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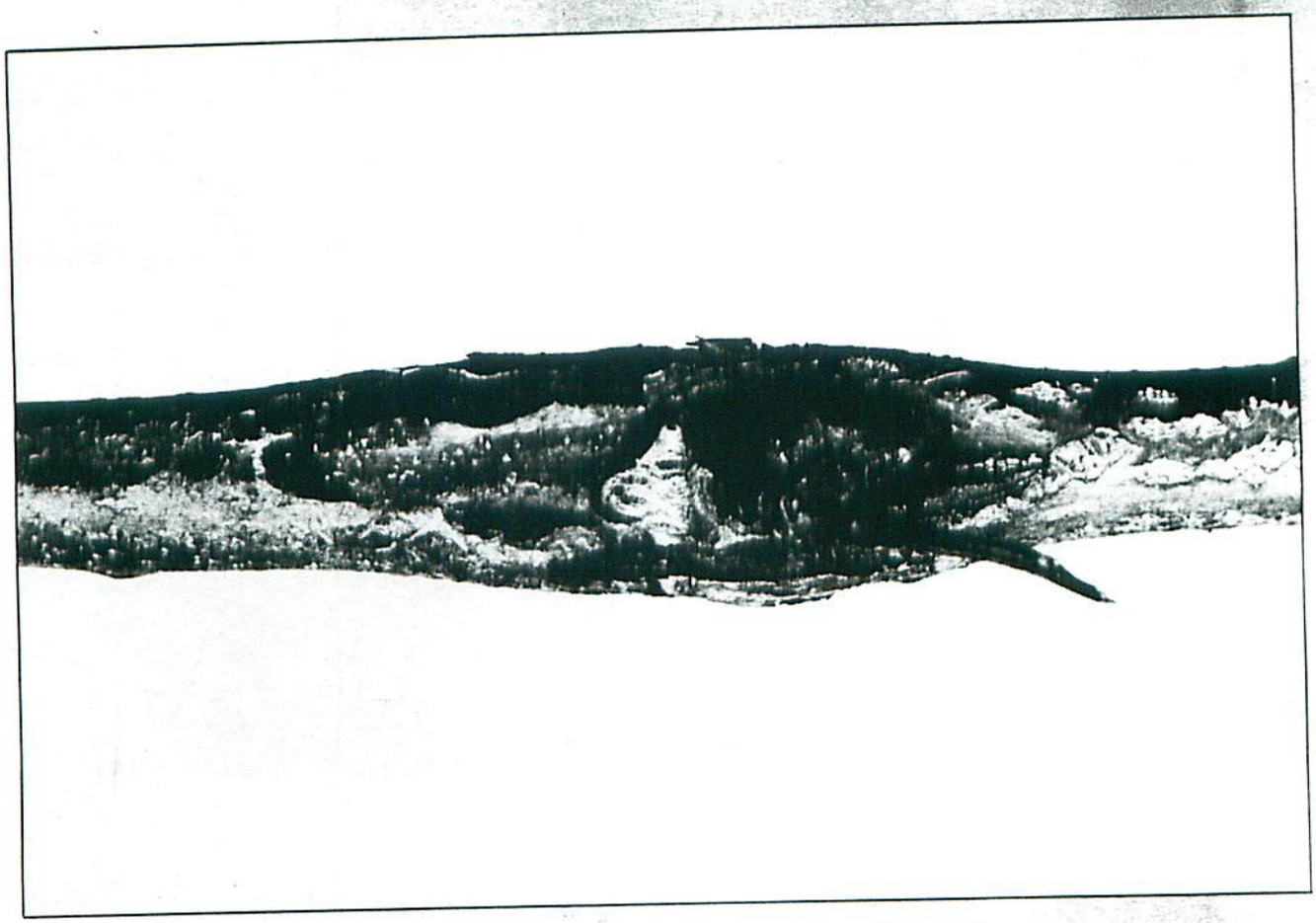
SURVEY BULLETIN

Forest Insect and Disease Conditions in Ontario
Fall 1991



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Canada

FOREST INSECT AND DISEASE CONDITIONS IN ONTARIO

~ Fall 1991 ~

Cover photo: Butternut Canker (*Sirococcus clavigignenti-juglandacearum*) recorded for the first time in Ontario.

This is the last of three bulletins issued by the Forest Insect and Disease Survey Unit (FIDS) of the Great Lakes Forestry Centre describing pest conditions in Ontario forests in 1991.

FOREST PEST REVIEW

The 15th annual Forest Pest Review for Ontario was held in Sudbury on 29 October. This year, a single session was held rather than the northern and southern reviews that have been the norm in previous years. A total of 105 people attended the review. The wide variety of topics discussed included the following: situation updates and defoliation forecasts for major pests such as the spruce budworm, gypsy moth, jack pine budworm, forest tent caterpillar and Scleroderris canker disease; the results of control operations against the spruce budworm and gypsy moth; virus research trials and biocontrol updates against the gypsy moth; forest health studies; preventing damage by the redheaded pine sawfly; pest-caused wood losses in Ontario from 1982 to 1987; biology of and damage by birch insects in the Sudbury area; plantation weed control; and the re-organization of the Forest Health and Protection Section. Presentations were made by representatives of the Ontario Ministry of Natural Resources (OMNR), Ontario Ministry of the Environment, Laurentian University and Forestry Canada (the Forest Pest Management Institute, Headquarters and Ontario Region).

FOREST INSECTS

Spruce Budworm, *Choristoneura fumiferana* (Clem.)

The summer *Survey Bulletin* provided a detailed description of spruce budworm infestations in Ontario. Briefly, the area of moderate-to-severe defoliation of balsam fir (*Abies balsamea* [L.] Mill.), white spruce (*Picea glauca* [Moench] Voss) and black spruce (*Picea mariana* [Mill.] B.S.P.) increased by some 2,282,520 ha to 9,065,781 ha. Most of the defoliation occurred in the North Central and Northwestern regions, but the main body of the infestation has now spread eastward to encompass parts of northwestern Wawa District and western Hearst District in the Northeastern and Northern regions. A number of smaller pockets of damage were mapped east of the main body in Hearst District. Very small, discrete pockets of new infestation were mapped in the Sudbury and North Bay districts. In southern Ontario, infestations in the northwestern corner of Algonquin Park District increased from 2,815 ha to 11,640 ha. Small pockets of damage were also mapped in a few white spruce plantations in the Lindsay, Maple, Huronia and Wingham districts.

Aerial surveys for the detection of spruce budworm-caused mortality were completed in August and September. A total area of 3,736,379 ha was mapped, an increase of 638,190 ha over the 3,098,189 ha mapped in 1990 (Fig. 1 and Table 1). Most of the increase, some 513,496 ha, occurred in the Nipigon, Terrace Bay and Thunder Bay districts. Smaller, scattered areas of new mortality were mapped in the Kenora, Red Lake, Dryden, Sioux Lookout, Ignace and Atikokan districts.

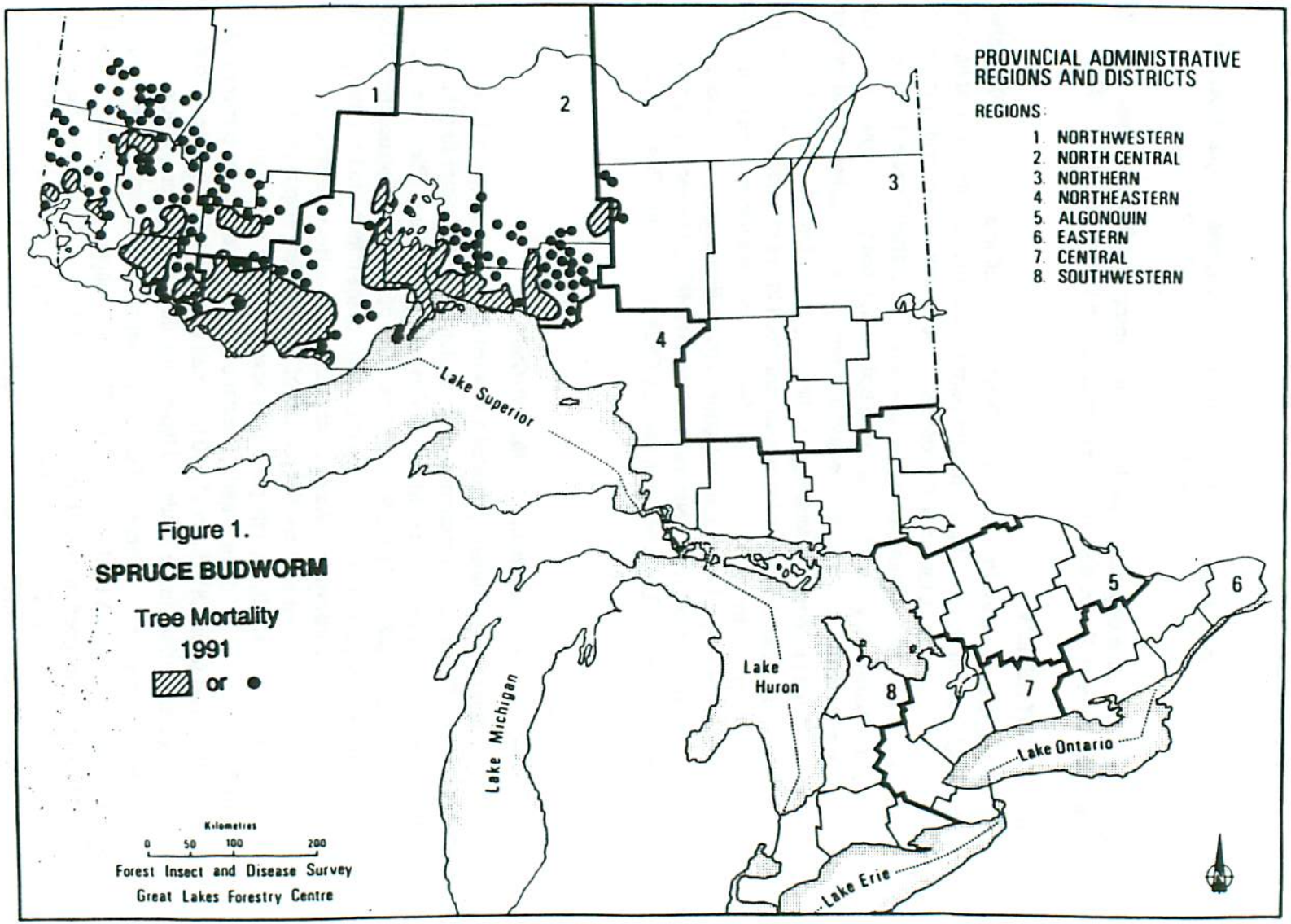

PROVINCIAL ADMINISTRATIVE REGIONS AND DISTRICTS
REGIONS:
1. NORTHWESTERN
2. NORTH CENTRAL
3. NORTHERN
4. NORTHEASTERN
5. ALGONQUIN
6. EASTERN
7. CENTRAL
8. SOUTHWESTERN
Lake Superior
Lake Michigan
Lake Huron
Lake Ontario
Lake Erie
SPRUCE BUDWORM
Tree Mortality
1991
or
Kilometres
0 50 100 200
Forest Insect and Disease Survey
Great Lakes Forestry Centre

Figure 1.

