RESULTS OF FOREST INSECT AND DISEASE SURVEYS IN THE CENTRAL REGION OF ONTARIO 1989

(FOREST DISTRICTS: HURONIA, LINDSAY, CAMBRIDGE, MAPLE AND NIAGARA)

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FORESTRY CANADA

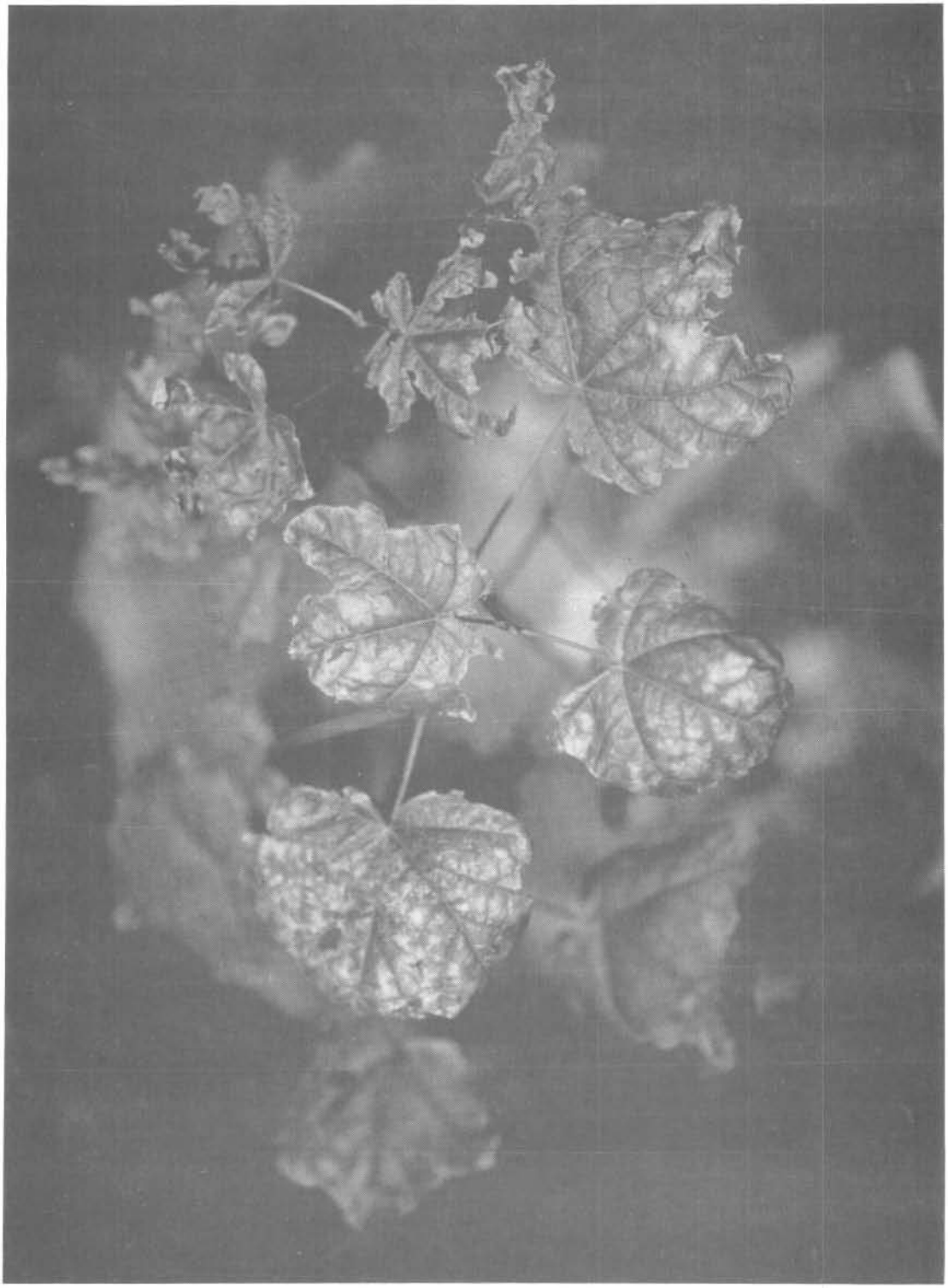
ONTARIO REGION

GREAT LAKES FORESTRY CENTRE

1990

MISCELLANEOUS REPORT NO. 90

Frontispiece



Typical damage to sugar maple (*Acer saccharum* Marsh.) foliage caused by pear thrips, *Taeniothrips inconsequens* (Uzel)

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INSECTS

Major Insects

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

Population levels of this complex of insects that feed on eastern white cedar (*Thuja occidentalis* L.) have been steadily increasing over the past couple of years. In 1988, moderate-to-severe damage was observed north of a line running from Peterborough in Lindsay District to Orangeville in Huronia District. However, in 1989, a marked reduction in populations was noted and, consequently, only occasional pockets of light-to-moderate damage were detected in two districts. Pockets of leafmining damage, usually 1 to 5 ha in size and in the 10 to 40% range, were found in the southern part of Lindsay District (particularly in Haldimand Township) and in Medonte, Tay and Flos townships in the Huronia District. Smaller populations were present at many other sites in the Central Region, but were not significant enough to cause noteworthy browning.

Another condition affecting eastern white cedar and causing it to turn brown was very apparent in 1989. In many areas across Huronia, Maple and Lindsay districts, a very heavy seed crop was present in 1988 and the cones turned brown and were retained by the tree until the following year. Therefore, the presence of this bumper crop of cones caused many stands to appear brown, and from a distance the damage appeared similar to that caused by cedar leafminers. In addition, winter browning, old damage by spider mite, *Oligonychus ununguis* (Jac.), and salt damage along roadways contributed to this condition.

Spruce Budworm, *Choristoneura fumiferana* (Clem.)

The population reductions recorded across the province in recent years were reversed in 1989. An increase of about one million ha of moderate-to-severe defoliation was recorded in northwestern Ontario. In all, 6,239,636 ha of moderate-to-severe defoliation were mapped in the Northwestern and North Central regions. Also, the gross area of budworm-killed balsam fir (*Abies balsamea* [L.] Mill.) rose by slightly over 500,000 ha to encompass an area of 15,044,874 ha. The increased areas of mortality were mapped in the Northwestern and North Central regions.

Similar population trends were found in the Central Region. Relatively high populations of spruce budworm, resulting in defoliation levels of 40 to 90% on the new growth, were present in two adjacent white spruce (*Picea glauca* [Moench] Voss) plantations totaling about 11 ha in Adjala Township, Huronia District. Moderate population levels were observed in a small white spruce plantation in Uxbridge Township, Maple District, with defoliation levels averaging 30%. Low populations were present in four other white spruce plantations located in West Gwillimbury Township, Huronia District; in Nichol and West Luther

townships, Cambridge District; and in Darlington Township, Lindsay District. Egg-mass surveys carried out in August revealed sufficient eggs for a severe infestation forecast for 1990 in the plantation in Uxbridge Township, Maple District and a moderate-to-severe infestation forecast in Adjala Township, Huronia District. Egg counts were lower at the locations sampled in Lindsay District, with a light-to-moderate infestation forecast for 1990 in Clarke Township and a light forecast in Darlington Township.

Larch Casebearer, *Coleophora laricella* (Hbn.)

Larch casebearer has been found at various population levels for the past several years in the Central Region. However, in 1989 there was a marked increase in population levels across the entire region.

This insect feeds equally on native and exotic larch (*Larix* spp.) and in Canada is considered the second most threatening insect pest of larch after the larch sawfly, *Pristiphora erichsonii* (Htg.). The tiny, silver-gray moth lays its eggs toward the end of June. After about 10 days, the eggs hatch; the newborn larva bores a hole into a needle and begins mining it, attacking more than one needle before autumn. When populations are high, foliar browning is noticeable from late August to early September. The larva remains enclosed in the needle. Later, it cuts the needle to form a chamber in which it spends the rest of the larval period; hence the name casebearer. With the onset of cold weather, the larva fastens its case to a twig near the base of new buds, where it overwinters. In spring, once the foliage has begun to develop, the larva begins its needle-feeding process again, with the hind part of its body hidden in the case. It is during this period, when the mature larva attacks the new needles, that the most serious damage occurs. The attacked needles are not completely consumed, but remain on the twigs to dry out and turn brown. A heavily infested stand will therefore appear brown.

Foliar browning in the 75-100% range was observed in 5 ha of scattered tamarack (*Larix laricina* [Du Roi] K. Koch) in Erin Township, Cambridge District, on 7 ha of European larch (*L. decidua* Mill.) in West Gwillimbury Township and at two locations in Adjala Township, Huronia District. Damage levels in the 50-80% range were found in small European larch plantations usually less than 1 ha in size in Medonte, Sunnidale and Flos townships in Huronia District, in Whitchurch and Uxbridge townships, Maple District, and in Reach Township, Lindsay District. An additional 10-ha plantation in Haldimand Township, Lindsay District suffered similar damage. Tamarack stands with foliar browning in the 50-80% range were also observed in Mono Township and over a 2-ha area in Amaranth Township, Huronia District. Foliar damage was noticeable on scattered European larch growing beside the Niagara Parkway in Willoughby Township, Niagara District. Lower damage levels were observed at numerous other sites in the region.

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

The growing populations of 1988 collapsed in 1989, as predicted in the egg survey. No areas suffered noticeable defoliation caused by this insect. In the study plots, average defoliation levels did not surpass 25%. Generally, moth catches were down, with the exception of minor increases at two sites in Huronia District, one plot in Maple District, and three of the four locations in Niagara District (Table 1). The numbers of eggs found at most of the plot locations were down from those of last year. However, egg numbers did increase at one site in the Dufferin County Forest, Huronia District, with the result that moderate defoliation was forecast for 1990. A review of the overall results for these study areas in the three districts indicates that oak leaf shredder will not be a problem in 1990.

