

Forest Insect and Disease Conditions in Canada

1995



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Forest Insect and Disease Conditions in Canada

1995

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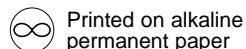
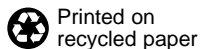
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Introduction

This report is the last in a series produced by the Forest Insect and Disease Survey (FIDS), a former nationally coordinated program that was implemented by the Canadian Forest Service (CFS). Historically, FIDS provided an annual overview of the extent and effects of insects, diseases, and abiotic factors on Canada's forests to forest managers, quarantine agencies, researchers, educators, nongovernment organizations, and the public. FIDS was established in eastern Canada in 1936 when scientists began assessments of an outbreak of the European spruce sawfly (*Gilpinia hercyniae* [Hartig]) which was damaging spruce forests. These insect specialists combined with the existing Forest Disease Survey unit in 1951 to form the Forest Insect and Disease Survey. More recently, the scope and orientation of FIDS evolved into the Forest Health Network (FHN) of the CFS.

The most important native insects infesting Canadian forests include the eastern spruce budworm (*Choristoneura fumiferana* [Clemens]), the forest tent caterpillar (*Malacosoma disstria* [Hbn.]), and bark beetles (Scolytidae [Partim]). Introduced insects including the balsam woolly adelgid (*Adelges piceae* [Ratz.]) on balsam fir (*Abies balsamea* [L.]), the beech scale (*Cryptococcus fagisuga* Lind.) on American beech (*Fagus grandifolia* Ehrh.), and the European gypsy moth (*Lymantria dispar* [L.]) on many hardwood species have also caused extensive damage. The introduced Dutch elm disease (*Ophiostoma ulmi* [Buisman] Nannf.) has also devastated populations of white elm (*Ulmus americana* L.). The white pine blister rust (*Cronartium ribicola* J.C. Fischer) has caused so much damage to eastern white pine (*Pinus strobus* L.) that it is now difficult to manage this species as a timber tree. Introduced organisms are often more damaging than native ones because of the absence of natural biological agents that limit growth of their populations.

The recently established FHN within the Canadian Forest Service has a lead role for reporting on major disturbances of forest ecosystems in Canada. Monitoring and research programs conducted by the FHN will be carried out in close collaboration with the provincial governments, industry, and nongovernment agencies. The FHN recognizes the need to maintain a capacity for extensive and intensive monitoring, methods development, and related research activities. National reports will be prepared periodically to describe the condition of Canada's forests and to help formulate policy for the sustainable management of forest resources. Beginning in 1998, a forest health assessment report will produce a national perspective on the health of Canada's forests through analyses of key stressors and ecological interactions of the forested ecozones of Canada.

In this final FIDS report the major insect pests are described first, then the most important diseases are described.

Abiotic stresses are discussed next. Abiotic stresses are commonly weather related and may include frost, drought, and windstorm damage. Surveys of forest health by the Acid Rain National Early Warning System (ARNEWS) and the North American Maple Project (NAMP) follow.

The appendix, "Other Insects, Diseases, and Damage," consists of summary tables of pests, diseases, and other effects that usually do not have widespread effects, but are important because of their potential for expansion, considerations of quarantine, and their possible role as vectors and indicators of other problems. Insects and diseases are listed alphabetically by their scientific name. (There is no report for the Maritimes Region in the appendix.)

The Select Bibliography consists of forest health-related articles, information reports, and presentations by CFS personnel. More detailed information on these and other pests and conditions can be obtained from CFS headquarters or regional establishments.

This report uses the terms trace, light, moderate, and severe defoliation to describe the effects of pests on forests. Trace indicates less than 5% defoliation, light 6–29%, moderate 30–69%, and severe greater than 70%.

Current nomenclature for pests is used. The taxonomy of species changes occasionally and old names persist, so an effort is made to communicate clearly to the reader and to respect taxonomic revisions.

The impact of insects on forest ecosystems is described as the area of forest within which there is moderate to severe defoliation or areas within which trees are killed by bark beetles. Growth loss begins to occur when defoliation levels approach 30% and varies over time, sometimes resulting in tree mortality. The degree of impact varies with forest type and the patterns of insect damage. Where damage is caused by bark beetles, the area within which there are beetle-killed trees and the numbers of trees or volumes of timber killed are reported.

Various levels of defoliation occur within infested areas. A forested area may be defoliated by more than one insect, and this may result in overlap in the reported figures. The area of defoliation reported may include small nonforested areas, roads, cultivated areas, lakes, burned areas, or unproductive forest. Areas reported as defoliated may include small patches not defoliated. Areas of forest defoliated by spruce budworm often contain other tree species that may not have been defoliated. For example, a forested area may contain trembling aspen (*Populus tremuloides* Michx.) defoliated by forest tent caterpillar, jack pine (*Pinus banksiana* Lamb.) defoliated by the jack pine budworm (*Choristoneura pinus pinus* Free.), and areas of balsam fir (*Abies balsamea* [L.]) defoliated by the spruce budworm.

Tree Diseases of Eastern Canada, Forest Insect Pests in Canada, and Common Tree Diseases of British Columbia

Table 1. Selected major pests—area of moderate to severe defoliation in 1995 (000 ha).

Province or Territory	Eastern spruce budworm	Jack pine budworm	Hemlock looper	Forest tent caterpillar
Newfoundland	0.0	0.0	22.8	0.0
Nova Scotia	0.0	0.0	trace	10.0
New Brunswick	4.3	0.0	0.0	435.0
Prince Edward Island	trace	0.0	0.0	0.0
Quebec	4.4	1.2	0.6	1.0
Ontario	3451.1	293.3	0.6	243.0
Manitoba	55.6	0.0	0.0	0.2
Saskatchewan	98.9	0.0	0.0	105.0
Alberta	203.7	0.0	0.0	222.0
British Columbia	27.0 ^a	0.0	0.0	102.0
Northwest Territories	36.8	0.0	0.0	22.7
Total	3881.8	294.5	24.0	1140.9

^aIncludes two-year-cycle budworm (*Choristoneura biennis* Freeman).

along with previous CFS publications describe the major diseases and insects affecting Canadian forests. They are identification aids with color photographs and detailed descriptions of the organisms.

The areas defoliated are mapped by CFS or its provincial and industrial cooperators. CFS acknowledges the field and laboratory staff of CFS establishments, officers of provincial and federal governments and agencies, the forest industry, and private individuals.

In 1995, various pests defoliated extensive areas of Canadian forests (Table 1). The greatest area of defoliation was caused by the eastern spruce budworm with the bulk of it occurring in Ontario. Levels of defoliation remain low in eastern Canada, but defoliation of hardwoods, particularly in western Canada, is increasing.

Major Insects and Diseases in Canadian Forests

This section contains descriptions of major species of insects and diseases currently damaging forests. The control measures and monitoring programs are described for the area over which damage occurs. These insects may have a national impact, like the eastern spruce budworm (*Choristoneura fumiferana* [Clemens]), or a regional impact, like the two-year-cycle budworm (*C. biennis* Freeman). Most of these organisms are causing widespread damage or have the potential to do so. Organisms with a more localized impact are listed in the appendix.

Major Insects

Eastern Spruce Budworm (*Choristoneura fumiferana* [Clemens])

The eastern spruce budworm continues to infest the spruce–fir forests across Canada. This insect defoliates primarily balsam fir (*Abies balsamea* [L.]) but also attacks white spruce (*Picea glauca* [Moench] Voss), red spruce (*P. rubens* Sarg.), and occasionally other conifers. Outbreaks are greatest in mature to overmature forests and usually after several years of warm dry spring weather. Extensive areas can be defoliated with consequent widespread growth loss and mortality. Growth of balsam fir begins to be affected once defoliation reaches about 30% of the foliage, and mortality often results after 4–5 years of moderate to severe defoliation. Outbreaks tend to be cyclical and for the past few years defoliation has been declining.

Populations of the eastern spruce budworm remained at low levels throughout much of eastern Canada in 1995 with limited defoliation east of Ontario (Table 2). Slight increases were recorded in New Brunswick and western Quebec. In most of Quebec, eastern spruce budworm populations persisted at endemic levels. Defoliation levels declined in Ontario by about 20% from 1994. Some regional increases in defoliation levels occurred in the northwestern part of the province but this was offset by substantial declines in the areas of Lake Nipigon and Thunder Bay districts. New pockets of defoliation were observed in northeastern Ontario and in southern Ontario in areas around Kemptville and Bancroft.

Table 2. Area of moderate to severe defoliation caused by the eastern spruce budworm, *Choristoneura fumiferana* (Clemens), 1991–95 (000 ha).

Province or Territory	1991	1992	1993	1994	1995
Newfoundland	2.3	1.9	0.0	0.0	0.0
Nova Scotia	0.0	0.0	0.0	0.0	0.0
New Brunswick	266.0	84.3	0.0	0.0	4.3
Prince Edward Island	0.1	35.0	33.8	2.5	0.0
Quebec	290.0	20.7	0.4	2.0	4.4
Ontario	9 066.0	9 595.8	8 991.2	4 266.7	3 451.1
Manitoba	30.0	26.3	13.8	48.5	56.0
Saskatchewan	16.0	87.0	22.6	52.3	98.9
Alberta	141.0	34.2	46.5	173.7	203.7
Northwest Territories	130.0	80.0	53.6	370.3	36.8
British Columbia	245.0	139.0	170.0	173.4	27.0
Total	10 186.4	10 104.2	9 331.9	5 089.4	3 882.2

The area of moderate to severe defoliation increased substantially in the Prairie provinces. Forests of balsam fir, white spruce, and mixed stands were all defoliated. In Manitoba, where eastern spruce budworm infestations began in 1979, reduced growth and mortality are evident. Most of the infestation occurred east of Lake Winnipeg. In Saskatchewan, infestations have continued in the same areas since 1993. Some areas have been defoliated for 8 consecutive years and caused considerable mortality of white spruce.

In Alberta, major infestations occurred in the northwestern portion of the province near the Chinchaga and Hay rivers and in the east-central portion of the province southwest of Fort McMurray. Small infestations were found along the Red Deer and North Saskatchewan rivers. The outbreak in Wood Buffalo National Park decreased from 46 975 ha in 1994 to 695 ha of moderate defoliation in 1995.

In the Northwest Territories, populations of eastern spruce budworm dropped significantly in 1995. While the insect was still widespread throughout white spruce forests, the area of defoliation decreased to 36 822 from 370 270 ha in 1994.

In British Columbia, the area of moderate to severe defoliation decreased from 173 400 ha in 1994 to 27 000 ha in 1995. The infestation occurred in 203 locations scattered in northwestern British Columbia. This is the lowest level of eastern spruce budworm activity recorded in over 10 years.

Limited control operations were undertaken in 1995 reflecting the generally low and decreasing levels of infestation. Some aerial spraying was done to protect foliage. Salvage logging was carried out to harvest insect-killed wood before

deterioration. Aerial spray operations in New Brunswick, Saskatchewan, and Alberta were carried out to protect foliage and reduce the intensity of outbreaks.

Large-scale operational spray programs of previous decades are now replaced by small research spray programs, or limited sprays for foliage protection in areas of high population. The pesticide used mostly is Bt, *Bacillus thuringiensis* Berliner and its varieties, with occasional use of Fenitrothion. Use of the latter is being discontinued.

An important part of the management strategy to cope with the budworm consists of population monitoring to assess current and predict future population levels. This enables managers to plan cost-effective protection measures.

Results of pheromone trapping and L2 surveys indicated populations will remain at low levels throughout much of eastern Canada in 1996. Continued damage can be expected in southeastern Prince Edward Island and in small patches in western Quebec. Surveys in New Brunswick identified potential areas of moderate to high infestation in the northwestern part of the province, and several low infestations were identified in central and northern New Brunswick. In Ontario, populations in northwestern Ontario may decline in 1996, but the area of mortality will probably increase. Results from surveys in the Prairie provinces indicate that budworm infestations will either stabilize or increase in 1996. No population monitoring activities were undertaken in the Northwest Territories in 1995. In British Columbia, defoliation is forecast to decline in 1996 based on the reduced numbers of egg masses on spruce foliage.

Western Spruce Budworm (*Choristoneura occidentalis* Freeman)

The western spruce budworm is a widely distributed and destructive defoliator of coniferous forests in western North America. Despite its common name, the budworm feeds primarily on Douglas-fir (*Pseudotsuga menziesii* [Mirb.] Franco var. *menziesii*). Other budworms currently active in fir–spruce stands in British Columbia include the eastern spruce budworm (*C. fumiferana* [Clemens]), in northeastern British Columbia, and the two-year-cycle budworm (*C. biennis* Freeman), 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, top-kill with resulting defects, and tree mortality. From analysis of 64 long-term study plots in stands monitored in the dry interior since 1986, about 13% (0–94%) of the open growing Douglas-fir have died.

Western spruce budworm populations virtually collapsed across the province to the lowest level in the last 20 years. After a major reduction in 1994, populations continued to decline, causing mostly light defoliation on 2000 ha in 27 scattered infestations.

An experimental trial with *Bacillus thuringiensis* var. *kurstaki* was carried out against western spruce budworm. Dipel 76AF at 60 BIU/ha in 3.0 L/ha, Dipel 48 AF at 50 BIU/ha in 3.9 L/ha, and Foray 48B at 60 BIU/ha in 4.8 L/ha were applied. The higher dose and volume of Foray was necessary in the more mountainous terrain, taller trees, and larger mass of foliage of trees in British Columbia.

Three plots were treated with synthetic pheromone in a trial to disrupt mating. The saturated polyvinyl chloride beads were applied by helicopter in early July. Preliminary results of data on male trapping indicate that a reduction of 80–95% was achieved, suggesting that this may be an operational technique for managing populations.

Western spruce budworm pheromone trapping using 0.03% aldehyde pheromone was carried out. An average 90 moths per trap were obtained, a slight increase from 1994 indicating little projected change in population levels. Thus, populations of western spruce budworm are expected to remain below outbreak levels during 1996.

Two-Year-Cycle Budworm (*Choristoneura biennis* Freeman)

Subalpine fir (*Abies lasiocarpa* [Hook.] Nutt.) and white spruce (*Picea glauca* [Moench] Voss) were defoliated over more than 70 000 ha in 106 infestations by the two-year-cycle budworm. Moderate to severe defoliation occurred over 60 000 ha north of Fort St. James, British Columbia. Damage also occurred near Williston Lake, British Columbia. In 1994,

over 200 000 ha of budworm damage occurred in central British Columbia.

Jack Pine Budworm (*Choristoneura pinus pinus* Freeman)

The jack pine budworm is a close relative of the eastern spruce budworm and is widespread in central and western Canada. It defoliates jack pine (*Pinus banksiana* Lamb.) causing growth losses and occasional mortality. Outbreaks have declined in western Canada with no defoliation since the collapse of the population in the late 1980s.

The budworm caused no damage east of Quebec, and only localized infestations were detected in western Quebec. In Ontario, the population of jack pine budworm which had increased steadily for 4 years, declined in 1995 (Table 3). The area of moderate to severe defoliation was 293 292 ha, and the intensity of defoliation also diminished with most of the defoliation moderate rather than severe. Most of the decline occurred in north-central Ontario.

No control operations were conducted for the budworm in 1995. For Ontario, infestations are expected to remain stable or decline slightly in 1996. In western Canada populations are anticipated to remain low.

Eastern Blackheaded Budworm (*Acleris variana* [Fern.])

The blackheaded budworm is a common pest in Newfoundland and defoliates trees by causing damage to the current year needles mostly in the upper portion of the crowns. Population levels were high in 1995, and the area of infestation increased to 1420 ha of which 470 ha were moderately to severely defoliated. Infestations are expected to increase in 1996 resulting in additional mortality and growth loss.

In northern New Brunswick, the budworm defoliated about 1900 ha in 1995. This is the first known outbreak of the insect in New Brunswick since the late 1940s when it defoliated balsam fir (*Abies balsamea* [L.] Mill.) across northern New Brunswick and Cape Breton, Nova Scotia. Defoliation

Table 3. Area of moderate to severe defoliation caused by the jack pine budworm, *Choristoneura pinus pinus* (Freeman), 1991–95 (000 ha).

