

**RESULTS OF FOREST INSECT  
AND DISEASE SURVEYS IN THE  
SOUTHERN REGION OF ONTARIO,  
1992**

*Forest Districts: Aylmer, Cambridge, Midhurst,  
Maple, Tweed and Kemptville*

*R.J. Sajan, S. Melbourne and E.J. Czerwinski*

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## SURVEY HIGHLIGHTS

This report describes the most significant biotic and abiotic conditions that affected trees in 1992 in the Ontario Ministry of Natural Resources' (OMNR) Southern Region of Ontario. This region was formed in the summer of 1992 with the amalgamation of the former Eastern, Central and Southwestern administrative regions.

There were drastic declines in the total area severely defoliated by the forest tent caterpillar and the gypsy moth across the entire region. The total area defoliated by the forest tent caterpillar declined by some 88%, encompassing only 35,520 ha, down from 305,661 ha in 1991. The largest area of decline occurred in the eastern portion of the region in Tweed District. The area heavily infested by the gypsy moth declined to 13,348 ha, down from 119,253 ha in 1991, with the majority of the decline occurring in the central portion of the region in the Midhurst, Maple and Tweed districts.

The eastern spruce budworm caused severe defoliation in several white spruce plantations across the region and the jack pine budworm was detected causing similar levels of defoliation across an area of 533 ha in Sheffield Township, Tweed District. The bronze birch borer caused whole-tree mortality throughout some 324 ha in Kemptville District, and heavy defoliation in pine plantings caused by the pine false webworm occurred at several locations in the Midhurst, Kemptville and Tweed districts. The balsam fir sawfly continues to increase in numbers, and both the redheaded and the jack pine sawflies were commonly encountered in the eastern portion of the region. The European pine sawfly was detected at high levels throughout the Midhurst and Maple districts. Populations of this sawfly have not been this high since the mid-1970s. For the second consecutive year, the satin moth caused severe defoliation of ornamental poplars throughout Canadian Forces Base (CFB) Borden in Midhurst District.

Hardwood leaf diseases were very common throughout the western half of the region, with damage levels often in the 70-90% range. Armillaria root rot was found to be heavily affecting pockets of trees in four pine plantations, with the heaviest damage occurring in a 40-year-old red pine plantation in the western half of Midhurst District. The annual survey for the European race of Scleroderma canker again produced negative results. Butternut canker was detected at 22 new locations in the region, and tip blight was commonly detected affecting various species of pine and resulting in branch and whole-tree mortality.

Forest decline was very evident across the northern portion of the entire region, especially affecting red oak. Branch and whole-tree mortality were aerially sketch-mapped across the northeastern portion of Midhurst District and the eastern portion of Tweed District. Low levels of frost damage were widespread on hardwoods across the western half of the region.

The annual evaluation of the fifty-six 25-tree sugar maple health plots, consisting of 26 woodland, 16 roadside and 14 urban plots, revealed that 95% of the trees sustained <20% dieback. In the 16 sugar maple woodland plots annually surveyed as part of the North American Maple Project (NAMP), the majority of trees were found to be very healthy, with 84% exhibiting <5% crown dieback. A general low level of decline was recorded in several of the ten 100-tree oak plots. This was attributed to the severe drought conditions and insect defoliation that have occurred in these plots in the past few years. No evidence of acid rain damage was recorded on the various tree species in any of the eight Acid Rain National Early Warning System (ARNEWS) plots.

Very cold, wet weather was experienced across the entire region during the 1992 season. This resulted in slow development rates and delayed hatching for numerous insects, especially the gypsy moth.

We have also presented the results of the routine surveys that were conducted at the four OMNR Forest Tree Nurseries in the region.



Insects and diseases described in this report are categorized on the basis of their importance:

**Major Insects/Diseases**

capable of causing serious injury to or death of living trees or shrubs

**Minor Insects/Diseases**

capable of causing sporadic or localized injury but not usually a serious threat to living trees or shrubs. (No minor diseases were reported in Central Region in 1992.)

**Other Forest Insects/Diseases (Tables)**

These tables provide information on two types of pest:

(1) those that are of minor importance and have not been known to cause serious damage to forest trees, and

(2) those that are capable of causing serious damage but, because of low population levels or for other reasons, that did not cause serious damage this year.

In the spring of 1992 there were a number of changes in the FIDS field staff assignments. William Biggs was transferred from Angus to Sioux Lookout, and Robert Sajan from Sioux Lookout to Angus, to assume the regional supervisor duties. Edward Czerwinski, the district technician at St. Williams, was transferred to the district technician position at Kemptville and Simon Melbourne was transferred from Geraldton to the district technician position at St. Williams.

The authors would like to express their appreciation to personnel of the various OMNR district and area offices and to various private individuals for their excellent cooperation during the 1992 field season.

*R.J. Sajan  
S. Melbourne  
E.J. Czerwinski*



FRONTISPIECE



*Severe decline of red oak (Quercus rubra L.) in the northeastern portion of Midhurst District.*

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## INSECTS

### Major Insects

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

Twenty-seven pine plantations were surveyed across the region for damage caused by this introduced pest of pines (*Pinus* spp.). The highest population and damage levels were detected in Dalhousie Township in Kemptville District. In a 5-ha red pine (*Pinus resinosa* Ait.) plantation, 100% of the 3.7-m trees sustained 97% defoliation. Similar infestation and defoliation levels were found in a 5-ha, 3.7-m red pine plantation in Huntingdon Township, Tweed District. In Holland and Sullivan townships, Midhurst District, 80 and 90% of the eastern white pine (*Pinus strobus* L.) trees were infested, respectively, resulting in 95% defoliation at each location (Fig. 1).

Incidence rates of 100% were detected in red pine and eastern white pine plantations in Cavan and Dummer townships, Tweed District. However the defoliation levels were considerably lower, averaging only 43%. Elsewhere in the district, 10% defoliation was recorded on 46% of the 0.7-m trees in a 4-ha red pine plantation in Huntingdon

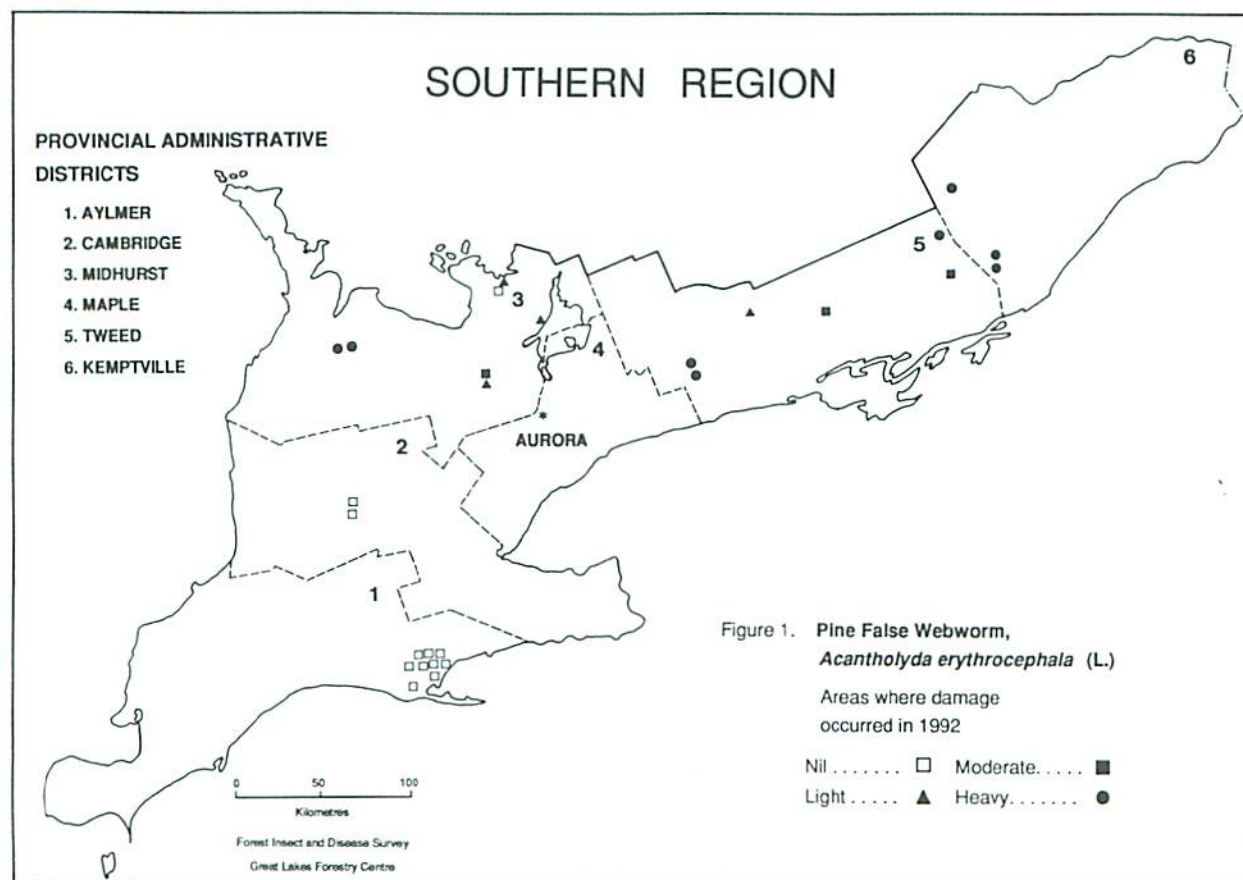
Township. This pest was not detected in plantations in the southwestern portion of the region. The complete results of this survey are presented in Table 1.

#### Bronze Birch Borer, *Agrilus anxius* Gory

In the eastern portion of the region, infestations by the bronze birch borer were detected in grey birch (*Betula populifolia* Marsh.) stands at several locations. Aerial surveys determined that approximately 324 ha were infested. This is the first time in 18 years that this pest has caused widespread whole-tree mortality in this portion of the region.

The total area infested comprised some 13 pockets of damage in the central portion of Kemptville District, ranging in size from 5 to 48 ha. A standard 150-tree evaluation conducted in a 48-ha pocket of damage in Gloucester Township revealed a current whole-tree mortality rate of 45%, and 27% of the trees were found to be severely affected, with numerous dead branches within the living crown. Additional, smaller pockets, all exhibiting similar damage levels, occurred in Cumberland, Russell, Clarence and Cambridge townships.

This pest was also commonly encountered infesting ornamental trees, especially weeping birch (*Betula*



*pendula* Roth), in numerous cities and towns across most of the region.

### Arborvitae Leafminer, *Argyresthia thuiella* (Pack.)

There was a slight and localized resurgence of this leafminer in the region in 1992. The highest population level recorded this year caused 75 to 100% foliar damage in a 10-ha area of North Sherbrooke Township, Kemptville District.

Moderate defoliation (25–40%) was recorded in three widely separated pockets: a 5-ha area of 5.6-m eastern white cedar (*Thuja occidentalis* L.) in Madoc Township, Tweed District; a 20-ha area of 9.7-m trees in Rideau

Township; and a 2-ha stand in North Gower Township, Kemptville District.

Foliar damage was recorded at the 10–15% level on ornamental cedar in Woodland Park, South Walsingham Township, Aylmer District, and on roadside trees in Grey Township, Cambridge District. Trace populations were noted at several other locations in the Tweed and Kemptville districts.

### Birch Skeletonizer, *Bucculatrix canadensisella* Cham.

Large populations of this late-season defoliator caused moderate-to-heavy foliar browning this season in the eastern portion of the region.

**Table 1. Summary of damage caused by the pine false webworm in 27 pine plantations in the Southern Region of Ontario in 1992.**

Location (Twp)	Tree species	Number of trees examined	Average height of trees (m)	Estimated number of trees per ha	Total area affected	Trees infested (%)	Average defoliation (%)
<i>Aylmer District</i>							
Charlotteville	ewP	150	1.6	1,800	2	0	0
Charlotteville	ewP	300	4.3	3,500	1	0	0
Charlotteville	ewP	150	3.5	2,500	2	0	0
Charlotteville	ewP	150	3.2	3,500	5	0	0
Charlotteville	ewP	150	3.2	2,500	4	0	0
Charlotteville	ewP	300	1.1	2,000	2	0	0
Charlotteville	ewP	150	2.3	2,500	1	0	0
Oxford	ewP	300	3.8	2,000	2	0	0
Walsingham	ewP	300	2.3	1,200	1	0	0
South Walsingham	ewP	150	3.5	3,000	1	0	0
<i>Cambridge District</i>							
Mornington	ewP	300	4.4	3,500	2	0	0
Mornington	ewP	300	4.2	2,000	1	0	0
<i>Kemptville District</i>							
Dalhousie	rP	150	3.7	2,200	5	100	97
South Crosby	rP	150	1.3	1,200	1	84	31
South Crosby	ScP	150	1.3	2,900	5	76	52
Oro	rP	150	2.1	2,100	3	15	95
Holland	ewP	150	2.5	2,200	3	80	95
Sullivan	ewP	150	2.3	2,100	7	90	95
Tay	rP	500	1.6	2,400	6	1	1
Tay	rP	500	1.1	2,450	12	0	0
Tosorontio	ewP	150	1.4	1,200	3	29	2
Tosorontio	ewP	150	3.0	1,200	2	11	1
<i>Tweed District</i>							
Bedford	rP	150	1.5	1,350	5	64	39
Cavan	ewP	150	2.8	370	5	100	56
Cavan	rP	150	2.8	2,300	5	100	46
Dummer	rP	150	4.5	900	3	100	27
Huntingdon	rP	150	3.7	2,800	4	46	10



A single, large infestation that caused moderate-to-severe defoliation totaling 945,220 ha was delineated through numerous ground checks in the northern portion of the Tweed and Kemptville districts (Fig. 2). This area is part of a larger outbreak that extends northward into Central Region. Damage to all ages of birch occurred in small clumps, ranging in size up to 5 ha, and encompassed the northeastern portion of Tweed District and most of Kemptville District. The favored host was white birch (*Betula papyrifera* Marsh.), although grey birch was the species more commonly defoliated in the northern portion of Kemptville District. Foliar damage averaged 75%, with a range of 20 to 95% across the infested area.