Table 1. Areas of spruce budworm-associated tree mortality in Ontario, 1990 and 1991.

Region and District	Total area (ha) 1990	Total area (ha) 1991	Increase (ha) 1991
North Central Region			
Atikokan	861,785	867,425	5,640
Geraldton	47,220	68,595	21,375
Nipigon	313,750	550,576	236,826
Terrace Bay	328,504	536,740	208,236
Thunder Bay	757,890	826,324	68,434
Total	2,309,149	2,849,660	540,511
Northwestern Region			
Dryden	188,129	197,858	9,729
Fort Frances	341,938	341,938	–
Ignace	127,268	140,076	12,808
Kenora	106,454	137,083	30,629
Sioux Lookout	16,729	37,940	21,211
Red Lake	8,522	31,824	23,302
Total	789,040	886,719	97,679
Over all	3,098,189	3,736,379	638,190

Egg-mass surveys to assist in forecasting population trends for 1992 were carried out during the latter part of the field season. Over all, egg-mass densities declined by 6% (Tables 2 and 3), with small reductions in the Northwestern and North Central regions and in southern Ontario, whereas increases occurred in the Northern and Northeastern regions. Egg-mass densities remain sufficiently high to allow a prediction of moderate-to-severe defoliation throughout most of the area infested in 1991.

In Northwestern Region, population levels will likely remain high throughout most of the area infested in 1991 and there may be some expansion along the northern edge of the outbreak in the Red Lake and Sioux Lookout districts. There is also the possibility of some slight expansion along the southern edge of the outbreak in Fort Frances District. Population levels are also expected to remain high in North Central Region, with the exception of southern and eastern Thunder Bay District and southwestern Nipigon District, where there may be some lessening in the intensity of defoliation.

Although egg-mass counts increased in the Northern and Northeastern regions, widespread defoliation is not expected. There may be some expansion of the infestation along the eastern edge of the outbreak, however, in western Hearst District and northwestern Wawa District, and new pockets of defoliation may come to light in other parts of both regions next year.

In southern Ontario, infestations may expand somewhat in the northwestern corner of Algonquin Park District and there is a possibility that other pockets of damage may be discovered. Nonetheless, widespread defoliation is unlikely.

Jack Pine Budworm, *Choristoneura pinus pinus* Free.

Jack pine budworm infestations increased in both size and intensity in 1991. In northwestern Ontario, the main area of infestation was located in Red Lake District, where 69,903 ha of moderate-to-severe defoliation were mapped north of the town of Red Lake in the Kirkness Lake–Little Vermilion Lake area. New infestations occurred in the Metionga Lake area on the Thunder Bay–Ignace district boundary, where 2,591 ha of moderate-to-severe defoliation were mapped.

In southern Ontario, infestations that developed in Parry Sound District in 1990 increased from 29,660 ha to 57,274 ha. This included the main body of infestation in Parry Sound District and smaller pockets of damage in southern Sudbury and Espanola districts.

Egg-mass surveys carried out in late August indicate that population levels will probably remain high in areas infested in 1991. In Red Lake District, infestations will persist in the Kirkness

Table 2. Comparison of spruce budworm egg-mass densities in Ontario in 1990 and 1991.

Region and District	Number of locations	Number of locations with increase	Average egg-mass density per 9.29 m^2 1990	1991	Change (%)
Northwestern Region					
Dryden	16	7	347.7	455.8	+31
Fort Frances	11	2	247.4	142.8	–42
Ignace	19	8	265.3	249.4	–6
Kenora	17	8	453.6	357.8	–21
Red Lake	15	7	450.1	443.2	–2
Sioux Lookout	19	10	359.2	326.5	–9
Total	97	42	356.8	335.4	–6
North Central Region					
Atikokan	15	10	145.2	239.6	+65
Geraldton	22	9	651.0	529.3	–19
Nipigon	24	5	675.6	331.8	–51
Terrace Bay	36	18	321.4	401.2	+25
Thunder Bay	61	31	271.7	305.7	+12
Total	158	73	385.2	356.3	–8
Northern Region					
Chapleau	6	1	5.3	2.2	–58
Cochrane	5	0	0.0	0.0	0
Gogama	3	1	0.0	4.7	+100
Hearst	18	10	157.9	197.2	+25
Kapuskasing	3	0	25.7	0.0	–100
Kirkland Lake	3	1	1.3	2.3	+77
Timmins	2	1	6.5	9.5	+46
Total	40	14	74.2	90.1	+21
Northeastern Region					
Blind River	3	2	16.7	38.3	+129
Espanola	2	1	8.0	25.0	+212
North Bay	3	1	2.3	2.0	–13
Sault Ste. Marie	5	1	0.0	3.0	+100
Sudbury	2	0	0.0	0.0	0
Temagami	2	0	0.0	0.0	0
Wawa	10	4	15.0	46.9	+213
Total	27	9	8.3	24.3	+193
Southern Ontario	22	5	146.5	137.4	–6

Lake–Little Vermilion Lake area and may expand slightly to the east. Infestations in the Metionga Lake area may expand somewhat into the Dove Lake area. In southern Ontario, population levels will likely remain high in Parry Sound District as well as in the small pockets of infestation in the Sudbury and Espanola districts. There may be some expansion of the small pockets of damage south of the town of Espanola. In addition to the above, egg-mass samples forecast moderate-to-severe defoliation at single locations in each of the Nipigon, Geraldton and Blind River districts. Light defoliation is forecast for a number of areas in the Blind River, Espanola, Chapleau and Temagami districts and at one location in Owen Sound District.

Table 3. Comparison of spruce budworm egg-mass densities in the regions of Ontario in 1990 and 1991.

OMNR Region	Number of locations common to 1990 and 1991	Average egg-mass density per 9.29 m^2 1990	1991	Change (%)
Northwestern	97	356.8	335.4	−6
North Central	158	385.2	356.3	−8
Northern	40	74.2	90.1	+21
Northeastern	27	8.3	24.3	+193
Southern Ontario	22	146.5	137.4	−6
Total	344	296.2	279.4	−6

Forest Tent Caterpillar, *Malacosoma disstria* Hbn.

Forest tent caterpillar infestations nearly doubled in size in 1991, increasing from 9,480,408 ha to 18,870,518 ha. The bulk of the defoliation occurred in northwestern and northern Ontario, but infestations also persisted in central Ontario between Sault Ste. Marie and North Bay and in southwestern Ontario. Egg-band surveys were carried out during the late summer and fall of 1991 to determine population trends for 1992. Numerous locations were sampled in and around infested areas throughout the province (Fig. 2, 3 and 4).

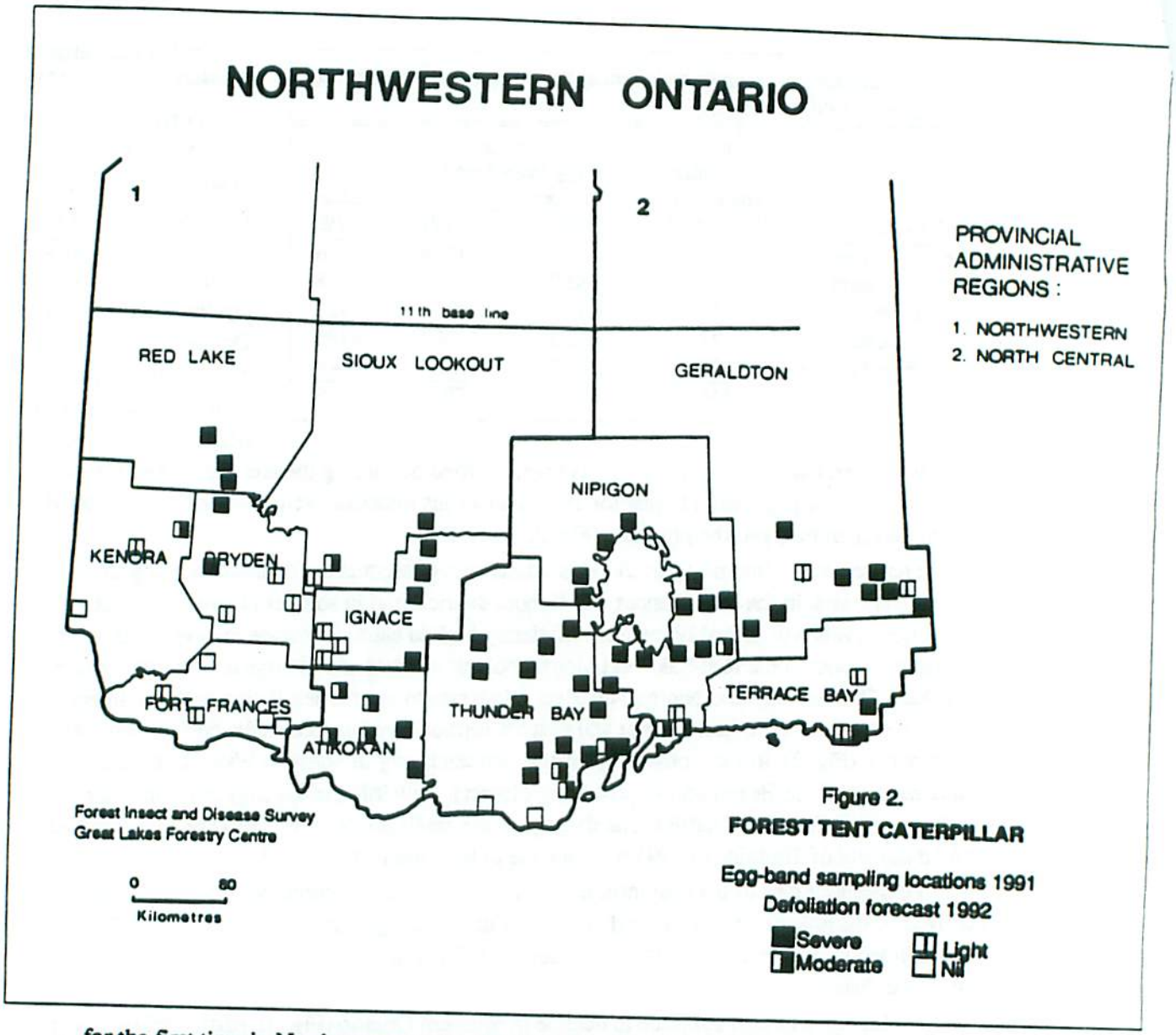
In northwestern Ontario (Fig. 2), populations and, consequently, defoliation will probably decline somewhat in the Fort Frances and Kenora districts and in southern Dryden District. Population levels will probably remain sufficiently high to cause moderate-to-severe defoliation in the southern parts of the Red Lake and Sioux Lookout districts and in large areas of the Ignace, Atikokan, Thunder Bay and Nipigon districts. Moderate-to-severe defoliation will also likely persist in southern Geraldton District and eastern Terrace Bay District. In the northeastern part of the province (Fig. 3), infestations will probably remain heavy in northern Wawa District and in the southern parts of the Hearst and Kapuskasing districts. New infestations may develop in the southwestern part of Cochrane District. The damage in the small pockets of defoliation that occurred around the city of Timmins in 1991 may decline to light intensity in 1992.