Province	1991	1992	1993	1994	1995
Quebec	0.0	0.6	0.2	0.3	1.2
Ontario	133.6	158.7	282.2	419.3	293.3
Manitoba	0.0	0.0	0.0	0.0	0.0
Saskatchewan	0.0	0.0	0.0	0.0	0.0
Alberta	0.0	0.0	0.0	0.0	0.0
Total	133.6	159.3	282.4	419.6	294.5

in New Brunswick occurred in several areas but was only at light and moderate levels.

In Ontario, the insect defoliated eastern hemlock (*Tsuga canadensis* [L.] Carrière) near North Bay. In Alberta and Saskatchewan, white spruce (*Picea glauca* [Moench] Voss) was damaged at light levels in several small infestations.

Eastern Hemlock Looper (*Lambdina fiscellaria fiscellaria* Guen.)

The eastern hemlock looper is a major defoliator of conifer forests in eastern Canada. The insect feeds on new and old foliage and can defoliate the entire tree in 1 year leading to extensive mortality. In this respect, it is a more damaging insect than spruce budworm which usually takes several years to kill trees. Control methods have centered on chemical sprays and the use of Bt. The area damaged by the eastern hemlock looper has greatly decreased since 1992 (Table 4) except in Newfoundland.

Table 4. Area of moderate to severe defoliation caused by the eastern hemlock looper, *Lambdina fiscellaria fiscellaria* Guen., 1991–95 (000 ha).

Province	1991	1992	1993	1994	1995
Newfoundland	4.0	9.8	4.4	11.4	21.6
Nova Scotia	0.0	3.6	0.0	0.0	0.10
New Brunswick	0.0	1.5	0.0	0.0	0.0
Quebec	0.0	1.1	0.4	0.4	0.6
Ontario	0.0	0.0	0.0	1.1	1.0
Total	4.0	16.0	4.8	12.9	23.3

The eastern hemlock looper was the major cause of forest depletion in Newfoundland and Labrador from 1988 to 1995. During the previous 5-year period, losses from mortality were estimated at 3 299 000 m³, and from growth loss an additional 343 200 m³. Approximately 353 000 m³ was salvaged. In 1995, the overall area of moderate and severe defoliation was 24 000 ha (Table 4). Infestations of the eastern hemlock looper continued to increase in distribution and severity in 1995 throughout Newfoundland. A total of 22 800 ha were moderately to severely defoliated. The infestations were concentrated in western Newfoundland.

Population levels were low in New Brunswick and in Nova Scotia in 1995. Moderate to severe infestations were minimal.

In Quebec, localized infestations occurred along the north shore of the St. Lawrence River and in the Abitibi–Témiscamingue region. In Ontario, the total area of moderate to severe defoliation was 645 ha and occurred on eastern hemlock (*Tsuga canadensis* [L.] Carrière), balsam fir (*Abies balsamea* [L.] Mill.), and eastern white-cedar (*Thuja occidentalis* L.) in several areas in southeastern Ontario.

No control operations were carried out for this insect in 1995. The 1995 monitoring surveys predicted a population increase in 1996 in eastern Nova Scotia. Samples were collected from 191 locations with 55 sites being in the high or extreme category.

Forest Tent Caterpillar (*Malacosoma disstria* Hubner)

The forest tent caterpillar has historically caused extensive defoliation of hardwoods throughout Canada except in Newfoundland, Prince Edward Island, and the Yukon (Table 5). The effect is mainly growth losses, but mortality may occur after prolonged defoliation. It is one of the major stresses

Table 5. Area of moderate to severe defoliation caused by the forest tent caterpillar, *Malacosoma disstria* Hubner, 1991–95 (000 ha).

Province	1991	1992	1993	1994	1995
Nova Scotia	0.0	0.0	0.0	0.0	9.6
New Brunswick	2.9	77.5	196.0	392.0	435.0
Quebec	50.0	37.0	39.9	3.7	1.0
Ontario	18 870.0	16 051.4	656.3	166.1	243.1
Manitoba	58.1	51.2	3.6	4.5	0.2
Saskatchewan	0.0	0.0	0.0	23.1	105.0
Alberta	129.9	0.0	19.0	102.1	222.0
British Columbia	131.0	47.3	86.0	93.6	102.0 ^a
Total	19 241.9	16 264.4	1 000.8	785.1	1 117.9

^aIn addition, aspen was also defoliated over 137 500 ha by the northern tent caterpillar (*M. californicum pluviale* [Dyar]), the satin moth (*Leucoma salicis* [L.]), and the large aspen tortrix (*Choristoneura confictana* [Wlk.]).

on aspens, contributing to declines of this species in western Canada. During the past few years, large areas of defoliation have occurred in Ontario, where, in 1992, over 16 million ha of moderate to severe defoliation took place.

In 1995, forest tent caterpillar was the major hardwood defoliator in the Maritimes for the fifth consecutive year. In New Brunswick, the area of moderate to severe defoliation on trembling aspen (*Populus tremuloides* Michx.) and other hardwoods was 435 000 ha, a large increase over previous years (Table 5). In Nova Scotia, limited defoliation occurred in the western part of the province. No defoliation was observed on Prince Edward Island.

In Quebec, most of the areas infested since 1988 declined except for some areas on the south shore of the St. Lawrence River. Defoliation occurred on trembling aspen (*P. tremuloides* Michx.), largetooth aspen (*P. grandidentata* Michx.), and gray birch (*Betula populifolia* Marsh.). In Ontario, the area of moderate to severe defoliation increased to 243 125 ha in 1995. Infestations persisted south of Cochrane and Hearst where moderate to severe defoliation occurred. Several small pockets of moderate to severe defoliation covering 1338 ha were surveyed in eastern Ontario.

In Manitoba, infestations collapsed with the area of defoliation covering only 163 ha at moderate levels. In Saskatchewan, the forest tent caterpillar infestation increased considerably over 1994 levels to 105 049 ha. In Alberta, the number of defoliated areas also increased substantially and the area of moderate to severe defoliation doubled over 1994 levels.

In British Columbia, trembling aspen (*P. tremuloides* Michx.) was defoliated over 102 000 ha in the north-central part of the province. The northern tent caterpillar (*Malacosoma californicum pluviale* [Dyar]) also defoliated red alder (*Alnus rubra* Bong.) in central Vancouver Island for the third consecutive year and increased elsewhere in eastern Vancouver Island and west of Prince Rupert. Moderate to severe levels of defoliation occurred over 137 500 ha in 1994.

No control measures were used against the forest tent caterpillar in 1995. Monitoring of population levels from Nova Scotia to Ontario indicate that defoliation levels in 1996 would be at similar or lower levels than 1995. Mostly light defoliation is expected in Manitoba; in Alberta and Saskatchewan, defoliation is predicted to be light with scattered pockets of moderate and severe defoliation. Defoliation of trembling aspen, black cottonwood (*P. trichocarpa* Torr. & A. Gray), and other deciduous trees and shrubs is forecast to continue in British Columbia in 1996 in most of the recently infested stands.

Spruce Beetle (*Dendroctonus rufipennis* [Kirby])

Spruce beetle causes considerable damage to white spruce (*Picea glauca* [Moench] Voss) and red spruce (*P. rubens* Sarg.),

particularly old trees. Control measures are mostly establishment of trap trees and salvage logging of damaged stands.

Small pockets of white spruce were killed by spruce beetles in western Newfoundland. In the Maritimes, infestations of spruce beetle increased in northwestern New Brunswick and Nova Scotia, but remained low in Prince Edward Island. It occurs throughout the Maritimes, except the Saint John River Valley. In Nova Scotia, the spruce beetle infestations continued to intensify and appeared in new areas of the province in 273 locations. Mortality occurred over 4470 ha with affected areas ranging from a few trees to over 300 ha throughout the province. Mortality was particularly noticeable in areas of pure stands of older white spruce.

In Quebec, a new outbreak occurred on white spruce at Bonaventure on the Gaspé Peninsula. No damage from the insect was observed in Ontario.

Spruce beetle infestations in Alberta were observed for the first time in several years in white spruce. Patches of scattered dead trees occurred on 23 771 ha, in addition to the infestation of 13 655 ha reported in 1994 in Wood Buffalo National Park.

In British Columbia and the Yukon, the area of mature white and Engelmann spruce (*P. engelmannii* Parry ex Engelm.) killed by spruce beetle remained at approximately 105 000 ha in 900 infestations. Although the total area of damage was similar to that in 1994, the infestations occurred in more northerly areas in 1995. The area of damage in the Yukon in 1995 was 47 000 ha.

The province of Alberta manages the pest primarily by salvage logging. During the winter of 1994–95, 14 781 m³ of white spruce were salvage logged, and 15 000 m³ of spruce are expected to be salvaged during the winter of 1995–96. 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.

Eastern Larch Beetle (*Dendroctonus simplex* LeConte)

Eastern larch beetle is a common pest in eastern Canada causing considerable damage to eastern larch trees (*Larix laricina* [Du Roi] K. Koch) and stands. High population levels continued to infest trees in eastern Newfoundland and throughout the Maritime provinces. In 1995, tree mortality was at similar levels to 1994.

In New Brunswick, eastern larch beetle was active in southern and eastern parts of the province; dead trees were in 8–30% of the stands surveyed. In Nova Scotia, trees were killed at several locations with new mortality observed over a few hectares. Recently killed trees occurred throughout Prince Edward Island, particularly in Prince County.

In Quebec, larch was damaged at moderate levels and some mortality was observed. In eastern Ontario, larch was

also damaged and small pockets of tree mortality occurred. In Saskatchewan, larch trees that had been defoliated by spruce budworm were infested resulting in subsequent mortality.

Douglas-fir Beetle (*Dendroctonus pseudotsugae* Hopkins)

Douglas-fir beetle commonly infests Douglas-fir in British Columbia and Alberta. Mortality usually results in the year of attack. Mature and overmature trees are particularly vulnerable.

The infestation of Douglas-fir beetle in Alberta, which was initially reported in 1991 in Jasper National Park, continued to expand in 1995. Areas containing killed Douglas-fir remained unchanged, but the number of dead trees increased. Most areas had fewer than 50 attacked trees that had been killed since the infestation began.

In British Columbia, in 1995, the area of mature Douglas-fir killed covered about 6500 ha, a decrease from 8800 ha in 1994. It was the second consecutive year of decrease.

Mountain Pine Beetle (*Dendroctonus ponderosae* Hopkins)

Mountain pine beetle is a pest of pine in western Canada. Its principal host is lodgepole pine (*Pinus contorta* Dougl. ex Loud. var *latifolia* Engelm.), but other western pine species are also 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 feeding by beetle larvae. The foliage of dying trees turns yellow the year following attack; then tree mortality can be detected by aerial surveys.

The monetary loss in commercial forests can be significant if beetle-killed trees are not salvaged quickly. Other consequences are a hastening of forest succession, a change in age and diameter distribution of the pine component of forests, a reduction in aesthetic values, and an increase in fire hazard. Control measures are centered on harvest of affected stands.

Mountain pine beetle is the most damaging insect pest in pine forests in British Columbia, where outbreaks have occurred since 1910. The current outbreak started in 1972, and since then, more than 230 million mature pine trees have been killed. Mountain pine beetle infestations remained low in Alberta in 1995. In British Columbia, the area of lodgepole pine and some western white pine (*P. monticola* Dougl. ex D. Don) killed by mountain pine beetle in 1995 increased slightly to about 40 000 ha in 8 000 infestations. The majority of the damage occurred in the southern interior of the province. In northwest British Columbia, the infested area increased by about 15% to more than 6 000 ha with new areas of beetle-killed trees being observed. In central British Columbia the area of killed pine more than doubled to 3 800 ha.

Harvesting of economically accessible beetle-killed pine continued in most beetle-infested areas in British Columbia.

In Alberta, beetles were detected at several locations using pheromone-baited trap trees. Baited trap trees, where attacks occurred, were felled and debarked and beetle broods were killed. In addition, the lodgepole pine beetle (*D. murrayanae* Hopk.) was found attacking several baited trap trees.

Mortality of mature lodgepole pine is forecasted to continue in 1996 in British Columbia. There was little overwintering brood mortality observed in the spring, indicating continued but declining infestations in 1996.

Balsam Fir Sawfly (*Neodiprion abietis* complex)

The balsam fir sawfly is a common pest of balsam fir (*Abies balsamea* [L.]) in eastern Canada. Outbreaks occur frequently but are not generally extensive, although mortality in infested stands is common. The balsam fir sawfly has defoliated young thinned balsam fir stands in western Newfoundland in 1995. Mortality on about 10% of trees occurred in areas that had been damaged since 1991. In 1995, there was a tenfold increase in the overall outbreak area to 12 600 ha from 1200 ha in 1994 in western Newfoundland. Light to moderate levels occurred along the fringes of the main area of outbreak. Although the current area of infestation is not large, this pest is important because it attacks highly valued and intensely managed balsam fir stands. Any mortality of these stands reduces the overall anticipated fiber volume, resulting in reduced economic benefit.

The results of the 1995 egg survey indicated that moderate to severe defoliation is expected to continue in 1996 in the same general areas. In eastern Nova Scotia, severe defoliation occurred over 250 ha. This level of defoliation has not been observed since 1976. Balsam fir sawfly was found at low levels in central New Brunswick and not found in Prince Edward Island. In Quebec, light to moderate damage occurred along the Rivière du Lièvre. In eastern Ontario, the sawfly caused defoliation up to 60% on balsam fir, with scattered damage elsewhere.

Yellowheaded Spruce Sawfly (*Pikonema alaskensis* [Roh.])

This insect is a pest of young open-grown white spruce (*Picea glauca* [Moench] Voss), black spruce (*P. mariana* [Mill.] BSP), and occasionally blue spruce (*P. pungens* Engelm.) trees. Trees in open areas such as roadsides, lake shores, hedges, and fields are most susceptible. Heavy infestations can result in considerable mortality. It is also commonly found in plantations.

In 1995, this insect affected up to 20% of black spruce trees in a plantation in central Newfoundland with defoliation from 10 to 30%. Ornamental spruces were also damaged in many areas in eastern Newfoundland.

Defoliation is widespread in southern New Brunswick affecting ornamental, wild, and plantation spruces. Damage has intensified in plantations of black spruce, as well as red spruce (*P. rubens* Sarg.) and Norway spruce (*P. abies* [L.] Karst.) near the Bay of Fundy. Moderate and severe defoliation also occurred at several locations in Prince County, Prince Edward Island. One occurrence at trace levels was recorded in Nova Scotia.

In most parts of Quebec the insect is at endemic levels. Defoliation occurred in the lower St. Lawrence area and the Gaspé Peninsula at light levels. The insect was also found in container-grown black spruce seedlings at a nursery near Quebec City. Given the threat that this insect represents for young plantations, treatment was recommended.

Increased sawfly populations were evident in several areas in northern Ontario. Numerous young planted black spruce and white spruce and natural regeneration were defoliated at levels of 30–40%, occasionally up to 100%. Damage also occurred on ornamentals. In southern Ontario, scattered, heavy infestations occurred in Algonquin Park, and around Parry Sound, Bancroft, and Pembroke. Heaviest infestations were along Highway 60 in Algonquin Park where defoliation of young white spruce averaged 80%. Occasional mortality was observed. High sawfly populations with defoliation occasionally as high as 90% also occurred in eastern Ontario.

Pine False Webworm (*Acantholyda erythrocephala* [L.]

The adult is an insect with a metallic blue body and bright orange head and the larvae feed on both new and old foliage. It was probably introduced into the St. John's area in Newfoundland before 1990. Light defoliation by this sawfly continued in 1995 in and near St. John's.

Increased populations of this pest were evident in southern Ontario where 45–90% of foliage was defoliated on eastern white pine (*P. strobus* L.), red pine (*P. resinosa* Ait.), and Scots pine (*P. sylvestris* L.) in plantations. In one plantation, 68% of the old foliage and 38% of the new foliage was consumed. Webworm damage was exacerbated by the root rot *Armillaria ostoyae* (Romagn.) Herink, which was found on most of the dead trees. Increased webworm populations were observed in eastern and central Ontario in many widespread and scattered infestations.

To control damage from the insect, a 24-ha stand of infested red pine was clearcut in the fall of 1994 and the tops left on the ground in the hope that adults emerging in the spring would attack them rather than nearby healthy trees. The strategy worked; numerous adults laid eggs on the cut tops. The emerging larvae then perished as the foliage dried.

