback, and mortality. Defoliation also ranged from moderate to severe in areas east of Lake Winnipeg and on the islands in the Interlake area.

Control - No aerial spraying programs were conducted in 1993. Some salvage harvesting is planned in severely damaged forests.

Monitoring - Surveys used to forecast population levels in 1994 were done by the Manitoba Department of Natural Resources. Light and light to moderate defoliation levels were predicted for 1994 in areas east of Lake Winnipeg.

Saskatchewan

Defoliation - In Saskatchewan, the total area of white spruce–balsam fir forests defoliated was 56 617 ha, a decrease of 35% from 1992. The survey was completed by FIDS and the Saskatchewan Department of Environment and Resource Management. Infestations continued at three of the same outbreak areas reported in 1992: north of Big River, near Red Earth, and southwest of Hudson Bay (Figure 3). A new infestation was observed at Morin Lake near La Ronge. About 60% of the area was lightly defoliated in 1993. This defoliation occurred in areas north of Big River where *Bt* was applied to control the infestation. The remaining infested area, 22 600 ha, was at moderate to severe levels.

Near Prince Albert, the spruce budworm infestation near Big River covered 41 717 ha. Most (34 017 ha) of the infestation was light, while the remainder (7 700 ha) was moderate to severe. Defoliation occurred in eight patches ranging in size from 100 to 2 800 ha. Some areas have been defoliated for up to seven consecutive years, and white spruce mortality is evident.

In the Hudson Bay Region, two major spruce budworm infestations were active in 1993, one near Red Earth (1 300 ha) and the other south of Hudson Bay (10 000 ha). High populations of spruce budworm have been reported in both areas since 1982.

Control - In 1993, an aerial spraying program using *Bt* was completed by the Saskatchewan Department of Environment and Resource Management over 34 017 ha to suppress populations and reduce the risk of timber losses. An area of 28 518 ha received two applications of *Bt*, the remainder received one application. Salvage cutting occurred in severely damaged sawlog timber, has been ongoing for several years, and continues to be the main strategy in spruce budworm management.

Monitoring - In 1993, 408 pheromone-baited traps were deployed at 136 sites by the Saskatchewan Department of Environment and Resource Management. This was the third consecutive year of trap deployment. The trap catches indicated high population densities throughout Saskatchewan's commercial forests and identified areas for follow-up L_2 surveys. Results from L_2 surveys indicated that light defoliation was to be expected in the Hudson Bay Region and at most locations in the Meadow Lake and Prince Albert regions in 1994.

Alberta

Defoliation - In Alberta, small infestations occurred west of Bowden, near Millett, in Big Knife Provincial Park, in Elk Island National Park, in Cypress Hills Provincial Park, and near Morningside. A small infestation along the Saskatchewan River in Edmonton continued from 1992 into 1993.

Major infestations were monitored with air and ground surveys by staff of the Alberta Department of Land and Forest Services and FIDS. These infestations continued in the Footner Lake, Peace River, Athabasca, and Lac La Biche forests. The infestation covered 48 546 ha, of which 96% was moderate to severe, and severe. The remaining area, 2 073 ha, was light.

In the Footner Lake Forest, the total area of infested white spruce forests in 1993 was 43 616 ha. Most of the infestations took place in the areas reported in 1992, although their size has decreased. A large infestation (10 036 ha) occurred along the Sousa Creek and up onto the Zama ridge. Other areas with moderate to severe defoliation were along the Hay River near Meander River (1 090 ha), and along the Steen (3 110 ha) and Yates (1 131 ha) rivers.

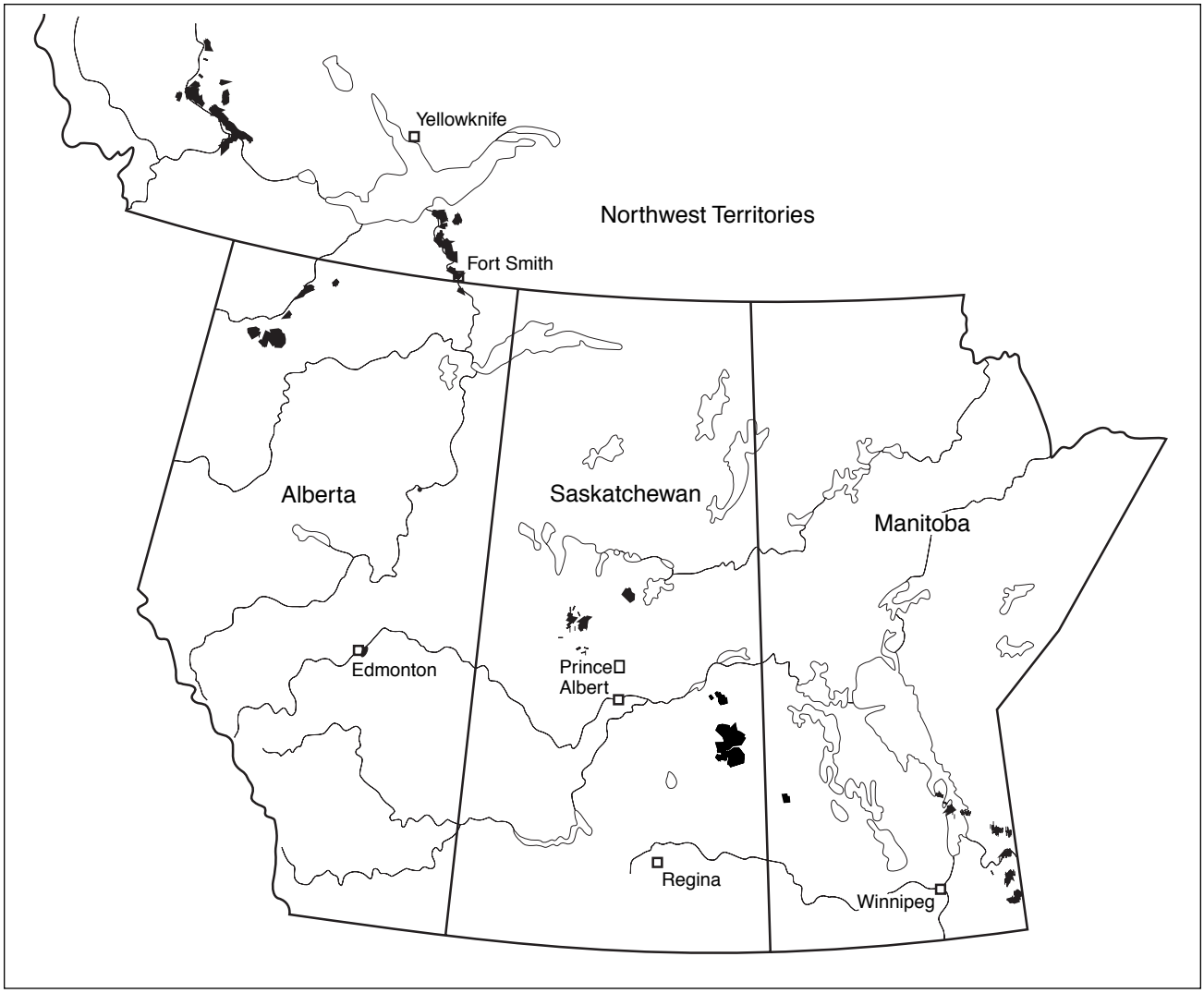

Figure 3. Area of Moderate to Severe Defoliation by the Spruce Budworm in the Northwest Region, 1993.

In the Athabasca and Lac La Biche forests the combined area of infested white spruce-balsam fir forests was 3 930 ha. About 47% of this area (1 857 ha) had moderate defoliation while the remainder was classed as light. All infestations occurred along the Athabasca River at about the same locations as in 1992.

In the Peace River Forest, moderate defoliation occurred over 1 000 ha of white spruce forests near Hawk Hills, the same area reported in 1992.

Control - For the fourth consecutive year, an aerial spraying program was conducted using *Bt* on 4 652 ha west of High Level along Highway 58. The pesticide *Bt* was applied on 3 146 ha in the Athabasca Forest and 432 ha in the Lac La Biche Forest. It appears that populations in both of these forests are dropping from epidemic to low endemic levels.

Monitoring - Alberta Land and Forest Services deployed pheromone-baited traps at many locations to monitor population levels. Moth counts >500 moths per trap were observed at nine locations in the Athabasca, Footner Lake, Peace River, and Slave Lake forests. Surveys (L_2) based on 1993 defoliation and pheromone trap results were conducted at Footner Lake and Athabasca. The results indicate that light to severe defoliation will occur in the main infestation area along the Chinchaga River and east along Highway 58 in the Footner Lake Forest in 1994. In the Athabasca Forest, light and moderate defoliation is expected in 1994.

Northwest Territories

Defoliation - Aerial surveys to map areas infested by the spruce budworm were conducted jointly by the Northwest Territories Department of Renewable Resources and FIDS.

Spruce budworm infestations occurred at about the same locations as 1992, but the area of defoliation has nearly doubled: where in 1992 about 90 000 ha were defoliated, the total rose by 92% to 173 117 ha in 1993.

Most defoliation (119 507 ha) was light or light to moderate, while the remainder was moderate to severe. Defoliation ranged from light to severe along the Slave River from Great Slave Lake to Fort Smith. Along the Taltson River east of the Slave River, defoliation was light to moderate. Light defoliation occurred at white spruce stands along the Liard River near Fort Liard. Additional areas of infestation extended along the Liard River near its confluence with the Mackenzie River. Along the Mackenzie River, from Wrigley to Wallace Creek, light to severe defoliation occurred, including adjacent areas along the North Nahanni River and in the Ebbutt Hills. A small, light to moderate infestation occurred in Nahanni National Park. Some tree mortality resulting from several years of spruce defoliation occurred near the south end of the Kotaneelee River and along the Liard River south of Fort Liard.

PACIFIC AND YUKON

Current and older foliage of white spruce and alpine fir was defoliated by eastern spruce budworm over 170 000 ha north and west of Fort Nelson in northeastern British Columbia. This is 20% more than the area defoliated in 1992. Defoliation was light over 80% of the area and moderate over the remainder, and extended into the Yukon and Northwest territories. This was the tenth consecutive year of defoliation in some areas around Fort Nelson. The increase in area of defoliation resulted from a general expansion throughout previously defoliated areas from Liard Hot Springs in the Fort Nelson River Valley to 60° N. Defoliation was forecast to continue in 1994 on the basis of the number of egg masses (average 33/m^2) on spruce foliage collected by the British Columbia Forest Service in the Snake and Fontas river drainages near Fort Nelson.

No control operations were done for spruce budworm in 1993.

Western Spruce Budworm

Choristoneura spp.

The western spruce budworm (*C. occidentalis* Free.) is a widely distributed and destructive defoliator of coniferous forests in western North America. Despite its common name, within British Columbia the budworm feeds primarily on Douglas-fir. Other budworms currently active in true fir-spruce stands in British Columbia include the eastern spruce budworm *(C. fumiferana* [Clem.]) in northeastern British Columbia, and two-year-cycle budworm (*C. biennis* Free.) in east-central and southeastern British Columbia.

At least six infestations of varying duration have occurred at irregular intervals in southern British Columbia since 1910. The effects of defoliation by western spruce budworm include loss of radial and height growth, topkill with resulting defects, and tree mortality.

The total area of mixed-aged Douglas-fir defoliated by western spruce budworm in 1993 in the southern interior of British Columbia declined to 43 000 ha (Figure 4). More than 90% of the 265 infested areas mapped in 1993 were in the Kamloops Region, with the remainder in the Cariboo and Vancouver regions. Trace defoliation was mapped over 350 ha west of Clinton in the Cariboo Region, down from 550 ha in 1992, and near Pemberton in the Vancouver Region on 3 700 ha. Populations in the western part of the Nelson Region were at endemic levels following a significant decline in 1992.

The intensity of defoliation was light on 95% of the area and moderate on the remainder, compared with 72%, 27% and 1% in 1992. Heavy rains this summer frequently washed the discolored foliage from the trees making aerial determinations of defoliation uncertain. The area of moderate defoliation totaled 2 300 ha, mostly near Lillooet and Pemberton. This was down from nearly 200 000 ha of moderate and severe defoliation in 1992.

Mortality of late-instar larvae due to disease averaged 35%, up 7% from 1992. An entomopathogen (*Entomophthoroceae*) was isolated from larvae in one collection in which 27% were killed. Parasitism of late-instar larvae, mostly by tachinids and hymenopterans, averaged 10%, a proportion similar to that in 1992.

The survey of egg masses at 33 sites forecasts severe defoliation at four sites, moderate at eight, trace or light at sixteen, and none at five.

Aerial applications of *Bt* (Berliner var. *kurstaki* Dipel 132®) by the British Columbia Forest Service were conducted over about 34 000 ha in the Kamloops Forest Region in 1993. Populations were considered successfully reduced with some degree of bud and foliage protection achieved.

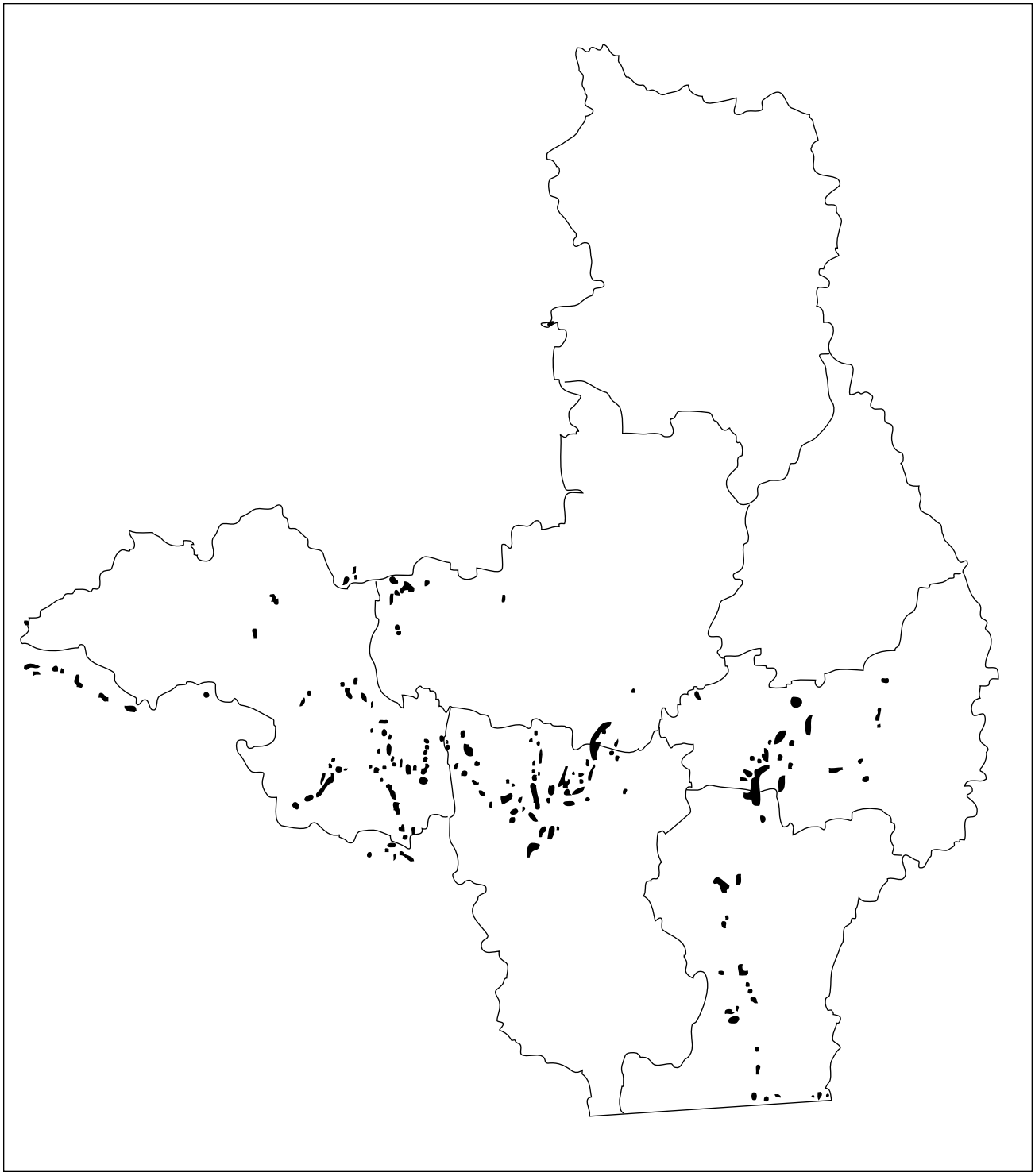

Figure 4. Area of Moderate to Severe Defoliation by the Western Spruce Budworm in the Kamloops Forest Region, British Columbia, 1993.

A study to improve and calibrate detection methods for western spruce budworm continued in 1993. Adult males were monitored at 11 sites in four regions with a history of budworm outbreaks but still with low populations. Up to 1 050 male adults were caught in a total of 49 MultiPher® non-sticky traps (average of 154 per trap), a total similar to last year's. The data also indicate that current populations will continue and will lightly defoliate stands in 1994.

Two-year-cycle Budworm

Choristoneura biennis Free.

Defoliation of spruce and alpine fir forests by two-year-cycle budworm was light and moderate over 107 000 ha in 135 separate infestations, as compared to 435 000 ha in 1992 (Figure 5).

Defoliation occurred on new buds on spruce and some fir over 97 000 ha in the Prince George Region, 10 000 ha in the northeast part of the Kamloops Region, 4 300 ha in the Nelson Region and 350 ha in East Kootenay. In the Mackenzie and Fort St. James forest districts of the Prince George Region, defoliation was mostly light over an estimated 88 300 ha and moderate over the remainder. This was a nearly fivefold increase from 1992, with the largest areas from Kloch Lake in the south to the Omineca River drainage in the north and northeast to the Ospika River drainage. Moderate and severe defoliation occurred on 10 000 ha east of Vernon over 4 300 ha in adjacent areas in the West Kootenay part of the Nelson Region. Defoliation was lighter than forecast in the East Kootenay part of the Nelson Region, where larvae were killed by late frost. On the basis of historical trends, the defoliation by "off-cycle" budworm is expected to continue in the Prince George, Kamloops, and Nelson regions.

Figure 5. Area of Moderate to Severe Defoliation by the Two-year-cycle Budworm in British Columbia, 1993.

Table 5. Area of the Outaouais Region (ha) Affected by the Jack Pine Budworm in 1993.

Management Unit	Defoliation			Total
	Light	Moderate	Severe	
Coulonge	362 (165)[1]	171 (0)	73 (592)	606 (757)

[1] ( ) = Area affected in 1992.

Adult male populations continued to be monitored in representative fir-spruce forests in five regions to improve identification and monitoring methods. About 4 330 adult males were collected in 65 non-sticky MultiPher® traps at 13 locations.

Jack Pine Budworm

Choristoneura pinus pinus Free.

QUEBEC

The jack pine budworm infestation detected in 1992 in the Outaouais region declined significantly this year.

The damage recorded in the main pocket of infestation on Grand-Calumet Island declined considerably in 1993. Damage was generally light, unlike 1992, when it was severe. Moderate to severe defoliation occurred only on a small part of the infested area. On the other hand, local infestations near Fort-Coulonge intensified from light in 1992 to moderate or severe in 1993. A new pocket of light infestation was also observed near Vinton (Table 5).

According to an overwintering larvae survey conducted in sectors where damage was observed in 1993, the populations are expected to remain at moderate levels in a few sectors of the Grand-Calumet Island pocket, while defoliation in the other local infestations near Fort-Coulonge is expected to range from light to moderate.

ONTARIO

Defoliation - The area of moderate to severe defoliation increased from 158 784 ha in 1992 to 282 247 ha in 1993, all in the eastern part of the province (Figure 6). Infestations which occurred in northwestern Ontario in 1992 collapsed, with no defoliation recorded in 1993. The largest area of defoliation (165 840 ha) and the largest increases in area occurred in Sudbury District. A small infestation which occurred in Sheffield Township, near Tweed in 1992, disappeared in 1993.

The area infested by the jack pine budworm increased from 158 784 ha in 1992 to 282 247 ha in 1993.

Damage - A total area of 50 937 ha of dead and moribund jack pine occurred along the Georgian Bay coast, between Point au Baril and the Pickerel River. Results from four sample plots show the incidence of bare (usually dead) tops ranging from 13 to 40%, with 26 to 38% dead trees.

Monitoring - Jack pine budworm egg-mass surveys were carried out at 271 locations. Analysis of the results, with a comparison of 183 locations sampled in 1992 and 1993, showed an overall increase in egg-mass densities of 16%. These results indicated that infestations would persist in 1994 in most of the areas where they occurred in 1993. There is potential for expansion in the Sudbury and North Bay districts where new areas may be invaded or defoliated areas coalesce to form a contiguous outbreak. Despite an increase in the density of egg-masses, infestations in the Parry Sound District could decline in 1994. This is because much of the jack pine host is severely damaged or dead after four years of infestation.

NORTHWEST

Jack pine budworm has not caused significant defoliation to pine stands in the prairie provinces since the last outbreak collapsed in 1987. Populations have been monitored by FIDS in Alberta and Saskatchewan and by the Department of Natural Resources in Manitoba. Detection surveys have concentrated on pheromone traps for male moths and egg-mass surveys. On the basis of these surveys, populations are expected to remain low, with little defoliation expected.

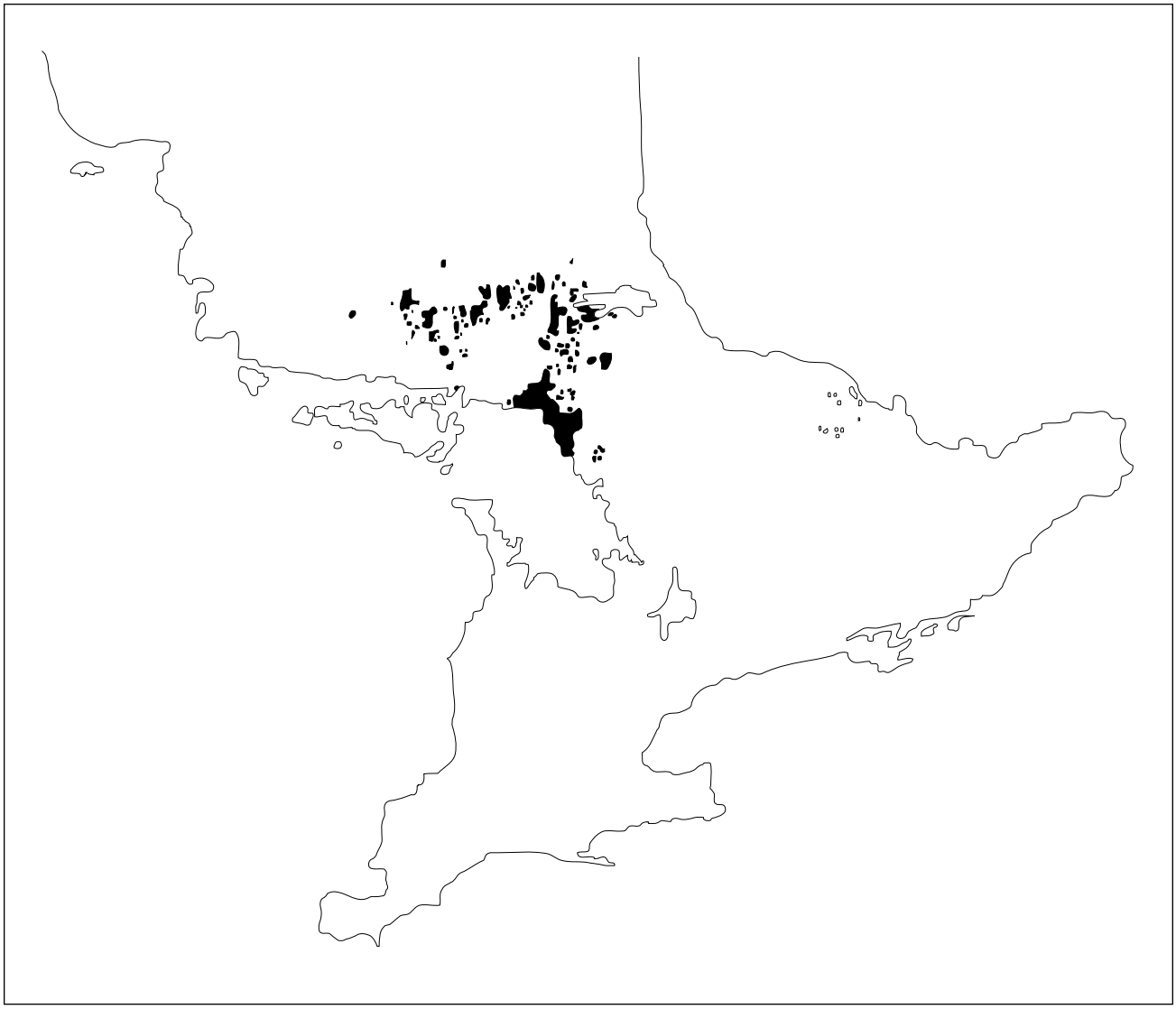

Figure 6. Area of Moderate to Severe Defoliation by the Jack Pine Budworm in Ontario, 1993.

Hemlock Looper

Lambdina f. fiscellaria (Gn.)

NEWFOUNDLAND AND LABRADOR

The area of infestation in Newfoundland increased from 9 800 ha in 1992 to 11 200 ha in 1993 with light, moderate and severe defoliation on 4 200, 2 600 and 4 400 ha respectively (Figure 7). The infestation on the Northern Peninsula collapsed in 1992 and no defoliation was observed in 1993. Significant defoliation occurred throughout central Newfoundland in 1993. Continued infestations caused moderate and severe defoliation on the Avalon Peninsula and small areas of light, moderate and severe defoliation near Clarenville in 1993.

Larvae were collected in 1993 for parasite rearing from infestations in central and eastern Newfoundland. Fewer than 1.0% of the larvae were parasitized; however diseases killed from 11.9% to 62.8% of developing larvae. Disease organisms were identified as bacteria, yeast-like organisms and fungi including *Entomophaga aulicae, Paecilomyces farinosus* and *Erynia* (=*Zoophthora*).

A grid of 50 pheromone traps were established in 1993 throughout Newfoundland. In 1993, the mean catches in western, central and eastern Newfoundland were 231, 419 and 419 respectively, which were similar to 1992 totals. Results support the prediction of moderate to severe defoliation in central Newfoundland in 1994.

Overwintering eggs were sampled at approximately 800 points across Newfoundland from mid- to late October.

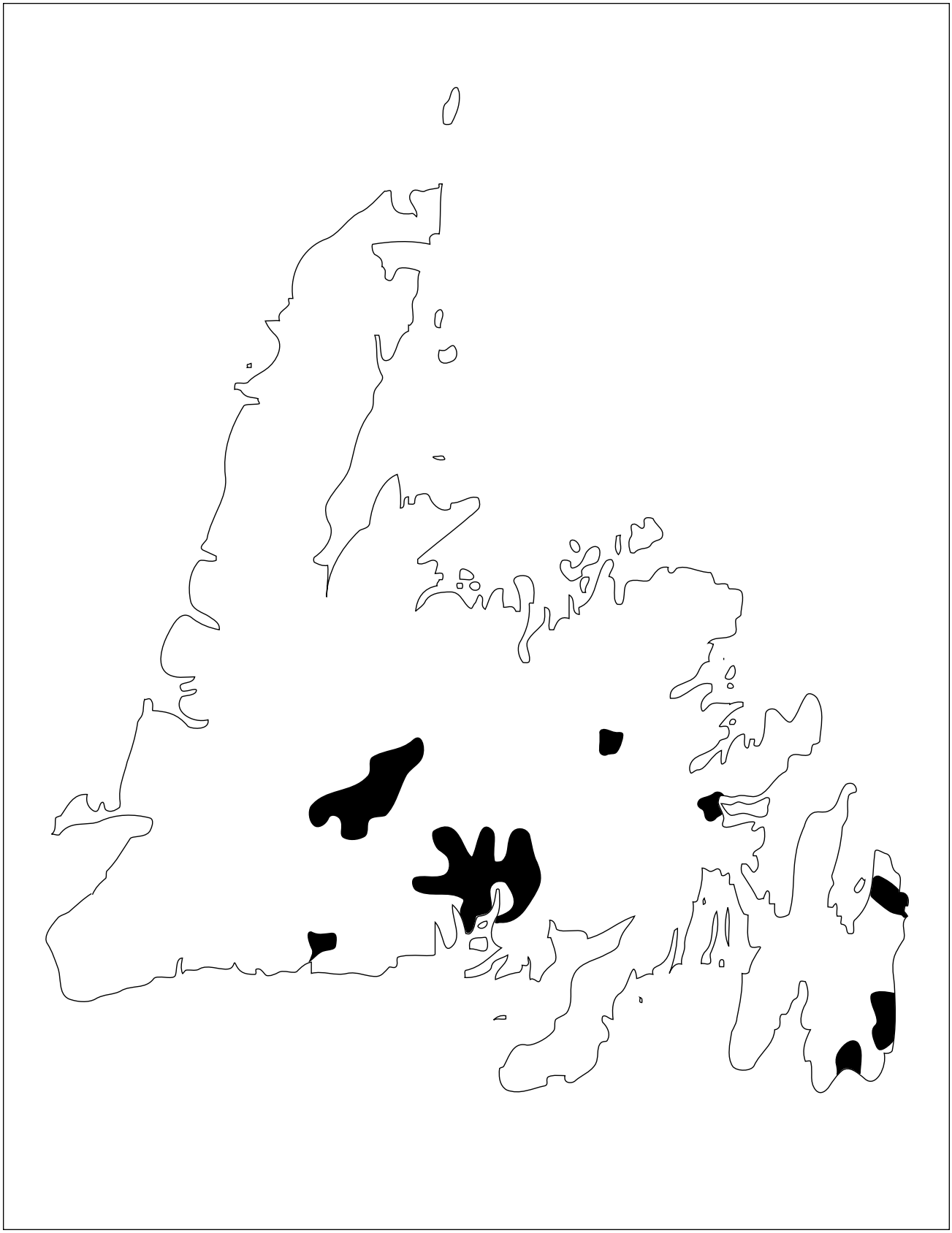

Figure 7. Area of Moderate to Severe Defoliation by the Hemlock Looper in Newfoundland and Labrador, 1993.

Moderate and severe defoliation was predicted to occur on 26 300 ha, light defoliation on 39 800 ha. The majority of the moderate to severe defoliation is expected to occur on 14 400 ha in central Newfoundland. Populations in the Bay d'Espoir area have declined and 5 800 ha is expected to be defoliated in 1994. Similarly, the outbreak in eastern Newfoundland remains scattered, with little defoliation forecast for 1994.

The Newfoundland Department of Forestry and Agriculture conducted an operational spray program against the hemlock looper in 1993. Balsam fir stands in central and south-central Newfoundland were treated with *Bt*.

MARITIMES

For the first time since 1989 defoliation by the hemlock looper was not detected during aerial surveys in the Maritimes.

In New Brunswick, populations declined rapidly in previously known outbreak areas and populations increased in new areas. Population declines occurred in central and southwest New Brunswick. Though insect numbers were comparatively small, larvae were found at locations in the southeast where they were rarely found during the 1989-93 period.

Foliage protection and population suppression in New Brunswick was conducted over 15 475 ha by Forest Protection Ltd.: 6 950 ha with two applications of fenitrothion at 210 g/ha/application and 8 525 ha with two applications of *Bt* (Foray 76B) at 30 BIU/ha/application. Egg sampling, conducted in the fall by NBDNRE at 353 plots in the northwestern, north-central, and southwestern regions of New Brunswick, found low populations at a few locations in Charlotte County and at a few locations in the north-central part of the province. Egg counts were negative elsewhere.

In Nova Scotia, few larvae were found at any of the locations sampled, and defoliation never exceeded trace levels. However, pheromone trap catches indicate an upward trend in population with three times the number of adults caught in 1992. Traps located on Cape Breton Island and central Nova Scotia showed the largest increases. A light trap at Kejimkujik National Park had an increase in the number of moths caught to 476 in 1993 from 15 last year.

The NSDNR conducted an egg survey at 19 locations in Halifax, Kings, Inverness, and Victoria counties. Twelve locations had negative results, seven others had low populations predicted for 1994. In Nova Scotia, it was estimated that one year of severe defoliation by the hemlock looper killed 325 000 m^3 of balsam fir.

No defoliation was observed in Prince Edward Island and larval populations were very low for the third consecutive year. However, the average number of moths per trap was 247 in 1993 as compared to 30 in 1992.

QUEBEC

No damage was recorded in the Lower St. Lawrence. Populations returned to an endemic level in the pocket at Parke. Two infested stands reported in 1992 south of the Rimouski wildlife area were controlled through salvage harvesting. No spread of the insect was observed in the sector next to the harvested areas.

The hemlock looper infestations observed in 1991 in the Lower St.Lawrence and North Shore regions collapsed in 1993. In 1994, populations are forecast to be trace to low.

An infestation in the Jupiter River sector of Anticosti Island in the North Shore region also declined. However, aerial surveys revealed damage southwest of the island near the sports camps at Rivière-à-la-Loutre and Bec-Scie. The damage at Bec-Scie consisted of light annual defoliation, additional to previous defoliation, whose cause could not be determined. In the sector of Rivière-à-la-Loutre, annual defoliation was observed on 472 ha: 320 ha were moderately, and 59 ha severely defoliated. Hemlock looper defoliation was also observed on fir trees in white spruce stands.

Forecast - An egg mass survey was conducted in the fall at 29 sites throughout the Lower St.Lawrence, Gaspé-Magdalen Islands and North Shore regions. The survey was conducted at stations of the pheromone trap network where average catches exceeded 400 moths per trap. All stations of the permanent plot network on Anticosti Island were sampled, regardless of catch size. Although the presence of eggs was detected at 72% of the stations visited, populations are forecast to be generally trace to low. The worst defoliation is expected to be moderate and was observed at only two sites on the western tip of Anticosti Island. No significant hemlock looper infestation is expected to occur in 1994.

ONTARIO

The first hemlock looper infestation in Ontario in many years was discovered at a 10-ha balsam fir-white cedar stand on Manitoulin Island in 1992. In 1993, the total

Figure 8. Area of Moderate to Severe Defoliation by the Western Hemlock Looper in British Columbia, 1993.

area infested was 1 260 ha. The largest area and most severe damage occurred on the Wikwemikong First Nation lands, where balsam fir stands sustained defoliation as high as 100%. In addition, small 5- to 10-ha pockets of damage were mapped in Burpee, Mills, Campbell and Assiginack townships and a single pocket of defoliation occurred on a small island in Beaverstone Bay adjacent to the nearby mainland. Balsam fir was the species most heavily attacked but eastern white cedar and scattered overstory white pine were sometimes severely defoliated. Black and white spruce, ground juniper, red maple, trembling aspen and white birch were also lightly defoliated in areas where balsam fir had been completely defoliated. A second hemlock looper infestation caused severe defoliation of about 70 ha of eastern hemlock in five pockets in eastern Ontario.

Hemlock looper has been a rare insect in Ontario but in 1993 nearly 1 400 ha of defoliation occurred on Manitoulin Island.

PACIFIC AND YUKON

The western hemlock looper (*Lambdina f. lugubrosa* [Hulst]) has caused extensive defoliation, topkill and tree mortality in western hemlock-western red cedar forests in British Columbia periodically since 1911. About half the 14 recorded infestations have been in coastal areas, with the remainder in interior forests. Outbreaks usually last 1-4 years. Tree mortality usually occurs if 80% of the crown is defoliated for two or more years. Populations in 3- to 4-year-old infestations have collapsed because of high numbers of egg and larval parasites and infection of larvae by disease and virus.

Old-growth western hemlock and western red cedar over 92 750 ha in 335 patches were defoliated by western hemlock looper in interior British Columbia during 1993 (Figure 8). This decline followed three years of increase to a peak of 186 000 ha in 1992. Defoliation in this fourth year of infestation was severe on half of the area, moderate on 25%, and light on the remainder.

Although there was an overall decline in the outbreak, particularly in the Cariboo and Kamloops regions, infestations increased in the Nelson and Prince George regions. More than half (48 500) the area of defoliation was in the northern part of the Nelson Region. Defoliation occurred over 43 000 ha in the eastern part of the Prince George Region, up 50% from 1992, the second year of defoliation, and represented the first outbreak for the area in more than 25 years. A single 100-ha patch of light defoliation occurred this year in the eastern part of the Cariboo Region, down from 22 750 ha in 1992. There was no defoliation in the Kamloops Region, where more than 88 000 ha were affected in 1992.

Larval mortality from parasitism averaged 10% — the same as in 1992. About 18% of the larvae died from infection by pathogens, mostly *Entomophthora*. Egg parasitism, likely by *Trichogramma* sp. and *Telenomus* sp., averaged 21% at 34 sites in four regions. Parasitism was highest at sites where high populations occurred for two or more years, but is likely too low at new sites to reduce populations significantly in 1994.

In 1994, defoliation at 34 sites is still expected to be severe at five, moderate at seven and light at 14; no damage is expected at the remaining eight.

Plots were established in 21 severely defoliated stands in four regions to monitor the impact of defoliation on tree growth and survival. Tree mortality averaged 6% at 13 plots in the Prince George and Cariboo regions and 40% at six sites in the Nelson Region; there was none at two plots in the Kamloops Region.

A study to develop a pheromone trapping and forecasting system for western hemlock looper, initiated in 1992 in cooperation with the Canadian Forest Service and Simon Fraser University, monitored 27 sites in four forest regions. Preliminary results found that adult and immature populations were related and that trap catches can predict populations in the succeeding generation.

Forest Tent Caterpillar

Malacosoma disstria Hbn.

NEWFOUNDLAND AND LABRADOR

In 1993, 100 baited delta traps were used to detect the introduction of forest tent caterpillar. Traps were placed near major urban centres and in national and provincial parks. The traps were collected and examined in September, but no indication of any introductions was found.

MARITIMES

For the third consecutive year in New Brunswick, the forest tent caterpillar was the major hardwood defoliator. The perimeters of the outbreak areas expanded in the central and southern part of the province. In Prince Edward Island and Nova Scotia, populations remained low.

In New Brunswick, trembling aspen and other hardwoods were defoliated over 196 000 ha, as compared to 77 500 ha in 1992. Of this total, 172 700 ha was severe and 23 300 ha moderate defoliation (Figure 9). Defoliation occurred in southeastern York County, the northeastern part of Charlotte, Sunbury, Queens, and Kings counties and in a large area in central Kent and northern Westmorland counties. Although larvae were present in Northumberland and Madawaska counties, little or no defoliation was observed.

In Nova Scotia, forest tent caterpillar populations remained low and defoliation was limited to trace levels at a few locations. In Prince Edward Island severe defoliation occurred on Manitoba maple and wild apple trees in a 0.5-ha area near Malpeque, Prince County.

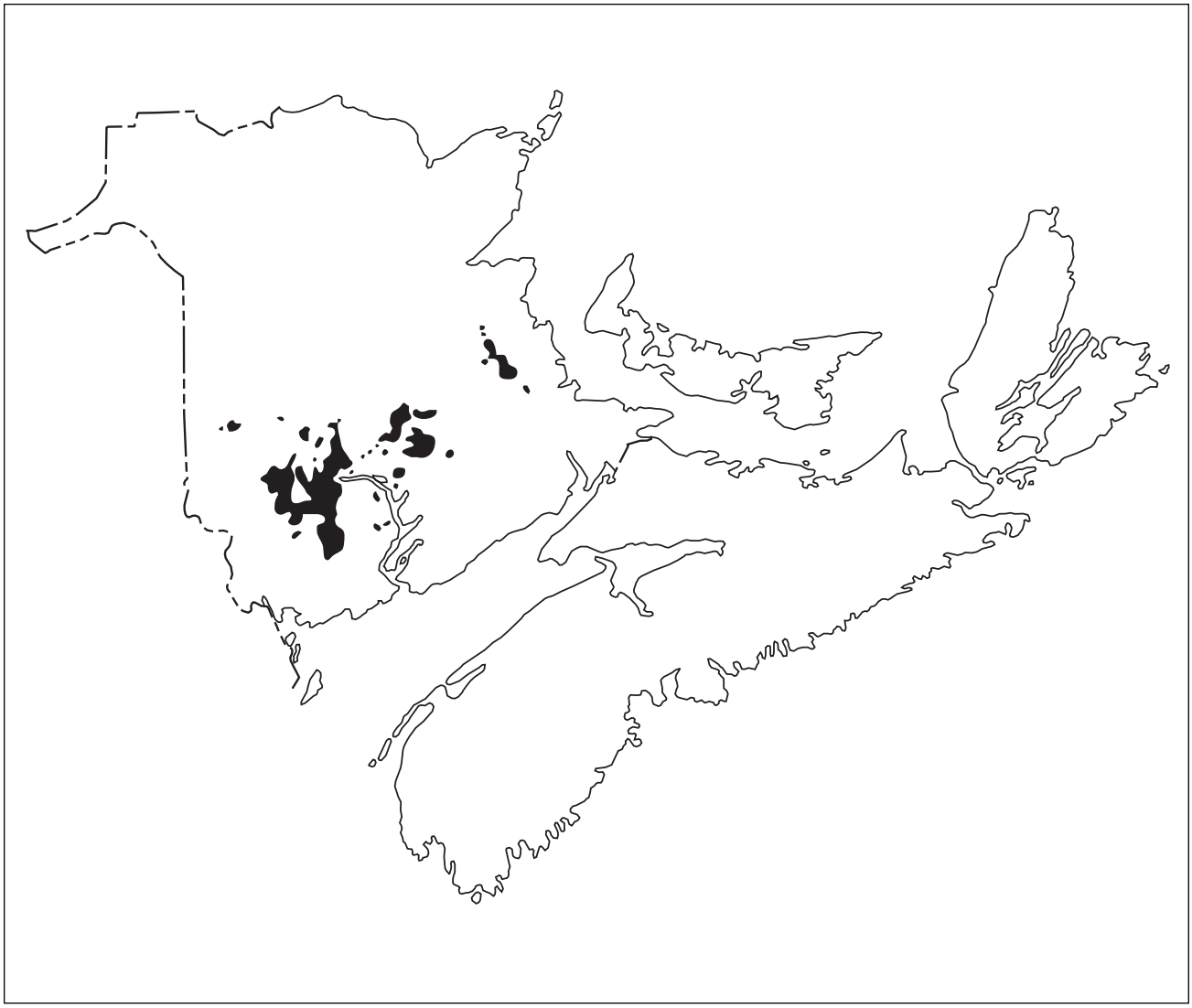

Figure 9. Area of Moderate to Severe Defoliation by the Forest Tent Caterpillar in New Brunswick, 1993.