Gypsy Moth, *Lymantria dispar* (L.)

Population levels of this insect have increased considerably in the Central Region, particularly in Lindsay and Niagara districts. Damage in 1988 covered an area of 889 ha and was found mainly in Lindsay District. In 1989 there was an increase of over 5,000 ha in the area damaged. The regional total for 1989 is 6,618 ha.

High populations were found in the south-central and southeastern parts of Lindsay District, with feeding mainly on oak (*Quercus* spp.), trembling aspen (*Populus tremuloides* Michx.) and eastern white pine (*Pinus strobus* L.). In 1989, moderate-to-severe defoliation extended over 4,071 ha, a substantial increase from the 861 ha mapped in 1988. The largest pockets of defoliation in the 75-100% range were found between the city of Peterborough and the southwestern part of Rice Lake in Cavan and Monaghan townships. The largest single area damaged was 500 ha (Fig. 1). An additional large pocket, about 200 ha in area, was found in the Hiawatha Indian Reserve where the Otonabee River flows into Rice Lake. Concentrations of pockets ranging in size from 5 to 185 ha were mapped south of Rice Lake in the Alderville Indian Reserve, and in Haldimand and Alnwick townships, Lindsay District. Scattered, small pockets of moderate-to-severe defoliation were present east of Peterborough up to the district boundary in Otonabee, Asphodel and Belmont townships, and to a lesser degree in Douro and Dummer townships. Isolated areas of damage up to 20 ha in size were found as far west as the Pontypool area in Clarke and Manvers townships. In the northeastern part of Lindsay District, some defoliation of oak and aspen was attributed to the forest tent caterpillar, *Malacosoma disstria* Hbn. However, gypsy moth populations were sufficiently high to cause moderate damage to about 500 ha in the Buckhorn area. Moderate defoliation was also detected at one very small site on Sturgeon Point in Fenelon Township. A concentration of light defoliation was found along the district boundary in the northern portions of Dummer and Smith townships. Larvae were observed at numerous other points in the Lindsay District, but not at damaging levels.

Table 1. Results of oak leaf shredder pheromone trapping, defoliation estimates and egg counts in 1989, and defoliation forecasts for 1990 in the Central Region (five traps deployed at each location)

Location (Twp)		Total no. of adults captured		Avg no. per trap		Leaves attacked 1989 (%)	Foliar damage 1989 (%)	Total no. of eggs		Defoliation forecast for 1990
		1988	1989	1988	1989			1988	1989	
Huronia District										
Awenda Prov Pk	4	524	17	105	3	b	b	24	4	light
	5	134	9	27	2	b	b	1	0	nil
	11	890	373	178	75	b	b	0	0	nil
Dufferin County Forest	3	90	0	18	0	86	21	0	0	nil
	9	207	4	41	0.8	86	16	7	0	nil
	10	812	730	162	146	76	16	3	2	light
	12	234	1[a]	47	0.2	75	13	1	0	nil
	95	612	353	122	71	68	11	1	0	nil
check	3	613	726	123	145	86	25	9	96	moderate
Hendrie	1	369	103	74	21	92	22	9	7	light
Midhurst	1	399	126	80	25	69	18	2	0	nil
Orr Lake - Danials		736	323	147	65	91	16	0	0	nil
Wildman Tract	4	19	1	4	0.2	73	15	0	0	nil
	7	368	189	74	38	86	15	1	0	nil
Maple District										
Uxbridge Twp	1	561	24	112	5	100	26	26	11	light
	2	634	674	127	135	87	17	20	2	light
Niagara District										
Cayuga Twp	1	118	41	24	8	25	2	2	0	nil
Thorold	6	473	825	118	165	0	0	30	29	light
Pelham	7	474	955	95	191	10	2	19	29	light
West Lincoln Twp	2	633	986	127	197	30	4	5	18	light

[a] four pheromone traps
[b] area defoliated by forest tent caterpillar or gypsy moth

CENTRAL REGION

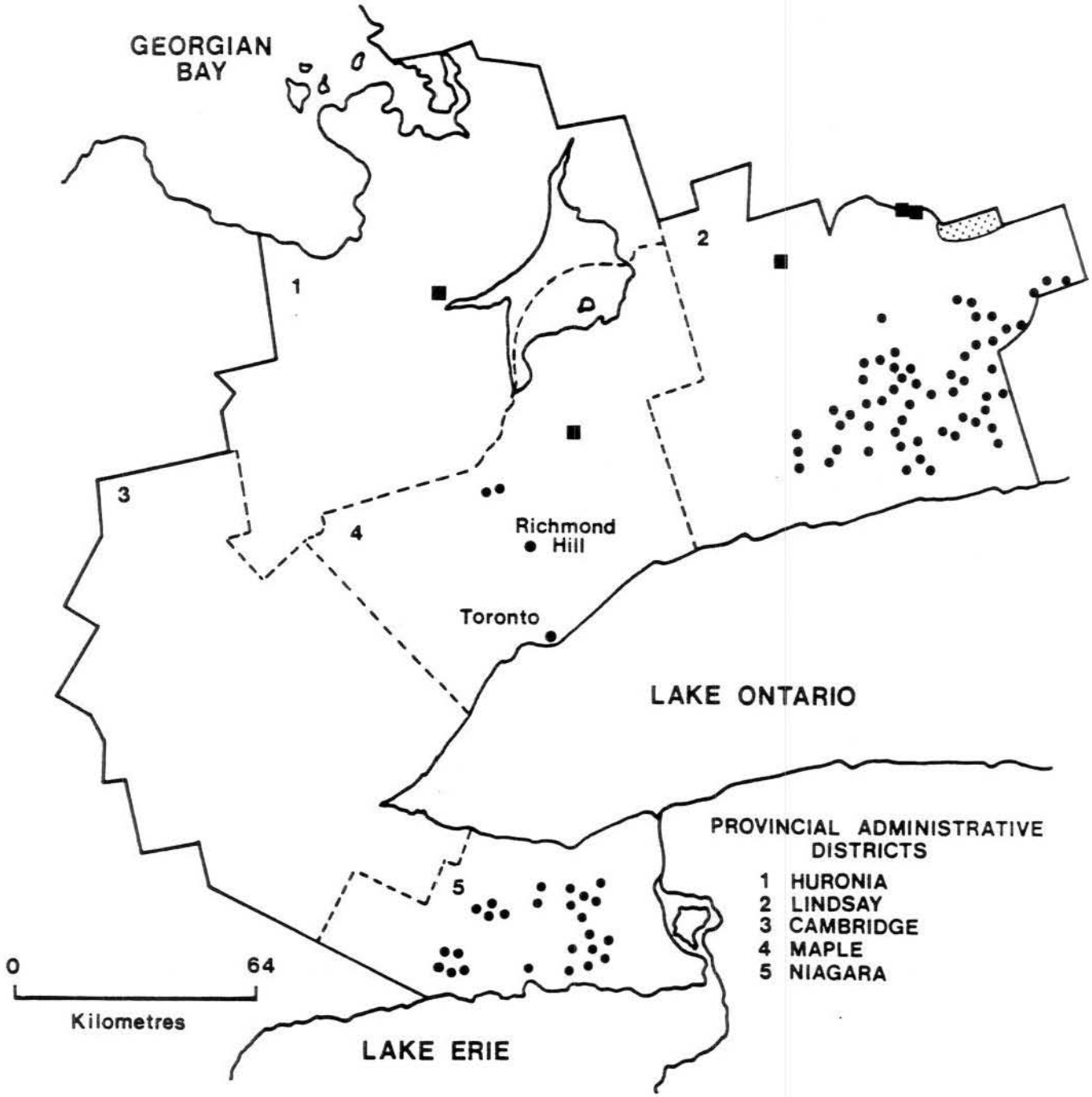

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Figure 1. **Gypsy moth, *Lymantria dispar*** (L.) Areas within which defoliation occurre in 1989

Moderate-to-severe .....
Moderate .....
Light .....

The Niagara District was the next most affected district in the region in 1989, with 2,177 ha of moderate-to-severe defoliation (Fig. 1) in comparison with only 28 ha in 1988. The largest single area of damage (1986 ha) was south of the city of Welland near Wainfleet Marsh. Here, gypsy moth larvae defoliated mainly trembling aspen, willow (*Salix* spp.) and alder (*Alnus* spp.). Near this large infestation, pockets ranging in size from 6 to 55 ha were mapped in Wainfleet and Cumberstone townships. The next largest concentration of moderate-to-severe defoliation was found in an area north of Fonthill through to Lake Moodie. This area, also known as the Short Hills and St. Johns Valley, was covered by numerous pockets of damage up to 100 ha in size. The tree species most affected in these areas was oak, with defoliation levels ranging from 45 to 80%. Moderate-to-severe defoliation of willow was aerially mapped in a cluster of eight pockets along the Grand River to the northwest of Dunnville. Additional isolated areas of defoliation were found in Gainsborough Township and lower populations were observed from Port Maitland east to Port Colborne along the Lake Erie shoreline in Niagara District, although no defoliation resulted.

Populations are increasing in the Maple and Huronia districts. For the first time, moderate-to-severe defoliation was detected in the Maple District. A 370-ha pocket of mixed hardwoods had defoliation levels in the 40-100% range. This pocket was located on a ridge that straddled Highway 400 in King Township (Fig. 1). Moderate defoliation of red oak (*Quercus rubra* L.) was evident in a 113-ha area in East Gwillimbury Township, Maple District, and in a 130-ha area just outside the city of Barrie in Vespra Township, Huronia District. Larvae were easily found in the Main and West tracts in Uxbridge Township, Maple District, but not at damaging levels. Larval populations were sufficiently high in Six Mile Lake and Awenda provincial parks, Huronia District, to cause some defoliation, but the presence of forest tent caterpillar defoliation made assessment impossible. Populations are building in the northern half of the Huronia District, with trace-to-low levels found at many sites in this area.