An infestation in a nearby plantation collapsed in 1995 partly due to large flocks of the common grackle (*Quiscalus quiscula* L.) which fed on the larvae.

Gypsy Moth (*Lymantria dispar* [L.]

The insect was introduced from Europe to New England in 1869 and has since spread throughout the northeastern United States and eastern Canada. It is not yet found in Newfoundland or Prince Edward Island, nor has it become established in western Canada. Gypsy moth defoliates most hardwoods and is the primary defoliator of red oak (*Quercus rubra* L.). It causes loss of growth and occasional mortality. The female moths do not fly so the insect is transported as minute larvae via air currents. Also, egg masses are often transported on vehicles which are the major means of spreading gypsy moth. The insect often defoliates ornamentals in urban areas and trees around cottages and camping areas. The Asian gypsy moth is a closely related pest and was discovered in British Columbia in 1991. Control efforts to protect forests have been successful and monitoring continues.

Gypsy moth has been present in New Brunswick and Nova Scotia since 1981. The distribution increased significantly in 1993 with the discovery of the insect in central New Brunswick. In 1995, additional infested areas were found both in New Brunswick and in western Nova Scotia. It is not known to occur in Prince Edward Island. In spite of its presence for at least 15 years, gypsy moth populations have rarely been high enough to cause more than trace levels of defoliation. In 1995, however, moderate and severe defoliation occurred on red oak, white birch (*Betula papyrifera* Marsh.), red maple (*Acer rubrum* L.), witch-hazel (*Hamamelis virginiana* L.), and eastern white pine (*Pinus strobus* L.) in Nova Scotia. In New Brunswick, gypsy moth is concentrated mostly in the southwestern and south-central areas. Infestations in New Brunswick and Nova Scotia tend to occur in cottage areas, provincial parks, campgrounds, and picnic sites.

In 1995, in Ontario, the area of moderate to severe defoliation increased to 19 879 ha from 5645 ha in 1994, the first such increase since 1991. Most defoliation was around Sudbury and occurred on white birch, trembling aspen (*Populus tremuloides* Michx.), and red oak growing on exposed rocky ridges. Other small infestations were observed in scattered areas in central and northern Ontario. No defoliation was observed in other provinces.

Pheromone traps are the method most commonly used. In 1995, gypsy moth was found at several new locations in Nova Scotia and New Brunswick, a significant increase in population from previous years, when egg masses were difficult to find. In Ontario, for the past several years adult moths have been caught at all locations where traps were deployed in the North Bay–Sault Ste. Marie corridor, which is approximately along the leading edge of the insect's established distribution.

In the Prairie provinces, a cooperative monitoring program with Agriculture and Agri-Food Canada (the lead department) is in place to detect the introduction of gypsy moth

into an area of Canada where the moth is not established. In 1995, as in most other years, no male gypsy moths were captured in Alberta or Manitoba. In Saskatchewan, two male gypsy moths were captured: one in Saskatoon, and one in White City east of Regina.

In British Columbia, the monitoring program was conducted using 16 000 traps in a cooperative program with Agriculture and Agri-Food Canada, the Canadian Forest Service, and the British Columbia Ministry of Forests. In 1995, 39 adult male moths were trapped. Two Asian race male moths were trapped at widely separated locations in the Lower Mainland. Population levels were at about the same levels as in 1994.

In British Columbia, a site with positive trap catches and egg masses was treated with *Bacillus thuringiensis* var. *kurstaki*. The pesticide was applied three times by air over a 352-ha block at a rate of 50 BIU/ha in May. Two ground sprays were applied over an area of 17 ha in late May and June. No gypsy moths have been recovered following treatment.

Balsam Woolly Adelgid (*Adelges piceae* [Ratz.]

The balsam woolly adelgid is an introduced pest on balsam fir (*Abies balsamea* [L.]) and causes extensive damage in eastern Canada. Trees are deformed and occasionally killed. No controls for the pest have been developed. It is not amenable to control by either pesticides or introduced predators. The spread and damage of the pest are monitored closely.

Severe damage caused by balsam woolly adelgid was common in many areas of Newfoundland in 1995, particularly in thinned stands where considerable investment has been made to increase stand productivity. Increased survey and research efforts are concentrating on remote sensing technology, site-specific surveys, and chemical characterization of foliage to develop hazard- and risk-rating systems. It is hoped, in this way, to promote better decision-making for management of this pest.

In British Columbia, a survey was carried out to determine the distribution of the pest in the southwestern portion of the province. No adelgids were found indicating that the pest has not spread to this part of the province within the last 3 years. Surveys north of the quarantine zone boundary on Vancouver Island indicated the presence of the insect in four widely separated mature stands. Thus, the adelgid appears to be present throughout Vancouver Island where *Abies* seedlings are grown for reforestation.

Tests of balsam woolly adelgid on artificially infested 1-year-old seedlings demonstrated successful reproduction of the adelgid after one growing season on containerized nursery stock. Survey and research trial results will be reviewed by the Plant Protection Advisory Council's Balsam Woolly Adelgid Committee to determine possible actions.

Spruce Budmoth (*Zeiraphera canadensis* Mut. & Free.)

Spruce budmoths comprise a group of closely related species: the spruce budmoth (*Zeiraphera canadensis* Mut. & Free.), the purplestriped shootworm (*Z. unfortunata* Powell), and the yellow spruce budworm (*Z. fortunata* [Kft.]). *Zeiraphera canadensis* is the most common and most important of the three. The budmoth is a frequent defoliator of white spruce (*Picea glauca* [Moench] Voss) in eastern Canada. Although feeding usually does little injury to mature spruce, serious damage can occur in plantation white spruce.

In 1995, the insect was common throughout Newfoundland wherever white spruce was present. Populations were generally low and caused light damage; occasional higher levels occurred in the Avalon Peninsula. In the Maritime provinces, shoot damage decreased slightly compared with 1994 and damage was usually at trace or light levels.

In Quebec, the budmoth was the most serious defoliator of white spruce plantations and was detected in 38% of the plantations surveyed. Damage and occurrence increased slightly over 1994 levels.

Large Aspen Tortrix (*Choristoneura conflictana* [Wlk.]

This pest is a defoliator of hardwoods throughout Canada and damages trembling aspen (*Populus tremuloides* Michx.) over extensive areas. In 1995, damage was less than in previous years and was concentrated in Quebec, Saskatchewan, and Alberta. In Quebec, the decline in populations and in the damage caused by it continued to such an extent that only a few pockets of defoliation at trace levels were observed in existing infested areas. In western Quebec, the outbreak increased, 1200 ha were defoliated, 33 ha moderately.

Populations of large aspen tortrix in Saskatchewan continued to decline, and in 1995, only 9947 ha were defoliated. In Alberta, the insect defoliated 58 710 ha at moderate to severe levels in several areas of infestation.

Major Diseases

Armillaria Root Rot (*Armillaria mellea* complex)

Armillaria root rot is a common disease of forest stands and particularly of plantations if trees are under stress from other factors. Considerable mortality can result from this organism with substantial economic effects in areas where investments in forests are high. The organism is a complex of species with one or more varieties dominating in different areas.

In Newfoundland, the disease was found on black spruce (*Picea mariana* [Mill.] BSP), balsam fir (*Abies balsamea* [L.]), and white birch (*Betula papyrifera* Marsh.). Increased research on detection using remote sensing and the identification of strains with biotechnology is continuing with the aim to develop a hazard rating system for the improved management of the disease. In the Maritime provinces, surveys in

plantations continue to monitor spread of the disease to determine whether there are differences in mortality as a function of the former cover type. Black spruce appears to be more susceptible than jack pine (*Pinus banksiana* Lamb.) on former mixedwood sites. Root rot has been identified as present throughout Quebec since 1992. It has been detected in 10% of the pine and spruce plantations surveyed.

In Ontario, *Armillaria* is widespread in young conifer stands and plantations. Infection levels were generally low in 1995 with less than 2% of trees being infected. Exceptions occurred in areas where trees had been damaged by other organisms.

Dutch Elm Disease (*Ophiostoma ulmi* [Buism.] Nannf.)

Dutch elm disease is a concern throughout Canada from Saskatchewan east where it continues to kill elms of all ages. No efficient control measures are available for forest trees although urban ornamentals are often treated because of their higher value.

In the Maritimes generally, the disease is present wherever elms are found. In Nova Scotia, the disease continued to intensify in 1995 within its known distribution with dead and dying trees being common. In Prince Edward Island, it was first identified in Prince County in 1979. No infected trees have been found in Queens and Kings counties since 1991 when infected trees were removed.

In Quebec, the disease was observed at Lac-Saint-Jean, and at a new location along the Iroquois River causing some mortality. In Ontario, damage occurred on white elm (*Ulmus americana* L.) at several locations.

In Manitoba, the disease is concentrated in Winnipeg and along rivers where elm is common. A sanitation program is in place to control the disease by preventing its spread. In Saskatchewan, in 1995, the disease was discovered in many new locations in the east-central part of the province. Control operations concentrated on removing infected trees. In Alberta, detection surveys monitor the smaller European elm bark beetle (*Scolytus multistriatus* Marsh.) and the native elm bark beetle (*Hylurgopinus rufipes* Eichh.). There is also a program in place that maintains an inventory of white elm and educates the public about the susceptibility of this tree to the bark beetle.

Lodgepole Pine Dwarf Mistletoe (*Arceuthobium americanum* Nutt. ex Engelm.)

This disease is common in western Canada on jack pine (*Pinus banksiana* Lamb.) and lodgepole pine (*P. contorta* Dougl. ex Loud. var. *latifolia* Engelm.). Other pine species are occasionally attacked. The disease reduces the quality and quantity of merchantable timber, reducing the growth and vigor of the host. The disease also predisposes trees to attack by bark beetles and other stresses.

In 1995, surveys were conducted in Alberta and Saskatchewan to map infestations of lodgepole pine dwarf mistletoe. In Alberta, the area of jack pine forest infested by dwarf mistletoe was 176 013 ha and lodgepole pine 54 528 ha. In Saskatchewan, 136 705 ha of jack pine forests were infested.

European Larch Canker (*Lachnellula willkommii* [R. Hartig] Dennis)

European larch canker is common in much of Nova Scotia and New Brunswick in coastal areas characterized by cool, damp weather. It has been introduced to the area and is quite damaging to all species of *Larix*. In 1995, the fungus was not found outside the area of known distribution in New Brunswick or Nova Scotia, although it is widespread within the current range.

In Prince Edward Island, two infected trees were found and killed. Since 1981, nearly 375 locations have been examined throughout the province but larch canker has only been found in three areas from which it has been eradicated. Overall, the known distribution of the European larch canker remains unchanged from 1994.

Butternut Canker (*Sirococcus clavignenti-juglandacearum* Nair, Kostichka & Kuntz)

During 1995, 21 butternut (*Juglans cinerea* L.) stands were examined for butternut canker in the Maritime provinces. Twenty stands were in southern New Brunswick and 1 in Prince Edward Island. The number of trees ranged from individuals to 7 trees at each location, reflecting the low numbers of butternut. The canker has not been found in the Maritime provinces to date.

In Quebec, the disease was detected for the first time in a lot of 250 butternut seedlings in the Quebec City region. Given the highly virulent nature of this fungus on butternut in several American states, the lot was killed.

Scleroderris Canker (*Gremmeniella abietina* [Lagerb.] Morelet) (European and North American Races)

Scleroderris canker is a stem disease of pines. The North American race infects young trees and rarely kills trees over 2 m high, whereas the European race is capable of killing trees of any age or size. The presence or absence of the races varies from province to province.

The European strain of the fungus causing scleroderris canker was accidentally introduced to Newfoundland in St. John's and it continued to infect Austrian pine (*Pinus nigra* Arnold) in 1995. All infected branches were pruned and burned, and as part of a public awareness campaign, nurseries and garden centers were visited, pamphlets were distributed, and the pines in the nurseries were surveyed for possible symptoms. The possible spread of the disease from the Avalon

Peninsula to the highly susceptible red pine (*P. resinosa* Ait.) stands in central and western Newfoundland remains a concern for forest managers.

In New Brunswick, the North American race of scleroderris is widespread, especially in the northern half of the province. It occurs on jack pine (*Pinus banksiana* Lamb.), red pine (*P. resinosa* Ait.), and Scots pine (*P. sylvestris* L.) in plantations. Scleroderris canker is being monitored at three locations in northern new Brunswick where the European or non-North American races were detected in the past. Scleroderris canker has not been found in Nova Scotia since 1978 and has never been found in Prince Edward Island.

In Quebec, the infection rate of the disease increased in 1995 in plantations. The disease was detected in 22% of pine plantations, and symptoms were observed on over 3% of the trees. It was found at five nurseries where the symptoms appeared late in the growing season in container-grown jack pine and red pine seedlings. A total of 6.9 million seedlings were culled before the seedlings were released for planting.

In Ontario, the European race is found in a small area in the south-central part of the province. In 1995, damage intensified within infected stands and plantations but there was little change in distribution. The European race was also observed on eastern white pine (*P. strobus* L.) in a previously infected location, the first record of the disease on this species in Ontario.

Samples of the North American race were collected at several locations where the European race was recorded and found at varying levels of infection. Species of red pine, Scots pine, and jack pine in plantations were all affected.

Abiotic Damage

In addition to the many insects and diseases that affect forests, other stresses of a nonbiological nature affect forest ecosystems. These include winter drying, drought, frost, hail, blowdown, and others. The appendix covers occurrences of significant abiotic damage by province as well as distributions of other insects and diseases not covered earlier.

Acid Rain National Early Warning System (ARNEWS)

The effects of air pollutants on the health of Canadian forests have been monitored systematically since 1984 when the Acid Rain National Early Warning System (ARNEWS) was established. The term "acid rain" encompasses all forms of air pollution—wet and dry deposition of sulfates (SO₄), nitrates (NO₃), ozone (O₃), gaseous pollutants, and airborne particles. ARNEWS assesses the health of the forest using

a common set of measurements taken on permanent sample plots established by personnel of the Canadian Forest Service.

ARNEWS aims to detect early signs of damage to forest trees and soils caused by acid rain and other pollutants. The monitoring program identifies causes of observed damage whether by insects, diseases, weather, air pollution, or other factors. The long-term goal is to determine ecosystem changes attributable to anthropogenic pollutants, and their significance.

Analyses of data collected from ARNEWS plots in 1995 and earlier indicate no large-scale declines in the health of Canadian forests caused by atmospheric pollution.

Tree mortality within the plots was in the range of 1–2% annually and was caused largely by competition within stands. This is the most common cause of tree mortality in these typically densely stocked natural stands. The effects of insects, diseases, drought, and storms were observed frequently. Mortality from these factors combined occasionally rose above 2%. Many stands are recovering from the effects of insect defoliation, which affected extensive areas of forest over the past two decades. However, some stands along the southern edge of the Canadian Shield do not appear to be recovering from insect damage. Although it is not clear that the damage is related to pollutants, these stands are primarily on acid-sensitive soils and in areas where pollution is damaging lakes and rivers.

There is a decline in the health of white birch (*Betula papyrifera* Marsh.) and eastern paper birch (*B. cordifolia* Regel) in eastern Canada around the Bay of Fundy in New Brunswick and in Nova Scotia. Trees have been damaged for several years by leaf browning and premature leaf fall. Many trees have died; others have many dead twigs or branches. The area of greatest damage is coincident with areas typified by the presence of acid fogs, at pH 3.0 or lower, that occur frequently in summer. Similar damage has been induced in the laboratory on leaves, and it is apparent that the damage is caused by pollution. The extent of the damage, which covered over 60 000 ha in 1994, was reduced in 1995. Damage occurred only in isolated areas scattered around the Bay of Fundy.

In New Brunswick, flecking on needles was reported on eastern white pine (*Pinus strobus* L.), red spruce (*Picea rubens* Sarg.), white spruce (*P. glauca* [Moench] Voss), black spruce (*P. mariana* [Mill.] BSP), and balsam fir (*Abies balsamea* [L.]) The observed damage resembles that caused by ozone, although the cause has not yet been determined.

North American Maple Project

In addition to ARNEWS, another network of plots is in operation to assess the condition of sugar maple (*Acer saccharum* Marsh.). This joint project between Canada and the

United States was established in 1988 and measures crown condition in unmanaged stands and in stands managed for the production of maple syrup.