### **Eastern Spruce Budworm, *Choristoneura fumiferana* (Clem.)**

#### **Provincial Situation**

The total 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.) caused by the eastern spruce budworm in Ontario increased by some 529,981 ha to 9,595,762 ha in 1992. The largest increase occurred in Northwest Region. The current area of infestation now extends from the Ontario-Manitoba border eastward to the northwestern portion of Northeast Region. Numerous, smaller pockets of new infestation were mapped east of the main body, in Hearst District. In Central Region, the infestation in Algonquin Park District increased from 11,640 ha to 26,900 ha. Smaller pockets of new infestation were also mapped in the Sudbury and North Bay districts. Severe defoliation was recorded in several white spruce plantations in the Cambridge, Midhurst, Maple and Kemptville districts of Southern Region (Fig. 3).

The total area of spruce budworm-induced whole-tree mortality increased by some 638,190 ha, bringing the provincial total to 3,736,379 ha this season. The majority of the increase, some 513,496 ha, occurred in the eastern portion of Northwest Region and the extreme western end of Northeast Region.

#### **Southern Region**

Moderate-to-severe defoliation was detected for the third consecutive year in a 2-ha, 15-m white spruce plantation in Uxbridge Township, Maple District. A new pocket of severe defoliation was aerially detected in a 5-ha, 9-m white spruce plantation in Oro Township, Midhurst District. The level of current defoliation ranged from 100% along the edge of the plantation to 80% throughout the stand. A second area of new defoliation, averaging 75%, was detected in a 10-ha, 18-m white spruce plantation in the La Rose Forest in Clarence Township, Kemptville District.

Moderate levels (40–60%) of defoliation were found in a 7-ha white spruce plantation and a 2.5-ha white spruce seed orchard in Adjala Township, Midhurst District, and in a 5-ha white spruce plantation in Gloucester Township, Kemptville District. Light defoliation (10–20%) was recorded in several white spruce compartments in the La Rose Forest. Declining populations were reported in a white spruce seed production area at the Orono Forest Tree Nursery, Maple District. A ground survey of the 9-m trees disclosed a current defoliation level of <10%, down from the 50% reported in 1991. A similar level of defoliation and a declining population were recorded in the 18-ha white spruce plantation in the Smeale Tract of Minto Township, Cambridge District.

Fourteen locations were sampled for the purpose of forecasting possible defoliation levels in 1993. Severe defoliation is forecast for plantations in Gloucester Township, Kemptville District, in Adjala and Oro townships, Midhurst District, and in Uxbridge Township, Maple District. A complete list of the locations sampled and the forecasts for 1993 are presented in Table 2.

Three spruce budworm pheromone traps were deployed at each of five locations across the region, two in each of the Aylmer and Midhurst districts, and one in Kemptville District. In Aylmer District, traps were set out in a white spruce plantation in South Walsingham Township and the results averaged 225 moths per trap. In a white spruce area in Charlotteville Township, two of the three traps were recovered, with an average of 144 moths per trap. In Midhurst District, traps were deployed in a white spruce plantation in Lindsay Township, resulting in the trapping of an average of only 16 moths per trap, and in a spruce-fir stand in St. Edmunds Township, an average of 46 moths per trap was recorded. In Lavant Township, Kemptville District, the three traps averaged 95 moths per trap.

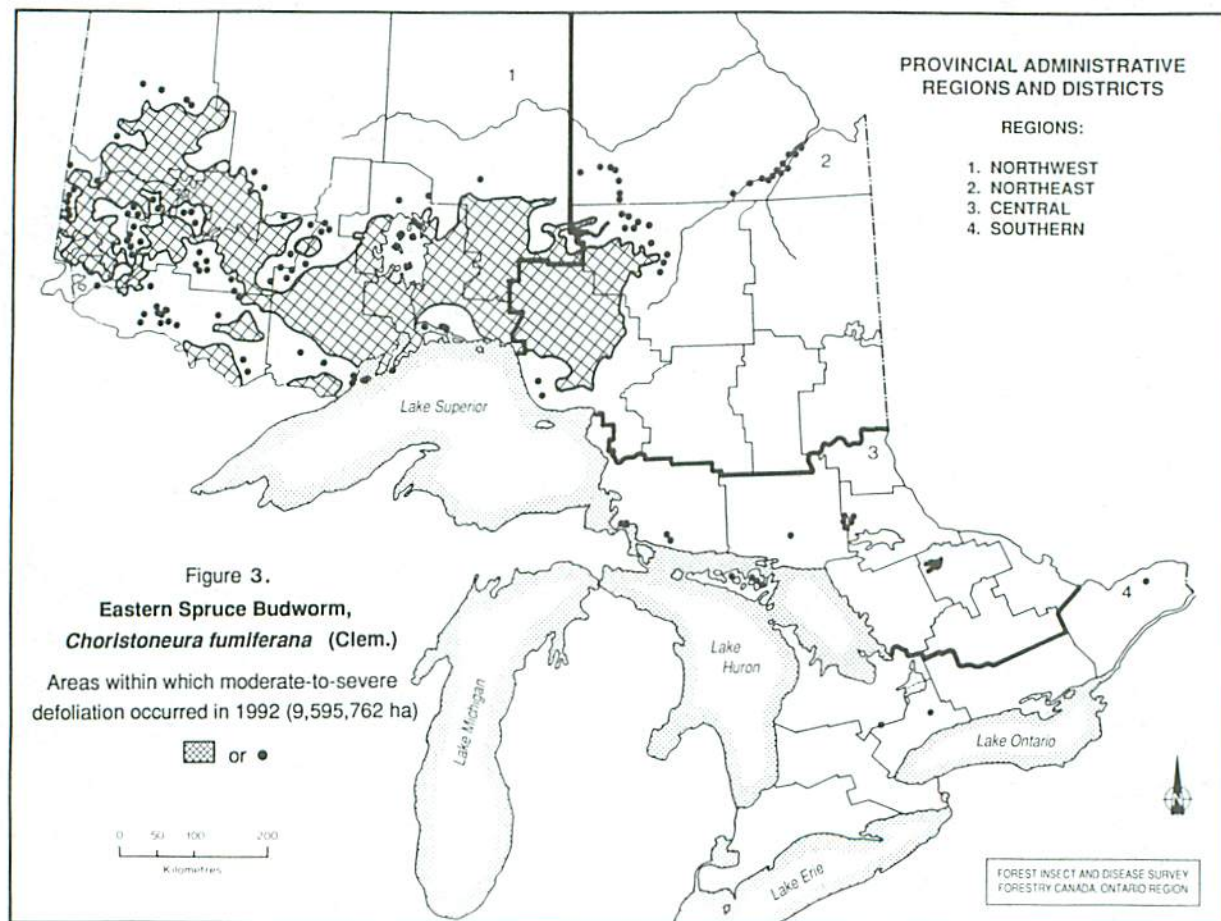
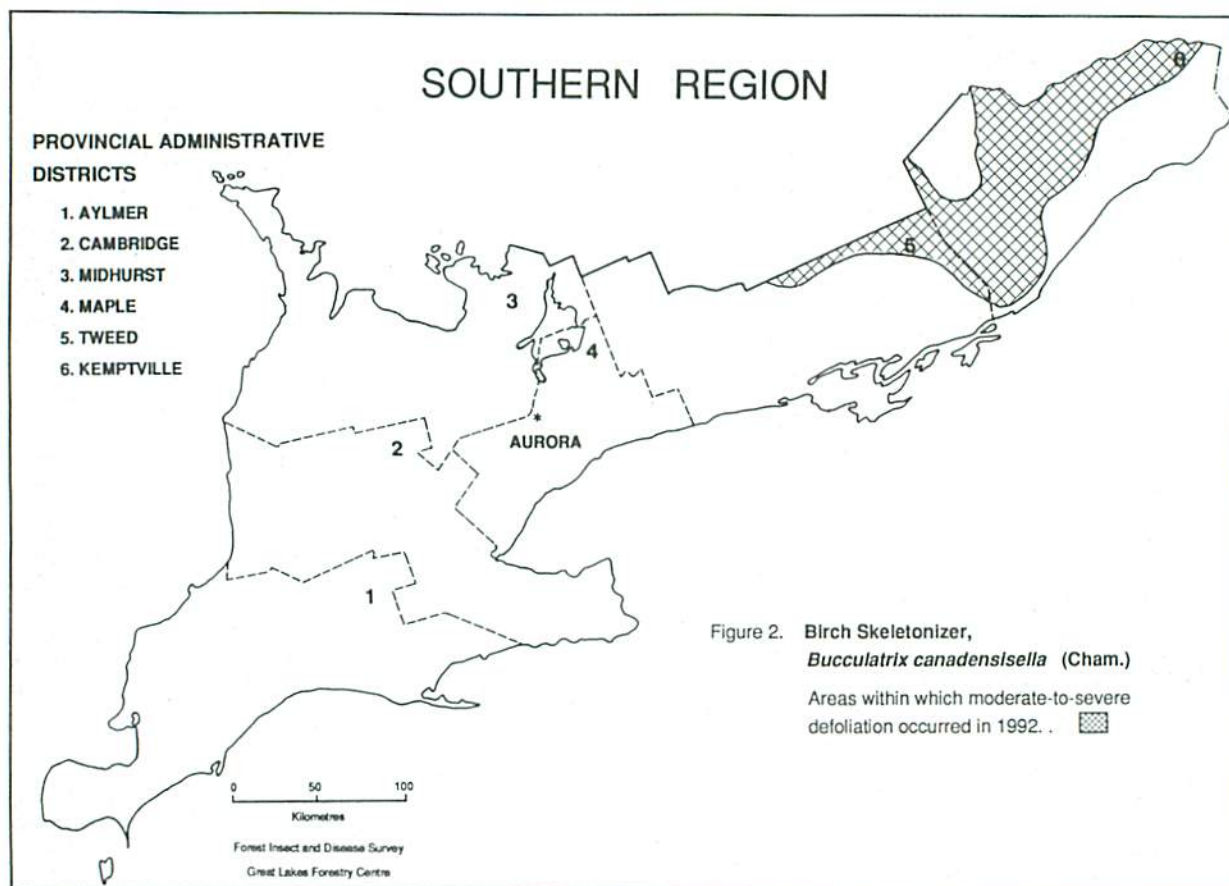
### **Jack Pine Budworm, *Choristoneura p. pinus* Free.**

Aerial surveys in the eastern portion of the region revealed a new infestation totaling some 533 ha south of the village of Kaladar in Sheffield Township, Tweed District. The infestation occurred on the northeastern side of Mellon Lake, extending west to the headwaters of the Claire River on the western side of Sheffield Long Lake.

Complete defoliation of the 6.5-m open-growing jack pine (*Pinus banksiana* Lamb.) occurred on rocky ridges in Sheffield Township, Tweed District. The old foliage on these trees was also consumed by the feeding of the jack pine sawfly (*Neodiprion pratti paradoxicus* Ross).

Trace defoliation was recorded at two locations in Kemptville District, in a 5-ha plantation of 5.8-m trees in





South Elmsley Township and recurring in a 15-m-high jack pine windbreak in Lanark Township.

A single egg-mass sample was collected from jack pine stands in each of St. Edmunds and Lindsay townships in Midhurst District for the purpose of forecasting possible defoliation levels for 1993. The same stands have been sampled for several years because of the history of jack pine budworm in the area. Although no populations or defoliation levels were detected in 1992, light defoliation is forecast for 1993 in each of the stands surveyed.

