Forestry Canada Forêts Canada
Ontario Region / Région de l'Ontario

SURVEY BULLETIN

Forest Insect and Disease Conditions in Ontario
Summer 1989

Gypsy moth larvae

Canada

FOREST INSECT AND DISEASE CONDITIONS IN ONTARIO

Summer 1989

This is the second of three bulletins to be issued in 1989 describing forest pest conditions in Ontario.

FOREST INSECTS

Spruce Budworm, *Choristoneura fumiferana* (Clem.)

A steady decline in spruce budworm populations has been evident in Ontario for the past several years. This trend reversed itself in 1989, when the overall area of moderate-to-severe defoliation increased by slightly over one million ha to a total of 6,239,636 ha (Table 1). Infestations remain confined to the Northwestern and North Central regions (Fig. 1) and budworm populations developed much as predicted by egg-mass surveys conducted in the fall of 1988. In the Northwestern Region, the area of moderate-to-severe defoliation decreased in the Ignace, Dryden, Fort Frances and Red Lake districts, but these declines were largely offset by increases in the Sioux Lookout and Kenora districts. In the North Central Region a small population decrease in Atikokan District was rendered insignificant by major increases in the Thunder Bay, Nipigon, Terrace Bay and Geraldton districts. The outbreak occupies much the same area as in 1988, with two large infestations surrounded by a number of smaller pockets. The largest infestation stretched from the Manitoba border eastward to the Golding-Soper-Blackwell townships area of Thunder Bay District. The size of this infestation was approximately 3.7 million ha, encompassing parts of the Kenora, Fort Frances, Red Lake, Sioux Lookout, Dryden, Ignace, Atikokan and western Thunder Bay districts. The second large infestation occupied some 2.1 million ha from eastern Thunder Bay District through the Nipigon District to the Caramat-Proctor Lake area of western Geraldton District and the Grenville Township area of western Terrace Bay District. A large part of the areas in the Geraldton and Terrace Bay districts was free of budworm damage in 1988 but became reinfested this year. A third significant infestation, of some 62,000 ha, occurred along the United States border in southern Thunder Bay District in the Rose Lake-Whitefish Lake-Middle Falls area. Approximately 130 smaller pockets ranging in size from a few to about 36,000 ha were mapped around and between the larger infestations. These included most of the islands in Lake Nipigon, along with most of the offshore islands around the northwestern coast of Lake Superior.

The upward trend in budworm populations was also noted in a number of other areas, including the Chapleau, Blind River, Gogama, North Bay, Espanola, Wingham, Lindsay, Cambridge and Huronia districts. In these districts, increased but still low population levels were observed on white spruce (*Picea glauca* [Moench.] Voss) and balsam fir (*Abies balsamea* [L.] Mill.). Moderate defoliation was recorded in small white

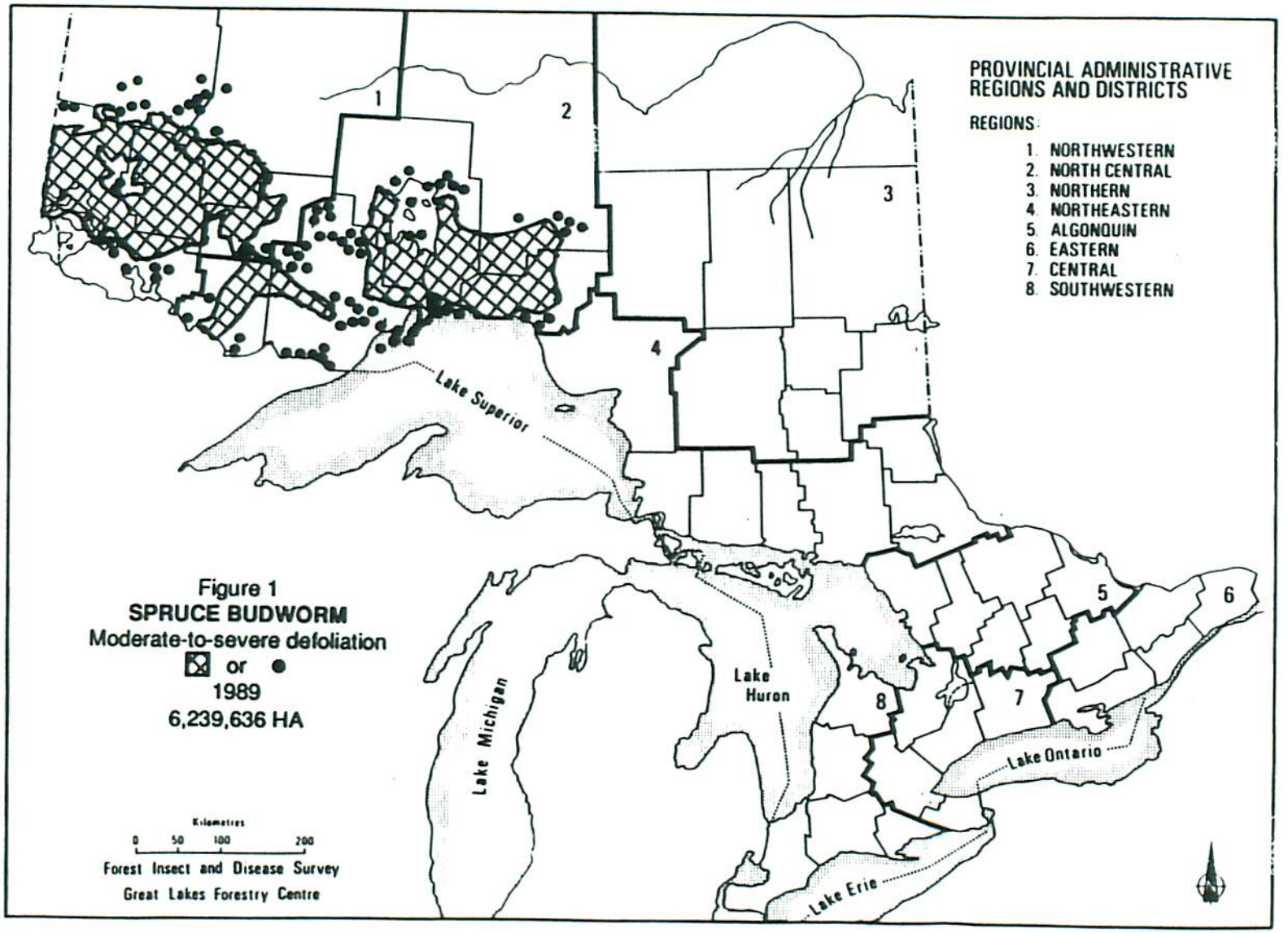

PROVINCIAL ADMINISTRATIVE
REGIONS AND DISTRICTS
REGIONS:
1. NORTHWESTERN
2. NORTH CENTRAL
3. NORTHERN
4. NORTHEASTERN
5. ALGONQUIN
6. EASTERN
7. CENTRAL
8. SOUTHWESTERN
Lake Superior
Lake Michigan
Lake Huron
Lake Ontario
Lake Erie
Figure 1
SPRUCE BUDWORM
Moderate-to-severe defoliation
or
1989
6,239,636 HA
Kilometres
0 50 100 200
Forest Insect and Disease Survey
Great Lakes Forestry Centre

Table 1. Gross area (ha) of current moderate-to-severe defoliation by spruce budworm in Ontario from 1985 to 1989.

Region / District	Area of moderate-to-severe defoliation (ha)				
	1985	1986	1987	1988	1989
Algonquin					
Bracebridge	720	436	350	0	0
Algonquin Park	800	206	0	0	0
	1,520	642	350	0	0
North Central					
Atikokan	918,500	890,691	808,508	578,464	482,208
Thunder Bay	2,315,563	2,005,718	1,101,963	376,395	597,382
Nipigon	1,125,751	985,961	987,526	605,741	940,513
Terrace Bay	1,168,400	1,023,773	528,555	260,393	624,724
Geraldton	683,178	400,486	211,954	13,956	389,750
	6,211,392	5,306,629	3,638,506	1,834,949	3,034,577
Northwestern					
Ignace	599,895	530,761	584,322	512,961	419,620
Dryden	952,385	891,997	835,308	907,685	902,750
Sioux Lookout	240,048	428,830	556,457	540,334	586,772
Fort Frances	700,172	542,176	497,579	275,817	199,084
Kenora	911,037	906,917	821,074	886,627	897,779
Red Lake	10	200,349	256,167	266,361	199,054
	3,403,547	3,501,030	3,550,907	3,389,785	3,205,059
Northern					
Chapleau	6,120	70	0	0	0
Cochrane	600	0	0	0	0
Gogama	11,570	428	0	0	0
Hearst	1,173,734	32,384	0	0	0
Kapuskasing	0	0	0	0	0
Kirkland Lake	1,125	0	0	0	0
	1,193,149	32,882	0	0	0
Northeastern					
Blind River	0	0	0	0	0
Espanola	1,980	408	0	0	0
North Bay	20,305	1,802	0	0	0
Sault Ste. Marie	7,875	0	0	0	0
Sudbury	105,805	455	0	0	0
Temagami	245	0	0	0	0
Wawa	1,386,547	11,389	0	0	0
	1,522,757	14,504	0	0	0
Total	12,332,365	8,885,687	7,189,763	5,224,734	6,239,636

spruce plantations in Adjala Township, Huronia District and Minto Township, Wingham District.