The condition of tree crowns is assessed by measuring crown dieback and crown transparency. Dieback is branch mortality that begins at the terminal portion of the branch and progresses downward. It is a result of stress on the tree. Transparency is the amount of skylight visible through the foliated portion of the crown. Results to date show that most of the trees (>90%) are healthy, and the health of sugar maples is similar in stands managed for syrup production, and unmanaged stands. Older trees tended to have more dieback than smaller, younger trees.

Crown dieback is increased in the highest deposition zone of nitrates. Maples on soils of low buffering capacity also had higher dieback than trees on well-buffered soils. Since dieback is closely correlated with tree health, this tendency is cause for concern for the health of sugar maple over the long term if acid deposition continues at current rates. The highest crown dieback in the project for 1995 was located in New Brunswick, where sugar bushes averaged 11.4% and nonsugar bushes 10%. Widespread freezing rain causing winter and spring damage is thought to be the cause of this dieback.

Stresses having a rapid effect on transparency include drought, damage from insects, frost, and air pollution. Transparency has fluctuated over the years in response to these stresses. In Quebec, in 1995, there were some increases in crown transparency reflecting the drought of that year. In Ontario, damage in one plot was caused by sugar maple borer (*Glycobius speciosus* [Say]). Trees were generally healthy with low levels of both dieback and transparency and any damage was caused by a variety of insects, diseases, and maple syrup tapping.

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Appendix

Other Insects, Diseases, and Damage

Newfoundland and Labrador

	Hosts	Location	Comments
Insects			
<i>Actebia fennica</i> (Tausch.) Black army cutworm	Herbaceous vegetation	Western Newfoundland	Low numbers. Experimental burn site, Glide Lake.
<i>Bucculatrix canadensisella</i> Cham. Birch skeletonizer	White birch, yellow birch	Central Newfoundland	Moderate to severe defoliation, Bay d'Espoir area.
<i>Coleophora serratella</i> (L.) Birch casebearer	White birch	Central, western, and northern Newfoundland	Severe in central Newfoundland, light damage elsewhere.
<i>Fenusa pusilla</i> (Lep.) Birch leafminer	White birch	Northern Peninsula, Labrador	Moderate to severe browning.
<i>Hemichroa crocea</i> (Geoff.) Striped alder sawfly	Speckled alder, white birch	Northern Peninsula	Severe defoliation, Rocky Harbour–Berry Hill area of Gros Morne National Park.
<i>Leucoma salicis</i> (L.) Satin moth	Willows, poplars	Eastern Newfoundland	Moderate to severe defoliation, Clarenville area.
<i>Neodiprion sertifer</i> (Geoff.) European pine sawfly	Pine species	Avalon Peninsula	Extensive defoliation.
<i>Phyllocnistis populiella</i> (Cham.) Aspen serpentine leafminer	Trembling aspen	Eastern Labrador	Light–moderate defoliation along Churchill, Penas, and Goose rivers and west end of Grand Lake.
<i>Pristiphora erichsonii</i> (Htg.) Larch sawfly	Eastern larch	Throughout Newfoundland	Severe damage in eastern and central Newfoundland, light damage elsewhere.
<i>Zeiraphera improbana</i> (Wlk.) Larch needleworm	Larch	Avalon Peninsula	Severe defoliation, Mount Pearl–Kilbride area.

	Hosts	Location	Comments
Diseases			
<i>Apiosporina morbos</i> (Schwein. : Fr.) v. Arx Black knot	Pin cherry, plum	Throughout Newfoundland	Varying degrees of damage.
<i>Chrysomyxa ledicola</i> (Peck) Lagerh. Spruce needle rust	Black spruce	Central Newfoundland	Plantations and on ornamentals.
<i>Chrysomyxa pirolata</i> (Körn.) Wint. Spruce cone rust	Black spruce, white spruce	Central Newfoundland	Up to 100% of cones affected.
<i>Cronartium ribicola</i> J.C. Fisch. White pine blister rust	White pine	Throughout the island	Variable damage.
<i>Cytospora</i> sp. Dieback	Norway maple	Central Newfoundland	Low incidence on ornamentals at Glenwood.
<i>Gymnosporangium cornutum</i> Arth. ex Kern Leaf rust	American mountain-ash	Avalon Peninsula	Low incidence near Paradise.
<i>Isthmiella faullii</i> (Darker) Darker Needle cast of balsam fir	Balsam fir	Western Newfoundland, St. John's	Forest trees and ornamentals.
<i>Melampsorella caryophyllacearum</i> Schröt. Fir broom rust	Balsam fir	Avalon Peninsula	Low incidence.
<i>Nectria cinnabarina</i> (Tode : Fr.) Fr. Nectria dieback	Maple	Avalon Peninsula	Low incidence on ornamentals, St. John's.
<i>Phomopsis juniperovora</i> Hahn Blight	Common juniper	Avalon Peninsula	Low incidence on ornamentals, St. John's.
<i>Potebniamyces coniferarum</i> (G. Hahn) DiCosmo et al. Potebniamyces canker and dieback	Siberian larch, hybrid larch	Avalon Peninsula	Low incidence of dieback, St. John's.
<i>Septoria betulae</i> Pass. Leaf spot	White birch	Northern Peninsula	Affected 5% of young trees, Roddickton area.

	Hosts	Location	Comments
<i>Septoria musiva</i> Peck Leaf spot and dieback	Balsam poplar	Central Newfoundland	Low incidence, Grand Falls area.
<i>Venturia macularis</i> (Fr. : Fr.) E. Müller & v. Arx <i>Venturia populina</i> (Vuill.) Fabric. Leaf and shoot blight	Trembling aspen, balsam poplar	Throughout Newfoundland	Low incidence.

Other Damage

Frost damage	Deciduous ornamentals, mugho pine	Avalon Peninsula	Low incidence, St. John's and Mount Pearl.
Snow and ice damage	Ornamental trees	Avalon Peninsula	Severe damage in St. John's area by spring sleet storm.

Quebec

	Hosts	Location	Comments
Insects			
<i>Alsophila pomataria</i> (Harr.) Fall cankerworm	Sugar maple	Saint-Henri (Lévis)	Light defoliation.
		Saint-Léonard-d'Aston	Moderate defoliation.
	Silver maple	Berthierville (Berthier)	Moderate defoliation.
	Red oak	Montmagny (Montmagny)	Light damage.
	Swamp white oak	Henryville (Iberville)	Moderate infestation over 4 ha.
	Basswood	Lac des Cèdres (Gatineau)	Moderate defoliation.
<i>Anisota virginiensis</i> (Drury) Pinkstriped oakworm	White birch	Lac du Cran, Lac à Côté, Notre-Dame-de-la-Doré, Saint-Félicien, Saint-Thomas-Didyme (Lac-Saint-Jean West)	Moderate to severe defoliation. Damage less intense than in 1994.
	Red oak	Kiamika (Labelle) Lac Pocknock (Gatineau)	Severe defoliation. >100 ha severely defoliated.

	Hosts	Location	Comments
<i>Arge pectoralis</i> (Leach) Birch sawfly	White birch	Saint-Félicien, Saint-Hedwidge, Saint-Prime (Lac-Saint-Jean West)	Smaller areas affected than in 1994. Moderate damage.
<i>Bucculatrix canadensisella</i> Cham. Birch skeletonizer	White birch	Lac de l'Ouest (Lac-Saint-Jean West)	Severe damage.
		Saint-Prime, Saint-Hedwidge (Lac-Saint-Jean West)	Moderate damage.
		Notre-Dame-de-la-Doré, Normandin	Light damage.
		Girardville (Lac-Saint-Jean West)	Moderate damage.
	Yellow birch	Sutton (Brome)	5 ha lightly defoliated.
<i>Cecidomyia resinicola</i> (O.S.) Jack pine resin midge	Jack pine	Saint-Félicien (Lac-Saint-Jean West)	Severe damage in a seed orchard.
<i>Coleophora laricella</i> (Hbn.) Larch casebearer	Eastern larch	Portneuf region	Moderate defoliation.
		Lac-à-la-Tortue (Champlain)	Moderate damage.
		Sainte-Adèle (Terrebonne)	Pockets of trees and roadside trees severely affected.
		Sainte-Sophie, Saint-Calixte (Montcalm)	Moderate defoliation.
		Saint-Bernard-de-Lacolle (Saint-Jean)	3 ha moderately defoliated.
		Sutton (Brome)	4 ha moderately defoliated.
		Sainte-Anne-de-la-Rochelle (Shefford)	4 ha moderately defoliated.
		Point Comfort (Gatineau)	Small stand lightly to moderately defoliated.
European larch	Saint-Amable (Verchères)	Light defoliation in the seed orchard.	
<i>Contarinia</i> sp. Midges	Scots pine	Amqui (Matapédia)	In progeny test, 48% of 700 trees moderately affected.
<i>Diprion similis</i> (Htg.) Introduced pine sawfly	Eastern white pine	Saint-Joachim-de-Courval (Yamaska)	12% of seed orchard with 800 trees lightly defoliated.

	Hosts	Location	Comments
<i>Dryocampa r. rubicunda</i> (F.) Greenstriped mapleworm	Red maple	Saint-Alphonse-de-Granby (Shefford)	7 ha lightly defoliated.
		Lac Pocknock (Gatineau)	More than 100 ha moderately defoliated.
	Silver maple, red maple	Fort-Coulonge (Pontiac)	80 ha severely defoliated.
	Sugar maple, red maple	Lac du Pin Blanc and Lac de la Tête d'Orignal (Témiscamingue)	Damage variable, light to severe.
<i>Enargia decolor</i> (Wlk.) Aspen twoleaf tier	Trembling aspen	South of Lac Kénogami (Chicoutimi)	Light to moderate damage.
		Vicinity of Ville-Marie (Témiscamingue)	Severe defoliation at many sites.
<i>Enargia infumata</i> (Grt.) Birch-aspen noctuid	Trembling aspen	Between Rivière Croche and Lac des Commissaires (Lac-Saint-Jean West)	Trace to moderate defoliation.
<i>Gilpinia hercyniae</i> Htg. European spruce sawfly	White spruce, Norway spruce	Widespread in plantations	55% of white spruce plantations, increase from 13% in 1994.
<i>Hemichroa crocea</i> (Geoff.) Striped alder sawfly	Speckled alder	Maria, Robidoux, and Reboul townships	Small areas particularly along roadsides.
		Lac Oatcake (Gaspé West)	Alders along roadsides were defoliated.
<i>Hyphantria cunea</i> (Drury) Fall webworm	Black ash	Doherty (Pontiac)	Small stand severely defoliated.
<i>Lepidosaphes ulmi</i> (L.) Oystershell scale	Beech	Calixa-Lavallée (Verchères)	Regeneration severely affected.
<i>Lymantria dispar</i> (L.) Gypsy moth	Hardwoods	Throughout Quebec	No defoliation observed.
<i>Neodiprion abietis</i> (Harr.) Balsam fir sawfly	Balsam fir	Lac Rhéaume (Papineau)	Light to moderate damage along the Rivière du Lièvre.
<i>Neodiprion pratti banksianae</i> Roh. Blackheaded jack pine sawfly	Jack pine	Kazabazua (Gatineau)	Trees defoliated around a plantation.
		Sainte-Famille-d'Aumond (Gatineau)	Plantation comprising 4000 trees, most of which were defoliated.
		La Croix (Gatineau)	Light defoliation.

	Hosts	Location	Comments
<i>Neodiprion swainei</i> Midd. Swaine jack pine sawfly	Jack pine	Mauricie/Bois-Francis and Saguenay/Lac-Saint-Jean regions	Small populations throughout the province. Local defoliation near Lac Cousacouta, Lac Gagnon, and north of Lac Saint-Jean.
<i>Nymphalis antiopa</i> (L.) Spiny elm caterpillar	Poplars, willows	Lac Étienne (Champlain)	Trees along roadsides severely defoliated.
<i>Operophtera bruceata</i> (Hulst) Bruce spanworm	Sugar maple	South plain of the St. Lawrence River	Widespread in maple and yellow birch stands.
<i>Otiorhynchus ovatus</i> L. Strawberry root weevil & <i>Otiorhynchus sulcatus</i> (F.) Black vine weevil	Norway, red, black spruce	Detected in 66 nurseries, bare-root and container stock affected	Many seedlings unfit for planting.
Pamphiliidae Sawflies	Red pine	Saint-Agapit (Lotbinière)	75% of plantation of 2000 trees lightly affected.
		Sainte-Sophie-de-Lévrard (Nicolet)	83% of plantation of 5000 trees moderately defoliated.
		Saint-Jean-Vianney (Frontenac)	Defoliation observed 2 years in a row.
		Sainte-Émélie-de-l'Énergie (Joliette)	6% of plantation of 500 trees affected to varying degrees.
		Saint-Félix-de-Valois (Joliette)	80% of plantation of 5000 trees moderately affected.
		Saint-Joseph (Pontiac)	84% of plantation of 3000 trees severely defoliated.
<i>Paraclemensia acerifoliella</i> (Fitch) Maple leafcutter	Sugar maple	Saint-Valère (Arthabasca)	Moderate damage.
		Richmond (Richmond)	Light damage, less than in 1994.
<i>Parthenolecanium corni</i> (Bouché) European fruit lecanium	Bitternut hickory	Cazaville (Huntingdon)	Trees severely affected throughout the stand.
	Maple sugar	Roxton Falls (Shefford)	Significant damage in a 40-ha maple stand.

	Hosts	Location	Comments
		Roxton Pond (Shefford)	Trees slightly affected. Regeneration severely affected.
		Lac des Îles (Papineau)	Significant damage observed over a distance of 2–3 km.
<i>Petrova albicapitana</i> (Bsk.) Northern pitch twig moth	Jack pine	In 27% of plantations surveyed	Moderate damage but did not hinder tree growth.
<i>Phyllocnistis populiella</i> (Cham.) Aspen serpentine leafminer	Trembling aspen	Along Highway 198 between L'Anse-Pleureuse and Gaspé (Gaspé West)	Light damage. Decline in the areas affected.
		Lac Pistuacanis, Lac au Chevreuil (Saguenay)	Light damage.
<i>Pissodes strobi</i> (Peck) White pine weevil	Eastern white pine, spruce	Throughout Quebec in plantations	Damaged 30% of spruce and 15% of pine plantations.
<i>Pristiphora erichsonii</i> (Htg.) Larch sawfly	Larches	Saint-Lambert (Lévis)	Severe defoliation in shelterbelts along Highway 73.
		Lac des Plaines, near Havre-Saint-Pierre (Saguenay)	2-ha stand severely defoliated.
		Lac Malouin (Saguenay)	Moderate defoliation.
	European larch	Saint-Amable (Verchères)	Seed orchard, 78% of trees with light damage.
	Hybrid larch	Saint-Amable (Verchères)	Seed orchard, 90% of trees with light defoliation.
<i>Rhynchaenus rufipes</i> (LeC.) Willow flea weevil	Willows	Saguenay/Lac-Saint-Jean	Fifth consecutive year with most ornamental willows severely affected. Mortality observed.
<i>Sericothrips tiliae</i> Hood Basswood thrips	Basswood	Saint-Hugues (Bagot)	Damage from trace levels to severe.
<i>Taeniothrips inconsequens</i> (Uzel) Pear thrips	Sugar maple	Roxton Falls (Shefford)	Significant damage in a 40-ha maple stand.
<i>Thecodiplosis piniresinosae</i> Kearby Red pine needle midge	Red pine	Saint-Zéphirin-de-Courval (Yamaska)	Plantation of 6400 trees, 26% affected.
		Sainte-Gertrude (Nicolet)	Plantation of 4000 trees; 15% affected.

Hosts	Location	Comments
	Saint-Wenceslas (Nicolet)	Plantation of 5300 trees, 30% affected.