QUEBEC

Despite several local population fluctuations over the past two years, the caterpillar continues to cause severe damage in these areas, and there has been a marked increase in its numbers on the south shore of the St.-Lawrence River. Small pockets of defoliation were also recorded this year in the Chaudière-Appalachian region. Although forest tent caterpillars were detected in a few other regions, they did not cause significant damage. Trembling aspen, grey birch and largetooth aspen were the species most seriously affected. The areas infested are shown in Table 6.

Forest tent caterpillar populations remained at an epidemic level for a fifth consecutive year in the Mauricie-Bois-Francs region. The first pockets of infestation were detected in 1988 on more than 2 800 ha in the La Tuque sector .

Table 6. Areas (ha) in the Mauricie-Bois-Francs and Chaudière-Appalachian Regions Affected by the Forest Tent Caterpillar in 1993.

Administrative Region	Management Unit	Defoliation			Total
		Light	Moderate	Severe	
Chaudière-Appalachian	34	10 (0)[1]	38 (0)	13 (0)	61 (0)
Mauricie-Bois-Francs	41	3 522 (496)	11 800 (2 783)	1 974 (3 342)	17 296 (6 621)
	42	1 212 (1 928)	14 107 (17 697)	7 903 (8 595)	23 222 (28 220)
	43	624 (197)	2 486 (3 044)	1 542 (1 563)	4 652 (4 804)
TOTAL		**5 368** (2 621)	**28 431** (23 524)	**11 432** (13 500)	**45 231** (39 645)

[1] ( ) = Area affected in 1992.

In the LaTuque sector, the caterpillar continued to cause severe defoliation along the Saint-Maurice River. It occupies essentially the same territory as in 1992, i.e., an area extending from Rivière-aux-Rats to roughly twelve km north of La Croche. Its population levels did, however, continue to fluctuate in these areas.

On the south shore of the St. Lawrence River, the infestation has spread along the edge of the areas observed in recent years, located within the rectangle formed by the municipalities of Gentilly, Daveluyville, Villeroy and Sainte-Françoise. The infestation has spread mainly south of this area towards Victoriaville. The severity of defoliation did, however, decline in existing pockets, ranging primarily from light to moderate in 1993, as compared to moderate to severe in 1992. Southwest of this area, the infestation has spread along the border of the two pockets detected in 1992. Generally moderate damage was recorded between the municipalities of Notre-Dame-du-Bon-Conseil and Saint-Léonard-d'Aston, while moderate to severe damage was observed between Saint-Zéphirin, Saint-Majorique-de-Grantham and Sainte-Brigitte-des-Saults.

In the Chaudière-Appalachian region, several small pockets of moderate to severe defoliation were recorded along the Jean Lesage Highway near Joly and Laurier Station. The last infestation in these sectors had collapsed in 1983.

Forecast - The forest tent caterpillar egg band count conducted last fall reveals that population levels should remain high in several sectors of the Mauricie-Bois-Francs region in 1994. The caterpillar is not expected to expand its range significantly along the edge of the areas infested in 1993.

ONTARIO

The area of moderate to severe defoliation declined from 16 051 424 ha in 1992 to 655 256 ha in 1993. Most of the decline occurred in northwestern Ontario where populations collapsed. No defoliation was recorded either there or in northern Ontario where the area of moderate to severe defoliation declined to 532 907 ha from 5 479 481 ha in 1992. Most of this area occurred in a large infestation in the south-central Hearst and Cochrane districts (Figure 10). Two widely separated patches totaling 85 463 ha had moderate to severe defoliation: one, nearly 50 000 ha in size, was located midway between Sudbury and North Bay; the other was in eastern Ontario and covered 36 886 ha.

Forest tent caterpillar populations collapsed in 1993 with 655 256 ha of defoliation, as compared to 16 051 424 ha in 1992, a 25-fold decrease.

Counts of egg bands indicated that populations in the Northern Region will decline, with the main areas of defoliation occurring in the central Cochrane District. Some pockets of defoliation may persist in the Sudbury-North Bay area and moderate to severe defoliation could

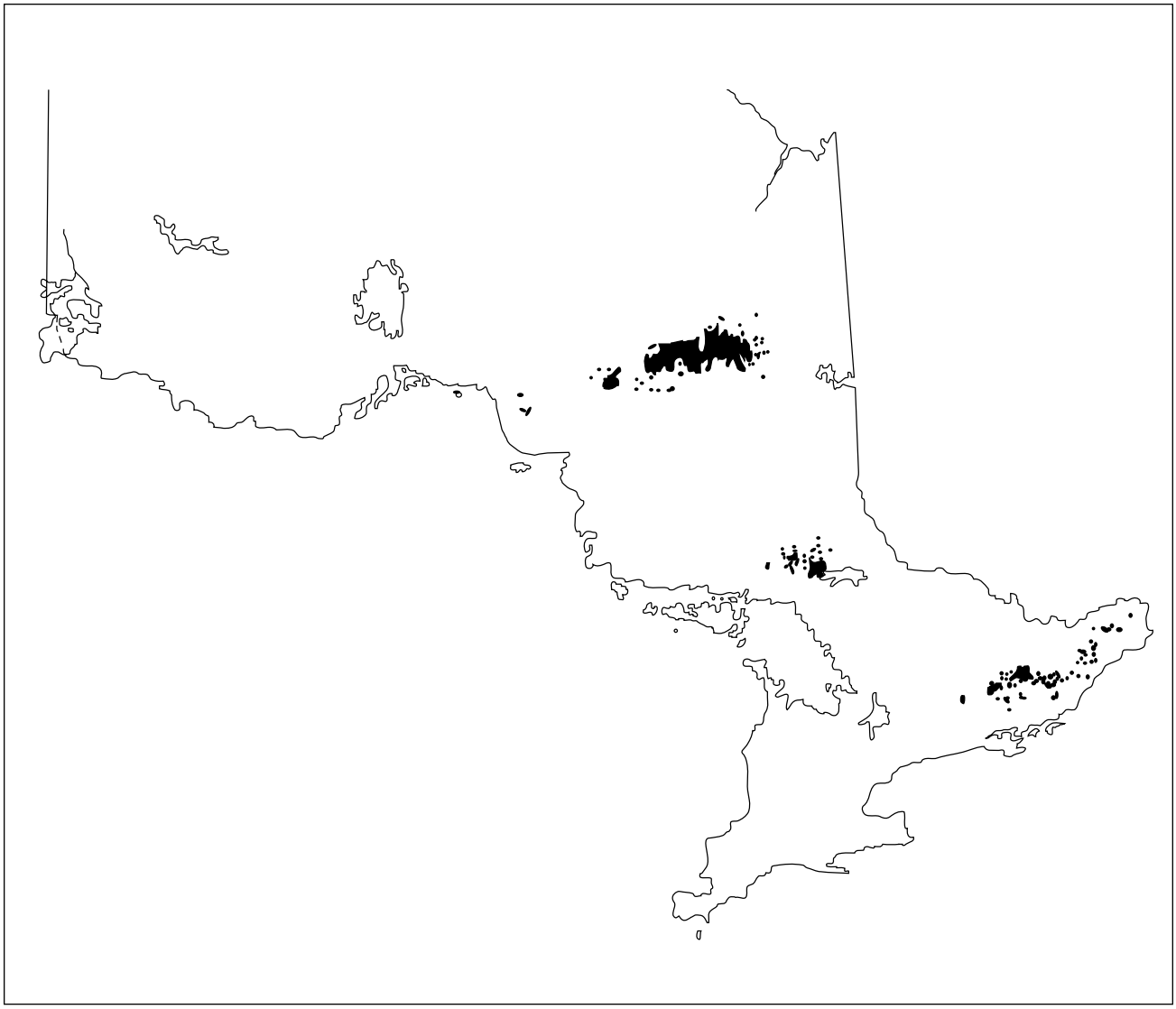

Figure 10. Area of Moderate to Severe Defoliation by the Forest Tent Caterpillar in Ontario, 1993.

recur in the southeast Bancroft District. Surveys in eastern Ontario indicate the infestations in Tweed and Kemptville districts could persist at about the same level as in 1993. It should be noted that all the infestations described are several years old and factors such as parasites, diseases, predators and smaller than normal egg bands, could cause population collapses.

PACIFIC AND YUKON

Defoliation by the northern tent caterpillar (*Malacosoma californicum pluviale* [Dyar]) increased on Vancouver Island, the Gulf islands, and near Stewart in the Prince Rupert Region, and was common in previously defoliated areas in and near Terrace.

Defoliation of trembling aspen by forest tent caterpillar totaled more than 86 000 ha in parts of two forest regions. This is about double the area affected in 1992.

Increased forest tent caterpillar populations in the Prince George Region moderately to severely defoliated 175 stands of trembling aspen, and to a lesser extent other deciduous trees totaling 39 000 ha, some for a fourth consecutive year. Infestations included areas near

McBride over 16 000 ha, south of Prince George to Quesnel over 22 000 ha, and in the Peace River area over several hundred hectares near Taylor. In the Cariboo Region defoliation occurred in 238 pockets over 47 000 ha, nearly double that of 1992. This was the fourth year of outbreak in the region. Most of the increase was expansions from previously defoliated stands between Horsefly and Quesnel lakes and from Horsefly to Williams Lake. Infestations in the Kamloops Region in the North Thompson River Valley collapsed after four years of infestation.

Defoliation of trembling aspen, cottonwood and other deciduous trees and shrubs is forecast to continue in 1994 in most of the recently infested stands. This is based on the number of new egg masses at 19 infested sites. Counts greater than 11 egg samples per tree usually result in moderate and severe defoliation. Moderate and severe defoliation is forecast near Prince George, McBride, and Dawson Creek where the average egg mass per tree was 19, as well as in the eastern Cariboo Region, where the average was 16.

Parasites and disease killed an average of 76% of the larvae at four sites in two regions. This mortality was up 17% from 1992 and 38% from 1991, and is expected to contribute to a decline of populations in older infestations in 1994. Increased populations of northern tent caterpillar defoliated alder over one hectare at Mira Creek west of Buttle Lake on central Vancouver Island for a second year, and defoliated stands on the east coast of Vancouver Island and on the Gulf Islands. Populations were common near Terrace and increased in patches between Meziadin and Stewart in the western part of the Prince Rupert Region. There was no defoliation of black cottonwood in the Skeena River drainage west of Terrace where patches totaling 1 375 ha were lightly defoliated in 1992.

Gypsy Moth

Lymantria dispar (L.)

NEWFOUNDLAND AND LABRADOR

The annual gypsy moth detection program was implemented by deploying 250 delta traps baited with disparlure in July 1993. Generally, sites chosen were Provincial and Federal Parks, urban and suburban sites, tourist chalets and wooded areas frequented by visitors. Agriculture Canada distributed 200 traps and FIDS distributed 50 traps throughout Newfoundland from the Avalon Peninsula to Port aux Basques to Plum Point on the Northern Peninsula. No insects were found in the traps.

MARITIMES

The gypsy moth has been present in parts of New Brunswick and Nova Scotia since 1981. The distribution increased significantly in 1993 with the discovery of the insect in south-central New Brunswick. Additional infested areas were found in western Nova Scotia. The gypsy moth is not known to occur in Prince Edward Island.

Surveys were organized by the Gypsy Moth Coordinating Committee, a multi-agency group, and assisted by hundreds of volunteers. The presence of various life stages other than male moths (larvae, pupae, female moths, egg masses) is used to determine the distribution of the moth. In 1993, the insect was present both at new and previously infested locations in New Brunswick and Nova Scotia.

In New Brunswick, the moth was found for the first time east of Fredericton, York County. Moths were found at locations along three major northeastern tributaries of the Saint John River: on both sides of Grand Lake; on both sides of Washademoak Lake, and along Belleisle Bay, in Queens and Kings counties. The insect was also found for the first time in the Sussex area in Kings County and in the Oromocto-French Lake area in Sunbury County. The 18 positive locations in south-central New Brunswick represent 7% of the 252 locations where egg mass surveys were conducted by NBDNRE. The common feature of all new locations was that they were provincial parks, campgrounds, picnic sites, and cottage areas. Both new and old egg masses were present in many of these areas, indicating that the gypsy moth has been there for at least two years. In south-central New Brunswick the ratio of new:old egg masses was 14:1, while in the old infested area in southwestern Charlotte County, the ratio was close to 1:1.

In southwestern Charlotte and adjacent York counties, egg masses were found at 27 of the 282 locations searched by NBDNRE in the southwestern part of the province (9.6%). Nineteen of these positive finds were at or close to previously infested points, while egg masses were found for the first time at eight other locations. There were few egg masses in most places, although 50 new masses were counted on a single tree in St. Stephen, Charlotte Co. In Fredericton, the gypsy moth was found in the two areas infested in 1992.

In western Nova Scotia, the gypsy moth was found at 14 old and 8 new locations. Egg mass surveys at some of the previously infested locations and in some areas of high male-moth catches will not be completed before the spring of 1994; consequently, the 22 infested locations may not reflect the actual situation. Gypsy moth was found for the first time in 1993 at new locations in seven of the nine counties in which the insect has been known to occur: Hants, Kings, Digby, Yarmouth, Shelburne,

Queens, and Halifax counties. Both new and old egg masses were found at some of the new locations, suggesting that the insect has been present there for at least two years. Populations were low in most of the infested areas, but defoliation was observed at New Minas, Kings County, and thousands of larvae were present at Brooklyn, Queens County.

The gypsy moth pheromone trapping program consisted of 4 273 traps returned to FIDS: 1 616 in New Brunswick, 2 344 in Nova Scotia, and 313 in Prince Edward Island. Of these, 4 051 were operational traps placed at the end of July and collected after mid-September. The other 222 were checked regularly to determine when moths were caught.

QUEBEC

Gypsy moth populations declined throughout their range in 1993. No significant damage was recorded in the Outaouais or Montérégie regions, where pockets of infestation had persisted in 1992. In view of the low population levels observed, no forecast survey for 1994 was conducted.

Following the discovery in the United States of an Asian race of gypsy moth and of Asian and European hybrids on military equipment from Germany, the Plant Protection Division of Agriculture and Agri-Food Canada has been conducting special monitoring of military equipment brought back into Canada from Canadian Forces bases in Germany since the summer. The appropriate quarantine measures are currently being taken. So far, approximately twelve egg masses have been detected on containers (or their contents) unloaded in the port of Montreal. The race or races have yet to be identified.

It is important to bear in mind that the Asian race of this moth represents a greater threat to our forests than the European race, which has been present in Quebec since 1924. The Asian race, like all hybrids, is better adapted to cold temperatures and, given the female's ability to fly, has the potential to spread very quickly. It also feeds on a wide variety of trees, including several species of conifer.

At the request of the Quebec Plant Quarantine Committee, FIDS-LFC carried out a program of pheromone trapping in eastern Quebec for the fourth consecutive year. Four traps were placed at each of the 28 plots under the protocol developed for the network. This year, a significant decline in the number of moths caught was recorded throughout the network. Captures averaged 0.34 moths per trap, down from 1.5 moths per trap in 1992. Catches of 10 moths per four traps were recorded at only one site near Quebec City, as compared to four sites in 1992. The Saint-Rédempteur, Neuville and Beaumont sites, where the insect has been most abundant since the introduction of the network operations, accounted for a total of 65% of the moths caught. Elsewhere, the numbers caught declined significantly, with no moths caught east of Trois-Pistoles.

ONTARIO

Gypsy moth populations declined dramatically in 1993 for the second consecutive year. The total area of moderate to severe defoliation was 9 784 ha, as compared to 34 460 ha in 1992. Most of the 1993 defoliation (6 645 ha) occurred in the south and west of the city of Sudbury. A total of 2 357 ha was mapped near Sarnia and Pinery Provincial Park. Three areas recorded moderate to severe defoliation totaling 129, 349 and 304 ha respectively in Tweed, Midhurst and Maple districts.

Gypsy moth populations have declined to their lowest level since 1982. Only 9 784 ha of Ontario forests were defoliated by the insect in 1993.

A program of pheromone trapping was carried out in cooperation with Agriculture Canada to track its spread. In 1993, 55 locations were trapped in northern Ontario parks and campgrounds. The highest and most persistent moth catches were made along the "leading" edge of the insect's range. Thus all traps in the Sudbury and North Bay areas caught moths, with 4 to 38 per trap. Further north and west catches were much lower and sporadic.

An aerial spraying operation against the gypsy moth was carried out at Canadian Forces Base Borden. A single, 9.1-ha block of trembling aspen, balsam fir and ornamental Carolina poplar along residential streets was treated. A Bell Jet Ranger helicopter was used to apply *Bt* at a rate of 40 BIU/ha on 29 May and 3 June. Subsequent surveys did not detect any defoliation within the treated area.

There were no surveys of gypsy moth egg-masses in 1993 so forecasts are based on historical trends. They indicate that there will probably be a resurgence in gypsy moth populations over the next several years, with the insect re-infesting areas previously defoliated. It is also probable that the moth will continue to extend its range to the north and west of the current infestation.

PACIFIC AND YUKON

More than 15 000 sticky traps were monitored throughout British Columbia in the eighteenth year of a cooperative program with Agriculture Canada (Plant Health), CFS/FIDS, and the British Columbia Forest Service. This year, 141 adult male gypsy moths were trapped in 100 traps in 15 areas. This compares with 166 males in 24 areas in 1992. Two of the 141 males were of the Asian race, as confirmed by DNA analysis, the first since 1991 when this race was first found in British Columbia, in Vancouver. Ten female gypsy moths and eleven egg masses were found during ground searches at Vancouver, Hope, and Victoria.

Most moths, including the Asian race specimens, were trapped at previously active areas including Hope (32 males, 2 females), Whiskey Creek, west of Parksville (32) on Vancouver Island, Vancouver (21 males, 8 females), and Nanaimo (29). Scattered insects were trapped in surrounding areas.

Moths were caught for the fifth consecutive year in Vancouver, and for the fourth consecutive year at Victoria and Coquitlam. Catches were made for the third consecutive year at Langley, Surrey, and Richmond, and for the second consecutive year at Hope, New Westminster, Merville, Nanaimo, Oak Bay, and Whiskey Creek near Coombs. New catches were made on the Sechelt Peninsula at Langdale, in the Fraser Valley at Vedder, and on Gabriola Island near Nanaimo. Moths were trapped at provincial parks where 153 traps were set out by FIDS at 91 forested recreation areas in national parks, commercial campgrounds, near military bases, and north coast ports.

Aerial (640 ha) and ground (70 ha) applications of *Bt* (Foray 48B) were made in late April and May 1993 in Richmond where 61 males of the European race had been found in 1992. Ground treatments and intensified trapping programs were implemented in 1993 in areas where high trap catches occurred in 1992 at Hope, Whiskey Creek, and Salt Spring Island. Post-treatment assessments indicated an eradication at Richmond and Salt Spring Island, but continuing populations at Hope and Whiskey Creek.

Spruce Beetle

Dendroctonus rufipennis Kby.

NEWFOUNDLAND AND LABRADOR

Populations of spruce bark beetle continue to expand in the Humber Valley between Pasadena and Corner Brook and in scattered areas throughout western Newfoundland. The infestation in the Humber Valley has caused significant white spruce mortality.

MARITIMES

Spruce beetle activity increased in Nova Scotia, decreased in Prince Edward Island, and remained low in New Brunswick.

In New Brunswick, infested trees were found along the Serpentine River, Victoria County, where 20% mortality of white spruce occurred. Dead or dying trees were also found in Northumberland and Charlotte counties.

Table 7. Area Infested and Volume Loss of Spruce Beetle-Infested White Spruce in Nova Scotia in 1993.

	Bark Beetle Damage			
	Low	**Moderate**	**High**	**Total**
Area (ha)	271	1 023	710	2 004
Volume Loss(m^3)	3 496	37 534	66 854	107 884

Source: Nova Scotia Department of Natural Resources, Entomological Services.

In Nova Scotia, spruce beetle infestations continued to intensify and expand causing mortality in white spruce stands. Affected areas ranged in size from a few trees to 10 or more hectares in all counties except Richmond and Shelburne. Damage was especially noticeable along the north coast of the Bay of Fundy, from Digby to Hants County and in northeastern Pictou and northern Antigonish counties. Aerial surveys conducted by NSDNR and FIDS showed an increase in the number of pockets of recently killed white spruce from Brier Island, Digby County to Minasville, Hants County. In Pictou and Antigonish counties, numerous patches of old and recently killed trees were observed over thousands of hectares. Approximately 2 000 ha of dead and dying white spruce were mapped by aerial surveys in Digby, Annapolis, Kings, Halifax, Hants, Pictou, and Antigonish counties.

Volume loss factors (m^3/ha) were determined at plots established in spruce beetle-infested white spruce stands representative of each of the three damage categories (Table 7). Nearly 108 000 m^3 of white spruce is estimated to have been killed by the spruce beetle, 60% in 1993.

In Prince Edward Island, mortality continued in small scattered patches of mature and overmature white spruce throughout the province, but newly infested, dying trees were less common than in the last three years. The

highest mortality was recorded at Cabot Provincial Park, Prince County, where 41% of the white spruce trees were attacked.

NORTHWEST

The Alberta Department of Land and Forest Services conducted a detection survey for spruce beetle using Lindgren funnel traps baited with pheromones. Traps were set up at one location in the Athabasca Forest, five locations in the Bow-Crow Forest, three locations in the Footner Lake Forest, eight locations in the Peace River Forest, and two locations in the Slave Lake Forest. Results of this survey were inconclusive. In the Peace River Forest where several patches of recently killed or dying trees were observed in 1992, large numbers of beetles were captured in traps, which indicates that a population still exists in the area.

The province uses three strategies to control the spruce beetle outbreak: deployment of pheromone-baited trap trees, felled trap trees, and salvage logging. During the winter of 1992–93, 9 829 m^3 of spruce were salvaged in the Hawk Hills area. More salvage cutting has been approved for the winter of 1993–94: 11 136 m^3 of spruce in the Hawk Hills area, and 70 831 m^3 of spruce in the Nina Lake area.

PACIFIC AND YUKON

Most of the 56 000 ha of infested spruce were in the Prince George Region, where populations have been increasing since 1985 in periodic accumulations of windthrown trees and some logging slash. Further reductions occurred near Kocho Lake southeast of Fort Nelson, where no new tree mortality occurred as a result of host depletion. Reductions also occurred over 6 000 ha north and east of Prince George near Carp and Weedon lakes and in the upper Parsnip and McGregor river drainages, due to salvage and trap tree programs. Tree mortality north and west of Mackenzie was mapped over 41 000 ha, an area similar to last year's total. Smaller patches totaled 1 200 ha near Fort St. James, and 400 ha near McBride. Populations are expected to remain at the same levels in 1994.

The area and volume of mature and overmature white and Engelmann spruce killed by the beetle in British Columbia decreased by 35%, after three years of increases.

Elsewhere in the province populations were mostly at endemic levels or increased slightly. Small patches of recent tree mortality, mostly associated with previously infested stands, totaled about 2 150 ha, up 20% from last year.

Populations in the northeastern part of Bowron Lake Provincial Park were endemic as forecast, following two years of decline. Follow-up surveys of populations in the park were discontinued after surveys in 1992 found attacks in only 11 trees, too few to threaten standing trees in the area. Recent mortality of mature spruce in the Kamloops Region increased 20% to 2 030 ha.

Recent tree mortality in the Nelson Region increased to 44 patches, up from 16 last year, totaling about 105 ha north of Golden. Most was in mature spruce adjacent to recently logged areas.

Beetle populations were maintained at lightly infested scattered patches of standing spruce totaling 65 ha in the Prince Rupert Region. These occurred in the eastern part of the region and could pose a threat to adjacent stands.

Timely salvage, sanitation, and host depletion in most regions should control present populations which are mostly in scattered windthrow, log decks, and butts of mature and overmature standing trees. Timely treatments of populations which mature in 1994 at infested stands in parts of the Prince George Region could limit the threat to adjacent, susceptible stands.

Mountain Pine Beetle

Dendroctonus ponderosae Hopk.

NORTHWEST

Mountain pine beetle infestations in Alberta remained very low during 1993. The presence of beetles was detected at several locations only by means of pheromone-baited trap trees. Aerial and ground surveys to detect recently beetle-killed trees were conducted by personnel of FIDS, the Alberta Department of Land and Forest Services, and the Canadian Parks Service. Survey efforts were conducted in areas where dispersing beetles might invade. Areas surveyed in southwestern Alberta included the foothills region from Willmore Wilderness Provincial Park to the Canada–U.S. border and Jasper, Banff, Waterton National Parks, and Cypress Hills Provincial Park in southeastern Alberta.

No mountain pine beetle-killed trees were observed in the Bow-Crow Forest. Pheromone baits were deployed on trap trees at 30 sites throughout the forest: three in the Turner Valley District, five in the Elbow District, three in the Ghost District and 19 in the Blairmore District.

Mountain pine beetle attacks occurred on baited trap trees at two sites near Tent Mountain and two sites near Allison Creek northwest of Coleman. These areas are near those between Coleman and the British Columbia border in which beetle attacks were reported in 1991 and 1992. Mountain pine beetle attacks also occurred on baited trees in the Oldman River area of the Blairmore District and at the Spray Lakes Reservoir and Lower Kananaskis Lake sites in the Elbow District. Lodgepole pine beetle (*D. murrayanae* Hopk.) and red turpentine beetle (*D. valens* LeC.) were also found attacking some of the baited trap trees near the Spray Lakes Reservoir. All mountain pine beetle attacks were unsuccessful in the Bow-Crow Forest.

No beetle-killed trees were observed in the Rocky-Clearwater Forest. Pheromone baits were placed on trap trees at six locations along the forest's boundary with Jasper and Banff national parks. No baited trees were attacked.

In the Edson Forest, pheromone baits were placed on trap trees at 23 locations, mainly along the boundary with Jasper National Park and in Willmore Wilderness Provincial Park. Mountain pine beetle attacks occurred near Morkill Pass, Beaverdam Pass, and the confluence of Jackpine River and Spider Creek in Willmore Wilderness Provincial Park. None of these attacks were successful. Aerial surveys failed to detect any mountain pine beetle-killed trees in the Edson Forest.

In the Grande Prairie Forest, no mountain pine beetle-killed trees were detected. No attacks were noted at three sites where pheromone baits were placed.

In cooperation with the Canadian Parks Service, FIDS conducted aerial surveys over portions of Banff and Jasper National Parks to sketch map areas of dead and dying lodgepole pine. No recently killed trees were observed in Banff National Park in the Healy Creek, Brewster Creek, Spray River, and Bow River valleys or in Jasper National Park. Mountain pine beetle attacks occurred at 2 of 12 locations in Jasper National Park: the Whirlpool River valley and the Miette River valley west of Jasper. None of these attacks were successful.

In the Alberta portion of the Cypress Hills, 201 pheromone baits were deployed on trap trees at 67 sites by park staff. No beetle attacks were observed in 1993.

PACIFIC AND YUKON

The principal host of the mountain pine beetle is lodgepole pine, but white pine and other western pine species are susceptible. Trees are attacked in mid- to late summer and are infected with several microorganisms, including blue stain fungi. Eggs are laid which yield larvae that feed on the inner bark. Infested trees usually die from the combined action of blue stain fungi and the feeding by the beetle larvae. The foliage of dying trees turns yellow the year following attack; then tree mortality can be detected by aerial surveys. In addition to tree mortality, other consequences are a hastening of forest succession, and changes in age and diameter distribution, a reduction in aesthetic values, and an increase in fire hazard. Forest operations have been altered to concentrate on harvesting of recently killed trees, particularly in interior British Columbia where large volumes of dead trees are involved.

The mountain pine beetle is British Columbia's most damaging insect pest of 1993. Outbreaks began to be recorded in 1910. Between 1972 and 1984 the infested area expanded annually, with especially rapid increases in the early 1980s. The beetle has killed more than 225 million trees in the province.

The area and volume of lodgepole pine and white pine killed by the mountain pine beetle in 1993 increased by about 10%, continuing a decline since 1985. More than 11 900 infestations are active on more than 49 450 ha from south of Cranbrook to north of Terrace (Figure 11).

Areas affected by tree mortality increased from 335 to 700 ha in the Cariboo Region; they also expanded by 33% to 12 750 ha in the Prince George Region, mostly north of Fort St. James, and by 31% to 7 700 ha in the Prince Rupert Region. On the other hand areas of recently killed mature pine shrank in other regions. For example, they decreased by 5% to 19 925 ha in the Kamloops Region; by 12% to 7 850 ha in the Nelson Region; and by 32% to 525 ha in the Vancouver Region.

There was little overwintering brood mortality this year. Brood assessments at 53 major infestations in four forest regions in May-June showed a ratio of progeny to parents greater than 4:1, indicating increasing populations for flight and attack in July. Ratios of less than 2.5:1 indicating declining populations occurred only at locations in the western part of the Nelson Region. In September an average 15% of the trees in 34 stands were newly attacked, about the same as last year. The highest regional average (28%) was in the Vancouver Region, and ranged from 7 to 20% in the remainder indicating infestations in 1994.

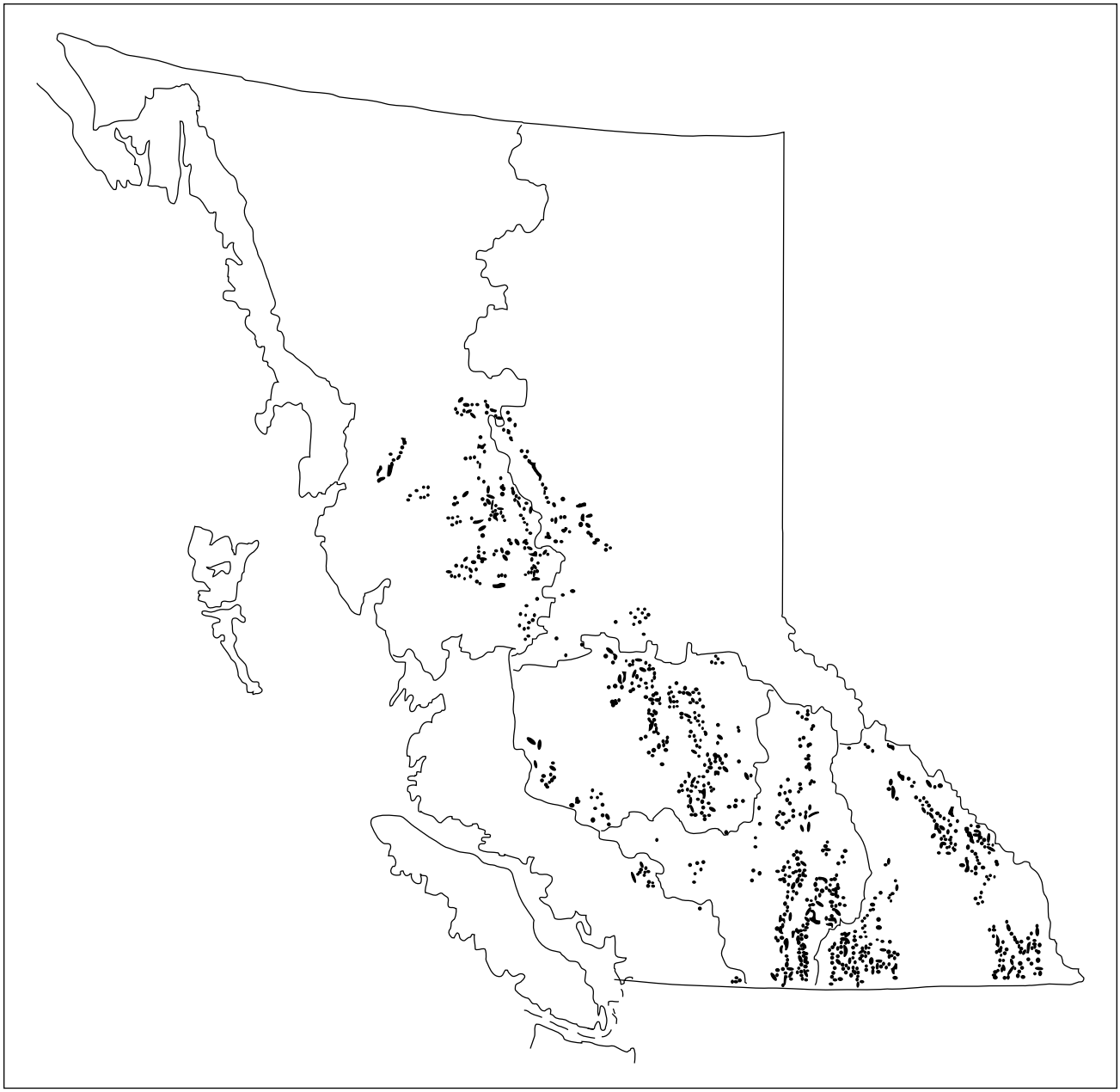

Figure 11. Area of Tree Mortality caused by the Mountain Pine Beetle in British Columbia, 1993.

Pine mortality increased throughout the Cariboo Region in more than 1 500 separate infestations totaling 700 ha. Patches occurred from Clinton north to Quesnel. Attacks are expected to continue to increase in 1994.

The area of mature pine killed by the beetle in the Kamloops Region in 1993 declined slightly following two years of increase. Beetle-killed trees (3.5 million, 1 782 000 m^3), were mapped over an estimated 19 925 ha in about 4 445 separate patches.

Areas of beetle-killed white pine were less numerous in the northern part of the region following three years of increase. Tree mortality is forecast to continue in the region in 1994,

In the Nelson Region, areas of beetle-killed pine declined 12% to 7 850 ha in 4 350 patches which contained 684 000 trees (248 000 m^3). This included about 80 000 trees killed over 765 ha in Glacier, Kootenay, Mt. Revelstoke, and Yoho national parks. The number of infestations along most of the British Columbia- Alberta border remained generally stable for the eighth consecutive year, but were 15% more numerous in Kootenay National Park. Newly attacked trees declined 5% overall to an average of 20% in 19 stands, mostly in the East

Kootenay. The most severely infested stands were south of Cranbrook and in Kootenay National Park. In the West Kootenay new attacks declined 7% to an average of 17%.

In the Prince George Region, the area containing recently killed pine increased by one-third to 12 750 ha in 451 patches which contained an estimated 660 000 trees (550 000m^3). Tree mortality occurred mostly in chronically infested areas northwest of Fort St. James and in the Skeena, Sustut, Middle, and Tachie river valleys, with new areas near Vanderhoof, Prince George, and McBride. On the basis of historical trends, mortality of pine is expected to continue in the western part of the region in 1994. Control of beetle populations in Mt. Robson Provincial Park continued for the ninth consecutive year, when 85 baited and subsequently beetle-attacked trees were felled and burned.

The area of mature lodgepole pine killed by the beetle in the Prince Rupert Region in 1993 increased about 30% to 7 700 ha which contained about 73 800 recently killed trees (62 450 m^3). The increase occurred mainly in the eastern part of the region in the Bulkley and Morice Timber Supply Areas (TSAs), and followed a four-year trend of decline. Tree mortality is forecast to continue in the region in 1994, on the expectation that an average of 7% of the trees will be newly attacked.

About 144 pockets containing beetle-killed pine totaled 525 ha (11 000 trees, 8 100 m^3) in the Vancouver Region in 1993. This occurred mostly north and west of Pemberton. Additional pine mortality is expected to occur in 1994 with 28% of the trees currently attacked.

CHAPTER 2

Insects and Diseases of Regional Importance

Descriptions of insects or diseases in this chapter have regional or provincial significance in that they have economic or biological impacts. They may also represent pests in the beginning or declining stages of outbreaks. Pests are described on a regional basis, so that the same pest may be described in more than one region.

Newfoundland and Labrador

EASTERN BLACKHEADED BUDWORM

Acleris variana (Fern.)

The latest outbreak of blackheaded budworm started on the Northern Peninsula in 1987 and covered 35 000 ha of balsam fir forests. Moderate and severe defoliation occurred mainly in overmature stands, with some light defoliation in pre-commercially thinned stands. In several areas of the outbreak blackheaded budworm fed in association with the hemlock looper and both insects contributed to tree mortality. The outbreak declined sharply in 1993 and no defoliation was observed on the Northern Peninsula. Scattered populations of blackheaded budworm were present on the Avalon Peninsula but no significant defoliation occurred. There was no experimental or operational control program against the blackheaded budworm in 1993. Overwintering egg numbers were sampled from mid- to late October. No defoliation is forecast for 1994.

BALSAM FIR SAWFLY

Neodiprion abietis (complex)

Populations of balsam fir sawfly in the Bay d'Espoir area collapsed in 1992 and no significant defoliation occurred in 1993. An infestation in western Newfoundland increased from 1 300 ha in 1992 to 1 800 ha in 1993. This infestation caused 1 500 ha of severe defoliation, 200 ha of moderate defoliation and 100 ha of light defoliation.

Several parasites were collected. One has been identified as *Otlophorus* sp. (*Hymenoptera: Ichneumonidae*), and additional work is in progress to identify others.

Counts of eggs on needles (1 branch per tree, 5 trees per sample) indicated that at Bay St. George in western Newfoundland, defoliation will increase to 11 700 ha in

1994. Egg counts in 1993 were high on many branches (>1000 per branch). This, coupled with the paucity of disease and parasites in 1993, suggest the western Newfoundland outbreak will continue.

BALSAM WOOLLY ADELGID

Adelges piceae (Ratz.)

Management of balsam fir stands in Newfoundland is complicated by the balsam woolly adelgid. Presently, foresters are lacking information on its biology and impacts. Populations of balsam woolly adelgid remain high throughout all areas except the Northern Peninsula where the insect is limited by low winter temperatures.

The total area in Newfoundland affected by the balsam woolly adelgid exceeds 160 000 ha, with 123 000, 22 200, and 14 800 ha of light, moderate and severe damage respectively.

The majority of the damage (108 000 ha) occurs in trees under 40 years of age. Approximately 5 000 ha of precommercially thinned stands have been damaged.

LARCH SAWFLY

Pristiphora erichsonii (Hgt.)

In 1993, high populations were recorded from ground checks in western Labrador from the Quebec border east to Churchill Falls and north to Esker. This area consists primarily of black spruce stands with small stands of larch growing mainly near marshes and river beds. The aerial survey conducted in late August, showed moderate to severe defoliation from Metchin River, east of Churchill Falls, to the Ossokmanuan reservoir. Defoliation was generally light in the Wabush and Ashuanipi Lake areas with scattered small moderate patches throughout. Low numbers of larvae were recorded in eastern Labrador near Goose Bay. In western Newfoundland, light defoliation was recorded on Japanese larch (*L. kaempferi*) at Pasadena and near Deer Lake. In central Newfoundland severe defoliation by this sawfly was recorded at several locations during the aerial survey.

EUROPEAN PINE SAWFLY

Neodiprion sertifer (Geoff.)