In the central part of the province, infestations will probably continue to decline in the Sault Ste. Marie, Blind River, Espanola and North Bay districts. Egg-band counts in Sudbury District are still sufficiently high to cause moderate-to-severe defoliation next year through much of the central part of the district.

Populations will also continue to decline in southern Ontario (Fig. 4), particularly in Owen Sound District, where egg-band counts forecast either nil or low levels of defoliation. Pockets of moderate-to-severe defoliation may persist in northern Parry Sound District and in parts of the Minden, Tweed, Carleton Place and Napanee districts.

Gypsy Moth, *Lymantria dispar* (L.)

The summer *Survey Bulletin* gave a detailed description of major increases in gypsy moth infestations in 1991. The total area of moderate-to-severe defoliation increased from 77,648 ha in 1990 to 347,415 ha in 1991, the largest area of infestation by this pest ever recorded in the province. Infestations and consequent defoliation were widespread in Simcoe District of Southwestern Region and in the Niagara, Maple, Lindsay and Huronia districts of Central Region. Infestations and damage were also widespread in the Parry Sound, Bracebridge, Minden and Pembroke districts of Algonquin Region. Populations declined somewhat and, consequently, damage was less severe in Eastern Region, mainly in the Tweed and Napanee districts. As the insect continues to extend its range north and west, moderate-to-severe defoliation was recorded



for the first time in Northeastern eastern Region. Small pockets of defoliation were recorded near Killarney in Sudbury District, near Wikwemikong and Sheguiandeh on Manitoulin Island, and near the village of Birch Island in Espanola District.

The annual gypsy moth pheromone trapping program was again carried out in northern Ontario parks and campgrounds as an aid in following the spread of this introduced insect. The procedure is to set out two traps in each park, one in a camping area and one near the park entrance. In some parks in which previous catches had been made, 10 traps were placed throughout the park. Traps placed at 19 locations in the Blind River, Espanola, Sudbury, North Bay, Gogama, Temagami and Kirkland Lake districts all yielded positive results (Fig. 5). The number of moths caught ranged from one at Kap-Kig-Iwan Provincial Park, Kirkland Lake District, to 54 at Gordons Lodge at Gore Bay on Manitoulin Island. In general, the higher counts were at locations closest to southern Ontario, something that can be expected as the insect extends its range north and west. Small numbers of moths (usually one or two) were caught at Fushimi and Remi Lake provincial

parks, Kapuskasing District, at Ivanhoe Provincial Park, Chapleau District, and at the Agawa Bay Campground in Lake Superior Provincial Park, Wawa District. Single moths were also caught at the following parks in northwestern Ontario: at French Lake in Quetico Provincial Park, Atikokan District, at Blue Lake Provincial Park, Dryden District, and at Pakwash Provincial Park, Red Lake District.

There is little data available at present upon which to base population forecasts for 1992. Some preliminary data associated with spray assessments indicates that declines may occur in some of the more heavily infested areas in southern Ontario. This fact notwithstanding, it is likely that the insect will continue to extend its range north and west and that infestations in the more northerly parts of its range will intensify and expand in area.