Diseases

<i>Ciborinia whetzellii</i> (Seaver) Seaver Ink spot	Trembling aspen	Portneuf and Charlevoix regions	50% of the trees in the northern part of these management units were affected.
		Lac Amariton (Saguenay)	Natural forest slightly affected.
		Barrage Sainte-Anne (Saguenay)	Natural forest moderately affected.
<i>Coleosporium asterum</i> (Dietel) H. Syd. & Syd. Pine needle rust	Jack pine	Sainte-Émélie-de-l'Énergie (Joliette)	Plantation moderately affected.
	Lodgepole pine	Saint-Amable (Verchères)	88% of trees in Beloeil arboretum moderately affected.
<i>Cronartium ribicola</i> J.C. Fisch. White pine blister rust	Eastern white pine	Saint-Hilarion (Charlevoix West)	Plantation moderately affected.
		Chesterville (Arthabaska)	Plantation severely affected.
<i>Cylindrocarpon</i> spp.	Various conifers	Nurseries generally	Extensive losses in bareroot and container stock.
<i>Discula umbrinella</i> (Berk. & Broome) Morelet Leaf spot	Ashes, willows	Quebec City, Hull, Montreal, Rivière-du-Loup and Mont-Saint-Hilaire	Severe defoliation in spring along roadsides and in parks.
	Red oak	La-Patrie (Compton)	6% of trees affected.
<i>Endocronartium harknessii</i> (J.P. Moore) Y. Hiratsuka Western gall rust	Lodgepole pine	Sainte-Françoise (Lotbinière)	Trees moderately affected.
	Jack pine	Rivière Gens de Terre falls (Gatineau)	Trees moderately affected.
<i>Gremmeniella abietina</i> (Lagerberg) Morelet Scleroderris canker	Lodgepole pine	Saint-Elzéar and Saint-Alphonse (Bonaventure), Fontenelle and Saint-Ignace (Gaspé East)	Trees were severely affected at Saint-Elzéar and Fontenelle, and moderately affected at the two other sites.

	Hosts	Location	Comments
	Jack pine	Lac Chabanel (Lac-Saint-Jean West)	Natural stand moderately affected.
<i>Gremmeniella abietina</i> var. <i>balsamea</i> O. Petrini et al. Scleroderris canker	Balsam fir	Lac des Pas Perdus (Charlevoix West)	Present in a natural forest.
<i>Nectria galligena</i> Bres. Nectria canker	Yellow birch	South of Montreal	4–18% of trees affected in several maple stands.
<i>Ophiostoma ulmi</i> (Buism.) Nannf. Dutch elm disease	White elm	Normandin (Lac-Saint-Jean West)	New pocket of infection over 10 km along shoreline of Rivière Ticouapé, where >50% of the elms are dead.
<i>Phytophthora megasperma</i> Drechs. Root rot	White spruce	Saint-Paul-d'Abbotsford (Rouville)	Mortality in a Christmas tree plantation.
<i>Phytophthora</i> spp. <i>Pythium</i> spp.	Various conifers	Nurseries generally	Extensive mortality in bare-root and container seedlings.
<i>Puccinia sparganioides</i> Ellis & Barth. Ash rust	White ash	Saint-Roch-de-Richelieu (Richelieu)	Most trees in plantation are affected.
<i>Pucciniastrum epilobii</i> G. Oth Fir-fireweed rust	Balsam fir	Lac des Pas Perdus (Charlevoix West)	Natural forest moderately affected.
<i>Sarcotrichila piniperda</i> (Rehm) Korf Snow blight	White spruce	Bonsecours (Shefford)	Certain trees in plantation are affected up to midcrown level.
<i>Sirococcus clavignenti-juglandacearum</i> V.M.G. Nair, Kostichka and Kuntz Butternut canker	Butternut	Ascot Corner (Sherbrooke), Frelighsburg (Missisquoi), and Glen Sutton (Brome)	Present in natural stands.
<i>Sphaeropsis sapinea</i> (Fr. : Fr.) Dyko & B. Sutton Tip blight of conifers	Red pine	Stanbridge East (Missisquoi)	30 trees affected in plantation.

Other Damage

Deer	Eastern white pine	Saint-Joachim-de-Courval (Yamaska)	Moderate damage in seed orchard from grazing.
Drought	Red pine	Frelighsburg (Missisquoi)	Young plantation moderately affected.

	Hosts	Location	Comments
	White birch	Abitibi–Témiscamingue	Premature fall of leaves in stands on thin soils.
Porcupines	Jack pine	Saint-Eugène-de-Guigues (Témiscamingue)	Severe damage to plantation.
	Norway spruce	Sainte-Hélène-de-Chester (Arthabaska)	Moderate damage to plantation.
Snowbreak	Red pine	Nouvelle (Bonaventure), Rivière-au-Renard, and Barachois (Gaspé East)	Three plantations moderately affected.
	Eastern white pine	Lac Denys (Gaspé East)	Moderate damage in one plantation.
	Softwoods	Gaspé–Magdalen Islands	Winter of 1994–95 caused substantial damage to several plantations.
Squirrels	Eastern white pine	Lac Laforest (Pontiac)	Moderate damage to plantation.
Winter drying	Red pine	Saint-Alban (Portneuf)	63% of trees in plantation moderately affected.
	Eastern white pine	La Bostonnais (Champlain)	27% of trees in plantation moderately affected.

Ontario

	Hosts	Location	Comments
Insects			
<i>Aceria fraxinivora</i> (Nal.) Ash gall mite	White ash	Town of Fort Frances	Heavy damage on 10% of 12-m ornamentals.
<i>Acleris variana</i> (Fern.) Eastern blackheaded budworm	Eastern hemlock	Central Region	Defoliation averaged 25% in Monck Township, Parry Sound District and in Killarney Provincial Park, Sudbury District.
<i>Adelges abietis</i> (L.) Eastern spruce gall adelgid	White spruce	Maple District	Low populations in 5-ha plantation in Caledon Township.

	Hosts	Location	Comments
<i>Adelges cooleyi</i> (Gill.) Cooley spruce gall adelgid	Douglas-fir	Maple District	Low populations on 3.3-m Christmas trees in Clarke Township.
<i>Adelges lariciatus</i> (Patch) Spruce gall adelgid	White spruce	Northeast Region	2% of trees infested in plantations in Idington Township, Hearst District and Sheldon Township, Cochrane District.
<i>Alsophila pomataria</i> Harr. Fall cankerworm and <i>Archips negundana</i> (Dyar) Larger boxelder leafroller	Manitoba maple	Northwest Region	Defoliation 30–100% in urban areas of Atikokan, Dryden, Fort Frances, Ignace, Hudson, Kenora, and Thunder Bay.
<i>Altica ambiens alni</i> Harrison Alder flea beetle	Alder	Algonquin Park District	High populations along Highway 60 corridor.
<i>Altica populi</i> Brown Poplar flea beetle	Balsam poplar	Southern Ontario	Defoliation up to 100% in Bancroft, Parry Sound, and Tweed districts.
<i>Anacampsis innocuella</i> (Zell.) Darkheaded aspen leafroller	Trembling aspen, largetooth aspen	Southern Region	Defoliation averaged 25% in a 25-ha stand of 14-m trees in Georgina Township, Maple District and in a 10-ha area in Tiny Township, Midhurst District.
<i>Anisota virginiensis</i> (Drury) Pinkstriped oakworm	Red oak	Sault Ste. Marie District	Defoliation up to 15% in many stands.
<i>Aphrophora cribrata</i> (Wlk.) Pine spittlebug	Eastern white pine, Scots pine Jack pine	Southern Region Dryden District	Common throughout. Frequently every branch tip damaged. 80% of 1-m trees in 10 ha near Sunstrum Lake lightly infested.
<i>Archips cerasivorana</i> (Fitch) Uglynest caterpillar	Cherry	Province wide	High populations in Fort Frances, Kenora, and Midhurst districts.
<i>Archips fervidana</i> (Clem.) Oak webworm	Red oak	Sault Ste. Marie District	Up to 50% defoliation of fringe trees in Striker and Long townships.

	Hosts	Location	Comments
<i>Arge scapularis</i> (Klug) Oak sawfly	Alder	Sault Ste. Marie District	Defoliation averaged 80% on shoreline trees at McCreight's Dam, Kirkwood Township and on Archibald Island, off the south end of St. Joseph Island.
<i>Argyresthia thuiella</i> (Pack.) and <i>Coleotechnites thujaella</i> (Kft.) Cedar leafminers	Eastern white cedar	Southern Ontario	Defoliation >75% at several sites in the Kawartha Lakes area and up to 75% at many other locations in the Tweed, Kemptville, Maple, and Midhurst districts.
<i>Bucculatrix ainsliella</i> Murt. Oak skeletonizer	Red oak	Midhurst District	A 2-ha stand severely defoliated in Mulmur Township.
<i>Bucculatrix canadensisella</i> Cham. Birch skeletonizer	White birch	Eastern and northern Ontario	Defoliation ranged from light to severe.
<i>Calligrapha multipunctata bigsbyana</i> (Kby.) Willow leaf beetle	Willow	Sault Ste. Marie District	Defoliation of 75% in low lying areas, Sault Ste. Marie.
<i>Cameraria aceriella</i> (Clem.) Maple leafblotch miner	Sugar maple	Central Region	Defoliation up to 30% in one stand in Sault Ste. Marie District and in much of the Parry Sound and Bancroft districts.
<i>Cecidomyia resinicola</i> (O.S.) Jack pine resin midge	Jack pine	Dryden and Sioux Lookout districts Sudbury and North Bay districts Chapleau District	Fourth consecutive year of damage. Branch tip mortality up to 100% along all major roads. Tip mortality 10–40% in several areas. 3% of trees damaged at the tree improvement center, Dalmas Township.
<i>Choristoneura conflictana</i> (Wlk.) Large aspen tortrix	Trembling aspen	Northwest Region	900 ha of moderate to severe defoliation in Yesno and Lahontan townships and Kama Hills between Nipigon and Schreiber, Nipigon District.

	Hosts	Location	Comments
		Northeast Region	Foliar damage of 20% persisted in Winget, Leeson, and Rennie townships, Wawa District.
		Southern Region.	A 20-ha stand in Gloucester Township, Kemptville District remained infested. Elsewhere populations collapsed.
<i>Coleophora laricella</i> Hbn. Larch casebearer	Larch	Central Region	Populations increased significantly. Damaged stands occurred from Sault Ste. Marie to Pembroke. Defoliation 20–75%.
	European larch, larch	Southern Region	Pockets of severe defoliation (>75%) from Aylmer District east to Kemptville District in natural stands and plantations.
<i>Conophthorus resinosae</i> (Hopk.) Red pine cone beetle	Jack pine	Sault Ste. Marie District	Incidence of 37% occurred in Lane Township test area.
		Kirkland Lake District	Up to 23% of trees damaged in Chamberlain Township.
<i>Contarinia baeri</i> (Prell) European pine needle midge	Scots pine	Sault Ste. Marie District	Foliar damage averaged 30% on 4-m trees in Thessalon Township.
	Red pine	Midhurst District	Low populations common on fringe trees at Canadian Forces Base Borden.
<i>Corythylus punctatissimus</i> Zimm. Pitted ambrosia beetle	Sugar maple	Midhurst District	20% mortality on regeneration in a 20-ha stand in Adjala Township.
<i>Corythucha elegans</i> Drake Poplar lace bug	Willow	Nipigon District	Foliar damage 90% on 3-m trees near the junctions of Highways 11 and 625.
<i>Croesia semipurpurana</i> (Kft.) Oak leafshredder	Red oak	Tiny Township, Midhurst District	67 ha of moderate to severe defoliation.
		Sault Ste. Marie District	Defoliation averaged 60% near Sault Ste. Marie.

	Hosts	Location	Comments
<i>Dasychira dorsipennata</i> (B. & McD.) Hardwood tussock moth	Red oak	Midhurst District	Trace populations on mature trees in Dufferin County Forest.
<i>Dioryctria abietivorella</i> (Grt.) Fir coneworm	Black spruce	Thunder Bay District	18% of cones on 2-m trees in Hardwick Township.
<i>Diprion similis</i> (Htg.) Introduced pine sawfly	Eastern white pine	Central Region	Defoliation averaged 10% in several plantations in the Sault Ste. Marie District.
		Thunder Bay District	Defoliation of 5% on 2.5-m trees in Neebing Township.
<i>Dryocampa r. rubicunda</i> (F.) Greenstriped mapleworm	Red maple	Sault Ste. Marie and Sudbury districts	Moderate to severe defoliation of 507 811 ha.
<i>Enargia decolor</i> (Wlk.) Aspen twoleaf tier	Trembling aspen	Northeastern Ontario	Moderate to severe defoliation of 4 802 965 ha.
<i>Epinotia aceriella</i> (Clem.) Maple trumpet skeletonizer	Sugar maple	Southern Region	Widespread incidence on ornamental trees and woodlots. Heaviest defoliation averaged 75% at Presqu'ile Provincial Park.
<i>Epinotia solandriana</i> (L.) Birch-aspen leafroller	White birch	Northwest Region	Moderate defoliation in Wiggins Township, Nipigon District, Red Lake District, and in the southeast portion of the Dryden District.
<i>Eucosma gloriola</i> Heinr. Eastern pine shoot borer	Jack pine	Northern Ontario	Damage in Shulman Township, Sault Ste. Marie District, Firstbrook Township, Temagami District, and in McNaught Township, Chapleau District. Leader damage was 19, 13, and 10%, respectively.
<i>Fenusa ulmi</i> Sund. Elm leafminer	White elm, slippery elm	Southern Region	Pockets of heavily damaged trees in Hillier Township, Tweed District, and in Augusta and Montague townships, Kemptville District.

	Hosts	Location	Comments
<i>Gargaphia tiliae</i> (Walsh) Basswood lace bug	Basswood	Southern Region	High populations caused severe browning at many locations in central and eastern areas.
<i>Glycobius speciosus</i> (Say) Sugar maple borer	Sugar maple	Central Region	Increased incidence in several stands particularly in Sault Ste. Marie District.
<i>Gonioctena americana</i> (Schaeff.) American aspen beetle	Trembling aspen	Algonquin Park District	High populations on open-grown trees in Sproule Township.
<i>Hemichroa crocea</i> (Geoff.) Striped alder sawfly	Alder	Dryden District	100% defoliation at several locations in Mafeking Township, Williams Bay, and along Highways 622 and 502.
<i>Hylobius radialis</i> Buch. Pine root collar weevil	Jack pine	Red Lake District	<1% of 1-m trees damaged at the Nungesser progeny test.
<i>Hyphantria cunea</i> (Drury) Fall webworm	Black ash	Kawartha Lakes area	Small stands, usually less than 1 ha, completely defoliated.
	Deciduous	Remainder of Ontario	Common on single and small groups of trees.
<i>Isochnus rufipes</i> (LeC.) Willow flea beetle	Willow	Sudbury and North Bay districts	90–100% foliar damage in area of Markstay, Wanapitei, Chelmsford, Sudbury, and North Bay.
<i>Lepidosaphes ulmi</i> (L.) Oystershell scale	Beech	Kemptville and Tweed districts	Heavy infestations combined with drought damaged trees at several locations.
<i>Leucoma salicis</i> (L.) Satin moth	Carolina poplar, European white poplar	Southern Region	Defoliation up to 100% at numerous locations, primarily on roadside trees, in the Maple, Midhurst, and Tweed districts.
<i>Malacosoma americanum</i> (F.) Eastern tent caterpillar	Deciduous	Southern Ontario	Moderate to severe defoliation of roadside and open-grown trees in southern Parry Sound, Bancroft, Tweed, and Kemptville districts.
<i>Malacosoma californicum pluviale</i> (Dyar) Northern tent caterpillar	White birch	Fort Frances District	25% defoliation occurred on 2-m trees in a 2-ha area at Cedar Narrows.

	Hosts	Location	Comments
<i>Micrurapteryx salicifoliella</i> (Cham.) Willow leafminer	Willow	Nipigon District	Severe browning at many locations.
<i>Monochamus scutellatus</i> (Say) Whitespotted sawyer	Jack pine	Dryden District	80% of trees in a 120-ha plantation near Snowdon Lake with severe defoliation. Branch damage ranged up to 60%.
<i>Neodiprion abietis</i> (Harr.) Balsam fir sawfly	Balsam fir	Northwestern Region	Defoliation up to 40% on all tree age-classes along Highways 588, 11, and 17, Thunder Bay District and along Highway 11, Fort Frances District.
		Central Region	Medium and heavy infestations persisted in Bagot Township, Pembroke District.
		Southern Region	Defoliation up to 60% on single trees and small groups of trees in Kemptville District.
<i>Neodiprion lecontei</i> (Fitch) Redheaded pine sawfly	Red pine	Midhurst District	Successful aerial spray program using Lecontvirus done on 43 ha on Christian Island.
		Sault Ste. Marie District	Several plantations with foliar damage up to 50%.
<i>Neodiprion n. nanulus</i> Schedl Red pine sawfly	Jack pine	Thunder Bay District	Defoliation up to 20% on all size-classes of trees in Devon Township.
<i>Neodiprion pratti banksianae</i> Roh. Blackheaded jack pine sawfly	Jack pine	Northwest Region	Defoliation up to 100% on trees up to 2 m along Highway 11, Fort Frances District. Larger trees had 5–40% defoliation. Scattered 4–6-m trees with foliar damage up to 50% along Highways 599 and 642 in Dryden and Sioux Lookout districts.