The European pine sawfly was first recorded in Newfoundland during 1974 at a Scots pine plantation near Windsor lake and has now infested 60-70% of the two-needle pines in St. John's and other locations on the Avalon Peninsula. In recent years the insect was recorded at Whitbourne, Tilton, Clarkes Beach, and Brigus. The insect continues to spread despite attempts to prevent the transportation of conifers from outside the Avalon Peninsula. In 1993 several ornamental pines at Burin were infested. This is the first time the pest has been recorded outside the Avalon Peninsula. The discovery of the sawfly in Burin is significant because this expansion in its range has increased the risk to Newfoundland's indigenous and rare red pine stands. Defoliation was minimal where sertifervirus spray was applied, but varying degrees of damage occurred at other sites. The European pine sawfly is expected to continue to spread throughout Newfoundland.

POPLAR SERPENTINE LEAFMINER

Phyllocnistis populiella Cham.

An infestation of leafminer has been active in eastern Labrador for the past 10 years and continues to cause defoliation in 1993. Moderate to severe defoliation was recorded in trembling aspen stands in the Churchill River Valley from Minipi River to Goose Bay and along the Goose River. Light to moderate damage occurred near the west end of Grand Lake and in small patches along the Beaver, Susan, Red Wine and Naskaupi Rivers. Light defoliation also was observed from Happy Valley to Northwest River. Light damage also occurred throughout central Newfoundland, with defoliation from 10 to 25%.

BRUCE SPANWORM

Operophtera bruceata (Hulst)

In eastern Labrador in 1992, the Bruce spanworm affected white birch stands between Pena's River and Edward's Brook, and in three areas on the north side of Churchill River where 1 000 ha of moderate and severe defoliation occurred. In 1993, damage to white birch on 3 000 ha occurred in the same area. A total of 1 200 ha was severely defoliated while light and moderate damage occurred on 1 800 ha. An infestation was recorded near Gander from 1954-55, but this is the first infestation in Labrador.

SPRUCE BUDMOTH

Zeiraphera canadensis Mut. & Free.

This pest remained common on white spruce throughout the western region. Light damage was recorded on less than 10% of the shoots on trees near the Arches Provincial Park. White spruce stands in the McKenzies Brook area in Gros Morne National Park were also damaged with 5-10% of the new shoots defoliated.

SCLERODERRIS CANKER

Gremmeniella abietina (Lagerb.) Morelet

Scleroderris canker continued to spread: two new infection sites were recorded at St. John's and Portugal Cove. Both were on Austrian pine with up to 20% of the shoots infected. The disease represents a threat to the native red pine stands in central and western Newfoundland. Enhanced surveys and sanitizing measures are planned for 1994.

WHITE PINE BLISTER RUST

Cronartium ribicola J.C. Fischer

Low incidences of blister rust were detected throughout the Island in 1993. In western Newfoundland infected trees were found along Southwest Brook; in Barachois Pond Provincial Park; at Howley and near Sheffield Lake where approximately 10% of young white pine trees were infected and some mortality was evident; and along Little Grand Lake Road where 25% of the young white pine trees were affected. In central Newfoundland numerous young white pine in various stages of the disease, and some mortality were observed along Northwest Gander River Road. Up to 15% of young white pine were affected along Terra Nova Village road in eastern Newfoundland.

SIROCOCCUS SHOOT BLIGHT

Sirococcus strobilinus Preuss

Sirococcus shoot blight was observed in patches in young to semimature balsam fir stands also infested by the balsam gall midge in western Newfoundland. This is a new host record for the disease. In urban gardens in St. John's up to 100% of the foliage of blue spruce were affected by this shoot blight. The disease was also recorded at Foxtrap, where 10% of the shoots of a blue spruce had symptoms.

BLACK KNOT

Apiosporina morbosa (Schw.) Arx

Black knot disease was widespread throughout Newfoundland. Seventy percent of the foliage and woody tissue was affected on scattered pin cherry trees in the Deer Lake to Cormack area. From Pasadena to Corner Brook up to 80% of the foliage of pin cherry was infected. Severe damage to foliage and some mortality were recorded on the Baie Verte Peninsula. High incidences of damage occurred near Burnt Berry Brook in central Newfoundland and on the Avalon Peninsula in the Outer Cove and Tilton areas. Low incidences were also observed near Clarenville, and other locations on the Avalon Peninsula.

Maritimes

EASTERN LARCH BEETLE

Dendroctonus simplex LeC.

Eastern larch beetle continued to attack and kill semi-mature and mature larch trees in all three provinces. Infested areas were small, generally less than 5 ha.

In New Brunswick, the insect remained active but was most common in the central and southern parts of the province. Tree mortality ranged from 4 to 20%, the highest occurring at Mates Corner, Westmorland County, where 20% of the trees were killed.

Activity was low in Nova Scotia, as in 1992. A few trees were attacked at three locations in the north-central part of the province.

In Prince Edward Island, larch mortality again occurred in Prince County, and at two locations in Queens County. The most severe attack was recorded at Camp Tamawaby Demonstration Woodlot, Prince County, where 32% of the mature trees were killed, an increase from 8% in 1992. A few trees were heavily infested in a young European larch (*Larix decidua*) plantation at Kildare South, Prince County.

SPRUCE BUDMOTHS

Zeiraphera spp.

Spruce budmoths comprise a group of closely related species: the spruce budmoth (*Zeiraphera canadensis* Mut. & Free.), the purplestriped shootworm (*Z. unfortunana* Powell) and the yellow spruce budworm (*Z. fortunana* [Kft.]). The most common and important is *Z. canadensis*, but the species mix varies.

Shoot damage by spruce budmoths on white spruce was slightly lower in New Brunswick and Nova Scotia, and slightly higher in Prince Edward Island in 1993 than in 1992. In New Brunswick, damage was generally light, with an average of 15% of the shoots affected at the 36 locations examined, as compared to 18% in 1992. The most serious injury was recorded at Nigadoo Lake, Gloucester County, where 57% of shoots affected had moderate damage on all trees examined. In Nova Scotia, damage was generally at trace levels, with some light or moderate infestations. Shoot injury averaged 12% at the 49 locations examined, as compared to 14% in 1992. Moderate damage was recorded at two locations in Inverness County, over a l-ha area at Presqu'ile and at Cap Rouge, where 64% of the shoots were affected.

In Prince Edward Island, an average of 21% of the shoots were injured at the 17 locations examined, as compared to 18% in 1992. Damage was trace or light at all locations except Rustico Island, Prince Edward Island National Park, Queens County, where 63% of the shoots affected had moderate damage.

LARCH CASEBEARER

*Coleophora laricella (*Hbn).

Larch casebearer populations declined throughout the Maritimes in 1993, resulting in less overall injury. Feeding was observed on patches of trees up to 10 ha, but most browning occurred on individual trees.

In New Brunswick, foliage discoloration occurred in most of the province, but was more common in southern areas, especially in Charlotte County. Foliage browning varied from trace to severe at 31 locations. The most noticeable browning was observed at Baillie, Mohannes, Rolling Dam, Sorrel Ridge, and St. Stephen, Charlotte County, where moderate or severe defoliation on 1-10 ha of larch occurred.

In Nova Scotia, larch casebearer populations have decreased for the first time since 1989. Discoloration affecting trees of all age classes occurred in patches at various intensity levels in all western counties, except Shelburne. In eastern Nova Scotia it was observed only in Inverness County. This represents a significant reduction in distribution and intensity from 1992 levels. Patchy, severe browning occurred in areas of generally less than 5 ha. After four years of population decline, there were no reports of larch casebearer damage in Prince Edward Island in 1993.

OAK LEAFROLLER

Pseudexentera spoliana (Clem.)

AND

OAK LEAFSHREDDER

Croesia semipurpurana (Kft.)

Historically, the oak leafroller has caused the majority of the damage in western Nova Scotia, whereas in New Brunswick and Prince Edward Island the oak leaf shredder is usually responsible. As a result of repeated defoliation, many red oak stands have various degrees of twig, branch, and crown dieback and tree mortality.

The oak leafroller and the oak leafshredder singly or together are the most serious pests of red oak in the Maritimes.

In Nova Scotia, the peak damage occurred in 1988 when 22 800 ha were damaged, with an average defoliation of 69%. In 1991, a severe spring frost caused a collapse of the insect population and defoliation declined to 5%. Since 1991, the average defoliation has gradually increased and in 1993 was 15% Overall defoliation in 1993 was in the trace and light categories with severe defoliation on a few trees at Hemlock Hill, Queens County.

In New Brunswick, damage has been relatively low for the past 10 years and this trend continued in 1993. Defoliation was reported as moderate at Douglas, York County, and light at Cranberry Lake, Queens County.

In Prince Edward Island, defoliation levels remained the same as in 1992 with defoliation reported as moderate at Brudenell Point, Kings County and light at North Milton, Queens County.

POPLAR SERPENTINE LEAFMINER

Phyllocnistis populiella Cham.

Population levels of the poplar serpentine leafminer decreased considerably in New Brunswick in 1993, but the insect continued to cause twig and branch dieback of trembling aspen in the northern half of the province. Population levels remained low in both Nova Scotia and Prince Edward Island.

In New Brunswick, at 32 random sampling points located in Madawaska, Victoria, Restigouche, Northumberland, and Gloucester counties, an average of 22% of leaves were mined on most trees (87%). This level represents a significant population reduction from that of 1992, when 44% of the leaves were mined on 89% of the trees. The highest infestation occurred along the Nepisiquit River east of Popple Depot, Northumberland County, where severe leafmining caused the crowns of trembling aspen to appear silvery. As in previous years, both incidence and intensity decreased from the northern half of the province to the Fundy coast. In the ten southern counties, infestation levels remained low with 10% of foliage affected on 58% of the trees. Trace leafmining damage was also found on largetooth aspen at Nine Mile Brook, Northumberland County, where 11% of leaves were affected on most trees (80%).

In Nova Scotia, population levels remained low in the northeastern part of the province. At seven random sampling points located in Kings, Colchester, Cumberland, Pictou, and Cape Breton counties, an average of 7% of trembling aspen leaves were mined on 39% of the trees. The highest infestation occured at Aylesford, Kings County, where 27% of foliage was affected on all trees.

In Prince Edward Island, population levels also remained low with an average of 2% of foliage affected on 23% of trembling aspen trees. The highest infestation occurred at Cavendish, Queens County, where 4% of the leaves were mined on 30% of trees.

ASPEN LEAFROLLERS

There are six species most commonly found rolling leaves of trees in the Maritimes region from mid-May to mid-July: an aspen leafroller, *Pseudexentera oregonana* (Wlsm.); spotted aspen leafroller, *Pseudosciaphila duplex* (Wlsm.); birch-aspen leafroller, *Epinotia solandriana* (L.); aspen leafroller, *E. criddleana* (Kft.); darkheaded aspen leafroller, *Anacampsis innocuella* (Zell.); and lightheaded aspen leafroller, *A. niveopulvella* (Cham.). These species are usually considered as a complex, as their damage is similar and simultaneous. Occasionally damage can be attributed to one species.

In New Brunswick, population levels of these insects have been increasing since 1991. In 1993, most were present at more locations than in 1991 and 1992. The most commonly found species was *P. oregonana*, and to a lesser extent, *P. duplex* and *E. solandriana*. *P. oregonana*, one of the earliest insects to roll leaves on aspen, caused defoliation in western New Brunswick, mostly along the Saint John River Valley from Connors, Madawaska County to Fredericton, York County. In the northwest, young stands of trembling aspen were often severely defoliated, especially at St. Leonard and at Morneault Brook, Madawaska County, where all leaves were attacked. At random sampling points, an average of 12% of the leaves were rolled in 1993, as compared to 18, 26, and 7% in 1992, 1991 and 1990 respectively. Although leaf damage decreased from 1992, the number of trees affected increased to 83% from 57% in 1992. *P. duplex*, more commonly found in the north-central, central, and eastern parts of the province, caused the most damage at McCormack Brook, Restigouche County and at Pokemouche Landing, Gloucester County, where 23% of the leaves were rolled on all trembling aspen trees. Although this species was present at more locations in 1993 than 1992, the percentage of rolled leaves (11% in 1993, 10% in 1992) was virtually unchanged, and the percentage of affected trees remained the same (80%).

E. solandriana has also gained some importance in 1993 and was present mainly along the Saint John River valley, in Victoria, Carleton, and York counties. In 1993, it was found on trembling aspen at 16 locations with an average of 11% of leaves rolled on 70% of the trees, as compared to only one location in 1992. The worst damage occurred at Upper Knoxford, Carleton County, where 36% of the leaves were rolled on all trembling aspen trees. Larvae were occasionally feeding in association with *P. oregonana*, usually in higher proportions southward. On white birch, trace levels of leafrolling were reported at a few locations in Madawaska, Northumberland, and York counties.

E. criddleana, A. innocuella, and *A. niveopulvella* were observed at trace levels at a few locations throughout the province; however, in most cases, damage levels and the number of locations increased since 1991. *E. criddleana* and *A. innocuella* larvae were occasionally feeding in association with *P. oregonana* and *P. duplex.*

In Nova Scotia, population levels also increased but distribution was more confined and damage levels generally lower than in New Brunswick. The most severe damage, in the north-central and northeastern parts of the province, was caused by *P. oregonana*. At random sampling points, an average of 13% of the leaves were rolled in 1993, as compared to 12% in 1992 and 1991. Moderate and severe leafrolling occurred on all trembling aspen trees at Heatherton, Antigonish County, Grand Anse River, Inverness County, and the Thorburn area, Pictou County.

In Prince Edward Island, population levels in 1993 remained low, as in previous years. *P. oregonana* was the most common species, and *P. duplex* and *E. solandriana*, observed at a few locations, caused trace levels of damage.

EUROPEAN LARCH CANKER

Lachnellula willkommii (Hartig) Dennis

The disease is widespread and common within the infected areas but did not spread in 1993. In New Brunswick, infections of more than 75% of trees were common. In Nova Scotia, cankers were present on 88, 75, and 66% of trees at Yankeetown and Dean, Halifax County, and Manganese Mines, Colchester County respectively. In Prince Edward Island, no larch canker-infected trees were found at the 31 areas examined in 1993. Larch canker has only been found at two stands, within 10 km of each other, in Prince County. Both cankers found in 1992 were removed and destroyed.

SIROCOCCUS SHOOT BLIGHT

Sirococcus conigenus (DC.) Cannon & Minter

Sirococcus shoot blight is present in the Maritime Provinces. Until this year it has been most widely distributed and most damaging in Nova Scotia, west of the Colchester-Pictou and Halifax-Guysborough county lines. In 1993, the disease became more widespread and damaging, especially in Nova Scotia and Prince Edward Island. In many areas repeated infection has resulted in increased deterioration of red pine stands and plantations.

In New Brunswick the disease was confined to previously infected areas in the southern part of the province. Red pine deterioration continued in Fundy National Park, Albert County, especially near the Park headquarters on Route 114, where 12% of the trees were dead and 57% had 51-99% shoot and branch mortality. At MacDougall Lake, Charlotte County, light damage was observed at a previously infected young natural red pine stand.

In Nova Scotia, the disease continues to damage red pine in the southwestern part of the province but also increased elsewhere in 1993. Areas in eastern Nova Scotia that had trace and light infection in 1992 are now in the moderate and severe infection categories. The increase in infection was caused by cool, wet weather conditions this spring and early summer which are ideal for spore release and infection. The most serious damage was observed at Perch Lake Road, Pictou County; Garden of Eden Barrens, Guysborough County; East Folly Mountain, Colchester County; and Fairmont, Antigonish County. The average shoot infection at FIDS plots increased from 17% in 1992 to 51% in 1993 at Perch Lake Road, and from 6 to 57% at East Folly Mountain. At Fairmont, a 3-ha pole-sized red pine plantation had moderate to severe infection on 60% of the trees. Severe damage was observed at Fougere Lake, which is the most easterly infected site reported to date.

The deterioration of red pine stands in western Nova Scotia and the spread of the disease to plantations in the eastern half of the province makes Sirococcus shoot blight the major plantation problem in Nova Scotia. A detailed survey of all red pine plantations was conducted by NSDNR to determine the status of the disease. Salvage and control operations are being initiated where red pine plantations are numerous in eastern Nova Scotia.

In Prince Edward Island the disease continues to intensify in the known infected red pine plantations and is becoming more widespread each year. The status of the disease in previously reported areas is as follows: an average of 40% of the shoots dead at Valley, and at Selkirk Road, Queens County; and an average of 5% at the Camp Tamawaby demonstration woodlot, Prince County. Moderate damage was recorded at Goose River, Kings County. New areas reported in 1993 are: Cardigan, Kings County, light damage in a small red pine plantation; Point Pleasant, Kings County, trace and light with some moderate damage on natural red pine; Selkirk Road, Queens County, 8% of red pine trees infected with one to two shoots dead per tree in a young plantation (adjacent to the older infected plantation mentioned above); and Rustico Island, Queens County, 4% of white spruce shoots on 20% of trees affected.

ARMILLARIA ROOT ROT

Armillaria mellea (Vahl: Fr.) Karst.

Armillaria root rot is widely distributed in the region and mortality of young and old trees was common again in 1993. Armillaria root rot killed trees in 7% of the 164 spruce and 66% of trees at the Yankeetown pine plantations surveyed in New Brunswick, and 6% of the 54 spruce and pine plantations assessed in Nova Scotia. Infection rates were generally low, mostly in the 2-6% range. The highest level of mortality was recorded in a black spruce plantation at Mountain Brook, Kent County, New Brunswick, where 10% of the trees were dead. Until 1991, spruce plantations appeared to be more vulnerable to the disease than pine plantations. However, infection was more common at New Brunswick pine plantations in 1992 and 1993, and in Nova Scotia during 1992. Armillaria root rot also caused sporadic tree mortality in natural forests: suppressed or stressed mature and semi-mature trees were killed in New Brunswick and Nova Scotia.

DUTCH ELM DISEASE

Ceratocystis ulmi (Buis.) C. Moreau

Dutch elm disease was active in all three Maritime provinces in 1993 (Figure 12). In New Brunswick, the disease is present wherever elm trees are found.

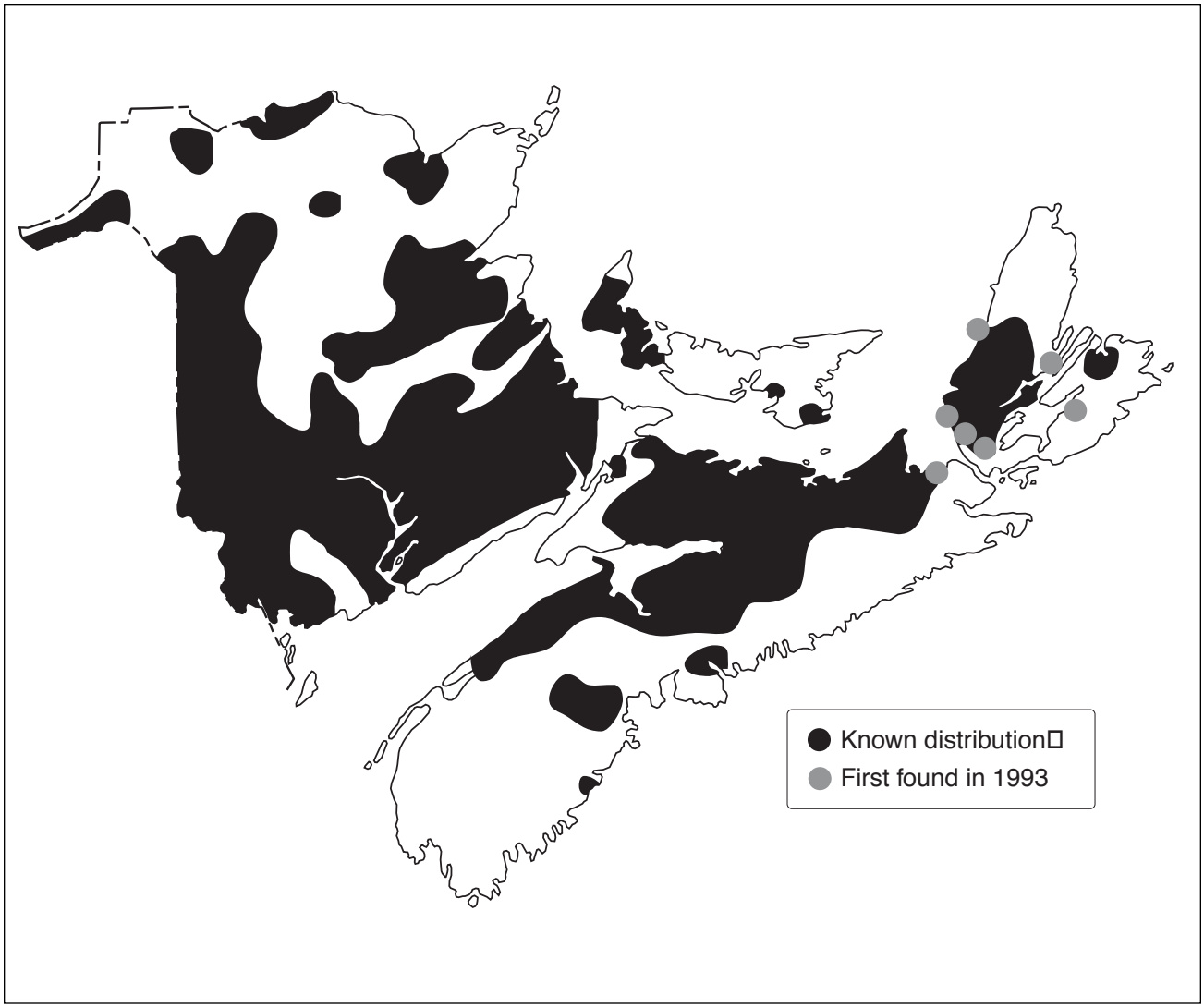

Figure 12. Extent of the Occurrence of Dutch Elm Disease in the Maritimes, 1993.

In Nova Scotia, Dutch elm disease continued to intensify: dead and dying trees were common throughout the province. On mainland Nova Scotia, the disease was found at the edge of the infected area in Monastery Dam, Antigonish County. On Cape Breton Island, the disease expanded southward to three new locations in Inverness County, at Judique Intervale Brook, Princeville and west of Kingsville. In addition, the disease expanded northward to Scotch Hill, Inverness County, and eastward to two locations: north of Glen Tosh, Victoria County and Big Pond, Cape Breton County. The Big Pond location represents an extension of the range of the disease.

In Prince Edward Island, diseased trees were more common in western Prince County where the disease was first identified in 1979. No infected trees were found in either Queens or Kings counties in 1993.

Quebec

SWAINE JACK PINE SAWFLY

Neodiprion swainei Midd.

Damage caused by the Swaine jack pine sawfly was generally light in most jack pine forests in 1993. Populations remained at the endemic level in western Quebec, while a few pockets of local defoliation were recorded in areas of central Quebec where an increase in populations was observed in 1992. The areas affected are essentially the same as those reported in 1992 in the Saguenay-Lac-Saint-Jean and Mauricie-Bois-Francs regions. Historically, the infested stands have been highly susceptible to outbreaks of sawflies.

Sawfly populations remained low in the Lanaudière region, although a slight population increase was observed in several sectors in Mauricie-Bois-Francs.

BRUCE SPANWORM

Operophtera bruceata (Hulst)

The Bruce spanworm is a major defoliator of maples. It also feeds on trembling aspen. Since 1991, increased incidence and population levels have been observed and, in 1993, measurable damage was recorded. Presence of the insect was recorded in several regions of the province. Moderate infestations were observed at Saint-Sylvestre (Lotbinière), Saint-Jacques-de-Leeds (Mégantic) and Saint-Eugène (L'Islet). Light damage occurred at a few maple stands in the Lower St.Lawrence, Beauce, Appalachian, Bas-Saint-Maurice and the Eastern Townships.

On the basis of counts of female adults caught in sticky traps during the fall, defoliation in 1994 is expected to be moderate in Saint-Jacques-de-Leeds and light in Saint-Sylvestre, Bernierville (Mégantic) and Saint-Eugène. Overall, Bruce spanworm populations in the various regions of the province are expected to increase.

LARGE ASPEN TORTRIX

Choristoneura conflictana (Wlk.)

Severe defoliation caused by large aspen tortrix was observed again in several Quebec regions during 1993. Populations remained stable in the Lanaudière region, increased in the Gaspé-Magdalen Islands region, and declined significantly in the Saguenay-Lac-Saint-Jean, Quebec City and North Shore regions. Local damage was also recorded in Abitibi-Témiscamingue, and a new pocket was detected in the Outaouais. The insect was also observed in other regions, but did not cause significant damage. In an aerial survey conducted in the Lanaudière, Gaspé-Magdalen Islands and North Shore regions, close to 17 900 ha of affected forest was observed in 1993, down from 36 900 ha in 1992. Damage was moderate to high on more than 86% of the total area affected.

In the Saguenay-Lac-Saint-Jean region, populations of large aspen tortrix have completely collapsed. In the Quebec City region, the infestation that has persisted for the past five years also declined significantly in 1993. The infested areas had increased substantially in 1992, while only a few pockets of light to moderate infestation were detected north of Baie Saint-Paul and Clermont in 1993. A dramatic decline in large aspen tortrix populations also occurred in the North Shore region. A total of only 357 ha was infested in the sectors of Franquelin and Dionne lakes (Saguenay), as compared to nearly 28 000 ha in 1992. Defoliation was light, with the exception of a small pocket of severe defoliation near Baie-Comeau.

The large aspen tortrix continued to cause damage in the known areas of infestation in the Lanaudière region. Infestations continue to occur south of the Taureau reservoir (Maskinongé) and east of Saint-Donat-de-Montcalm, with local population fluctuations in these areas. Damage in the Saint-Donat-de-Montcalm sector was worse in 1993 than in 1992, but it was less severe in several pockets south of the Taureau reservoir. However new pockets of mostly moderate defoliation were recorded there. A total of 5 634 ha was infested in 1993 and defoliation was moderate or severe over 91% of this area.

One pocket of severe infestation was recorded this year in the Outaouais region in an aspen stand located along Highway 148, near Quyon (Pontiac). The insect was also detected in the Abitibi-Témiscamingue region. However, defoliation was generally light except for a few localized pockets near the municipalities of Cloutier and Montbeillard (Témiscamingue), where moderate to high defoliation occurred.

The pockets of infestation detected during 1992 in the region of Gaspé-Magdalen Islands continued to spread this year. The sectors affected are located south of Sainte-Anne-des-Monts and southeast of Murdochville. The area infested has more than tripled, from 3 516 ha in 1992 to 11 901 in 1993. Damage was also more severe than last year. Moderate to high defoliation occurred on close to 87% of the total area infested.

Ontario

PINE SHOOT BEETLE

Tomicus piniperda (L.)

The pine shoot beetle was found in Ontario for the first time in 1993 in the Niagara Peninsula and Cambridge area.

The pine shoot beetle first came to the attention of FIDS in the summer of 1992 with its discovery at Christmas tree plantations in several adjacent states. Subsequently, in October 1992 Agriculture Canada imposed restrictions on the importation of pine material from infested areas in the United States. In the spring of 1993 Agriculture Canada trapped adult beetles at four locations in the

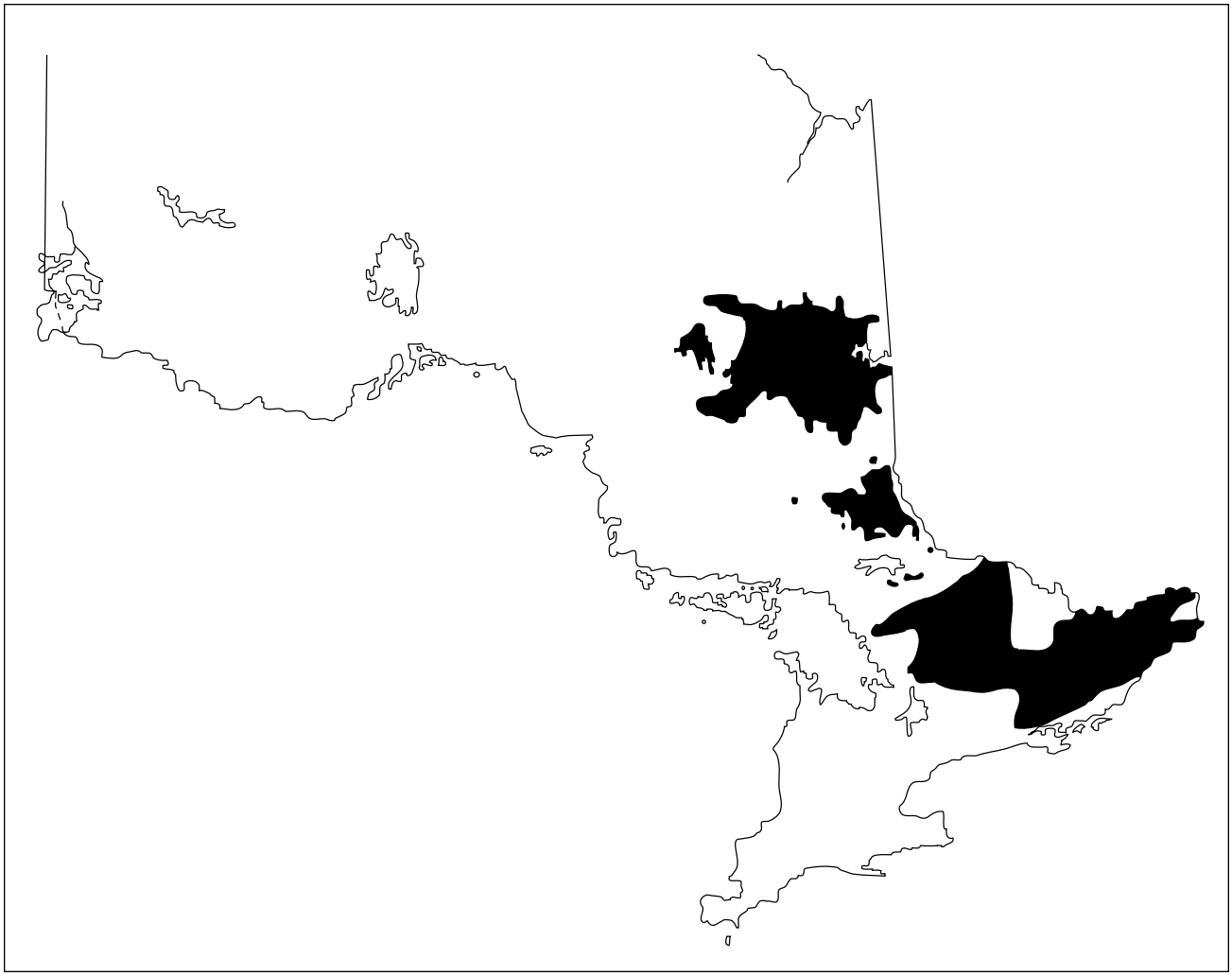

Figure 13. Area of Moderate to Severe Defoliation by the Birch Skeletonizer in Ontario, 1993.

Niagara area of southern Ontario. Follow-up checks by FIDS rangers confirmed infestations near the towns of Fort Erie and Dunnville. Subsequent surveys by Agriculture Canada and FIDS personnel detected 12 additional occurrences. All are located in the Niagara Peninsula and adjacent areas including the counties of Hamilton-Norfolk, Hamilton-Wentworth, Niagara, Waterloo and Wellington. As a result, those counties have been declared infested by the Plant Protection Division of Agriculture Canada and quarantine restrictions have been imposed on the movement of pine material from them.

BIRCH SKELETONIZER

Bucculatrix canadensisella Cham.

There was moderate to severe defoliation over 7 858 495 ha, a decline from 12 103 480 ha in 1992. Despite the declines, three large infestations affected white birch stands within an area of 3 509 077 ha in the Hearst, Cochrane, Kirkland Lake, Temagami, Timmins and Chapleau districts of the Northeast Region and the North Bay and Sudbury districts of the Central Region (Figure 13).

The birch skeletonizer defoliated nearly eight million hectares of forest this year. Outbreaks of this pest seldom last long, however.

In southern Ontario, a large infestation of 4 310 290 ha stretched from the southern Parry Sound and Pembroke districts east through parts of Bancroft, Tweed and Kemptville districts to the Quebec border. White birch and yellow birch were severely defoliated within this area, as were grey birch stands in the Kemptville District.

The insect was also widespread in the Midhurst and Maple districts but damage was sporadic, with only occasional trees severely defoliated.

There is no method for predicting population trends of this pest. Historical records, however, show that outbreaks are usually of short duration and, since the current one is several years old, it is probable that infestations will continue to decline in 1994.

PINE FALSE WEBWORM

Acantholyda erythrocephala (L.)

The pine false webworm is usually a pest of young pine, attacking trees from seedling size to about 3 m in height. The insect feeds inside protective web masses along twigs and branches, consuming the old foliage on the trees. In 1993, an unusual situation was discovered in Oro Township, Midhurst District, where 287 ha of red and white pine 15 to 20 m tall were heavily infested. Defoliation averaged 75%, although in some of the more heavily infested plantations 100% of the old foliage was consumed along with 30% of the new foliage. This insect also heavily damaged red pine 10 to 12 m tall at four plantations near Rice Lake in Hope Township, Tweed District, where 80% of the old foliage and 30% of the new foliage was consumed.

The pine false webworm normally attacks young pine trees up to 3 metres tall but this year it defoliated 287 ha of 15- to 20-m red and white pine in plantations.

Similar defoliation levels were observed at a 4-ha plantation of red pine 7 m tall in Snowdon Township, Bancroft District. Infestations were widespread on young red pine plantations in Parry Sound and Bancroft districts, with defoliation as high as 66% and the proportion of trees infested ranging from 82 to 99%. The pine false webworm was found for the first time at infestation levels in Thunder Bay District, where 31% of the trees were infested at a plantation of jack pine 2.8 m tall, with defoliation as high as 70%. Red pine plantations were infested in Algonquin Park, Tweed and Kemptville with damage in the light to moderate range.

EARLY ASPEN LEAFCURLER

Pseudexentera oregonana (Wlsm.)

There was a marked decrease in defoliation levels of this early-season pest. The area of moderate to severe defoliation declined from 1 867 828 ha in 1992 to 839 840 ha in 1993. Major infestations in the Sudbury and Chapleau districts collapsed, but large areas remained infested in the southern Cochrane District and adjacent areas in the northeastern Timmins District and northwestern Kirkland Lake District. Small pockets of defoliation occurred in the Hearst, Chapleau, Timmins, Kirkland Lake and Temagami districts.

There is no method for forecasting populations of this insect. However, as with the birch skeletonizer, outbreaks of this pest are usually of short duration and it is expected that populations will continue to decline in 1994.

PEAR THRIPS

Taeniothrips inconsequens (Uzel)

In 1989, the Ontario FIDS Unit carried out a special survey to determine the status of pear thrips in sugar maple stands. The results showed that the insect was present in a large part of the range of sugar maple at generally low population levels. In 1993, a follow-up survey was conducted in cooperation with Agriculture Canada to assist with a study on climate-matching techniques. The survey concentrated on the northern edge of the sugar maple range and on areas where pear thrips had been scarce in the previous survey.

Results of the 1993 survey confirmed the presence of pear thrips in most of the range of sugar maple in Ontario. The insect was collected at 9 of 29 sites sampled in the Central Region, with positive samples in the Parry Sound, North Bay, Sudbury and Sault Ste. Marie districts. It was not collected, however, in the Temagami or Kirkland Lake districts at the extreme northern range of sugar maple. In the Southern Region, confirmed collections were made at 10 of 18 sites sampled in the Tweed, Kemptville, Aylmer and Midhurst districts. In addition to the special survey, routine surveillance disclosed varying levels of pear thrips damage along a 4.5 km stretch of the Niagara escarpment in the city of St. Catharines. Foliar damage of 30 to 40% was observed in the most heavily infested stands, with most damage on the lower foliage. The same level of damage occurred on 22-m sugar maple at one stand in Hallowell Township, Tweed.

SCLERODERRIS CANKER

Gremmeniella abietina (Lagerb.) Morelet

There was a marked increase in the occurrence of the European race of scleroderris canker disease in the Central Region in 1993. A total of thirty-three collections from red pine were confirmed as the European race. Twenty-four of the collections were from or near stands where the disease had been collected previously. Nine of the collections were from new sites which, although located in the same general area as previous finds, did represent a significant spread (approximately 60 km in one case) of the fungus. It was also evident that infection levels at previously infected sites and in adjacent areas had intensified.

The incidence of the European race of scleroderris canker disease increased considerably over levels in 1992 in Ontario. This disease is a major cause of damage in red pine plantations in eastern Canada.

There were a number of reports of the North American race in young jack pine and red pine stands in northern Ontario as well as in the Parry Sound District of southern Ontario. With a few exceptions, infection levels were low and damage was light. In Villeneuve Township, Sault Ste. Marie District, 84% of the trees in a 13-ha red pine plantation were infected, 10% severely, with mortality of 2.7% recorded. The highest incidence was in Kirkwood Township, Sault Ste. Marie District, where 90% of the red pine 3.1 m tall were infected.

DIPLODIA TIP BLIGHT

Sphaeropsis sapinea (Fr.) Dyko & Sutton

Diplodia tip blight was widespread in southern Ontario on a variety of hosts including Scots pine, red pine, Austrian pine, white pine and blue spruce. Heavy infections were evident on ornamental and highway-roadside plantings of Austrian pine at a number of locations in the Midhurst, Cambridge and Aylmer districts, with branch and shoot mortality as high as 70%. Scots pine plantations were heavily infected in Beverly, Maryborough and Brantford townships, Cambridge District, and King Township, Maple District. Perhaps the most severe damage on this species was near the town of Angus, Midhurst District, where two 5-ha Scots pine Christmas tree plantations were cut and burned because heavy infections had rendered the trees unsaleable. A heavy infection occurred on 45-year-old red pine along the Dieppe Road at Canadian Forces Base Borden.

In northern Ontario, the most severe damage was on red pine 15 m tall at French Lake Provincial Park, Fort Frances District, where 75% of the trees were infected, with an average of 75% shoot damage. In Skead Township, Kirkland Lake District, 31% of the trees at a 5-ha red pine plantation sustained 10% shoot mortality. The disease was reported at lower infection levels in the Chapleau and Temagami districts.

SPRUCE NEEDLE RUSTS

Chrysomyxa ledi (Alb. & Schw.) de Bary and *C. ledicola* Lagerh.

Heavy infections of these rust diseases were reported from the Wawa and Nipigon districts. The most severe damage was in a stand of black spruce 2 m tall at Baxter Lake, Nipigon District, where 100% of the trees were infected and foliar damage averaged 90%. Similar infection levels occurred at a 25-ha mixed stand of black and white spruce near the town of Wawa, where 100% of the trees 10 m tall were infected and foliar damage averaged 80%. At this site, damage was more severe on white spruce than black spruce. Infection levels at numerous other black and white spruce stands in the two districts ranged from 50 to 100%, with foliar damage levels of 20 to 80%. The diseases were reported from a number of other areas in northern Ontario, and although infection levels were occasionally high, foliar damage was usually low. Infection levels and foliar damage which had been high in parts of the Cochrane, Hearst, Timmins and Kirkland Lake districts for several years declined in 1993. At several of the more severely infected stands in the Wawa and Nipigon districts, a rust parasite (*Fusarium avenaceum* [Fr.] Sacc.) was found in the rust pustules on more heavily infected trees.

Northwest

DOUGLAS-FIR BEETLE

Dendroctonus pseudotsugae Hopk.

The infestation of Douglas-fir beetle in Alberta which was initially reported in 1991 at Jasper National Park continued to expand in 1993. Concern over this infestation has led park staff to conduct intensive aerial and ground surveys to detect Douglas-fir beetle activity. The results of these surveys indicate that about 383 trees were killed in 1990 and 1991, 528 trees in 1992, and 685 trees in 1993. The killed trees were located in patches

scattered along the Athabasca River valley, in areas adjacent to the Jasper townsite and Jasper Park Lodge, and at several locations up to 15 km north and south of the town of Jasper.

LARGE ASPEN TORTRIX

Choristoneura conflictana (Wlk.)

In Saskatchewan, all aspen defoliation was caused by large aspen tortrix. Defoliation classed as light and light to moderate occurred on 5 187 ha and 59 736 ha respectively. There were 16 398 ha of moderately defoliated aspen while 359 434 ha of aspen received moderate to severe defoliation. This defoliation occurred predominantly in the area bounded by Meadow Lake, Horse Head, Cater, Big River and Green Lake. Smaller areas of moderate defoliation were observed east of Hackett Lake and near Meeting Lake. Defoliation ranged from light to moderate at several small patches northwest of Big River, in Prince Albert National Park, Red Earth Indian Reserve, and southwest of Hudson Bay near the Piwei lakes and the Etomami River. At one location southwest of Hudson Bay, aspen twoleaf tier (*Enargia decolor* [Wlk.]) caused defoliation in association with large aspen tortrix.

In Manitoba, large aspen tortrix was detected near Wabowden and north of Fairford. In Alberta, large aspen tortrix caused light defoliation northwest of Peace River, around Red Earth Creek, and south of Grande Prairie.