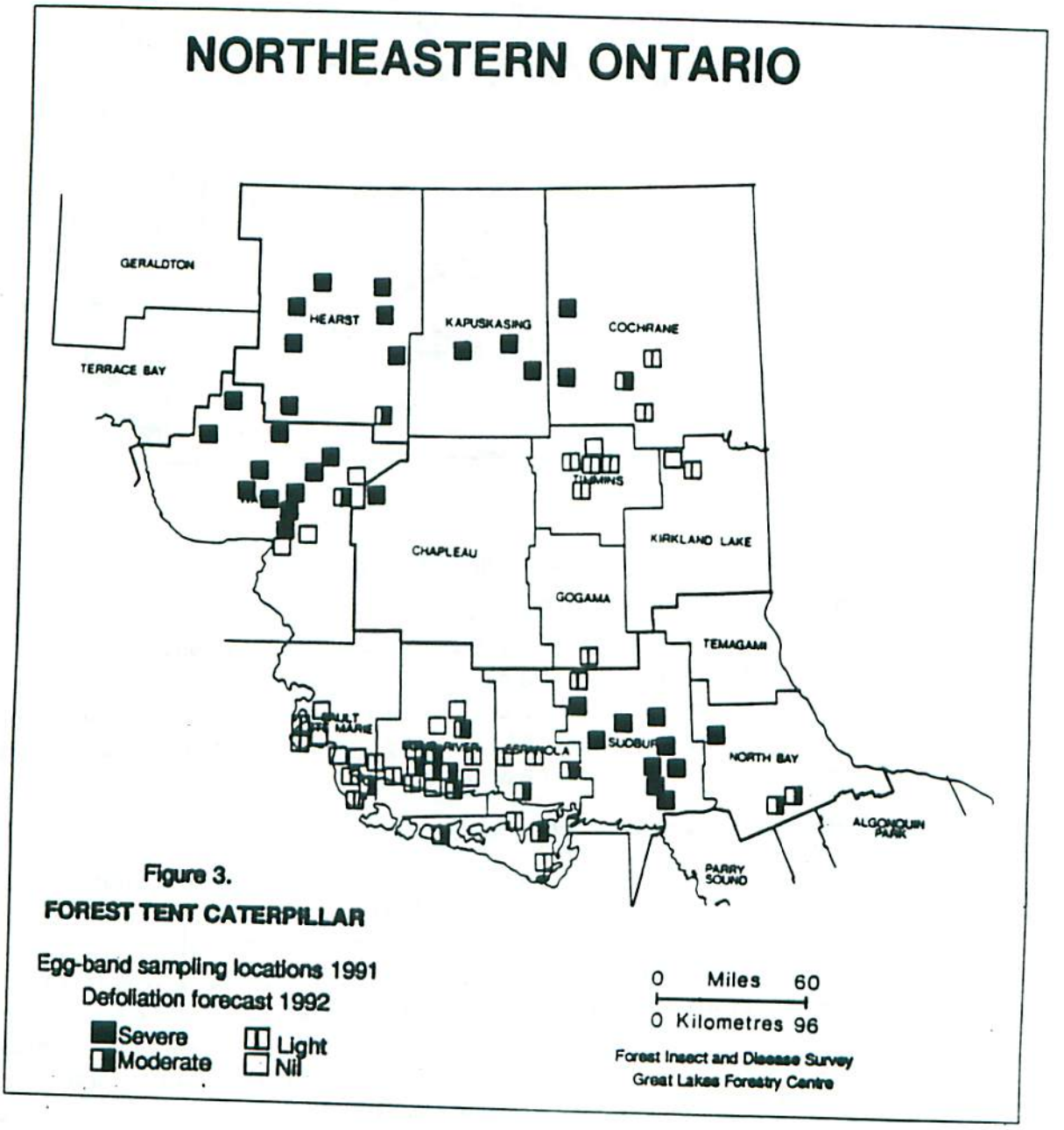


Figure 3.
FOREST TENT CATERPILLAR

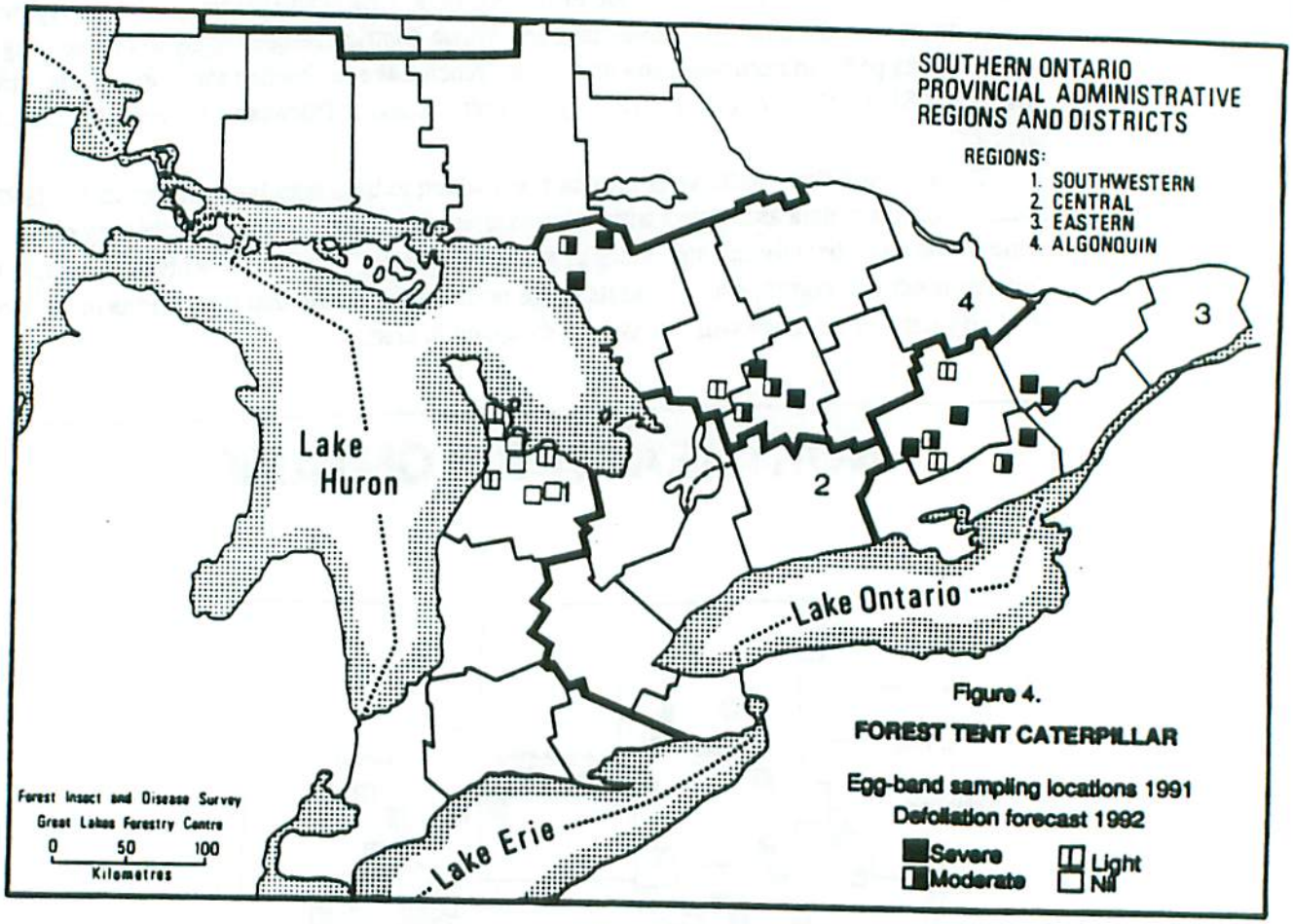


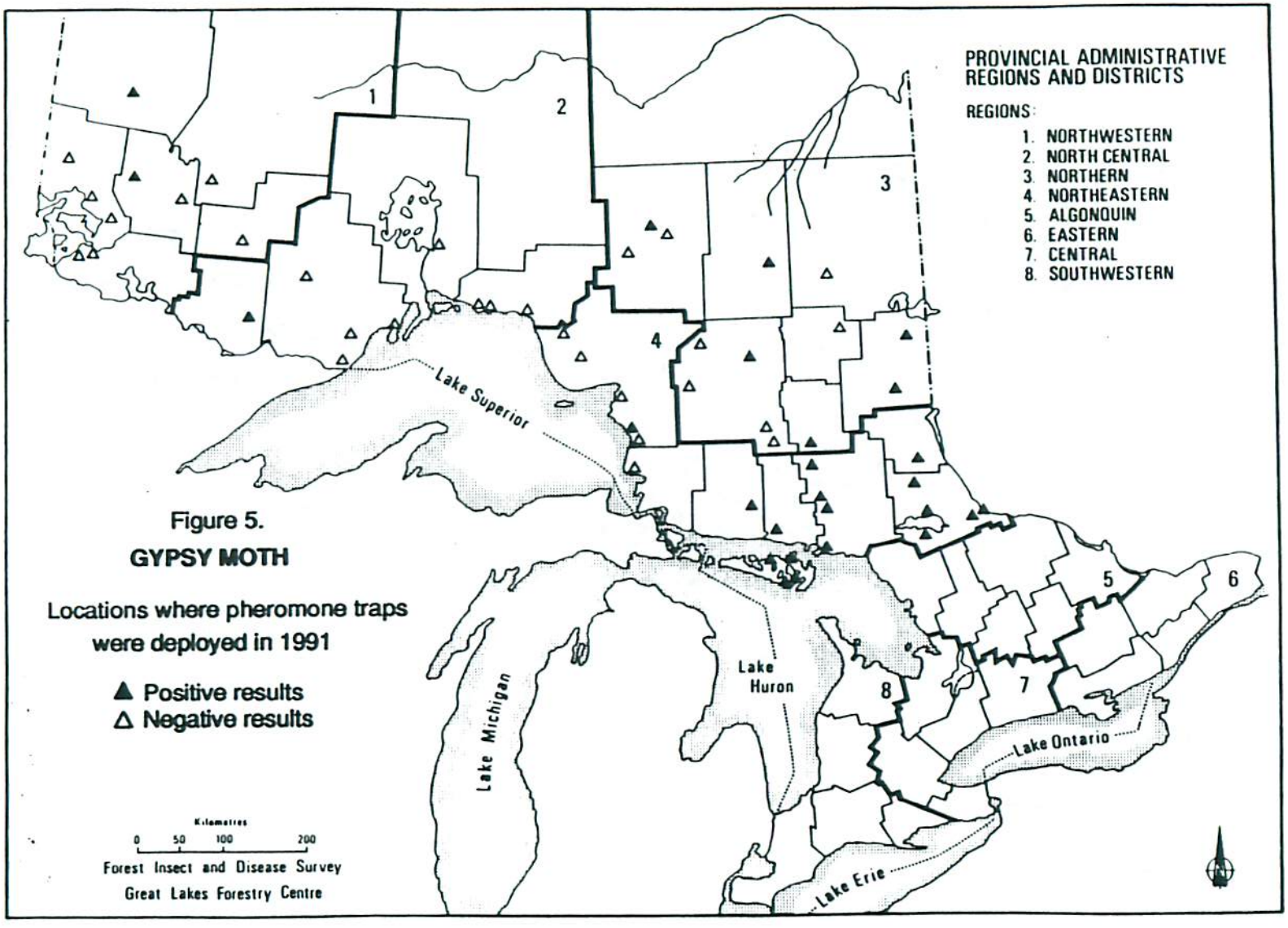
Figure 4.
FOREST TENT CATERPILLAR

Pine False Webworm, *Acantholyda erythrocephala* (L.)

Further to information presented in the summer *Survey Bulletin*, heavy infestations occurred on ornamental trees in and around the city of Thunder Bay. Small numbers of red pine (*Pinus resinosa* Ait.), white pine (*P. strobus* L.) and jack pine (*P. banksiana* Lamb.) sustained foliar damage as high as 100% at a number of locations in the urban area. A further report from Bancroft District described an infestation in a 1.5-ha red pine plantation in Monteagle Township, where 47% of the trees sustained an average of 17% defoliation.

Birch Skeletonizer, *Bucculatrix canadensisella* Cham.

Populations of this late-season pest, which began increasing in 1990, reached outbreak proportions this year (Fig. 6). A total area of 3,077,454 ha of moderate-to-severe defoliation was mapped in northeastern and southern Ontario. The largest area of infestation occurred in the northern half of Chapleau District and extended into southern Kapuskasing District and the adjacent corners of the Wawa and Hearst districts. A second large infestation occupied parts of central Timmins District and southwestern Cochrane District, and extended into the southeastern corner of Kapuskasing District. Two sizable patches of defoliation were mapped in central Kapuskasing District and on the Hearst–Kapuskasing district boundary. Numerous smaller pockets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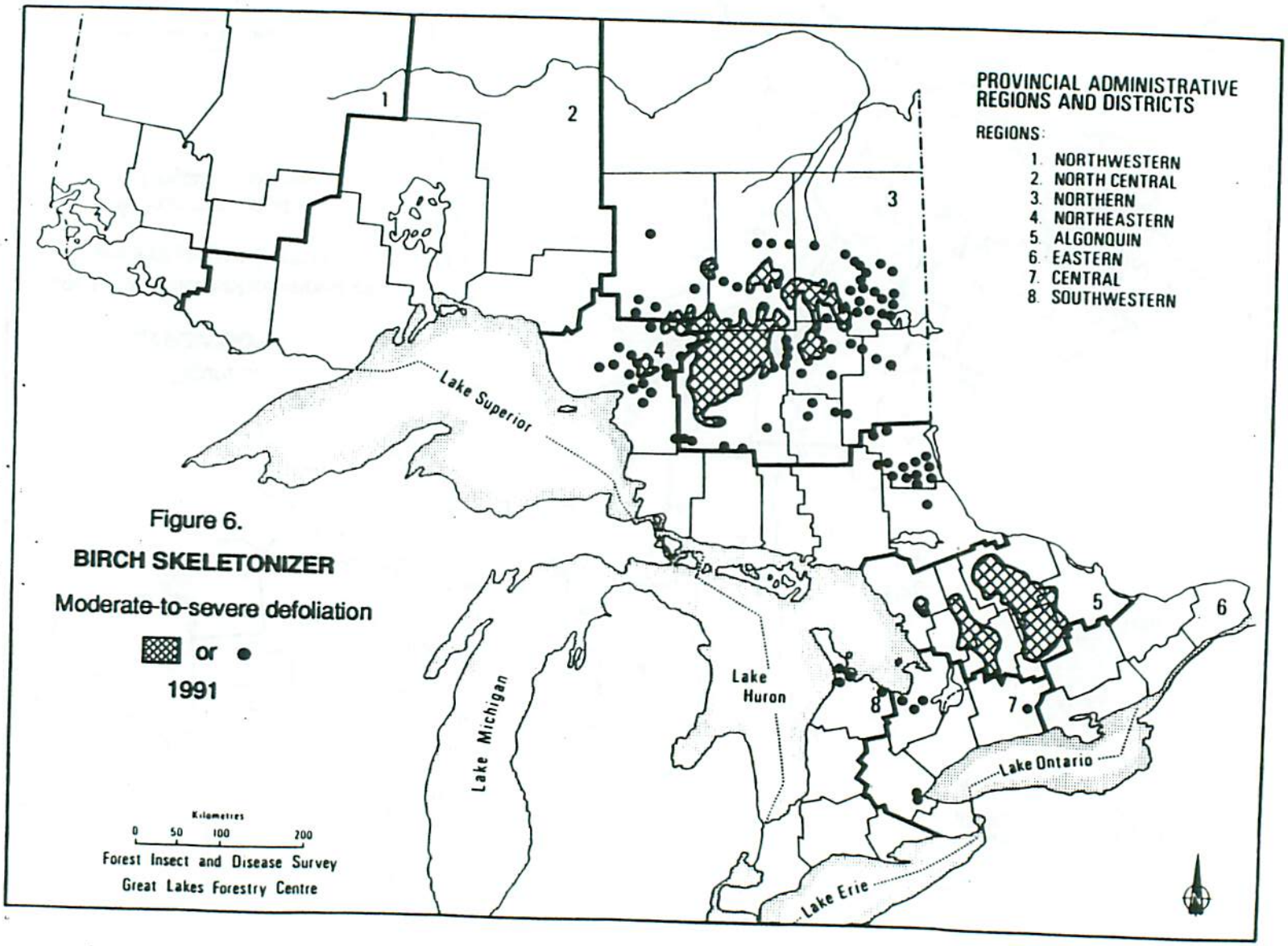
7. CENTRAL
8. SOUTHWESTERN
Lake Superior
Lake Michigan
Lake Huron
Lake Ontario
Lake Erie
Figure 5.
GYPSY MOTH
Locations where pheromone traps were deployed in 1991
▲ Positive results
△ Negative results
Kilometres
0 50 100 200
Forest Insect and Disease Survey
Great Lakes Forestry Centre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7. CENTRAL
8. SOUTHWESTERN
Lake Superior
Lake Michigan
Lake Huron
Lake Ontario
Lake Erie
Figure 6.
BIRCH SKELETONIZER
Moderate-to-severe defoliation
or
1991
Kilometres
0 50 100 200
Forest Insect and Disease Survey
Great Lakes Forestry Centre

of damage were mapped in birch (*Betula* spp.) stands in the Wawa, Hearst, Kapuskasing, Cochrane, Chapleau, Timmins, Gogama, Kirkland Lake, Temagami, North Bay and Sudbury districts.

In southern Ontario the largest area of infestation occupied the central parts of the Algonquin Park and Bancroft districts and extended slightly into the western part of Pembroke District. A second large area of infestation occurred in central Bracebridge and Minden districts and a third smaller patch was located in central Parry Sound District. Small, scattered pockets of defoliation were observed in the Owen Sound, Huronia, Niagara and Maple districts.

Pitted Ambrosia Beetle, *Corthylus punctatissimus* (Zimm.)

A number of reports of this pest of sugar maple (*Acer saccharum* Marsh.) regeneration were received this year. Mortality ranged from 5 to to 30% of 0.7-m regeneration in a semimature stand in Adjala Township, Huronia District, and mortality levels of 20 and 40% were recorded at two locations in Bass Lake Provincial Park in the same district. Fifty percent of the 0.5-m regeneration was killed on a 2-ha site at Hagens Hill in Thessalon Township, Blind River District. The same mortality level was reported within an Acid Rain National Early Warning System plot near the village of Athens in Brockville District.