	Hosts	Location	Comments
<i>Neodiprion pratti paradoxicus</i> Ross Jack pine sawfly	Jack pine	Southern Region	Moderate to severe defoliation over 2129 ha in Kaladar area, Tweed District and in 11 widely separated areas over 902 ha in Kemptville District.
	Jack pine, Scots pine	Central Region	Medium infestations in Ross and McNab townships, Pembroke District and in Miller and Methuen townships, Bancroft District.
<i>Neodiprion sertifer</i> (Geoff.) European pine sawfly	Red pine	Bancroft District	Defoliation averaged 10% on 1-m trees, Carlow Township.
	Scots pine	Tweed District	Stand of 50, 2-m trees in Pittsburg Township moderately defoliated.
<i>Neodiprion swainei</i> Midd. Swaine jack pine sawfly	Jack pine	Temagami District	Up to 40% defoliation on 3–12-m trees on Island 127 in Lake Temagami.
<i>Neodiprion virginiana</i> Roh. (complexe) Redheaded jack pine sawfly	Jack pine	Wawa District	Single tree defoliation of 75% in Gertrude Township.
<i>Nymphalis antiopa</i> (L.) Spiny elm caterpillar	Deciduous	Central and Northwest regions	Widespread occurrence on single trees. Defoliation up to 60%.
<i>Oligonychus ununguis</i> (Jac.) Spruce spider mite	Jack pine	Dryden and Sioux Lookout districts	Foliar discoloration throughout both districts on trees under 3 m.
	White spruce	Maple District	Heavy damage on ornamentals.
<i>Paraclemensia acerifoliella</i> (Fitch) Maple leafcutter	Sugar maple	Aylmer District	Defoliation averaged 25% on 24-m trees in a 30-ha woodland in Houghton Township.
<i>Petrova albicapitana</i> (Bsk.) Northern pitch twig moth	Jack pine	Northwest Region	Damage up to 6% on 1–3-m trees in Red Lake, Kenora, Fort Frances, and Dryden districts.

	Hosts	Location	Comments
		Sault Ste. Marie District	Main stem attacks on 22% of 1.2-m trees in Daumont Township.
<i>Phyllocnistis populiella</i> Cham. Aspen serpentine leafminer	Trembling aspen	Northwest Region	88 440 ha of severe mining on all tree sizes in the north-eastern Nipigon District. Small areas of regeneration were heavily damaged in the Thunder Bay and Sioux Lookout districts.
		Hearst District	Foliar damage averaged 40% to 14-m trees in a 0.5-ha area in Studholme Township.
<i>Phyllonorycter lucidicostella</i> (Clem.) Lesser maple leafblotch miner	Sugar maple	Parry Sound District	Light defoliation in several stands.
<i>Phyllonorycter nipigon</i> (Free.) Balsam poplar leafblotch miner	Balsam poplar	Northwest Region	High populations throughout the region. Many locations where foliar damage averaged 80%.
<i>Phyllonorycter ontario</i> (Free.) Aspen leafblotch miner	Trembling aspen	Northwest Region	80–100% defoliation in several areas of the Nipigon, Dryden, and Sioux Lookout districts.
		Northeast Region	Moderate to severe damage in Strickland Township, Wawa District.
<i>Pineus strobi</i> (Htg.) Pine bark adelgid	Eastern white pine	Timmins District	Light damage on 25 and 17% of roadside regeneration in Turnbull and Paudash townships, respectively.
<i>Pissodes strobi</i> (Peck) White pine weevil	Eastern white pine	Northern Ontario	In many plantations, damage less than 10%.
<i>Podapion gallicola</i> Riley Pine gall weevil	Red pine	Midhurst District	15% branch kill on 17-m fringe trees in Mulmur Township.

	Hosts	Location	Comments
<i>Pristiphora geniculata</i> (Htg.) Mountain-ash sawfly	Mountain-ash	Northeast Region	Complete defoliation of 0.5- to 3.0-m trees in Maisonsville Township, Kirkland Lake District and Massey Township, Timmins District.
		Remainder of province	Widespread incidence.
<i>Profenusa thomsoni</i> (Konow) Ambermarked birch leafminer	White birch	Cochrane District	Low numbers in Dempsay Township.
<i>Pseudexentera oregonana</i> (Wlsm.) Early aspen leafcurler	Trembling aspen	Northeast Region	Moderate to severe defoliation on 300 ha north of Timmins, Timmins District, and in small pockets in Leitch, Nesbitt, and Clute townships, Cochrane District.
<i>Psilocorsis reflexella</i> Clem. Flat leaftier	Sugar maple, red oak, white birch	Bancroft and Parry Sound districts	Scattered light foliar damage.
<i>Pulvinaria innumerabilis</i> (Rathv.) Cottony maple scale	Silver maple	Aylmer District	Varying levels of defoliation on ornamentals around Windsor.
<i>Resseliella pinifoliae</i> (Felt) White pine needle midge	Eastern white pine	Wawa District	6% of 1.2-m regeneration damaged in Noganosh Township.
<i>Rheumaptera hastata</i> (L.) Spearmarked black moth	White birch	Nipigon District	Light foliar damage on 90% of trees near Schreiber.
<i>Schizura concinna</i> (J.E. Smith) Redhumped caterpillar	Trembling aspen	Sault Ste. Marie District	Scattered single small fringe trees were often completely defoliated in the Thessalon and Elliot Lake areas.
<i>Scolioneura betuleti</i> Klug Birch leaf edgeminer	White birch	Thunder Bay District	Foliar damage up to 80% on 6-m ornamental in Thunder Bay, a new occurrence of the pest.
<i>Symmerista canicosta</i> Franc. Redhumped oakworm	Red oak White oak	Bancroft District	50% defoliation on 12-m trees near Mississagua and Gold lakes, Harvey Township.
<i>Tetralopha applastella</i> (Hulst) Aspen webworm	Balsam poplar, trembling aspen	Temagami District	5-m trees with 5% defoliation in Strathy Township.

	Hosts	Location	Comments
<i>Tetralopha asperatella</i> (Clem.) Maple webworm	Sugar maple	Southern Region	Widespread incidence, generally at low levels of defoliation.
<i>Thecodiplosis piniresinosae</i> Kearby Red pine needle midge	Red pine	Sault Ste. Marie District	Damage over 3000 ha in Kirkwood forest. Damage reduced from 1994.
<i>Tricholochmaea d. decora</i> (Say) Gray willow leaf beetle	Willow	Northwest Region	Large areas of severe defoliation in Dryden, Kenora, Nipigon, and Sioux Lookout districts.
<i>Zeiraphera canadensis</i> Mut. & Free. Spruce budmoth	White spruce	Sault Ste. Marie District	Shoot damage as high as 80% occurred on roadside plantings in several areas.

Diseases

<i>Apiognomonina errabunda</i> (Roberge) Höhn. Anthracnose	White ash, black ash	Bancroft District	Defoliation 20–50% at Ells Creek, Burleigh Township.
	White ash	Midhurst District	Roadside trees in Oro Township 40% defoliation.
<i>Asteroma ulmeum</i> (Miles) Leaf spot	White elm	Parry Sound District	60% defoliation in Huntsville.
<i>Chrysomyxa arctostaphyli</i> Dietel Spruce broom rust	Black spruce	Dryden and Sioux Lookout districts	Low levels of brooms common in older stands.
<i>Chrysomyxa ledi</i> de Bary var. <i>ledi</i> Savile and <i>Chrysomyxa ledicola</i> (Peck) Lagerh. Spruce needle rusts	White spruce, black spruce	Northern Ontario	Light defoliation. An exception was in Neys Provincial Park, Nipigon District, where <i>C. ledicola</i> caused 100% foliar damage to a small clump of black spruce.
<i>Ciborinia whetzeli</i> (Seaver) Seaver Ink spot	Trembling aspen	Northwest Region	Small pockets <1 ha with foliar damage 20–80% in Nipigon, Dryden, and Sioux Lookout districts.
<i>Coleosporium asterum</i> (Dietel) H. Syd. & Syd. Pine needle rust	Jack pine	Nipigon District	Most trees damaged; 66% and 40% damage on trees <2 m in Booth and Ledger townships, respectively.

	Hosts	Location	Comments
		Hearst District	Defoliation averaged 55% on 1.7-m trees over >500 ha of regeneration in Elgie Township.
	Jack pine, red pine	Remainder of Ontario	Widespread generally at low damage levels.
<i>Cronartium comptoniae</i> Arth. Sweet fern blister rust	Jack pine	Thunder Bay District	Infection rate of 36% on 3-m trees at the Kakabeka Falls seed orchard.
		Cochrane District	15% of mature trees damaged at one location in Calvert Township.
<i>Cronartium ribicola</i> J.C. Fisch. White pine blister rust	Eastern white pine	Temagami District	19% incidence on 1-m trees in a small area in Strathy Township.
		Fort Frances District	14% infection on 4.5-m trees in a 5-ha area in Lash Township.
<i>Cryphonectria parasitica</i> (Murrill) Barr Chestnut blight	American chestnut	Aylmer Township	A few heavily infected trees in Leamington area, Gosfield South Township.
<i>Cylindrocladium</i> spp. and <i>Fusarium</i> spp. Root rots	Black spruce	Kirkland Lake District	Associated with mortality of growing stock at Swastika Tree Nursery.
<i>Davisomycella ampla</i> (J.C. Davis) Darker Tar spot needle cast	Jack pine	Northwest Region	80% foliar damage on 10% of regeneration in Mafeking Township and near Route Bay, Dryden District.
		Northeast Region	Incidence up to 34% and foliar damage up to 25% at 15 locations.
		Central Region	Foliar damage 18–55%. Heaviest defoliation in Alice, Clara, and Richards townships, Pembroke District.
<i>Endocronartium harknessii</i> (J.P. Moore) Y. Hiratsuka Western gall rust	Jack pine	Northwest Region	Number of affected trees up to 45% in Sioux Lookout, Dryden, and Red Lake districts.

	Hosts	Location	Comments
		Northeast Region	Incidence of trees affected increased from 2.1% in 1994 to 4.9% in 1995 at 16 locations.
		Central Region	Trees affected averaged 10%.
		Southern Region	Sanitation control done in a heavily infected Christmas tree plantation in Tiny Township, Midhurst District.
<i>Erwinia amylovora</i> (Burrill) Winslow et al. Fire blight	Mountain-ash	Thunder Bay District	20% branch mortality and 50% defoliation on ornamental at Marina Park in Thunder Bay.
	Apple	Parry Sound District	Heavy branch mortality in Stisted Township.
<i>Gnomonia leptostyla</i> (Fr. : Fr.) Ces. & De Not. Leaf spot	Butternut	Midhurst District	90% defoliation on 20, 10- to 12-m roadside trees in Holland Township.
<i>Gymnosporangium cornutum</i> Arth. ex Kern Mountain-ash-juniper rust	Mountain-ash	Nipigon District	10% foliar damage along the Cameron Falls Road north of Nipigon.
<i>Gymnosporangium juniperi-virginianae</i> Schwein. Cedar-apple rust	Eastern red cedar	Tweed District	Averaged 10 fruiting bodies per 4-m tree in North Fredericksburgh Township and 15 per 7-m tree in Sophiasburgh Township.
<i>Heterobasidion annosum</i> (Fr. : Fr.) Bref. Fomes root rot	Red pine	Kemptville District	On mature trees in LaRose Forest, Clarence Township.
<i>Hypoxyylon mammatum</i> (Wahlenb.) P. Karsten Hypoxyylon canker	Trembling aspen	Northwest Region	Varying degrees of tree mortality across the region.
<i>Inonotus tomentosus</i> (Fr. : Fr.) Teng Tomentosus root rot	White spruce	Sault Ste. Marie District	Many stands of dead and dying trees in Gaudette Township.
<i>Isthmiella crepidiformis</i> (Darker) Darker Needle cast	White spruce	Pembroke District	Up to 40% foliar damage in Wylie Township.

	Hosts	Location	Comments
<i>Isthmiella faullii</i> (Darker) Darker Needle cast	Balsam fir	Thunder Bay District	20% needle infection on 3 to 6-m trees in the Milkshake Lake area of the Sibley Peninsula.
<i>Linospora tetraspora</i> G.E. Thompson Linospora leaf blight and <i>Mycosphaerella populicola</i> G.E. Thompson Septoria leaf spot	Balsam poplar	Northern Ontario	Moderate to severe defoliation and premature leaf drop of all size-classes of trees. Districts with the most damage: Sudbury, Temagami, Dryden, Fort Frances, Sioux Lookout, Thunder Bay, Nipigon, and the entire Northeast Region.
		Southern Region	Points of moderate defoliation (30–75%) in Dummer Township, Tweed District and in St. Edmunds Township, Midhurst District.
<i>Lophophacidium dooksii</i> Corlett & Shoemaker Dook's needle blight	Eastern white pine	Central Ontario	Observed in 1994 as browning of eastern white pine, sporadic infection.
<i>Mycosphaerella dearnessii</i> Barr Brown spot needle blight	Mugho pine	Midhurst District	60% of old foliage damaged on ornamental at Sauble Falls Provincial Park, Amabel Township.
<i>Mycosphaerella effigurata</i> (Schwein.) House Leaf spot	White ash	Southern Region	75% defoliation on fringe trees in Sullivan Township.
	Black ash		Edge trees with 40% foliar damage in Brock Township, Maple District.
<i>Ophiostoma ulmi</i> (Buisman) Nannf. Dutch elm disease	White elm	Southern Ontario	Widespread and high incidence on juvenile trees in Kemptville and Maple districts, east of Lake Simcoe, Midhurst District, and in the western portion of the Tweed District.
		Northern Ontario	Current infection rate of 6% in Fort Frances, 2% in Sault Ste. Marie, and in Hagar Township, Sudbury District.

	Hosts	Location	Comments
<i>Phacidium taxicola</i> Dearn. & House Snow blight	Ground hemlock	Sault Ste. Marie District	Severely damaged shrubs on Archibald Island in the north channel of Lake Huron.
<i>Phyllosticta tiliae</i> Sacc. & Speg. Leaf spot	Basswood	Southern Region	Caused 10% defoliation on five, 7-m edge trees in Sullivan Township, Midhurst District and in Brock Township, Maple District.
<i>Plasmopara viburni</i> Peck Downy mildew	Highbush cranberry	Orono Tree Nursery, Maple District	Caused 75% foliar damage to seedlings in one compartment.
<i>Pucciniastrum americanum</i> (Farl.) Arth. Late yellow rust	White spruce	Parry Sound District	Foliar damage averaged 8% on 1.5-m trees in Laurier Township.
<i>Septoria betulae</i> Pass. Leaf spot	White birch	Nipigon District	Moderate to severe defoliation on 3700 ha in townships of Wiggins, Yesno, and Lahontan.
		Remainder of northern Ontario	Foliar damage up to 70% along major travel routes in Sudbury, North Bay, Nipigon, Dryden, Fort Frances, and Sioux Lookout districts.
<i>Sirococcus clavignenti-juglandacearum</i> V.M.G. Nair, Kostichka & Kuntz Butternut canker	Butternut	Sault Ste. Marie District	New distribution point in Hilton Township, St. Joseph Island.
<i>Sphaeropsis sapinea</i> (Fr. : Fr.) Dyko & B. Sutton Tip blight of conifers	Austrian pine, Scots pine, red Pine	Southern Region	Overall incidence declined, numerous collections made on ornamental, fringe, and roadside trees.
<i>Stegophora ulmea</i> (Schwein. : Fr.) H. Syd. & Syd. Leaf spot	White elm	Midhurst District	Affected 60% of foliage on several 6-m fringe trees in Sullivan Township.
<i>Tubakia dryina</i> (Sacc.) B. Sutton Oak leaf spot	Red oak, white oak	Bancroft District	Scattered single trees suffered 40–70% defoliation in an 8-ha area of Cavendish Township.
<i>Uncinula adunca</i> (Wallr. : Fr.) Lév. Powdery mildew	Balsam poplar, willow	Dryden District	Severe leaf infection on regeneration at junction of Highways 642, 622.