The Ontario Ministry of Natural Resources (OMNR) aerially sprayed some 30,516 ha of spruce/fir forest in the Thunder Bay and Nipigon districts with the bacterial insecticide, *Bacillus thuringiensis* (B.t.). The purpose of the program was to minimize defoliation of commercial stands of balsam fir and spruce, a provincial park and some plantations.

Forest Tent Caterpillar, *Malacosoma disstria* Hbn.

The forest tent caterpillar outbreak in Ontario continued to expand in 1989. Provincewide aerial and ground surveys mapped 7,915,111 ha of moderate-to-severe defoliation, nearly double the 3,965,229 ha mapped last year. Increases were recorded in all regions in the province, but by far the largest (nearly 10-fold) were recorded in the Northwestern and North Central regions (Table 2). Three major infestations occurred this year, as well as numerous small pockets of various sizes (Fig. 2). In northwestern Ontario, a major infestation totaling 2,554,424 ha occupied large areas in the Kenora, Dryden, Fort Frances and Atikokan districts with an eastward extension into Ignace District. A number of smaller patches of moderate-to-severe defoliation occurred around the periphery of the large infestation, one of which extended into McAree Township, Sioux Lookout District. In Thunder Bay District, ten pockets ranging in size from a few to 8,956 ha were mapped in the Upsala, Lac des Mille Lacs, Kashabowie and Conmee - Kaministikwia areas west of the city of Thunder Bay. Numerous scattered pockets were mapped north and south of Highway 11 between Fairloch Lake and Jellicoe in eastern Nipigon District.

The largest infestation in Ontario occurred in the central part of the province, stretching from the area of Sault Ste. Marie on Lake Superior across the width of the province to an area between Burnaby Township and the town of Deep River on the Ottawa River. This huge infestation encompassed approximately 3,460,690 ha, including large areas in the Pembroke, Algonquin Park, Bracebridge, Parry Sound, North Bay, Temagami, Sudbury, Espanola, Blind River and Sault Ste. Marie districts, including a large part of Manitoulin Island. Numerous smaller pockets also surround this infestation, including the infestations on St. Joseph Island and many of the smaller islands in the North Channel area of Lake Huron. Infestations in Wawa District and a small area in adjacent Terrace Bay District expanded somewhat in 1989. Numerous small patches of infestation now extend from the Lecours Township-Hemlo area in the southeastern corner of Terrace Bay District east to the Rennie-Stover townships area of Wawa District. The two largest pockets were located in the White Lake Provincial Park area (27,200 ha) and in the Lochalsh-Renabie area (28,117 ha). A similar situation occurred in the Hearst and Kapuskasing districts, in which infestations in the Hearst area spread north to the junction of the Little Drowning and Kenogami rivers and east almost to the town of Kapuskasing. The two largest pockets here were located in the Hearst-Calstock area (55,292 ha) and along the

Kabinakagami and Kenogami rivers and their tributaries, centered on the abandoned village of Mammamattawa (36,768 ha). Much of the defoliation in this more northerly area was located in narrow bands along the numerous rivers and small creeks.

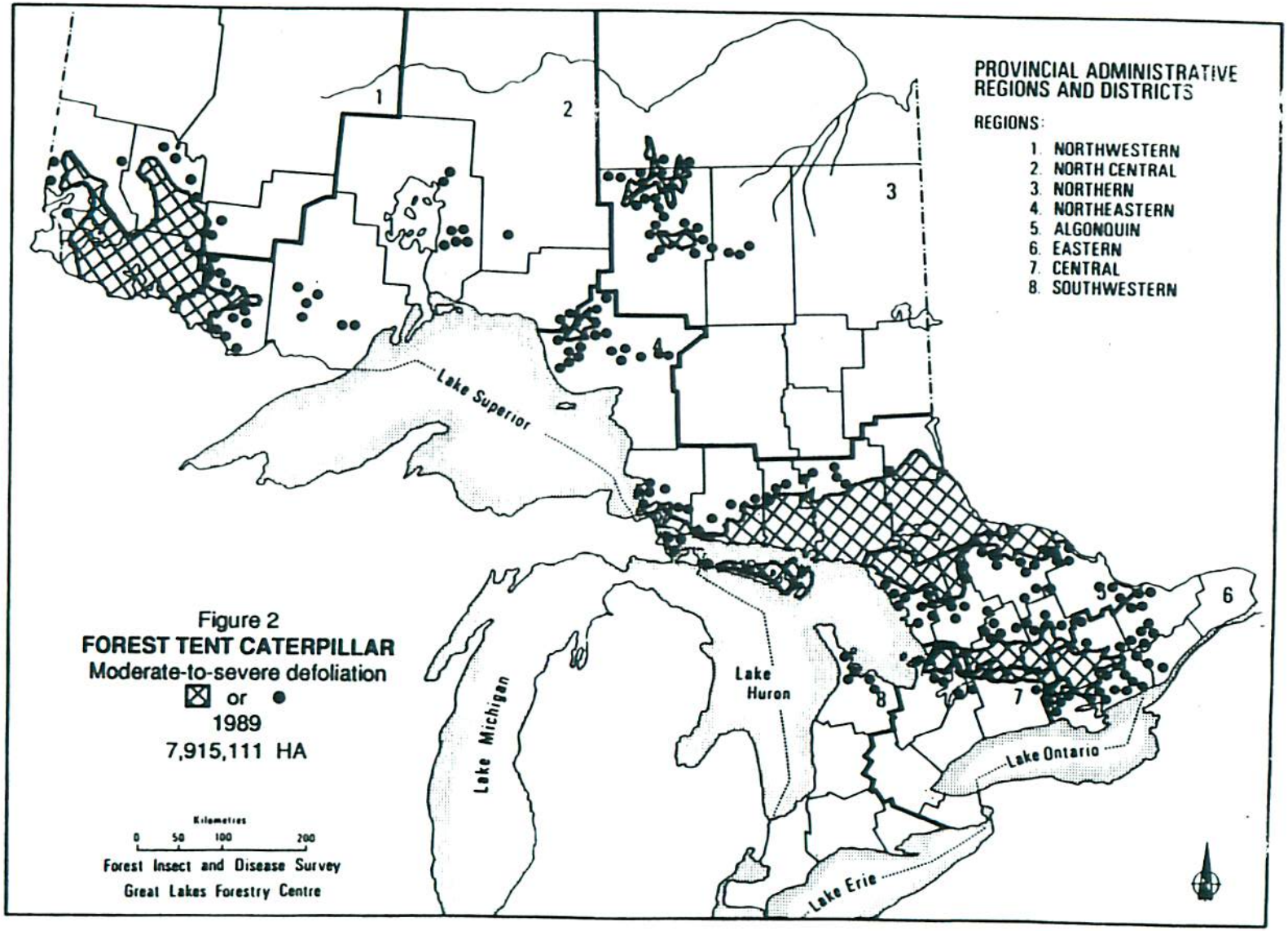
Table 2. Gross area of current moderate-to-severe defoliation by the forest tent caterpillar in Ontario from 1986 to 1989.

Region / District	Area of moderate-to-severe defoliation (ha)			
	1986	1987	1988	1989
Northwestern				
Ignace	0	0	0	12,403
Sioux Lookout	0	0	0	450
Dryden	0	0	610	564,902
Fort Frances	0	5,025	257,305	1,048,876
Kenora	0	0	15,070	553,487
	0	5,025	272,985	2,180,118
North Central				
Geraldton	0	0	0	180
Atikokan	0	1,770	28,160	423,404
Thunder Bay	250	280	4,230	19,739
Nipigon	0	0	560	8,535
Terrace Bay	0	380	690	4,255
	250	2,430	33,640	456,113
Northeastern				
Wawa	14,335	10,720	12,087	80,143
Sault Ste. Marie	0	11,340	26,560	116,107
Blind River	4,940	35,867	102,852	208,878
Espanola	5,230	67,010	415,273	615,345
Sudbury	0	39,394	442,274	843,409
Temagami	163,540	292,913	252,650	160,770
North Bay	86,920	584,501	856,053	1,031,622
	274,965	1,041,745	2,107,749	3,056,274
Northern				
Kapuskasing	0	0	0	7,482
Hearst	0	0	10,550	150,438
Kirkland Lake	123,280	112,452	0	0
Gogama	21,370	0	0	0
Chapleau	1,975	460	10,550	300
	146,625	112,912	10,550	158,220

(cont'd)

Table 2. Gross area of current moderate-to-severe defoliation by the forest tent caterpillar in Ontario from 1986 to 1989. (concl.)