#### Larch Casebearer, *Coleophora laricella* (Hbn.)

Aerial and ground surveys indicated that moderate to severe defoliation occurred on tamarack (*Larix laricina* [Du Roi] K. Koch) in a total of 49 stands scattered throughout the Kemptville and Tweed districts, in one stand in Maple District, and in two stands in Midhurst District. Areas infested ranged in size from 0.5 to 81 ha,

with foliar damage in many stands averaging >75% (Fig. 4). Severe defoliation was detected in a 5-ha plantation of European larch (*Larix decidua* Mill.) in Uxbridge Township, Maple District. Foliar damage levels of 20% were recorded on Japanese larch (*Larix leptolepis* [Sieb. & Zucc.] Gord.) in a seed production area in Rideau Township, Kemptville District, and at Sandbanks Provincial Park in Hallowell Township, Tweed District. No defoliation was detected in the Minesing Swamp in Vespra Township, Midhurst District, where 470 ha of defoliation occurred in 1991.

#### Satin Moth, *Leucoma salicis* (L.)

For the third consecutive year this introduced pest has caused severe defoliation of poplars (*Populus* spp.) at various locations across the region. The largest area of defoliation occurred throughout Canadian Forces Base Borden, in Midhurst District. Many of the residential streets

**Table 2. Summary of eastern spruce budworm defoliation estimates and egg-mass counts in the Southern Region of Ontario in 1992 and infestation forecasts for 1993.**

Location (Township)	Host	Estimated % defoliation 1992	No. of egg masses per 9.29 m <sup>2</sup> of foliage	Infestation forecasts for 1993 <sup>a</sup>	Accumulated damage <sup>b</sup>
<i>Aylmer District</i>					
Charlotteville (Turkey Point)	wS	2	52	M	0
South Walsingham (OMNR Tree Nursery)	wS	1	0	N	0
<i>Cambridge District</i>					
Minto	wS	13	170	M-S	0
<i>Kemptville District</i>					
Clarence (La Rose Forest)	wS	55	653	S	1
Gloucester	wS	52	594	S	1
Lavant (Robertson Lake)	bF	1	0	N	0
<i>Maple District</i>					
Clarke (Orono Seed orchard)	wS	5	62	M-S	1
Uxbridge	wS	4	213	S	0
<i>Midhurst District</i>					
Adjala	wS	24	445	S	2
Adjala (Seed Production Area)	wS	73	274	S	3
Lindsay	wS	0	11	L	0
Oro	wS	58	1,012	S	3
St. Edmunds	wS	0	0	N	0
<i>Tweed District</i>					
Bexley (Balsam Lk Prov. Pk)	wS	3	31	L-M	0

<sup>a</sup> S = severe, M = moderate, L = light, N = nil

<sup>b</sup> Accumulated damage: 0 = undamaged; 1 = light damage, <25% total defoliation, usually one season of severe defoliation; 2 = moderate damage, 25 to 60% total defoliation, two or three season of severe defoliation; 3 = severe damage, 60 to 80% total defoliation, three to five seasons of severe defoliation, will recover.



and main thoroughfares in the base are lined with mature Carolina poplar (*Populus X canadensis* Moench), and virtually every tree sustained 75 to 100% defoliation. In addition, at numerous locations across the base, ornamental willows (*Salix* sp.), trembling aspen (*P. tremuloides* Michx.) and balsam poplar (*P. balsamifera* L.) sustained similar levels of defoliation. In mid-August, severe browning of poplar foliage was observed across the base as a result of skeletonizing of the leaves by newly hatched larvae, prior to seeking hibernation sites. This late-season damage indicates that high population levels will likely persist in 1993.

In the eastern portion of the region, defoliation by this pest occurred at 16 widely scattered locations. Ornamental poplars were once again the primary host, and defoliation levels often exceeded 75%. Small pockets of ornamental and windbreak silver poplar (*P. alba* L.), ranging from 10 to 18 m in height, sustained 100% defoliation at various locations in Brighton and Tyendinaga townships in Tweed District and in Augusta Township in Kemptville District (Fig. 5).

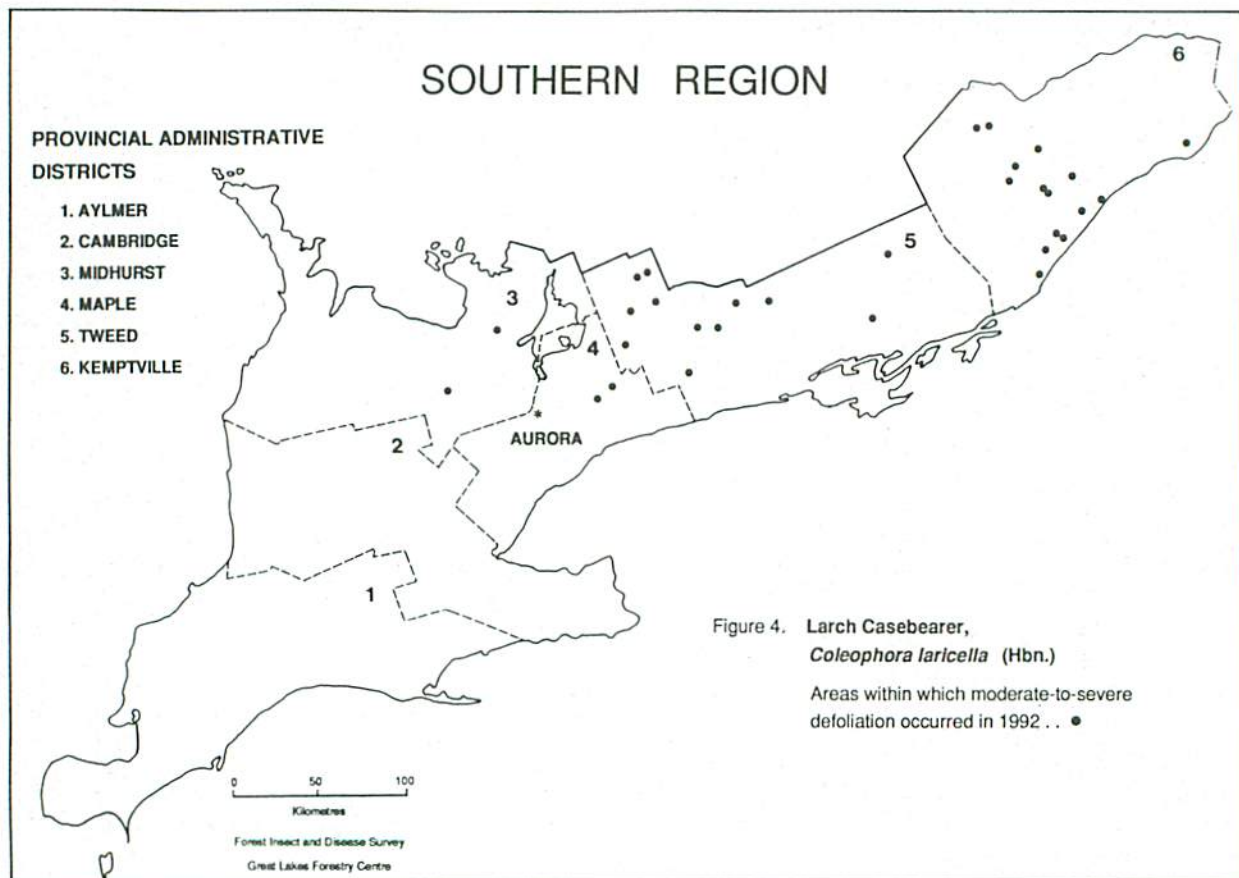
Defoliation levels averaging 90% were recorded on 100% of the trees in an 18-m-tall Carolina poplar windbreak in Matilda Township, and on 30% of the trees in a Lombardy poplar (*P. nigra* L. var. *italica* Muenchh.)

windbreak in West Carleton Township, Kemptville District. A 10% defoliation level was reported on 15-m silver poplar in Hope Township, Tweed District.

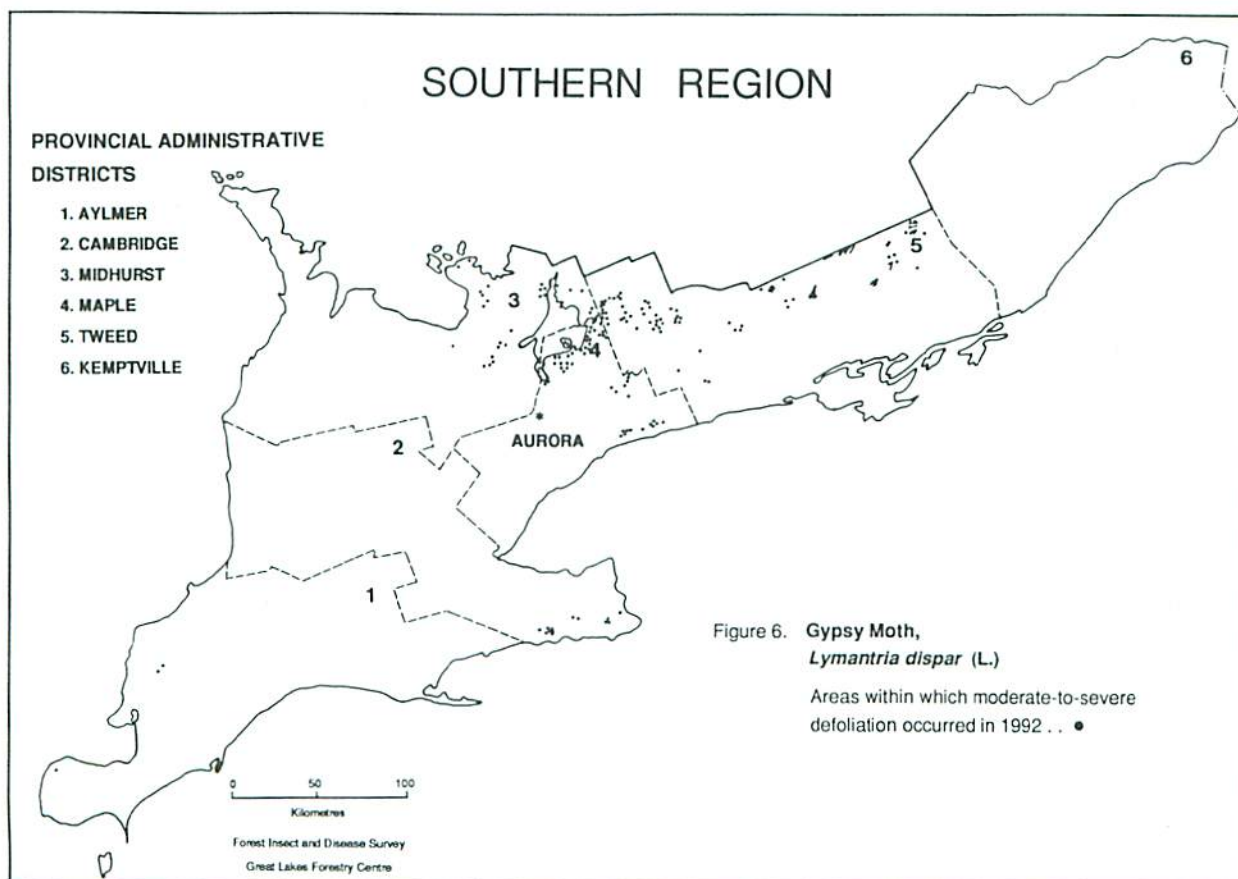
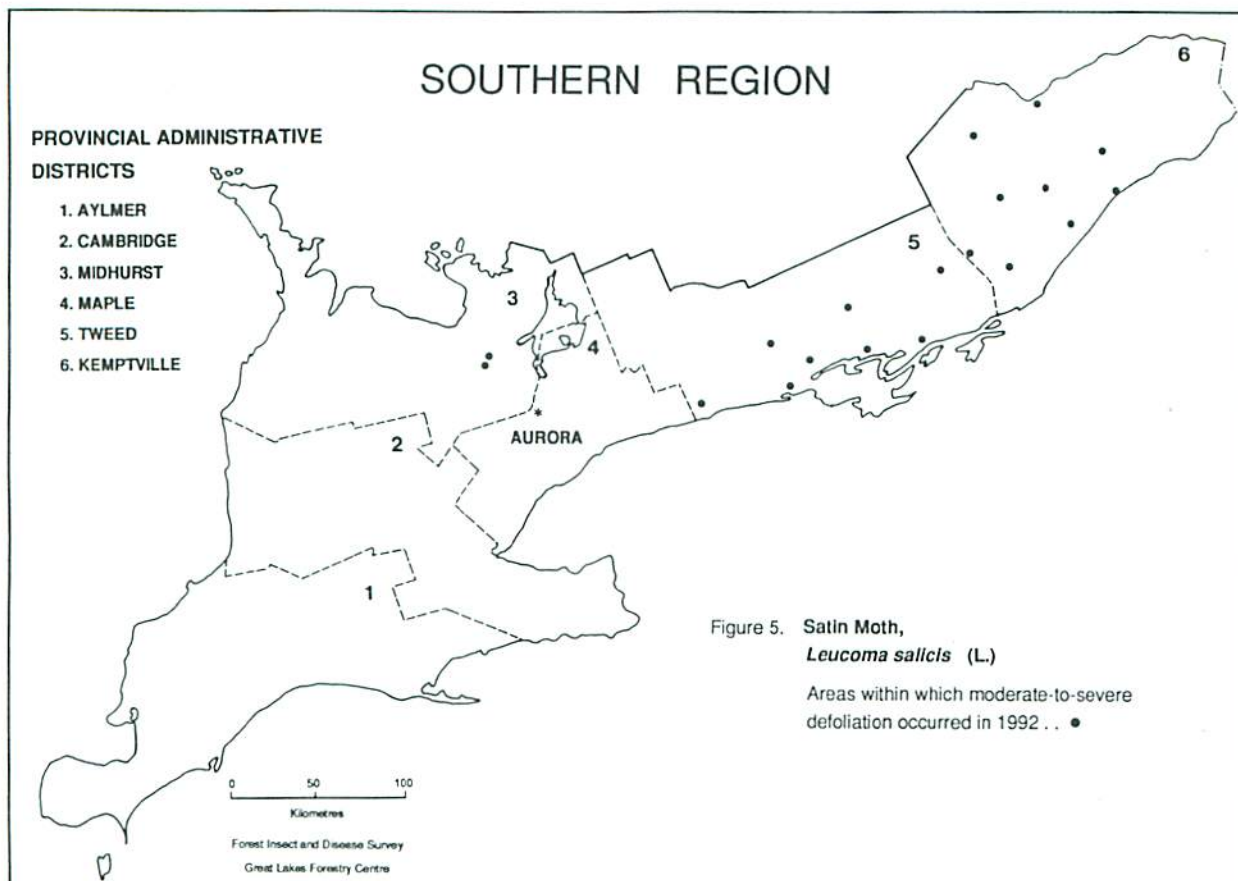
#### Gypsy Moth, *Lymantria dispar* (L.)