	Hosts	Location	Comments
<i>Venturia macularis</i> (Fr. : Fr.) E. Müller & v. Arx Shoot blight of aspen	Trembling aspen	Northwest Region	Regeneration had >60% incidence in cutovers in Dryden and Sioux Lookout districts.
		Sault Ste. Marie District	Terminal shoot damage 20% of 3-m trees in Proctor Township.

Other Damage

Mortality	Jack pine	Wawa District	Dead and dying trees in Pukaskwa National Park, Spooner and Welsh townships.
Salt damage	Red pine, eastern white pine	Kenora District	Foliar damage 30–70% at junction of Highways 17 and 71.
Scorch damage	Red maple, white birch, speckled alder	Northwest Region	Several areas of leaf damage; largest area occurred between Windigoostigwan Lake and Mine Centre, Fort Frances District, where foliar damage varied between 20 and 80%.
		Southern Region	Trace to moderate level of damage on fringe and open-grown trees in the Tweed and Kemptville districts.
Winter drying	Red pine	Central Region	Foliar damage up to 22% in four plantations in the Parry Sound and Bancroft districts.
	Eastern white pine	Nipigon District	Small roadside trees (<2 m) averaged 50% defoliation along Highway 11 from Ledger Township to Kilkenny Township.

Northwest

	Hosts	Location	Comments
Insects			
<i>Acleris variana</i> (Fern.) Eastern blackheaded budworm	White spruce	Saskatchewan Manitoba	Low populations on white spruce in Prince Albert National Park, the Porcupine Hills, and throughout Manitoba.
<i>Adelges lariciatus</i> (Patch) Spruce gall adelgid	Spruce	Alberta Saskatchewan Manitoba Northwest Territories	Common throughout.
<i>Adelges laricis</i> Vallot Pale spruce gall adelgid	Spruce	Alberta Saskatchewan Manitoba Northwest Territories	Common throughout.
<i>Anomogyna elimata</i> (Gn.) Chameleon caterpillar	Jack pine	Alberta	Low populations feeding on jack pine east of the Peace River near Deadwood.
<i>Archips cerasivorana</i> (Fitch) Uglynest caterpillar	Cherry	Manitoba	Common throughout eastern Manitoba.
<i>Chrysomela scripta</i> F. Cottonwood leaf beetle	Trembling aspen	Alberta Northwest Territories	Low populations found near Trout River and in Wood Buffalo National Park.
<i>Hylobius warreni</i> Wood Warren's root collar weevil	Jack pine, lodgepole pine	Alberta Saskatchewan Manitoba	Mortality noted generally throughout the region.
<i>Malacosoma californicum lutescens</i> (N. & D.) Prairie tent caterpillar	Cherry	Saskatchewan Manitoba	Observed near North Battleford, Saskatchewan, and east of Winnipeg, Manitoba.
<i>Micrurapteryx salicifoliella</i> (Cham.) Willow leafminer	Willow	Alberta Northwest Territories	Severe damage in northern Alberta and in NWT where defoliation has occurred for several consecutive years.
<i>Parthenolecanium corni</i> (Bouché) European fruit lecanium	Green ash, elm	Alberta	Severe outbreak in Edmonton.

	Hosts	Location	Comments
<i>Petrova albicapitana</i> (Bsk.) Northern pitch twig moth	Pine	Alberta Saskatchewan	Common throughout.
<i>Phyllocnistis populiella</i> (Cham.) Aspen serpentine leafminer	Aspen	Northwest Territories	Observed in Wood Buffalo National Park and north of Fort Liard.
<i>Pikonema alaskensis</i> (Roh.) Yellowheaded spruce sawfly	Spruce	Alberta Saskatchewan Manitoba	High populations throughout the region mostly on ornamentals.
<i>Pissodes strobi</i> (Peck) White pine weevil	Spruce	Alberta Saskatchewan Manitoba Northwest Territories	Commonly found on roadside and plantation regeneration.
<i>Pissodes terminalis</i> Hopping Lodgepole terminal weevil	Jack pine, lodgepole pine	Alberta Saskatchewan Manitoba Northwest Territories	Common on regeneration.
<i>Pontania proxima</i> (Lep.) Willow redgall sawfly	Willow	Alberta	High populations in Edmonton.
<i>Pristiphora erichsonii</i> (Htg.) Larch sawfly	Larch	Northwest Territories	Defoliation observed in Wood Buffalo National Park, east of Hay River, west of Taltson River, and Great Slave Lake.
<i>Rheumaptera hastata</i> (L.) Spearmarked black moth	White birch	Northwest Territories	Moderate defoliation observed near Fort Liard and the Blackstone River.
<i>Tricholochmaea d. decora</i> (Say) Gray willow leaf beetle	Willow, trembling aspen	Manitoba	Defoliation on both species in eastern Manitoba.
<i>Zeiraphera canadensis</i> Mut. & Free. Spruce budmoth	White spruce	Manitoba	Moderate to high populations in eastern Manitoba.

Diseases

<i>Armillaria ostoyae</i> (Romagn.) Herink Armillaria root rot	Pine species	Alberta Saskatchewan Manitoba Northwest Territories	Infection centers widespread.
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	Hosts	Location	Comments
<i>Atropellis piniphila</i> (Weir) Lohman & Cash Atropellis canker	Lodgepole pine	Alberta	Common near Rocky Mountain House, Robb, between Blairmore and Livingstone Falls.
<i>Chrysomyxa arctostaphyli</i> Dietel Yellow witches'-broom	Spruce	Alberta	High incidence of the disease in Banff National Park, north of Banff, in the Bow River valley.
<i>Chrysomyxa ledicola</i> (Peck) Lagerh. Labrador tea rust or spruce needle rust	White spruce	Alberta	Moderate to high population levels in the Foothills near Hinton and in Jasper National Park.
<i>Chrysomyxa pirolata</i> (Körn.) Wint. Spruce cone rust	White spruce	Alberta	Common near Robb, in Kananaskis Provincial Park, and in Jasper National Park along the Athabaska and Miette rivers.
<i>Elytroderma deformans</i> (Weir) Darker Needle cast	Lodgepole pine	Alberta	Commonly observed.
<i>Endocronartium harknessii</i> (J.P. Moore) Y. Hiratsuka Western gall rust	Pine	Alberta	High incidence between Blairmore and Livingstone Falls, in Jasper National Park, and Duck Mountain Provincial Forest.
<i>Lophodermella arcuata</i> (Darker) Darker Needle cast	Limber pine	Alberta	Moderate damage observed in the Porcupine Hills.
<i>Lophodermella concolor</i> (Dearn.) Darker Pine needle cast	Lodgepole pine	Alberta	Observed in the Rocky Mountains national parks and in the northern east slopes region; reduced levels from previous years.
<i>Meria laricis</i> Vuill. Larch needle cast	Alpine larch	Alberta	Severe damage observed near Lemah Lake and the headwaters of the Spray River.
<i>Rhabdocline pseudotsugae</i> H. Syd. Rhabdocline needle cast	Douglas-fir	Alberta	Low populations observed in the Porcupine Hills.
<i>Sphaeropsis sapinea</i> (Fr. : Fr.) Dyko & B. Sutton Tip blight of conifers	Jack pine, red pine	Manitoba	Prevalent in southeastern Manitoba. Causes cankers on stems.

	Hosts	Location	Comments
<i>Venturia macularis</i> (Fr. : Fr.) E. Müller & v. Arx Aspen leaf and twig blight	Trembling aspen	Alberta	Infestations near Pierre Greys Lakes east of Grande Cache and in the Bow River valley in Banff National Park.

Other Damage

Aspen mortality	Aspen	Alberta Saskatchewan	Mortality from drought and past insect defoliation was common in the southern northeast boreal region and southern portions of the Meadows Lake region.
Hail damage	Balsam fir, white spruce, trembling aspen	Alberta	About 400 ha of forest were severely damaged in a 1994 storm northeast of Grande Cache.

Pacific and Yukon

	Hosts	Location	Comments
Insects			
<i>Acleris gloverana</i> (Wlsh.) Western blackheaded budworm	Western hemlock	Nelson and Kamloops regions	Populations collapsed along Kootenay Lake and in Glacier National Park.
<i>Actebia fennica</i> (Tausch.) Black army cutworm	Spruce	Golden	Cutworm killed about 20% of the seedlings over 20 ha. Only limited pheromone trapping conducted due to limited fires and cutworm activity.
<i>Adelges abietis</i> (L.) Eastern spruce gall adelgid	Spruce	Terrace	Scattered on both native and exotic hosts.
<i>Adelges cooleyi</i> (Gill.) Cooley spruce gall adelgid	Douglas-fir, Engelmann spruce, Sitka spruce	All regions	Discoloration on Douglas-fir, galls on spruce, common; can stunt growth of young spruce.
<i>Adelges tsugae</i> Ann. Hemlock woolly adelgid	Western hemlock	Vancouver region	Low populations in some natural stands.

	Hosts	Location	Comments
<i>Altica ambiens</i> LeC. Alder flea beetle	Alder	Terrace	Small pocket of scattered severe defoliation.
<i>Apteronia crenulella</i> forme <i>helix</i> (Siebold) Snailcase bagworm	Douglas-fir	Kootenays	New distribution record.
<i>Argyresthia</i> sp. A cypress tip moth	Ornamental cypress, juniper, and cedar	Victoria	Foliage lightly discolored with some branch tips killed.
<i>Argyresthia columbia</i> Free. Larch shoot miner	Western larch	Columbia Lake	12 % of the terminals killed in sixth year of damage.
<i>Cecidomyia</i> sp. Midge	Black cottonwood	Babine River	Target-like galls again common.
<i>Cecidomyia piniinopis</i> (O.S.) Gouty pitch midge	Ponderosa pine	Okanagan	Severe on new shoots of roadside trees.
<i>Cecidophyopsis psilaspis</i> (Nalepa) Yew big bud mite	Western yew	Prince Rupert	New distribution record.
<i>Coleophora laricella</i> (Hbn.) Larch casebearer	Western larch	Kamloops region	Light defoliation on 70 ha near Vernon.
<i>Contarinia pseudotsugae</i> Condrashoff A needle midge	Douglas-fir	Little Fort Vavenby Nelson region	Severe discoloration with needle loss on regeneration for second year. Discoloration of current growth common in drier areas, for fourth year in southwest.
<i>Cryptorhynchus lapathi</i> (L.) Poplar-and-willow borer	Willow, poplar, birch, black cottonwood	Prince Rupert, Cariboo, Nelson, Prince George regions	Common; numerous shoots and stems killed, many in poplar plantations.
<i>Dendroctonus brevicomis</i> LeC. Western pine beetle	Ponderosa pine	West Kootenay	In trees attacked by <i>D. valens</i> in southwestern areas of the Kootenays.
<i>Dendroctonus valens</i> LeC. Red turpentine beetle	Ponderosa pine	Kamloops	Scattered single attacks near urban areas.
<i>Dioryctria cambiicola</i> (Dyar) Western pine moth	Scots pine	Langley	New host record.

	Hosts	Location	Comments
<i>Elatobium abietinum</i> (Wlk.) Spruce aphid	Sitka spruce	Queen Charlotte Islands and Vancouver Island	Scattered, moderate defoliation along the east coast of Graham Island. Common on east coastal Vancouver Island.
	Ornamental spruce	Vancouver Region	Endemic in urban areas.
<i>Eriophyes parapopuli</i> Keif. Poplar trunk gall mite	Trembling aspen	Watson Lake Takhini Hot Springs	Light damage on most trees for third year.
<i>Fenusa pusilla</i> (Lep.) Birch leafminer	White birch	Prince Rupert, Prince George, Vancouver regions	40% of foliage discolored on trees at Smithers; 30% of foliage infested at Liard Hot Springs Provincial Park; moderate discoloration from Yale to Vancouver.
<i>Gnathotrichus</i> spp. <i>Trypodendron</i> spp. Ambrosia beetles	Douglas-fir, lodgepole pine, western hemlock	Kamloops, Nelson, Prince Rupert, and Vancouver regions	Common in bark beetle- attacked trees and log decks.
<i>Gossyparia spuria</i> (Mod.) European elm scale	Elms	Kamloops	Causing light to moderate defoliation in parks.
<i>Harmonia axyridis</i> (Pallus) A ladybird beetle		Vancouver Island, Gulf Islands, Fraser Valley	This aphid predator, introduced to the United States, is now common enough in British Columbia to draw enquiries from the public.
<i>Hylobius warreni</i> Wood Warren's root collar weevil	Lodgepole pine	Interior regions, particularly central part of Prince Rupert region	Common in natural stands and plantations; usually less than 1% mortality annually.
<i>Hylocurus hirtellus</i> (LeC.) Willow bark beetle	Trap	Richmond	New distribution record.
<i>Hyphantria cunea</i> (Drury) Fall webworm	Alder, cherry	Kamloops, Vancouver, Nelson regions	Common, widespread, light to severe defoliation, and numerous webs.
<i>Ips pini</i> (Say) Pine engraver	Lodgepole pine	Cariboo, Kamloops, Nelson, Prince Rupert regions	Common in trees killed by mountain pine beetle and near edges of cut blocks.
<i>Lambdina fiscellaria</i> <i>lugubrosa</i> (Hulst) Western hemlock looper	Western hemlock, western red cedar	Prince George, Cariboo, Kamloops, Nelson regions	Populations collapsed after up to five successive years of defoliation in the interior cedar/hemlock zone of British Columbia.

	Hosts	Location	Comments
<i>Lambdina fiscellaria somniaria</i> (Hulst) Western oak looper	Garry oak, Douglas-fir	Saltspring Island	Trees were killed over 25 ha in Mount Maxwell Provincial Park.
<i>Leptoglossus occidentalis</i> Western conifer seed bug	Douglas-fir, western red cedar, lodgepole pine	West Kootenay Vancouver Island	Chronic moderate to high numbers; nuisance in urban areas. Common in seed orchards.
<i>Lyonetia speculella</i> Clem. Birch leafminer	White birch	Prince Rupert, Nelson, Kamloops regions	Light to severe defoliation over 220 ha at Bob Quinn Lake, and increased defoliation in the northern half of the Nelson region; low-moderate defoliation on 1650 ha near Adams Lake.
<i>Melanolophia imitata</i> (Wlk.) Greenstriped forest looper	Western hemlock	Prince Rupert region	Over 700 ha severely defoliated northeast of Hazelton.
<i>Micrurapteryx</i> sp. Willow leafminer	Willow	Fort Nelson	Severe discoloration of willow in patches throughout area.
<i>Mindarus</i> sp. Balsam twig aphid	Amabilis fir	Vancouver region	Endemic after 1989 epidemic.
<i>Nalepella</i> sp. Eriophyid mite	Spruce	Vernon	New host record.
<i>Neodiprion</i> sp. Sawfly	Western hemlock	Queen Charlotte Islands Glacier National Park	Endemic. Slight population increase along with blackheaded budworm.
<i>Nepytia phantasmaria</i> (Stkr.) Phantom hemlock looper	Douglas-fir, western hemlock	Burnaby	Increased populations severely defoliated mature trees over 10 city blocks.
<i>Neuroterus saltatorius</i> (Edw.) Jumping gall wasp	Garry oak	Southern Vancouver Island	Decreased populations.
<i>Operophtera brumata</i> (L.) Winter moth	Garry oak White birch, fruit and ornamental trees	Vancouver Island Vancouver, Lower Fraser Valley	Continued light defoliation of widely scattered trees. Trace and light defoliation.