Region	Area of moderate-to-severe defoliation (ha)			
District	1986	1987	1988	1989
Algonquin				
Bancroft	0	28,628	148,125	212,540
Minden	0	53,653	268,633	267,576
Parry Sound	11,160	241,399	408,302	390,886
Bracebridge	0	150,104	330,845	174,171
Algonquin Park	0	0	62,579	171,988
Pembroke	0	180	39,425	102,795
	11,160	473,964	1,257,909	1,319,956
Eastern				
Brockville	0	0	0	720
Cornwall	0	0	445	0
Carleton Place	0	78	3,835	11,847
Tweed	0	902	121,174	345,104
Napanee	0	0	190	81,248
	0	980	125,644	438,919
Central				
Maple	0	0	0	2,130
Lindsay	0	5,198	47,752	132,578
Huronia	0	7,723	104,240	124,513
	0	12,921	151,992	259,221
Southwestern				
Owen Sound	0	0	4,760	46,290
	0	0	4,760	46,290
Total	433,000	1,649,977	3,965,229	7,915,111


PROVINCIAL ADMINISTRATIVE REGIONS AND DISTRICTS
REGIONS:
1. NORTHWESTERN
2. NORTH CENTRAL
3. NORTHERN
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5. ALGONQUIN
6. EASTERN
7. CENTRAL
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Lake Superior
Lake Michigan
Lake Huron
Lake Ontario
Lake Erie
Figure 2
FOREST TENT CATERPILLAR
Moderate-to-severe defoliation
or
1989
7,915,111 HA
Kilometres
0 50 100 200
Forest Insect and Disease Survey
Great Lakes Forestry Centre

The third large body of heavy infestation occurred in southern Ontario. Approximately 1,945,500 ha of moderate-to-severe defoliation were mapped from the vicinity of Awenda Provincial Park on Georgian Bay, in Huronia District, and eastward through the southern Bracebridge, Minden and Bancroft districts, western and central Tweed District and the northern portions of the Napanee and Lindsay districts. A number of smaller pockets occurred around this large infestation, including several in the Eganville area of Pembroke District, a few small patches in the northwestern corner of Brockville District and numerous, scattered pockets in the area between South Sherbrooke Township and Constance Bay on the Ottawa River, in Carleton Place District.

In Owen Sound District, four large patches of defoliation ranging in size from 8,680 to 18,888 ha were mapped. Two of these were located south of Owen Sound, mainly in Euphasia and Sydenham townships, and two were situated on the Bruce Peninsula, mainly in Keppel and Albemarle townships. In many of the areas in the Lindsay, Bancroft, Tweed, Napanee and Brockville districts, the forest tent caterpillar and gypsy moth (*Lymantria dispar* L.) were both present in large numbers in the same stands, which made mapping of the damage very difficult and caused added stress to the trees. Since the feeding period for forest tent caterpillar is slightly ahead of that for the gypsy moth, many trees had begun to refoliate after the depredations of the tent caterpillar only to receive the full onslaught of gypsy moth feeding; this must have placed very heavy stress on some stands.

In spite of the huge, overall increase in the area of moderate-to-severe defoliation, declines were observed in several areas. Much of southern Parry Sound District and central Bracebridge District was free of moderate-to-severe defoliation and population declines were evident in northern Temagami District for the second consecutive year. In addition, diseased larvae were observed and collected at many locations in the central and southern parts of the province, often accompanied by large numbers of the parasitic flesh fly, *Sarcophaga aldrichi* Park., leading to speculation that populations may begin to collapse in these areas next year. Egg-band counts to be carried out later in the fall may also give some indication of population trends for 1990.

Gypsy Moth, *Lymantria dispar* (L.)

The area of moderate-to-severe defoliation by this defoliator increased substantially for the second consecutive year in 1989. Altogether, some 81,640 ha of defoliation were mapped in southern Ontario, up from 29,693 ha last year (Fig. 3, Tables 3, 4 and 5). Much of the increase occurred in the Eastern Region, particularly in Tweed District, where the area affected doubled to about 39,000 ha; in Napanee District, where the area affected more than doubled to about 15,000 ha; and in Brockville District, where a six-fold increase brought the area affected to 12,250 ha. A four-fold increase (to 4,071 ha) occurred in Lindsay District of the Central Region. Increases were also recorded in all other districts affected with the exception of the Carleton Place and

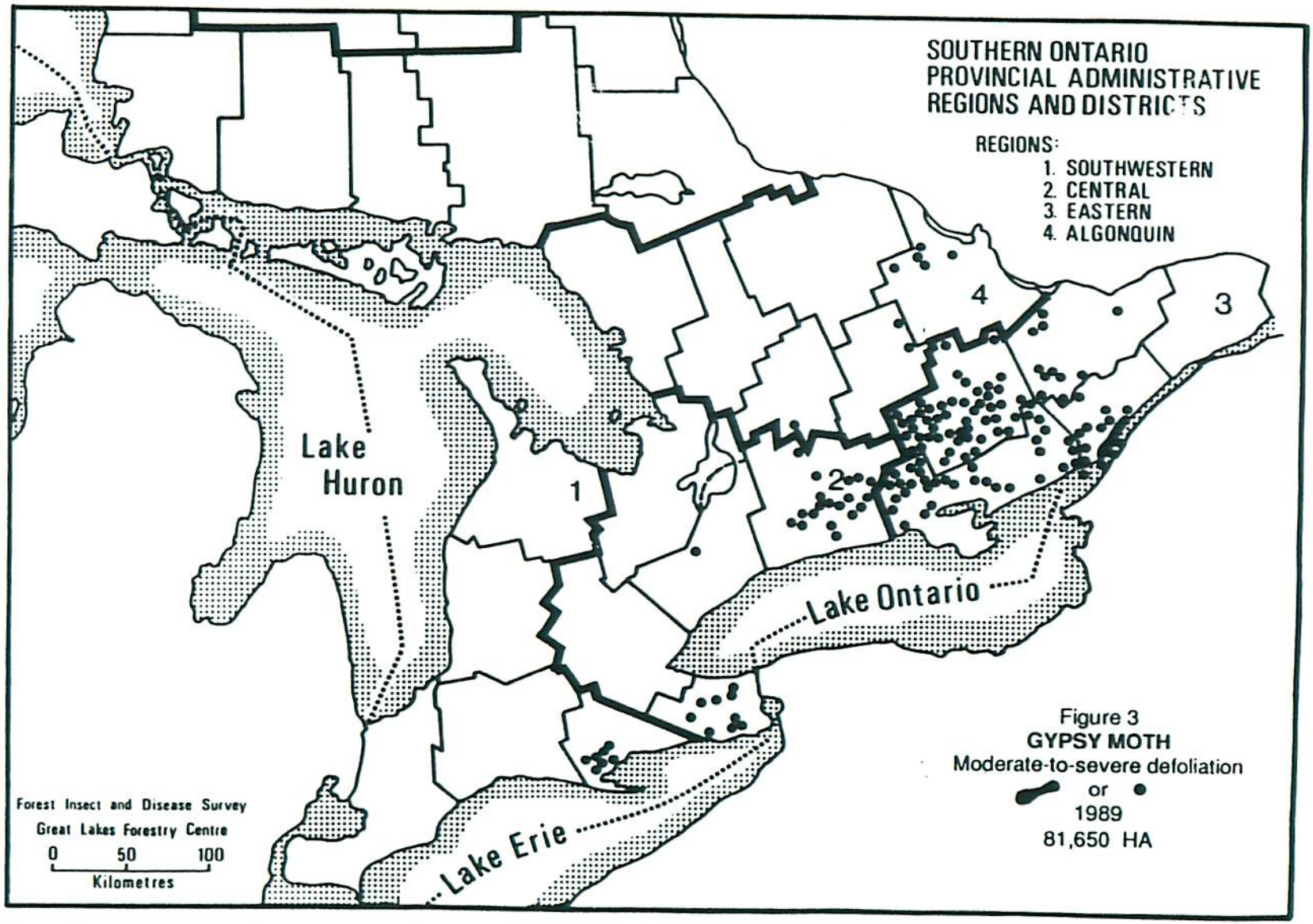

SOUTHERN ONTARIO
PROVINCIAL ADMINISTRATIVE
REGIONS AND DISTRICTS
REGIONS:
1. SOUTHWESTERN
2. CENTRAL
3. EASTERN
4. ALGONQUIN
Lake Huron
Lake Ontario
Lake Erie
1
2
3
4
Forest Insect and Disease Survey
Great Lakes Forestry Centre
0 50 100
Kilometres
Figure 3
GYPSY MOTH
Moderate-to-severe defoliation
or
1989
81,650 HA

Table 3. Gypsy moth infestations in Ontario, 1981-1989.

Year of infestation	Gross area of moderate-to-severe defoliation (ha)
1981	1,450
1982	4,800
1983	40,954
1984	80,624
1985	246,342
1986	167,776
1987	12,678
1988	33,697
1989	81,640

Table 4. Gross area (ha) of moderate-to-severe defoliation by the gypsy moth in Ontario, 1985-1989.