As can be seen from Table 2, larvae have now been caught in all provincial parks where burlap traps are placed except for Earl Rowe in Huronia District. Numbers of male moths captured in the pheromone traps increased in 1989 except in two parks in the Lindsay District (Table 2). From a very limited number of egg-mass observations made, it appears that gypsy moth populations will continue to grow where the insect is already established.

Eastern Tent Caterpillar, *Malacosoma americanum* (F.)

Populations were a little lower in 1989 in comparison with the high levels of the past few years. Numerous small cherry (*Prunus* spp.) shrubs growing along roadways sustained fair-sized insect populations and were stripped of their foliage at many sites across the region. As in recent years, scattered mature black cherry (*P. serotina* Ehrh.) growing in mixed hardwood stands had defoliation levels ranging from 50 to 80% at

Table 2. Summary of gypsy moth burlap and pheromone trapping in provincial parks in the Central Region of Ontario

Location	Burlap traps				Pheromone traps				
	Total no. of larvae caught in 10 burlap traps		Avg no. of larvae per observation		No. of traps in 1989	Total no. of moths caught		Avg no. per trap	
	1988	1989	1988	1989		1988	1989	1988	1989
Cambridge District									
Bronte Creek	58	818	8	68	2	50	81	25	40
Huronia District									
Awenda	240	547	13	61	2	41	93	20	46
Bass Lake	43	333	2	48	2	31	71	15	35
Devil's Glen	0	1	0	<1	2	33	50	16	25
Earl Rowe	0	0	0	0	2	36	49	18	24
Mara	0	44	0	4	2	31	55	15	27
McRae Point	30	172	7	17	2	36	48	18	24
Six Mile Lake	821	373	43	93	2	21	53	10	26
Springwater	26	103	4	4	2	23	69	11	34
Wasaga Beach	9	53	4	2	2	36	65	18	32
CFB Borden[a]	-	-	-	-	10	138	232	14	23
Lindsay District									
Balsam Lake	17	489	b	61	2	24	28	12	14
Darlington	11	26	b	5	1	39	22	19	22
Emily	4	291	b	9	1	45	48	22	48
Mark S. Burnham	0	8	0	<1	2	45	32	22	16
Serpent Mounds	36	502	b	125	2	27	33	13	16
Maple District									
Sibbald Point	0	1	0	<1	2	33	39	16	19
Niagara District									
Rock Point	-[a]	-	-	-	2	-	78	-	39

[a] no burlap trapping done
[b] data unavailable

various points in Tiny and Medonte townships in Huronia District. Tents made by this insect were common on shrubs and small trees at many other points in the region.

Forest Tent Caterpillar, *Malacosoma disstria* Hbn.

The gross area of moderate-to-severe defoliation of various hardwoods increased by slightly over 100,000 ha. The total area infested in 1989 in the Lindsay, Huronia and Maple districts was 259,221 ha.

The infestation in the Lindsay District increased by 84,826 ha and now covers an area of 132,578 ha. The moderate-to-severe defoliation was evident mainly on trembling aspen and red oak across the northern portion of the district (Fig. 2), with most of Bexley, Harvey, Dummer and Belmont townships being affected. The northern portions of Eldon, Fenelon, Verulam, Smith and Douro townships made up the remainder of the area infested by forest tent caterpillar in the Lindsay District.

The area damaged in Huronia District was much the same as in 1988, although more defoliation was detected east of Lake Simcoe and in the Midland-Waubaushene area. The total area of infestation was 124,513 ha in 1989. Moderate-to-severe defoliation of trembling aspen and red oak was evident north of a line running from the Thunder Beach area southeast to Orillia (Fig. 2). Pockets of heavy defoliation were present over much of Rama Township and the northern and eastern parts of Mara Township. West of Highway 11 heavy damage was evident in most of Orillia, Matchedash and Baxter townships, with the northern portions of Tay and Tiny townships infested also. There was a reduction in area in the northern part of Baxter Township, which reflected the situation in Parry Sound District. Scattered pockets of moderate defoliation were mapped in Medonte and Oro townships as far west as the Edgar area.

For the first time noteworthy defoliation was found in the Maple District (Fig. 2). The infestation was made up of scattered pockets totaling 2,130 ha, with Georgina Island in Lake Simcoe making up the largest of these areas. Smaller scattered pockets of moderate defoliation of trembling aspen were observed in Brock, Thorah, Georgina and North Gwillimbury townships to the south and east of Lake Simcoe, Maple District. Individual larvae were observed at one location in Pelham Township, Niagara District.

An egg-mass survey was carried out in September to forecast infestation levels in 1990 (Table 3). At each of the sites, sampled trees were cut down and the number of new egg bands found on the branches was recorded. These data can be used to forecast the infestation level for the next season. Generally, the infestation is expected to persist in the areas in which it was currently found. At almost all of the sample points across the northern part of the Huronia and Lindsay districts, forecasts for 1990 were for severe damage. Although egg counts were not extremely high, sufficient numbers were present to warrant a forecast of severe defoliation for 1990. Pockets of moderate

HURONIA, MAPLE and LINDSAY DISTRICTS

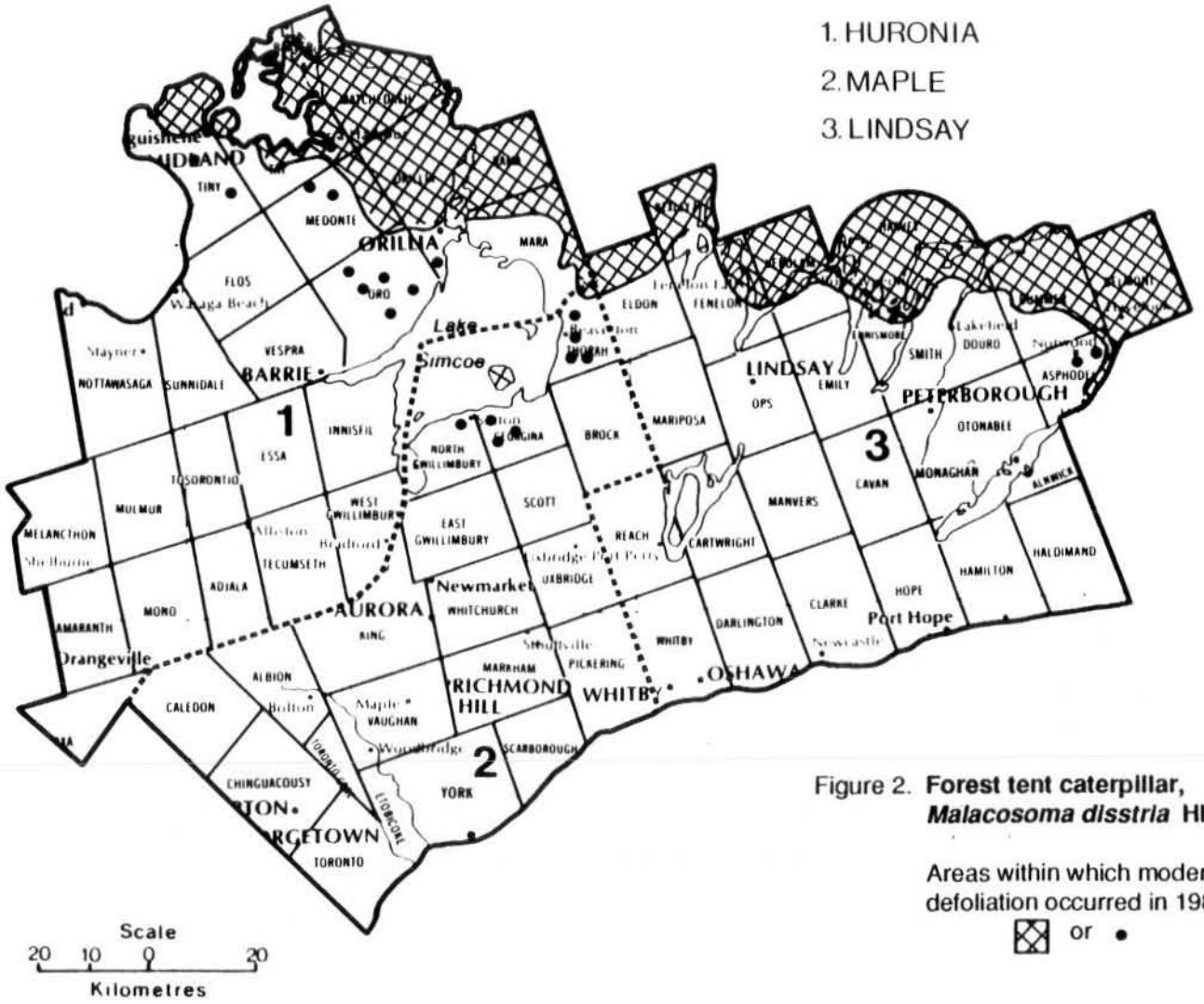

Figure 2. **Forest tent caterpillar, *Malacosoma disstria* Hbn.**

Areas within which moderate-to-severe defoliation occurred in 1989

⊠ or ●

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and severe damage may be present in the northern part of Maple District. Light and moderate infestation forecasts were recorded for the north-eastern corner of Lindsay District and for more southerly locations in the Huronia District (Fig. 3).

Table 3. A summary of forest tent caterpillar egg-band counts on trembling aspen in the Central Region, with infestation forecasts for 1990.