Beech Scale, *Cryptococcus fagisuga* Lindinger

Heavy infestations by this vector of beech bark disease occurred at Presqu'ile Provincial Park, Napanee District, and at Mark S. Burnham Provincial Park in Lindsay District. Lower population levels of the insect were reported at five locations in Niagara District and at a few other locations in the Cornwall and Brockville districts. Although the fungus *Nectria galligena* Bresad. was collected from one beech (*Fagus* sp.) tree on the Gananoque golf course in Front of Leeds and Lansdowne Township, Brockville District, the *faginata* variety, which causes beech bark disease, has not been found to date in Ontario.

Introduced Pine Sawfly, *Diprion similis* (Htg.)

Increased but small numbers of this pest were detected in white pine stands of various age classes inland from the Georgian Bay coastline in Carling, Cowper, Conger, Foley, Freeman and Gibson townships, Parry Sound District. In most cases, defoliation was near 10%, although previous feeding by the gypsy moth gave the impression of much more serious damage in some cases. A similar situation occurred in Draper, Muskoka, Morrison and Ryde townships of Bracebridge District, where low population levels of the introduced pine sawfly were detected in white pine stands previously damaged by the gypsy moth. Low population levels were reported at Boyle's Bay on Big Basswood Lake and at the Thessalon Forest Tree Nursery in Kirkwood Township, Blind River District, and in the Garden River Indian Reserve in Sault Ste. Marie District.

Maple Trumpet Skeletonizer, *Epinotia aceriella* (Clem.)

High population levels recurred in a 25-ha sugar maple stand in Hallowell Township, Tweed District. At this location, 80% of the mature trees sustained 50% defoliation and 90% defoliation was recorded on 90% of the regeneration. A mature 5-ha sugar maple woodlot at Sandbanks Provincial Park had 30% of the trees attacked, with defoliation averaging 25%. A number of hill-top sugar maple stands in Deans Township, Chapleau District, were attacked by the same pest and sustained an average of 10% defoliation.

Eastern Pine Shoot Borer, *Eucosma gloriola* Heinr.

This insect, which causes stem deformities similar to those caused by the white pine weevil (*Pissodes strobi* [Peck]), was found in increased numbers in northern Ontario in 1991. The most serious damage occurred in young jack pine stands in the Thunder Bay and Atikokan districts. At Fallscamp Lake and Burchell Lake, Thunder Bay District, leader damage levels of 48.5 and 43.5%, respectively, were recorded. Leader damage of 39% occurred in an 8-ha jack pine plantation at Windigoostigwan Lake, Atikokan District, and 36% leader damage was recorded in a 5-ha jack pine stand at Bluebird Lake, Thunder Bay District. Leader damage ranged from 17 to 34% at seven other locations surveyed in the two districts. High population levels were observed in a young 30-ha jack pine stand in Strom Township, Chapleau District, where 32.7% of the leaders were destroyed. The insect also caused significant damage in jack pine stands in the Cochrane, Espanola, North Bay, Sudbury, Timmins, Temagami, Kirkland Lake, Ignace and Wawa districts, and the most severe attacks affected from 10.7 to 18.7% of the leaders.

Reports from southern Ontario were scarce; however, observations in Lindsay District showed generally low population levels, with leader damage reaching 5.3% in one white pine plantation in Cavan Township.

Saddled Prominent, *Heterocampa guttivitta* (Wlk.)

The heavy infestations that occurred in the central part of Minden District and a few areas in Bracebridge District last year collapsed in 1991. Small numbers of larvae were still found in previously infested sugar maple stands as well as in the northern parts of the Bracebridge and Parry Sound districts, but defoliation was negligible. Somewhat higher population levels were reported in Dungannon, Cardiff and Mayo townships, Bancroft District, and in Lyndoch, Matawatchan and Raglan townships, Pembroke District. Defoliation was generally light in these areas, but sometimes ranged as high as 50% on individual sugar maple trees. A medium infestation with defoliation near 50% was observed in a 50-ha sugar maple stand near Franklin Lake in Bridgland Township, Blind River District. Very low population levels caused 5% defoliation on 2-m understory sugar maple in Oro Township, Huronia District.

Fall Webworm, *Hyphantria cunea* (Drury)

Populations increased to high levels at a number of locations in the Tweed, Brockville and Carleton Place districts of Eastern Region and the Cambridge and Huronia districts of Central Region. Large numbers of nests resulted in complete defoliation of black ash (*Fraxinus nigra* Marsh.) and red maple (*Acer rubrum* L.) along with a variety of other deciduous hosts along Highway 7 in Kennebec and Kaladar townships, Tweed District; in Oxford on Rideau and Augusta townships and along Highway 401 in Front of Leeds and Lansdowne township, Brockville District; and in Nepean Township, Carleton Place District. Defoliation levels near 100% were also reported in small stands of white ash (*F. americana* L.) and white elm (*Ulmus americana* L.) in Vespra and Medonte townships, Huronia District. Scattered 10-m white ash were completely defoliated in Nottawasaga Township, and a small group of 6-m trees in Tosorontio Township were completely encased in webbing. Less severe but still heavy defoliation occurred in small groups of white ash and white elm trees in a number of other townships in Huronia District and in Puslinch and Wellesley townships, Cambridge District. Population levels were generally low in the remainder of southern Ontario, with the exception of a small black ash stand in Dudley Township, Minden

District, which sustained 90% defoliation and occasional open-grown, roadside trees, which were severely defoliated in the Aylmer, Simcoe and Chatham districts.

Population levels were generally low in northern Ontario, with two exceptions. A variety of deciduous trees were heavily attacked in O'Connor Township, Thunder Bay District, and along the Garden Lake Road in Johnson Township, Sault Ste. Marie District.

Redheaded Pine Sawfly, *Neodiprion lecontei* (Fitch)

The heaviest infestations in the province were again located in Espanola District. The most severe damage occurred in an 85-ha red pine plantation in Tennyson Township, where 79% of the 1.8-m trees sustained an average of 71% defoliation. Many of the trees at this location were completely defoliated, and this will probably result in some mortality. A number of smaller red pine plantations in Tennyson and Salter townships sustained defoliation ranging from 10 to 54%. Populations declined in previously infested areas north of Webbwood but repeated defoliation has resulted in 40% mortality in a 20-ha red pine plantation in Gough Township and 35% mortality in a 10-ha red pine plantation in Shakespeare Township. A number of moderate infestations occurred on planted red pine in the Sudbury and North Bay districts, with average defoliation ranging from 5 to 20%. Staff of E.B. Eddy Forest Products and OMNR carried out a number of control operations in young plantations in the North Bay and Espanola districts using Leconte virus and Malathion®. Population levels that had been high in Parkinson Township, Blind River District, declined this year, with defoliation levels reduced to less than 1%. A single infestation was noted in a 100-ha red pine plantation in Lewis Township, where 9% of the trees were infested and defoliation ranged from 5 to 90%. Increased but still generally low population levels were reported in the Algonquin Park, Bancroft, Pembroke and Minden districts of Algonquin Region. The highest population levels in this part of the province were recorded in Monteagle Township, Bancroft District, where 9% of 0.7-m red pine in a 5-ha plantation sustained an average of 43% defoliation.

Swaine Jack Pine Sawfly, *Neodiprion swainei* Midd.

Generally low numbers of this potentially damaging insect were reported in the Temagami and Kirkland Lake districts in 1991. Moderate-to-severe defoliation was evident in a 2-ha jack pine stand on Island #156 in the northeastern arm of Lake Temagami in Briggs Township, Temagami District. Populations remained generally low in the Banks–Makobe lakes area on the Temagami–Kirkland Lake district boundary, where heavy infestations have occurred several times in the past.

Maple Leafcutter, *Paraclemensia acerifoliella* (Fitch)

This insect damaged 80% of the foliage in a 10-ha sugar maple stand near the village of Ompah in Palmerston Township, Tweed District. The same level of foliar damage was also recorded in a 5-ha sugar maple stand at Shawenegog Lake in Barrie Township, Tweed District. Low population levels were observed in sugar maple stands at a number of points in the Tweed, Napanee, Carleton Place, Brockville and Cornwall districts.

Northern Pitch Twig Moth, *Petrova albicapitana* (Bsk.)

In addition to infestations described in the summer *Survey Bulletin*, increased populations were observed in the Hearst, Kapuskasing and Cochrane districts. The most severe damage occurred in a small jack pine plantation in Kennedy Township, Cochrane District, where 50% of the trees were attacked and 35% of the trees had main-stem damage. In Findlay Township, Cochrane District, 14% of the trees were damaged and 12.7% had main-stem damage. Increased but still low population levels were observed at a number of other locations.

Aspen Leafblotch Miner, *Phyllonorycter ontario* (Free.)

Populations increased markedly in the northeastern part of the province, with the heaviest infestations occurring in the southern part of Kirkland Lake District. Here, some 2,000 ha of young trembling aspen (*Populus tremuloides* Michx.) stands in Pense, Robillard and Dack townships sustained foliar damage near 100%. The same levels of foliar damage were recorded on trembling aspen regeneration in Rose and Bridgland townships, Blind River District. Increased populations were reported in numerous trembling aspen stands in Hearst District; the highest population levels occurred in Wicksteed Township, resulting in foliar damage of 95%. High population levels were observed in Geraldton District and the southern parts of the Nipigon and Thunder Bay districts, with foliar damage ranging from 30 to 100%. Somewhat lower population levels were recorded in small trembling aspen stands along the Highway 17 corridor between Kenora and Dryden in the Kenora and Dryden districts; foliar damage levels averaged 40%.

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

Infestations were widespread and damage was sometimes severe in northern Ontario. The heaviest infestations were in the Fraserdale area of Cochrane District, where a 200-ha white spruce plantation had 91% of its trees infested, with an average defoliation of 93% and mortality of 9.3%. Similar damage occurred in a 3-ha white spruce plantation in Glackmeyer Township, where 83% of the trees were infested, with an average of 70% defoliation and 7% mortality. Heavy defoliation was widespread in the Thunder Bay and Atikokan districts, particularly on small black spruce and white spruce in open situations such as roadsides, shorelines, plantations and ornamental plantings. Defoliation averaged 60% in many of these areas but sometimes reached as high as 90%. Populations declined somewhat in the Geraldton and Terrace Bay districts, except for a couple of locations where large numbers persisted. In Roberta Township, Terrace Bay District, foliar damage on young black spruce and white spruce averaged 65%, with scattered, light mortality. Populations in a small black spruce plantation at Burrows Lake, Geraldton District, declined markedly, with defoliation levels reduced to about 10%; however, cumulative mortality in this plantation has reached 80%. High population levels caused severe defoliation to ornamentals in the towns of Chapleau and Foleyet and in several provincial parks in Chapleau District. Defoliation of these trees often reached 75% and scattered mortality was common.