ASPEN LEAFROLLER

Pseudexentera oregonana (Wlsm.)

In the spring of 1993, aspen leafroller caused light, light-to-moderate, and moderate defoliation in the Peace River, Grande Prairie and Slave Lake forests. Most of this defoliation occurred along the Little Smoky River from just east of Highway 34 to the Smoky River confluence, and then along the Smoky River to the Peace River confluence. Approximately 27 350 ha of aspen were defoliated.

SPRUCE GALL MIDGE

Mayetiola piceae (Felt)

In 1992, an infestation of spruce gall midge was detected in northern Alberta and adjacent areas in the Northwest Territories. In 1993, an intensive survey was conducted for this pest throughout the Footner Lake Forest, in the northwest region of Athabasca Forest along the Birch River, and in the Northwest Territories (Figure 14). Thirty-two plots were examined for the midge, which forms galls that kill young shoots. On trees that were moderately or severely infested, twig mortality may have reduced radial growth. Tree terminals were not attacked. Branches at three crown levels were sampled but no differences were observed in the intensity of damage at the three levels.

In 1993, no spruce gall midge infestations were found at eight sample plots. Twelve plots were lightly infested (<25% of current shoots infested), seven plots moderately (26–50%) and five plots severely (>50%). Moderate to severe infestations occurred from Paddle Prairie north through High Level into the Northwest Territories just south of Enterprise, northwest of High Level to Zama Lake, and southeast of High Level to just south of Fort Vermilion. Light infestations were located southwest of High Level near Rainbow Lake, near Wadlin Lake and east to the Birch River, and in the Northwest Territories near the communities of Hay River and Trout River.

Although spruce budworm infestations along the Chinchaga River and on the Zama ridge included spruce gall midge damage, it had decreased there. This midge was also found in 1993 shoots at less intensively sampled sites west of Zama Lake along the Hay River and northeast of High Level as far north as the Yates River. Some samples showed evidence that infestations began as early as 1991, but now it appears that populations are static.

DUTCH ELM DISEASE

Ophiostoma ulmi (Buis.) Nannf.

In Manitoba, the current range of the disease extends through the southern portion of the province in riparian forests and in communities north to Swan River. In Winnipeg, the incidence remains at 2.4%.

In 1992, 32 communities participated in a cost-shared program with the Manitoba Department of Natural Resources to undertake sanitation pruning and basal spraying with insecticide to reduce vector beetle populations. Replacement plantings were also done.

In Saskatchewan, three new locations were recorded as having infected elms: the town of Langenburg, just outside of MacNutt, and in the Qu'Appelle River valley southeast of Crooked Lake in the Cowessess Indian Reserve. At Langenburg three trees were infected in the town and one infected tree was found just outside of town. Near Round Lake about 100 trees were infected. In 1993, intensive ground surveys were conducted in areas known to be infested; the Souris River valley south of Estevan, the Qu'Appelle River valley between Crooked Lake and Round Lake, and in the Wascana Creek area. Samples were taken from 237 trees, of which 11 samples were identified as positively infected by the disease. No aerial surveys were done in 1993.

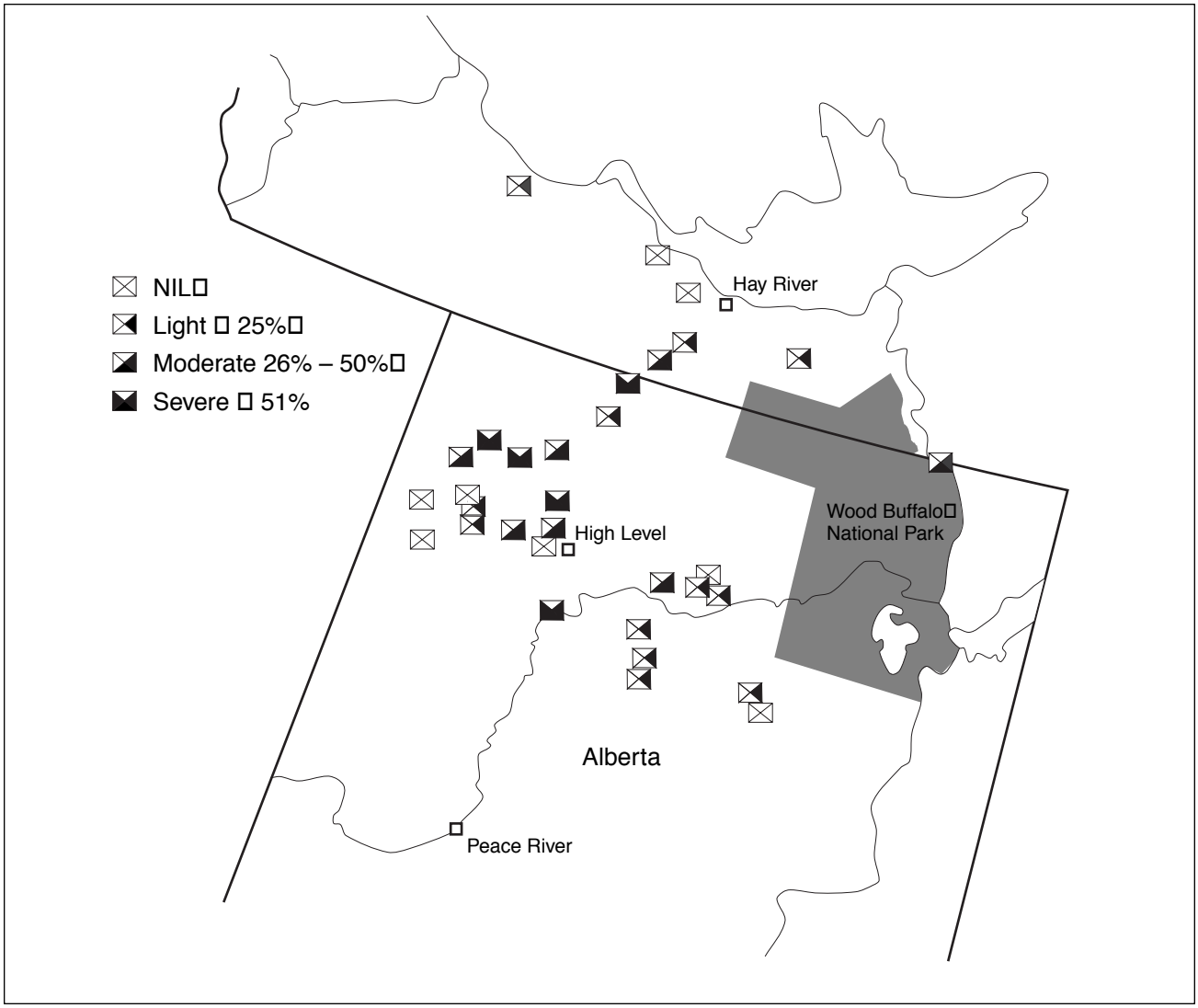

Figure 14. Spruce Gall Midge Survey Locations and Infestation Levels in Alberta and the Northwest Territories, 1993.

Staff of the provincial Dutch Elm Disease Program distributed about 80 traps baited with the smaller European elm bark beetle (*Scolytus multistriatus* [Marsh.]) pheromone to 34 communities for deployment. In traps placed in and around Estevan a few native elm bark beetles (*Hylurgopinus rufipes* [Eichh.]) were captured but no *S. multistriatus* were trapped. Both beetles species are important vectors of the disease. Control operations were carried out by removing infected trees. Twenty trees were removed in the Sherwood Forest Country Club west of Regina and 10 trees were removed in the community of Carrot River.

Surveys to detect the incidence of the disease were conducted by the municipalities of Medicine Hat, Red Deer, Calgary, Edmonton, and by the Alberta Department of Agriculture under the Dutch Elm Disease Initiative. The initiative consists of three programs: monitoring the disease, and the smaller European elm bark beetle as well as the native one; maintaining an inventory of American elm (*Ulmus americana* L.); and monitoring ports of entry to confiscate elm firewood. Elm bark beetle monitoring was conducted at 30 locations in Alberta from Cold Lake to the Crowsnest Pass. Most monitoring sites were at points of entry into the province. Traps were baited with the smaller European elm bark beetle pheromone and trap logs. There were no reports of the disease or beetle vectors in the province.

Pacific and Yukon

PINE SHOOT BEETLE

Tomicus piniperda (L.)

Special surveys of Christmas tree plantings, particularly Scots pine, were initiated in the region in 1992 to detect the pine shoot beetle. Results were negative in 1993. The surveys followed the recent discovery of the introduction of this European pest into North America.

DOUGLAS-FIR BEETLE

Dendroctonus pseudotsugae Hopk.

Tree mortality occurred mostly in the Fraser River drainage in the Cariboo, the Kamloops, Prince George and Vancouver regions. Most of the beetle-killed trees were in groups of 2 to 15 and occasionally more up to 500 trees.

Increased beetle populations killed mature Douglas-fir in about 3 975 separate areas totaling 13 000 ha in five regions. This was the sixth year of increase and more than double the area recorded in 1992.

In the Cariboo Region, tree mortality increased threefold in 2 545 separate pockets totaling about 6 950 ha. The largest increase was in the Chilcotin Military Block near Riske Creek with over 5 320 ha in 240 patches, up fourfold from 1992. Additional patches of recently killed trees were in or near previous infestations from Clinton north to Quesnel and from Horsefly west to Redstone.

Beetle-killed Douglas-fir were widely scattered in about 970 patches of 5-20 trees in the Thompson River and North Okanagan drainages over 1 175 ha, up fourfold from 1992. Most were in previously and chronically infested stands from Cache Creek to Pavilion, in the Deadman River Valley, north of Kamloops Lake, the Shuswap River Valley, and near Sugar and Mabel lakes.

Mature beetle-killed Douglas-fir in the Nelson Region occurred in about 70 widely scattered groups in the Rocky Mountain Trench totaling about 950 ha. This was similar to last year and occurred in previously infested areas south of Cranbrook, near Fairmont, along McNaughton Lake, and near Columbia, Whiteswan and Whitetail lakes, with slight increases in the Lussier River drainage and north of Radium. Patches of ten or fewer beetle-killed trees were common along Kootenay and Slocan lakes and Kootenay River drainages in the West Kootenay.

Douglas-fir mortality in the Prince George Region continued for the fourth consecutive year at about 300 patches totaling 4 500 ha, up 25% from 1992. Most were again north of Fort St. James and along Canoe Reach south of Valemount, with increasing populations over about 1 200 ha in the southern part of the Prince George Forest District.

Tree mortality in the Vancouver Region was mapped in about 195 separate patches totaling 360 ha, about double the area of 1992. These infestations were in the Anderson, Fraser, Chilliwack and Skagit river drainages, and to a lesser extent east of Bella Coola in the Mid-Coast district.

Mortality of mature and overmature Douglas-fir is expected to continue in 1994 in most recently infested stands, particularly in the Cariboo Region. At 10 stands surveyed in the military training area near Riske Creek, an average of 31% of the trees were currently under attack.

DOUGLAS-FIR TUSSOCK MOTH

Orgyia pseudotsugata (McD.)

Douglas-fir trees were severely defoliated by the tussock moth in the Kamloops Region in 1993 at 64 patches of 1-10 ha totaling 1 150 ha. This followed defoliation over 1 850 ha west of Kamloops in 1992. Ornamental Douglas-fir and spruce in urban areas of Kamloops, Vernon, Kelowna, and Penticton were defoliated, some for the sixth consecutive year.

The number of male adults trapped in pheromone-baited sticky traps declined for the second consecutive year. A total of 2 717 adult males were trapped in 91% of the 112 traps at permanent sites in the Kamloops and Nelson regions. This is 35% fewer than in 1992. In addition, 166 males were trapped in 31 of 57 traps in 12 areas to locate the focus of the infestation. The British Columbia Forest Service collected 4 039 males at 152 sites.

Trap data and the reduced number of egg masses in 1993 indicate the potential for light defoliation in 1994 of Douglas-fir at single sites near Kamloops and Cache Creek. Little or no defoliation is expected at 14 sites in the southwestern part of the Nelson Forest Region, or near Chilliwack.

Treatments of active populations were completed at seven sites totaling about 610 ha near Savona and Rayleigh in the Kamloops Region. Results after aerial applications of a nuclear polyhedrosis virus in two formulations — Virtuss and ™Biocontrol-1 — indicated effective viral spread and a significant reduction of

populations. An experimental pheromone male confusion trial conducted by the CFS over 30 ha near Kamloops found that mating was effectively blocked.

PINEWOOD NEMATODE

Bursaphelenchus xylophilus (Steiner & Buhrer) Nickle

New surveys were conducted in 1993 to obtain data for a possible exemption for yellow cedar from the ban on non-kiln dried softwood exports from Canada to the European Community. Bait log trials continued for a possible exemption for western hemlock, and a product survey was initiated in cooperation with the Forest Industry Associations.

The FIDS did a cooperative product survey with industry to test for the presence of this nematode. FIDS was also part of the technical team involved with the European Community.

Samples of yellow cedar were collected from logs at 23 sites including dry-land sorts and log decks. Most sites were in the Vancouver Region on Vancouver Island (15), with fewer from the lower mainland (2), the mid-coast (2) and coastal areas of the Prince Rupert Forest Region (4). None of the 31 extracted samples contained pinewood nematode, but 45% contained other insect-associated or fungal-associated nematodes of the families *Rhabditidae* and *Tylenchidae*. New or old insect activity was evident in some of the logs at some sites, but the activity was confined mostly to near the cambium and most galleries were incomplete. Woodborer galleries identified in 5% of the logs at 11 sites were caused by *Semanotus ligneus ampla* and other *Cerambycidae,* but not by Monochamus beetle (*Monochamus* spp.). Ambrosia beetle (*Trypodendron* sp.) attacks were found in about 5% of the logs at three sites and cedar bark beetles (*Phloeosinus* sp.) occurred at four sites.

A follow-up to the 1992 bait log survey continued with western hemlock and lodgepole pine. Freshly cut logs from standing western hemlock (18) and pine (12) were placed at sites with active woodborer populations in each of the Cariboo, Nelson, and Vancouver regions, in late May to early June. Woodborer attacks were fewer in 1993 than 1992 in the Vancouver Region, but only slightly fewer in the other regions.

In 1993, a lumber product survey for pinewood nematode was initiated. None of the approximately 1 000 samples collected and examined during July to December from 50 mills contained pinewood nematode. Eight samples contained other insect- or fungal-related nematodes, of the families *Rhabditidae*, *Tylenchidae*, and *Monhysteridae*. Of all the samples collected at random, 5% contained sap stain, 5% had bark, and 3% had grub holes. Samples included 301 western hemlock, 228 spruce, 205 true fir, and 192 Douglas-fir.

In surveys of natural stands throughout British Columbia and Yukon territory since 1980, only six predisposed trees from widely scattered locations and one woodborer, *Monochamus [maculosus=] clamator* Hald. contained pinewood nematode. In log bolt studies from 11 sites in six regions in 1993, with more than 550 samples, the nematode was present in 13% of the pine and none of the western hemlock.

CHAPTER 3

Monitoring, Declines and Other Damage

This chapter contains descriptions of damage not caused by insect or disease pests, but which influence the health of trees and forests. Two monitoring networks are also described: the National Forest Health Monitoring Network and the Sugar Maple Crown Condition Network.

Acid Rain National Early Warning System (ARNEWS)

During the 1980s concerns began to be raised about the possible impacts of air pollutants, primarily acid rain, on forests. At this time there was public concern about the forests in Europe which were apparently being damaged by air pollution, specifically acid rain. It was feared that similar events might occur in Canada, particularly since damage to forests had already occurred near point sources of pollution in this country.

Further to these concerns, a study of the opinions of air pollution biologists indicated a belief in future losses in growth and consequent economic loss if pollution were to continue at current levels. This was all despite the low pollutant levels, when compared to those in Europe, and the lack of observed effects in Canada.

As a result of scientific projections and public concern, therefore, the CFS initiated a national program to monitor the health of our forests. This system, called the Acid Rain National Early Warning System (ARNEWS), was started in 1984.

The objectives of the ARNEWS are:

• to detect the possible damage to forest trees and soils caused by acid rain by identifying the damage sustained by Canadian forests that are not attributable to natural causes or management practices; and

• to monitor vegetation and soils over the long term, to detect changes attributable to acid deposition and other pollutants in representative forest ecosystems.

A series of permanent sample plots were established in representative forests across Canada in 1984, and augmented by additional plots in 1992-93. There are now 149 plots in the system. The FIDS conducts the field measurements and data gathering, identifies the causes of stresses and changes in the condition of trees and interprets the results. The objectives were developed when the program was established and remain relevant today although a number of changes and refinements have occurred to the system.

The results of the program have shown that there is no large-scale decline in the health of Canadian forests that can be attributed directly to atmospheric pollution. Evidence of the classic symptoms of air pollution were sought but few indications of pollution damage were found.

Damage that may be related to air pollution has been described on birch in the Bay of Fundy area of New Brunswick.

Research is now underway to determine the relationship between the acid fogs in the area and the observed damage. Flecking on conifer needles has also been observed in ARNEWS plots in the Maritimes and British Columbia. These resemble symptoms caused by high concentrations of ozone: again, CFS is attempting to determine whether there is a cause-and-effect relationship between them.

Several regions participated in a Quality Control Workshop July 26-28, 1993, at Fundy National Park, New Brunswick.

The effects of insects, diseases, drought, and storms were observed frequently. Many factors, including a wide range of insects and diseases as well as climatic factors such as drought and regional air pollution, affect forest health. It is possible, of course, that trees have been weakened or stressed by external factors such as air pollution and that this stress is not apparent.

Tree mortality has been at levels consistent with those in unmanaged forests in Canada: 1-3%. Mortality was caused primarily by natural thinning in stands and occasional, but known, other damage. Higher levels of mortality or damage on jack pine, balsam fir, white birch, and trembling aspen were attributed to stress from blowdown, root rots, stem cankers, and spruce budworm or other defoliating insects.

Results of the national program are published annually in greater detail. Regional summaries and analyses are also published.

North American Maple Decline Project (NAMP)

A decline in the appearance and health of sugar maple stands in Quebec during the late 1980s led to surveys by the CFS and the provincial government. Results indicated that no single factor such as elevation, management practices, tapping, insects or diseases adequately explained the observed damage. The NAMP research project was established to determine the rate of change in the condition of sugar maple trees, and to see whether the change was affected by pollutants, management systems, or the initial level of decline. The project consists of 62 permanent sample plots in Canada: 24 each in Ontario and Quebec, 12 in New Brunswick, and 2 in Nova Scotia. Evaluations of crown condition are done annually.

Results to date indicate that the condition of maples is generally stable and may have improved slightly since measurements began. Deterioration in maple condition was observed in areas of sustained drought and where insect outbreaks occurred, but trees recovered within 1-2 years. The condition of maples appeared unaffected by management regime or deposition zone of pollutants.

MARITIMES

Analysis of results showed that the condition of sugar maple in this region, as measured by crown dieback and transparency, has changed little since the plots were established in 1988. The results are similar for both managed sugar bushes and unmanaged stands.

QUEBEC

The overall situation of the extent of topkill at the 24 plots in Quebec in 1993 is illustrated in Figure15. The majority of trees fell into the 5% class, i.e. between 1% and 5% topkill. This is similar to last year's situation. There was no significant difference between the condition of managed sugar bushes and that of undisturbed stands.

A second critical parameter assessed in this project is foliage transparency, which is defined as the average percentage of the foliated portions of the crown through which skylight is visible. Leaf density and opacity is measured. In 1993, the majority of sugar maples observed fell, in almost equal proportions, into the 5% and 10% transparency classes (Figure16). This represents a significant improvement over 1992 (a full class), i.e. from the 10% and 20% classes in 1992 to the 5% and 10% classes in 1993. In our view, there are two possible explanations for this situation. There may have been real

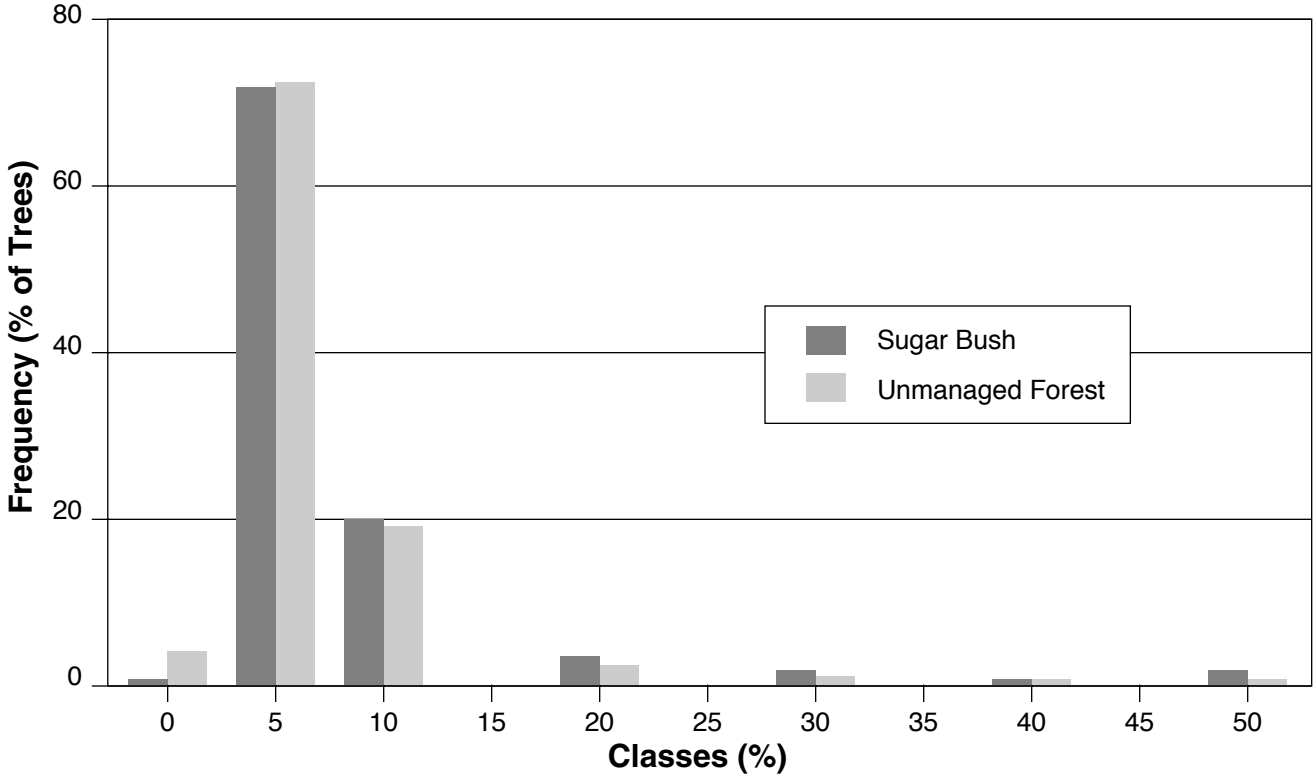

Figure 15. Distribution of Topkill in All Dominant and Codominant trees in Managed Sugar Bushes and Undisturbed Stands at the 24 Plots Studied in Quebec, 1993.

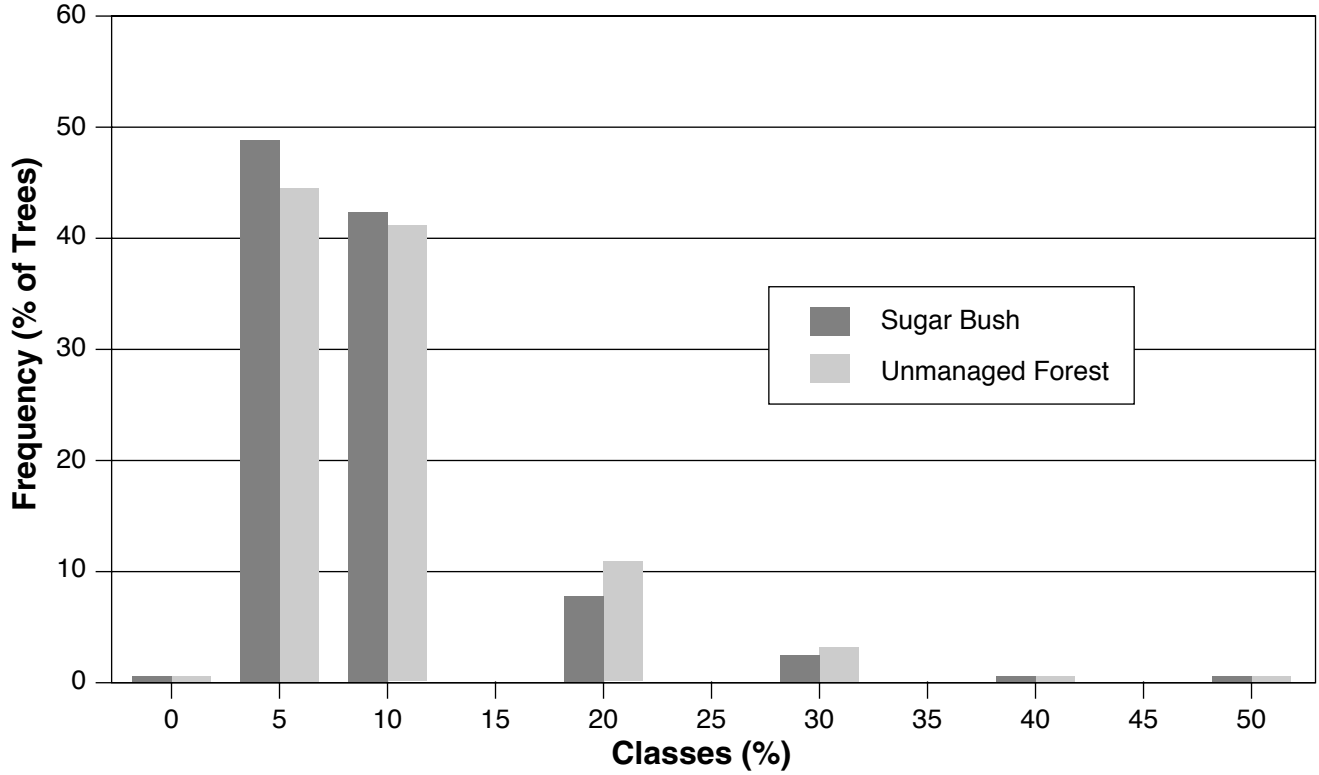

Figure 16. Distribution of Foliage Transparency in all Dominant and Codominant Trees in Managed Sugar Bushes and Undisturbed Stands at the 24 Plots Studied in Quebec, 1993.

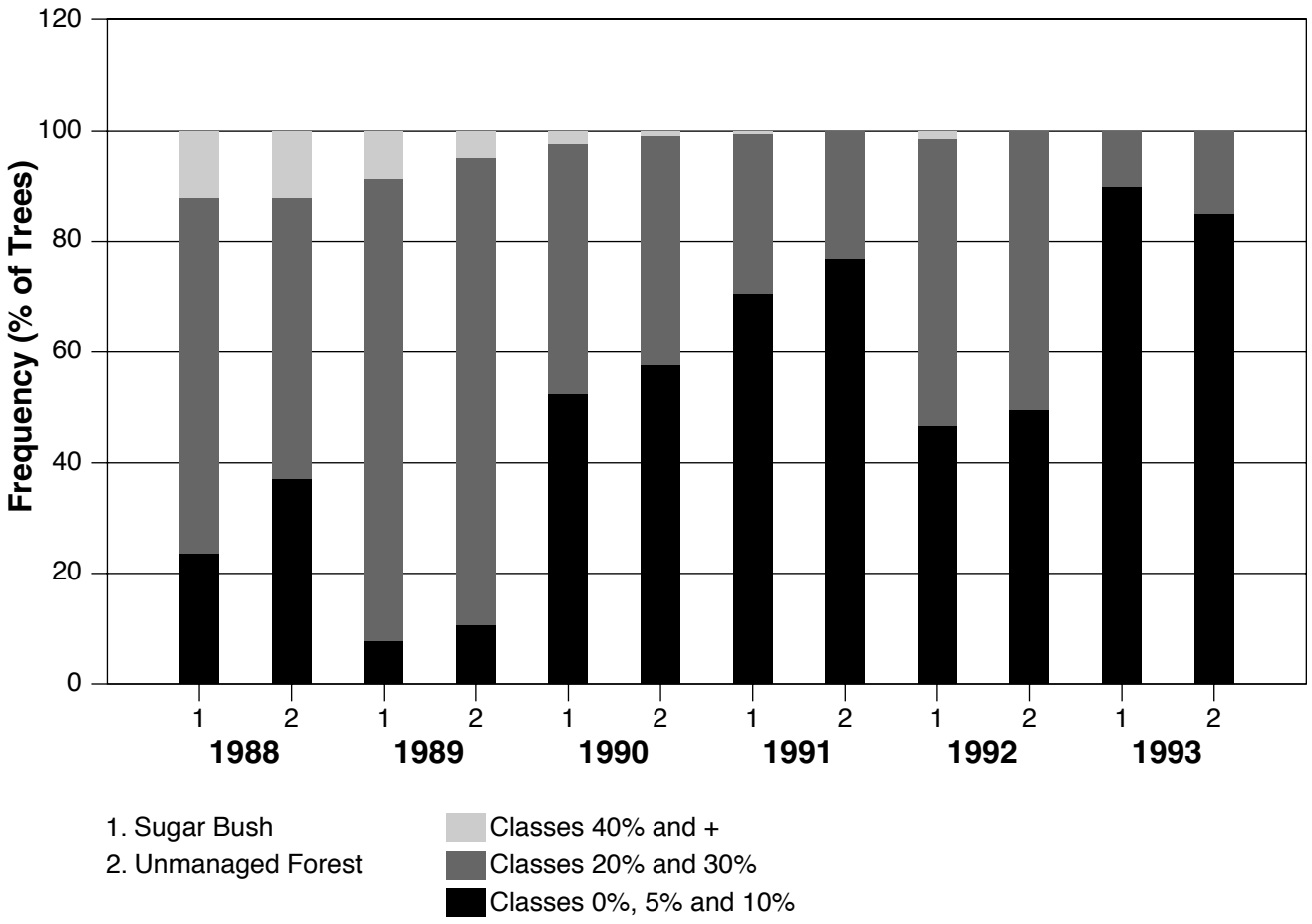

Figure 17. Percentage of Sugar Maples with Light, Moderate and Severe Foliage Transparency for all Dominant and Codominant Trees in Managed Sugarbushes and Undisturbed Stands at the 24 Plots Studied in Quebec, 1988-1993.

improvement in leaf density due to exceptional growing conditions in 1993 as compared to the relatively cool, extremely wet weather of 1992. Leaf density is highly sensitive to the weather conditions of the current year. On the other hand, an experimental factor cannot be ruled out since the evaluation was conducted by a new team of observers this year. However, the team received the same training and standardization as in previous years.

In terms of general change (Figure 17), the parameter of foliage transparency seems to illustrate clearly the difficult growing season observed in 1992. However, links cannot be drawn between a given level of transparency and topkill, which appears to be the result of several years of growing conditions and to be relatively unaffected by annual variations.

ONTARIO

In Ontario, the data show that 94% of dominant and co-dominant trees in undisturbed stands have zero-to-low levels of dieback, unchanged from conditions in 1992. In sugar bush stands, 94% of the dominant and co-dominant trees were in the zero-to-low dieback class, as compared to 93% in 1992. A number of insect and disease organisms were observed in the plots but damage in all cases was negligible. A total of 0.6% of the trees have died since the plots were established in 1988, which is normal for stands of this size and age.

Declines, Abiotic and Mammal Damage

Abiotic damage is injury not caused by an organism.

It includes climatically related damage, windstorm damage to foliage, blowdown, frost and winter drying. In some areas damage from mammals is also a problem. Stress-related damage, forest declines and evidence of

damage from air pollution are also included in this section. Damage is reported on a regional basis.

NEWFOUNDLAND AND LABRADOR

Frost Damage

Symptoms of frost damage occurred on 30% of the foliage of 50% of the trees in mainly white birch stands along the north side of East Arm and at Southeast Brook, Gros Morne National Park. Frost damage was also recorded on red maple, elm, trembling aspen, copper beech (*Fagus sylvatica*), Norway maple (*Acer platanoides*), larch (*Larix laricina*) and balsam poplar throughout the Island. In eastern Labrador frost killed or severely damaged approximately 12 000 spruce seedlings at the holding area of the provincial nursery in Happy Valley. Lack of snow cover during winter contributed to the damage. An entire seedlot of European larch (*L. decidua*) was also killed or severely damaged. This species is probably unsuitable for the Labrador climate. (Frost also damaged 25-50% of the new shoots on larch in a plantation at Muskrat Lake. Larch in plantations along South Branch road received very light damage.) A low incidence of frost damage was recorded in jack pine plantations along South branch and Churchill roads, and many dead leaders and shoots were present from previous years.

Frost also affected the new growth on balsam fir regeneration in many areas near Goose River, South Branch, and Grand Lake roads causing severe damage to scattered small pockets in cutover areas. Light damage also occurred on young white birch in those areas.

Winter Drying

This type of damage was common and widespread in 1993. In a black spruce plantation 7 km west of Flat Bay Brook up to 30% of the foliage was affected on 90% of the trees. Severe damage caused by winter drying in combination with salt spray occurred at Sandbanks Provincial park and 30% of the foliage of Scots pine was affected on 70% of the trees in Grand Codroy Provincial Park. In a Sitka spruce plantation near Stag Lake up to 30% of the foliage on most of the trees was affected and 20% of Sitka spruce in a hedgerow at the Pasadena nursery is dying or dead as a result of repeated winter drying. Light to severe damage occurred to exposed white spruce and balsam fir along the highway near Parsons Pond on the Northern Peninsula. Several species of pine on the Avalon Peninsula were also severely damaged with up to 100% of the foliage on up to 50% of the trees affected. A high incidence of winter drying affected 10-20% of the foliage on jack pine in plantations near Peters River and Echo Lake in eastern Labrador. Evidence of light winter drying was also observed in plantations along the Churchill road.

MARITIMES

Weather-related problems were observed on red spruce and on several hardwood species. In New Brunswick, winter drying was most severe and common in the southeastern part of the province, especially in Fundy National Park and throughout Albert, Queens, Kings, and Saint John counties. Reddening of needles was also observed at locations in Charlotte, York, Carleton, and southern Westmorland counties, with damage ranging from 4 to 75%. This damage was first noticed in April and remained until the foliage dropped off in early summer.

Red foliage was most noticeable in Fundy National Park, Albert County, where most observations and assessments were made in an attempt to establish a pattern of damage. Winter drying affected the 1992 needle complement, but in the worst cases caused damage to foliage as old as that produced in 1990. Trees with more than one year's needle complement affected often had bud and shoot mortality as high as 70%. Reddened foliage was observed on entire crowns, but was more common and severe on the top third. Trees affected ranged in size from seedlings to mature trees, and damage occurred on trees growing within stands, at stand edges, and in open areas, plantations and thinnings. Red spruce was the only species affected. The most severe damage was at Saddleback Mountain, Kings County and at Henderson Settlement, Queens County, where 75% of trees had moderate reddening.

In Nova Scotia, red foliage was not as common as in New Brunswick, but moderate and severe reddening occurred at three locations: East Branch, Yarmouth County; Marshy Hope, Antigonish County; and Economy Lake, Colchester County. No damage was observed on red spruce in Prince Edward Island.

Wind Damage on Hardwoods

Wind damage to foliage occurred on hardwoods in northern Colchester and northwestern Inverness counties. Damage was most serious on Folly, Cobequid, and Lynn Mountains in Colchester County, and on the South Cape Highlands, near MacKinnons Brook and at Sight Point, in Inverness County. Stands affected were at high elevation sites. Light and moderate leaf browning, mainly of sugar maple, covered hundreds of hectares. Most of the affected leaves showed signs of physical injury, being torn or shredded to various degrees. The damage was probably the result of strong southeastern winds recorded in early July.

ONTARIO

Red Oak Dieback

In 1992, widespread areas of oak dieback and mortality occurred in the Parry Sound, Bancroft and Tweed districts. In addition, many trees had moderate to severe crown dieback. The condition was probably caused by several years of severe stress related to drought and defoliation by forest tent caterpillar and gypsy moth.

In 1993, conditions in the Bancroft and Parry Sound districts stabilized, and few areas of new mortality were found. Some trees that had been badly damaged continued to deteriorate. Trees on poor sites in the Tweed District continued to die. Aerial surveys revealed numerous small patches of new mortality totalling 3 880 ha, bringing the two-year total in Tweed District to 5 607 ha.

Similar stress-related damage occurred on red oak, trembling aspen and white birch around the city of Sudbury, Sudbury District. The red oak and white birch decline occurred in small pockets, usually on exposed ridge tops with shallow soils, between the La Cloche mountain and Wanapitei Lake. These trees had also been subjected to several years of drought, and defoliation by forest tent caterpillar and gypsy moth. The white birch in the area had also been attacked by bronze birch borer and armillaria root rot. Widespread dieback on trembling aspen occurred northwest of the city of Sudbury in the area between Gaiashk Township and Capreol, probably caused by the same stress factors mentioned above.

Thirteen 100-tree plots established in 1977 are used to monitor the health of red oak. Results indicate that an overall improvement in tree health has occurred. Some 70.3% of the trees showed light dieback symptoms, as compared to 61.2% in 1992. Moderate to severe dieback symptoms were recorded on 6.8% of the trees, as compared to 19.5% in 1992. The proportion of dead trees increased to 20.3% from 19%, and 2.6% of the trees have been destroyed by windfall or cutting.

Jack Pine Mortality

An extensive area of jack pine mortality (24 515 ha) occurred in four townships in the northeast Wawa District. Numerous patches of similar damage occurred in adjacent areas of Hearst District, bringing the total area affected to 31 260 ha. Trees had been subjected to extreme stress by drought, windstorms and snowstorms for several years. Damage in the form of broken branches, wind-thrown and wind-snapped trees as well as drought-killed trees provided abundant brood material for bark beetles and wood borers, which then attacked adjacent healthy trees.

Sugar Maple Network

The FIDS maintains a network of 119 25-tree plots throughout the range of sugar maple in Ontario in addition to those in the North American Maple Project. There are 82 plots in forest or woodlot situations, 20 in urban areas, and 17 rural-roadside plots.

An analysis of 1993 results showed little change in the status of the 2 000 woodlot trees. Some 92% were in the nil to low dieback class, as compared to 94% in 1992. A total of 4% had moderate to severe symptoms and 1% were dead. In 1992, 7.5% had moderate to severe symptoms and 0.5% were dead. In the rural-roadside plots, 81% of the 500 trees had nil to light dieback symptoms and 17% had moderate to severe symptoms. The corresponding figures for 1992 were 82% and 18%. The 500 urban trees had 90% in the nil to light category and 10% in the moderate to severe category, as compared to 89% and 11% in 1992.

NORTHWEST

Trembling Aspen Decline

Surveys of trembling aspen stands were started in 1992 to monitor the incidence, distribution, and abundance of insect and disease pests, defects, and tree mortality. The survey used the forest inventory permanent sample plot (PSP) sites established by the provinces. In 1993, 12 PSP sites in Alberta, 10 PSP sites in Saskatchewan, and 10 PSP sites in Manitoba were assessed. Aboveground tree components were examined for insect and disease injury. On recently dead or dying trees the root collar area was examined for insect- and fungus-caused injury to determine the cause of decline.

Results of the 1993 survey indicate that pest incidence was not significantly different from 1992. Aspen defoliators — forest tent caterpillar, large aspen tortrix, leaf beetles, and the decay fungi *Phellinus tremulae* (Bond.) Bond. & Boriss and *Peniophora polygonia* (Pers.:Fr.) B. & G. — were the most common pests.

In Alberta, of the trees that were assessed, 0.8% were dying, 5.0% had been dead for less than two years, and 12.9% had been dead for two or more years. There were similar values for Saskatchewan: 2.0% were dying, 3.7% had been dead for less than two years, and 31.2% had been dead for more than two years. In Manitoba, 2.3 and 16.1% of the trees assessed were dying or had been dead for more than one year, respectively.

PACIFIC AND YUKON

Winter Drying and Frost

Discoloration of seedlings, young conifers and mature deciduous stands caused by climatic factors, mostly winter drying and frost, was widespread in the Prince Rupert Region and Yukon Territory. Slightly above-average temperatures (+0.7°C) occurred at 13 of 15 sites in the region during the growing season. Precipitation ranged from 88% to 174% of the 30-year norm. This had little effect on pests during the summer, but needle diseases are expected to be conspicuous in 1994.