Location (Twp)	Avg DBH of trees (cm)	Avg no. of egg bands per tree	Infestation forecast for 1990
Huronia District			
Baxter - Six Mile Lake Prov. Pk	16	19	severe
Mara	16	43	severe
Matchedash	17	40	severe
Medonte	16	7	moderate
Orillia	16	18	severe
Oro	16	8	moderate
Rama	16	23	severe
Tiny	16	3	light
Tiny - Awenda Pk	21	36	severe
Lindsay District			
Belmont	9	3	moderate
Bexley	10	6	severe
Dummer	9	1	light
Harvey	10	10	severe
Maple District			
Brock	14	9	severe
Georgina	14	4	moderate
Thorah	16	3	light

HURONIA, MAPLE and LINDSAY DISTRICTS

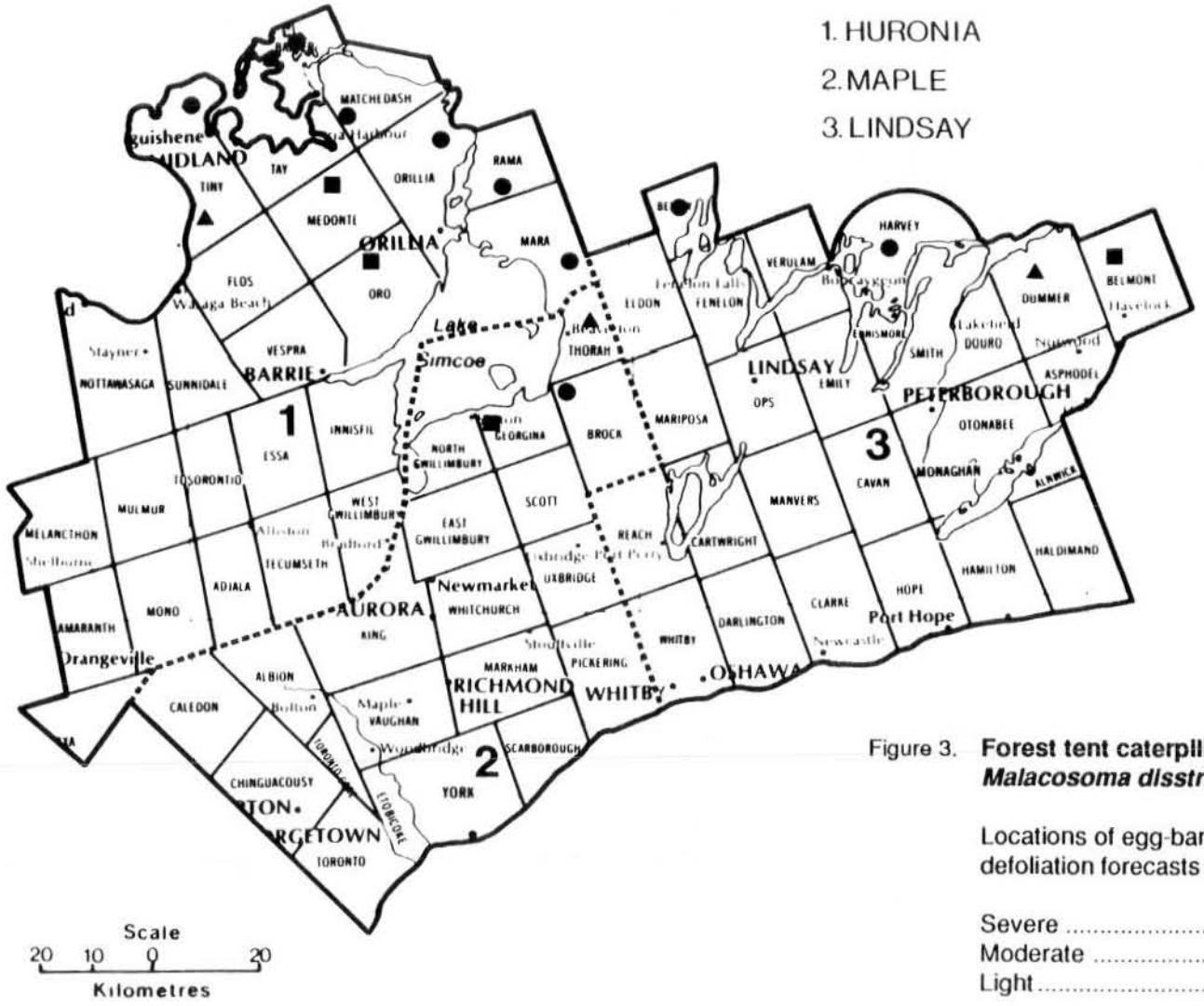

Figure 3. **Forest tent caterpillar, *Malacosoma disstria* Hbn.**

Locations of egg-band counts and defoliation forecasts for 1990

Severe ..... ●
Moderate ..... ■
Light ..... ▲

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Forestry Canada, Ontario Region

Table 4. Other forest insects

Insect	Host(s)	Remarks
Acantholyda erythrocephala (L.) Pine false webworm	rP	The highest numbers were encountered in a 5-ha plantation of 5-m red pine (*Pinus resinosa* Ait.) in Harvey Twp, Lindsay District. Defoliation levels averaged 90%, with all trees in the plantation attacked. Populations were again heavy in a small patch of trees within a 2-m red pine plantation in Oro Twp, Huronia District. Additional information about this insect can be found in the Eastern White Pine Plantation writeup of the Special Survey portion of this report.
Alsophila pometaria (Harr.) Fall cankerworm	hard-woods	low populations in Sheppards Bush in Whitchurch Twp, Maple District
Chionaspis pinifoliae (Fitch) Pine needle scale	scP	high populations in an 18-ha plantation in Wainfleet Twp, Niagara District
Coleophora comptoniella (McD.) Lesser birch casebearer	wB	low numbers on 4-m trees in Hope Twp, Lindsay District
Corthylus punctatissimus (Zimm.) Pitted ambrosia beetle	sM	Mortality levels of 10% in 50-cm regeneration were common at a few sites in the region.
Datana integerrima G. & R. Walnut caterpillar	bWa, Bu	Defoliation levels ranging from 80 to 100% on 5% of 8-m trees were observed in Seneca Twp, with 50% defoliation levels on occasional 5-m trees in Thorold Twp, Niagara District.
Dioryctria reniculelloides Mut. & Mun. Spruce coneworm	wS	a light infestation in a 2-ha plantation of 5-m trees in Bexley Twp, Lindsay District
Diprion similis (Htg.) Introduced pine sawfly	scP	low populations on 2-m roadside trees in Haldimand Twp, Lindsay District

(cont'd)

Table 4. Other forest insects (cont'd)

Insect	Host(s)	Remarks
Fenusa pusilla (Lep.) Birch leafminer	birch	Populations were much lower this year, except on a few ornamentals near the town of Alliston in Huronia District.
Griselda radicana Heinr. Redstriped needleworm	rP	light defoliation of 5-m trees in a plantation in Bexley Twp, Lindsay District
Hyphantria cunea (Drury) Fall webworm	hard-woods	Populations were up slightly in Niagara District, with 50% defoliation levels observed on scattered trees in Dunn Twp. Elsewhere in the region, only single tents were seen at various locations.
Ips pini (Say) Pine engraver	rP	This insect is usually associated with dead or stressed trees. High populations were found in pockets of tree mortality in Hope and Hamilton twps, Lindsay District.
Neodiprion abietis complex Balsam fir sawfly	wS	low numbers of larvae on 1% of the 5-m trees in a 2-ha plantation in Bexley Twp, Lindsay District
Neodiprion sertifer (Geoff.) European pine sawfly	rP, scP, jP, mP	Increased populations were recorded in the Lindsay District. Defoliation levels ranging from 30 to 50% were observed on roadside trees in Hope and Haldimand twps. Moderate populations were detected in a 5-ha plantation of 5-m trees in Harvey Twp and on ornamentals in Bexley Twp, Lindsay District. High numbers were observed on a few young trees in West Gwillimbury Twp, Huronia District. Various population levels were recorded at many other points in the region.

(cont'd)

Table 4. Other forest insects (concl.)

Insect	Host(s)	Remarks
Pikonema alaskensis (Roh.) Yellowheaded spruce sawfly	wS	In Eldon Twp, Lindsay District, 21% of the 1-m trees in a 3-ha plantation had average defoliation levels of 11%; <1% tree mortality resulted. Previously recorded populations in the Huronia District collapsed in 1989.
Pissodes strobi (Peck) White pine weevil	wP	For information about this insect in 1989 refer to the Eastern White Pine Plantation writeup in the Special Surveys section of this report.
Podapion gallicola Riley Pine gall weevil	rP	Mortality of lower branches was common in many older plantations across the region.
Rhyacionia buoliana (D. & S.) European pine shoot moth	scP	10 to 25% lateral shoot infestation on 2-m trees in Bertie Twp, Niagara District
Rhynchaenus rufipes (LeC.) Willow flea weevil	W	High populations continued at McRae Point Provincial Park, Huronia District.
Tetralopha asperatella (Clem.) Maple webworm	sM	Defoliation levels ranging from 5 to 20% were found in stands previously damaged by the forest tent caterpillar in Huronia District and on 15-m ornamentals in Otonabee and Mariposa twps, Lindsay District.

TREE DISEASES

Major Diseases

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

In all, 34 red pine (*Pinus resinosa* Ait.) plantations ranging in height from 1 to 22 m were examined in 1989 (Fig. 4). There was no sign of infection by the European or North American races of this fungus in the stands examined. The tip blight, *Cenangium ferruginosum* Fr. : Fr., was found fruiting on dead branches of some of the 5-m red pine in a 2-ha plantation in Nottawasaga Township, Huronia District. Various other types of damage were observed, and were attributed to agents such as tip blight, *Sphaeropsis sapinea* (Fr.) Dyko & B. Sutton, Armillaria root rot, *Armillaria ostoyae* (Romagn.) Herink, Fomes root rot, *Heterobasidion annosum* (Fr.) Bref., pine gall weevil, *Podapion gallicola* Riley, porcupines, and lightning strikes.

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

A reduction in new infections was observed in 1989. This is possibly due in part to the dry summers we have been having over the past couple of years. The spores that spread this disease are usually released during periods of wet weather. In an 18-ha Scots pine (*Pinus sylvestris* L.) plantation in Wainfleet Township, Niagara District, the cumulative level of tree mortality was approximately 80%. It appeared that these 7-m trees had been under heavy attack by this disease for the past 3 to 4 years. Branch and whole-tree mortality of 2-m red pine was found in Clarke and Haldimand townships, Lindsay District. The cumulative affect of this tip blight on Scots pine is still very noticeable in the central parts of Maple and Cambridge districts, and to a lesser degree in parts of Huronia District. It is a recurring problem for homeowners with ornamental pine, particularly red and Austrian pine (*P. nigra* Arnold).