In southern Ontario, high population levels were recorded on open-growing ornamental or roadside white spruce in a number of areas in the Minden, Bracebridge and Lindsay districts. Defoliation of ornamentals was often in the 80–100% range and this will probably result in some mortality. An infestation in a 3-ha plantation of 1.7-m white spruce in Eldon Township, Lindsay District, persisted for the third consecutive year. An assessment of the damage revealed that 68% of the trees were infested in 1991, with an average defoliation level of 14%, although some trees had 90% foliar loss and mortality of 1% was recorded.

Scattered open-grown white spruce sustained defoliation near 50% in a number of areas in Wilberforce Township, Pembroke District.

White Pine Weevil, *Pissodes strobi* (Peck)

Populations increased marginally in young coniferous stands in northern Ontario. Although numerous reports of the pest were received, leader damage was less than 10% in the majority of cases. The heaviest infestations and resulting damage were as follows: 16.5% leader damage in a 10-ha jack pine plantation at Burchell Lake, Thunder Bay District; 22.6% damage in an 8-ha white

spruce plantation in Davies Township, Terrace Bay District; 22% damage in a 200-ha white spruce plantation in Chelsea Township, Hearst District; 18% damage in a 10-ha white spruce plantation in Raven Township, Cochrane District; 29.7% damage in a 36-ha black spruce plantation at the Island Lake Tree Improvement Area in Dalmas Township, Chapleau District; 17 and 18% damage, respectively, in 100- and 50-ha jack pine stands in Reaney and Borden townships, Chapleau District; 28, 20 and 21% damage, respectively, in 100-, 30- and 50-ha jack pine stands in Hurlburt, Hughes and Hynes townships, Sault Ste. Marie District; 26% damage in a 60-ha jack pine stand in Salter Township, Espanola District; and 21.3 and 17.3% damage, respectively, in 1- and 3-ha white pine plantations in Pardo and Sisk townships, North Bay District. Leader damage declined from 36.7% to 12.7% in a 200-ha black spruce plantation in Bragg Township, Cochrane District.

Increased but still mainly low population levels were reported in southern Ontario. The highest population level was reported in a 1-ha white pine plantation in Charlotteville Township, Simcoe District, where 8% of the trees sustained leader damage. Clipping operations were carried out by OMNR in a number of white pine plantations in Owen Sound District but no data is available on the initial infestation levels. Low population levels were also reported from areas in the Bracebridge, Lindsay, Huronia, Cambridge, Niagara, Aylmer and Wingham districts.

Spearmarked Black Moth, *Rheumaptera hastata* (L.)

Infestations in 1990 that had caused moderate-to-severe defoliation of white birch (*Betula papyrifera* Marsh.) stands over about 2,000 ha in Quetico Park, southern Atikokan District, declined slightly in 1991. However, new infestations occurred in adjacent areas of Thunder Bay District between Owakonze and Northern Light Lake and increased the total affected area to 21,390 ha. Low population levels of the moth caused 10% defoliation in a birch dieback plot in Cochrane District.

Other Noteworthy Insects

Heavy infestations of the balsam poplar leafblotch miner (*Phyllonorycter nipigon* [Free.]) were reported in Wicksteed Township, Hearst District, St. John Township, Cochrane District, and Robillard and Dack townships, Kirkland Lake District.

Population levels of the maple webworm (*Tetralopha asperatella* [Clem.]), which have been high in the Owen Sound and Huronia districts, declined markedly in 1991.

Feeding by adults of the pales weevil (*Hylobius pales* [Hbst.]) killed 18% of newly planted red pine on an 18-ha site on the Burma Lake Road, Sioux Lookout District.

Feeding by adult sawyer beetles (*Monochamus* spp.) damaged a total of 35 ha of jack pine adjacent to six harvested areas in the Atikokan and Thunder Bay districts. Damage was also reported on jack pine near Link Lake, north of Armstrong in Nipigon District, and on tamarack (*Larix* sp.) and jack pine in Kennedy Township, Cochrane District, and Rogers Township, Hearst District.

The mountain-ash sawfly (*Pristiphora geniculata* [Htg.]) was reported causing various levels of damage to mountain-ash (*Sorbus* spp.) trees in the Chapleau, Nipigon, Terrace Bay, Thunder Bay, Wingham, Hearst and Kapuskasing districts.

The pine gall weevil (*Podapion gallicola* Riley) caused branch mortality ranging from 10 to 20% on 14- to 18-m red pine trees in many plantations in Simcoe County, Huronia District.

High population levels of the imported willow leaf beetle (*Plagiodera versicolora* [Laich.]) caused 80 to 100% leaf browning of willow (*Salix* spp.) trees along streams and in lowlying areas in the Aylmer, Simcoe and Niagara districts.

Severe foliar browning caused by the cottonwood leafminer (*Paraleucoptera albella* [Cham.]) was reported in a small stand of balsam poplar (*Populus balsamifera* L.) in Mono Township, Huronia District. Low population levels were observed at other scattered locations in the Owen Sound, Huronia, Cambridge and Maple districts.

The fir coneworm (*Dioryctria abietivorella* [Grt.]) damaged 20% of black spruce cones at the Thunder Bay breeding orchard, Thunder Bay District.

Damage typical of that caused by the pear thrips (*Taeniothrips inconsequens* [Uzel]) was observed on sugar maple regeneration in a North American Maple Project plot in Hallowell Township, Napanee District.

Heavy infestations by the willow flea weevil (*Rhynchaenus rufipes* [LeC.]) were reported on ornamental willow trees at a number of locations in the Carleton Place, Napanee, Algonquin Park, Bancroft, Pembroke, Aylmer, Chatham and Wingham districts.

The walnut caterpillar (*Datana integerrima* G. & R.) caused 40 to 100% defoliation of open-grown black walnut (*Juglans nigra* L.) trees at scattered locations throughout the Aylmer, Simcoe and Niagara districts.

High population levels of the twolined chestnut borer (*Agrilus bilineatus* [Web.]) were associated with mortality of oak (*Quercus* spp.) trees stressed by drought and gypsy moth defoliation at Turkey Point Provincial Park, Simcoe District.

The redhumped oakworm (*Symmerista canicosta* Franc.) completely defoliated red oak (*Quercus rubra* L.) regeneration in a small area in Frontenac Provincial Park, Napanee District.

Heavy infestations of the alder flea beetle (*Macrohaltica ambiens* [LeC.]) were reported in the Kirkland Lake and Timmins districts.

Populations of the redheaded jack pine sawfly (*Neodiprion virginiana* complex) declined in a number of previously infested areas in the Chapleau and Gogama districts.

Increased but low population levels of the ambermarked birch leafminer (*Profenusa thomsoni* [Konow]) occurred in the Kirkland Lake, Timmins and Temagami districts.

TREE DISEASES

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

As reported in the summer *Survey Bulletin*, the European race of Scleroderris canker was confirmed at 11 locations in 1991. Although the frequency of attack increased this year, none of the finds represents any significant spread in the range of this disease. Five of the collections this year were from McMurrich Township and two were from Ryerson Township, Parry Sound District; one was from Stevenson Township, Bracebridge District; and three were from Mayo Township, Bancroft District. Follow-up surveys indicated that infection levels had increased from 1% to 3% at one of the Mayo Township sites.

Additional reports of the North American race were received from the Geraldton, Terrace Bay and Nipigon districts. The highest incidence was in Strey Township, Terrace Bay District, where 38% of the 3.5-m jack pine in a 35-ha plantation were infected. In the Lukinto Lake area of Geraldton District, 28% of the 4.5-m jack pine in a 50-ha jack pine plantation were infected, with

6% of the trees supporting stem cankers. At Neys Provincial Park, 60% of red pine natural regeneration were infected and near the Namewaminikan River, Nipigon District, 12.6% of 4.3-m jack pine were infected.

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

As reported earlier, the two main Armillaria root rot diseases were widespread in young coniferous stands in the province but, in most cases, infection levels were quite low, usually less than 2%. Additional surveys have turned up a few areas in which higher infection levels prevailed, most of which were in seed orchards or family-test areas in Thunder Bay District. The heaviest infection level was at the Bluebird Lake family-test site, where 13% of the 1.3-m jack pine were infected in a 5-ha area. Infection levels of 6 and 4%, respectively, were recorded in 1.2- and 1.3-m 5-ha jack pine plantings in the Roth and Fallscamp Lake family-test areas. An infection level of 3.3% was recorded in a 10-ha black spruce seed orchard in Robson Township. In McEwing Township, Hearst District, an infection level of 7.3% was detected in a 300-ha stand of 1.5-m jack pine. Both diseases were associated with widespread pockets of white birch mortality in southern Espanola and Sudbury districts. Mortality was particularly conspicuous around the city of Sudbury, where trees have been subject to a number of stress factors such as forest tent caterpillar defoliation, drought and growth on poor, rocky sites.

Dutch Elm Disease, *Ceratocystis ulmi* (Buism.) C. Moreau

The incidence of this disease increased in the Central and Southwestern regions in 1991. Young regeneration white elm from 6 to 12 m in height were heavily infected in Vespra, Sunnidale and Nottawasaga townships, Huronia District; in Whitchurch and Markham townships, Maple District; in Beverly and Wellesley townships, Cambridge District; and in St. Vincent and Bruce townships, Owen Sound District. Mortality as high as 20% was recorded in these areas, with numerous infected trees apparent in hedgerows and small, discrete stands. The disease was also more common in the Wingham, Aylmer, Chatham and Simcoe districts, with infection levels ranging from 3 to 27% and mortality from 3 to 68%.

Spruce Needle Rusts, *Chrysomyxa ledi* (Alb. & Schwein.) de Bary and *C. ledicola* (Peck) Lagerh.

These rust diseases declined in intensity in the Hearst, Kapuskasing and Cochrane districts, where numerous heavy infections had occurred in 1990. The diseases were still widely distributed in these districts, but although incidence levels sometimes reached 100%, actual foliar damage was usually at the trace or light levels. A single exception was noted in Kennedy Township, Cochrane District, where 95% of the 0.8-m black spruce sustained average foliar damage of 29%. Observations of a rust parasite in the above areas indicate that it may have played some role in reducing the intensity of infection levels in some stands.

Heavy infections, with infection levels of 100% and foliar damage ranging from 35 to 70%, were recorded in black spruce stands in Sandy, Hoey, Coppell and Reaney townships, Chapleau District. Generally low levels of damage were reported in the Kirkland Lake, Temagami and Thunder Bay districts.

Leaf Diseases of Balsam Poplar, *Linospora tetraspora* G.E. Thompson, *Mycosphaerella populicola* G.E. Thompson and *Septoria* spp.