Region	District	1985	1986	1987	1988	1989
Eastern	Tweed	172,232	73,525	3,329	16,089	39,096
	Napanee	58,326	57,780	4,781	6,198	15,001
	Carleton Place	4,197	13,386	1,355	3,918	2,634
	Brockville	11,232	22,283	2,099	1,865	12,250
Algonquin	Pembroke	90	221	0	124	1,154
	Bancroft	240	164	111	370	15
	Minden					65
Central	Lindsay	25	417	888	861	4,071
	Niagara	0	0	0	28	2,127
	Maple	0	0	0	0	370
Southwestern	Simcoe	0	0	115	240	4,807
Total		246,342	167,776	12,678	29,693	81,640

Table 5. Gross area (ha) of moderate-to-severe defoliation by the gypsy moth, 1986-1989.

County	1986	1987	1988	1989
York	0	0	0	370
Northumberland	1,430	2,131	7,791	8,231
Peterborough	179	167	1,593	3,045
Hastings	11,668	4,511	5,625	22,262
Lennox and Addington	8,627	407	10,007	12,660
Prince Edward	540	0	0	340
Frontenac	109,442	1,775	1,861	11,625
Leeds	22,283	2,099	1,865	12,250
Lanark	13,356	1,355	3,918	2,590
Ottawa-Carleton	221	0	0	44
Durham	0	118	280	50
Haldimand-Norfolk[a]	0	115	240	4,937
Victoria	0	0	385	35
Renfrew	0	0	124	1,154
Niagara[a]	0	0	28	2,047
Total	167,776	12,678	33,697	81,640

[a] regional municipality

Bancroft districts, for which small decreases were recorded. The infestation pattern consisted of clusters of small patches of defoliation ranging in size from a few to about 2,000 ha rather than large contiguous areas of damage. This pattern of defoliation occurred across most of southern Tweed District and extended southwest into the western half of Napanee District. Generally smaller pockets of defoliation were recorded in the adjacent southeastern corner of Lindsay District. Here, clusters of pockets of defoliation were centered south of Rice Lake, including a number of islands in the eastern end of Rice Lake; north of the eastern end of Rice Lake, mainly in Asphodel Township; and southwest of Peterborough, centered on the Frazerville area. A sizable pocket of moderate-to-severe defoliation was mapped in the Buckhorn area of Harvey Township on the Lindsay-Minden district boundary. Pockets of defoliation were recorded along the northern shore of the St. Lawrence River in western Brockville District, where the largest single pocket of defoliation (7,127 ha) was mapped in the Ivy Lea-Butternut Bay area. Hardwoods, mainly oak (*Quercus* spp.), were also damaged on a number of islands in the St. Lawrence River, including Grenadier, Hill and Stove islands. A cluster of pockets of defoliation also occurred in the Jones Falls area of Brockville District. In Carleton Place District, a number of small patches of defoliation were located in the Bennett Lake area of Bathurst Township and several somewhat larger pockets were mapped in the area of Darling and Pakenham townships. In Pembroke District, a sizable pocket of moderate-to-severe defoliation was mapped north of Golden Lake in North Algona Township and several small pockets of damage were also mapped in Burns, Richards, Frazer and Wilberforce townships.

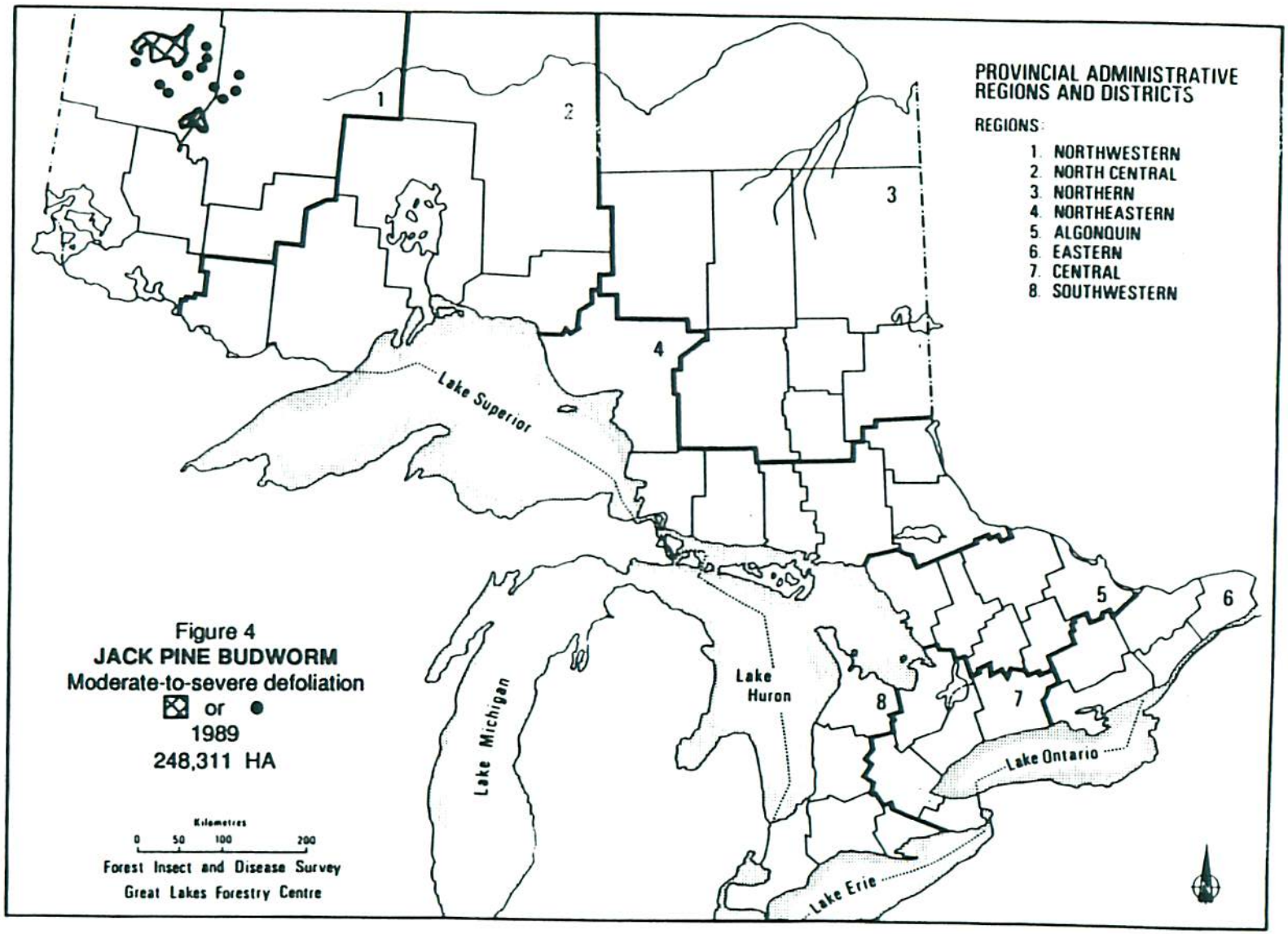
In southwestern Ontario, a major increase in population levels was evident in Simcoe District and, to a lesser extent, in Niagara District. In Simcoe District, the area of moderate-to-severe defoliation increased from 240 ha in 1988 to 4,807 ha, all of which was located in the area northwest of Turkey Point between the towns of Cultus and Simcoe. Infestation in Niagara District increased from 28 to 2,177 ha. Most of the defoliation occurred south of Welland and in Ridgeville, both in Pelham Township. Smaller areas of defoliation were mapped along the Grand River, west of Dunnville, south of Winslow and south of Silverdale.

Elsewhere, a single pocket of heavy infestation straddled Hwy 400 in King Township, Maple District and caused moderate-to-severe defoliation of 370 ha. A small area of defoliation was also observed adjacent to the city of Barrie in Vespra Township, Huronia District. Reports have been received of a general gypsy moth population increase in southern Ontario, with small numbers of larvae and light defoliation in many areas.

OMNR conducted aerial spraying with B.t. on a total of 12,951 ha of Crown land (1,176 ha) and private land (11,775 ha). Spraying on Crown land was done in the Simcoe, Tweed and Carleton Place districts and private-land spraying occurred in the Niagara, Lindsay, Tweed, Carleton Place and Brockville districts. The spray program started late in May and was completed by June 19.

Jack Pine Budworm, *Choristoneura pinus pinus* Free.

Jack pine budworm populations declined dramatically in 1989; the total area of moderate-to-severe defoliation decreased from 737,482 ha to 248,311 ha (Table 6). All of the defoliation this year was confined to areas in the Red Lake and Sioux Lookout districts (Fig. 4). The largest remaining infestation (165,716 ha) was located in northern Red Lake District between the Berens River and Nungesser Lake. Small extensions of this body of infestation reached as far west as Prideaux and Kirkness lakes and northeast to Madden Lake. Large areas to the north of this infestation that were defoliated in 1988 were completely burned off by uncontrolled fires in the fall of 1988 and spring of 1989. South and east of this large infestation, four pockets of defoliation ranging in size from 325 to 12,039 ha were mapped between Coathup Lake and the southwestern shoreline of Trout Lake. Two other infestations, 37,682 and 2,448 ha in size, straddled the Red Lake-Sioux Lookout district boundary in the Aerofoil Lake area and the Perrigo-Wakeman lakes area. Three other pockets of infestation were recorded in the Christina Lake (5,584 ha), Brokenmouth Lake (2,700 ha) and Kesaka Creek (6,865 ha) areas of Sioux Lookout District. Throughout much of the areas described above, defoliation was moderate rather than severe, although scattered, individual trees sometimes supported very large populations of the budworm.