There was a marked decrease in the total area of moderate-to-severe defoliation caused by this introduced pest across the entire region in 1992. Extensive aerial and ground surveys revealed that numerous small pockets of damage occurred at several locations across the region, totaling some 13,348 ha, compared with 119,253 ha in 1991 (Fig. 6). The largest decrease occurred in the central portion of the region, where some 99,675 ha were heavily defoliated in 1991, compared with only 5,247 ha in 1992 (Table 3). Except for the eastern portion of the region, the majority of the damage this season occurred in poplar stands. This major decline was seen province-wide, with only 34,460 ha of moderate-to-severe defoliation being reported this year, compared with 347,415 ha last year.

The largest concentration of scattered pockets of moderate-to-severe defoliation extended from the western side of Pigeon Lake in Verulam and Emily townships, Tweed District, westward, south of Balsam Lake, to the eastern shore of Lake Simcoe in the Beaverton area. The defoliation continued southwest along the southern shore of







**Table 3. Total area of moderate-to-severe defoliation caused by the gypsy moth in the Southern Region of Ontario and the yearly change in total area infested, by district, for 1991 and 1992.**

District	Total area of moderate-to-severe defoliation (ha)		Change from 1991 to 1992 (ha)
	1991	1992	
Aylmer	3,388	123	-3,265
Cambridge	45,445	225	-45,220
Kemptville	280	0	-280
Maple	8,383	3,986	-4,397
Midhurst	45,847	1,036	-44,811
Tweed	15,910	7,978	-7,932
	119,253	13,348	-105,905

Lake Simcoe to the town of Keswick in East Gwillimbury Township, Maple District. These pockets ranged in size from 1 to 1,130 ha, with trembling aspen (*Populus tremuloides* Michx.) and balsam poplar (*P. balsamifera* L.) being the primary hosts. The largest single pocket (1,130 ha) occurred in the northern end of Thorah Township in Maple District.

A second area of scattered pockets of defoliation occurred in the eastern portion of Tweed District, with pockets extending from the northwestern corner of Sheffield Township, northeasterly across Kennebec and Olden townships. Again, the size of the areas defoliated varied greatly, from 5 to 195 ha, and the primary host defoliated in these areas was red oak (*Quercus rubra* L.). The largest area (195 ha) was detected in the northwestern corner of Sheffield Township, extending southwest into Hungerford Township. Several additional pockets in this area were estimated at 35 to 148 ha in size.

Several large scattered pockets were mapped west of this area in Marmora, Madoc and Elzevir townships, ranging in size from 56 to 1,330 ha. The largest pocket occurred in red oak and trembling aspen stands extending from the western side of Jarvis Lake in Marmora Township eastward into Madoc Township. A 575-ha area was mapped along the northern boundary of Elzevir Township, extending north into Grimsthorpe Township of the Central Region. The remaining areas averaged 50 to 75 ha in size.

Approximately 15 small pockets, ranging from 10 to 70 ha in size, were mapped in the extreme southeastern corner of Maple District. The areas of defoliation extended from the eastern edge of Pickering Township eastward, north of the cities of Whitby and Oshawa, to the Bowmanville area of Darlington Township.

Elsewhere in the region, moderate-to-severe defoliation occurred in numerous, widely scattered pockets varying from 10 to 90 ha in size. These extended from the northern

end of Tiny Township in Midhurst District, south to Bertie Township, west of the city of Fort Erie in the southern end of Cambridge District. Three areas were also detected in the extreme western end of the region in Aylmer District. The first, a long, narrow strip of oak growing along the shoreline at Rondeau Provincial Park in Harwich Township, totaled 76 ha. The second area consisted of two adjacent oak woodlots, 29 and 13 ha in size, in Enniskillen and Moore townships, and the third was a 5-ha pocket within the city of Windsor.

No defoliation was aerially detected throughout the western half of Midhurst District, most of the Cambridge and Aylmer districts and all of Kemptville District. However, trace numbers of gypsy moth larvae and light (<25%) defoliation could be detected readily in many stands throughout these districts.

Dead and dying larvae were observed and collected at three locations in Tweed District. A nuclear polyhedrosis virus was found to be the cause of the mortality in Marmora and Ameliasburg townships and the larval fungus *Entomophaga maimaiga* Humber, Shimazu & Soper was confirmed again this year in samples collected in Adolphustown Township, where it was first collected in 1991.

An aerial control operation was conducted against the gypsy moth at Canadian Forces Base Borden in Essa Township, Midhurst District: 286.6 ha, consisting of five blocks (158.1, 60.6, 41.1, 25.0 and 1.8 ha), were sprayed. Each block received a double application of the biological insecticide *Bacillus thuringiensis* (B.t.), at a 5-day interval. Monitoring of one of the red oak stands prior to spraying confirmed the hatch of the larvae on 13 May, and by the start of the spray operation on 28 May, 60% of the larvae had reached the first instar and 40% the second instar. Ground checks completed in late June in the five spray blocks failed to detect any gypsy moth larvae, confirming the success of the control operation. The annual aerial survey for gypsy moth defoliation also failed to detect any noticeable foliar damage in this area.

#### **Forest Tent Caterpillar, *Malacosoma disstria* Hbn.**

The total area of moderate-to-severe defoliation by the forest tent caterpillar declined drastically across the entire region in 1992. Extensive aerial and ground surveys revealed an 88% reduction in the total area infested, from 305,661 ha in 1991 to only 35,520 ha in 1992 (Table 4). The largest area of decline, some 202,952 ha, occurred in Tweed District. The total area infested this season comprised a multitude of small, widely scattered pockets, which may indicate a collapsing population. This decline was seen across the province, with some 16,051,424 ha of moderate-to-severe defoliation reported in 1992 versus 18,870,508 ha in 1991.



Moderate-to-severe defoliation was detected at several widely scattered locations, with the largest single area of continuous damage in the western end of Midhurst District. Some 1,020 ha of trembling aspen and balsam poplar defoliation were detected straddling the borders of Arran and Amabel townships in the southern portion of the Saugeen Indian Reserve. Complete defoliation of red oak occurred east of the town of Actinolite in Hungerford Township, Tweed District, and extended along the southern side of Highway 7 into Kaladar and Sheffield townships. Similar defoliation levels were aerially sketch-mapped along the shores of Rideau Lake in South Sherbrooke, North Crosby, North Burgess, Bathurst and South Elmsley townships in Kemptville District. Small stands of trembling aspen were also heavily defoliated in

the Winchester Bog in Mountain and Winchester townships and in Caledonia Township (Fig. 7).

Pockets of moderate (25–75%) defoliation of trembling aspen and red oak were mapped at numerous locations in Kaladar, Kennebec, Olden, Oso, Hungerford, Sheffield, Hinchinbrooke and Bedford townships in Tweed District. This level of damage was also detected in the vicinity of Constance Lake in March Township, Kemptville District.

Light-to-moderate defoliation occurred in a 75-ha area of trembling aspen and balsam poplar along the southern boundary of Mara Township, Midhurst District, and the adjacent northern end of Thorah Township, Maple District. The area defoliated was also infested by the gypsy moth, which eventually caused complete defoliation of the poplars in the area, thus obscuring the forest tent caterpillar defoliation. Trace populations were encountered at numerous locations in Midhurst District and to a lesser extent in the northern end of Maple District.

Quantitative egg-band counts were conducted at nine locations in the region for the purpose of forecasting possible defoliation levels in 1993 (Fig. 8). Severe defoliation is forecast at four locations in Kemptville District and for one location in Tweed District. However, it should be noted that this sampling procedure often overestimates expected defoliation levels in a declining infestation. The complete results of this survey and the locations sampled are presented in Table 5. In the Kemptville and Tweed districts, further decline may also be attributed to the occurrence of a widespread larval fungus (*Furia crustosa* [MacLeod & Tyrrell] Humer) and parasitism of pupae by the flesh fly (*Arichnido myia aldrichi* [Park.] Stet.).

**Table 4. Total area of moderate-to-severe defoliation caused by the forest tent caterpillar in the Southern Region of Ontario in 1991 and 1992.**

District	Gross area of moderate-to-severe defoliation (ha)		Change (%)
	1991	1992	
Kemptville	49,122	7,905	-84
Maple	551	0	-100
Midhurst	26,441	1,020	-96
Tweed	229,547	26,595	-88
	305,661	35,520	-88

**Table 5. Forest tent caterpillar egg-band samples collected in four districts of the Southern Region of Ontario in 1992, with infestation forecasts for 1993.**