Climatic injury to conifers was most severe and widespread in the Yukon Territory where winter drying discolored all but the current foliage of most immature and mature lodgepole pine on south-facing slopes in the Rancheria River valley. This usually results in premature drop of the foliage. In the northern part of the Prince Rupert Region, most trees on south-facing slopes of over 500 ha near Good Hope Lake were severely discolored, and young exposed lodgepole pine were severely affected in the Telkwa River Valley, at Harold Price Creek and at McKendrick Pass north of Smithers. Young spruce were dead in widely scattered plantations along the Morice-Telkwa road and in the Lakelse River drainage, following severe damage to new growth by late frost last year.

Foliar discoloration and branch dieback attributed to cold weather and high winds in late winter and early spring were common on conifers throughout the upper Fraser Valley in the Vancouver Region. Similar damage was common also at higher-elevation young stands north of Campbell River on Vancouver Island.

Mammal Damage

Feeding by a variety of mammals in 1993 again damaged young trees in the Yukon Territory, increased in the Cariboo and Vancouver regions, but declined in the Kamloops and Prince Rupert forest regions.

Porcupines - Young and semimature conifers were killed and topkilled by porcupines (*Erethizon dorsatum* L.) chewing patches of bark from stems and branches. This damage occurred on 228 chronically infested areas (3 000 ha) in the western part of the Prince Rupert Region. Porcupine damage has been a significant factor in reducing stocking levels, particularly in artificially spaced lodgepole pine and western hemlock stands.

Squirrels - Feeding by squirrels (*Tamiasciurus* sp.) was again widespread in lodgepole pine throughout northwestern British Columbia and southwestern Yukon Territory. Damage increased in the Cariboo and Vancouver regions. Dead and discolored branch tips and partial branch girdling were occurring in patches of 10-100 trees in the southwestern Yukon and northern part of the Prince Rupert Region. Damaged trees were most common from Pelly Crossing to the south end of the Canol Road, and near Atlin, Takhini, Lake Laberge and Rancheria. Similar damage occurred in the northern part of the Prince Rupert Region at Swift River and to a lesser extent near Boya and Dease lakes, where immature cones were stripped from up to 15 branches per tree on about 40% of the trees.

Increased squirrel populations in the Cariboo Region near Gaspard Creek killed the tips on up to 30 branches on semimature and mature lodgepole pine in patches up to 0.5 ha. Increased damage occurred in the Vancouver Region, where successive years of feeding damage to 10-15-year-old ponderosa pine near Little Lillooet Lake (near Pemberton), resulted in multiple tops and poor form. Leader and lateral buds in the tops of 7-year-old Douglas fir were clipped in a plantation near Roberts Creek near Sechelt.

Squirrel populations declined to endemic levels at stands in the Kamloops Region where young lodgepole pine had been killed in 1992. Alternative food sources, including sunflower seeds distributed aerially by the British Columbia Forest Service, have reduced damage.

Voles - About 25% and 7% of the recently planted western red cedar seedlings at two sites north of Revelstoke in the Nelson Region were killed by meadow voles (*Microtus* sp.). Increased populations killed about 20% of the year-old Douglas-fir in a 1993 plantation near Mission in the Vancouver Region. Seedlings at one site in the western part of the Prince Rupert Region were partially damaged, but there was no mortality at previously damaged sites in the northern Kamloops Region, and the eastern Nelson Region.

CHAPTER 4

Surveys of Nurseries, Seed Orchards and Young Stands

For several years FIDS has surveyed pest conditions in nurseries and seed orchards. As reforestation programs expand there are large areas of forest established at considerable investment. As these 'new' forests make up more and more of Canada's commercial forests their importance will be reflected in the operations of FIDS. Results of these surveys are reported on a regional basis. In 1993 these operations were carried out in all regions except Newfoundland. Damage in Newfoundland nurseries is reported in Chapter 3.

Nurseries

MARITIMES

A wide variety of pest-related problems occurred in forest nurseries. The most important were overwintering injury and frost damage. Insects and diseases described occurred although monitoring and control measures were intensive. Good nursery practices limited their damage potential. Several insects and diseases damaged primarily white, red and black spruce. Insects included the crane fly (*Tipulidae*), the ragged sprucegall adelgid (*Pineus similis* [Gill.]) and the spruce harlequin (*Palthis angulalis* [Hbn.]). Diseases included gray mold (*Botrytis cinerea* Pers.), needle rust (*Chrysomyxa ledicola* Lagerh.), and sirococcus shoot blight (*Sirococcus conigenus* [DC.] Cannon & Minter).

QUEBEC

Under the *Quebec Forest Act*, the production, sale and transportation of tree seedlings for purposes other than ornamental uses have been subject to health controls since 1987. Three types of inspection have been developed to achieve the objectives of the Act: certification, prevention and independent inspections.

Certification inspections are designed primarily to prevent the spread of insects and diseases at epidemic populations, and to ensure that outplanted seedlings are

in good health. This type of inspection focuses mainly on seedling lots intended for outplanting, but also on lots shipped to other nurseries for storage or pricking out. In 1993, certification inspections were conducted from March 31 to August 24. A total of 262 million seedlings at 45 nurseries (1 156 lots) were inspected. Of that total, 27% were found to be free of insects and disease. The remaining 73% were affected by at least one pest or had suffered abiotic damage.

Insect, disease and abiotic damage detected through certification inspections resulted in losses of close to 10 million seedlings. The most significant damage was caused by frost (5.7 million seedlings), root rot (4.1 million), shoot blight (115 000), needle rust (40 000) and strawberry root canker (29 000).

The extent of the losses is underestimated because they generally include only the percentage of seedlings affected by an organism. The number of seedlings eliminated through culling is far greater than the number of seedlings affected.

Shoot blight caused by *Phoma* sp. was significant in red and Eastern white pine lots from a nursery in the Quebec-City region. More than 100 000 seedlings had symptoms of the disease and the lots had to be culled.

Scleroderris canker (*Gremmeniella abietina* [Lagerb.] Morelet) was recorded at four nurseries in the administrative regions of Saguenay-Lac-Saint-Jean, Abitibi-Témiscamingue and Gaspé-Magdalen Islands. Certificates were withheld for three jack pine lots and one red pine lot in order to allow culling of the seedlings affected. Only the lot of 1 100 red pines had to be destroyed.

Root frost was detected in 241 seedling lots at 37 nurseries. A damage assessment was conducted only on lots shipped after June 1. Before that date, the symptoms were too weak to assess the extent of the problem. As a result, several regions delayed the delivery of seedling lots to allow time for the effective culling of all affected seedlings. Significant losses were reported in the Saguenay-Lac-Saint-Jean, Mauricie-Bois-Francs, Abitibi-Témiscamingue and Laurentian regions. More than 5.5 million seedlings were affected. All species of pine and spruce suffered losses.

Root rot caused by *Cylindrocarpon destructans* (Zinss.) Scholten, *C. floridanum* Sobers & Seymour and *Fusarium* spp. was detected in bareroot stock from nine nurseries. The losses recorded in the spring of 1993 were much worse than those forecast when the inspections were conducted in the fall of 1992. Entire seedling lots had to be destroyed at three of the four nurseries where lots requiring culling had been identified in the fall. At the fourth nursery, heavy culling was carried out, resulting in significant losses. Province-wide, a total of 4.1 million spruce seedlings (2.6 million black spruce and 1.5 m.illion white and red spruce) were destroyed because of root rot.

Damage caused by the tarnished plant bug (*Lygus lineolaris* [P. de B.]) was observed in all administrative regions except the Outaouais. This insect, which was detected at 16 nurseries, causes seedling malformations in both bareroot and container stock.

Needle cast was identified at two nurseries in the Mauricie-Bois-Francs and Outaouais regions. At the first nursery, 95% of the 88 400 red pines were moderately affected by an immature needle cast. At the other, 32% of the seedlings in two red pine lots (127 000 seedlings) were severely affected by *Lophodermium* sp.

Rodent damage was reported on both bareroot and container stock at 13 nurseries. Losses were generally small and were limited to three or fewer lots at each nursery. At one nursery in the Outaouais region, leaf spot caused by an agent tentatively identified as *Septoria alnifolia* E. & E. was observed in a lot of 60 000 American green alder. The disease affected close to 20% of the seedlings in that lot.

ONTARIO

The FIDS carries out regular inspections of six provincial forest tree nurseries during the summer to detect pest problems and assist in resolving them. Several were detected at the southern Ontario nurseries in St. Williams, Orono and Kemptville. A leaf spot (*Mycosphaerella effigurata* [Schw.] House) caused 35% foliar damage to rising 2-0 green ash in one compartment, and frost caused 85% foliar damage to rising 2-0 white ash in another at the St. Williams Nursery. An unexplained mortality of 50% of 2-0 white pine was detected in one compartment of the same nursery. At the Orono Nursery, European crane fly larvae or leatherjackets (*Tipula paludosa* Meigen) caused 60% mortality in one compartment and 5% mortality in another of rising 1-0 red pine.

The European pine sawfly (*Neodiprion sertifer* [Geoff.]) caused an average of 60% defoliation on 90% of 2-m Scots pine in a Christmas tree grower's clonal seed orchard at the same nursery. The pest was controlled with a single aerial application of the insecticide carbaryl. The

larch casebearer (*Coleophora laricella* [Hbn.]) caused 95% foliar damage to windbreak European larch, and the European alder leafminer (*Fenusa dohrnii* [Tisch.]) caused 30% foliar damage to European alder *(Alnus incana* [L.] Moench) in a single compartment. Fomes root rot (*Heterobasidion annosum* [Fr.] Bref.) caused 40% dead and dying trees in a 1-ha, 50-year-old red pine plantation at the nursery. Highbush cranberry (*Virburnum trilobum* Marsh.) in one compartment sustained 75% foliar damage from attacks by the cranberry leaf beetle (*Pyrrhalta viburni* [Paykull]) and downy mildew (*Plasmopara viburni* Peck).

At the Kemptville Nursery, spruce budworm caused 75% defoliation of white spruce 15 m tall in two compartments. The larch casebearer caused 80-100% foliar damage on scattered 12-m tamarack trees and introduced pine sawfly (*Diprion similis* [Htg.]) caused 15% defoliation of 4.5-m white pine in a 0.2-ha tree improvement stand. A leaf spot disease (*Marssonina tremulae* [Lib.] Kleb.) caused 10 to 75% foliar damage on hybrid poplar stool beds. Downy mildew also caused severe foliar damage at this nursery, with 100% foliar damage and premature leaf drop on 3-0 highbush cranberry in one compartment. A number of other organisms were also reported at the three southern Ontario nurseries but caused little damage.

There were no major pest problems at the Swastika, Dryden and Thessalon nurseries in northern Ontario. Frost completely defoliated white ash in one compartment at the Thessalon Nursery, but the trees refoliated with no permanent damage. Armillaria root rot (*Armillaria ostoyae* [Romagn.] Herink) caused 6% mortality of white pine seed orchard trees at the Thessalon Nursery and a combination of winter drying and a disease (*Kabatina juniperi* Schneider & Arx) severely damaged a single bed at the Swastika Nursery. A spruce needle rust tentatively identified as (*Chrysomyxa ledi* [Alb. & Schwein.] de Bary) caused 20% foliar damage at the Swastika Nursery and yellowheaded spruce sawfly (*Pikomena alaskensis* [Roh.]) severely defoliated a few ornamental white spruce at the Dryden Nursery. Other insects and diseases occurred but caused little damage.

NORTHWEST

The FIDS staff conducted a pest survey of the Pine Ridge Forest Nursery and its associated plantations and seed orchards near Smoky Lake, Alberta. The 1993 survey was conducted on 24–25 June. Nursery stock inspected included bare-root, 2–0, and 3–0 white spruce seedlings and container-grown white spruce and lodgepole pine. Seed orchards, shelterbelt trees, and other trees in the nursery were also inspected.

In the seedling beds, the most prevalent pest found was a woolly aphid (*Mindarus obliquus* Cholodkovsky) closely related to the balsam twig aphid (*M. abietinus* Koch), which can be a serious pest of fir and spruce. In many seedling beds, groups of seedlings contained high populations of aphids which damaged the flushing shoots, causing shoot mortality.

Other pests found in and around the seedling beds included a damping-off disease, probably *Fusarium* sp., *Lygus* sp., and adult strawberry root weevils (*Otiorhynchus ovatus* [L.]). All these pests were found at very low endemic populations and were not causing serious injury to seedlings.

PACIFIC AND YUKON

More than 220 samples from forest nurseries were assessed. Losses of seedlings in forest nurseries from diseases included larch needle cast *(Meria laricis* Vuill.) on 1- and 2-year-old western larch. More than 10% of the seedlings were killed at one nursery previously considered free of the disease. Keithia leaf blight (*Keithia thujina* [Durand]) again caused significant losses in western red cedar nursery stock and outplanted seedlings. Increased late season needle blight (*Sirococcus strobilinus* Preuss) caused stem cankers and resulted in culling of lodgepole pine at three nurseries. Gray mold (*Botrytis cinerea* Pers.), seedling root rots (*Fusarium* sp., *Cylindrocarpon* sp. and *Pythium* sp.) and storage mold (*Septonema* sp.) were common on nursery stock.

Forest tree seed collected in British Columbia and Yukon Territory for international trade is certified under the Organization for Economic Cooperation and Development (OECD) agreement by the Pacific Forestry Centre in Victoria. In 1993, 2 530 kg of seed valued at more than $1.4 million was extracted from spruce, pines, firs, hemlock, cedar and alder.

Seed Orchards

Seed orchard pests include those that damage the seeds or cones, those that affect the trees and indirectly affect cone and seed production, and those that are primarily defoliators and may feed on cones.

MARITIMES

Cone production was low at most Maritime spruce and larch seed orchards although few seed and cone insects and diseases were observed. Insect pests included jack pine flower sawfly (*Xyela* sp.), spruce cone maggot (*Strobilomyia appalachensis* Michelsen), conifer swift

moth (*Korscheltellus gracilis*), red spruce adelgid (*Pineus floccus* [Patch]), spider mites (*Tetranychidae*), spruce budmoth (*Zeiraphera* sp.), and white pine sawfly (*Neodiprion pinetum* [Nort.]). Needle rust on spruce (*Chrysomyxa ledi* [Alb. & Schwein.] de Bary) was the only disease observed.

NORTHWEST

In the seed orchards, all pests observed were found at low endemic populations causing little damage. Cytospora canker (*Cytospora chrysosperma* Pers. : Fr.), Venturia leaf and shoot blight, a gall midge (*Cecidomyia* sp.), aspen leaf beetle (*Chrysomela crotchi* Brown), and a leaf-rolling sawfly were observed on aspen. Conifer–aspen rust (*Melampsora medusae* Thuemen) was found on larch, while Armillaria root rot, a woolly aphid (*Mindaris obliquus*) and a bark weevil (*Pissodes schwarzi* Hopkins) were observed on white spruce. A *Dioryctria* sp., northern pitch twig moth, and porcupine (*Erethizon dorsatum* L.) damage were noted on jack pine. Other abiotic damage symptoms noted in the nursery plantations were winter injury on jack pine and frost injury to green ash.

PACIFIC AND YUKON

Forest pests in the 15 coastal orchards surveyed were common but caused little economic damage in 1993. Integrated pest control programs have limited damage from pests to acceptable levels. Most damaging was the balsam woolly adelgid (*Adelges piceae* [Ratz.]) which severely infested and distorted growth on up to 90% of the amabilis fir at four of five true fir seed orchards. This included gouting from previous years' attacks on 30% of the trees. A western hemlock seed orchard was severely infested by hemlock woolly adelgid (*Adelges tsugae* Ann.). Two western hemlocks in a coastal orchard were infected and killed by Armillaria root disease (*Armillaria ostoyae* [Romagn.] Herink) and an additional 15 trees had rhizomorphs. This infestation has resulted in root raking to remove inoculum at a nearby seed orchard site.

The most common pest on Douglas-fir in seed orchards, the Cooley spruce gall adelgid (*Adelges cooleyi* [Gill.]) infested all trees at two orchards and about 20% of the tips on 20% of the Sitka spruce at four orchards. Douglas-fir needle midge (*Contarinia pseudotsugae* Condrashoff) lightly infested 10% of the trees at five orchards. Fir coneworm (*Dioryctria abietivorella* [Grt.]), lightly infested 2% of the cones at five orchards and mined under the bark of 7 to 10% of the trees at two orchards. About 10% of one-year-old needles on 70% of lodgepole pine at one interior orchard were infected and discolored by needle cast (*Lophodermella concolor* [Dearn] Darker).

Young Stands

MARITIMES

Pest assessment surveys at young stands assessed conditions on about 12 750 trees in 241 plantations and l4 thinned stands in 1993. Assessment procedures required detailed examination of 50 trees at each plantation or thinned stand. Ten subplots of five trees each were selected along a predetermined line. Field assessments were carried out by the staff of cooperating organizations and sample identification and data summaries were done by the FIDS. Cooperating agencies in 1993 were: the New Brunswick Department of Natural Resources and Energy, J.D. Irving, Ltd., the Nova Scotia Department of Natural Resources, and the Maritime Forest Ranger School. There were 179 plantations and 14 thinned stands assessed in New Brunswick, 60 plantations assessed in Nova Scotia and 2 plantations assessed in Prince Edward Island. Most of the plantations were single species of pine or spruce.

Most plantation trees (about 93%) in the Maritimes are healthy. Many plantation problems occurred at severe or moderate levels on pine and spruce. Trees with moderate or severe damage were found in seven of the New Brunswick thinned areas. The damage-causing agents were: animals, balsam twig aphid, forest tent caterpillar, frost, mechanical injury, sawyer beetle, shoestring root rot, and white pine weevil.

The balsam twig aphid (*Mindarus abietinus* Koch) caused widespread damage to Christmas trees in 1992, particularly in Nova Scotia. Associations of Christmas tree growers and provincial extension agencies organized field days and technical sessions. Growers were informed by FIDS of predictions, the value and importance of insect monitoring and hazard assessment, and control technology. The balsam twig aphid outbreak declined dramatically in 1993 for unknown reasons.

The balsam twig aphid population collapse also occurred in natural forests. Trace and light damage was found across New Brunswick, with shoot damage averaging 12% (60% in 1992 and 27% in 1991) at 61 areas assessed. Surveys conducted by NBDNRE showed that twig aphid occurrence has been declining, present at 63% of the 644 locations assessed in 1993, as compared to 79% in 1992 and 66% in 1991. In Nova Scotia, trace and light damage was observed on an average of 4% of shoots (55% in 1992) at 34 areas. In Prince Edward Island, an average of 2% of shoots (55% in 1992) had trace damage at five locations.

Balsam gall midge (*Paradiplosis tumifex* Gagné) was at lower levels of incidence and damage than in 1992, and was of little concern to growers in 1993. No damage occurred

in natural stands, 2-3% of needles were affected. The only major infestation at natural stands in the Maritimes was at Middle Musquodoboit, Halifax County, Nova Scotia, where 12% of needles had galls on 40% of the trees. Spruce spider mite (*Oligonychus ununguis* (Jac.]) populations were high in some areas. Provincial extension staff in New Brunswick and Nova Scotia report that damage was severe on a few trees scattered within Christmas tree lots in Victoria, Carleton, York, Kings, and Kent counties in New Brunswick and several mainland counties in Nova Scotia.

Spruce budworm caused noticeable damage to balsam fir Christmas trees in southern Queens and Kings counties, Prince Edward Island, where mature softwood stands consisting mostly of white spruce were defoliated.

QUEBEC

White Pine Weevil
Pissodes strobi (Peck)

White pine weevil infestations remained relatively unchanged from 1992 throughout Quebec. This pest was detected at nearly 30% of the spruce plantations and 15% of the pine plantations, just as in 1992. It continues to affect primarily white spruce in the Abitibi-Témiscamingue region, Norway spruce in Mauricie-Bois-Francs, Outaouais and the Eastern Townships and Eastern white pine in the Lanaudière, Laurentian and Montérégie regions.

White pine weevil damage was observed at 80% of the white spruce plantations in Abitibi-Témiscamingue, up from 72% in 1992. As in 1992, more than 8% of the outplanted white spruce trees in this region had symptoms of new and previous damage. Most trees affected are found at plantations in the 6- to 20-year and >20-year age classes, where the level of annual activity is light. Elsewhere in Quebec, an increased incidence of damage at plantations in the Trois-Rivières region and Eastern Townships was observed. There was damage at 35% of the plantations visited, up from 27% in 1992. In the Saguenay-Lac-Saint-Jean and Lanaudière regions, white pine weevil damage was observed at 23% of the plantations visited. In the Outaouais, Quebec City and Chaudière-Appalachian regions, the insect was observed at one of every six plantations. In all regions, the majority of trees affected were at plantations where the level of annual activity persisted at trace levels. The white pine weevil was also observed at 4% of the plantations visited in the Lower St. Lawrence and Gaspé-Magdalen Islands, but at trace levels only. In the North Shore region, the insect was not detected in white spruce.

The Norway spruce is highly susceptible to attack by the white pine weevil. The incidence of infestation is high, ranging from 25 to 100% depending on the region. The Mauricie-Bois-Francs, Outaouais and Eastern Townships regions have the highest percentage of trees affected by white pine weevil, ranging from 6 to 10%. There has been a significant decline in the percentage of trees affected in the Eastern Townships, while the figure has remained relatively unchanged in Mauricie-Bois-Francs and the Outaouais. Most of the affected trees are at plantations in Mauricie-Bois-Francs (annual damage light to moderate), the Eastern Townships (light to severe), Lower St. Lawrence (moderate) and other regions (light).

White pine weevils were detected at 58% of the Eastern white pine plantations visited in 1993, up from 53% in 1992. As in 1992, significant damage was observed in the Laurentian, Lanaudière and Montérégie regions, where 91% of the plantations visited showed signs of recent or previous damage. Most of the damaged trees are at plantations where annual insect activity levels range from light to severe.

Northern Pitch Twig Moth
Petrova albicapitana (Bsk.)

The northern pitch twig moth was detected at 17% of the plantations visited across the province, down from 30% in 1992. The highest incidence of damage was observed in the North Shore, Mauricie-Bois-Francs and Laurentian/Lanaudière regions, where it ranged from trace to light. In the Saguenay-Lac-Saint-Jean region, there has been a dramatic decline in northern pitch twig moth damage, observed at only 3% of the jack pine plantations visited, as compared to 57% in 1992. Elsewhere, the moth generally was observed at one of every six Quebec jack pine plantations visited, and damage was light.

Yellowheaded Spruce Sawfly
Pikonema alaskensis (Roh.)

The decline in yellowheaded spruce sawfly populations continued in 1993 at all plantations visited in the Gaspé-Magdalen Islands and Lower St. Lawrence, where 25 plantations that had been attacked last year were evaluated. Moderate damage was observed at only three of them, with average defoliation of less than 10% at the remaining 22. Ten plantations were evaluated in the Quebec City region: four were moderately defoliated (average attack rate of over 80%) as in 1992, while the rest suffered light defoliation (average rate of 23%).

In the Mauricie-Bois-Francs region, moderate defoliation was observed at one white spruce plantation near Cap-de-la-Madeleine for the second consecutive year, with 74% of the trees affected. Elsewhere in the province, populations of this sawfly remained at endemic levels.

Scleroderris Canker
Gremmeniella abietina (Lagerb.) Morelet

This canker was observed at 24% of Quebec plantations in 1993, as compared to 21% in 1992. Nearly 3.8% of the pines outplanted showed signs of the disease. The percentages of infected trees were highest in the Gaspé-Magdalen Islands/Lower St. Lawrence and Mauricie-Bois-Francs regions at 15% and 9% respectively in 1993, as compared to 19% and 3% in 1992.

As in 1992, the disease was present at 25% of the jack pine plantations and affected 4.2% of the trees. There was a significant decline in the percentage of trees affected by scleroderris canker in the Gaspé-Magdalen Islands/Lower St. Lawrence region, and the Quebec City and Chaudière-Appalachian regions. Diseased trees are located primarily at plantations in the 6- to 20-year age class, where the infestation ranged from trace to light. In the Mauricie-Bois-Francs and the Outaouais regions, the infestation increased slightly; affected trees were found generally at plantations where the infestation was moderate. In the Outaouais region, the disease occurred at trace levels.

As in 1992, scleroderris canker was present at 20% of the red pine plantations in Quebec, and 1.2% of the trees were affected. The most severely infested regions were the QuebecCity/Chaudière-Appalachian and the Lower St.Lawrence, where more than 5% of the trees were attacked. In Mauricie-Bois-Francs, a significant decline in the percentage of infected trees was observed.

The extensive scleroderris canker detection program initiated in 1983 was completed this year with the intensive inventory of Décarie Wells and Bigelow townships in the Laurentian region, and Papineau township in the Outaouais. The results showed 53% of the 43 plantations visited to be affected. Of that number, 43% were infected by the European race and 22% by the American race. In all other cases, it was impossible to identify the race of the disease.

ONTARIO

Yellowheaded Spruce Sawfly
Pikonema alaskensis (Roh.)

The yellowheaded spruce sawfly is a damaging pest of young white and black spruce at plantations, and ornamentals and fringe trees along roadsides, lakeshores and other exposed sites.

In northern Ontario, numbers increased in Thunder Bay, Nipigon and Fort Frances districts, while populations declined in Hearst, Cochrane and Kirkland Lake districts. Roadside white and black spruce were heavily attacked along the Highway 17 corridor between Nipigon and Thunder Bay, with defoliation varying from 40 to 100%. Roadside trees were heavily damaged along Highways 17 and 11 between Kakabeka Falls and Kashabowie. Ornamental white spruce and blue spruce sustained defoliation ranging from 30 to 100% in the city of Thunder Bay and the towns of Atikokan, Fort Frances and Ear Falls. Black spruce were heavily infested along the Vermilion River road, Sioux Lookout District, and in small windbreaks between Thunder Lake and Dryden, Dryden District.

The most severe damage in southern Ontario was in Bastard Township, Kemptville District, where white spruce 1.9 m tall in a 2-ha plantation had 65% defoliation on 18% of the trees. Open-grown roadside white spruce was defoliated (20-40%) at several locations in Parry Sound and Bancroft districts, and the same level of damage occurred on ornamental white spruce in the town of Bancroft and at Carson Lake Provincial Park, Bancroft District.

White Pine Weevil
Pissodes strobi Peck

Populations declined in northern Ontario, and while infestations were numerous, usually less than 10% of leaders were damaged. In Smilsky, Cuthbertson and McNie townships, Sault Ste. Marie District, 16.0%, 14.7% and 13% of leaders respectively were damaged at young jack pine stands in the 2 to 4 m height range. At Kenozhe Lake, Fort Frances District, 12% of jack pine 1.3 m tall were attacked, but at Sunny Lake in the same district, the incidence of leader damage declined from 21% in 1992 to 6.7% in 1993. The weevil destroyed 16% of the leaders at a 1.5-ha white pine plantation 2.3 m tall in Olrig Township, North Bay District.

Populations were higher at a number of locations in southern Ontario. The most severe damage (60%) occurred at a 3-ha white pine plantation 4.6 m tall in Charlotteville Township, Aylmer District. Leader damage ranged from 22 to 33.3% at white pine plantations in Parry Sound, Cambridge, and Kemptville districts. Norway spruce at a small plantation in Lanark Township, Kemptville District, sustained 16.7% damage; while in Hungerford Township, Tweed District, 18.7% of the trees were attacked, up from 0.7% in 1992.

Redheaded Pine Sawfly
Neodiprion lecontei (Fitch)

The heaviest damage was in North Bay District where several plantations were severely defoliated. In Cameron Township, a small, 1.7-m red pine plantation was 50% defoliated, with some trees completely stripped. Populations declined elsewhere, particularly in Sudbury District where control programs planned by the E.B. Eddy Paper Company and the Ontario Ministry of Natural Resources were cancelled as a result of unexpected declines in sawfly populations.

Armillaria Root Rot
Armillaria ostoyae (Romagn.) Herink

This disease is common at young coniferous plantations and regeneration stands in Ontario. In most cases involving young stands, infection levels and mortality are below 3%, although occasionally higher damage levels occur. In 1993, a mortality rate of 7.3% was recorded at the Bluebird Lake jack pine family test site in Thunder Bay District and 6% mortality occurred at a 1-ha jack pine seed orchard in Kirkwood Township, Sault Ste. Marie District. In the Midhurst District the organism caused pockets of 50 or more dead and dying trees at separate 35- and 45-year-old red pine plantations in Oro Township. Smaller pockets of dead and dying trees were discovered in red pine plantations at Canadian Forces Base Borden, Midhurst District, and Uxbridge and Clarke townships, Maple District.

White Pine Blister Rust
Cronartium ribicola J.C. Fischer

This disease is a serious and damaging problem in the establishment of white pine plantations and on young natural regeneration sites in Ontario. The most severe damage reported in 1993 was at a 3-ha plantation of white pine 2.4 m tall in Monteagle Township, Bancroft District, where 40% of the trees had stem attacks and 8% recent mortality had occurred, partly because of rodent feeding on the resinous cankers. Low infection levels were reported on young white pine at a number of locations in Parry Sound, Timmins, Pembroke, Temagami, Sault Ste. Marie, Wawa and Midhurst districts.

NORTHWEST

Young coniferous stands were surveyed for insects, diseases, and other damaging agents in Alberta (the Bow-Crow and Grande Prairie forests), Saskatchewan (the Meadow Lake and Prince Albert regions) and Manitoba (the Saskatchewan River Section).

Young coniferous stands were generally healthy. Within the surveyed stands in Alberta, Saskatchewan, and Manitoba, 95.8, 98.6 and 97.3% of the trees respectively were healthy; 1.7, 0.8 and 1.9% of the trees were declining; and 2.5, 0.6 and 0.8% of the trees were dead. The 1993 values for healthy, declining, and dead trees were comparable to the values reported for stands surveyed in 1992.

In Alberta's Bow-Crow Forest, animal browse was evident on 12% of the lodgepole pine and 7% of the alpine fir trees surveyed. No other pest or pest symptom caused significant levels of damage.

In the Grande Prairie Forest, Alberta, the most prevalent damaging agents on lodgepole pine were (percentages of damaged trees in parentheses): a pine needle rust, *Coleosporium asterum* [Dietel] Syd. & P. Syd. (20.8%); western gall rust, *Endocronartium harknessii* [J.P. Moore] Y. Hirat. (11.3%); and lodgepole terminal weevil, *Pissodes terminalis* Hopping (1.9%). Animal browse occurred on 3.3% of the white spruce trees and 7.1% of the alpine fir trees surveyed. Ragged spruce gall adelgid, *Pineus similis* (Gill.), was found on 13.3% of the white spruce trees surveyed.

In Saskatchewan's Prince Albert Region, the jack pine trees surveyed were affected by lodgepole terminal weevil (18.6%), animal browse (13.9%), northern pitch twig moth, *Petrova albicapitana* [Bsk.] (0.4%) and Armillaria root rot, *Armillaria* sp. (0.4%). Spruce gall adelgid, *Adelges lariciatus* (Patch), was found on 4.5% of the white spruce trees surveyed.

In the province's Meadow Lake Region, 17.6% of the jack pine trees surveyed were attacked by lodgepole terminal weevil. The surveyed white spruce trees were affected by spruce gall midge, *Mayetiola piceae* [Felt] (5.3%), white pine weevil (5.3%), and Armillaria root rot (2.9%).

In the Saskatchewan River Section, damage from animal browsing was evident on 6.1% of the black spruce trees surveyed. Venturia leaf and shoot blight, *Venturia macularis* (Fr.:Fr.) E. Mueller & Arx, was found on 2.5% of the trembling aspen.

Two years of survey data indicate that stands are generally healthy. Some stands have pests causing losses and mortality: the most common ones include browsing animals, root collar weevils, terminal weevils, Armillaria root rot, western gall rust, and needle casts and rusts. Poor planting methods resulting in J-root deformation are a common problem influencing the health of young conifers.

PACIFIC AND YUKON

Approximately 30 000 trees were surveyed at 242 young natural and planted stands. The survey continued to focus on major pests and environmentally related problems in young stands, particularly those established or treated under the Canada-British Columbia Forest Resource Development Agreement. Pines were the major component at 43% of the stands, with spruce at 23%, Douglas-fir at 18% and hemlock at 10%. True firs, cedar, larch, trembling aspen and poplar comprised the remainder. About 44% of the stands were healthy or contained pests which were relatively minor. Of the remainder, 13% contained pests which caused losses to current growth potential, and 43% contained pests which caused significant damage.

Locally significant and damaging pests included root diseases, spruce and pine terminal weevils, pine root collar weevil, and stem rust cankers on pine. Less significant but widespread problems included climatic injury, mammal feeding, and infection of new and older needles by native diseases and adelgids on new spruce shoots.

Mortality of young conifers caused by diseases, mainly Armillaria root disease (*Armillaria ostoyae* [Romagn.] Herink) and to a lesser extent Phellinus root rot (*Phellinus weirii* [Murr.] Gilb.) and Inonotus root disease (*Inonotus tomentosus* [Fr.:Fr.] S. Teng) were recorded at 25% of the stands. Armillaria root disease infected and killed an average of 4% of the conifers at 7% of the 44 stands examined. The highest incidence was in the Nelson Region near Revelstoke, where 22% of the 40-year-old pruned Douglas-fir were infected. Mortality of new spruce terminals caused by terminal weevil (*Pissodes strobi* [Peck]) averaged 13% at 18% of the 55 spruce plantations surveyed, mostly in the Prince George Region. Half the 8-year-old planted spruce were infested at one site near Kitimat in the Prince Rupert Region, and 43% and 36% respectively at two sites east of Prince George.

New attacks by pine terminal weevil averaged 2% at 20% of the 103 immature lodgepole pine plantations surveyed in five regions, a rate similar to that of previous years. Warren's root collar weevil (*Hylobius warreni* Wood) infested and killed an average of 3% of the immature lodgepole pine at 9% of 103 pine plantations. All infested sites were in the eastern Nelson Region.

Although common at pine plantations, stem and branch diseases had generally little immediate impact on stocking levels. The blister rusts (*Cronartium* spp.) infected an average of 4% of the immature lodgepole pine at 6% of the pine sites. Infections were primarily on stems; however, tree mortality, frequently the result of perennial stem cankers, was less than 1%.

Western white pine were infected by white pine blister rust (*Cronartium ribicola* J.C. Fischer) at 10% of the sites, mostly in the western part of the Nelson Region. Branch and stem infections by western gall rust (*Endocronartium harknessii* [J.P. Moore] Y. Hirat.) were common on 4% of the trees at 29% of the lodgepole pine stands in five forest regions. There was little impact on stocking levels. Atropellis stem cankers (*Atropellis* spp.) infected 1-28% of lodgepole pine at 6% of the stands, mostly in the Prince Rupert Region.

On average, 4% of the trees at 6 of 134 pine, hemlock and larch plantations were infected by dwarf mistletoes (*Arceuthobium* spp.) an incidence similar to that recorded in previous years' surveys. Most common were *A. tsugense* (Rosendahl) G.N. Jones on western hemlock, *A. americanum* Nutt. ex Engelm. on lodgepole pine and *A. laricis* (Piper) St. John on western hemlock. Postharvest removal of mistletoe-infected trees in recent years has reduced the threat of infection in the next generation of forests significantly; however proposed management practices could increase the incidence of this disease.

The most common pest of Douglas-fir was the Cooley spruce gall adelgid (*Adelges cooleyi* [Gill.]). Tree growth, vigor and tree form are not usually affected seriously.

Trees damaged by hail, snow, ice and frost were examined at about 34% of the stands. Hail severely damaged 39% of the conifers at a 5-year-old plantation in the Prince Rupert Region; and 18% of the pine at a pruned site near Prince George were seriously damaged by snow press.

Browsing and related damage caused by mammals on stems and branches of a variety of conifers occurred at 37% of the 242 stands surveyed in six regions. Damage was caused by deer, elk, moose, bear, beaver, cattle, porcupine, squirrels, voles, hares and birds. Deer browsed 57% of the 11-year-old trees at a Texada Island plantation and moose damaged 30% of the stems of 18-year-old trees at a plantation east of Prince George. Overall stocking levels were not affected.

Foliar diseases infected and discolored new and older needles on conifers at about half the young stands surveyed in six forest regions. Most moderate and severe infections resulted in premature needle loss which may affect vigor but not form. The most common disease on pines was a needle cast (*Lophodermella concolor* [Dearn.] Darker) which infected half of the trees at 22% of the pine stands. Most damage was conspicuous enough to be mapped during aerial surveys: over 116 000 ha was mapped in the western part of the Cariboo Region. Fir-fireweed rust (*Pucciniastrum epilobii* Otth.) discolored new foliage on up to 100% of the true firs at 13% of plantations, mostly in the Prince George and Prince Rupert regions.

As part of a cooperative international survey, lodgepole pine, Scots pine, Siberian larch and Norway spruce seedlings planted in 1986 were examined to assess pest losses at four sites in the Prince George Region and at one site in the Yukon Territory. Pine stem and branch rusts were the most damaging pests recorded. About 10% of the pines at all four plots in the Prince George Region were infected by western gall rust (*Endocronartium harknessii* [J.P. Moore] Y. Hirat.) which was also recorded for the first time in the Yukon Territory.

Stem cankers of comandra blister rust (*Cronartium comandrae* Peck) were found for the first time infecting lodgepole pine at Takhini. Stalactiform blister rust (*C. coleosporioides* Arthur) infected 18% of the pine near

Mackenzie, up 10% from 1992. About 60% of the year-old needles on half the lodgepole pine at the Halfway River plot near Fort Nelson were infected and discolored by a needle cast (*Lophodermella* sp.).

Climatic damage caused by frost, snow, ice, and cold winds was less extensive than previously, but still caused some multiple tops and bushy form on Siberian larch (*Larix sibirica* [Ledeb.]), lodgepole pine and Norway spruce. Damage was most severe at Nation Bay in the Prince George Region, where 52% of the larch and 23% of the pine have poor form. Elsewhere, an average of 10% (range 5-15%) of the lodgepole pine was affected at two sites, as was 5% of the Siberian larch at two sites and 10% of the Norway spruce near Fort Nelson. About 10% of the larch is barely surviving at the plot near Whitehorse, following frost damage and feeding by snowshoe hares in 1990-91, and about 9% of the Scots pine near Fort St. James has severe basal sweep caused by snow.

Black Army Cutworm
Actebia fennica (Tausch.)

Outbreaks of black army cutworm have occurred in interior parts of the Pacific and Yukon Region periodically since 1943. Defoliation most frequently occurs at sites burned in the 12 months prior to planting. Cutworm populations at recently burned and planted sites in interior British Columbia have generally remained at low levels, after a significant decline in 1989. This year, small numbers of recently planted lodgepole pine seedlings and herbaceous ground cover were lightly defoliated over 100 ha south of Tumbler Ridge in the Prince George Region. This was the first record of damage to conifer seedlings in the region, east of the Rockies.

Lodgepole pine and spruce seedlings were lightly defoliated and ground cover severely defoliated at four recently burned and planted sites in the Prince George Region. Small patches of ground cover were very lightly defoliated at a recently burned but unplanted site north of Golden in the Nelson Region. Cutworm populations could be a threat to seedlings at 1994 plantings in areas slash-burned during 1992-93 where the number of adult males captured in pheromone-baited sticky traps exceeds 600 males per site.

Rhizina Root Disease
Rhizina undulata Fr.

Mass fruitings of Rhizina root disease in forest situations may follow wildfires or prescribed burns. The fungus normally survives for only a few years and most seedling mortality occurs within the first year of infection.

Some seedling mortality associated with new fruiting bodies of Rhizina root disease occurred at only 11 previously burned areas in two of five regions surveyed in 1993. This finding was similar to last year's and contributes to the sixth consecutive year of seedling mortality caused by the disease. Declines were due mostly to planned delays of planting where fruiting bodies had been present the previous year.

Seedling mortality was highest in the eastern part of the Cariboo Region, where 40% of the lodgepole pine and 10% of the spruce seedlings were killed in small patches at two recently burned and planted sites. Seedling mortality averaged 10% at nine sites in the western part of the Nelson Region, where an additional 5% of the seedlings infected last year were dead or dying this year. The overall infection of seedlings at new plantings is expected to drop in 1994 because of reductions in slash burns and planned delays of new plantings where fruiting bodies are present.

Poplar Leaf Rust
Melampsora medusae Thuemen f. sp. *deltoideae*

Surveys to detect a new strain of poplar leaf rust were initiated this year. It was first detected in North America in 1991 on infected and defoliated hybrid poplars (*Populus trichocarpa - deltoides*) at plantations in the lower Columbia River Valley in Washington and Oregon. The rust spread rapidly and was detected close to the Canadian border in the fall of 1992. The rust was first confirmed in British Columbia on hybrid poplar in the Fraser Valley and on Vancouver Island in October 1993. Damage was light because the initial infections had occurred late in the growing season. More severe defoliation and mortality of susceptible clones is likely to occur in the next 2-3 years.

Susceptible clones will have to be replaced with the more tolerant hybrids such as *P. trichocarpa - maximowiczii*. Where the rust has been established for several years at plantations in the United States, mortality has been reported in some of the more susceptible clones. Eurasian poplar rust (*Melampsora larici-populina* Klebahn) has been discovered in Washington State, but it is not yet known in Canada.