	Hosts	Location	Comments
<i>Orgyia antiqua badia</i> Hy. Edw. Rusty tussock moth	White spruce, alpine fir, lodgepole pine, alder, Douglas-fir	Prince George and Cariboo regions Fraser Valley	Endemic; following defolia- tion over 13 000 ha in 1992.
<i>Orgyia pseudotsugata</i> (McD.) Douglas-fir tussock moth	Douglas-fir	Kamloops region	No defoliation for the second consecutive year. Collapse was attributed to naturally occurring infection by the nuclear polyhedrosis virus.
<i>Orthotomicus caelatus</i> (Eichh.) Pine bark beetle	Scots pine	Matsqui	New host record.
<i>Phyllocnistis populiella</i> (Cham.) Aspen serpentine leafminer	Trembling aspen	Adams River Valley	Occasional light defoliation.
<i>Phylloxera</i> sp. nr. <i>glabra</i> (Heyden) Oak leaf phylloxeran	Garry oak	Greater Victoria Gulf Islands	Severe discoloration and premature leaf drop on 10% of trees.
<i>Pikonema alaskensis</i> (Roh.) Yellowheaded spruce sawfly	Ornamental spruce	Castlegar	Chronic to severe defolia- tion in urban areas.
<i>Pineus</i> sp. An adelgid	Engelmann, Sitka, white spruce	Kamloops, Nelson, Prince George, and Prince Rupert regions	Infested tips on some trees common in most areas; some deformity and stunting.
<i>Pissodes terminalis</i> Hopping Lodgepole terminal weevil	Lodgepole pine	Central and southern interior Yukon	Common in most immature stands but usually in less than 10% of the trees. Affected 10% of the termi- nals in a stand near Atlin.
<i>Pleroneura brunneicornis</i> Roh. Balsam shootboring sawfly	Grand fir, alpine fir	Southern interior	Endemic through southern host range.
<i>Pristiphora erichsonii</i> (Htg.) Larch sawfly	Larch Western larch	Prince Rupert Yukon Territory Vancouver region	Trace to light defoliation near Yukon border and in patches along Robert Campbell Highway north of Watson Lake. Light and moderate defo- liation of small groups of trees at UBC Research Forest.

	Hosts	Location	Comments
<i>Profenusa thomsoni</i> (Konow) Ambermarked birch leafminer	White birch	Hazelton Terrace Pemberton	Light and moderate discoloration of trees along roadsides, in city areas, and in natural stands.
<i>Pseudexentera oregonana</i> (Wlsm.) Aspen leafroller	Trembling aspen	Prince Rupert region	Scattered aspen leaf curl along the Skeena River.
<i>Pseudohylesinus tsugae</i> Swaine Bark beetle	Alpine fir	Terrace	Common in lower boles of stressed and disturbed trees.
<i>Pyrrhalta luteola</i> (Müll.) Elm leaf beetle	Elms	Kamloops, Penticton, Nelson	Light to moderate defoliation in parks.
<i>Rhyacionia buoliana</i> (D. & S.) European pine shoot moth	Exotic pine	Fraser and Okanagan valleys	Continues to infest exotic pine trees at low levels.
<i>Saperda calcarata</i> Say Poplar borer	Trembling aspen, black cottonwood	Cariboo and Kamloops regions	Up to 20% of trees in widespread patches killed or with stem breakage.
<i>Scolytus multistriatus</i> (Marsh.) Smaller European elm bark beetle	Pheromone traps	Kelowna Grand Forks Midway	Again caught in traps near Kelowna and for the first time near Grand Forks and Midway. As one of the few areas to be free of the disease, British Columbia exports more than 10 000 elm seedlings annually.
<i>Synanthedon sequoiae</i> (Hy. Edw.) Sequoia pitch moth	Lodgepole pine	Kamloops and Prince George regions	Widespread scattered stem attacks with some breakage.
<i>Tomicus piniperda</i> (L.) Pine shoot beetle	Pines	Pacific and Yukon region	Negative in surveys since 1992 following finds in the American lake states.
<i>Tricholochmaea decora carbo</i> (LeC.) Pacific willow leaf beetle	Willow	Nelson region	Severe discoloration of foliage in parts of west Kootenays.
<i>Yponomeuta malinella</i> Zell. Apple ermine moth	Apple, crabapple	Vancouver region	Decreased colonies and less widespread.
<i>Yponomeuta padella</i> (L.) Cherry ermine moth	Mountain-ash, cherry, hawthorn, plum	Victoria Delta	Increased; numerous tents and widespread light damage.

	Hosts	Location	Comments
<i>Zeiraphera canadensis</i> Mut. & Free. Spruce budmoth	White spruce, Sitka spruce	Prince Rupert, Queen Charlotte Islands	Common in new shoots.
<i>Zeiraphera improbana</i> (Wlk.) Larch budmoth	Western and alpine larch	East Kootenay (Elk Valley)	700 ha moderate and severe defoliation for first time in recent years.
<i>Zelleria haimbachi</i> Bsk. Pine needle sheathminer	Lodgepole pine	Southern interior	Widespread with occasional light feeding in scattered stands.
<i>Zelleria lepariella</i> Stainton Ash skeletonizer	Oregon ash	Victoria	First record of an apparent introduction on ornamentals.

Diseases

<i>Arceuthobium americanum</i> Nutt. : Engelm. Lodgepole pine dwarf mistletoe	Lodgepole pine	Cariboo, Nelson, Kamloops, Prince George, Prince Rupert regions	Occasional severe brooming causing increment loss.
<i>Arceuthobium douglasii</i> Engelm. Douglas-fir dwarf mistletoe	Douglas-fir	West Kootenay, South Okanagan	Severe brooming in patches.
<i>Arceuthobium laricis</i> (Piper) St. John Larch dwarf mistletoe	Western larch	Nelson region	Widespread.
<i>Arceuthobium tsugense</i> (Rosend.) G.N. Jones Hemlock dwarf mistletoe	Western hemlock	Prince Rupert and Vancouver regions	Widespread in old growth coastal areas.
<i>Armillaria ostoyae</i> (Romagn.) Herink Armillaria root rot	Douglas-fir, lodgepole pine, ponderosa pine, western larch	All forest regions	Found in all age-classes of most conifer stands. Tree mortality most common in immature stands in coastal areas and in all age-stands in the interior.
<i>Bertia moriformis</i> (Tode : Fr.) De Not. Wood decay fungi	Trembling aspen	Kamloops	New host record.
<i>Biscogniauxia bartholomaei</i> (Peck) L.N. Vasilyeva Wood decay fungi	Red alder	Metchosin	New record.

	Hosts	Location	Comments
<i>Biscogniauxia mediterranea</i> (De Not.) Kuntze Wood decay fungi	Red alder	Metchosin	New record.
<i>Bisporella citrina</i> (Batsch : Fr.) Korf & S. Carpenter Wood decay fungi	Trembling aspen	Kamloops	New host record.
<i>Calosphaeria pulchella</i> (Pers. : Fr.) J. Schröt. in Cohn Canker fungus	Cherry	Slocan Valley	New host record.
<i>Chrysomyxa ledicola</i> (Peck) Lagerh. Spruce needle rust	Sitka spruce	Queen Charlotte Islands	Common, moderate damage to new growth from near Tlell to north of Port Clements.
		Kamloops	Light discoloration on regeneration.
	White spruce	Dease Lake	Common in patches.
<i>Cronartium coleosporioides</i> Arth. f. sp. <i>coleosporioides</i> Orange stalactiform blister rust	Lodgepole pine	Cariboo, Prince Rupert, Prince George, Kamloops, Nelson regions	Cankers common in west and southern parts of Cariboo region; widespread in eastern part of Prince Rupert region; common elsewhere.
<i>Cronartium comandrae</i> Peck Comandra blister rust	Lodgepole pine	Prince George and Prince Rupert regions, Yukon Territory	Cankers common in scattered stands.
<i>Cronartium ribicola</i> J.C. Fisch. White pine blister rust	Western white pine	Kamloops and Nelson regions	Branch and stem cankers and tree mortality common throughout the host range.
		Queen Charlotte City	Several trees in provenance trial infected. Not native to area.
	Whitebark pine	Cariboo, Kamloops, Prince Rupert regions	Stem cankers common on high-elevation trees.
<i>Delphinella</i> sp. Delphinella tip blight	Alpine fir	Prince Rupert region	Common throughout southern areas.
<i>Dichomera gemmicola</i> Funk & Sutton Bud necrosis	Douglas-fir	North Thompson River valley	Severe on regeneration at scattered locations.

	Hosts	Location	Comments
<i>Didymascella thujina</i> (E.J. Durand) Maire Cedar leaf blight	Western red cedar	Nelson, Prince Rupert, and Vancouver regions	Endemic. Light to moderate discoloration observed throughout host range.
<i>Discula destructiva</i> Redlin Dogwood leaf blight	Dogwood	Vancouver region	Less common than in 1994 on lower mainland and eastern Vancouver Island; branch mortality, occasionally trees killed.
<i>Durandiella pseudotsugae</i> Funk Dime canker	Douglas-fir	West Kootenay and Vancouver region	Widespread on immature trees but little effect on tree growth.
<i>Echinodontium tinctorium</i> (Ellis & Everh.) Ellis & Everh. Yellow-brown stringy rot	Western hemlock	Prince Rupert, Kamloops, Nelson regions	Common in old growth trees.
<i>Elytroderma deformans</i> (Weir) Darker Elytroderma disease	Ponderosa pine	Southern British Columbia	Common and widespread; perennial infections on many trees.
	Lodgepole pine	Clinton	Over 30% of the trees had 20% of the foliage infected.
<i>Endocronartium harknessii</i> (J.P. Moore) Y. Hiratsuka Western gall rust	Lodgepole pine	All regions	Common in immature stands; up to 35% incidence.
<i>Fomes fomentarius</i> (L. : Fr.) J. Kickx fil. White spongy trunk rot	White birch	Nelson region	Stem decay common especially in drier areas.
<i>Ganoderma applanatum</i> (Pers.) Pat. White mottled rot	American mountain-ash	Nelson	New host record.
<i>Gnomonia intermedia</i> Rehm var. <i>alni</i> Barr A leaf blight	Red alder	Williams Lake	Up to 30% new shoots killed on young alder over 2 ha.
<i>Gremmeniella abietina</i> (Lagerb.) Morelet Scleroderris canker	Lodgepole pine	Castlegar	Again collected at Nancy Greene Lake but limited to a few dead branches on a few trees. Not found at 16 other sites surveyed.
<i>Guignardia</i> cf. <i>niesslii</i> A leaf blight	Black cottonwood	Terrace	Collected from nursery; believed to be first record in western North America.

	Hosts	Location	Comments
<i>Herpotrichia</i> sp. Brown felt blight	Engelmann spruce, alpine fir	Cariboo region	Common on lower branches and young trees in high- elevation natural stands.
<i>Hypodermella laricis</i> Tub. Needle cast	Western larch	Kamloops	Light discoloration in patches throughout host range.
<i>Hypoxylon mammatum</i> (Wahlenb.) P. Karsten Hypoxylon canker	Trembling aspen	Quesnel	5% of trees killed over 1 ha, otherwise generally rare in British Columbia and Yukon.
<i>Hypoxylon rubiginosum</i> (Pers. : Fr.) Fr. Hypoxylon canker	Trembling aspen	Kamloops	New host record.
<i>Inonotus tomentosus</i> (Fr. : Fr.) Teng Tomentosus root rot	Engelmann spruce, white spruce	Prince George, Cariboo, Nelson regions	Widely scattered in immature and mature stands.
<i>Leptographium abietinum</i> (Peck) M.J. Wingfield Stain fungus	White spruce	Aleza Lake	New provincial host record.
<i>Linospora tetraspora</i> G.E. Thompson Linospora leaf blight	Black cottonwood	Skeena River valley Sayward	Blotches on some foliage on most trees in the area for third year. 40% of infected trees severely damaged at clonal trials.
<i>Lirula macrospora</i> (Hartig) Darker Needle cast	Sitka spruce	Queen Charlotte Islands	Light discoloration of needles at scattered sites.
<i>Lophodermella concolor</i> (Dearn.) Darker Pine needle cast	Whitebark pine, ponderosa pine, lodgepole pine	Cariboo, Kamloops, Nelson, Prince Rupert, Vancouver regions and southern Yukon Territory	Widespread, severe discol- oration of needles in most regions.
<i>Lophodermium seditiosum</i> Minter, Staley & Millar Needle cast	Scots pine	Matsqui	New host record.
<i>Melampsora medusae</i> Thuem. f. sp. <i>deltoidae</i> Conifer-aspen rust	Poplar hybrids	Agassiz, Riske Creek	Scattered moderate infec- tion on some clones.
<i>Melampsora occidentalis</i> Jacks. Conifer-cottonwood rust	Black cottonwood, Douglas-fir	Kamloops and Cariboo regions	Moderate infection of foliage near Lumby and Canim Bridge.

	Hosts	Location	Comments
<i>Melampsora</i> spp.	Hybrid poplars	Sayward	Only 7% of trees rusted at trace levels at clonal trials.
<i>Meria laricis</i> Vuill. Larch needle cast	Western larch	Kamloops and Nelson regions	Endemic.
<i>Mycosphaerella pini</i> Rostr. (= <i>Scirrhia pini</i> Funk & Parker) Needle blight	Western white pine, lodgepole pine	British Columbia	Endemic; no significant discoloration.
<i>Mycosphaerella populicola</i> G.E. Thompson Septoria leaf spot	Black cottonwood	Skeena River	Foliage discolored on planted trees for third year.
	Hybrid poplars	Harrison Mills	Light in plantations.
<i>Peziza ostracoderma</i> Korf Cup fungus on seed	Coulter pine	Surrey	New record.
<i>Peziza repanda</i> Pers. Cup fungus on rotting debris	Spruce	Parksville	New host record.
<i>Phaeoramularia maculicola</i> (Rom. & Sacc.) B. Sutton Leaf spot on poplar	Black cottonwood	Houston	Common.
<i>Phellinus pini</i> (Brot. : Fr.) A. Ames Red ring rot	Western hemlock	Prince Rupert region	Common in old growth in western part of the region.
<i>Phellinus punctatus</i> (Fr.) Pilât White heart rot	Walnut	Vernon	New record.
<i>Phellinus tremulae</i> (Bondarstev) Bondartsef & Borisof False tinder fungus	Trembling aspen	Prince Rupert and Nelson regions	Common causing extensive decay.
<i>Phellinus weirii</i> (Murrill) R.L. Gilbertson Laminated root rot	Douglas-fir	Vancouver, Kamloops, Nelson regions	Common; pockets of 4–5 infected trees in 30- to 80-year-old stands.
<i>Pucciniastrum epilobii</i> Otth Fir-fireweed rust	Alpine fir	Cariboo, Prince George, Prince Rupert, Nelson, and Kamloops regions	Common at low levels.

	Hosts	Location	Comments
<i>Rhabdocline pseudotsugae</i> H. Syd. Douglas-fir needle blight	Douglas-fir	Nelson region Clinton, Williams Lake	Common in Christmas tree plantations. Common.
<i>Rhabdocline weirii</i> A.K. Parker & J. Reid Douglas-fir needle blight	Douglas-fir	Kamloops region	Average 30% foliage infected in scattered immature stands.
<i>Septoria populicola</i> Peck Septoria leaf spot	Hybrid poplar	Vancouver Island	Leaf spotting occurred on 39% of the trees.
<i>Taphrina flectans</i> Mix Taphrina leaf curl	<i>Prunus</i> sp.	Hazelton	Gouting and witches'-brooms on many stems.
<i>Venturia macularis</i> (Fr. : Fr.) E. Müller & v. Arx Shepherd's crook	Trembling aspen	Prince Rupert region	Widespread severe discoloration of new shoots.
<i>Venturia populina</i> (Vuill.) Fabric. Venturia blight of cottonwood	Black cottonwood	Fraser Valley Hazelton Smithers	Scattered infections killed up to 20% shoots.

Other Damage

Bear	Douglas-fir, lodgepole pine	Kamloops region	Severe scarring on 10% of trees in spaced stands at Seymour Arm and Hurley River.
Drought	Lodgepole pine	East Kootenay and Southern Rocky Mountains Trench	An average 30% of pole size lodgepole pine killed over 2800 ha.
Maple leaf scorch (unknown cause)	Big leaf maple	Vancouver region	Severe foliar browning and branch dieback throughout host range.
Porcupine	Lodgepole pine	Kamloops region	50% incidence of debarking in immature managed stands at Grayback Lake.
Voles	Conifer and deciduous	Nelson region	High populations in the northwest areas.

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