PROVINCIAL ADMINISTRATIVE
REGIONS AND DISTRICTS
REGIONS:
1. NORTHWESTERN
2. NORTH CENTRAL
3. NORTHERN
4. NORTHEASTERN
5. ALGONQUIN
6. EASTERN
7. CENTRAL
8. SOUTHWESTERN
1
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Lake Superior
Lake Michigan
Lake Huron
Lake Ontario
Lake Erie
Figure 4
JACK PINE BUDWORM
Moderate-to-severe defoliation
or
1989
248,311 HA
Kilometres
0 50 100 200
Forest Insect and Disease Survey
Great Lakes Forestry Centre

Table 6. Gross area of current moderate-to-severe defoliation by the jack pine budworm in the Northwestern Region of Ontario from 1987 to 1989.

District	Area of moderate-to-severe defoliation (ha)		
	1987	1988	1989
Red Lake	286,949	613,096	212,265
Fort Frances	11,237	0	0
Ignace	21,194	0	0
Kenora	69,344	0	0
Sioux Lookout	30,520	123,786	36,046
Dryden	85,505	0	0
Total	504,749	736,882	248,311

Aerial surveys in the English River area of Thunder Bay District did not detect defoliation in the area in which some 600 ha of mature jack pine (*Pinus banksiana* Lamb.) were defoliated in 1988. In June 1989, some 4,763 ha of forest were aerially sprayed with B.t. by OMNR. Earlier, in April and May of 1989, Canadian Pacific Forest Products Limited harvested some 200-250 ha of the most heavily infested timber. This project was designed to suppress an incipient infestation that threatened extensive stands of jack pine.

No infestations were reported elsewhere in the province, although small numbers of larvae were observed at two locations in Dryden District and one location in Wawa District.

Pear Thrips, *Taeniothrips inconsequens* (Uzel)

The pear thrips is an introduced pest that was first found in North America in 1904 in California. It has since spread to most of the United States and recent heavy infestations on sugar maple (*Acer saccharum* Marsh.) in the northeastern states have prompted concern about whether the insect was present in Ontario. Accordingly, the Forest Insect and Disease Survey (FIDS) Unit undertook a major detection survey throughout the range of sugar maple in the province. Numerous samples of thrips on sugar maple were submitted to the Sault Ste. Marie laboratory, and most of these have been forwarded to the Biosystematics Research Institute in Ottawa for confirmation.

So far, a single collection from Vaughan Township, Maple District, has been confirmed as pear thrips. At this location, understory trees and the lower branches of larger trees sustained about 10% defoliation.

The adult thrips emerge from the soil in early spring to feed and reproduce. Eggs are laid on the leaf epidermis, mainly along veins and petioles, and leave brown scars. Feeding damage consists of fallen green leaves, smaller than normal foliage, chlorotic and tattered leaves with the leaf margins often browned or wilted, and, frequently, puckered or wrinkled leaves. Prolonged outbreaks can result in growth loss and crown dieback, including top killing. Following the feeding period, the thrips larvae enter the soil, where they complete their development and overwinter to emerge as adults the following spring. The forest species most often affected by pear thrips include the maples (*Acer* spp.), birches (*Betula* spp.), ash (*Fraxinus* spp.), black cherry (*Prunus serotina* Ehrh.) and beech (*Fagus* spp.).

Pine False Webworm, *Acantholyda erythrocephala* L.

Heavy infestations caused 90% defoliation of 5.3-m red pine (*Pinus resinosa* Ait.) in a 5-ha plantation in Harvey Township, Lindsay District. Defoliation averaging 28% but ranging as high as 100% was recorded in a 15-ha red pine plantation in McMurrich Township, Parry Sound District, along with similar defoliation levels in nearby Ryerson Township. A heavily infested white pine (*Pinus strobus* L.) seed orchard in Snowdon Township, Minden District was chemically treated with a follow-up hand pruning operation to control the insect. Continued defoliation over several years has caused branch and occasional tree mortality in a 2-m red pine plantation in Fitzroy Township, Carleton Place District. Populations here were somewhat reduced but damage was still high (60% defoliation) in this stand. A heavy infestation persisted in a 2-m red pine plantation in Oro Township, Huronia District, and light infestations were reported in a number of areas in the Tweed, Carleton Place, Napanee, Algonquin Park, Bancroft and Pembroke districts. A small infestation on a few white pine trees in Blind River District represents a new distribution record.

Fall Cankerworm, *Alsophila pometaria* (Harr.)

For the second consecutive year, heavy infestations with defoliation ranging from 40 to 90% occurred on ornamental Manitoba maple in the town of Sioux Lookout in Sioux Lookout District.

Defoliation in the 20% range was recorded on a few ornamental Manitoba maple (*Acer negundo* L.) in the city of Thunder Bay, Thunder Bay District, and light infestations were reported on a variety of hardwoods in Sheppards Bush in Whitchurch Township, Maple District.

Cedar Leafminers, *Argyresthia aureoargentella* Brower,
A. canadensis Free., *A. thuiella* (Pack.) and
Coleotechnites thujaella (Kft.)

Widespread declines were evident in the outbreak of this complex of leafmining insects in southern Ontario. Population declines were most

evident on Manitoulin and Cockburn Islands in the North Channel of Lake Huron, where very few insects could be found in areas that had been severely damaged in 1988. Sharp declines were also evident in Owen Sound District, although damage in the 10 to 40% range was observed on already sparse foliage of cedar stands in Saugeen and Amabel townships. Similar damage persisted in Medonte, Tay and Floss townships, Huronia District, and in Haldimand Township, Lindsay District, where substantial population reductions were also evident. Populations were somewhat higher in the Pembroke and Bancroft districts, where foliar damage as high as 65% was recorded in several townships.

In the Eastern Region, infestations decreased to light levels in the Napanee and Tweed districts, but large numbers of larvae continued to cause sporadic, severe browning of cedar foliage in the Brockville, Carleton Place and Cornwall districts. In some of these areas, infestations by the spruce spider mite, *Oligonychus ununguis* (Jac.), also added to the damage sustained by cedar stands.

Large Aspen Tortrix, *Choristoneura conflictana* (Wlk.)

Populations across most of the province have declined to endemic levels. The only exception was in Terrace Bay District, where defoliation in the 15-20% range was recorded along the Trans Canada Highway between Hay Lake and the Aguasabon River in Priske and Strey townships. Small numbers of larvae were recovered from a few locations in the Geraldton, Wawa and Chapleau districts.

Lesser Birch Casebearer, *Coleophora comptoniella* (McD.) and
Cherry Casebearer, *C. pruniella* Clem.

The combined feeding of these two insects caused conspicuous foliar damage to white birch (*Betula papyrifera* Marsh.) in Bertram and Falconer townships, North Bay District. Large populations of the insects were also recorded on white birch at Sandbanks Provincial Park, Napanee District and Carillon Provincial Park, Cornwall District. Small populations occurred at two locations in each of the Sudbury and Espanola districts and at single locations in the North Bay, Lindsay and Wawa districts.

Larch Casebearer, *Coleophora laricella* (Hbn.)

Increased numbers of this spring defoliator were reported from many areas in southern Ontario. Foliar damage in the 80-100% range occurred on tamarack (*Larix laricina* [Du Roi] K. Koch) stands in South Plantagenet Township, Cornwall District and Erin Township, Cambridge District. Similar damage levels were apparent on European larch (*Larix decidua* Mill.) plantings at numerous locations in the Southwestern Region, along the Niagara Parkway in Niagara District, in West Gwillimbury Township in Huronia district, and in Haldimand and Reach townships

and at the Orono Forest Tree Nursery in Lindsay District. Moderate damage, with defoliation often in the 50% range, occurred in a number of the areas mentioned above as well as in the Maple, Owen Sound, North Bay, Parry Sound, Bracebridge and Minden districts. Light defoliation was reported in single stands in the Chapleau and Sault Ste. Marie districts.

Jack Pine Tip Beetle, *Conophthorus banksianae* McP.

Declining populations of this jack pine pest were reported from the Chapleau, Gogama and Blind River districts, where heavy infestations occurred in 1988. No significant damage was evident in jack pine stands in Langlois and Hutcheon townships, Chapleau District, and Battersby Township, Gogama District, where moderate-to-severe damage occurred last year.

The number of infested shoots declined from 68 to 23.3% in Blind River District and from 21 to 7.3% in Timbrell Township. The same level of attack (7.3%) occurred in an 8-ha stand of 1.2-m jack pine in Lumsden Township, Sudbury District.

Oak Leaf Shredder, *Croesia semipurpurana* (Kft.)