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APPENDIX

Other Insects, Diseases and Damage

Newfoundland and Labrador

Insect, disease or damage	Host(s)	Location	Remarks
A gall sawfly on willow *Pontania* spp.	Willow, trembling aspen	Eastern Labrador	Light damage. Common on willows at Otter Creek.
Alder leaf beetle *Chrysomela m. mainensis* Bechst.	Speckled alder	Central Newfoundland	Low numbers. Trace of defoliation.
Animal damage	Red pine, black spruce balsam fir, jack pine	Western Newfoundland, eastern and western Labrador	Light squirrel damage (5-10%) recorded at red pine stands near Howley. Porcupine damage was also observed on black spruce and balsam fir in eastern Labrador and on jack pine in western Labrador.
Anthracnoses *Kabatiella apocrypta* (E. & E.) Arx	Red maple	Western Newfoundland	Low incidence on red maple at Corner Brook and Pasadena nursery.
Marssonina betulae (Lib.) Magn.	White birch	Central Newfoundland	*M. betulae*, a new record, caused light damage to white birch in central Newfoundland.
Apple scab *Venturia inaequalis* (Cooke) Wint.	Crab apple	Avalon Peninsula	Low incidence on ornamentals at St. John's.
A sawfly *Nematus limbatus* Cress.	Willow	Western and eastern Newfoundland	Defoliation ranged from 50 to 100% in western Newfoundland.
Balsam gall midge *Paradiplosis tumifex* Gagné	Balsam fir	Central and western Newfoundland	High populations, damage in thinned stands.
Balsam twig aphid *Mindarus abietinus* Koch	Balsam fir	Western Newfoundland	Common throughout the Lomond Gros Morne National Park (GMNP) area.
Birch casebearer *Coleophora serratella* (L.)	White birch	Avalon Peninsula, central Newfoundland	Low populations, light defoliation.
Birch leafminer *Fenusa pusilla* (Lep.)	White birch	Labrador, eastern Newfoundland	Damaged ornamentals.
Black army cutworm *Actebia fennica* (Tausch.)	Black spruce, miscellaneous hardwoods	Western Newfoundland	Little damage.
Blackcheeked aspen caterpillar *Ipimorpha pleonectusa* Grt.	Trembling aspen	Central Newfoundland	Low numbers. 20% defoliation.
Broom rust *Melampsorella caryophyllacearum* Schroet.	Balsam fir	Eastern Newfoundland	High incidence.
Dotted line looper *Protoboarmia porcellaria indicataria* (Wlk.)	Balsam fir	Central Newfoundland	Low population.

Insect, disease or damage	Host(s)	Location	Remarks
Early aspen leafcurler *Pseudexentera oregonana* (Wlsm.)	Trembling aspen Central and eastern	Newfoundland	Light damage. Common throughout central Newfoundland.
Eastern dwarf mistletoe *Arceuthobium pusillum* Peck	Black spruce	Eastern Newfoundland	High incidence near Gambo.
European alder leafminer *Fenusa dohrnii* (Tisch.)	Speckled alder	Central Newfoundland	Populations low. Light defoliation.
European poplar canker *Dothichiza populea* Sacc. & Briard	Lombardy poplar	Avalon Peninsula	High incidence.
European spruce sawfly *Gilpinia hercyniae* (Htg.)	White spruce, black spruce	Western Newfoundland, eastern Labrador	Low numbers.
Foureyed spruce bark beetle *Polygraphus rufipennis* (Kby.)	Black spruce	Eastern Labrador	Found on scattered dead host trees near Muskrat Falls.
Gray mold blight *Botrytis cinerea* Pers.	White oak, red currant, gooseberry	Mount Pearl Greenhouse, Pasadena Nursery	Light to moderate damage.
Green balsam looper *Cladara limitaria* (Wlk.)	Balsam fir	Throughout Newfoundland	Low populations. No significant damage.
Greenheaded spruce sawfly *Pikonema dimmockii* (Cress.)	White spruce	Western and central Newfoundland	Low populations.
Ink spot *Ciborinia whetzelii* (Seaver) Seaver	Trembling aspen	Eastern Labrador	Light damage.
Larch needle rust *Melampsora medusae* Thuemen	Larch (tamarack)	Western Labrador, central Newfoundland	Damage concentrated along major roads.
Leaf and shoot blight of poplars *Venturia macularis* (Fr.: Fr.) E. Mueller & Arx	Trembling aspen	Central and western Nefoundland, Eastern Labrador	Light to moderate damage.
Leaf blister *Taphrina carnea* Johanson	Yellow birch	Burin Peninsula	Common throughout the area with up to 40% of the foliage affected.
Leaf rusts *Melampsora abieti-capraearum* Tub.	Willow	Central Newfoundland	Severe incidence between South Brook (Halls Bay) and Badger.
M. abietis-canadensis Ludwig ex Arth.	Trembling aspen	Central Newfoundland	Light damage in Wooddale tree nursery.

Insect, disease or damage	Host(s)	Location	Remarks
Leaf spot *Marssonina brunnea* (E. & E.) Magn.	Trembling aspen	Central Newfoundland	Low incidence.
Phyllosticta minima (B. & C.) Underw. & Earle	Red maple	Western and eastern Newfoundland	Common near Pipers Hole Provincial Park.
Mountain ash sawfly *Pristiphora geniculata* (Htg.)	American mountain-ash	Central Newfoundland	Low to high numbers. Trace to light defoliation.
Nectria canker *Nectria galligena* Bres.	Horse chestnut, maple, pin cherry	Avalon Peninsula	Low to high numbers. Trace to light defoliation.
Nectria dieback *Nectria cinnabarina* (Tode: Fr.) Fr.	Golden chain, maple, horse chestnut	Western Newfoundland, Avalon Peninsula	Low incidences.
Needle cast *Hypodermella laricis* Tub. *Isthmiella faullii* (Darker) Darker	Tamarack larch, balsam fir	Bonavista Peninsula, eastern Newfoundland, eastern Labrador	Low to moderate incidence in eastern Labrador. 5% of balsam fir regeneration stand affected near Alexander Bay.
Needle rust of spruce *Chrysomyxa ledicola* Lagerh.	Black spruce, white spruce, blue spruce (*P. pungens*)	Avalon Peninsula, Bonavista Peninsula	Incidence at high levels.
Northern conifer tussock moth *Dasychira plagiata* (Wlk.)	Balsam fir	Western Newfoundland	Populations low.
Pine aphid *Cinara* sp.	White pine, Scots pine	Western Newfoundland	High populations. Light to moderate damage.
Pine false webworm *Acantholyda erythrocephala* (L.)	Scots pine, red pine	Avalon Peninsula	Trace of damage observed on ornamentals at St. John's.
Pine looper *Hypagyrtis piniata* (Pack.)	Balsam fir	Western Newfoundland	Low populations.
Spruce gall adelgid *Adelges lariciatus* (Patch)	White spruce	Avalon Peninsula	Low populations on ornamentals at Tilton, Conception Bay.
Redlined conifer caterpillar *Feralia jocosa* (Gn.)	Balsam fir, white spruce	Western Newfoundland	Low populations.
Redstriped needleworm *Griselda radicana* Heinr.	White spruce	Western Newfoundland	Low numbers.
Rusty tussock moth *Orgyia antiqua nova* Fitch	Balsam fir	Western and central Newfoundland	Low numbers.
Saddleback looper *Ectropis crepuscularia* (D. & S.)	Balsam fir	Western Newfoundland	Low populations.

Insect, disease or damage	Host(s)	Location	Remarks
Satin moth *Leucoma salicis* (L.)	Willow, balsam poplar	Western Newfoundland, Avalon Peninsula	Severe defoliation at Corner Brook in western Newfoundland. Light to moderate damage at two locations on the Avalon Peninsula.
Shoot blight of jack pine *Hormonema* spp.	Jack pine	Eastern Labrador	Damage on exotic species, plantations.
Shot hole *Coccomyces hiemalis* Higgins	Pin cherry	Western and central Newfoundland, Avalon Peninsula	Moderate to high incidences throughout all areas.
Snow blight *Phacidium infestans* Karst.	Balsam fir, black spruce	Eastern Labrador	Light damage.
Spruce climbing cutworm *Syngrapha alias* (Ottol.)	Balsam fir	Western Newfoundland	Low numbers.
Spruce coneworm *Dioryctria reniculelloides* Mut. & Mun.	White spruce	Western Newfoundland	Low numbers.
Striped alder sawfly *Hemichroa crocea* (Geoff.)	Speckled alder	Western Newfoundland and western Labrador	Low populations. Severe defoliation recorded along Fig River near Winokapau Lake.
Uglynest caterpillar *Archips cerasivorana* (Fitch)	Chokecherry, white birch, speckled alder	Western Newfoundland	Common on south shore of Deer Lake.
Warren's root collar weevil *Hylobius warreni* Wood	Scots pine, jack pine	Labrador, western Newfoundland	Damage on exotic pines in plantations.
Whitespotted sawyer *Monochamus scutellatus* (Say)	Balsam fir, black spruce	Western Newfoundland, eastern Labrador	Low numbers.
Willow blights *Fusicladium saliciperdum* (Allesh. & Tub.) Tub. *Glomerella miyabeana* (Fukushi) Arx & Mueller	Golden willow, laurel willow	Eastern Newfoundland	High incidences.
Willow-and-poplar beetle *Chrysomela falsa* Brown	Willow	Central Newfoundland	Moderate populations. Light defoliation.
Willow leafminer *Micrurapteryx salicifoliella* (Cham.)	Willow	Eastern Labrador	Severe defoliation on willows at Otter Creek.
Witches' broom *Taphrina cerasi* (Fuckel) Sadeb.	Pin cherry	Eastern Labrador	Moderate incidence in Happy Valley-Goose Bay area.

Maritimes

Insect, disease or damage	Host(s)	Location / Remarks
Alder flea beetle *Altica ambiens* LeC.	Alder	Overall, intensity similar to 1992 levels in the region. Various levels of leaf browning, mostly in southern New Brunswick, throughout Nova Scotia and in eastern Prince Edward Island.
Ambermarked birch leafminer *Profenusa thomsoni* (Konow)	Beech, white birch, wire birch, yellow birch	Found at various levels in New Brunswick. Highest, severe, at Kellys Beach, Kent Co. Trace damage at six locations in Nova Scotia and two in Prince Edward Island.
Anthracnose of hardwoods *Discula quercina* (Westend) Arx	Basswood, white ash	In Nova Scotia, leaf browning on ornamentals at two locations. No observations from New Brunswick or Prince Edward Island.
Anthracnose of maple *Kabatiella apocrypta* (E. & E.) Arx	Red maple, sugar maple	No observations in 1993.
Apple-and-thorn skeletonizer *Choreutis pariana* (Cl.)	Apple	Damage of varying intensity at ten locations, mainly in eastern Nova Scotia. No observations from New Brunswick or Prince Edward Island.
Ash rust *Puccinia sparganioides* Ell.& Barth.	White ash	No observations in 1993.
Aspen webworm *Tetralopha aplastella* (Hulst)	Trembling aspen	No observations in 1993.
Bagworm *Thyridopteryx ephemeraeformis* (Haw.)	Balsam fir, red spruce	In Nova Scotia, a few larvae found at four locations with no associated damage. No observations from New Brunswick or Prince Edward Island.
Balsam bark weevil *Pissodes dubius* Rand.	Balsam fir, red spruce	Found at five locations in three counties in New Brunswick. Highest, 20% of balsam fir infested at Vandine Brook, Northumberland Co. No observations from Nova Scotia or Prince Edward Island.
Balsam fir bark beetle *Pityokteines sparsus* (LeC.)	Balsam fir	Trace damage at one New Brunswick location. No observations from Nova Scotia or Prince Edward Island.
Balsam fir sawfly *Neodiprion abietis* (Harr.)	Balsam fir, black spruce, red spruce, white spruce	Population levels low in northern New Brunswick. Low at 13 locations throughout Nova Scotia and trace defoliation at two sites in Prince Edward Island.
Balsam fir tip blight *Delphinella balsameae* (Waterman) Mueller	Balsam fir	No observations in 1993.
Balsam woolly adelgid *Adelges piceae* (Ratz.)	Balsam fir	In New Brunswick, incidence and infestation levels similar to 1992. Highest (76%) stems attacked at Rocks, Grand Manan, and 65% twig damage on 80% of trees at Otter Cove, Charlotte Co. An average of light twig damage at 16 locations in Nova Scotia; highest, moderate twig damage at Round Bay, Shelburne Co., and west of Big Tracadie, Antigonish Co. Present at low levels in Prince Edward Island.

Insect, disease or damage	Host(s)	Location / Remarks
Beech bark disease *Nectria coccinea* var. *faginata* Lohm., Wats. & Ayers Beech scale *Cryptococcus fagisuga* Lind.	Beech	Cankered trees common throughout the region. Infection ranged from 12 to 100% of trees in numerous stands examined.
Birch casebearer *Coleophora serratella* (L.)	Alder, beech, white birch, wire birch, yellow birch	In New Brunswick, found at more than 100 locations at 1992 levels of mainly trace or light. Severe damage at Palfrey Brook, York Co., and Serpentine Lake, Northumberland Co. Damage in Nova Scotia at 1992 levels of mainly trace or light at 66 locations, highest (35%) of white birch leaves at Grand Etang, Inverness Co. In Prince Edward Island, damage down from 1992, at mainly trace levels, averaging 26% of white birch leaves. Highest, moderate on all white birch trees at Stanhope, Queens Co.
Birch leafminer *Fenusa pusilla* (Lep.)	White birch, wire birch yellow birch	Infestation increased from 1992 with patches of trace to severe throughout New Brunswick. Most common in central Kings and western Albert counties with moderate and severe damage. In Nova Scotia found at 20 locations, mainly in western part of province, at trace or light levels. Levels down in Prince Edward Island. Only trace or light damage in Prince Co.
Birch leaf spot *Septoria betulina* Pass.	White birch	Varying intensity levels mainly in central and eastern Nova Scotia; highest, several kilometers of roadside trees with light, moderate, or severe browning, in Pictou, Guysborough and Inverness counties. Trace or light spotting at scattered locations in New Brunswick and Prince Edward Island.
Birch sawfly *Arge pectoralis* (Leach)	Alder, white birch, wire birch	Defoliation levels in New Brunswick down from 1992, with patchy light or moderate damage at a few locations, mainly in Restigouche Co. In Nova Scotia, trace or light damage at six locations. Single report on a few trees in Prince Edward Island.
Birch skeletonizer *Bucculatrix canadensisella* Cham.	White birch, yellow birch	More widespread in New Brunswick than in 1992; most common and severe in Charlotte and Kent counties. Levels down for second consecutive year in Nova Scotia, only trace damage at a few sites. In Prince Edward Island, skeletonizing increased to light and moderate with severe patches throughout; highest at Rustico Island, Queens Co.
Bruce spanworm *Operophtera bruceata* (Hulst)	Apple, sugar maple, trembling aspen, white birch	In New Brunswick, mostly low numbers; highest (moderate) damage on white birch at Rivière à la Truite, Madawaska Co. Trace damage at one location in Nova Scotia. No observations from Prince Edward Island.
Canker of larch *Potebniamyces coniferarum* (Hahn) Smerlis	Tamarack	Trace damage at each of two locations in New Brunswick and Prince Edward Island. No observations from Nova Scotia.
Canker of spruce *Botryosphaeria piceae* Funk	White spruce	No observations in 1993.

Insect, disease or damage	Host(s)	Location / Remarks
Cedar leafminers: *Argyresthia aureoargentella* Brower *A. freyella* (Wlsm.) *A. thuiella* (Pack.) *Coleotechnites thujaella* (Kft.)	Cedar	In New Brunswick, incidence remained at 1992 levels. Intensity decreased from trace to severe foliage damage to trace and light with a few moderate patches. Two reports from Nova Scotia; highest, moderate on ornamentals at Cherryfield, Lunenburg Co. No observations from Prince Edward Island.
Cherry casebearer *Coleophora pruniella* Clem.	Trembling aspen	Trace damage at four locations in eastern Nova Scotia. In Prince Edward Island, damage decreased for the second year; mainly trace, with a few small moderate patches in Queens Co. No observations from New Brunswick.
Deterioration of cedar	Cedar	In Saint John County, N. B., condition of trees improved, with current shoot mortality down significantly from 1992 levels. The initial cause of the deterioration remains uncertain. No observations from Nova Scotia or Prince Edward Island.
Diplodia tip blight *Sphaeropsis sapinea* (Fr.) Dyko & Sutton	Austrian pine, red pine, Scots pine	Moderate damage on several Scots pine, Argyle Head, Yarmouth County, and on one tree at Kingsburg, Lunenburg Co., N.S. Severe on Austrian pine, Southport, Queens Co., P.E.I. No observations from New Brunswick.
Eastern blackheaded budworm *Acleris variana* (Fern.)	Balsam fir, red spruce, white spruce	More common than in 1992, trace to moderate damage, especially in northern New Brunswick. Trace damage at five locations in each of Nova Scotia and Prince Edward Island.
Eastern dwarf mistletoe *Arceuthobium pusillum* Peck	Spruce	Found at many locations across Nova Scotia. Highest incidence in northern Antigonish and western Inverness counties, where numerous brooms with associated mortality were common. Trace damage at one location in Prince Edward Island. No observations from New Brunswick.
Eastern spruce gall adelgid *Adelges abietis* (L.)	Black spruce, red spruce, white spruce	Present throughout the region, with damage to both 1992 and 1993 shoots generally trace and light. Highest (12% of 1993 shoots) at Rivière-du-Portage, Northumberland Co., N. B., Southwest Margaree (25% of 1992 shoots) Inverness Co., N.S. and Rustico Island (11% of 1992 shoots) Queens Co., P.E.I. See Chapter 4 for surveys of nurseries, seed orchards and young stands.
Eastern tent caterpillar *Malacosoma americanum* (F.)	Alder, apple, cherry	Found throughout New Brunswick except in Gloucester and Madawaska counties. Population levels significantly higher than in 1992, very common in the south-central part of the province. In Nova Scotia, levels similar to 1992, with nests common throughout most of the province. Scattered nests throughout Prince Edward Island.
Elm leaf beetle *Pyrrhalta luteola* (Müll.)	Elm	Outbreak persists. Damage similar to 1992, with moderate and severe foliage browning widespread throughout the city of Fredericton, York Co., N.B. No observations from Nova Scotia or Prince Edward Island.
Elm leafminer *Fenusa ulmi* Sund.	Elm	Damage similar to 1992: light and moderate leaf browning with some severe patches on exotic elms throughout Nova Scotia and Prince Edward Island. No observations from New Brunswick.

Insect, disease or damage	Host(s)	Location / Remarks
European pine sawfly *Neodiprion sertifer* (Geoff.)	Red pine, Scots pine	Trace, light or moderate damage at three locations in Nova Scotia. No observations from New Brunswick or Prince Edward Island.
European pine shoot moth *Rhyacionia buoliana* (D.& S.)	Red pine, Scots pine	Trace or light damage on young pine trees throughout Nova Scotia and Prince Edward Island. No observations from New Brunswick.
European spruce sawfly *Gilpinia hercyniae* (Htg.)	Balsam fir, spruce	Present in low numbers throughout the region, causing only trace defoliation. Most common in Nova Scotia.
Fall cankerworm *Alsophila pometaria* (Harr.)	Hardwoods	Incidence and intensity levels increased throughout the region, mainly moderate and severe defoliation on ornamentals.
Fall webworm *Hyphantria cunea* (Drury)	Hardwoods	Nests more common throughout southern New Brunswick than in 1992. Nest counts up for the third year, very common throughout Nova Scotia. One or two nests per site, common throughout Prince Edward Island as in 1992.
Flat leaftier *Psilocorsis reflexella* Clem.	Hardwoods	Trace or light damage at 22 locations throughout Nova Scotia, trace at three locations in New Brunswick and one location in Prince Edward Island.
Foureyed spruce bark beetle *Polygraphus rufipennis* (Kby.)	Spruce	Found at one location in each of New Brunswick and Nova Scotia. No observations from Prince Edward Island.
Frost damage Conifer	Hardwoods	Severe damage at only two locations in New Brunswick, elsewhere trace or light. Trace at a few locations in Nova Scotia and Prince Edward Island. See Chapter 4 for surveys of nurseries, seed orchards and young stands.
Gall mites *Eriophyidae*	Hardwoods	Mites affected an average of 28%, 22% and 29% of leaves in New Brunswick, Nova Scotia and Prince Edward Island respectively, ranging from 1 to 83%.
Globose gall rust *Endocronartium harknessii* (J.P. Moore) Y. Hirat.	Jack pine, Scots pine	Found at four locations in New Brunswick, most damage on jack and Scots pine at Upper Blackville, Northumberland Co. and at a single location in Prince Edward Island. No observations from Nova Scotia. See Chapter 4 for surveys of nurseries, seed orchards and young stands.
Greenheaded spruce sawfly *Pikonema dimmockii* (Cress.)	Spruce	Present in low numbers throughout region.
Greenstriped mapleworm *Dryocampa rubicunda* *rubicunda* (F.)	Maple	Damage levels up in New Brunswick, with severe defoliation over 20 ha at Weldfield and four ha at Rosaireville, Northumberland Co. Trace or light feeding at six locations in Nova Scotia. No observations from Prince Edward Island.
Hail damage	Sugar maple, red maple, yellow birch	Trace or light damage at a location in each of New Brunswick and Nova Scotia. No observations from Prince Edward Island.
Hare damage	Conifers	No observations in 1993.

Insect, disease or damage	Host(s)	Location / Remarks
Hypoxylon canker *Hypoxylon mammatum* (Wahl.) J.H. Miller	Trembling aspen	Damage increased throughout the region in 1993. In New Brunswick, found throughout, averaging 15% mortality; highest (90% of trees) dead or dying, Caribou Depot, Restigouche Co. An average of 16% trees infected at eight locations in Nova Scotia. In Prince Edward Island, an average of 19% trees at four locations were dead or dying.
Ink spot of aspen *Ciborinia whetzelii* (Seaver) Seaver	Trembling aspen	In New Brunswick, damage of varying intensity at five locations; highest, severe along 0.5 km of roadside trees, Wrights Brook, Northumberland Co. Trace damage at one location in Nova Scotia. No observations from Prince Edward Island.
Jack pine budworm *Choristoneura pinus pinus* Free.	Jack pine	No damage observed, but slight increase in number of adult moths caught in pheromone and light traps.
Larch needleworm *Zeiraphera improbana* (Wlk.)	Tamarack	No damage observed. A few adult moths caught in light traps in the Maritimes.
Larch sawfly *Pristiphora erichsonii* (Htg.)	Tamarack	In New Brunswick, for the third consecutive year, severe defoliation on a 2 ha area at Rexton, Kent Co., also, severe on 2 ha at MacDonald Lake, Queens Co. In Nova Scotia, eight reports; highest, moderate and severe on 3 ha, Conquerall Mills, Lunenburg Co. No observations from Prince Edward Island.
Large aspen tortrix *Choristoneura conflictana* (Wlk.)	Trembling aspen	No observations in 1993.
Leaf and twig blight of aspen *Venturia macularis* (Fr.: Fr.) E. Mueller & Arx	Largetooth aspen, trembling aspen	Damage down slightly from 1992 levels in the Maritimes. Average 9% of shoots on 64% of trees throughout New Brunswick; highest, severe on 67% of young trees, Chelmsford, Northumberland Co. In Nova Scotia, mostly trace or light damage; highest, light and moderate on 1 ha of young trees, Piedmont, Pictou Co. Trace or light damage at four locations in Prince Edward Island.
Leaf blister *Taphrina carnea* Johanson *T. dearnessii* Jenkins *T. flava* Farlow	Red maple, sugar maple, white birch, wire birch, yellow birch	*T. carnea* caused trace or light injury to yellow birch leaves at a few locations throughout the region. *T. dearnessii* brought similar injury levels to red maple and/or sugar maple at eight locations in New Brunswick, 13 in Nova Scotia and one in Prince Edward Island. *T. flava* produced trace, light or moderate leaf injury at 12 locations in Nova Scotia; highest, (moderate) blistering on 72% of white birch leaves at Whycocomagh, Inverness Co. Light at five locations in New Brunswick. No observations from Prince Edward Island.
Leaf blotch of horse chestnut *Guignardia aesculi* (Peck) V.B. Steward	Horse chestnut	Found wherever host occurs in the region. In New Brunswick, intensity down from 1992 to trace and light. In Nova Scotia, intensity up, mainly moderate or severe damage. Intensity up, light to severe leaf browning, across Prince Edward Island.
Leafcone caterpillars *Caloptilia* spp.	White birch, wire birch, yellow birch	Common throughout New Brunswick, trace to moderate damage; highest, moderate on all white birch southwest Miramichi River, York Co. Trace in Nova Scotia and Prince Edward Island.

Insect, disease or damage	Host(s)	Location / Remarks
Leaf fungus of largetooth aspen *Astrodochium coloradense* Ell.& Ev.	Largetooth aspen	Damage similar to 1992, moderate and severe foliage discoloration on scattered trees throughout western Nova Scotia; highest, moderate leaf browning on several dozen trees at Upper Vaughan, Hants Co. No observations from New Brunswick or Prince Edward Island.
Leaf spot on poplar *Drepanopeziza tremulae* Rimpau	Trembling aspen	Patches of light, moderate or severe damage found throughout Nova Scotia and Prince Edward Island. No observations from New Brunswick.
Lesser maple spanworm *Itame pustularia* (Gn.)	Red maple, sugar maple	Lower incidence throughout the region than in 1992. Trace to moderate damage at five locations in New Brunswick. Trace at 15 locations in Nova Scotia and three locations across Prince Edward Island.
Maple bladdergall mite *Vasates quadripes* (Shimer)	Red maple	Common and widespread throughout region. In New Brunswick an average of 28% of leaves affected on 72% of trees at 24 locations. In Nova Scotia, 40% of leaves on 76% of trees at 53 locations; 57% of leaves on 85% of trees across Prince Edward Island.
Maple leafroller *Sparganothis acerivorana* MacK.	Red maple	In New Brunswick, leafroller damage was similar to 1992, averaging 7% of leaves on 60% of trees at 22 locations. In Prince Edward Island, less intense this year, mostly trace damage; highest light and moderate at Brudenell, Kings Co. No observations from Nova Scotia.
Maple spindlegall mite *Vasates aceris-crumena* (Riley)	Red maple, sugar maple	Common throughout the region. In New Brunswick, an average of 30% of leaves with galls at 29 locations; highest (64%) at Reddin Brook Johanson, Kings Co. In Nova Scotia, 24% of leaves affected at 11 locations; highest (71%) at South Cape Highlands, Inverness Co. In Prince Edward Island, 54% of leaves affected at six locations; highest (87%) at Stanchel, Queens Co.
Mountain ash sawfly *Pristiphora geniculata* (Htg.)	Mountain ash	In New Brunswick, light at three locations; severe on several ornamentals Fredericton, York Co. No observations from Nova Scotia or Prince Edward Island.
Needle casts:		
Bifusella linearis (Peck) Hoehnel	White pine	No observations in 1993.
Hypodermella laricis Tub.	Tamarack	Trace damage at one location in Prince Edward Island. No observations from New Brunswick or Nova Scotia.
Lirula macrospora (Hartig) Darker	Black spruce, red spruce	In New Brunswick, moderate damage to black spruce at Hunters Brook, Madawaska Co. In Nova Scotia, trace or light at nine locations; highest (30% of red spruce needles), Pomquet Forks, Antigonish Co. No observations from Prince Edward Island.
L. mirabilis (Darker) Darker	Balsam fir	Light damage in New Brunswick; trace in Nova Scotia; severe on a few trees in Prince Edward Island.
L. nervata (Darker) Darker	Balsam fir	Trace or light damage at one location in each of New Brunswick and Prince Edward Island. In Nova Scotia, damage averaged 3% at 14 locations; highest, severe on scattered Christmas trees at Northwest, Lunenburg Co.

Insect, disease or damage	Host(s)	Location / Remarks
Phaeocryptopus gaeumannii (Rohde) Petrak	Douglas-fir	Light damage at one location in Prince Edward Island. No observations from New Brunswick or Nova Scotia.
Rhabdocline weirii Parker & J. Reid	Douglas-fir	No observations in 1993.
Needle flecking	Conifers	Trace or light damage at 13 locations in Nova Scotia and at two locations in Prince Edward Island. No observations from New Brunswick.
Needle rusts of balsam fir: *Melampsora abieti-capraearum* Tub. *Pucciniastrum epilobii* Otth. *P. goeppertianum* (Kuehn) Kleb. *Uredinopsis* spp.	Balsam fir	Trace or light infection at 74 locations throughout the region. The highest, light damage on 18% of needles by *Uredinopsis* spp. at Square Lake, Westmorland Co., New Brunswick.
Needle rusts of eastern hemlock: *Melampsora* spp. *M. abietis-canadensis* Ludwig ex Arth. *M. farlowii* (Arthur) J.J. Davis *Pucciniastrum vaccinii* (Wint.) Jorstad	Eastern hemlock, trembling aspen	One report of *M. abietis-canadensis* on trembling aspen from each province; moderate in New Brunswick; trace in Nova Scotia and light in Prince Edward Island. Two reports of *P. vaccinii* from Nova Scotia. *Melampsora* spp. caused severe damage at one location in Prince Edward Island. No observations of *M. farlowii*.
Needle rusts of pine: *Coleosporium* spp. *C. asterum* (Dietel) Syd. & P. Syd. *C. viburni* Arthur	Jack pine, red pine	*C. asterum* caused trace or light damage on pine at one location in New Brunswick and two locations in Prince Edward Island. *C. viburni* caused trace or light damage on jack pine at one location in each of Nova Scotia and Prince Edward Island. *Coleosporium* spp. caused trace damage on red pine at one location in Nova Scotia.
Needle rusts of spruce: *Chrysomyxa* spp. *C. ledi* (Alb. & Schw.) de Bary *C. ledicola* Lagerh.	Black spruce, Colorado blue spruce, red spruce, white spruce	*C. ledi* and *C. ledicola* caused trace to severe damage throughout region. Highest, severe, by mainly *C. ledi* on ornamental Colorado blue spruce throughout Westmorland, Kent, Northumberland and York counties, New Brunswick. *Chrysomyxa* spp. caused trace damage at 17 locations throughout Nova Scotia and two locations in Prince Edward Island. See Chapter 4 for surveys of nurseries, seed orchards and young stands.
Needle rust *Melampsora medusae* Thuemen	Balsam poplar, tamarack	Trace or moderate damage at two locations in each of New Brunswick and Prince Edward Island. Highest, moderate on 72% of needles of all tamarack trees at Lawson Brook, Gloucester Co., N.B. No observations from Nova Scotia.
Northern pitch twig moth *Petrova albicapitana* (Bsk.)	Jack pine	Trace damage at 17 locations in New Brunswick, two in Nova Scotia and one in Prince Edward Island.

Insect, disease or damage	Host(s)	Location / Remarks
Oak leaftier *Psilocorsis quercicella* Clem.	Beech, red oak, white birch	Trace or light damage at one location in New Brunswick and two in Nova Scotia. No observations from Prince Edward Island.
Obliquebanded leafroller *Choristoneura rosaceana* (Harr.)	Hardwoods	In New Brunswick, trace or light defoliation at eight locations; highest, 28% of white birch leaves on all trees at Alwood Brook, Westmorland Co.; all light trap catches showed slight population increase. In Prince Edward Island at endemic levels. No observations from Nova Scotia.
Ocean salt spray	Conifers, hardwoods	In Nova Scotia, light to severe damage at four locations. Late June storm caused light to severe foliage browning along north shore of Prince Edward Island. No observations from New Brunswick.
Ocellate gall midge *Cecidomyia ocellaris* O.S.	Red maple, sugar maple	Present across New Brunswick, average leaf damage 14% on 68% of trees; highest (39% on all sugar maple) at Gillis Gulch, Restigouche Co. Present throughout Nova Scotia, averaging 10% of leaves; highest (31%) at several locations in western Nova Scotia. Average of 7% on 61% of trees in Prince Edward Island.
Orange spruce needleminer *Coleotechnites piceaella* (Kft.)	Black spruce, red spruce, white spruce	Trace damage across Nova Scotia and Prince Edward Island. No observations from New Brunswick.
Pear thrips *Taeniothrips inconsequens* (Uzel)	Sugar maple	Low numbers at three locations in New Brunswick, no visible defoliation. No observations from Nova Scotia or Prince Edward Island.
Pepper-and-salt moth *Biston betularia cognataria* (Gn.)	Trembling aspen	At endemic levels in Nova Scotia. No observations from New Brunswick or Prince Edward Island.
Pine bark adelgid *Pineus strobi* (Htg.)	White pine	Trace at three locations in Nova Scotia. No observations from New Brunswick or Prince Edward Island.
Pine engraver *Ips pini* (Say)	Red pine	No observations in 1993.
Pine leaf adelgid *Pineus pinifoliae* (Fitch)	Black spruce, red pine, red spruce, white pine	Light damage at one location in New Brunswick. Trace or light infestation, mainly on spruce, across Nova Scotia. No observations from Prince Edward Island.
Pinewood nematode *Bursaphelenchus xylophilus* (Steiner & Buhrer) Nickle	Conifers	Lumber samples submitted by Maritime Lumber Bureau inspectors and the Association des manufacturiers de bois de sciage du Québec were processed by the Forest Insect and Disease Survey in Maritimes Region. All samples from the Maritimes and Quebec were negative.
Pinkstriped oakworm *Anisota virginiensis virginiensis* (Drury)	Red oak, white birch	Single moth caught in a light trap in Nova Scotia. No observations from New Brunswick or Prince Edward Island.
Poplar felt mite *Phyllocoptes didelphis* Keifer	Largetooth aspen, trembling aspen	Found throughout New Brunswick at trace to moderate levels; highest (73%) trembling aspen leaves on all trees at Blackland Brook, Restigouche Co. In Nova Scotia, average 20% of foliage at 21 locations; highest (47%) north of Forest Glen, Colchester Co. Trace damage in Prince Edward Island.

Insect, disease or damage	Host(s)	Location / Remarks
Poplar leaffolding sawfly *Phyllocolpa* spp.	Largetooth aspen, trembling aspen	Common throughout region. In New Brunswick, found at 41 locations, average of 15% of leaves folded on 67% of trees; highest percentage (52% on all trees) at Pirate Brook, York Co. In Nova Scotia, average of 7% on 70% of trees at 24 locations; highest (25%) North of Homeville, Cape Breton Co. In Prince Edward Island, average of 10% on 72% of trees.
Poplar leafmining sawfly *Messa populifoliella* (Towns.)	Balsam poplar, Carolina poplar, trembling aspen	No observations in 1993.
Poplar petiolegall moth *Ectoedemia populella* Busk.	Trembling aspen	Found at a few locations in the region causing trace damage.
Porcupine damage *Erethizon dorsatum* L.	Conifers	Girdled trees common throughout New Brunswick and Nova Scotia. Highest percentage (44%) of balsam fir trees damaged at Crombie Settlement, Victoria Co., New Brunswick. In Nova Scotia, several dozen ha of plantation red pine with 25% of the stems girdled at Garden of Eden Barrens, Guysborough Co., and in the Trafalgar burn area, Pictou Co. Porcupines do not occur in Prince Edward Island.
Ragged sprucegall adelgid *Pineus similis* (Gill.)	Black spruce, red spruce, white spruce	In Nova Scotia, population levels similar to those in 1992. Found at 14 locations; highest proportion (37% of red spruce shoots) at Hattie Lake, Guysborough Co. No observations from Prince Edward Island. See Chapter 4 for observations at New Brunswick nurseries, seed orchards and young stands.
Red flag of balsam fir *Fusicoccum abietinum* (Hartig) Prill. & Delacr.	Balsam fir	In Nova Scotia, light damage at two locations. No observations from New Brunswick or Prince Edward Island.
Red pine cone beetle *Conophthorus resinosae* Hopk.	Red pine	A few larvae at one location in Nova Scotia. No observations from New Brunswick or Prince Edward Island.
Red spruce adelgid *Pineus floccus* (Patch)	Red spruce	Light damage at a few locations in New Brunswick and Nova Scotia. No observations from Prince Edward Island. See Chapter 4 for seed orchard pests.
Roadside salt damage	Conifers	Various intensity levels at numerous locations throughout the region. Most common on red pine and white pine.
Saddled prominent *Heterocampa guttivitta* (Wlk.)	Red maple, sugar maple	No damage observations in 1993. Slight increase in light trap catches in region.
Satin moth *Leucoma salicis* (L.)	Silver poplar	Damage up slightly in New Brunswick, moderate or severe at 11 locations. Incidence and intensity up in eastern Nova Scotia to moderate and severe; highest (severe) on several dozen trees at Red Islands and Hay Cove, Richmond Co., and Port Hastings, Inverness Co. Mainly moderate damage on ornamentals throughout Prince Edward Island. Numbers up slightly at all light trap locations throughout region.
Seedling debarking weevil *Hylobius congener* D.T., Sch. & Marsh.	Conifer seedlings	Found at three black spruce plantations in Charlotte Co., N.B. with 20%, 30% and 55% seedling mortality. No observations from Nova Scotia or Prince Edward Island.

Insect, disease or damage	Host(s)	Location / Remarks
Snow damage	Jack pine, red pine	Trace or light injury to a few trees in region. See Chapter 4 for surveys of nurseries, seed orchards and young stands.
Spearmarked black moth *Rheumaptera hastata* (L.)	White birch	Trace or light defoliation at two locations in New Brunswick. Endemic levels in Nova Scotia. No observations from Prince Edward Island.
Spider mites *Tetranychidae*	Conifers	Present at four locations in New Brunswick; highest incidence (severe) on red spruce at Rivère du Portage, Northumberland Co. Trace to severe at 25 locations throughout Nova Scotia; highest (severe) at Robert Brook, Inverness Co. In Prince Edward Island found at 10 locations; most damage (moderate or severe) on tamarack. See Chapter 4 for surveys of nurseries, seed orchards and young stands.
Spittlebugs *Aphrophora* spp. *Cercopidae*	Conifers, hardwoods	Present at trace population levels throughout region.
Spotted tussock moth *Lophocampa maculata* Harr.	White birch	Endemic levels in Nova Scotia. Low numbers in light traps in region.
Spruce bud midge *Rhabdophaga swainei* Felt	Black spruce, Norway spruce, red spruce, white spruce	Found at mostly trace damage levels throughout the region. See Chapter 4 for surveys of nurseries, seed orchards and young stands.
Spruce bud scale *Physokermes piceae* (Schr.)	Black spruce, red spruce, white spruce	Single report of trace damage in New Brunswick. Most common in Nova Scotia, trace or light damage throughout province. Trace shoot damage at a few locations in Prince Edward Island.
Spruce gall adelgid *Adelges lariciatus* (Patch)	White spruce	No observations in 1993.
Spruce twig aphid *Mindarus* sp.	Red spruce, white spruce	Significant decline in Nova Scotia to trace damage at six locations. Single report of trace damage in Prince Edward Island. No observations from New Brunswick.
Stillwell's syndrome	Balsam fir	Incidence increased in central and northern New Brunswick and throughout western Nova Scotia. Highest (4-5 balsam fir per ha) at Archibald Brook, Restigouche Co., N.B. and scattered individuals throughout central and western N.S. Mortality throughout Prince Edward Island but not as common as in 1992.
Sugar maple borer *Glycobius speciosus* (Say)	Sugar maple	Single report of trace damage in both New Brunswick and Prince Edward Island. No observations from Nova Scotia.
Sunscorch	Balsam fir, Manitoba maple	Varying intensity levels of wilting and subsequent browning mainly in western and northern New Brunswick; highest (severe) common in northern Madawaska Co. Trace damage at one location in each of Nova Scotia and Prince Edward Island.