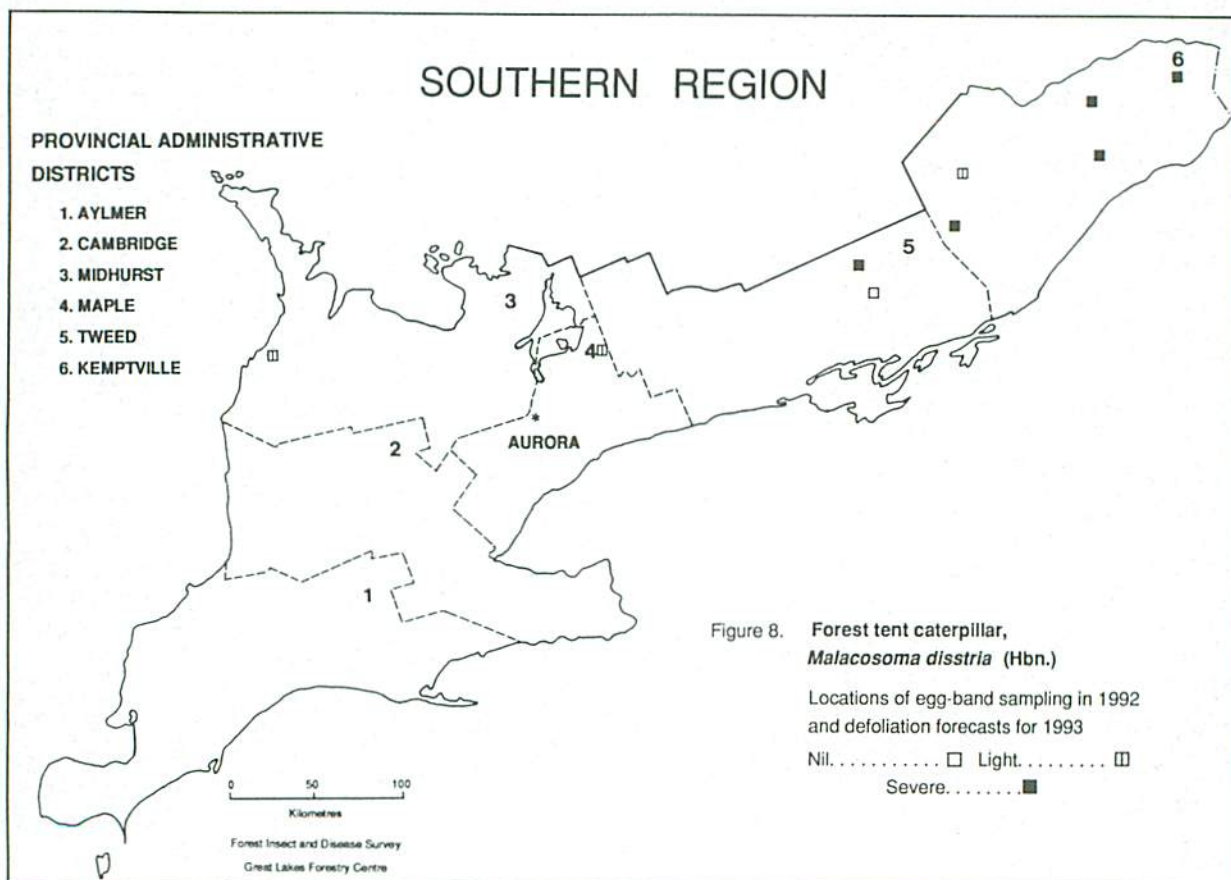
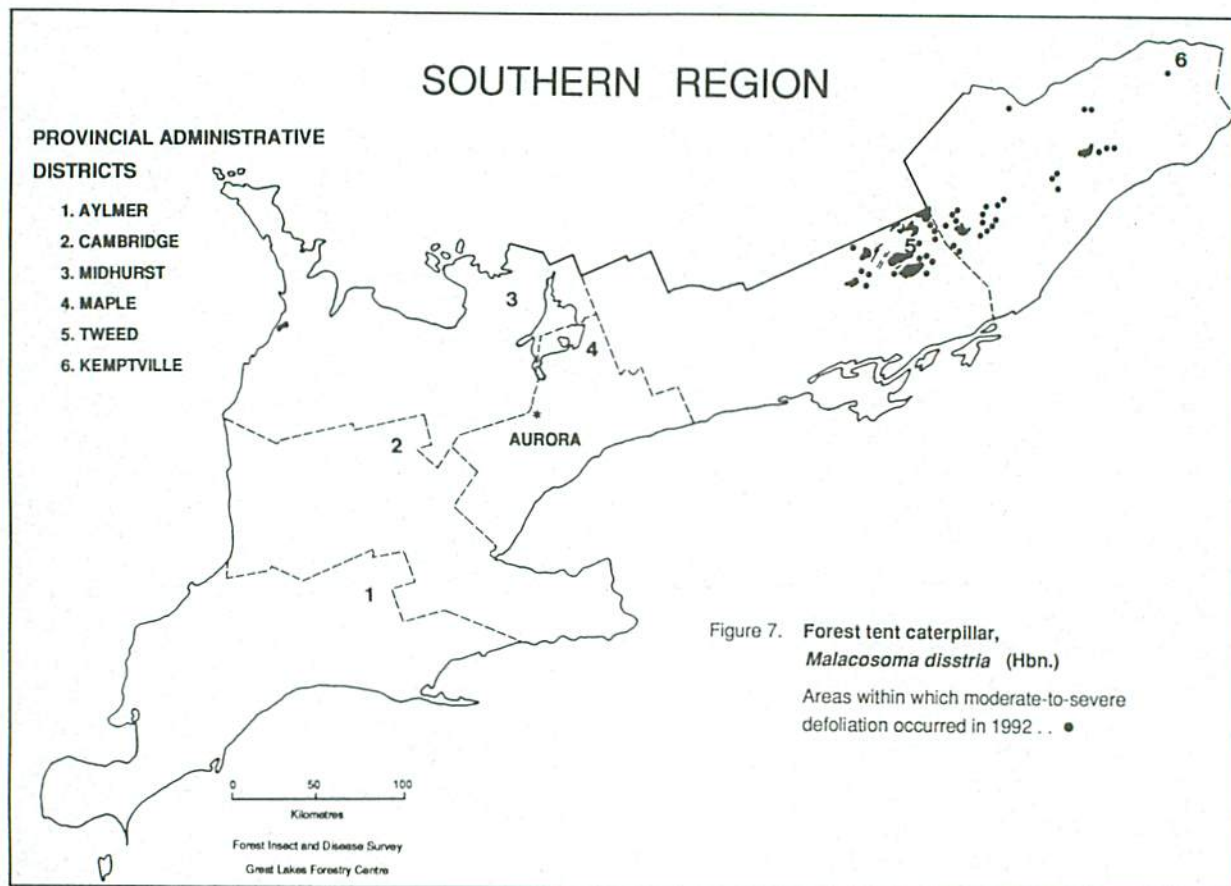
District (Township)	Host	Avg. DBH of trees (cm)	Avg. no. of egg bands per tree	Infestation forecast for 1992
<i>Kemptville</i>				
Caledonia	tA	14.8	25	Severe
Cumberland	tA	9.5	28	Severe
Lanark	sM	26.0	1	Light
Mountain	tA	16.0	77	Severe
South Sherbrooke	tA	13.8	38	Severe
<i>Maple</i>				
Thorah	tA	11.0	1	Light
<i>Midhurst</i>				
Amabel	tA	11.0	1	Light
<i>Tweed</i>				
Kaladar	tA	14.0	42	Severe
Sheffield	tA	12.7	0	Nil

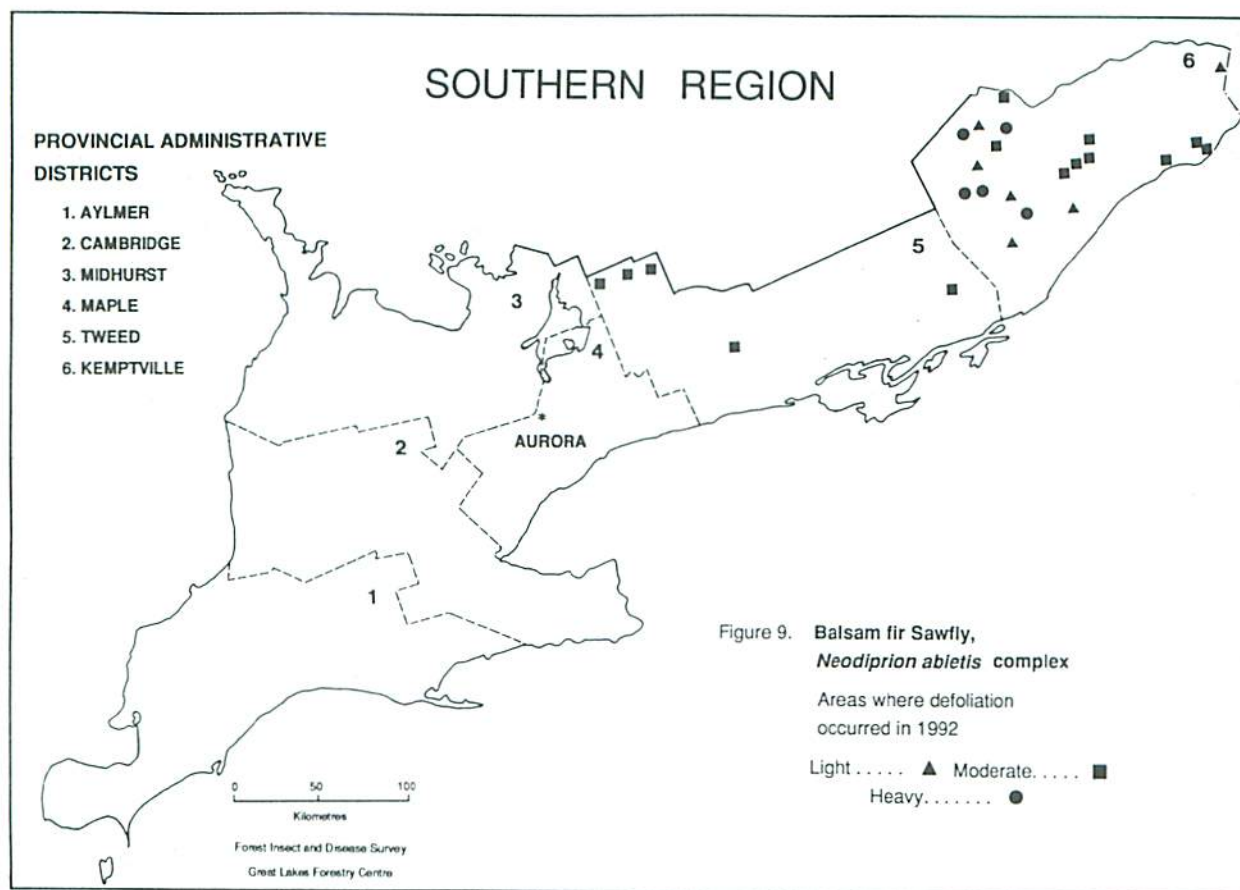
#### **Balsam Fir Sawfly, *Neodiprion abietis* complex**

For the second consecutive year, population levels of this sawfly increased across the eastern portion of the region, resulting primarily in light-to-moderate defoliation in numerous balsam fir stands (Fig. 9).

The highest populations levels were once again detected in the northwestern portion of Kemptville District. A 65-ha stand surveyed in Pakenham Township, which was typical of the level of damage in the area, revealed that 92% of the 17.5-m trees averaged 75% defoliation. Stands surveyed throughout the southwestern portion of the district revealed that 50 to 94% of the trees were infested, with foliar damage ranging from 20 to 75%. Similar damage levels were recorded in Otonabee Township in Tweed District.







Similar incidence but lower defoliation levels were recorded in the southeastern end of Tweed District and the eastern portion of Kemptville District. Assessment of stands in these area revealed foliar damage ranging from 8 to 40% on >75% of the infested trees (Photo 1).

#### **Redheaded Pine Sawfly, *Neodiprion lecontei* (Fitch)**

This red pine sawfly annually causes defoliation in plantations across the eastern portion of the region. The heaviest defoliation levels recorded this season occurred in a 3-ha red pine plantation of 1.1-m trees in Huntingdon Township, Tweed District. A standard 150-tree evaluation revealed that 15% of the trees were infested, sustaining an average of 58% defoliation. Similar surveys in a 5-ha plantation of 1.5-m trees in Bedford Township disclosed that 41% of the trees averaged 29% foliar damage, with several trees sustaining 95% defoliation. In Somerville Township, Maple District, 25% of the trees in a 7-ha plantation of 1.2-m trees also averaged 29% defoliation. Defoliation levels of >90% and branch and whole-tree mortality were observed in one area of this plantation.

A low level of damage was also recorded in a 3-ha plantation in Huntingdon Township, with 4% of the 1-m trees sustaining 10% defoliation. Single colonies, causing

trace defoliation, were also observed at numerous, scattered locations in the northwestern end of Kemptville District.

#### **Jack Pine Sawfly, *Neodiprion pratti paradoxicus* Ross**

Surveys for this pine sawfly revealed that moderate-to-severe defoliation occurred in jack pine plantations and natural stands at a number of locations in the Kemptville and Tweed districts. The most heavily infested area occurred in Sheffield and Kennebec Townships, Tweed district, where 500 ha of open-growing jack pine on a very rocky site sustained severe defoliation. A standard 150-tree evaluation in a portion of this stand of 4.9-m trees indicated that 100% of the trees were infested, with an average of 89% defoliation. In Madoc Township, Tweed District, 100% of the 3.8-m trees in a 1.0-ha plantation were attacked, sustaining an average of 52% foliar damage, and in a similar sized plantation in North Burgess Township, Kemptville District, 100% of the trees were infested, with an average defoliation rate of 23% (Table 6).

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

This pest of Scots pine (*Pinus sylvestris* L.), which consumes previous years' foliage (Photo 2), was



widespread across the region, especially in the Midhurst, Maple and Cambridge districts, where population levels had been very low since the mid-1970s (Fig. 10). The highest level of foliar damage was recorded in Uxbridge Township, Maple District, where 34% of the trees in a 3-ha plantation of 2.2-m trees were infested, with defoliation levels averaging 60%. In Aylmer District, two Scots pine

plantations, one each in Middleton and Charlotteville townships, were found to have infestation levels of 87% and 42%, respectively; however, defoliation levels were less than 10% in both cases. Similar foliar damage was recorded in the Tweed and Kemptville districts, where evaluations in red pine and Scots pine plantations disclosed 5 to 10% defoliation on 5 to 25% of the trees. None of the plantations surveyed averaged more than three colonies of insects per tree (Table 7).

**Table 6. Damage caused by the jack pine sawfly at seven locations in the Southern Region of Ontario in 1992 (counts based on an examination of 150 randomly selected jack pine trees at each location).**

District (Township)	Average height of trees (m)	Estimated number of trees per ha	Total area affected	Trees infested (%)	Average defoliation (%)
<i>Kemptville District</i>					
North Burgess	3.7	2,700	1	100	22.7
Lanark	4.1	1,100	2	92	18.2
Drummond	4.0	7	—	100	80.0
South Elmsley	5.8	2,700	5	96	22.5
<i>Tweed District</i>					
Kennebec	4.9	980	5	100	89.1
Madoc	3.8	1,200	1	100	52.0
Ernestown	2.8	2,900	5	100	8.0

#### **White Pine Weevil, *Pissodes strobi* (Peck)**

Twenty-seven white pine plantations were surveyed in the region to detect the presence of and damage level caused by this pest. The overall incidence and level of leader damage were determined not to be major problems in the areas surveyed.