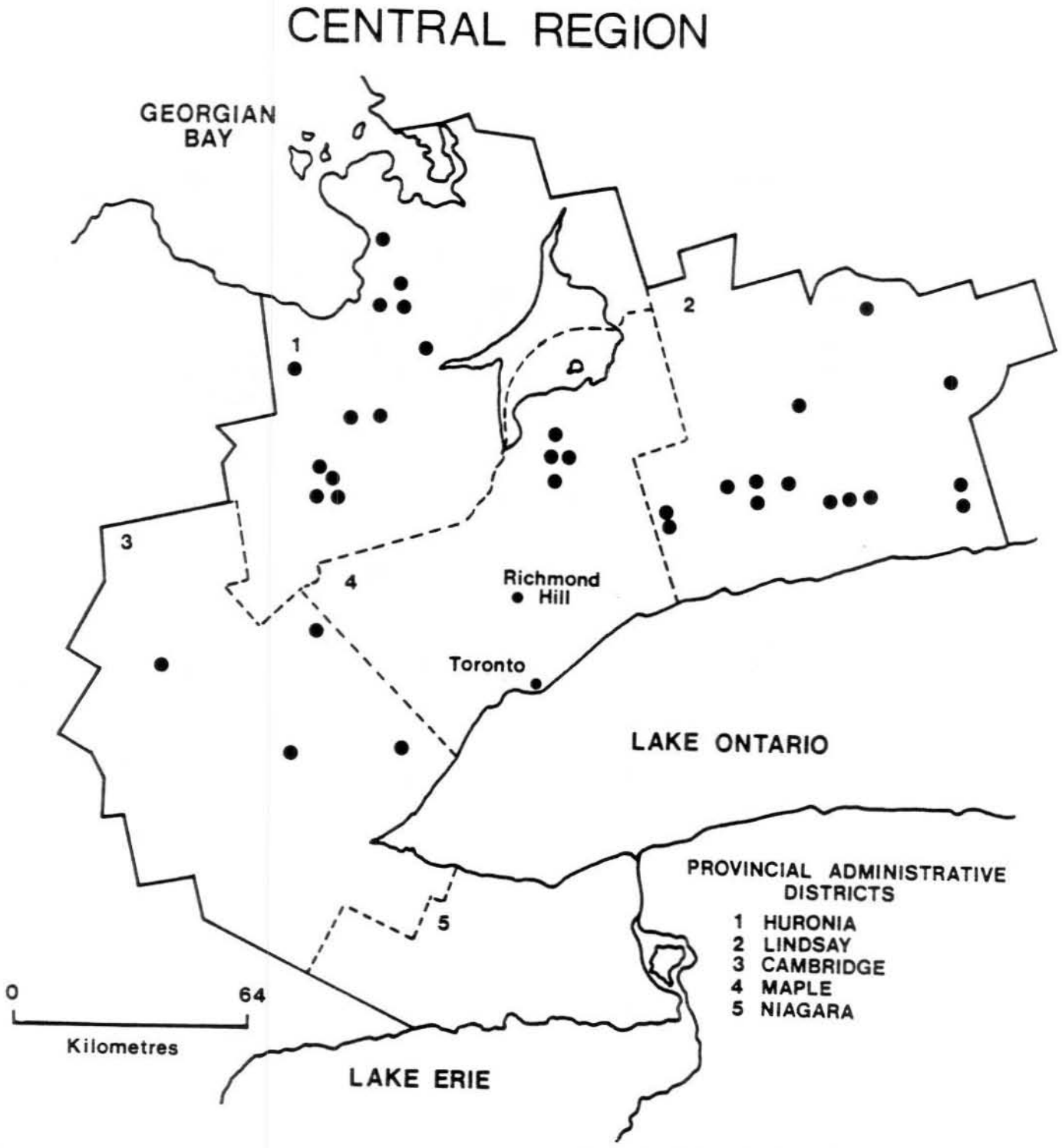

Figure 4. **Scleroderris canker, *Ascocalyx abietina* (Lagerb.) Schläpfer - Bernhard**

Locations at which red pine plantations were surveyed in 1989 ..... ●

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Forestry Canada, Ontario Region

Table 5. Other forest diseases

Organism	Host(s)	Remarks
Asteroma caryae (Peck) B. Sutton Leaf spot of hickory	sHi	20% leaf infection on 100% of the trees in woodlots ranging in size from 2 to 15 ha in the southwest corner of Niagara District
Ceratocystis ulmi (Buism.) C. Moreau Dutch elm disease	wE	As the next generation of trees becomes more noticeable so does the recurrence of the disease. Infection levels are on the increase, and branch infection and tree mortality have been observed more frequently at various locations across the region.
Discula sp. Anthracnose	wAs, Be	Ornamentals suffered various degrees of defoliation in Niagara District.
Heterobasidion annosum (Fr.) Bref. Fomes root rot	rP	sometimes associated with mortality of older trees in various plantations in the region
Microstroma juglandis (Bereng.) Sacc. White mold	Hi	50% foliar infection at one site in Niagara District
Mycosphaerella populicola G.E. Thompson Septoria leaf spot	bPo	A marked reduction was observed in the heavy infection levels of the past couple of years. The incidence was low at widely scattered points in the region.
Phyllosticta sphaeropsoidea Ell. & Ev. Leaf blotch	horse-chestnut	95% foliar damage widespread across the Niagara District

FOREST HEALTH

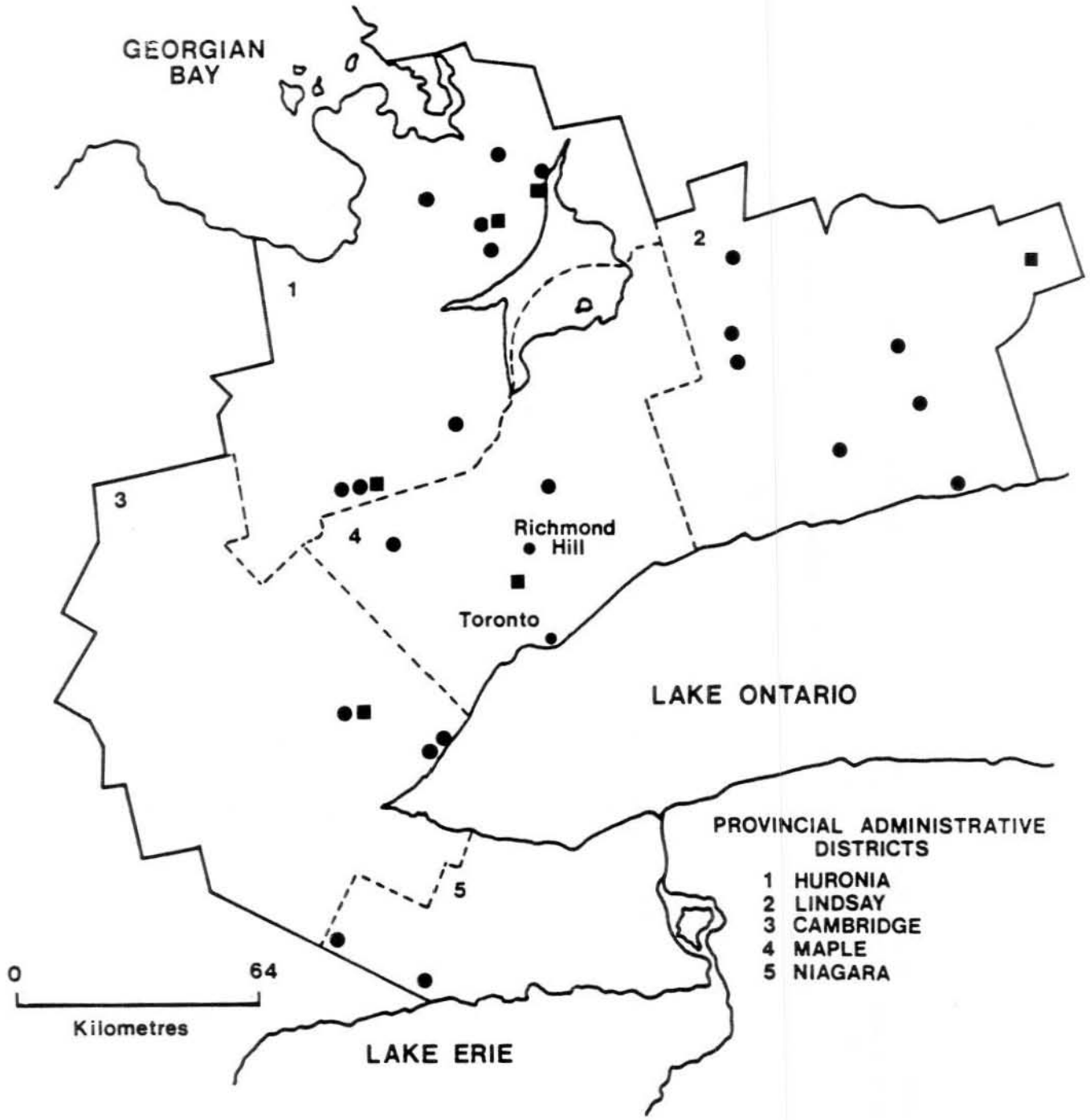
Maple Health

The work that was originally started in 1987 to study the condition of sugar maple (*Acer saccharum* Marsh.) in the Central Region was expanded this year with the addition of more 25-tree plots (Fig. 5). The original 10 plots were established in woodlots while the new ones were set up in two other types of areas in which maple is commonly found in southern Ontario. The first was a rural location in which trees were growing adjacent to a roadway. The other included trees planted as ornamentals in urban centers, usually as boulevard or park trees. Data on current and cumulative dieback from the original woodlot plots are summarized in Table 6 and those from the urban/rural plots are summarized in Table 7. Current dieback is based on only those branches that died in the past year and cumulative dieback is the total dieback that has accumulated over a period of time. Almost all of the trees examined were sugar maple, with the exception of those in the urban plot in Little Britain, Lindsay District, about half of which were black maple (*A. nigrum* Michx. f.).