Maritimes (Continued)

Insect, disease or damage	Host(s)	Location / Remarks
Tar spot of maple *Rhytisma acerinum* (Pers.: Fr.) Fr.	Red maple	Found at 21 locations in Nova Scotia. Average incidence, 22%; highest (81%) at South Range, Digby Co. Trace damage at one location in New Brunswick, and two locations in Prince Edward Island.
Uglynest caterpillar *Archips cerasivorana* (Fitch)	Hardwoods	Less common in New Brunswick than in 1992; highest number of nests were in Kent Co. Nest numbers similar to 1992 levels in Nova Scotia; highest at Ben Eoin, Cape Breton Co.; Great Village, Colchester Co.; and Brooklyn, Queens Co. No observations from Prince Edward Island.
Variable oak leaf caterpillar *Lochmaeus manteo* Dbly.	Beech, red oak, sugar maple	Both incidence and intensity increased greatly from 1992 levels. Damage of varying intensity throughout York County, N.B. and at several locations in western Nova Scotia. Highest, moderate over 50-ha of beech, Southhampton, York Co., N.B. and moderate or severe on understory beech, South Brookfield, Queens Co.; N.S. No observations from Prince Edward Island. See Chapter 2 for new pest records in the Maritimes.
Wax filament scale *Xylococculus betulae* (Perg.)	White birch, yellow birch	Found in southern New Brunswick, average incidence on 88% of white birch at 11 locations. In Nova Scotia; highest (46%) of white birch, Eatonville, Cumberland Co. No observations from Prince Edward Island.
Weevil *Strophosoma melanogrammus* Forst.	Balsam fir, red maple, white birch, white spruce	A few weevils were found at four locations in Nova Scotia. No observations from New Brunswick or Prince Edward Island.
Whitemarked tussock moth *Orgyia l. leucostigma* (J.E. Smith)	Balsam fir	In Nova Scotia, larvae found at four locations, with no significant injury. No observations from New Brunswick or Prince Edward Island.
White pine blister rust *Cronartium ribicola* J.C. Fischer	White pine	In New Brunswick, found at 12 locations; highest mortality (16% of trees killed) at Harris Brook, Northumberland Co. In Nova Scotia, two locations: highest incidence on 12-ha plantation, with 70-80% of trees observed with branch or stem cankers, northeast of Big Pond Centre, Cape Breton Co. Trace damage at Scotchfort, Queens Co., P.E.I.
White pine sawfly *Neodiprion pinetum* (Nort.)	White pine	A few larvae at one location in Nova Scotia. No observations from New Brunswick. See Chapter 4 for seed orchard pests in Prince Edward Island.
White pine weevil *Pissodes strobi* (Peck)	Black spruce, jack pine, Norway spruce, red pine, white pine, white spruce	Common and widespread throughout region. In New Brunswick, found at 27 locations; highest incidence (40% of white pine) at Bettsburg, Northumberland Co. Incidence increased in Nova Scotia; highest, moderate over several ha of young white pine at Rossignol Lake, Queens Co. In Prince Edward Island, six locations: highest (16%) at Foxley River, Prince Co. See Chapter 4 for surveys of nurseries, seed orchards and young stands.
Whitespotted sawyer *Monochamus* spp. *M. scutellatus* (Say)	Conifers	In New Brunswick found at 13 locations; highest incidence, moderate injury of balsam fir shoots at two locations. Trace or light damage at 21 locations in Nova Scotia and one in Prince Edward Island.

Insect, disease or damage	Host(s)	Location / Remarks
Willow blight *Venturia saliciperda* Nuesch	Willow	Severe damage on one tree only, in each of Nova Scotia and Prince Edward Island. No observations from New Brunswick.
Willow flea weevil *Rhynchaenus rufipes* (LeC.)	Willow	Incidence increased from 1992 levels. Moderate and severe browning at five locations in New Brunswick; highest, severe at Bathurst, Gloucester Co., and throughout Nova Scotia and Prince Edward Island.
Wind damage	Conifers, hardwoods	In New Brunswick, physical damage, in the form of brown and tattered leaves, was mostly light at several locations; highest (moderate) at Caledonia Mountain, Albert Co. Trace to moderate foliage damage throughout Nova Scotia; highest, light or moderate in Halifax, Lunenburg and Queens counties. A suspected tornado uprooted and broke off a number of trees over a 2-ha site near Oxford Lake, Victoria Co., N.S. In Prince Edward Island, 26% of leaves with mostly light damage at 25 locations; highest, moderate on sugar maple at Richmond, Queens Co. See also Chapter 3 for abiotic damage.
Winter drying	Conifers	Trace and light damage was found at a few locations in northern New Brunswick. In Nova Scotia, damage was moderate and severe throughout; largest area affected (moderate and severe) reddening of young balsam fir along two kilometers of road near Big Barren, Victoria Co. In Prince Edward Island, trace or moderate damage at two locations. See also Chapter 3 for abiotic damage.
Winter moth *Operophtera brumata* (L.)	Hardwoods	Less widespread throughout region than in 1992. Light and moderate damage at two locations in Nova Scotia. Moderate or severe defoliation throughout Prince Edward Island. No observations from New Brunswick.
Witches' broom of balsam fir *Melampsorella caryophyllacearum* Schroet.	Balsam fir	Common and widespread throughout the region.
Witches' broom of spruce *Chrysomyxa arctostaphyli* Diet.	White spruce	No observations in 1993.
Woolly alder aphid *Prociphilus tessellatus* (Fitch)	Alder	Moderate and severe population levels in Kent and Northumberland counties, N.B. In Nova Scotia, trace, light or moderate levels throughout. In Prince Edward Island, trace levels at one location.
Yellowheaded spruce sawfly *Pikonema alaskensis* (Roh.)	Black spruce, Colorado blue spruce, Norway spruce, white spruce	Damage levels similar to 1992. Found at nine locations in New Brunswick; highest incidence, pockets of severe damage at a black spruce plantation in Hammondvale, Kings Co. Found at six locations in Nova Scotia; highest (severe) on a white spruce hedge at Alton, Colchester Co. Moderate and severe throughout Prince Edward Island; highest, severe patches at St. Gilbert and North Enmore, Prince Co.

Quebec

Insect, disease or damage	Host(s)	Location	Remarks
Anthracnoses:			
Colletotrichum acutatum J.H. Simmonds	Largetooth aspen	Pointe-au-Chêne (Argenteuil)	First record of this species in Quebec.
Discula umbrinella (Berk. & Br.) Sutton	Beech	Sainte-Julienne (Montcalm)	21.8% of the foliage affected in a natural forests. Suppressed trees are the most severely affected.
	Red oak	Cazaville (Huntingdon)	High frequency in the plantation. Presence of cankers. The disease is found at several other sites in the region.
Monostichella robergei (Desm.) Hoehnel	Hop-hornbeam	Portage-du-Fort (Pontiac)	Cankers on branches.
Aspen serpentine leafminer *Phyllocnistis populiella* (Cham.)	Trembling aspen	Midway between Gaspé and Murdochville (Gaspé East)	Light damage. Reduction in the area affected.
		Along Highway 198 between L'Anse-Pleureuse and Murdochville (Gaspé West)	Light damage. Decline continued.
		Sector of Petit-Saguenay (Chicoutimi)	Most leaves are mined.
		Sainte-Hedwidge, Lac du Cran and LaDoré (Lac-Saint-Jean West)	Increase in areas affected and in the severity of damage.
		Along the Sainte-Marguerite River and south of the Outardes IV reservoir (Chicoutimi)	Trees moderately mined.
		Shores of the Toulnustouc River (Saguenay)	Aspens severely mined.
Balsam fir sawfly *Neodiprion abietis* (Harr.)	Balsam fir	Luskville (Pontiac)	Light defoliation.
		From Gatineau to Angers (Papineau)	Observation of several pockets of infestation.

Quebec (Continued)

Insect, disease or damage	Host(s)	Location	Remarks
Beech bark diseases:			
Nectria coccinea var. *faginata* Lohm., Wats. &Ayers	Beech	Saint-Valère (Artabaska) and Saint-Narcisse (Champlain)	Two stands lightly affected by *N. galligena*.
N. galligena Bres.		Bolton-Glen (Brome)	Trace levels of *N. galligena*.
		Sutton (Brome) and Saint-Armand-Station (Missisquoi)	*N. coccinea* detected at moderate levels in Sutton and at high levels in Saint-Armand.
Birch sawfly *Arge pectoralis* (Leach)	White birch	Lac Labrecque (Chicoutimi)	Light defoliation.
		Lac Saint-Jean area.	Moderate to high defoliation. Increase in the attack level and number of trees infested.
Birch casebearer *Coleophora serratella* (L.)	White birch	Mt. Albert in Parc de la Gaspésie	Moderate damage.
		In the census division of Lac-Saint-Jean West and on the North Shore	Several sites lightly to moderately affected.
Birch skeletonizer *Bucculatrix canadensisella* Cham.	White birch	Lac-Saint-Jean region	Foliage lightly mined.
		In the Chaudière River watershed	Significant damage
		North of Trois-Rivières	Trees severely affected throughout the area.
		North of Montreal	Moderate to severe damage.
		Vicinity of Noranda	Several pockets of infestation.
	Yellow birch and gray birch	South of Montreal	Moderate to severe damage throughout the area.
Black army cutworm *Actebia fennica* (Tausch.)	Spruce and jack pine	Northwest of Forestville and of Baie-Comeau (Saguenay)	Light to moderate damage on seedlings planted in 1991, 1992 and 1993 in 1991 burns. Of the 15 500 seedlings examined, 16% are lightly defoliated, 47% moderately defoliated and 37% severely defoliated.

Quebec (Continued)

Insect, disease or damage	Host(s)	Location	Remarks
Crown gall *Agrobacterium tumefaciens* (Smith & Townsend) Conn	Bitternut hickory	Cazaville (Huntingdon)	High incidence of galls on branches and trunks in a sugar maple-bitternut hickory stand.
Cytospora canker *Cytospora* sp.	White spruce	Lac Wren and Otter Lake (Pontiac)	Plantations severely affected.
C. pruinosa (Fr.) Sacc.	White ash	Mt. Éléphant (Brome)	Presence in natural forests.
		Sainte-Cécile-de-Milton (Shefford)	More than 80% of a plantation affected. Several cankers on the trunks of trees.
Diplodia canker *Sphaeropsis sapinea* (Fr.) Dyko & Sutton	Lodgepole pine	Saint-Amable (Verchères)	1% of the trees in the Belœil arboretum affected.
Dutch elm disease *Ophiostoma ulmi* (Buis.) Nannf.	White elm	Nouvelle (Bonaventure)	Expansion of the range of the disease. Elsewhere in Quebec, the disease continues to spread at sites already known to be infected.
Early birch leaf edgeminer *Messa nana* (Klug.)	White birch	Saint-Sauveur-des-Monts (Terrebonne)	Moderate damage.
Eastern pine shoot borer *Eucosma gloriola* Heinr.	Jack pine	Naquagami Bay (Montmorency No.1)	Plantation lightly affected.
Elm lace bug *Corythucha ulmi* O. & D.	White oak	Notre-Dame-de-la-Salette (Papineau)	Roadside damage along Highways 309 and 105. Premature foliage loss.
European spruce sawfly *Gilpinia hercyniae* (Htg.)	White and red spruce	Gaspé-Magdalen Islands, Lower St. Lawrence and Mauricie-Bois-Francs regions	Presence at 37% of the white spruce plantations and 44% of the Norway spruce plantations visited. Damage generally at trace levels.
Fall cankerworm *Alsophila pometaria* (Harr.)	Red oak	Saint-Louis-de-France (Champlain)	Trace levels of the insect.
		Sainte-Thérèse-de-la-Gatineau	Pocket of light infestation over an area of 3 to 4 ha.
Fall webworm *Hyphantria cunea* (Drury)	White elm	Breckenridge (Pontiac)	Light damage along roadside over a distance of 5 km.
Fomes root rot *Heterobasidion annosum* (Fr.) Bref.	Red pine	Buckingham (Papineau), Harrington and Saint-Philippe-d'Argenteuil (Argenteuil)	The disease was found at three new plantations in 1993. First detected in Quebec in 1989.

Quebec (Continued)

Insect, disease or damage	Host(s)	Location	Remarks
Greenstriped mapleworm *Dryocampa rubicunda rubicunda* (F.)	Sugar maple, red maple	Area between Trois-Rivières, Victoriaville and Drummondville	Presence of the insect.
		Joliette (Joliette)	Decline in the infestation, from moderate to light.
		Notre-Dame-de-Lourdes and Saint-Ambroise-de-Kildare (Joliette)	Two pockets of infestation. The first is light, the second moderate.
		Sainte-Angèle-de-Monnoir (Rouville)	Moderate defoliation over four ha. A decline in damage was observed.
Hail	Hardwoods and softwoods	Decelles Reservoir (Témiscamingue)	Roughly 100 ha affected on June 22 in a corridor located south of the reservoir.
		Rollet (Témiscamingue)	Approximately 400 ha of forest stripped in late June.
		Rémigny Township (Témiscamingue)	50 ha affected.
	Hardwoods	North of Maniwaki (Gatineau)	Light damage to hardwoods during the June 27 storm.
Ink spot *Ciborinia whetzelii* (Seaver) Seaver	Trembling aspen	Grosse-Roche camp (Chicoutimi)	90% of the foliage affected at a 1km^2 stand. Elsewhere in Quebec, the disease is present throughout the province.
Introduced pine sawfly *Diprion similis* (Htg.)	Eastern white pine	Grand-Calumet Island and Norway Bay (Pontiac)	Significant presence of this sawfly along the Outaouais River.
Larch casebearer *Coleophora laricella* (Hbn.)	Tamarack	Grenville (Argenteuil)	Tamaracks lightly affected.
		Sainte-Sophie (Terrebonne) and Saint-Calixte (Montcalm)	Moderate damage.
		Lacolle (Saint-Jean)	Foliage of tamaracks lightly mined over an area of 8 ha.
	European larch	Saint-Amable (Verchères)	78% of the trees at a tree seed orchard are lightly affected.

Quebec (Continued)

Insect, disease or damage	Host(s)	Location	Remarks
Leaf rust *Melampsora medusae* Thuemen	Hybrid poplar	Maria and Carleton (Bonaventure)	A few ornamental trees severely affected.
		Biron (Bonaventure)	Plantation moderately affected.
Maple leafcutter *Paraclemensia acerifoliella* (Fitch)	Sugar maple	Saint-Valère (Artabaska)	Light damage.
		Kingsbury (Richmond)	Presence.
		Sutton (Brome), East Dunham (Missisquoi), Boscobel, Sainte-Marie-d'Ely and Racine (Shefford)	Moderate damage.
		North of Valcourt (Shefford)	New pocket of infestation. Moderate defoliation over 190 ha.
Nectria canker *Nectria galligena* Bres.	Yellow birch, trembling aspen	Sutton (Brome)	12% and 8% of the birches affected in two maple stands. Presence elsewhere in the region.
Needle casts: *Davisomycella ampla* (J.J. Davis) Darker	Jack pine	Otter Lake (Pontiac)	Plantation affected at trace level.
		West of Lac Saint-Jean	Several plantations affected as well as regeneration along roadside.
		Lac Foie, Lac du Goéland (Champlain) and Saint-Michel-des-Saints (Berthier)	Three plantations lightly affected.
Lophodermium seditiosum Minter, Staley & Millar	Jack pine	Lac du Nippon (Lac-Saint-Jean West)	Damage less severe than in 1992, but extends over a larger area (20 ha).
	Red pine	Lac Matambin (Berthier)	Plantation moderately affected.
Needle rusts: *Chrysomyxa ledi* (Alb. & Schw.) de Bary *C. ledicola* Lagerh.	White spruce	Lac des Caleçons and Saint-Hilarion (Charlevoix East)	Plantations where level of attack is moderate.
Coleosporium asterum (Dietel) Syd. & P. Syd.	Jack pine	Saint-Rosaire (Artabaska)	Plantation in which 100% of the trees are moderately affected.
	Lodgepole pine	Saint-Amable (Verchères)	60% of the trees at the Belœil arboretum are moderately affected.

Quebec (Continued)

Insect, disease or damage	Host(s)	Location	Remarks
Oak leafshredder *Croesia semipurpurana* (Kft.)	Red oak	Orleans Island and Côte-de-Beaupré	Situation stable. Light to severe damage.
		Montmagny	Light defoliation.
		Saint-Louis-de-France (Champlain)	Defoliation increased from light to severe.
		Saint-Laurent-du-Fleuve (Verchères)	Moderate defoliation over four ha.
Oystershell scale *Lepidosaphes ulmi* (L.)	Beech	Saint-Ours (Richelieu)	Beech severely affected over an area of 1 ha.
Pear thrips *Taeniothrips inconsequens* (Uzel)	Sugar maple	Mt. Pinacle and Frelighsburg (Missisquoi)	Damage apparent on regeneration.
Pine needleminer *Exoteleia pinifoliella* (Cham.)	Pitch pine	Saint-Antoine-Abbé (Huntingdon)	100% of the trees affected at trace levels in the Pin-Rigide ecological reserve.
Pinkstriped oakworm *Anisota virginiensis virginiensis* (Drury)	White birch	Saint-Thomas-Didyme and LaDoré (Lac-Saint-Jean West)	Severe defoliation; increase in infested area.
	White oak and red oak	Fort-Coulonge (Pontiac)	Severe defoliation.
	Red oak	Gracefield (Gatineau)	Presence.
Porcupines	Jack pine	Fabre (Témiscamingue)	26% of the trees in a natural stand damaged. Elsewhere in Quebec, damage at several plantations.
Redheaded pine sawfly *Neodiprion lecontei* (Fitch)	Red pine	Mauricie-Bois-Francs, Outaouais, Laurentian and Montérégie regions	Damage generally at trace level; moderate to high levels at four plantations only.
Satin moth *Leucoma salicis* (L.)	Balsam poplar	Grande-Vallée (Gaspé East)	Severe defoliation of ornamental trees.
	Trembling aspen	Petit Lac Saint-Nicolas (Saguenay)	Severe damage over an area of 4 ha along Highway 138.
Spruce budmoth *Zeiraphera canadensis* Mut. & Free.	White spruce	Lower St. Lawrence and Gaspé-Magdalen Islands regions	Decline in populations has continued since 1988. Recorded in 40% of the plantations visited, but small number of trees affected.

Quebec (Continued)

Insect, disease or damage	Host(s)	Location	Remarks
Tar spot *Rhytisma acerinum* (Pers.: Fr.) Fr	Silver maple	Pierreville (Yamaska)	At one stand, all trees affected.
		Berthierville (Berthier)	A city park severely affected.
Webspinning sawfly *Cephalcia* sp.	Red pine	Sainte-Gertrude (Nicolet)	Plantation of 4 000 trees, 15% of which are affected.
		Lac-à-Foin (Labelle)	Plantation of 2 000 pines, 44% of which are moderately affected; 28% of the trees affected contained more than ten nests.
		Notre-Dame-du-Laus (Labelle)	Plantation of 2 100 seedlings, 27% of which are lightly affected and 14% of which contain more than ten nests per tree.
		Saint-Joseph (Pontiac)	Insect present in 61% of the trees in a plantation.
		Notre-Dame-de-la-Paix (Papineau)	Plantation of 5 000 trees, 46% of which are moderately affected. Of the total, 29% had more than ten nests.
White pine blister rust *Cronartium ribicola* J.C. Fischer	Eastern white pine	Clermont (Charlevoix East)	Plantation moderately affected.
		Lac de la Hache (Montcalm)	Natural forest moderately affected.
		Lac Lesueur and Lac Robert (Berthier)	Two sites severely affected.
		Lac aux Orignaux (Champlain) and Lac Hickey (Pontiac)	Two plantations severely affected.
Willow flea weevil *Rhynchaenus rufipes* (LeC.)	Willows	Saguenay-Lac-Saint-Jean administrative region	Most ornamental willows are severely mined.
Windfall	Hardwoods and softwoods	Wottonville (Wolfe)	On August 31, trees were uprooted over an area of 10 ha.
		Melbourne Township (Richmond)	On September 3, a tornado struck a 0.7-ha maple stand and a 7–ha swath of a mixed hardwood-conifer stand.

Ontario

Insect, disease or damage	Host(s)	Location	Remarks
American aspen beetle *Gonioctena americana* (Schaeff.)	Trembling aspen	Central Region	Caused 60% defoliation of 2-m regeneration in Mayo Township, Bancroft District and 20% defoliation on 6-m trees in Halfway Lake Provincial Park, Sudbury District.
Anthracnoses:			
Apiognomonia errabunda (Rob.) Hoehnel	White ash	Midhurst and Maple districts	Caused 60-70% foliar damage in several areas.
	Bur oak	Kemptville District	Foliar damage of 75-100% occurred in Caledonia and East Hawkesbury townships.
A. veneta (Sacc. & Speg.) Hoehnel	Sycamore	Aylmer Disrict	Twig and branch mortality was reported in Point Pelee National Park.
Discula campestris (Pass.) Arx	Sugar maple	Parry Sound and Bancroft districts	Medium to heavy infections were observed at numerous stands in these two districts.
Aspen leaf blotch miner *Phyllonorycter ontario* (Free.)	Trembling aspen	Northwest Region	Increased populations and heavy damage occurred at young stands from the Manitoba border east to the Geraldton and Wawa districts. Heavy infestations also were reported in the central Kirkland Lake District and the eastern Timmins District.
Balsam fir sawfly *Neodiprion abietis* (complex)	Balsam fir	Tweed and Kemptville districts	The most severe damage occurred at a 65-ha stand in Pakenham Township, Kemptville District, where defoliation averaged 60%. Usually low numbers prevailed elsewhere.
		Central Region	Incidence was widespread in Parry Sound, Bancroft, Pembroke, North Bay and Sudbury districts although the average defoliation was generally less than 20%.
Balsam poplar leaf diseases: *Linospora tetraspora* G. Thompson *Mycosphaerella populicola* G. Thompson	Balsam poplar	Northern Ontario	Severe leaf browning and premature leaf drop were observed in Fort Frances, Thunder Bay, Nipigon, Hearst and Cochrane districts.
Bark beetle *Orthotomicus caelatus* (Eichh.)	Red pine	Central Region	Associated with tree mortality at young plantations in Christie, McDougall, McMurrich and McKellar townships, Parry Sound District and in Somerville Township, Bancroft District.
Beech scale *Cryptococcus fagisuga* Lind.	Beech	Niagara peninsula	Heavy populations were found in one area of Thorold Township, while lower numbers occurred in a few nearby areas.

Insect, disease or damage	Host(s)	Location	Remarks
Birch edgeminer *Scolioneura betuleti* Klug	White birch	Central Region	Extensions in the range of this introduced pest were recorded with collections made in Sudbury and Sault Ste. Marie districts. Caused 90% foliar damage to 15-m trees in Cardiff Township, Pembroke District.
Birch leaf blight *Septoria betulae* Pass.	White birch	Central Region	Moderate foliar damage occurred in northern Sault Ste. Marie, Sudbury and North Bay districts.
Birch leafminer *Fenusa pusilla* (Lep.)	White birch	Northwest Region	Observations of foliar damage were in the 80-100% range in Dorion Township, Thunder Bay District; from 20-80% in the Dryden area, Dryden District; and 20% along Highway 72, Sioux Lookout District.
Black canker of willow *Glomerella cingulata* (Stonem.) Spaulding & Schrenk Willow scab *Venturia saliciperda* Nuesch	Willow	Sudbury and Sault Ste. Marie districts	Unusually heavy infections occurred on all sizes of trees in open-grown, ornamental, roadside and fringe situations. Defoliation was often 100%.
Blackheaded jack pine sawfly *Neodiprion pratti banksianae* Roh.	Jack pine	Southern and Central regions	Defoliation averaged 58% through a 500-ha area in Sheffield and Kennebec townships, Tweed District. Varying degrees of damage in smaller areas (plantations) were recorded in Lanark, Finch, Bastard and Kenyon townships, Kemptville District and in McNabb Township, Pembroke District.
Bronze birch borer *Agrilus anxius* Gory	White birch	Sudbury District	High populations persisted on ridge tops in the Sudbury city area.
Brownheaded ash sawfly *Tomostethus multicinctus* (Roh.)	Black ash	Thunder Bay District	Caused moderate defoliation of 12-m trees at Middle Falls Provincial Park.
Butternut canker *Sirococcus clavignenti-juglandacearum* V.M.G. Nair, Kostichka & Kuntz	Butternut	Southern Region	A total of six new infection sites were recorded in the districts of Tweed, Kemptville, Aylmer and Cambridge.
Cedar leafminers: *Argyresthia thuiella* (Pack.) *A. aureoargentella* Brower *Coleotechnites thujaella* (Kft.)	Eastern white cedar	Southern Region	The heaviest damage occurred in Cambridge Township, Kemptville District, where 75% foliar damage was recorded at a 5-ha stand. Elsewhere the degree of defoliation varied, usually ranging from 5 to 50%.
Comandra blister rust *Cronartium comandrae* Peck	Jack pine	Thunder Bay District	Incidence rates of 3.3% and 2.6% were recorded on young trees at the Kakabeka seed orchard and at the Fallscamp Lake family test site.

Ontario (Continued)

Insect, disease or damage	Host(s)	Location	Remarks
Cytospora canker *Leucostoma kunzei* (Fr.) Munk	Balsam fir	Geraldton District	Stem cankers affected 10% of trees in a 5-ha area near Raynor Lake.
Drought damage	Deciduous	Tweed District	A total area of 548 ha was affected on shallow soil sites between Kingston and Gananoque.
Dutch elm disease *Ophiostoma ulmi* (Buis.) Nannf.	White elm	Southern and Northwest regions	Infection levels were high on remnant and reproduction trees across the area. Incidence ranged as high as 62%.
Eastern gall rust *Cronartium quercuum* (Berk.) Miyabe ex Shirai f. sp. *banksianae* Burds. & G. Snow	Scots pine	Midhurst District	Infection levels of 30% were recorded on Christmas trees at two locations in Tiny Township, with 27 and 15% of the trees severely galled.
Eastern pine shoot borer *Eucosma gloriola* Heinr.	Jack pine	Northern and southern Ontario	Populations were generally reduced from those of 1992. The highest leader damage of 28.6% occurred on 1.7-m trees at Fallscamp Lake, Thunder Bay District. Leader damage ranging as high as 13% was encountered in Wawa, Sault Ste. Marie, Sudbury and Geraldton districts.
	White pine, Scots pine	Southern Ontario	Common in Parry Sound, Midhurst, Maple, Tweed and Kemptville districts. A high count of 76% damage on 4.5-m white pine occurred in Oxford on Rideau Township, Kemptville District.
Eastern tent caterpillar *Malacosoma americanum* (F.)	Deciduous	Southern Ontario	Defoliation ranged from 50-65% on 75% of the preferred host, cherry, in Clarendon, Miller and Palmerston townships, Bancroft District. Elsewhere, low numbers generally prevailed.
European fruit lecanium *Parthenolecanium corni* (Bouché)	Sugar maple, ironwood, black cherry, pin cherry	Central Region	High populations persisted at sugar maple stands in Minden, Eyre, Havelock and Harburn townships, Bancroft District; in Machar and Ridout townships, Parry Sound District; in Sproule and Airy townships, Algonquin Park District; and in Sisk Township, Bay District. Branch mortality of up to 60% was observed on 1-5 m sugar maple at some locations.
European pine sawfly *Neodiprion sertifer* (Geoff.)	Scots pine	Southern Region	Widespread occurrence, usually at low levels. Notable areas of damage occurred on 2-m Scots pine in North Maryborough Township, Tweed District and in Clarke Township, Maple District, where in both areas 90% of the trees suffered about 50% defoliation.

Insect, disease or damage	Host(s)	Location	Remarks
Fall cankerworm *Alsophila pometaria* (Harr.)	Deciduous	Province-wide	Populations collapsed. Remnant numbers caused less than 10% foliar damage in Caradoc and Burford townships, Aylmer District.
Fall webworm *Hyphantria cunea* (Drury)	Deciduous	Southern Ontario	Generally low numbers prevailed. Pockets of medium and occassionly heavy localized infestations occurred in many areas, primarily on black ash.
Flood damage	Conifers	Central Region	A high incidence of damage was reported in low-lying areas of Bancroft and Parry Sound districts.
Frost	Conifers, deciduous	Province-wide	Reports were recieved from numerous areas. While the proportion of trees affected was often high, the foliar damage was generally light.
Gall rust *Gymnosporangium cornutum* Arthur ex Kern	Mountain ash	Nipigon District	Heavy infections of this rust turned foliage a brillant orange color at many points along Lake Superior.
Greenstriped mapleworm *Dryocampa rubicunda rubicunda* (F.)	Red maple	Central Region	The heaviest damage occurred in Broder Township, Sudbury District, where 80% of the trees averaged 60% defoliation. Damage was also reported in other areas near the city of Sudbury, in MacBeth Township, North Bay District and in Maria Township, Pembroke District.
Hail damage	Balsam fir, white spruce	Thunder Bay District	An area of 5 570 ha was severely damaged in the Mott Lake-Keelor Lake area.
Ink spot of aspen *Ciborinia whetzelii* (Seaver) Seaver	Trembling aspen	Northern Ontario	Small pockets of intense foliar damage (30-80%) were recorded at locations near Ouimet Canyon, McTavish Township, Thunder Bay District; in Villeneuve and Curtis townships, Sault Ste. Marie District; and in Waldie Township, Sudbury District. Several areas of similar damage also occurred in the Timmins, Kirkland Lake and Temagami districts.
Introduced pine sawfly *Diprion similis* (Htg.)	White pine	Parry Sound District	Moderate to severe defoliation, often very heavy as it affected both new and old foliage, was reported on shoreline trees along the coast and on the islands of Georgian Bay in Carling, Cowper and Conger townships.
Jack pine needle blight *Hendersonia pinicola* Wehm.	Jack pine	Geraldton District	Aerial surveys disclosed pockets of heavy defoliation, up to 90%, in a 200-ha area of trees west of Nakina.

Ontario (Continued)

Insect, disease or damage	Host(s)	Location	Remarks
Jack pine resin midge *Cecidomyia resinicola* (O.S.)	Jack pine	Dryden District	Heavy infestations recurred on roadside trees along Highway 17 between English River and Ignace. Branch tip mortality of 100% was common.
Larch casebearer *Coleophora laricella* (Hbn.)	Tamarack	Kemptville District	The largest area, 81 ha of defoliation (90%), occurred in Marlborough Township. Smaller stands in the surrounding area were similarily infested.
	Tamarack	Pembroke and Tweed districts	There were several small areas of usually moderate defoliation recorded.
	European larch	Aylmer, Maple and Midhurst districts	Moderate to severe defoliation occurred in numerous areas, generally in small plantations.
	Japanese larch	Kemptville District	Moderate damage occurred at the Tree Seed Production Area, Marlborough Township.
Large aspen tortrix *Choristoneura conflictana* (Wlk.)	Trembling aspen	Northeast Region	An area totaling 40 305 ha was infested in the eastern part of the Wawa District and the adjoining Chapleau District.
		Nipigon District	Defoliation occurred over a 4 100 ha area in the Gull Bay area on the west side of Lake Nipigon.
		Southern Region	Pockets totaling 19 ha were infested in Essa and Tiny townships, Midhurst District and a total of 260 ha was infested in Gloucester Township, Kemptville District.
Larger boxelder leafroller *Archips negundana* (Dyar)	Manitoba maple	Northwest Region	Severely defoliated ornamentals in the towns of Sioux Lookout, Ear Falls, Kenora, Fort Frances, Dryden and Thunder Bay.
Leaf blight *Marssonina tremulae* (Lib.) Kleb.	Largetooth aspen	Midhurst District	Caused 60-90% defoliation of scattered host trees in Lindsay Township.
	Carolina poplar	Kemptville District	Foliar damage from 10-75% was recorded in stool beds at G. Howard Ferguson Forest Tree Nursery.
Leaf blister *Taphrina caerulescens* (Desm. & Mont.) Tul.	Red oak	Maple District	Infecting 20% of seedlings in one compartment at the Orono Tree Nursery.
		North Bay District	Foliar damage as high as 75% occurred on open-grown ornamentals in the city of North Bay.

Ontario (Continued)

Insect, disease or damage	Host(s)	Location	Remarks
Leaf scorch	Sugar maple	North Bay District	Defoliation averaged 70% on 30% of the host in a 3-ha stand in Nipissing Township.
	Sugar maple Red maple	Southern Region	Widespread but generally light damage occurred in the Aylmer and Cambridge districts.
Leaf spot *Marssonina betulae* (Lib.) Magn.	White birch	Northwest Region	An increased incidence was noted in the Nipigon and Geraldton districts where infection levels of 50-75% were recorded.
Maple trumpet skeletonizer *Epinotia aceriella* (Clem.)	Sugar maple	Southern Region	Low populations occurred in many stands. A small heavy infestation caused 75% defoliation of fringe trees in Clark Township, Maple District.
Mountain ash sawfly *Pristiphora geniculata* (Htg.)	Mountain ash	Northern Ontario	There were areas of high populations in Sudbury District, moderate in Kirkland Lake and Temagami districts and low in Fort Frances and Thunder Bay districts.
Needle cast *Cyclaneusma minus* (Butin) DiCosmo	Scots pine	Thunder Bay District	There were scattered pockets of severe damage in a Christmas tree plantation in McIntyre Township. Defolation ranged from 10 to 80% and averaged 60%.
Northern pine weevil *Pissodes approximatus* Hopk.	Red pine	Sudbury District	Caused 60% mortality on 1.4-m trees in a 0.5-ha area, Tehkummah Township.
	White pine	Southern Ontario	Infested 2% of 1.5-m trees in the Mattawan Township seed orchard, North Bay District and 1% of 5-m trees over a 10 ha area in Egremont Township, Midhurst District.
Northern pitch twig moth *Petrova albicapitana* (Bsk.)	Jack pine	Northern Ontario	Light infestations were reported in several young plantations in Timmins, Temagami, Thunder Bay and Sudbury districts.
Oak leafshredder *Croesia semipurpurana* (Kft.)	Red oak	Central Region	Caused light and occassionally moderate foliar damage of individual trees at locations in Pembroke and Sault Ste. Marie districts.
Oak skeletonizer *Bucculatrix ainsliella* Murt.	Red oak	Southern Region	Light infestations occurred in numerous stands in Midhurst, Maple and Kemptville districts.
Pine flower sawfly *Xyela minor* Nort.	White pine	Pembroke District	A heavy infestation occurred on 7-m trees in Horton Township.

Ontario (Continued)

Insect, disease or damage	Host(s)	Location	Remarks
Pine needle rust *Coleosporium asterum* (Dietel) Syd. & P. Syd.	Jack pine	Province-wide	There were numerous reports, usually with very low damage. Exceptions occurred in Rowell Township, Dryden District; near Shebandowan, Thunder Bay District; and in Mountain Township, Kemptville District where foliar damage ranged as high as 30%.
Pine tip moth *Rhyacionia adana* Heinr.	Jack pine	Kirkland Lake District	Low populations were collected at young plantations in Evelyn Township, Timmins District and in Firstbrook Township, Temagami District.
Pitted ambrosia beetle *Corthylus punctatissimus* Zimm.	Sugar maple, maple	Midhurst	Light mortality (1-5%) of understory regeneration was reported from a few stands in Kemptville, Sault Ste. Marie, Parry Sound and North Bay districts. A high of 20% mortality occurred in Chisholm Township, North Bay District.
Poplar flea beetle *Altica populi* Brown	Balsam poplar	Central Region	Heavy infestations caused severe browning of foliage throughout most of Parry Sound, Pembroke and Bancroft districts. Sporadic damage occurred in the North Bay District.
		Southern Region	Scattered stands were heavily damaged in Tweed and Kemptville districts.
Redheaded jack pine sawfly *Neodiprion virginana* Roh. (complex)	Jack pine	Northwest Region	Light defoliation was reported along the Graham Road, Thunder Bay District and the Sturgeon Bay Road, Nipigon District.
		Parry Sound District	Foliar loss of 60% occurred on 8-m open-grown trees in Carling Township.
Red pine cone beetle *Conophthorus resinosae* Hopk.	Jack pine	Northern Ontario	Low populations were reported in Hearst, Geraldton, Nipigon, Kirkland Lake and Temagami districts. Highest count was in Stoddart Township, Hearst District where 16% of 2.7-m trees were affected.
Red pine sawfly *Neodiprion nanulus nanulus* Schedl.	Red pine	Central Region	In the Bancroft, Pembroke and Sudbury districts the number of trees affected ranged from 10 to 55% with accompanying defoliation ranging from 10 to 45%.
Salt damage	White pine	Province-wide	Notable areas of damage occurred along Highway 11, North Bay District and along Highway 24, Aylmer District.

Ontario (Continued)

Insect, disease or damage	Host(s)	Location	Remarks
Satin moth *Leucoma salicis* (L.)	Poplars	Southern Ontario	High populations recurred on Canadian Forces Base Borden, Midhurst District for the third consecutive year. Aerial control for gypsy moth reduced numbers but severe defoliation was reported on 2 ha of untreated trembling aspen and on some scattered Carolina poplar. There were a few locations with severe damage in the Kemptville and Tweed districts.
Sawyer beetles *Monochamus* spp.	Jack pine	Red Lake District	Adult feeding caused noticeable mortality along road rights of way and along the fringes of cutover areas in the North and Nungesser roads areas.
Shoot blight *Sirococcus conigenus* (DC.) Cannon & Minter	Red pine	Sault Ste. Marie District, Lake Superior	Caused an average of 24% shoot mortality on 70% of the 2.4-m trees at Agawa Bay, Lake Superior Provincial Park.
Shoot blight of aspen *Venturia macularis* (Fr: Fr.) E. Mueller & Arx	Trembling aspen	Northwest Region	Infection levels ranged from 75 to 100% in areas of regeneration in the Dryden, Sioux Lookout and Thunder Bay districts.
Snowstorm damage	All species	Northeast Region	Heavy early snowfalls in October of 1992 caused widespread damage in the form of permanently bent and snapped- off trees along with severe branch breakage. It was most evident along stand edges, in the Chapleau, Kirkland Lake and Timmins disticts.
Spider mite *Oligonychus* sp.	Red pine	Maple District	Low populations were reported and controlled in three compartments at the Orono Forest Tree Nursery.
Spongy root rot *Perenniporia subacida* (Peck) Donk	Silver maple	Aylmer District	Associated with declining trees in a mixed maple-walnut plantation, Parkhill Conservation Area, McGillivray Township.
Spruce budmoths *Zeiraphera* spp.	White spruce	Central Region	Small pockets of heavy infestation occurred at locations in Sault Ste. Marie, Sudbury and North Bay districts.
Spruce spider mite *Oligonychus ununguis* (Jac.)	Tamarack	Kemptville District	Foliar damage ranged from 20 to 75% on 4-6 m trees at plantations in Edwardsburgh Township.
Striped alder sawfly *Hemichroa crocea* (Geoff.)	White birch	Geraldton District	Caused 60% defoliation of 10-m trees at the Geraldton OMNR fire base.
Swaine jack pine sawfly *Neodiprion swainei* Midd.	Jack pine	Temagami District	An infestation on Island No. 127 in Lake Temagami increased from light to heavy this year.

Ontario (Continued)

Insect, disease or damage	Host(s)	Location	Remarks
Sweetfern blister rust *Cronartium comptoniae* Arthur	Jack pine	Sault Ste. Marie District	Main stem cankers were found on 13% of the semimature trees in Rioux Township.
Tar spot needle cast *Davisomycella ampla* (J.J. Davis) Darker	Jack pine	Northern Ontario	There was a widespread occurrence at plantations across the north, with incidence ranging as high as 60% and foliar damage of up to 40%.
Walnut caterpillar *Datana integerrima* G.& R.	Black walnut	Tweed District	Low populations resulted in 5-15% defoliation on 17.5-m trees in Pittsburgh Township.
		Aylmer District	Moderate to severe damage on a few young trees in Point Pelee National Park.
Western gall rust *Endocronartium harknessii* (J.P. Moore) Y. Hirat.	Jack pine	Province-wide	Widespread incidence was recorded. The highest occurred on regeneration severely galled trees ranging from 3.3 to 4%.
White pine cone beetle *Conophthorus coniperda* (Schw.)	White pine	Sault Ste. Marie District	Heavy infestations caused premature cone drop in the Blind River area.
White pine needle midge *Resseliella pinifoliae* (Felt)	White pine	Southern Ontario	Caused 70-80% foliar loss on young (5-6-m) trees in Pembroke District and on mature trees in Canisbay Township, Algonquin Park District. Foliar damage of 60% occurred in Laxton Township, Bancroft District and 40% in Puslinch Township, Cambridge District.
Willow flea weevil *Rhynchaenus rufipes* (LeC.)	Willow	Central Region	The area of heavy defoliation recurred in the City of Sudbury area and expanded to other areas of the Sudbury and North Bay districts.
Winter drying	Conifers	Province-wide	There were numerous reports of damage. The highest level was at a 5-ha white pine plantation near the Luther Marsh, Cambridge District. Foliar damage averaged 85% on 100% of the trees.