The highest percentage of trees infested was recorded in an eastern white pine plantation in Bastard Township, Kemptville District. A



**Photo 1.** Severe defoliation of balsam fir (*Abies balsamea* [L.] Mill.) caused by the balsam fir sawfly (*Neodiprion abietis* complex).



**Photo 2.** Colony of European pine sawflies (*Neodiprion sertifer* [Geoff.]).



standard 150-tree evaluation revealed that 20% of the leaders on the 2.4-m trees were infested. In Charlotteville Township, Aylmer District, 18% of the 3.2-m trees sustained leader damage, and 16% of the 1.7-m trees were found to be infested in Sullivan Township, Midhurst District (Fig. 11). The complete results and a list of the locations surveyed are presented in Table 8.

## Minor Insects

### Ocellate Gall Midge, *Acericecis cellaris* (O.S.)

Sugar maple stands throughout the Midhurst, Maple, Cambridge and Aylmer districts were affected by this gall midge. Although damage levels were low (<5%), most of the stands examined had a 100% incidence level. This caused some concern among owners of maple woodlots, who mistakenly took the feeding damage of the midge, a brown spot on the leaves, to be caused by acid rain.

The heaviest damage occurred in Wilmot Township, Cambridge District, where 100% of the trees in a 10-ha woodlot were found to have 20% of the foliage affected. At

all locations, the understory sugar maple regeneration sustained a higher infestation level (20 to 30%), with several feeding spots per leaf commonly observed.

### Fall Cankerworm, *Alsophila pometaria* (Harr.)

For the second consecutive year this cankerworm caused moderate levels of defoliation in woodlots in the Aylmer and Cambridge districts. In two adjacent mature sugar maple woodlots in Caradoc Township, Aylmer District, defoliation levels averaged 50% across the 16 ha that were infested. In three woodlots along Regional Road 21 and Highway 403, totalling some 34 ha, foliar damage averaged 30% in the mixed sugar maple, silver maple (*Acer saccharinum* L.), white elm and white ash (*Fraxinus americana* L.) stands.

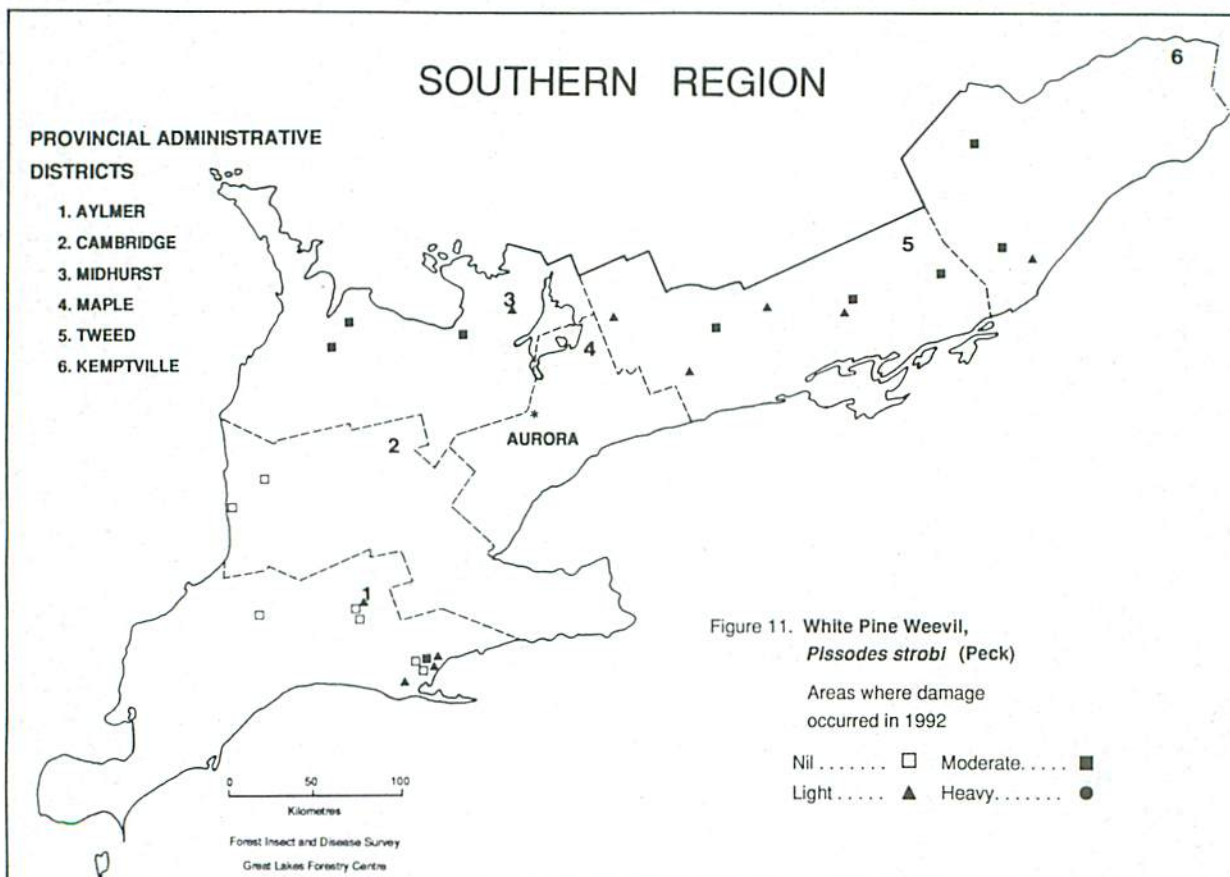
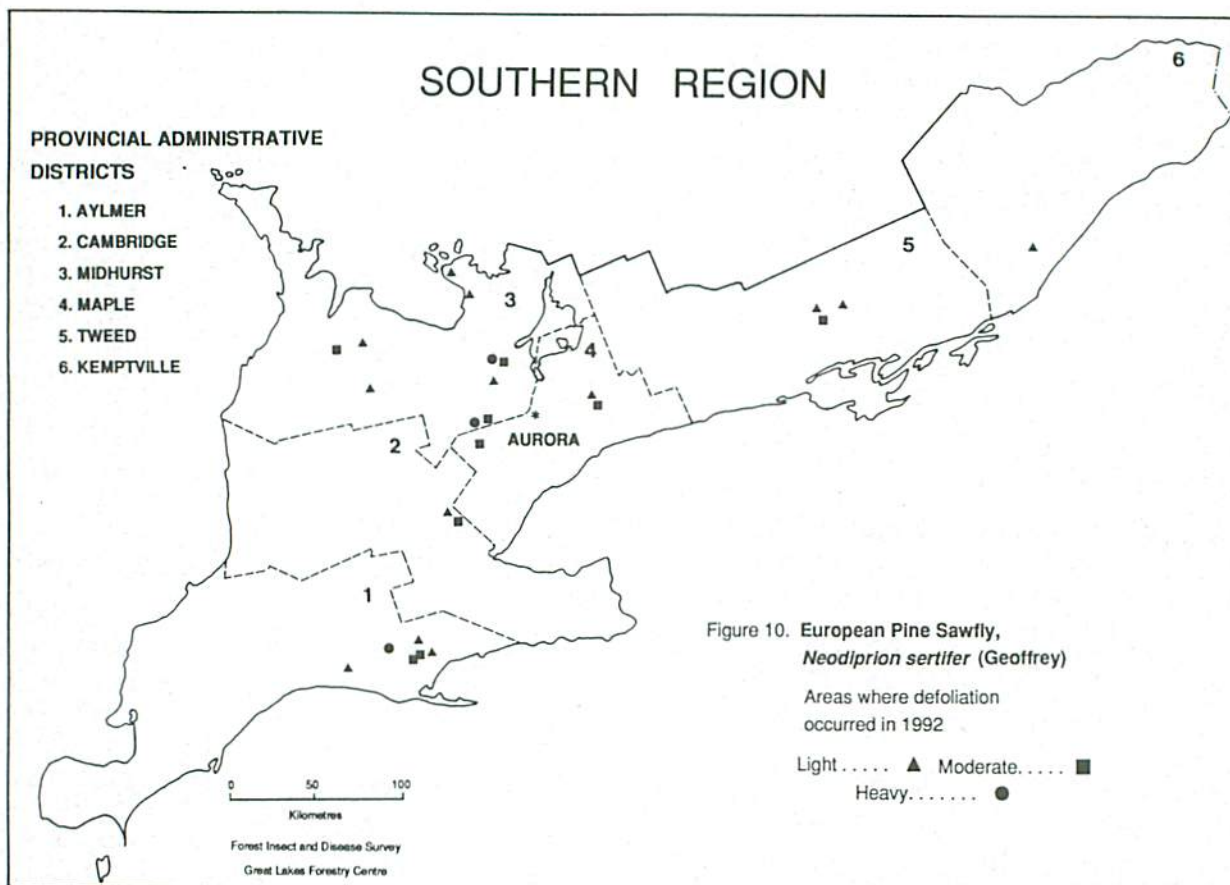
### Maple Petiole Borer, *Caulocampus acericaulis* (MacG.)

The maple petiole borer caused light defoliation in numerous sugar maple (*Acer saccharum* Marsh) stands and on ornamental trees in the western half of the region. The

**Table 7. Damage caused by the European pine sawfly at 17 locations in the Southern Region of Ontario in 1992.**

District (Township)	Tree species	Number of trees examined	Average height of trees (m)	Estimated number of trees per ha	Total area affected	Trees infested (%)	Number of colonies per tree
<i>Aylmer District</i>							
Middleton	ScP	150	2.1	2,500	2	87	3
Charlotteville	ScP	150	2.2	2,500	1	42	2
Charlotteville	ScP	150	1.3	2,500	4	14	1
Charlotteville	ScP	150	1.8	2,500	3	30	3
Windham	ScP	150	1.4	2,500	1	4	1
Malahide	ScP	150	1.4	2,500	5	20	1
<i>Cambridge District</i>							
Puslinch	ScP	50	1.7	1,700	1	1	1
Puslinch	ScP	150	1.8	2,500	8	29	1
<i>Maple District</i>							
Uxbridge	ScP	150	3.7	1,000	5	21	3
Uxbridge	ScP	100	2.2	1,000	3	34	3
<i>Midhurst District</i>							
Tiny	ScP	100	3.0	1,400	2	7	1
Sullivan	ScP	150	3.0	2,000	3	30	2
<i>Kemptville District</i>							
Rear of Yonge and Escott	ScP	150	2.2	1,620	7	20	n/a
<i>Tweed District</i>							
Huntingdon	rP	150	1.5	2,200	1	5	n/a
Hungerford	ScP	150	0.7	2,500	2	20	n/a
Huntingdon	rP	150	0.7	2,600	1	25	n/a





feeding of this pest causes the leaves to drop from the trees in mid-summer, and this resulted in many calls from concerned homeowners and landowners.

Defoliation levels averaging <10% were reported in an area extending from the Uxbridge area of Maple District, westward through the city of Barrie to the Owen Sound area of Midhurst District. No damage was detected north of Owen Sound, along the Bruce Peninsula or south of a line running from the Goderich area, through Kitchener, to the city of Oakville in Cambridge District.