These foliar diseases were widespread in northern Ontario, usually at high infection levels. *Linospora tetraspora* infected most balsam poplar stands in Northern Region. Infection levels of

100% and foliar damage in the 90–100% range caused complete defoliation of many stands by early September. The disease was also present at damaging levels in the Sioux Lookout, Ignace and Kenora districts. Foliar damage by *M. populicola* was widespread in the Ignace, Sioux Lookout, Terrace Bay, Red Lake, Geraldton and Nipigon districts as well as in St. John Township, Cochrane District, and Wicksteed Township, Hearst District. High levels of infection and of foliar damage were apparent in these areas. The disease also caused moderate foliar damage in the Sudbury, Espanola, North Bay and Thunder Bay districts and at one location on CFB Borden in Huronia District. Foliar damage by *Septoria* spp. ranged from 55 to 75% in a number of areas in the Fort Frances, Kenora, Dryden, Red Lake, Sioux Lookout and Ignace districts.

Leaf Blight, *Septoria betulae* Pass.

This late-season foliar disease of white birch was widespread in northwestern and northeastern Ontario. The most severe damage occurred in central Sioux Lookout District, where numerous pockets of 7- to 10-m white birch sustained an infection level of 90%, with foliar damage ranging from 30 to 75%. Somewhat lower infection levels, with foliar damage ranging from 10 to 20%, occurred in many areas of the Red Lake and Ignace districts. Incidence of the disease ranged from 10 to 60% in numerous white birch stands in the Timmins, Temagami and Kirkland Lake districts as well as in the northern portions of the Espanola, Sudbury and North Bay districts. The infection level was somewhat higher in Olinyk Township, Sudbury District, where a 15-ha stand was 80% infected, with 40% foliar damage. Small stands along the Ely Road in Bright Township, Blind River District, had 100% infection levels and 100% foliar damage.

Butternut Canker, *Sirococcus clavigignenti-juglandacearum* N.B. Nair, Kostichka & Kuntz

In 1991, this disease was positively identified for the first time in Ontario forests when it was collected from severely damaged butternut (*Juglans cinerea* L.) trees at four locations in Southwestern Region. Branch mortality levels of 70 and 80% were recorded on trees averaging 12 and 16 m tall, respectively, at Point Pelee National Park in Mersea Township and in Ipperwash Provincial Park in Bosanquet Township, Chatham District. At the Parkhill Conservation Area in McGillivray Township, Aylmer District, 17-m butternut trees sustained 75% branch mortality. The disease was also collected from severely cankered and dying 12-m trees in the McKay Forest in Southwold Township, Aylmer District.

Butternut canker is caused by the fungus *Sirococcus clavigignenti-juglandacearum*, the spores of which infect trees, usually through leaf scars, buds and wounds. The organism grows within the tree, killing cambial tissue and causing cankers that exude an inky black, thin fluid in the spring. Beneath the canker, the wood is stained black or very dark brown. Between the bark and the wood, the fungus forms thin, black structures that lift up the outermost layer of bark. It is here that spores are produced by the fungus; they are later disseminated by rain. Trees produce epicormic shoots below dead portions of branches or stems, but these are readily infected and rapidly killed by the fungus. Trees eventually die from the effect of multiple branch and stem cankers.

Diplodia Tip Blight, *Sphaeropsis sapinea* (Fr.) Dyko & B. Sutton

The summer *Survey Bulletin* reported this disease causing widespread damage to Austrian pine (*Pinus nigra* Arnold) and Scots pine (*P. sylvestris* L.) in the Eastern and Southwestern regions. Surveys since that time revealed branch mortality in the 30–40% range but occasionally as high as 80% on roadside plantings of Austrian pine in the Maple and Huronia districts. Scots pine plantations in Beverly Township, Cambridge District, had similar levels of branch mortality and

1% tree mortality. Further surveys in the Wingham, Aylmer and Simcoe districts showed infection rates ranging from 2 to 80% and shoot damage of 20 to 61% on Austrian pine and Scots pine. The disease was also collected on black spruce in the Marson seed orchard, Fort Frances District, where approximately 2% of the trees were infected, with average damage levels of 5% and tree mortality of about 1%. Shoot damage near 10% was observed on 60% of 12-m red pine at French Lake in Quetico Provincial Park, Fort Frances District.

Other Noteworthy Diseases

High infection levels of a shoot blight (*Venturia macularis* [Fr.] E. Müller & v. Arx) were evident in trembling aspen stands in the Red Lake and Sioux Lookout districts and to a lesser extent in Ignace District. Low infection levels were reported in the Sudbury and North Bay districts along with a moderate infection in Shakespeare Township, Espanola District.

Ink spot of aspen (*Ciborinia whetzelii* [Seaver] Seaver) caused light or occasionally moderate foliar damage to trembling aspen at a number of sites in Timmins District and at one location in Shakespeare Township, Espanola District.

The parasitic plant eastern dwarf mistletoe (*Arceuthobium pusillum* Peck) was responsible for a pocket of dead or heavily infected 16-m white spruce trees near the Angus gate at CFB Borden, Huronia District.

A small Scots pine Christmas tree plantation in Tiny Township, Huronia District, had approximately 10% of the trees infected with western gall rust (*Endocronartium harknessii* [J.P. Moore] Y. Hirats.).

A needle cast (*Lophodermium piceae* [Fuckel] Höhnel) was responsible for 40% loss of old foliage on 18-m white spruce in a seed collection area near Friday Lake in Best Township, Temagami District.

A leaf anthracnose (*Aureobasidium apocryptum* [Ell. & Ev.] Hermanides–Nijhof) caused 100% foliar damage on open-grown and roadside sugar maple and Norway maple (*Acer platanoides* L.) at scattered locations in the Aylmer, Simcoe and Niagara districts.

Foliar damage of 80 to 100% was caused by a leaf spot of hickory (*Asteroma caryae* [Peck] B. Sutton) on hickory (*Carya* spp.) trees in woodlots in the Chatham, Aylmer, Simcoe and Niagara districts.

Horse-chestnut leafblotch (*Phyllosticta sphaeropsoidea* Ell. & Ev.) caused foliar damage as high as 100% on ornamental horse-chestnut (*Aesculus hippocastanum* L.) trees in a number of towns in Niagara District as well as in the town of Cobourg, Lindsay District, and in the town of Gore Bay on Manitoulin Island, Espanola District.

The fungus *Cryptodiaporthe populea* (Sacc.) Butin was the causal agent in a row of 120 dead and dying Lombardy poplar (*Populus nigra* var. *italica* Muenchh.) trees in West Gwillimbury Township, Huronia District. A number of other heavy infections were observed in the Maple, Cambridge and Owen Sound districts.

ABIOTIC CONDITIONS

Drought

Drought conditions have occurred in various parts of the province for the past several years. In 1991, drought damage was widespread in Northwestern Region (see the summer *Survey Bulletin*), North Central Region and Northern Region, and the lingering effects of drought in previous years were still being experienced in southern Ontario.

In Northwestern Region, drought damage took the form of very small, scattered clumps of dead and damaged trees, mainly on shallow-soil sites, such as high ridges or rocky slopes, and other dry sites. Typically, small pockets of from 2 to 20 trees were damaged.

Damage in North Central Region was more widespread, with pockets ranging from a few trees to several thousand hectares in size. In all, some 196,356 ha of drought damage were mapped in the Thunder Bay and Nipigon districts, most of which was located on dry sites such as rocky ridges, hillsides and mesa tops. White birch, balsam fir and jack pine were the species most affected (Fig. 7).

Drought damage was also widespread in Northern Region, particularly in the Hearst, Kapuskasing and Cochrane districts, where approximately 238,000 ha of damage were recorded (Fig. 8). Much of the damage here was in poplar (*Populus* spp.) stands that had been previously defoliated by the forest tent caterpillar. Trees that flushed for a second time were faced with hot, dry conditions that caused their foliage to wither and fall prematurely. Small pockets of damage