Northwest

Insect, disease or damage	Host(s)	Location	Remarks
American aspen beetle *Gonioctena americana* (Schaeff.)	Aspen	Alberta	Observed defoliating aspen in the southern foothills.
Aphids *Chaitophorus populifolii neglectus* (Hottes & Frison) *Pterocomma bicolor* (Oestlund)	Aspen	Alberta	High populations of these aphids caused severe damage in many areas of Calgary.
Armillaria root rot *Armillaria ostoyae* (Romagn.) Herink	Pine species	Alberta, Saskatchewan	Infection centers found throughout most of the region.
Ash borer *Podosesia syringae* (Harr.)	Ash	Saskatchewan	Injury noted on ornamentals in Saskatoon.
Aspen leaf beetle *Chrysomela crotchi* Brown	Aspen	Saskatchewan, Manitoba	Found defoliating aspen regeneration in northeastern Saskatchewan. Also found in Spruce Woods Provincial Forest in Manitoba.
Aspen mortality	Aspen	Alberta, Saskatchewan	Mortality resulting from drought and past insect defoliation observed throughout Athabasca and Lac La Biche forests in Alberta and throughout north-central Saskatchewan.
Aspen serpentine leafminer *Phyllocnistis populiella* (Cham.)	Aspen	Northwest Territories	Observed low population densities near Fort Liard.
Atropellis canker *Atropellis piniphila* (Weir) Lohman & Cash	Pine	Alberta	Commonly found on lodgepole pine near Rocky Mountain House.
Balsam fir mortality	Balsam fir	Alberta	Observed in Slave Lake, Athabasca, Lac La Biche, Whitecourt, and Grande Prairie forests.
Bark beetles *Pityophthorus* sp.	Jack pine	Saskatchewan	Found attacking jack pine regeneration that had been girdled by hares.
Birch leafminers: *Fenusa pusilla* (Lep.) *Profenusa thomsoni* (Konow) *Heterarthrus nemoratus* (Fall.)	Birch	Alberta, Manitoba	Leaf mining occurred throughout north-central Alberta and most urban areas. Also prevalent in Manitoba.
Birch skeletonizer *Bucculatrix canadensisella* Cham.	White birch	Alberta	Moderate to severe injury noted in the Fox Creek and Whitecourt area. Light injury noted near Swan Hills.
Climatic damage	Lodgepole pine, alpine larch	Alberta	Sunscald damage noted on lodgepole pine near Grande Cache. Alpine larch cones damaged by late frosts between Coleman and Canmore.

Insect, disease or damage	Host(s)	Location	Remarks
Conifer–aspen rust *Melampsora medusae* Thuemen	Aspen	Alberta	Trees south of Longview were moderately to severely infected with this disease.
Cytospora canker *Leucostoma kunzei* var. *piceae* (Fr.) Munk	Blue spruce, white spruce	Manitoba	Damage observed on spruce shelterbelts.
Diplodia tip blight *Sphaeropsis sapinea* (Fr.) Dyko & Sutton	Red pine	Manitoba	Prevalent in southeastern Manitoba. Caused cankers on the stems.
Dothiorella wilt *Dothiorella ulmi* Verrall & May	American elm	Alberta	Crown wilt and defoliation occurred on one tree in Edmonton.
Eastern larch beetle *Dendroctonus simplex* LeC.	Tamarack	Saskatchewan	Found attacking tamarack trees that had been defoliated by spruce budworm near Red Earth. Scattered patches over 10 km^2.
European fruit lecanium *Parthenolecanium corni* (Bouché)	Green ash, elm	Alberta	Severe outbreak in some parts of Edmonton, especially near the university.
Gall-forming mites and midges *Aceria dispar* (Nal.) *Cecidomyia* sp.	Aspen	Alberta	Found causing damage to regenerating aspen near Peace River.
Hemlock looper *Lambdina f. fiscellaria* (Gn.)	Conifers	Saskatchewan	Moths captured in spruce budworm pheromone traps in the Big River area.
Ink spot of aspen *Ciborinia whetzelii* (Seaver) Seaver	Aspen	Alberta	Patches of aspen severely defoliated in the Bow-Crow Forest near Highwood River.
Larch sawfly *Pristiphora erichsonii* (Htg.)	Tamarack	Alberta, Northwest Territories	Defoliation ranged from light to moderate in tamarack stands along the Slave River in northern Alberta and the NWT.
Large-spored spruce Labrador tea rust *Chrysomyxa ledicola* Lagerh.	Spruce	Alberta, Saskatchewan	Observed in northeastern Alberta near Fort McMurray and southwest of Rocky Mountain House. Also found north of Hudson Bay, Saskatchewan.
Linden looper *Erannis tiliaria tiliaria* (Harr.)	Hardwoods	Alberta	Light, light to moderate, and moderate defoliation on hazelnut and other hardwoods south of Grande Prairie.
Linospora leaf blight *Linospora tetraspora* G. Thompson	Aspen	Manitoba	Found throughout the southern range of balsam poplar in Manitoba.
Lodgepole pine beetle *Dendroctonus murrayanae* Hopk.	Lodgepole pine	Alberta	Several infested trees found in Jasper National Park.

Insect, disease or damage	Host(s)	Location	Remarks
Lodgepole pine dwarf mistletoe *Arceuthobium americanum* Nutt. ex Engelm.	Pine	Alberta, Saskatchewan, Manitoba	Important cause of degradation and mortality in commercial pine stands in the Northwest Region.
Lodgepole terminal weevil *Pissodes terminalis* Hopping	Jack pine, lodgepole pine	Alberta, Saskatchewan	Jack pine regeneration (about 2 m tall) infested in central Saskatchewan. Common on lodgepole pine (2–7 m tall) near Hinton, Alberta, and on jack pine near The Pas, Manitoba.
Marssonina leaf spot *Marssonina tremuloides* Kleb.	Aspen	Alberta	Severe infestation at Belly River campground in Waterton Lakes National Park.
Northern pitch twig moth *Petrova albicapitana* (Bsk.)	Pine	Alberta	High population observed attacking pine regeneration in Whitecourt Forest and in Rocky-Clearwater Forest.
Pine engraver *Ips pini* (Say)	Tamarack, jack pine	Saskatchewan	Found attacking tamarack weakened by spruce budworm defoliation and on weakened jack pine near Prince Albert.
Pine needle casts: *Davisomycella ampla* (J.J. Davis) Darker *Elytroderma deformans* (Weir) Darker *Lophodermella concolor* (Dearn.) Darker	Lodgepole pine	Alberta	Needle casts observed in the Rocky Mountain national parks and in Edson, Rocky-Clearwater, and Bow-Crow forests.
Poplar-and-willow borer *Cryptorhynchus lapathi* (L.)	Poplar	Alberta	Found for the first time in St. Albert, near Redwater, and Edmonton.
Ragged sprucegall adelgid *Pineus similis* (Gill.)	Spruce	Alberta	In Banff and Jasper national parks near Saskatchewan River Crossing.
Salt damage	Jack pine	Northwest Territories	Several patches of dead or dying jack pine regeneration were found along Highway 5 east of Hay River killed by accidental deposits of road salt.
Septoria leaf spot *Mycosphaerella populicola* G. Thompson	Aspen	Alberta	Moderate infestation observed in Waterton Lakes National Park.
Snow mold *Herpotrichia* sp.	Alpine fir, spruce	Alberta	Common at high elevations in Waterton Lakes National Park.
Snowshoe hare *Lepus americanus* Erxleben	Jack pine, white spruce	Saskatchewan	Severe tree mortality noted in jack pine and white spruce regeneration southeast of Hudson Bay in the Porcupine Hills.
Spruce cone axis midge *Kaltenbachiola rachiphaga* (Tripp)	White spruce	Alberta	Found feeding in spruce cones collected for seed from Lac La Biche and Peace River forests.

Insect, disease or damage	Host(s)	Location	Remarks
Spruce cone maggot *Strobilomyia neanthracina* Michelsen	White spruce	Alberta	Found feeding in spruce cones collected for seed from Lac La Biche and Peace River forests.
Spruce cone rust *Chrysomyxa pirolata* Winter	White spruce	Alberta	Severely infested cones noted in William A. Switzer Provincial Park.
Spruce gall adelgids *Adelges cooleyi* (Gill.) *A. lariciatus* (Patch) *A. strobilobius* (Kltb.)	Spruce	Alberta Saskatchewan	All three adelgids commonly observed throughout northern and western Alberta and northwestern Saskatchewan.
Spruce seed chalcid *Megastigmus atedius* Walker	White spruce	Alberta	Found feeding in white spruce cones collected for seed from Lac La Biche and Peace River forests.
Spruce seed moth *Cydia strobilella* (L.)	White spruce	Alberta	Found feeding in white spruce cones collected near Jasper National Park.
Spruce spider mite *Oligonychus ununguis* (Jac.)	Spruce	Alberta	Severe damage occurred in Edmonton and in rural shelterbelts throughout the Northwest Region.
Stalactiform blister rust *Cronartium coleosporioides* Arthur	Lodgepole pine	Alberta	High incidence of this disease in Banff and Jasper national parks.
Striped ambrosia beetle *Trypodendron lineatum* (Oliv.)	Aspen	Saskatchewan	Found as a secondary pest attacking dead or dying aspen succumbing to drought in eastern Saskatchewan.
Sulphur dioxide damage (SO_2)	Aspen	Alberta	Light damage attributed to SO_2 noted on aspen west of High Level near Zama Lake.
Venturia leaf and shoot blight *Venturia macularis* (Fr.: Fr.) E. Mueller & Arx	Aspen	Alberta	Infestations of this blight were observed in aspen regeneration in southern Alberta in the foothills and near Peace River.
Warren's rootcollar weevil *Hylobius warreni* Wood	Jack pine, lodgepole pine	Alberta, Manitoba	Mortality caused by *H. warreni* noted generally throughout the Northwest Region. Severe damage noted near The Pas in northern Manitoba.
Western gall rust *Endocronartium harknessii* (J.P. Moore) Y. Hirat.	Pine	Alberta, Saskatchewan, Manitoba	Common on pines throughout the Northwest Region.
Wetwood or slime flux	Elm	Manitoba	Numerous reports of this symptom (caused by a bacterium) received from landowners in Manitoba.
White pine weevil *Pissodes strobi* (Peck)	Spruce	Alberta, Saskatchewan, Manitoba	Commonly found on roadside trees and plantations throughout the north-central region of Alberta and Saskatchewan, and Manitoba.
Willow leafminer *Micrurapteryx salicifoliella* (Cham.)	Willow	Alberta	Severe damage observed from Alberta – NWT border to just north of High Level.

Pacific and Yukon

Insect, disease or damage	Host(s)	Location	Remarks
A balsam shootboring sawfly *Pleroneura* sp.	Grand fir Alpine fir	Creston, Vancouver Region, Nelway, Christina Lake	Endemic following damage in 1991 and 1992. Common in new shoots in mainland areas; highest in Manning Park. Endemic at Summs Creek.
A balsam twig aphid *Mindarus* sp.	Amabilis fir, grand fir, alpine fir	Vancouver Region, Okanagan Valley	Endemic after 1989. Collapsed after light damage to trees at scattered locations in 1992.
A bud midge *Dasineura* sp.	Black cottonwood	Vancouver Region	Five to ten percent of buds killed on plantation and natural regeneration trees along Fraser River for seventh year.
A bud necrosis *Dichomera gemmicola* Funk & Sutton	Douglas-fir	North Thompson River Valley	Severe on regeneration at scattered locations.
A cypress tip moth *Argyresthia* sp.	Ornamental cypress, juniper and cypress	Victoria	Foliage lightly discolored with some branch tips killed; slightly less than in previous six years.
Adelgids:			
Adelges cooleyi (Gill.)	Douglas-fir, Engelmann & white spruce	All regions	Discoloration on Douglas-fir, galls on spruce, common; minimal impact.
	Douglas-fir, Sitka spruce	Queen Charlotte Islands	
Adelges tsugae Ann.	Western hemlock	Vancouver Region, Terrace	High populations in seed orchards; common in natural stands.
Pineus coloradensis (Gill.)	Lodgepole pine	Burns Lake	Increased; common on young pine trees.
Pineus spp.	Engelmann, Sitka and white spruce	Kamloops, Nelson, Prince George, Prince Rupert regions	Infested tips on most trees; common in most areas; minimal impact.
A dieback fungus *Apostrasseria* sp.	Pacific yew	Pemberton	New host record.
A gall miner *Dioryctria* sp.	Lodgepole pine	Merritt	Common in rust galls at Stirling Creek.
Alder flea beetle *Altica ambiens* LeC.	Alder	North Thompson River Valley	Collapsed after severe defoliation in 1992.
Alder woolly sawfly *Eriocampa ovata* (L.)	Alder	Vancouver Region Prince Rupert Revelstoke	Light defoliation in sawfly patches for third year. Severe in single patch. Moderate defoliation; first record in interior.

Pacific and Yukon (Continued)

Insect, disease or damage	Host(s)	Location	Remarks
A leaf beetle *Chrysomela* sp.	Black cottonwood	Osoyoos	Increased light cottonwood defoliation in Inkaneep Park.
Ambrosia beetles *Gnathotrichus* spp. *Trypodendron* spp.	Douglas-fir, lodgepole pine, hemlock	Kamloops, Nelson, Prince Rupert and Western Vancouver regions	Common in bark beetle-attacked trees and log and decks.
A needle midge *Contarinia pseudotsugae* Condrashoff	Douglas-fir	Little Fort	Increased severe discoloration, with needle loss on regeneration.
An elm leafminer *Agromyza aristata* Malloch	Elm	Prince George	Foliage lightly infested for seventh consecutive year on city boulevards.
An oak leaf phylloxeran *Phylloxera* sp. nr. *glabra* (Heyden)	Garry oak	Greater Victoria, Gulf Islands, Sumas, Comox, Kelowna	Severe discoloration and premature leaf drop on 10% of trees. First record of tree mortality. New distribution record. Low populations.
Anthracnose *Discula umbrinella* (Berk. & Br.) Sutton	Red oak	Vancouver	New host record.
Apple-and-thorn skeletonizer *Choreutis pariana* (Cl.)	Apple	West Kootenay	Endemic: declined from light skeletonizing at scattered locations last year.
Apple ermine moth *Yponomeuta malinella* Zell.	Apple, crabapple	Vancouver Region	Fewer colonies and less widespread, causing very little damage.
A saprophyte *Endothiella aggregata* Funk	Whitebark pine	Kootenay Lake	New host record.
Atropellis cankers *Atropellis pinicola* Zeller & Good. *A. piniphila* (Weir) Lohman & Cash	Lodgepole pine	All regions	Stem infections common in dense stands; up to 5% of the trees killed.
		Prince Rupert Region	Branch infections in scattered patches.
A twig beetle *Pityophthorus* sp.	Lodgepole pine	Burns Lake	Endemic in trees girdled by hares in 1992.
	Ponderosa pine	Okanagan Mountain Park	Severe tip flagging on open growing trees.
A twig borer *Pityophthorus orarius* Bright	Douglas-fir	Shuswap	Collapsed after tips killed on trees in Adams River drainage in 1992.
A wilt disease *Fusarium* sp.	Lombardy poplar	Masset, Queen Charlotte Islands	New host record.

Insect, disease or damage	Host(s)	Location	Remarks
Balsam woolly adelgid *Adelges piceae* (Ratz.)	Amabilis fir, grand fir	Vancouver Region	New distribution near Spuzzum and Campbell River outside the quarantine zone. Significant growth impact on regeneration within the zone on Vancouver Island near Port Alberni.
Bark beetles:			
An alpine fir bark beetle *Pityokteines* sp.	Alpine fir	Kamloops Region	Associated with mortality of 10% of trees in young stands at McPhail Creek.
A spruce bark beetle *Dryocoetes affaber* (Mann.)	White spruce	Dease Lake	Tree mortality and topkill of trees in small patch.
Douglas-fir engraver *Scolytus unispinosus* LeC.	Douglas-fir	Hedley	Endemic at Johns Creek, were common in 1992.
Fir engraver *S. ventralis* LeC.	Amabilis fir	Vancouver Region	Common at scattered sites in north shore drainages.
Fir root bark beetle *Pseudohylesinus granulatus* (LeC.)	Amabilis fir	Vancouver Region	Populations common in weakened trees at scattered locations.
Hylurgops rugipennis (Mannerheim)	Lodgepole pine	Prince Rupert Region	Declined; in trees predisposed by root diseases and/or mountain pine beetle.
Pine engraver *Ips pini* (Say)	Lodgepole pine	Cariboo, Kamloops and Nelson regions	Common in trees killed by mountain pine beetle and near edges of cutblocks.
Ips tridens (Mannerheim)	White spruce	Babine Lake	Endemic: declined from 1992 when common in trees killed by *D. rufipennis.*
Red turpentine beetle *Dendroctonus valens* LeC.	Ponderosa pine	Canal Flats to Fort Steele, West Kootenay, Okanagan Valley	Killed up to 30 trees in each of 170 patches in spaced, snow-damaged, and drought-stressed stands.
Scierus annectens LeC.	Spruce	Kispiox River	Endemic; declined from 1992 when common in spruce blowdown.
Western pine beetle *Dendroctronus brevicomis* LeC.	Ponderosa pine	West Kootenay Kamloops Region	In trees killed by *D. valens* in southwestern areas. Tree mortality on 300 ha mostly in Okanagan Valley.
Birch leafminers:			
Fenusa pusilla (Lep.)	White birch	Prince Rupert and Vancouver regions	Forty percent of foliage discolored on trees at Smithers; moderate discoloration from Yale to Vancouver.

Insect, disease or damage	Host(s)	Location	Remarks
Lyonetia sp.	White birch	Prince Rupert and Nelson regions	Light to severe defoliation over 5 000 ha in Iskut Valley, and in northwestern part of the Nelson Region.
	Willow	Atlin	Widespread skeletonizing.
L. speculella Clemens	White birch	Adams Lake	Increased; 25% defoliation in scattered stands.
Ambermarked *Profenusa thomsoni* (Konow)	White birch	Quesnel, Hazelton, Terrace	Light and moderate discoloration of trees along roadsides, in city areas and in natural stands.
		Hope, Chilliwack	Collapsed following defoliation in 1992.
		West Kootenay	Severe discoloration.
Brown felt blight *Herpotrichia* sp.	Engelman spruce, alpine fir	Nelson Region	Common on young trees in high-elevation natural stands.
Cherry ermine moth *Yponemeuta padella* (L.)	Mountain ash, cherry, plum, hawthorn	Victoria, Delta	Increased; numerous tents and moderate defoliation of numerous trees.
Conifer weevils:			
Conifer seedling weevil *Steremnius carinatus* (Boh.)	Sitka spruce	Queen Charlotte Islands	Declined to endemic at a few sites.
Magdalis sp.	Lodgepole pine	Chilcotin, 100 Mile House	Thirty percent defoliation on 20% of trees.
Dime canker *Durandiella pseudotsugae* Funk	Douglas-fir	West Kootenay	Widespread on immature trees but little impact on tree growth.
Dogwood leaf blight *Discula destructiva* Redlin	Dogwood	Vancouver Region	Common on lower mainland and eastern Vancouver Island with branch mortality and occassionally trees killed.
Douglas-fir beetle *Dendroctonus pseudotsugae* Hopk.	Douglas-fir	Cariboo, Kamloops, Nelson, Prince George, and Vancouver regions	Trees killed over more than 6 000 ha; usually predisposed by maturity, root disease, and recent droughts.
Dwarf mistletoes:			
Arceuthobium americanum Nutt. ex Engelm.	Lodgepole pine	Cariboo, Nelson, Kamloops regions	Severe brooming causing increment loss.
A. douglasii Engelm.	Douglas-fir	West Kootenay	Severe brooming in patches in southwest.

Insect, disease or damage	Host(s)	Location	Remarks
A. laricis (Piper) St. John	Western larch	Nelson Region, St. John	Widespread.
A. tsugense (Rosendahl) G.N. Jones	Western hemlock	Prince Rupert and Vancouver regions	Widespread in coastal areas.
Elm leaf beetle *Pyrrhalta luteola* (Müll.)	Elm	Okanagan Valley	Light and moderate defoliation in parks and boulevards for fourth year.
European alder leafminer *Fenusa dohrnii* (Tisch.)	Alder	Hazelton	Endemic; declined from 80% of foliage on most trees infested in 1992.
European fruit fly *Parthenolecanium corni* (Bouché)	Maple	Terrace	Severe infestation on urban trees.
European leafroller *Archips rosana* (L.)	Willow	Lillooet Carpenter Lake	Moderate defoliation of roadside trees.
Fall webworm *Hyphantria cunea* (Drury)	Deciduous trees and shrubs	Kamloops, Vancouver and Nelson regions	Common, widespread light to severe defoliation and numerous webs.
Fir coneworm *Dioryctria abietivorella* (Grt.)	Douglas-fir	Surrey, Sechelt	Partial girdling at base of terminal leaders on few immature trees and in grafting scars in seed orchard trees.
		East Kootenay	Common in Christmas trees.
	Lodgepole pine	Ootsa Lake	Branch tips killed on trees in plantation.
Gray spruce looper *Caripeta divisata* Wlk.	Western hemlock	West Kootenay	Endemic since collapse in 1992; killed trees salvaged over 400 ha.
Green larch looper *Semiothisa sexmaculata* (Pack.)	Western larch	West Kootenay	Endemic; collapsed in 1991 following defoliation over 12 000 ha in 1990, the first year of defoliation.
Greenstriped forest looper *Melanolophia imitata* (Wlk.)	Douglas-fir	Kamloops and Vancouver regions	Endemic; larvae common in collections but no defoliation.
Jumping gall wasp *Neuroterus saltatorius* (Edwards)	Garry oak	Saanich-Sooke, Victoria-Sidney, Duncan, Nanaimo	Severe discoloration and premature leaf fall; increased for eighth year.
Larch casebearer *Coleophora laricella* (Hbn.)	Western larch	Nelson Region	Increased populations in East Kootenay; light discoloration over 1 260 ha near Creston.
		Kamloops Region	Light discoloration in small patches.
Larch sawfly *Pristiphora erichsonii* (Htg.)	Tamarack	Prince Rupert, Yukon Territory	Trace to light defoliation near Yukon border, and in patches along Robert Campbell Highway, north of Watson Lake.
	Western larch	Vancouver Region	Severe defoliation of small groups of trees at UBC Research Forest.

Pacific and Yukon (Continued)

Insect, disease or damage	Host(s)	Location	Remarks
Larch shoot pest *Argyresthia columbia* Freeman	Western larch	Columbia Lake	Five percent of miner terminals and 10% of tree laterals killed, 30% with multiple leaders in young stands. Fourth year of damage.
Large aspen tortrix *Choristoneura conflictana* (Wlk.)	Trembling aspen	Yukon Territory	Severe defoliation over 3 000 ha, down threefold, Carcross to Jakes Corner.
		Prince George Region	Defoliation over 3 000 ha north of Mackenzie for fifth year; near Vanderhoof on 3 000 ha.
Leaf beetles:			
Alder flea beetle *Altica ambiens* LeC.	Alder	Prince Rupert Region	New on 400 ha north of Kitwanga.
		Kitwanga	Severe defoliation on 400 ha.
Chrysomela sp.	Black cottonwood, alder	Babine Lake	Endemic; down from common on most trees in 1992.
Pacific willow leaf beetle *Pyrrhalta decora carbo* (LeC.)	Willow	Prince Rupert Region	Moderate to severe defoliation in patches from Kitwanga to Cranberry Junction.
Leaf blights:			
Ciborinia whetzelii (Seaver) Seaver	Trembling aspen	South Okanagan	Declined to endemic, from common in widespread patches in 1992.
Colletotrichum gloeosporioides (Penz.) Penz. & Sacc.	Giant sequoia	Courtenay	New host record.
Discula umbrinella (Berk. & Br.) Sutton	Garry oak	Victoria	New host record.
Drepanopeziza populorum (Desm.) Hoehnel	Hybrid poplar	Harrison Mills	Light infection in plantations.
Glomerella cingulata (Stonem.) Spaulding & Shrenk.	Pacific yew	Port Hardy	New host record.
Linospora tetraspora G. Thompson	Black cottonwood	Skeena River Valley	Blotches on some foliage on most trees in the area for second year.
Mycosphaerella populicola G. Thompson	Black cottonwood	Skeena River	Foliage discolored on planted trees for second year.
	Hybrid poplars	Hazelton	Increased, widespread foliar discoloration.
		Harrison Mills	Light to moderate infections in plantations.

Insect, disease or damage	Host(s)	Location	Remarks
M. tassiana (De Not.) Johans.	Black cottonwood	Terrace	New host record.
Passalora alni (Chupp & Greene) Deighton	Alder	Fraser Canyon	Common.
Phaeoramularia maculicola (Romn. & Sacc.) Sutton	Black cottonwood	Houston	Common.
Phloeosporella padi (Lib.) Arx	Cherry	Vancouver Region (Sunshine Coast to Hope)	Common and widespread moderate discoloration, shot-holes and leaf drop.
Phoma glomerata (Corda) Wollenweb. & Hochapf.	Silverberry	100 Mile House	New host record.
Rhytisma punctatum (Pers.:Fr.) Fr.	Big leaf maple	Fraser Valley, Sunshine Coast	Common tar spot fungus.
Scirrhia conigena (Peck) Barr	Lawson cypress	Duncan	New record.
	Juniper	Alexis Creek	New record.
Septoria alnifolia E. & E.	Alder	Texada Island	Common; light spots only.
	Mountain alder	Hazelton	New host record.
Taphrina populina Fries	Black cottonwood	Powell River	Common on most trees in plantation.
Venturia populina (Vuill.) Fabric.	Lombardy poplar	Campbell River	New host.
Leaf blotch miners: *Phyllonorycter populiella* (Cham.)	Trembling aspen	Babine Lake	Twenty percent of foliae infested on all trees in area.
Zeugophora sp.	Black cottonwood	Babine Lake	Endemic; declined from common on most trees in 1992.
	Hybrid poplars	Herrling Island near Chilliwack	Planted trees lightly discolored.
Leafrollers: *Epinotia* sp. *Pseudexentera oregonana* (Wlsm.)	Trempling aspen	Golden, Bull River	Decreased in area but still moderate to severe defoliation over 465 ha.
Leaf rust *Melampsora hypericorum* G. Wint.		St. Johns, Victoria	New record.
Lodgepole terminal weevil *Pissodes terminalis* Hopping	Lodgepole pine	Cariboo, Prince George, Prince Rupert, Kamloops, Nelson regions, Yukon Territory	Common in most immature stands but usually in less than 10% of the trees.

Insect, disease or damage	Host(s)	Location	Remarks
Maple leaf scorch	Maple, bigleaf	Vancouver Region	Severe foliar browning (unknown cause)
Midges:			
Cecidomyia sp.	Black cottonwood	Babine River	Target-like galls again common.
Gouty pitch midge *Cecidomyia piniinopis* O.S.	Lodgepole pine	Summerland	Endemic; down from 20% of roadside trees affected in 1992.
Rhabdophaga sp.	Willow	Babine Lake	Stems on roadside trees again heavily galled.
Mites:			
Alder gall mite *Phytoptus laevis* (M.)	Alder	Cedric Creek	Common on foliage for second year.
Eriophyes parapopuli Kiefer	Trembling aspen	Watson Lake, Takhini Hot Springs	Light damage on most for second year.
Phytoptus lionotus (M.)	White birch	Moricetown	Common on leaves on all trees for second year.
Trisetacus chamaecypari Smith	Yellow cedar	Vancouver Region	Common in seed orchards and on ornamentals on southern Vancouver Island.
Yew big mud mite *Cecidophyopsis psilapsis* (Nalepa)	Western yew	Vancouver Region	Buds infested on most trees in coastal areas since first found on southern Vancouver Island in 1991.
Mourningcloak butterfly *Nymphalis antiopa* (L.)	Willow	Okanagan Lake	Declined to endemic after light defoliation of roadside trees in 1992.
Needle blights:			
Didymascella thujina (Durand) Maire	Western red cedar	Nelson, Prince Rupert and Vancouver regions	Light to moderate discoloration throughout host range.
Hypodermella laricis Tub.	Western larch	Kamloops and Nelson regions	Moderate discoloration in patches throughout host range; 420 ha in Okanagan Valley.
Leptomelanconium allescheri (Schnabl) Petrak	Whitebark pine	Hedley	Needle dieback on 50% of the trees at Mt. Riordan.
Lirula macrospora (Hartig) Darker	Sitka spruce	Queen Charlotte Islands	Light discoloration of needles at scattered sites.
Lirula sp.	White spruce	Hazelton	50% of year-old needles infected in plantation.

Insect, disease or damage	Host(s)	Location	Remarks
Lophodermium decorum Darker	Amabilis fir	Pemberton	New host record.
L. piceae (Fuckel) Hoehnel	Alpine fir	Smithers	Sixty percent of needles discolored on understory trees.
L. seditiosum Minter, Staley and Millar	Lodgepole pine	Vancouver mainland, Skagit Valley	Common on regeneration.
Mycosphaerella pini Rostr. Munk (=*Scirrhia pini* Funk & Parker)	Western white pine, lodgepole pine	British Columbia	Endemic; no significant discoloration.
Phaeoseptoria contortae Parmelee & Y. Hirat.	Ponderosa pine Lodgepole pine	Osoyoos Houston	New host record. Thirty percent of needles killed in mid- and upper crowns over 100 ha.
Needle casts:			
Elytroderma deformans (Weir) Darker	Ponderosa pine	Southern B.C.	Common and widespread; perennial infections on many trees.
	Lodgepole pine	Clinton	Endemic; foliage not significantly affected.
Hendersonia pinicola Wehm.	Ponderosa pine	Duncan	New host record in association with *L. concolor*.
Lophodermella concolor (Dearn.) Darker	Lodgepole pine	Cariboo, Kamloops, Nelson, Prince Rupert, Vancouver regions and southern Yukon Territory	Widespread, severe discoloration of needles in most regions.
	Ponderosa pine	Clinton	New host record.
Lophodermium piceae (Fuckel) Hoehnel	Alpine fir	Terrace	New host record at Khyex River.
Meria laricis Vuill.	Western larch	Kamloops Region	Endemic.
Rhabdocline pseudotsugae Sydow	Douglas-fir	Nelson Region	Severe needle loss over 19 000 ha in east Kootenay.
Needle diseases:			
Hendersonia pinicola Wehm.	Lodgepole pine	Kamloops, Nelson, Vancouver, Prince Rupert regions, Yukon Territory	Common on year-old needles on natural and plantation trees infected by Lophodermella needle cast.
Phaeocryptopus gaeumannii (Rohde) Petrak	Douglas-fir	Adams River	Declined from light discoloration on 20% of trees in 1992.
		Sayward	Common; light infection in lower crowns of second growth.

Insect, disease or damage	Host(s)	Location	Remarks
P. nudus (Peck) Petrak	Amabilis fir	North Vancouver	Light to severe needle discoloration on most trees for second year.
Phaeoseptoria contortae Parmelee & Y. Hirat.	Lodgepole pine	Okanagan Valley	Endemic; less common on older needles near Blue Lake than in 1992.
Needle rusts:			
Conifer-aspen rust *Melampsora medusae* Thuemen	Douglas-fir	Cariboo Region	Up to 70% of new needles discolored on 50% of trees in patches, worst at Voght Creek.
Conifer-cottonwood rust *Melampsora occidentalis* Jacks.	Douglas-fir	Cariboo Region	Endemic; down from moderate discoloration on new shoots in Chilcotin in 1992.
Fir-fireweed rust *Pucciniastrum epilobii* Otth.	Alpine fir	Cariboo, Prince George, Nelson, Prince Rupert, Kamloops regions	Common; 50% of new needles on 30-60% of trees discolored in patches.
P. goeppertianum (Kuehn) Kleb.	Alpine fir	North Thompson	Moderate infection of foliage on 30% of trees in patches.
Large-spored spruce Labrador tea rust *Chrysomyxa ledicola* Lagerh.	Sitka spruce	Smithers	Declined to endemic.
	Engelmann spruce	Babine Lake	Endemic; down from severe in patches in 1992.
	Sitka Spruce	Port Hardy	Severe infection of all regenerations over 25 ha at Waukwaas Creek.
Spruce broom rust *Chrysomyxa arctostaphyli* Diet.	Engelmann spruce, white spruce	Nelson, Prince George, Prince Rupert regions, Yukon Territory	Common; perennial brooms cause growth loss.
Western pine-aster rust *Coleosporium asterum* (Dietel) Syd. & P. Syd.	Lodgepole pine	Lytton	Twenty-five percent of needles infected on rust pine; 80% of immature trees at George Creek.
Northern lodgepole needleminer *Coleotechnites starki* (Freeman)	Lodgepole pine	Ootsa Lake	Declined to trace to light pine defoliation in second year.
Pine butterfly *Neophasia menapia* (F. & F.)	Ponderosa pine	Pritchard, Okanagan Valley	Endemic; no adults seen.
Pine needle scale *Chionaspis pinifoliae* (Fitch)	Douglas-fir	Clinton	Common; 30% of foliage on 5% of trees infected.

Insect, disease or damage	Host(s)	Location	Remarks
Pine needle sheathminer *Zelleria haimbachi* Bsk.	Lodgepole pine	Vavenby, Monte Lake, East Kootenay	Collapsed; down from defoliation on 8 250 ha in 1992.
	Ponderosa pine	Okanagan Valley	Collapsed at Blue Lake.
Pine shoot beetle *Tomicus piniperda* (L.)	Pines	Pacific and Yukon regions	Negative in surveys initiated in 1992, following recent findings in the USA, Lake States.
Pine stem rusts:			
Cronartium coleosporioides Arthur	Lodgepole pine	Cariboo, Prince Rupert, Prince George, Nelson regions	Cankers common in western and southern parts of Cariboo Region; widespread in eastern part of Prince Rupert Region; common elsewhere.
C. comandrae Peck	Lodgepole pine	Prince George, Prince Rupert regions	Cankers common in scattered stands.
White pine blister rust *C. ribicola* J.C. Fischer	Western white pine	Kamloops and Nelson regions	Branch and stem cankers and tree mortality common throughout the host range.
		Queen Charlotte City	All the introduced trees in a provenance trial were eliminated following discovery of the infection in 1992.
	Whitebark pine	Cariboo, Kamloops, Prince Rupert regions	Stem cankers common on high-elevation trees.
Poplar borer *Saperda calcarata* Say	Aspen, cottonwood	Cariboo, Kamloops regions	Up to 20% of trees in widespread patches killed or with stem breakage.
Poplar shoot blights:			
Venturia macularis (Fr.: Fr.) E. Mueller & Arx	Trembling aspen	Prince Rupert, Kamloops regions	Widespread severe discoloration of new shoots; common, light infections.
Venturia populina (Vuill.) Fabric.	Black cottonwood	Prince Rupert Region	Endemic; down from light infections in the west for two years.
Poplar-and-willow borer *Cryptorhynchus lapathi* (L.)	Willow, poplar, birch, black cottonwood	Prince Rupert, Cariboo, Nelson, Prince George regions	Common; numerous shoots and stems killed, many in poplar plantations.
Root and heart rot diseases:			
Annosus root rot *Heterobasidion annosum* (Fr.) Bref.	Ponderosa pine	Naramata	New host record.

Pacific and Yukon (Continued)

Insect, disease or damage	Host(s)	Location	Remarks
Armillaria root rot *Armillaria ostoyae* (Romagn.) Herink	Douglas-fir, lodgepole, ponderosa pine, western larch, white pine *P. strobiformis*	British Columbia Southwestern Nelson	Found in all age classes of most conifer stands. Tree mortality most common at immature stands in coastal areas and stands of all ages in the interior. New host record.
Blackstain root disease *Leptographium wageneri* (Kendr.) Wingf.	Lodgepole pine, Douglas-fir	East Kootenay, Kamloops Region	New infection centers near Kimberley; patches of diseased trees in North Thompson River Valley.
Hypoxylon fuscum (Pers.: Fr.) Fr.	Balsam poplar	Chetwynd	New host record.
Phellinus weirii (Murr.) Gilbn.	Douglas-fir	Hedley	Common; pockets of 4-5 infected trees in 30-80 -year old stands.
Red ring rot *Phellinus pini* (Thore:Fr.) A. Ames	Western hemlock	Prince Rupert Region	Common in old growth in western part of the region.
Tomentosus root rot *Inonotus tomentosus* (Fr.: Fr.) S. Teng	Engelmann spruce	Barriere Prince George,	Widely scattered foci.
	White spruce	Nelson Region	Widespread in mature stands; 59% of mature trees at higher elevations infected.
Yellow-brown stringy heart rot *Echinodontium tinctorium* (E. & E.) E. & E.	Western hemlock	Prince Rupert Region	Common in old-growth trees in western part of the Region.
Rough bark *Didymosphaeria oregonensis* Goodding	Red alder	Skeena River Valley	Stem cankers throughout, particularly at Salvus Creek.
Rusty tussock moth *Orgyia antiqua badia* Hy. Edw.	White spruce, alpine fir, lodgepole pine, alder, Douglas-fir	Prince George, Cariboo regions	Outbreak collapsed following defoliation of over 13 000 ha in 1992.
		Frasey Valley	Endemic; declined from low numbers in 1992.
Satin moth *Leucoma salicis* (L.)	Trembling aspen	Kamloops and Nelson regions	Declining populations with light defoliation in 9 patches over 250 ha in Kamloops Region. Increased to 2 650 ha near Golden and 250 ha in southwestern part of Nelson Region.
Sawflies:			
Neodiprion spp.	Western hemlock	Queen Charlotte Islands,	Endemic.
		Revelstoke	Populations collapsed following increase in 1991.
Yellowheaded spruce sawfly *Pikonema alaskensis* (Roh.)	Ornamental spruce	Castlegar, Terrace	Moderate defoliation in urban areas, for third year.

Insect, disease or damage	Host(s)	Location	Remarks
Scleroderris canker *Gremmeniella abietina* (Lagerb.) Morelet	Lodgepole, ponderosa pines	All regions	Detected in native pines in British Columbia only at four locations in 1970s but not since.
Silverspotted tiger moth *Lophocampa argentata* (Pack.)	Douglas-fir	Vancouver Region	Colonies numerous, particularly on southern Vancouver Island.
Sphinx moth *Hyles galli* (Rottemburg)	Fireweed	Prince Rupert Region	Endemic; down from light defoliation in 1992 in eastern part of the region.
Spruce aphid *Elatobium abietinum* (Wlk.)	Sitka spruce	Vancouver Region, Queen Charlotte Islands	Common on east coastal Vancouver Island, but down on Queen Charlotte Islands because of previous cold winter.
	Ornamental spruce	Vancouver	Common in urban areas, but less severe than in 1992.
	White spruce	Bell-Irving River	All new tips infected on all plantation trees.
Spruce budmoth *Zeiraphera* sp.	White spruce, Sitka spruce	Prince Rupert, Queen Charlotte Islands	Common in new shoots.
Striped alder sawfly *Hemichroa crocea* (Geoff.)	Alder	Skeena River	Declined at Hellsgate Slough from moderate defoliation in 1992.
Tip blights:			
Delphinella sp.	Alpine fir	Bush and Blaeberry river valleys	Endemic: down from tips killed on 50-70% of trees over 600 ha in 1992.
Sclerophoma pithyophila (Corda) Hoehnel	Lodgepole pine	Ootsa Lake	Endemic where shoots infected last year.
Uglynest caterpillar *Archips cerasivorana* (Fitch)	Trembling aspen, Chokecherry	Chetwynd Adams River	Declined along Hart Hwy. Increased light defoliation.
Warren's rootcollar weevil *Hylobius warreni* Wood	Lodgepole pine	Interior regions, central part of Prince Rupert Region	Common in natural stands and plantations; usually less than 1% mortality annually.
Western balsam bark beetle *Dryocoetes confusus* Swaine	Alpine fir	British Columbia	Common; mortality of mature high-elevation trees in widespread patches.

Insect, disease or damage	Host(s)	Location	Remarks
Western blackheaded budworm *Acleris gloverana* (Wlsm.)	Western hemlock	Vancouver and Queen Charlotte Islands, Nelson Kamloops	Endemic since collapse in 1989-90; topkill and tree mortality still evident. Increased light defoliation at Kootenay Lake; common with hemlock looper north of Golden.
	Alpine fir	Yukon Territory	Trace defoliation at Haines Road, near B.C. border.
Western conifer seed bug *Leptoglossus occidentalis* Heid.	Douglas-fir, western red cedar, lodgepole pine	West Kootenay	High numbers for 2nd year; nuisance in urban areas.
Western false looper *Nepytia freemani* Mun.	Douglas-fir, hemlock	Kamloops Region	Light defoliation on 40 ha at Mara Hill associated with tussock moth and western spruce budworm.
Western gall rust *Endocronartium harknessii* (J.P. Moore) Y. Hirat.	Lodgepole pine	British Columbia	Common throughout host range on branches and stems; tree mortality generally less than 1%.
Western pine moth *Dioryctria cambiicola* (Dyar)	Ponderosa pine	Okanagan Falls	Up to 30% of shoots on young trees infested in two stands at McIntyre Bluff.
Winter moth *Operophtera brumata* (L.)	Garry oak, birch, fruit and ornamental trees	Vancouver, lower Fraser Valley	Increased trace and light defoliation.
Yew blight *Dothiora taxicola* (Peck) Barr	Pacific yew	West Kootenay, Squamish River	Endemic; less common than in eastern Cariboo during 1992.
Yew shoot and leaf blight *Discochora philoprina* (Berk. & Curt.) Bisset	Pacific yew	Fraser Canyon	Common on dead twigs and branches.

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