**Table 8. Damage caused by the white pine weevil at 27 locations in the Southern Region of Ontario in 1992 (counts based on an examination of 150 randomly selected white pine trees at each location).**

District (Location)	Average height of trees (m)	Estimated number of trees per ha	Estimated area of stand (ha)	Leaders attacked (%)
<i>Aylmer District</i>				
South Walsingham Township	3.5	3,000	1	0.7
Charlotteville Township	3.5	2,500	2	0.0
Charlotteville Township	3.2	3,500	5	18.6
Charlotteville Township	3.2	2,500	4	3.0
Charlotteville Township	1.1	2,000	2	0.0
Charlotteville Township	2.3	2,500	1	1.4
Lobo Township	4.2	2,375	1	0.0
West Oxford Township	5.8	2,990	3	2.0
West Oxford Township	2.3	1,800	1	0.0
Dereham Township	3.9	2,500	2	0.0
<i>Cambridge District</i>				
Blandford Township	5.5	1,250	1	0.0
Hullett Township	7.0	1,200	50	0.0
Goderich Township	5.0	2,000	1	0.0
<i>Kemptville District</i>				
Bastard Township	2.4	1,870	2	20.0
Yonge and Escott	2.2	2,600	6	1.3
Ramsay	3.1	2,900	3	8.0
<i>Midhurst District</i>				
Sunnidale Township	3.3	2,000	3	14.0
Medonte Township	2.0	2,200	10	4.0
Sullivan Township	1.7	2,000	5	16.0
Sydenham Township	2.5	2,000	15	6.0
<i>Tweed District</i>				
Bedford Township	1.8	1,100	2	7.3
Hungerford Township	1.8	1,300	20	18.0
Hungerford Township	1.7	2,000	3	0.7
Douro Township	2.7	3,000	3	6.7
Belmont Township	2.3	900	5	2.7
Eldon Township	2.0	2,500	3	3.0
Cavan Township	2.8	370	5	3.0

### Fall Webworm, *Hyphantria cunea* (Drury)

This late-summer defoliator was commonly encountered on various hardwoods throughout the region. Ash (*Fraxinus* spp.) and white elm (*Ulmus americana* L.) were the species most affected, except in Aylmer District, where black walnut (*Juglans nigra* L.) and black cherry (*Prunus serotina* Ehrh.) were predominantly affected. The most noticeable damage in Aylmer District occurred in Point Pelee National Park, where the feeding tents formed

by this insect were very apparent on the black walnut trees, although foliar damage was low (10 to 15%). The heaviest damage in Maple District was observed on ash in an area extending from Sutton to Beaverton along the Lake Simcoe shoreline, where defoliation averaged 20 to 30%. Similar damage levels were recorded in Vespra and Oro Townships in Midhurst District. In Tweed District, similar foliar damage levels were commonly encountered along Highway 7. Small numbers of webmasses were commonly encountered on fringe trees throughout the remainder of the Tweed and Kemptville districts.

### Spruce Spider Mite, *Oligonychus ununguis* (Jac.)

Damage to ornamental Norway spruce (*Picea abies* [L.] Karst.) and Colorado blue spruce (*P. pungens* Engelm.) was very common across the western half of the region. The majority of the actual damage caused by the feeding of this spider mite occurred in 1991, but the full extent of the damaged foliage was not evident until this season. As the season progressed and the weather warmed, the damaged needles turned brown and began to drop from the trees. Often, several large branches on a 10- to 15-m tree were affected. This severe browning and loss of foliage resulted in numerous inquiries from private landowners. At one location within the city of Richmond Hill, Maple District, 60 to 70 mature Norway spruce growing along a property line sustained an average of 20%



defoliation. In the northern portion of Cambridge District, current defoliation averaging 10 to 15% was detected on eastern white cedar in Goderich and Grey townships and on eastern red cedar (*Juniperus virginiana* L.) in the southern portion of the district in the Niagara area.

In the eastern portion of Aylmer District, declining Norway spruce has been a problem for several years.

Examination of these trees at several sites in the St. Thomas area revealed extensive damage caused by the spider mite. Population levels of this mite peak during hot, droughty periods, a condition that has been recurring in the area for the past several years. The mites' feeding damage would add greatly to the stress caused by the drought on these ornamental and roadside trees, thus bringing about an accelerated rate of decline.

**Table 9. Other forest insects.**

Insect	Host(s)	Remarks
<i>Acrobasis juglandis</i> (LeB.) Pecan leaf casebearer	bWa, Bu	A 10% defoliation level was recorded on a single black walnut in Colborne Township, Cambridge District, and 20% of the shoots were destroyed on a single open-growing 7.5-m butternut ( <i>Juglans cinerea</i> L.) in Portland Township, Tweed District.
<i>Adelges abietis</i> (L.) Eastern spruce gall adelgid	wS	Trace populations infested <1% of the needles on 7-m host trees in a 5-ha plantation in Lindsay Township, Midhurst district.
<i>Aphrophora cribrata</i> (Wlk.) Pine spittlebug	ewP, ScP	Low-to-moderate population levels were commonly encountered causing 15 to 35% needle damage at several locations in the Aylmer, Cambridge, Midhurst and Maple districts.
<i>Archips cerasivorana</i> (Fitch) Uglynest caterpillar	cCh	Roadside shrubbery <1 m tall was heavily defoliated (75%) along Highway 48 in Thorah Township, Maple District, and along Highway 93 in Tiny, Vespra and Flos townships, Midhurst District.
<i>Caloptilia umbratella</i> (Braun) Maple leafroller	sM	Trace populations were detected on 100% of the trees in a 10-ha woodlot in Wilmot Township, Cambridge District.
<i>Cecidomyia resinicola</i> (O.S.) Jack pine resin midge	jP	Shoot mortality ranged from 25 to 60% on 48% of the roadside trees in Camden East Township, Tweed District, and low levels of shoot damage were observed in plantations at widely separated sites in the Tweed and Kemptville districts.
<i>Choristoneura conflictana</i> (Wlk.) Large aspen tortrix	tA	Moderate-to-severe defoliation occurred in three pockets of trembling aspen totaling 32 ha near Ottawa Airport in Gloucester Township, Kemptville District. Light defoliation was recorded in many stands in the western part of Eldon Township, Tweed District.
<i>Corythuca</i> sp. Lacebug	Ha	Foliar damage was recorded up to 15% on several hackberry ( <i>Celtis occidentalis</i> L.) trees in Point Pelee National Park, Mersea Township, Aylmer District.
<i>Coleophora serratella</i> (L.) Birch casebearer	wB	Defoliation levels of <1% occurred on 19-m trees in a 5-ha area in Oxford Township, Kemptville District.
<i>Cryptococcus fagisuga</i> Linding. Beech scale	Be	High population levels were recorded on the bark of mature host trees in Presqu'ile Provincial Park, Brighton Township, Tweed District, and low population levels were noted in one woodlot in Humberstone Township, Cambridge District.
<i>Datana ministra</i> (Drury) Yellownecked caterpillar	Ba	A single 10-m roadside tree sustained 75% defoliation in Essa Township, Midhurst District.
<i>Dendroctonus simplex</i> LeC. Eastern larch beetle	tL	High population levels of this insect were associated with whole-tree mortality in stands in lowlying areas through Oxford and Edwardsburgh Townships, Kemptville District, and in Essa Township, Midhurst District.

(cont'd)



**Table 9. Other forest insects. (cont'd)**

Insect	Host(s)	Remarks
<i>Diprion similis</i> (Htg.) Introduced pine sawfly	wP, jP	Trace populations were detected on 35% of the trees in a 0.5-ha white pine plantation in Bastard Township, Kemptville District, and on 4% of the trees in a white pine seed orchard in Tosorontio Township, Midhurst District. Trace populations were also noted in a 1-ha jack pine plantation in Madoc Township, Tweed District.
<i>Elaphidionoides</i> sp. Twig pruner	Oak	Light damage occurred at widely separated sites in Aylmer District.
<i>Epinotia nanana</i> (Treit.) European spruce needleminer	NS	Severe foliar browning was recorded for the second consecutive year in a 10-ha woodlot of 26-m trees in Houghton Township, Aylmer District. A moderate population level was recorded on 17-m ornamental trees within the city of Aurora, Maple District.
<i>Exoteleia pinifoliella</i> (Cham.) Pine needleminer	jP	Foliar damage averaged 15% in a 2-ha plantation of 4.9-m trees in Huntley Township, Kemptville District.
<i>Fenusa pusilla</i> (Lep.) Birch leafminer	wB, gB	Defoliation ranged from 45 to 90% at numerous, widely separated locations across the region, with the heaviest damage occurring on mature fringe and open-grown ornamental trees.
<i>Fenusa ulmi</i> Sund. Elm leafminer	wE	This insect caused 75 to 100% foliar browning on scattered groups of trees averaging 9.5 m tall in Kemptville District and the eastern portion of Tweed District.
<i>Gnophothrips</i> sp. Pine thrips	ScP, muP	Ornamental mugho pine ( <i>Pinus mugo</i> Turra var. <i>mughus</i> Zenari) sustained 35% foliar damage at one location in Hungerford Township, Tweed District. In a 7-ha stand of 1.4-m Scots pine, foliar damage was recorded on the trees in Rear of Yonge and Escott Township, Kemptville District. Similar damage levels were reported in numerous Christmas tree plantations.
<i>Gossyparia spuria</i> (Mod.) European elm scale	wE	Very large numbers of scales were recorded on three ornamental trees within the city of Brantford, Cambridge District.
<i>Heterocampa guttivitta</i> (Wlk.) Saddled prominent	sM, Be	Low population levels causing <10% defoliation were observed in Clarke Township, Maple District.
<i>Ips pini</i> (Say) Pine engraver	ScP	This insect was a contributing factor to a 5-ha area of dead and dying 15-m trees in Colborne Township, Cambridge District.
<i>Macremphytus testaceus</i> (Nort.) Dogwood sawfly	Dogwood	Extremely high population levels became a nuisance to homeowners as mature larvae burrowed into housing material while seeking pupation sites in the Odessa-Kingston area of Ernestown Township, Tweed District.
<i>Messa nana</i> (Klug) Early birch leaf edgeminer	wB	100% foliar browning was recorded on several 9.5-m trees along the Ottawa Airport Parkway, Gloucester Township, Kemptville District. In Presqui'le Provincial Park, Brighton Township, Tweed District, three 8.5-m trees sustained 5% defoliation.
<i>Paraclemensia acerifoliella</i> (Fitch) Maple leafcutter	sM	Trace populations, causing <1% defoliation, were recorded in a semimature maple stand in Nassagaweya Township, Maple District.
<i>Phratora purpurea purpurea</i> Brown Aspen skeletonizer	tA	Foliar damage ranging from 25 to 40% was noted on 11-m trees in a 5-ha stand in Edwardsburgh Township, Kemptville District.

(cont'd)



Table 9. Other forest insects. (concl.)

Insect	Host(s)	Remarks
<i>Phyllonorycter lucidicostella</i> (Clem.) Lesser maple leafblotch miner	sM	This leafminer was very common throughout Aylmer District at very low damage levels (<5%).
<i>Pikonema alaskensis</i> (Roh.) Yellowheaded spruce sawfly	wS	High population levels caused 75% defoliation on many roadside trees, <2.5 m in height, at scattered locations in the Tweed and Kemptville districts.
<i>Podapion gallicola</i> Riley Pine gall weevil	rP	Two to three major branches per tree have been killed by this weevil on 16 open-growing trees in Blackdown Park, Canadian Forces Base Borden, Midhurst District.
<i>Pristiphora geniculata</i> (Htg.) Mountain-ash sawfly	aMo	Small numbers of sawflies were recorded causing <10% defoliation of ornamentals in Serpent Mounds Provincial Park, Otonabee Township, Tweed District.
<i>Pseudexentera oregonana</i> (Wlsm.) Early aspen leafcurler	ltA	Low-to-moderate population levels were detected on host trees across the southern end of Canadian Forces Base Borden, Midhurst District.
<i>Psilocorsis reflexella</i> (Clem.) Flat leaftier	ltA, sM	Small populations were observed on semimature trees across the southern portion of Canadian Forces Base Borden, Midhurst District, and on fringe trees in Esquesing Township, Maple District.
<i>Sparganothis pettitana</i> (Roh.) Maple-basswood leafroller	Ba	Small numbers of leafrollers were reported on 12- to 15-m trees in Puslinch Township, Cambridge District, and in Egremont Township, Midhurst District.
<i>Tetralopha asperatella</i> (Clem.) Maple webworm	sM	Trace populations were observed causing <1% defoliation on semimature trees in stands in Esquesing and Nassagaweya townships, Maple District; in Wilmut Township, Cambridge District; and in Egremont Township, Midhurst District.
<i>Zelleria haimbachi</i> Bsk. Pine needle sheathminer	jP	Population increases were noted at several locations in the eastern portion of the region. Foliar damage averaged 86% on 100% of the 2.8-m host trees in a 5-ha plantation in Ernestown Township, Tweed District. In Madoc Township, Tweed District, 90% of the 3.8-m trees in a 1-ha area sustained 18% defoliation. Trace numbers of larvae were observed in a 2-ha plantation of 4.1-m trees in Lanark Township, Kemptville District.

## TREE DISEASES

### Major Diseases

**Anthracnoses, *Apiognomonia errabunda* (Roberge) Höhnelt, *Aureobasidium apocryptum* (Ell. & Ev.) Hermanides-Nijoff, *Discula campestris* (Pass.) v. Arx, *Gnomonia caryea* Wolf var. *caryea*, *G. leptostyla* (Fr.:Fr.) Ces. & de Not., and *Monostichella robergei* (Desm.) Höhnelt**

Due in part to the very wet season, anthracnose diseases were prevalent throughout much of the region. The highest incidence and variety of tree species affected occurred in the western half of the region. The percentage of trees

affected often exceeded 75%, with defoliation levels averaging 10 to 20%.