Some minor increases in the amount of dieback were recorded in the woodlot plots. In seven of the 10 woodlot plots small numbers of trees moved up a category into the 6-20% dieback range (Table 6). The plot in Oneida Township, Niagara District exhibited the greatest changes, with more trees in each of the dieback categories except the >60% category. In addition, one tree was cut down in this plot, which is currently being managed for maple syrup production. Damage typical of that caused by pear thrips, *Taeniothrips inconsequens* (Uzel), was found affecting 100% of the sugar maple regeneration and understory trees in the stand in Trafalgar Township, Cambridge District. (For further information on pear thrips, see Special Surveys.) No damage of any consequence was found on the plot trees on the woodlot sites.

There was a marked difference in the condition of the sample trees examined in both the urban and the rural plots in comparison with those of the woodlots. Much more dieback was evident in the urban and rural plots (Table 7). This is due mainly to the greater range of disturbances and stress factors that can have an impact on these trees. There were from three to seven trees in the 41-60% cumulative dieback range in four of the plots. Five plots also had small numbers of trees in the $\geq$61% range. The percentage of trees in the 6-20% current dieback range varied from 28 to 60% in comparison with a maximum of only 16% in the woodlot plots. Defoliation by insects was not a problem in any of the plots this year; only 8% average defoliation by forest tent caterpillar was recorded in the Peterborough plot and 6% defoliation by maple webworm was recorded in the Peterborough and Little Britain plots in Lindsay District. Damage by the sugar maple borer, *Glycobius speciosus* (Say), was found in 24% of the trees in Clarke Township and 8% and 4% of the trees in Little Britain and Peterborough, respectively, in Lindsay District. Some trees on five of the plots were affected by heartwood rot fungus, but without further internal investigation the

CENTRAL REGION



Forest Insect and Disease Survey
Forestry Canada, Ontario Region

Figure 5. **Maple health plots 1989**

25-tree plots ..... ●
North American Maple
Project plots ..... ■

Table 6. Summary of maple health at woodlot locations in the Central Region from 1987 to 1989 (25 sugar maple examined at each location)

Location (Twp)	Avg ht (m)	Avg DBH (cm)	Year	Current dieback[a]						Cumulative dieback[a]						Trees blown down or cut
				0	1	2	3	4	5	0	1	2	3	4	5	
				No. of trees												
Cambridge District																
Nassagaweya	27	31.5	1987	25	0	0	0	0	0	25	0	0	0	0	0	0
			1988	25	0	0	0	0	0	25	0	0	0	0	0	0
			1989	25	0	0	0	0	0	25	0	0	0	0	0	0
Trafalgar	35	43.6	1987	25	0	0	0	0	0	25	0	0	0	0	0	0
			1988	25	0	0	0	0	0	25	0	0	0	0	0	0
			1989	23	2	0	0	0	0	23	2	0	0	0	0	0
Huronia District																
Adjala	21	33.0	1987	25	0	0	0	0	0	25	0	0	0	0	0	0
			1988	24	1	0	0	0	0	24	1	0	0	0	0	0
			1989	23	2	0	0	0	0	23	2	0	0	0	0	0
Flos	27	33.4	1987	25	0	0	0	0	0	25	0	0	0	0	0	0
			1988	25	0	0	0	0	0	25	0	0	0	0	0	0
			1989	25	0	0	0	0	0	25	0	0	0	0	0	0
Medonte	30	38.0	1987	25	0	0	0	0	0	25	0	0	0	0	0	0
			1988	25	0	0	0	0	0	25	0	0	0	0	0	0
			1989	21	4	0	0	0	0	21	4	0	0	0	0	0
Oro	23	26.5	1987	25	0	0	0	0	0	25	0	0	0	0	0	0
			1988	25	0	0	0	0	0	25	0	0	0	0	0	0
			1989	24	0	0	0	0	0	24	0	0	0	0	0	0

(cont'd)

Table 6. Summary of maple health at woodlot locations in the Central Region from 1987 to 1989 (25 sugar maple examined at each location) (concl.)

Location (Twp)	Avg ht (m)	Avg DBH (cm)	Year	Current dieback[a]						Cumulative dieback[a]						Trees blown down or cut
				0	1	2	3	4	5	0	1	2	3	4	5	
				No. of trees												
Maple District																
Albion	29	39.7	1987	25	0	0	0	0	0	25	0	0	0	0	0	0
			1988	25	0	0	0	0	0	25	0	0	0	0	0	0
			1989	24	1	0	0	0	0	24	1	0	0	0	0	0
Whitchurch	21	35.5	1987	25	0	0	0	0	0	25	0	0	0	0	0	0
			1988	25	0	0	0	0	0	25	0	0	0	0	0	0
			1989	25	0	0	0	0	0	25	0	0	0	0	0	0
Niagara District																
Oneida	27	40.4	1987	25	0	0	0	0	0	25	0	0	0	0	0	0
			1988	24	1	0	0	0	0	25	1	0	0	0	0	0
			1989	19	3	1	1	0	0	19	1	3	1	0	0	0
South Cayuga	21	21.2	1987	25	0	0	0	0	0	25	0	0	0	0	0	0
			1988	25	0	0	0	0	0	25	0	0	0	0	0	0
			1989	24	1	0	0	0	0	24	1	0	0	0	0	0

[a] 0 = 0-5%, 1 = 6-20%, 2 = 21-40%, 3 = 41-60%, 4 = ≥61%, 5 = dead tree

Table 7. Summary of maple health at 12 urban and rural locations in the Central Region in 1989 (25 maple trees examined at each location)

Location	Plot type[a]	Avg ht (m)	Avg DBH (cm)	Current dieback[b]						Cumulative dieback[b]						Trees blown down or cut
				0	1	2	3	4	5	0	1	2	3	4	5	
				No. of trees												
Cambridge District																
Oakville	U	20	82.5	13	10	2	0	0	0	13	10	2	0	0	0	0
Huronia District																
Mono Twp	R	18	54.0	1	9	6	7	1	1	1	9	5	7	2	1	0
Orillia	U	21	66.1	7	14	4	0	0	0	7	11	4	3	0	0	0
Oro Twp	R	19	66.9	12	12	1	0	0	0	12	11	2	0	0	0	0
West Gwillimbury	R	15	69.9	8	8	4	5	0	0	8	7	4	5	1	0	0
Lindsay District																
Clarke Twp	R	15	72.9	15	8	2	0	0	0	9	7	6	1	2	0	0
Cobourg	U	18	68.5	12	10	3	0	0	0	10	10	3	1	1	0	0
Fenelon Twp	R	14	57.3	13	8	3	1	0	0	12	7	5	1	0	0	0
Hamilton Twp	R	18	71.1	12	9	4	0	0	0	9	6	9	1	0	0	0
Little Britain	U	21	67.6	14	9	2	0	0	0	10	9	6	0	0	0	0
Ops Twp	R	13	61.1	5	15	4	1	0	0	2	8	10	4	1	0	0
Peterborough	U	19	51.1	18	7	0	0	0	0	12	13	0	0	0	0	0

[a] u = urban, R = rural (roadside)

[b] 0 = 0-5%, 1 = 6-20%, 2 = 21-40%, 3 = 41-60%, 4 = ≥61%, 5 = dead tree

extent of the damage could not be determined. Many of the urban and rural plot trees had open wounds and scars on them that were indicative of the environment in which they were living and of the fact that many of them were overmature.

North American Maple Project

The plots established in 1988 were tallied again in 1989 (Fig. 5). For the purpose of this particular study crown dieback was based on an estimation of the volume of crown foliage lost as a result of the premature death of branches. Only recently killed branches in the upper exposed portions of the crown were considered. Any dead branches within the interior of the crown or in the lower portion of the crown were not considered to be the result of dieback but rather of suppression. Furthermore, snag branches without small twigs that died much earlier were not tallied as dieback. This system is similar to that used for current dieback in the Maple Health plots (Tables 6 and 7) except that the dieback classes are more defined in this study (Table 8). In 1989, most of the plot trees exhibited less than 5% dieback, but up to 10 trees were in the 6-15% range which, for the purpose of this survey, is considered to be indicative of light decline. In three plots more trees were recorded in the 16-25% class than in 1988. Single trees exhibited greater degrees of dieback, but they represented a very small percentage (2%) of the total trees examined. No significant new defects were observed this year. Defoliation by the forest tent caterpillar averaged 20% in Belmont Township, Lindsay District, and was down from the moderate-to-severe levels recorded last year.

Oak Health

Between 1988 and 1989, no dramatic changes were observed in the status of the red oak trees examined in the oak health plots. In the current dieback category, more trees were recorded in the 6-20% range in the Tiny Township plot at Awenda Provincial Park and a minor increase in the number of trees in the higher dieback ranges was observed in a few of the other plots (Table 9). Increased numbers of trees were recorded in the 6-20% range in the cumulative dieback category, particularly in the plots in Awenda Provincial Park in Huronia District and in Uxbridge Township in Maple District. Two plots in Huronia District contained more trees in the 21-40% cumulative dieback class than in 1988. Mortality levels increased by two trees at one plot and by one tree in each of two other plots (Table 9).

The oak leaf shredder did not have any impact on the plot trees in 1989, but forest tent caterpillar feeding resulted in average defoliation levels of 75% in the Awenda Provincial Park plot and 30% in the Farlain Lake plot in Huronia District. Population levels of the gypsy moth were sufficient in the Clarke Township location in Lindsay District to cause an average of 7% defoliation.