This major pest of oak was not found in significant numbers in Ontario this year. In Huronia District, where various degrees of damage have been recorded for many years, no defoliation was observed. Defoliation ranging from less than 1% to 4% was reported on red oak (*Quercus rubra* L.) and black oak (*Q. velutina* Lam.) at four locations in the Niagara and Simcoe districts. At two locations in Blind River District, for which 1988 forecasts on the basis of egg-mass counts had indicated moderate-to-severe defoliation might occur in 1989, the stands were swamped with forest tent caterpillar larvae, which made detection of oak leaf shredder damage impossible. Defoliation in the 2-5% range was reported on 10-m red oak trees in the Dokis Indian Reserve in Bertram Township, North Bay District.

Linden Looper, *Erannis tiliaria* (Harr.)

The area affected by linden looper increased in Terrace Bay District but the level of damage was lower this year than in 1988. Defoliation averaged 35% over some 23,285 ha in contrast with defoliation in the 50% range over 8,835 ha last year. The infestations occurred along the northern coast of Lake Superior between Schreiber and Marathon, with the largest pocket occupying 10,030 ha in Tuuri and Syine townships and the area north of these to the vicinity of Larry Lake. A second large pocket (7,020 ha) of defoliation occurred north of Terrace Bay between Owl Lake and the northern part of Strey Township. An infestation of 2,200 ha was mapped north of the Coldwell Peninsula in Walsh and Grain townships and another, of 1,860 ha, was mapped north of Hwy 17 east of Seely Mountain. A number of smaller pockets of defoliation ranging from 40 to 505 ha in size occurred around these larger bodies of infestation.

White birch was the main host but trembling aspen (*Populus tremuloides* Michx.) and deciduous shrubbery were also attacked by the insect.

Pine Needleminer, *Exotelia pinifoliella* (Cham.)

Heavy infestations destroyed 80% of the old foliage in a 130-ha jack pine stand in Bigwood Township, Sudbury District. Defoliation in the 50% range was recorded in a 2-ha stand in Curtin Township, Espanola District, and in a 5-ha stand in McPherson Township, North Bay District. This insect, feeding in conjunction with the pine needle sheathminer (*Zelleria haimbachi* Bsk.), caused 78% foliar damage in a 5-ha jack pine plantation in Ernestown Township, Napanee District.

Birch Leafminer, *Fenusa pusilla* (Lep.)

Damage by this insect was lower than usual in the southern part of the province but increased in a number of areas in northern Ontario. The only damage of any significance in southern Ontario was in the Eastern Region, where severe browning of roadside white birch and ornamental birch was reported in Ottawa, Kingston, Kemptville, Belleville and Brighton, in Presqu'ile and Sharbot Lake Provincial Parks, and in the southern sections of the Simcoe, Aylmer and Chatham districts.

In contrast, moderate-to-severe defoliation was widespread in northern Ontario. The heaviest infestations again appear to be in the Temagami District, where defoliation in the 80-100% range occurred in numerous small stands in six townships in the northern part of the district. Defoliation averaged 50% over approximately 200 ha in the Cobalt-Gillies-Latchford area. Defoliation ranged from 30 to 90% in urban areas in the Hearst, Kapuskasing, Cochrane and Timmins districts. Somewhat lower levels of defoliation (20-50%) were observed on small pockets of white birch along Hwy 631 between Hwy 11 and Hornepayne, near Iroquois Falls, and north of Wade Lake on the Detour Mine Road.

In the Northeastern Region, severe leafmining was evident on ornamentals in most urban areas, including the city of Sault Ste. Marie, where many trees sustained 75-100% damage. Sporadic heavy damage was also evident in forest situations, particularly in the Searchmont area and in Ryan Township, Sault Ste. Marie District.

Reduced, medium-to-high population levels were present in many areas of the North Central Region. Sporadic pockets of heavy infestations ranging from 0.5 to 5 ha in size, with defoliation ranging from 75 to 90%, occurred in several areas of the Terrace Bay, Nipigon and Geraldton districts. Ornamentals in the towns of White River, Geraldton, Longlac and Manitouwadge sustained 45-85% defoliation. Scattered pockets of moderate-to-severe damage, with defoliation averaging 50%, were recorded in the Red Rock area of Nipigon District. The same level of damage was encountered in small white birch stands and fringe trees in rural areas west and south of the city of Thunder Bay, between Kakabeka

Falls and Shebandowan, and along Hwy 527 from Thunder Bay to the Eaglehead River in Thunder Bay District. Low population levels were observed in Atikokan District.

American Aspen Beetle, *Gonioctena americana* (Schaeff.)

Populations of this early-spring defoliator remained high in the Gogama and southern Chapleau districts. Young trembling aspen trees along roadsides in cutover areas and in other open-growing situations often sustained defoliation in the 90% range. The most severe damage reported was in the Racine Lake area of Chapleau District, where young trembling aspen and balsam poplar (*Populus balsamifera* L.) were 95% defoliated. Small, widely scattered, heavy infestations were also recorded on trembling aspen reproduction in newly cut areas in the northern portions of the Espanola, Sudbury and North Bay districts. Reports of small populations causing damage in the 10% range were received from the Timmins, Temagami, Kirkland Lake, Geraldton and Thunder Bay districts.

Bark Beetles, *Hylurgops pinifex* Fitch, *Ips pini* (Say), *Pityogenes hopkinsi* Swaine and *Trypodendron rufitarsus* (Kby.)

Increased attack by bark beetles was evident in red pine and white pine stands in a number of areas in the Eastern and Algonquin regions and in Lindsay District of the Central Region. Most of the associated tree mortality was in stands weakened by the drought conditions of 1988 or stressed by some other factor such as shallow soil, winter drying or salt damage. The damage occurred in small pockets, and mortality usually ranged from 3 to 40 trees; however, in some locations in the Eastern Region, as many as 80 trees were killed. The bulk of the damage was caused by the pine engraver beetle, *Ips pini* (Say).

Eastern Tent Caterpillar, *Malacosoma americanum* (F.) and Northern Tent Caterpillar, *M. californicum pluviale* (Dyar)

Heavy infestations of the eastern tent caterpillar persisted at many locations in southern Ontario. Large numbers of tents with accompanying severe defoliation were observed on black cherry, pin cherry (*Prunus pensylvanica* L.f.), choke cherry (*P. virginiana* L.) and a variety of other deciduous hosts in many areas of the Carleton Place, Brockville, Tweed and Napanee districts as well as in northwestern Lindsay District and southwestern Minden District. Lighter but still moderate-to-severe defoliation was widespread in the Parry Sound, Bracebridge, Pembroke, Algonquin Park and Bancroft districts. Populations declined somewhat in the Huronia and Owen Sound districts but heavy defoliation persisted on large black cherry trees in woodlots in Tiny and Medonte townships, Huronia District, and in Keppell Township, Owen Sound District. Open-grown cherry and birch were severely defoliated at scattered locations in the Southwestern Region. Heavy defoliation was also evident on open-

grown cherry and, to a lesser extent, on aspen and birch in the southern North Bay, Sudbury and Espanola districts, including Manitoulin Island, and in Patton and Thessalon townships, Blind River District.

High population levels of the northern tent caterpillar occurred on trembling aspen, willow (*Salix* spp.), white birch and cherry shrubbery and on small trees in Pattinson, Floranna and Lipsett townships, central Chapleau District and in Elmhirst Township, Nipigon District. Generally low and occasionally medium population levels occurred at numerous other locations in northern Ontario.

Pine Sawflies, *Neodiprion nanulus nanulus* Schedl., *N. pratti banksianae* Roh., *N. pratti paradoxicus* Ross

Populations of the jack pine sawfly, *N. pratti paradoxicus* were widely distributed and were often found at high levels in the Eastern Region. The most severe damage occurred at a location in Carleton Place District, where 3.5-m jack pine suffered 80% defoliation. At numerous other locations in the Brockville, Cornwall, Tweed and Napanee districts, ornamental and small plantations of jack pine sustained defoliation ranging from 10 to 80%.

The closely related blackheaded jack pine sawfly, *N. pratti banksianae*, was most prevalent in the Thunder Bay and Atikokan districts. Infestations were recorded on fringe and roadside trees at French, Nym and Perch lakes in the Atikokan District and at various locations in Devon, Hartington, Goldie, Fallis and Conacher townships and near Huronia Lake in Thunder Bay District. Defoliation as high as 60% was observed on some trees near French Lake, but in most instances damage was in the 10% range. Small numbers of insects were reported at one location in Freele Township, Cochrane District, and in a number of widely distributed points in the Timmins, Temagami and Kirkland Lake districts.

Colonies of the red pine sawfly, *N. nanulus nanulus*, were most frequently observed in Temagami District, with the largest populations on red pine and jack pine around the northeastern arm of Temagami Lake. Small numbers of larvae were also reported at a few locations in the Sault Ste. Marie, Blind River, Chapleau, Nipigon, Ignace and Sioux Lookout districts.

European Pine Sawfly, *Neodiprion sertifer* (Geoff.)