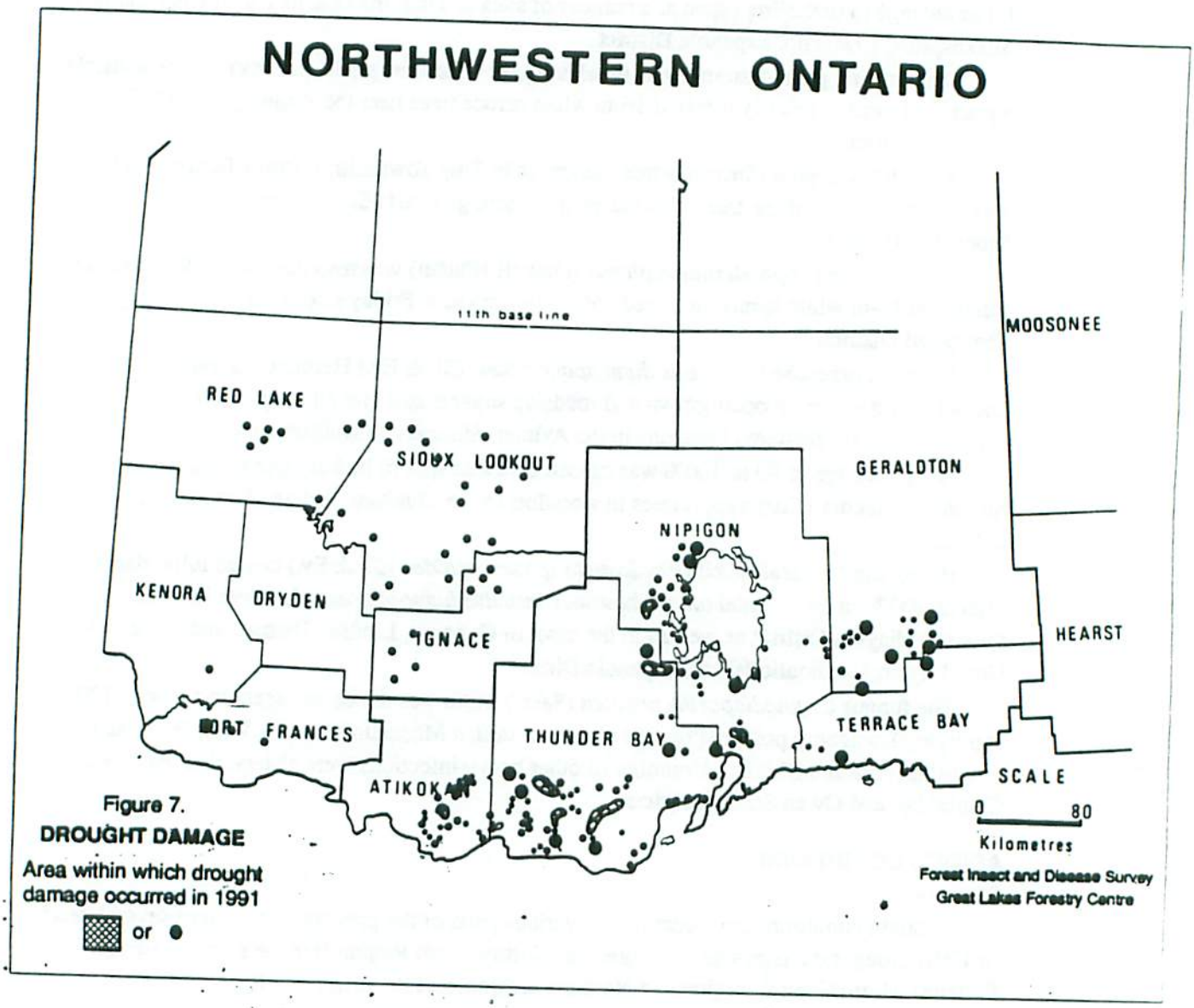
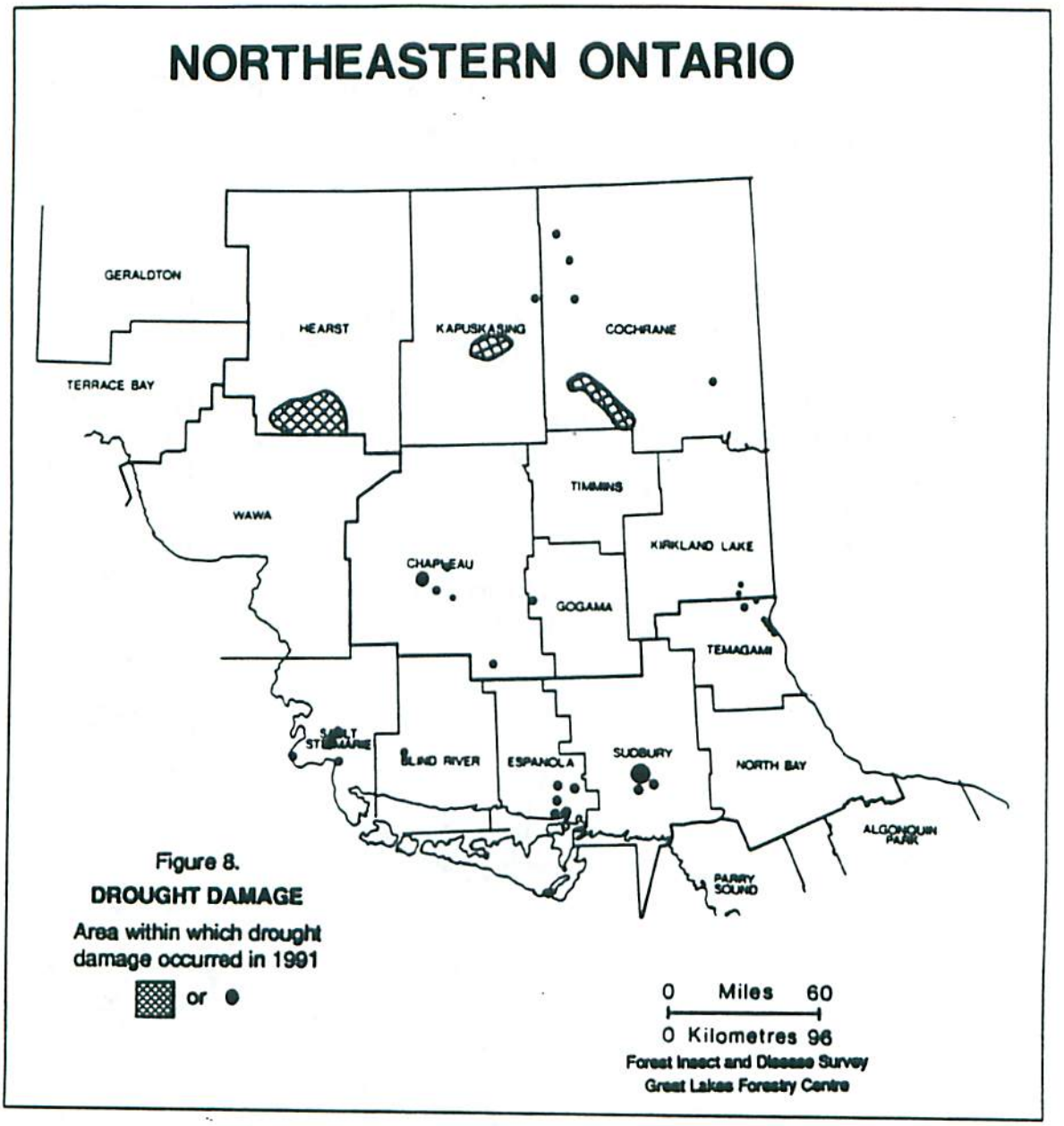


Figure 7.



also occurred in the Chapleau, Wawa, Espanola and Sudbury districts on a variety of coniferous and deciduous hosts.

There was little current drought damage in southern Ontario, but the effects of this condition in previous years continue to be seen. These include branch and twig dieback, and top killing or whole-tree mortality of red oak, white oak (*Quercus alba* L.), sugar maple and other hardwoods as well as of hemlock (*Tsuga* spp.) and white pine. Oak has been particularly susceptible since it has been subjected to defoliation by the forest tent caterpillar and gypsy moth and widespread mortality of this species is becoming evident. In all, approximately 22,170 ha of damage were mapped in the Parry Sound, Bracebridge, Minden, Lindsay, Bancroft and Pembroke districts (Fig. 9). The bulk of the damage occurred on oak; however, hemlock, white birch and a variety of other species were also affected.

Ash Dieback

Dieback of black ash stands was mapped in several townships southwest of the city of Thunder Bay, Thunder Bay District, in 1991. A total of 764 ha of damage was mapped in eight separate areas in Scoble, Paipoonge, Blake and Neebing townships. No biotic causal agents could be found and it is suspected that drought conditions may have been a predisposing factor in this situation.

Leaf Scorch

Leaf scorch damage was particularly severe on open-grown fringe and roadside sugar maple, beech, red maple and yellow birch (*Betula alleghaniensis* Britton) in numerous areas in the Southwestern and Algonquin regions. Foliar damage in the 80–100% range was recorded at a number of locations in the Parry Sound, Bracebridge, Minden, Simcoe, Chatham and Niagara districts. In one case in East Oxford Township, Simcoe District, red maple in a 22-ha woodlot sustained 100% foliar damage and premature leaf shedding. Somewhat lower levels of damage (30 to 80%) were recorded on trees in open situations in the Wingham and Aylmer districts of Southwestern Region and in Huronia District of Central Region.

In northern Ontario, conspicuous damage was evident in sugar maple stands north of the city of Sault Ste. Marie, in parts of Aweres, Van Koughnet and Deroche townships, where 75% infection levels were usually accompanied by damage levels of 100%. Smaller areas of severe

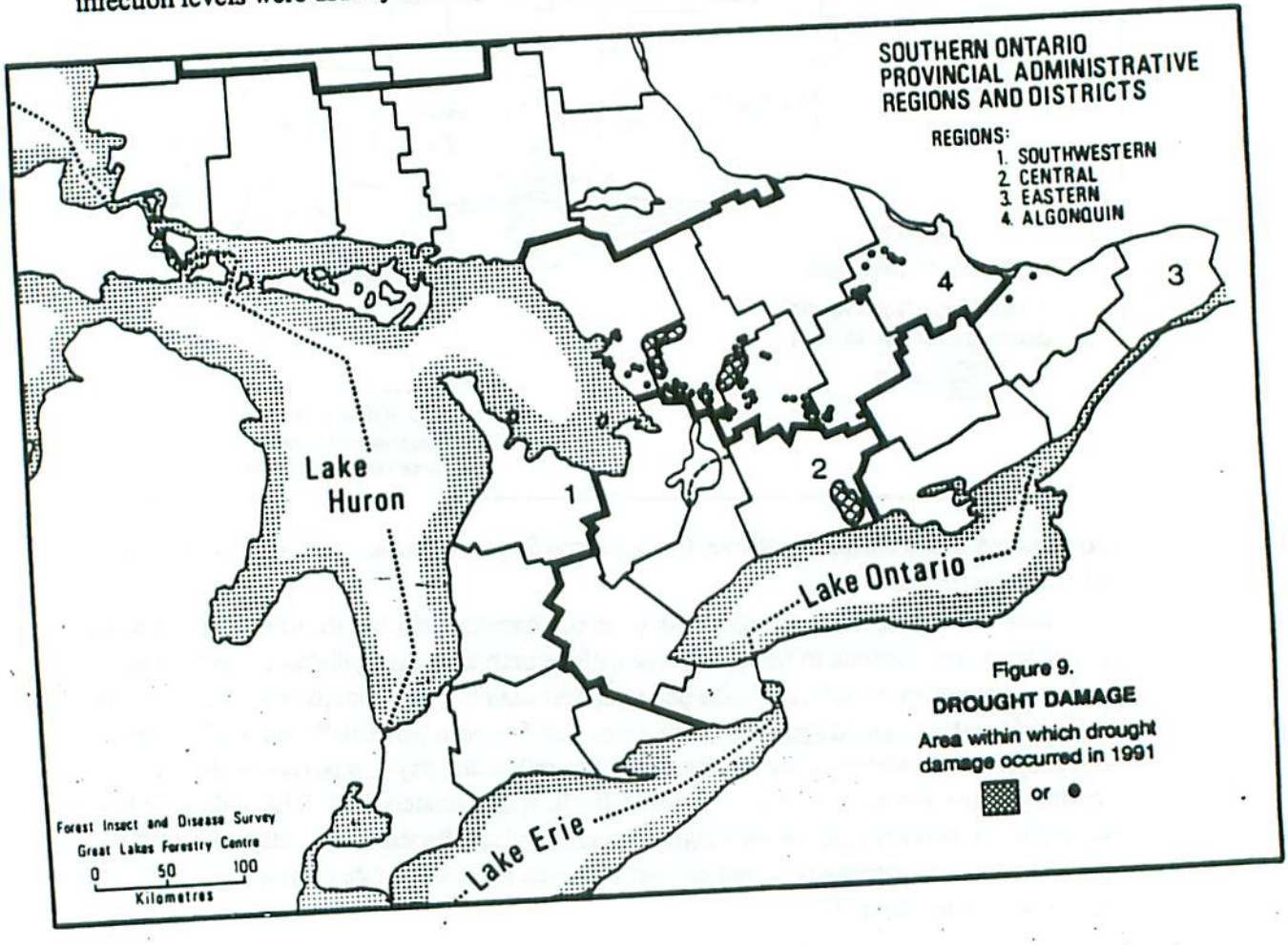


Figure 9.

damage were noted in sugar maple stands east of the city of Sault Ste. Marie, in Aberdeen, Aberdeen Additional, Meredith and Galbraith townships, Sault Ste. Marie District. Small pockets of severe damage were also evident in Casson and Gould townships near the village of Iron Bridge in Blind River District. Leaf scorch was also found in small pockets in the southern portions of the Espanola and North Bay districts; however, damage in these areas was much lower, usually in the 20–50% range.

Blowdown

In addition to damage reported in the summer *Survey Bulletin*, a heavy storm caused some 650 ha of blown-down trees east of Highway 631 in Cooper Township, Wawa District. Trembling aspen and black spruce were the main species affected.

Hail

Hail damage was observed in four black spruce seedling compartments at the Dryden Forest Tree Nursery in Zealand Township, Dryden District. When the beds were examined, approximately 10% of the seedlings were dead or dying.

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