Table 8. Summary of the crown condition of sugar maple at six North American Maple Project plots in the Central Region in 1988 and 1989

Location (Twp)	Avg DBH (cm)	Year	No. of sugar maple examined	Total percentage of dead crown (No. of trees)												Trees dead	Trees blown down or cut
				0	1-5	6-15	16-25	26-35	36-45	46-55	56-65	66-75	76-85	86-95	96-100		
Cambridge District																	
Nassagaweya[a]	30.0	1988	49	26	19	3	0	1	0	0	0	0	0	0	0	0	0
		1989	49	10	34	4	1	0	0	0	0	0	0	0	0	0	0
Huronia District																	
Adjala[a]	30.4	1988	65	24	37	4	0	0	0	0	0	0	0	0	0	0	0
		1989	65	2	49	8	4	1	0	0	0	0	0	1	0	0	0
Orillia[b]	36.7	1988	53	25	24	3	1	0	0	0	0	0	0	0	0	0	0
		1989	53	16	29	7	1	0	0	0	0	0	0	0	0	0	0
Oro[a]	23.5	1988	80	50	27	3	0	0	0	0	0	0	0	0	0	0	0
		1989	66	14	49	3	0	0	0	0	0	0	0	0	0	0	14
Lindsay District																	
Belmont[b]	26.6	1988	55	0	43	9	2	0	0	0	0	0	0	1	0	0	0
		1989	55	0	38	10	6	0	0	0	0	0	0	1	0	0	0
Maple District																	
Vaughan[b]	30.8	1988	47	33	8	5	0	0	0	0	0	0	0	0	0	0	0
		1989	47	23	19	4	0	0	0	0	1	0	0	0	0	0	0

[a] Undisturbed woodlot

[b] Trees currently tapped for maple syrup

Table 9. Summary of oak health at five locations in the Central Region of Ontario from 1984 to 1989 (100 red oak examined at each location).

Location	Avg ht[a] (m)	Avg DBH[a] (cm)	Year	Current dieback[b]						Cumulative dieback[b]						Trees blown down or cut
				0	1	2	3	4	5	0	1	2	3	4	5	
				No. of trees												
Huronia District																
Tiny Twp Awenda Prov. Pk	21.9	25.9	1984	76	0	0	0	0	9	6	56	9	4	1	9	15
			1985	74	2	0	0	0	9	4	62	9	0	1	9	15
			1986	75	0	0	0	0	10	31	41	2	1	0	10	15
			1987	69	5	0	0	0	11	41	29	4	0	0	11	15
			1988	49	25	0	0	0	11	30	37	7	0	0	11	15
			1989	10	58	4	2	0	11	8	49	13	4	0	11	15
Tiny Twp Farlain Lake	22.0	26.0	1984	67	0	0	0	0	33	0	31	25	6	5	33	0
			1985	64	1	0	0	0	34	0	49	12	3	1	34	1
			1986	61	0	0	0	0	33	28	25	7	1	0	33	6
			1987	56	4	1	0	0	33	36	22	2	1	0	33	6
			1988	c	c	c	c	c	33	23	32	5	1	0	33	6
			1989	33	26	2	0	0	33	25	27	8	1	0	33	6
Mulmur Twp Dufferin Forest	21.0	28.2	1984	90	2	0	0	0	4	1	52	33	6	0	4	4
			1985	89	3	0	0	0	4	0	71	19	2	0	4	4
			1986	92	0	0	0	0	4	55	35	2	0	0	4	4
			1987	87	2	1	0	0	6	64	22	3	0	1	6	4
			1988	61	26	1	1	0	7	52	33	3	0	1	7	4
			1989	48	33	5	1	0	9	39	34	12	2	0	9	4

(cont'd)

Table 9. Summary of oak health at five locations in the Central Region of Ontario from 1984 to 1989 (100 red oak examined at each location) (concl.).

Location	Avg ht[a] (m)	Avg DBH[a] (cm)	Year	Current dieback[b]						Cumulative dieback[b]						Trees blown down or cut
				0	1	2	3	4	5	0	1	2	3	4	5	
				No. of trees												
Maple District																
Uxbridge Twp Durham Forest	21.2	26.1	1984	74	2	0	0	0	24	0	40	27	6	3	24	0
			1985	75	0	0	0	0	25	0	53	17	4	1	25	0
			1986	75	0	0	0	0	25	0	62	12	1	0	25	0
			1987	53	20	1	0	0	26	4	46	24	0	0	26	0
			1988	8	47	1	0	0	26	3	33	19	1	0	26	0
			1989	43	28	1	1	0	27	7	47	17	2	0	27	0
Lindsay District																
Clarke Twp	20.6	22.9	1984	87	3	0	0	0	10	37	39	10	2	2	10	0
			1985	74	12	1	2	0	11	21	45	19	2	2	11	0
			1986	86	1	1	0	1	11	28	38	16	5	2	11	0
			1987	80	7	1	0	0	12	37	42	6	2	1	12	0
			1988	49	32	4	0	2	13	23	54	7	1	2	13	0
			1989	67	16	2	1	0	14	28	48	7	1	2	14	0

[a] from 1977 measurements

[b] 0 = 0-5%, 1 = 6-20%, 2 = 21-40%, 3 = 41-60%, 4 = ≥61%, 5 = dead tree

[c] data missing - 75 trees examined

ABIOTIC DAMAGE

Drought

Drought-caused damage mapped in 1989 decreased from 1988. The only areas in which drought-stressed trees were mapped were in the northeastern corner of Huronia District. In all, 550 ha of predominantly red oak growing on rocky sites lost their leaves in August. The damaged areas comprised three pockets in Matchedash Township and one pocket in Orillia Township. Another small (62-ha) patch of red oak in Orillia Township was stressed to the point at which the leaves remained on the trees, but were dried out and brown. Drought-related damage was also observed by OMNR in newly established conifer plantations.

Table 10. Other abiotic damage

Type of damage	Host(s)	Remarks
Salt	rP, wP, eC	Brown foliage was a common sight; up to 100% of the trees adjacent to many of the major roads at numerous points in the region were affected.
Scorch	sM	Trees growing along fence lines and in open areas had upwards of 70% of their leaves affected at many locations across the region.

SPECIAL SURVEYS

Eastern White Pine Plantations

This is the fourth time a special survey of selected eastern white pine plantations has been carried out. Table 10 summarizes the three major pests found affecting the trees examined in 1989. Though not recorded in the table, defoliation levels caused by the pine false webworm were very low. Moderate leader damage caused by the white pine weevil was found on 2.7-m trees in a plantation in Fenelon Township, Lindsay District. The most significant problem encountered in 1989 was white pine blister rust, which is caused by the fungus *Cronartium ribicola* J.C. Fischer. Tree mortality caused by this fungus was observed in two plots in Lindsay District, where stem cankers were also present (Table 10).

Additional insects were observed at some of the plantations. In most cases, just one pitch mass borer, *Synanthedon pini* (Kell.), was found on the trunks of 41% of the trees in Albion Township, Maple District. The eastern pine shoot borer, *Eucosma gloriola* Heinr., was recorded on 1% of the trees in Douro and Fenelon townships, Lindsay District, and on 2% of the trees in Tosorontio Township, Huronia District. Pine spittlebug, *Aphrophora cribrata* (Wlk.), was observed on 11% of the trees in Douro Township, with an average of three spittlebug colonies per tree.

A comparison of damage by five pests, which indicates the number of plantations affected and the average percentage of trees attacked during the 4 years that eastern white pine was surveyed, is given in Table 11. White pine weevil and blister rust had the greatest effect over the years because of the type of damage they inflict upon the trees. Weevil damage causes leader mortality involving more than 1 year's growth and blister rust infections on the main stem usually result in the death of the tree affected. White pine weevil damage was heaviest in 1983 and blister rust incidence was highest in 1980, with the 1989 levels close behind (Table 11).

Eastern White Pine Cone and Seed Pests

As part of the focus on eastern white pine in 1989 a sample of 100 green second-year cones was collected from 15-m trees in a seed production area in Albion Township, Maple District. Over all, 20% of the cones were found to be damaged. Damage by the white pine cone borer, *Eucosma tocullionana* Heinr., was found in 40% (i.e., eight) of the cones, within which seed loss amounted to 47%. The white pine cone beetle, *Conophthorus coniperda* (Schw.), was found to have damaged six cones in the sample, and this resulted in a 41% seed loss. Damage to the remaining six cones was attributed to unknown causes. In comparison with the results of a similar survey carried out in 1986, fewer damaged cones and causal agents were found in the 1989 sample.

Acid Rain National Early Warning System

Again in 1989, the sugar maple plot that was established in 1984 and the eastern white pine plot established in 1985 were checked for signs of damage by insects, diseases or abiotic agents. The only foliar damage present was caused by a trace population of maple webworm in the sugar maple plot in Oro Township, Huronia District. One eastern white pine in Erin Township, Cambridge District was damaged by porcupines, wtih the result that the top 3-m section of the tree died. No other type of damage was detected in the plots in 1989.

Table 11. A summary of the results of the eastern white pine plantation survey carried out in the Central Region in 1989

Location (Twp)	Avg ht of trees (m)	Estimated stocking (trees/ha)	Estimated area affected (ha)	Pine false webworm	White pine weevil	White pine blister rust		
				Trees affected (%)	Leaders affected (%)	Trees affected (%)	Stem cankers (%)	Mortality (%)
Cambridge District								
Erin	14.0	1,500	1.0	0	0	1	1	0
Huronia District								
Oro	0.9	2,500	1.0	0	0	0	0	0
Tosorontio	1.5	900	0.5	15	0[a]	1	0	0
Lindsay District								
Douro	1.5	2,500	2.0	5	3	13	7	3
Fenelon	2.7	2,100	5.0	3	9	8	5	1
Maple District								
Albion	16.0	700	2.0	0	0	0	0	0

[a] Portions damaged by weevil were pruned.