A general increase in the numbers of this pest of pine was evident in southern Ontario. Small stands of roadside Scots pine (*Pinus sylvestris* L.) and red pine at a number of locations in the Napanee, Brockville, Carleton Place and Tweed districts sustained defoliation ranging from 10 to 50%. Moderate defoliation ranging from 30 to 50% was recorded on infested Scots pine and red pine in Hope, Haldimand and Harvey townships, Lindsay District. In a 10-ha, 1.4-m red pine stand in Somerville Township, Minden District, 11% of the trees sustained about

10% defoliation. A Scots pine Christmas tree plantation in Charlotteville Township, Simcoe District, had 74% of the trees infested with defoliation that averaged 30% but ranged as high as 90% on some trees. Low population levels recurred on open-grown Scots pine regeneration in Gordon Township on Manitoulin Island, Espanola District.

Bruce Spanworm, *Operophtera bruceata* (Hlst.)

Populations of the Bruce spanworm declined drastically in 1989 in Thunder Bay District. The total area of moderate-to-severe defoliation decreased from 680,455 ha in 1988 to 54,335 ha this year. Most of this defoliation occurred in a single large infestation located between Lac des Mille Lacs and the Burchell-Greenwater lakes area. Three smaller pockets were located north, south and west of Moss Lake in Moss Township. Most of the defoliation was in the moderate range in numerous pockets within the infested area. In the eastern part of the main infestation, the spanworm fed in conjunction with the forest tent caterpillar, which made mapping of the damage difficult. The spanworm was also reported in very small numbers at single locations in the Terrace Bay and Carleton Place districts.

Yellowheaded Spruce Sawfly, *Pikonema alaskensis* (Roh.)

As in the past, the largest numbers of this insect were recorded in Kirkland Lake District and in adjacent areas of the Timmins and Temagami districts. Moderate-to-severe defoliation was reported at many points on white spruce in open situations such as plantations, snow hedges, windbreaks and in old fields. Spray projects were carried out by OMNR in a seed orchard in Chamberlain Township and at the Swastika Forest Tree Nursery in Kirkland Lake District. The Ontario Ministry of Transportation and Communication also carried out spray projects on roadside snow hedges at several locations in the same district. Elsewhere in northern Ontario, the insect caused 60% defoliation of white spruce snow hedges east of the town of Cochrane and 10 to 30% defoliation around Remi Lake, east of Kapuskasing. Generally low populations were recorded on ornamentals in the city of Sault Ste. Marie and at one point near Blind River in the Sault Ste. Marie and Blind River districts.

In southern Ontario, large populations were observed in a white spruce plantation in Eldon Township, Lindsay District causing up to 100% defoliation of individual trees and light mortality, although overall defoliation averaged 11%. Roadside white spruce in Snowdon Township, Minden District, sustained an average of 50% defoliation on 96% of the trees, with defoliation on some trees reaching 95%. Defoliation of ornamental white spruce was in the 75% range at several locations in Minden District and a 1-ha plantation in Loughborough Township, Napanee District, sustained 50% defoliation. Low levels of defoliation were reported on roadside white spruce at one location in Faraday Township, Bancroft District.

Early Aspen Leafcurler, *Pseudexentera oregonana* (Wlsm.)

Infestations in the Red Lake District were significantly reduced in comparison with those recorded in 1989. Nevertheless, some 22,655 ha of moderate-to-severe defoliation was aerially sketch-mapped. The three main infestations were located as follows: in the vicinity of Red Lake itself, including McKenzie Island (5,800 ha), around the northern end of Little Vermilion Lake (5,000 ha) and along the northern side of Murdock Lake (7,120 ha). Nine additional pockets of damage, ranging from 220 to 1,560 ha, occurred north and south of the larger infestations. Two patches of light defoliation were reported in the Dixie Lake and Bruce Lake areas of Red Lake District and in the Hudson, Sioux Lookout and Kathlyn lakes area of Sioux Lookout District. Heavy infestations also recurred in Hearst District, where a total area of 15,703 ha of moderate-to-severe defoliation was mapped. The largest pocket encompassed 12,610 ha from the northern part of Rogers Township north to the end of the Rogers road and northeast to Limestone Rapids on the Kabinakagami River. A second pocket of 775 ha that stretched into the northern part of Fushimi Township was located on the Kabinakagami River south of Limestone Rapids. An infestation of about 1,940 ha was mapped in the west-central part of Auden Township and two small pockets of 130 and 250 ha occurred in the central part of Rogers Township. Occasional, heavily infested, individual trees were observed in central Kapuskasing District and southwestern Cochrane District.

Mainly moderate defoliation was reported in some 1,600 ha of trembling aspen stands in the Gull Bay area of Nipigon District. Light defoliation was evident in Hele Township, Nipigon District; in the Kabitotikwia Lake area of Thunder Bay District; in Whitney and Mountjoy townships, Timmins District; and in Taylor, Carr, Currie, Beatty and Hislop townships, Kirkland Lake District. Small numbers of larvae were also reported at a few areas in the Geraldton and Terrace Bay districts. A small pocket (1.5 ha) of heavy defoliation occurred in North Easthope Township, Wingham District.

European Pine Shoot Moth, *Rhyacionia buoliana* (D. & S.)

Increased population levels were evident in the Southwestern Region. The most severe damage occurred in a 2-ha plantation of 0.5-m Scots pine Christmas trees in Charlotteville Township, Simcoe District, where 80% of the leaders were infested. The insect was also reported in a number of other Scots pine Christmas tree plantations, with laterals and leaders being attacked. Chemical control and shoot clipping was carried out in several areas. Roadside Scots pine at one location in Niagara District sustained shoot damage ranging from 10-25% and approximately 100 young mugho pine (*Pinus mugo* Turra var. *mughus* Zenari) planted on the Hwy 401 right-of-way in Tyendinaga Township, Napanee District, were lightly infested.

Other Noteworthy Insects

The balsam fir sawfly, *Neodiprion abietis* complex, caused 10-25% defoliation of scattered balsam fir trees in Fitzroy, Beckwith and Drummond townships, Carleton Place District.

Relatively high numbers of the spruce coneworm, *Dioryctia reniculelloides* Mut. & Mun., were observed feeding on white spruce and black spruce (*Picea mariana* [Mill.] B.S.P.) in conjunction with the spruce budworm at Eyk Lake, Atikokan District, and in Blackwell Township, Thunder Bay District. A light infestation occurred in a 2-ha plantation of 5-m white spruce in Bexley Township, Lindsay District, and 7% of the black spruce in the Pacific Progeny Test in Sioux Lookout District were infested.

Heavy infestations of the pine tortoise scale, *Toumeyella parvicornis* (Ckll.), occurred in small, single groups of jack pine trees in the Espanola, Sudbury, North Bay, Timmins, Temagami and Kirkland Lake districts. Somewhat lighter damage occurred at single locations in Ignace and Red Lake districts.

Small numbers of larvae of the introduced pine sawfly, *Diprion similis* (Htg.), were collected on a red pine tree in the town of Atikokan, possibly a new distribution point for this insect. Light infestations were recorded in a Scots pine plantation in Haldimand Township, Lindsay District and on red pine in Somerville Township, Minden District.

Increased populations of the satin moth, *Leucoma salicis* (L.), were found on silver poplar (*Populus alba* L.) at a number of locations in the Carleton Place, Napanee and Tweed districts.

The pine needle sheathminer, *Zelleria haimbachi* Bsk., caused approximately 78% defoliation in one plantation and 40% defoliation in another one nearby in Ernestown Township, Napanee District.

Heavy infestations of the imported willow leaf beetle, *Plagiodera versicolora* (Laich.), caused 100% foliar browning to streambank trees in Murphy's Point Provincial Park, Carleton Place District.

The spruce spider mite, *Oligonychus ununguis* (Jac.), was associated with cedar browning along with a number of other factors at numerous locations in the Eastern Region and in Lindsay District of the Central Region. It also caused moderate-to-severe damage to white spruce hedges in the town of Stratton, Fort Frances District.

TREE DISEASES

Armillaria Root Rot, *Armillaria mellea* (Vahl:Fr.) Kummer and *A. ostoyea* (Romagn.) Herink

These diseases are present in many young conifer stands in Ontario. With a few exceptions, surveys this year showed infection levels in the 1-2% range. Exceptions occurred in Ashmore Township, Geraldton District, where 1.5-m jack pine regeneration in a 2-ha cut block had a 15-20% infection rate by *A. mellea*. In another nearby 2-ha cut block, the disease caused 5% mortality.

Scleroderris Canker, *Ascocalyx abietina* (Lagerb.) Schläpfer-Bernhard

The intensive annual detection surveys for the European race of this disease have so far failed to turn up any new infection centers. The European race has previously been confirmed in Mayo Township, Bancroft District, Macaulay Township, Bracebridge District and the adjacent townships of McMurrich and Ryerson, Parry Sound District. No significant spread has been recorded from the areas of the initial finds. A few samples from these general areas are still being cultured for positive identification.

There were a few reports of the North American race of the disease from northern Ontario. In Haughton Township, Blind River District, quantitative sampling in a 10-ha jack pine stand revealed that the infection rate had increased from 67 to 78%. An evaluation in a 10-ha red pine stand in Olrig Township, North Bay District, disclosed an infection level of 12.7% and mortality of 1.3% of the 0.8-m trees. Infection levels ranging from 1 to 7.3% were reported from young jack pine stands at two locations in Geraldton District and one location in Nipigon District.