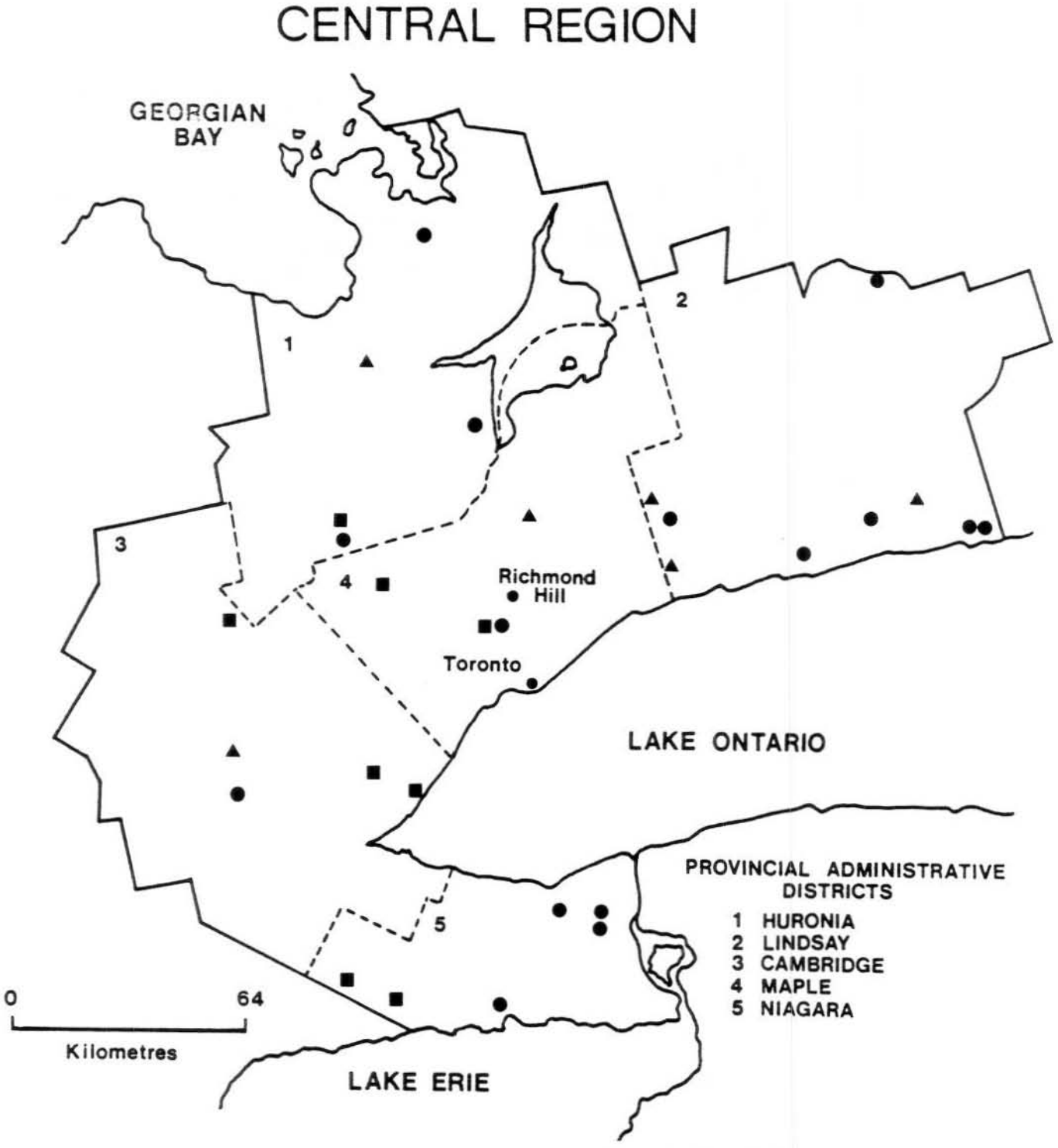
Pear Thrips, *Taeniothrips inconsequens* (Uzel)

The pear thrips has recently become an important pest of forest trees, most noticeably on sugar maple in the northeastern United States. Previously, it was considered to be a problem only in fruit tree management. Records from the Ontario Ministry of Agriculture and Food research station at Vineland indicate that the pear thrips has been found in some Ontario orchards for a number of years; however, it is not considered to be a problem.

The adult pear thrips has sucking mouth parts, and most of the damage is inflicted when it feeds on the leaf surface. In forest stands, symptoms include fallen green leaves, leaves smaller than normal, chlorotic and tattered leaves, leaf margins frequently brown or wilted and leaves punctured or wrinkled. In addition, brown scars where eggs have been laid are generally evident on the veins and petiole on the underside of the leaf.

Because of the damage to forest stands in the United States, it was decided that FIDS staff should do a special survey to see if this tiny insect was present in sugar maple in Ontario. Pear thrips was found throughout most of the range of sugar maple in Ontario. In the Central Region, 22 sites were visited in May, 1989 and a sample of sugar maple flowers and leaf buds was collected from each site. Pear thrips adults were found in 15 of the samples (Fig. 6). Lindsay District had the highest number of positive samples, with adults found in Haldiman, Whitby, Clarke, Hope and Harvey townships. Four samples with adults present were collected in Niagara District, one in each of Wainfleet and Louth townships and two in Thorold Township. Pear thrips adults were also found in sugar maple flowers in Adjala, Medonte, and West Gwillimbury townships, Huronia District; in Waterloo Township, Cambridge District; and in Vaughan Township, Maple District. One sample from Darlington Township, Lindsay District contained thrips, but the species of thrips had not been identified at the time this report was written.

Later in the summer, damage to sugar maple typical of that caused by pear thrips was found at eight sites in four districts of the region (Fig. 6). The heaviest damage was observed on the regeneration and understory in a small portion of a stand in Trafalgar Township, Cambridge District, and on the regeneration at scattered points in a sugar bush in Oneida Township, Niagara District. The damage at both sites was similar to that previously mentioned, i.e., brown margins, wrinkled surface and chlorotic patches, and was found to be affecting 70-90% of the foliage (see Frontispiece). This same type of damage was found on sugar maple regeneration in stand openings in a mature stand in Vaughan Township, Maple District. It was also at this site that adult pear thrips were collected in May. Considerably smaller amounts of damage (1 to 5%) symptomatic of pear thrips were found on regeneration in West Garafraxa and Nassagaweya townships, Cambridge District; in Adjala Township, Huronia District; in Albion Township, Maple District; and in North Cayuga Township, Niagara District.



Forest Insect and Disease Survey
Forestry Canada, Ontario Region

Figure 6. **Pear thrips,**
Taeniothrips inconsequens (Uzel)

Results of surveys in 1989

Positive adult sample ..... ●
Typical damage observed ..... ■
Negative adult sample ..... ▲

Climatic Data

Various extremes in weather can cause different kinds of damage to forest trees. The extremes can mean either too much of one thing, such as very high winds causing blowdown, or a lack of another, such as low precipitation levels causing drought stress. Table 12 lists the mean monthly temperatures and total precipitation for 1989, as recorded by the Atmospheric Environment Service. The deviation from the 30-year average values is reported, and a comparison is made between the percentages of deviation in 1988 and 1989. Climate can vary greatly from district to district and these data represent information from two stations only in the Central Region.

Table 13. A summary of temperature and precipitation for 1989 at two locations in the Central Region of Ontario

Location	Month	Mean temperature (°C)		Deviation from normal		Total precipitation (mm)		Deviation from normal		
		Normal	Actual	(°C)	(%)	Normal	Actual	1989 (mm)	(%)	1988 (%)
Peterborough Airport	January	-9.3	-5.1	+4.2	+45	44.1	36.4	-7.7	-17	-7
	February	-8.5	-7.9	+0.6	+7	48.9	25.2	-23.7	-48	+19
	March	-2.5	-4.3	-1.8	-72	62.9	58.8	-4.1	-6	-44
	April	6.0	3.9	-2.1	-35	71.8	43.4	-28.4	-40	-1
	May	12.1	12.7	+0.6	+5	57.1	93.6	+36.5	+64	+6
	June	16.8	17.9	+1.1	+7	60.4	97.6	+37.2	+62	-32
	July	19.2	20.1	+0.9	+5	77.9	5.4	-72.5	-93	-42
	August	18.1	17.9	-0.2	-1	74.2	74.4	+0.2	+<1	-41
	September	14.0	13.9	-0.1	-1	72.9	106.2	+33.3	+46	+5
	October	7.9	8.1	+0.2	+2	59.9	101.2	+41.3	+69	+50
	November	2.1	0.3	-1.8	-86	69.4	112.2	+42.8	+62	+17
	December	-6.0	-19.2	-13.2	-220	74.3	26.0	-48.3	-65	-24
Lester B. Pearson International Airport	January	-6.7	-2.2	+4.5	+67	50.4	26.0	-24.4	-48	-57
	February	-6.1	-6.5	-0.4	-7	46.0	18.9	-27.1	-59	+40
	March	-1.0	-2.1	-1.1	-110	61.1	36.8	-24.3	-40	-61
	April	6.2	5.1	-1.1	-18	70.0	41.1	-28.9	-41	-21
	May	12.3	13.0	+0.7	+6	66.0	79.2	+13.2	+20	-40
	June	17.7	18.4	+0.7	+4	67.1	94.7	+27.6	+41	-63
	July	20.6	21.5	+0.9	+4	71.4	70.4	-1.0	-1	+54
	August	19.7	19.7	0.0	0	76.8	39.6	-37.2	-48	-52
	September	15.5	15.6	+0.1	+1	63.5	44.1	-19.4	-31	+11
	October	9.3	9.8	+0.5	+5	61.8	76.2	+14.4	+23	+9
	November	3.3	1.1	-2.2	-67	62.7	80.4	+17.7	+28	-2
	December	-3.5	-14.7	-11.2	-320	64.7	23.8	-40.9	-63	-51