Pine Needle Rust, *Coleosporium asterum* (Dietel) Sydow

This foliar disease was reported in numerous jack pine stands in northern Ontario in 1989. Probably the most widespread and heavy infections were in Chapleau District, where the heaviest infection was in a 25-ha stand of 0.5-m jack pine. Here, 99% of the trees were infected and average foliar damage was 45%. Infection levels of 90-99% were also recorded in Alcona, Copperfield, Darcy, Marshall, Cortez and Warren townships, Chapleau District and in Macmurchy and Garibaldi townships, Gogama District, with foliage damage levels in the 7-30% range. Near the Granite River in Thunder Bay District, 66% of the 1.8-m trees sustained an average of 15% foliar damage. In Atikokan District, a 10-ha stand of 1.6-m trees west of Lerome Lake had 48% of the trees infected and an average foliar damage of 16%. A 5-ha stand of 1.3-m trees near Old Man Lake had 45% of the trees infected with 10% foliar damage. This disease was reported from many other areas, sometimes with infection levels in the 80-100% range, but in most cases actual foliar damage was 5% or less.

Sweet Fern Blister Rust, *Cronartium comptoniae* Arthur

This disease is widespread in jack pine stands in northern Ontario but evaluation in most cases in 1989 revealed infection levels of 3% or less. Exceptions were in de Gaulle Township, Chapleau District, where 5% of the trees in a 10-ha plantation were infected, and near Sprat Lake in Atikokan District, where 8% of the trees in a 14-ha stand of jack pine were infected.

White Pine Blister Rust, Cronartium ribicola J.C. Fischer

Reports of this perennial pest of white pine were received from a number of areas in northern and southern Ontario. In southern Ontario, incidence in white pine plantations varied from 0 to 20% and the incidence of stem cankers ranged from 0.7 to 9.3%. The most severely affected stand was in Rawdon Township, Tweed District, where 20% of the trees in a 1-ha plantation of 1-m trees were infected, 9.3% of them severely. In Ross Township, Pembroke District, 14% of the 5-m trees were infected, with approximately 4% suffering stem cankers. In Douro Township, Lindsay District, 12.7% of 1.5-m trees in a 2-ha plantation were infected, 7.3% severely, and 3.3% were dead.

In northern Ontario, the incidence of infection ranged from 3 to 26%. In Kosny Township, Chapleau District, 26% of the trees in a small, natural stand were infected. The most serious damage was recorded in a 31-ha plantation of 1.3-m trees in Antoine Township, North Bay District, where 23.3% of the trees were infected and 12.3% were severely infected with basal stem cankers. A survey of mature white pine in Chapleau and Gogama districts showed that 15-20% of the trees were infected, and exhibited the distinctive dead tops characteristic of this rust.

Tar Spot Needle Cast, *Davisomycella ampla* (J. Davis) Darker

This foliar disease was widely distributed on jack pine and occasionally on Scots pine in northern Ontario. The most severe damage was reported from Chapleau District, where infection levels in Neelands, de Gaulle, Chappise and Copperfield townships ranged from 25 to 65%, with accompanying foliar damage of 17 to 30%. Similar infection and damage levels were recorded in Vrooman, Invergarry and Garibaldi townships, Gogama District. A single stand in Nimitz Township, Chapleau District had 90% of the trees infected with an average of 25% foliage damage. Reports were received from numerous other areas but, in most cases, damage was not significant.

Western Gall Rust, *Endocronartium harknessii* (J.P. Moore) Y. Hirats.

The incidence of attack by this disease of jack pine varied widely across northern Ontario. In a 10-ha plantation of 1.7-m trees in de Gaulle Township, Chapleau District, 30% mortality was recorded, with

45% of the remaining trees infected, 25% severely. In the same district, another stand of 1-m trees sustained a 50% infection rate, with 42% of the trees severely damaged. An infection rate of 57% was recorded on 1.9-m trees in Lane Township, Blind River District, with 30% of the trees severely galled. An evaluation in a 100-ha jack pine stand on the Vermilion River Road, Sioux Lookout District, revealed that 37% of the trees were infected, 21% severely, and a 75-ha stand on the Sowdon Lake Road, Ignace District, had 35% of the trees infected, 11% severely. A 14-ha stand of 3.3-m jack pine on the Mack Road, Thunder Bay District, had a 38% infection rate, with 22% of the trees severely damaged. Numerous other reports of infection rates ranging from 1 to 21% were received.

Other Noteworthy Diseases

Widespread reports of a tip blight, *Sphaeropsis sapinea* (Fr.) Dyko & B. Sutton, were received from southern Ontario. Branch and twig mortality and whole-top mortality were reported at various levels in the Eastern, Central and Southwestern regions.

The spruce cone rust, *Chrysomyxa pirolata* (Körn.) Winter, destroyed 8% of the cone crop on 1.5-m grafted stock at the Thunder Bay Forest Nursery, Thunder Bay District.

Septoria canker, *Septoria musiva* Peck, caused 1% mortality of about 10,000 hybrid poplar stems in a 1-ha area on Hwy 42 south of Westport, Brockville District.

A heavy infection by the hemlock-poplar rust, *Melampsora abietis-canadensis* C.A. Ludwig ex Arthur, damaged 60% of the hemlock cones in a 10-ha woodlot in Dereham Township, Aylmer District.

A light infection by a root rot, *Cylindrocladium floridanum* Sob. & C.P. Seym., was reported in one compartment in the Thessalon Forest Tree Nursery, Blind River District.

A needle blight, *Rhizosphaera kalkhoffii* Bubák, infected 8% of the trees in an 80-ha black spruce plantation near Limestone Lake, Geraldton District, and 26% of the trees in another 30-ha plantation in the same area. Foliar damage at both locations was 5%.

The fir broom rust, *Melampsorella caryophyllacearum* Schröter, was found infecting 10% of the balsam fir trees in a stand near Waweig Lake, Nipigon District.

ABIOTIC CONDITIONS

Cedar Browning

Abnormal browning of cedar (*Thuja* spp.) foliage was evident at many locations in the Cornwall, Carleton Place, Brockville, Napanee and Tweed districts of the Eastern Region and in southern Lindsay District of the Central Region. The condition is thought to be the result of a number of stress factors in 1988 and 1989. Severe drought conditions in the summer of 1988 were accompanied by a very heavy cone crop, which caused unusually thin crown conditions. Severe winter drying conditions in the spring of 1989, accompanied by lower than normal rainfall, placed additional stress on the stands. Heavy infestations of the cedar leaf-miner complex also occurred in 1988 and 1989 and were accompanied, in a few cases, by large populations of spruce spider mite. Along with the very thin crowns, branch and tip mortality is evident in some stands. However, in most of the severely affected areas, new growth was becoming evident during late June, an indication that stands are beginning to recover.

Salt Damage

Salt damage is a perennial problem on trees, particularly conifers growing adjacent to Ontario highways. Most severely affected are trees growing near intersections, curves, hills and other areas where heavy salting operations are carried out. In 1989, reports of severe damage were received from several districts. In the Sault Ste. Marie and Blind River districts, defoliation ranging from 50 to 75% and sporadic mortality was evident on red pine and white pine at several locations along Hwy 17 in the Garden River-Echo Bay areas and near Iron Bridge. Defoliation levels of 80% were recorded on roadside red pine in Richards Township, Pembroke District and 40% foliar damage was apparent on red pine along Hwy 62 in Monteagle Township, Bancroft District. Heavy salt damage was also reported in a number of areas in the Lindsay, Bracebridge, Minden and Parry Sound districts on red pine, white pine and eastern white cedar (*Thuja occidentalis* L). At one location in Chaffey Township, Bracebridge District, 90% foliage damage was recorded.

Frost

Reports of frost damage were scarce in Ontario this year. Sporadic, mainly light, damage was recorded in a few areas in the Nipigon, Thunder Bay, Atikokan, Fort Frances and Ignace districts. The most severe damage was in the O'Connor Seed Orchard in Thunder Bay District, in which 45% of 1.0-m white spruce sustained 50% foliar damage. At most other locations, foliar damage was 3% or less, although the proportion of trees affected was as high as 97%.

Winter Browning

This condition is caused by warm, dry weather in late winter or early spring. The warm conditions dry foliage at a time when frozen stems and root systems cannot replace lost moisture, resulting in brown foliage and, occasionally, in bud and branch mortality. The condition was reported to be severe in Bouck Township, Blind River District, where 58% of 1.4-m red pine sustained 30% foliar damage. In Parkinson Township of the same district, 75% of 1.7-m pitch pine (*Pinus rigida* Mill.) suffered average foliar damage of 28%. Roadside red pine and white pine in a 25-ha area along Highway 401 in Kingston Township, Napanee District, sustained severe foliar browning. Similarly, roadside red pine and white pine along Hwy 417 in Cumberland and Cambridge townships, in the adjacent Carleton Place and Cornwall districts, had 50 to 100% foliar browning.

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