The heaviest damage detected occurred in a 12-ha sugar maple (*Acer saccharum* Marsh.) woodlot in Greenock Township, Midhurst District. An evaluation of the woodlot determined that 100% of the trees were affected with the fungus *Aureobasidium apocryptum*, causing an average of 75% foliar damage. In the northern end of Cambridge District, *Apiognomonia errabunda* was found affecting sugar maple stands in East Wawanosh Township, causing defoliation levels as high as 90%, and in Goderich Township, along Regional Road 13, roadside trees sustained foliar damage levels of up to 70%. This was the most commonly detected anthracnose in maple and oak stands across the region, causing average defoliation levels of 10 to 20% at numerous locations.



*Discula campestris* was detected on roadside sugar maple in Sullivan Township, Midhurst District, causing 30 to 40% defoliation. Roadside shagbark hickory (*Carya ovata* [Mill.] K. Koch) growing along the Dry Lake Road in Oneida Township, Cambridge District, sustained 80% foliar damage caused by the anthracnose *Gnomonia caryae*. In Rondeau Provincial Park in Harwich Township, Aylmer District, virtually all of the blue-beech (*Carpinus caroliniana* Walt.) were infected with *Monostichella robergei*, causing an average of 25% foliar damage. Throughout the entire Tweed and Kemptville districts, *Gnomonia leptostyla* caused defoliation levels of 80% on butternut wherever the host occurred.

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

Thirty-seven pine plantations were surveyed across the region for *Armillaria* root rot (Fig. 12). Standard 150-tree evaluations were conducted at each location and only nine plantations were found to be affected, with the highest incidence rates recorded in the older age classes (Table 10). In this table, the percentage of trees affected is synonymous with the amount of current, whole-tree mortality.

In a 45-year-old, 25-ha red pine plantation in Amabel Township, Midhurst District, four large pockets of mortality were examined (Photo 3). The problem has been occurring for 5 years, and the affected areas have increased in size annually. The largest pocket now consists of approximately 50 dead trees, with an additional 10 to 12 trees on the perimeter of the damage exhibiting decline symptoms. The second area consists of some 35 dead trees, with a similar decline condition occurring along the edges of the pocket. The two remaining areas were smaller in size, with totals of 20 and 12 dead trees recorded at each site and with the surrounding trees declining.

**Table 10. Summary of data collected from 37 pine plantation surveyed for *Armillaria* root rot in the Southern Region of Ontario in 1992 (counts based on an examination of 150 trees at each location).**

Location (Twp)	Tree species	Average height of trees (m)	Estimated area of stand (ha)	Average number of trees per ha	Trees affected <sup>a</sup> (%)
<i>Aylmer District</i>					
Charlotteville	ewP	1.6	2	1,800	2.7
	ScP	2.7	1	2,500	0.0
	ScP	1.3	4	2,500	0.0
	ScP	1.8	3	2,500	0.0
	ewP	3.5	2	2,500	0.0
	ewP	3.2	5	3,500	0.0
	ewP	3.2	4	2,500	0.7
	ScP	2.1	2	2,500	0.0
Middleton	ewP	3.8	2	2,000	0.0
Oxford	ewP	3.5	1	3,000	0.0
South Walsingham	ewP	3.5	1	3,000	0.0
Windham	ScP	1.4	1	2,500	0.0
<i>Cambridge District</i>					
Mornington	ewP	4.4	2	3,500	0.0
	ewP	4.2	1	2,000	0.0
<i>Kemptonville District</i>					
Bathurst	rP	0.9	1	2,000	0.0
	rP	0.6	6	2,500	0.0
Dalhousie	rP	1.3	4	2,100	0.0
	rP	2.6	5	2,200	0.0
Lanark	rP	1.9	3	2,700	0.0
Lavant	rP	1.3	10	2,850	0.0
Pakenham	rP	0.6	5	2,180	0.0
North Burgess	rP	2.7	12	2,800	0.0
Torbolton	rP	2.9	3	2,850	0.0
<i>Midhurst District</i>					
Amabel	rP	17.0	25	1,200	15.0
Holland	ewP	2.5	3	2,200	0.7
Medonte	rP	17.0	20	1,100	3.0
Sullivan	ewP	2.3	7	2,100	1.3
Tay	rP	1.6	6	2,400	0.0
	rP	1.1	12	2,450	0.0
Tosorontio	rP	16.0	20	1,200	14.0
	ewP	1.4	3	1,200	0.0
	ewP	3.0	2	1,200	0.0
Vespra	rP	11.0	15	1,200	11.0
<i>Tweed District</i>					
Elzevir	rP	1.8	2	2,900	0.0
Huntingdon	rP	1.1	3	n/a	1.3
	rP	1.4	1	2,990	0.0
	rP	1.5	1	2,200	0.0
Madoc	rP	2.2	1	200	0.0

<sup>a</sup> whole-tree mortality



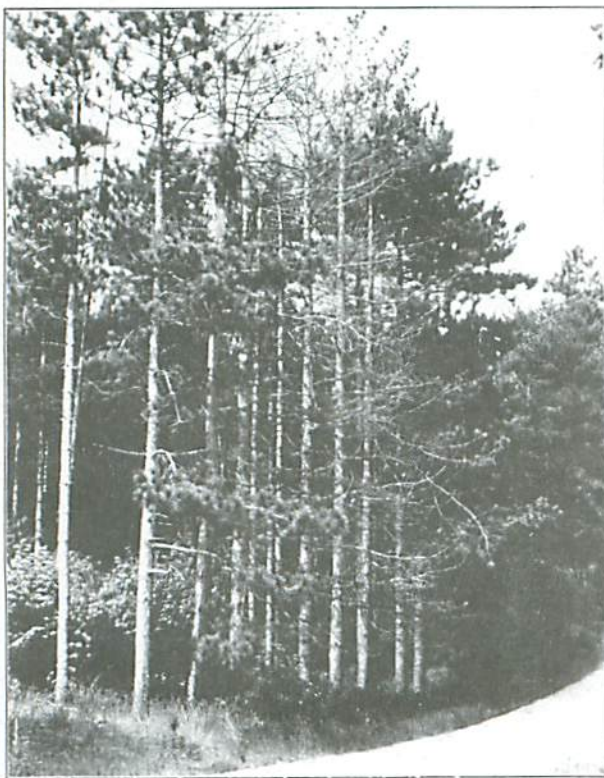
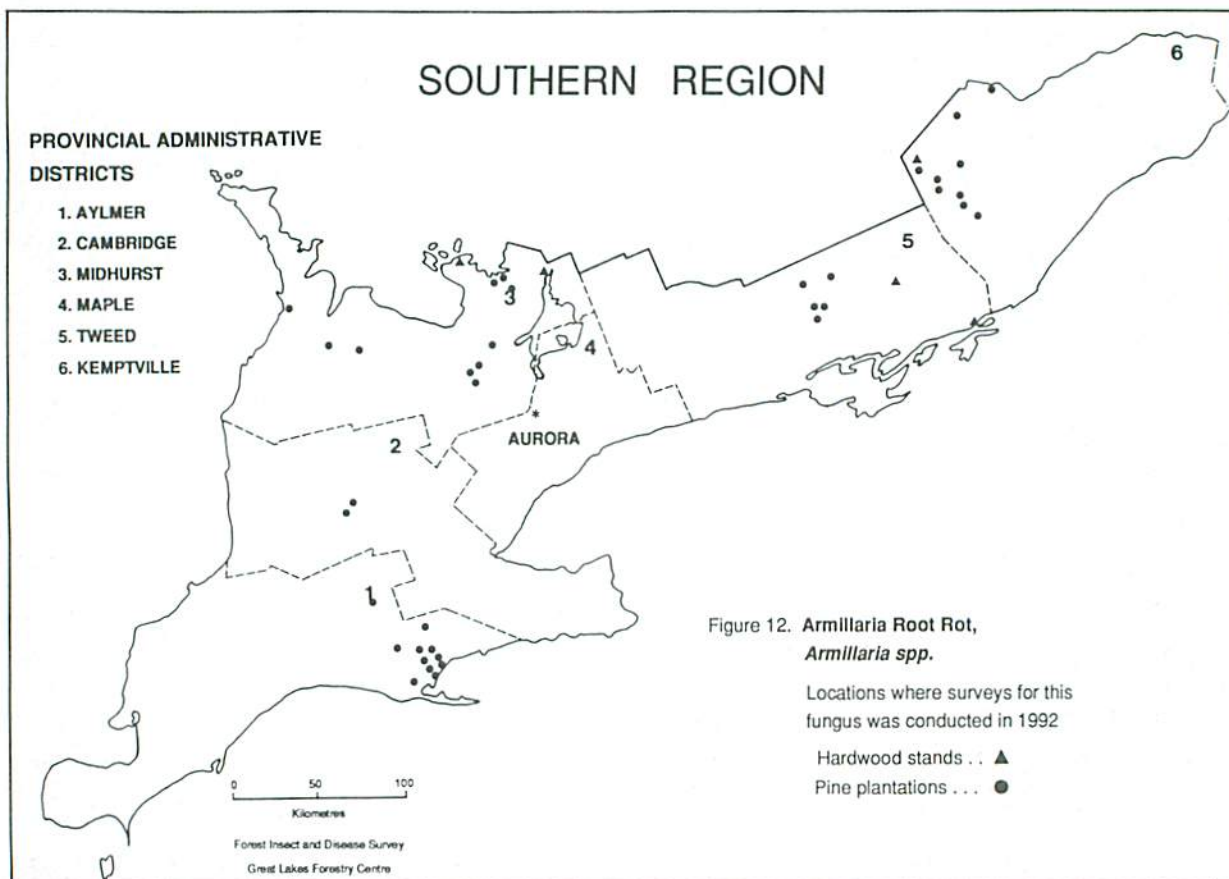


Photo 3. Pocket of dead red pine (*Pinus resinosa* Ait.) caused by *Armillaria* root rot (*Armillaria ostoyae* [Romagn.] Herink).

In a 40-year-old, 20-ha red pine plantation at the northern end of Canadian Forces Base Borden in Tosorontio Township, Midhurst District, a very large pocket of whole-tree mortality (70 trees) was detected. Again, the damage has been occurring for a few years, and is still active and expanding (as indicated by the declining trees on the periphery of this pocket). Large populations of bark beetles and wood-boring insects were also noted infesting the declining trees.

Severely declining hardwood stands in the northern end of Midhurst District, the eastern end of Tweed District, and the northwestern corner of Kemptville District were surveyed for evidence of this root rot fungus. In the Sparrow Lake area of Orillia Township, Midhurst District, 34% of the trees were dead and were found to be heavily affected. In Tweed District, similar surveys in oak stands southwest of Mellon Lake in Sheffield Township detected a mortality rate of 46% and at Joe Lake in Lavant Township, Kemptville District, mortality averaged 10%. All of these areas have experienced severe drought conditions in the past few years as well as severe defoliation by both the forest tent caterpillar and the gypsy moth. Additional information on this hardwood decline problem can be found under the *Forest Health* section of this report.

At the Bear Campgrounds in Awenda Provincial Park, Midhurst District, a clump of six recently dead red oak trees



was sampled and found to be heavily infected by this root rot. Armillaria was also a contributing factor in a 2-ha pocket of dead white ash (*Fraxinus americana* L.) and red oak on Cedar Island in Pittsburgh Township, Tweed district.

#### **Scleroderris Canker, *Gremmeniella abietina* (Lagerb.) Morelet**

Extensive aerial and ground surveys were conducted in the northern portion of the region to detect any presence of this disease. Once again no evidence of either the North American or European races of the disease was detected. Sixteen red pine and four Scots pine plantations, ranging in height from 0.6 to 2.9 m, were surveyed across the northeastern portion of Kemptville District, the northern portion of Tweed District and the northwestern corner of Midhurst District.

#### **Fomes Root Rot, *Heterobasidion annosum* (Fr.) Bref.**

A special survey was conducted this year wherein discs were cut from juvenile red pine trees and set out overnight as traps to detect the abundance of spores disseminated by this fungus.

In Essa Township, Midhurst District, nine of the 11 discs set out demonstrated the presence of the fungus as did the two samples in Charlotteville Township, Aylmer District; of these, one disc produced a very high spore count. Five discs set out in Oxford on Rideau Township, Kemptville District, trapped no spores.

A known pocket of this root rot was monitored in a 55-year-old 20-ha red pine plantation at Canadian Forces Base Borden in Essa Township, Midhurst District. The affected area consisted of 30 to 35 dead trees, surrounded by several declining trees, but there was no evidence of current mortality. Due to the presence of a large population of bark beetles (*Ips pini* Say) in the dead and declining trees, the pocket was cut down to help prevent the spread of the beetles.

Six dead red pine, killed by this fungus, were detected on the fringe of a 40-year-old plantation in Charlotteville Township, Aylmer District. In an adjacent white pine plantation, a single tree, 1 m tall, was also found to be infected with this disease.

#### **Dutch Elm Disease, *Ophiostoma ulmi* (Buisman) Nannf.**

This wilt disease, which is capable of causing whole-tree mortality of elms (*Ulmus* sp.), appears once again to be widespread throughout the region. In particular, juvenile elm growing along roadsides and fencelines, having

reached 10 to 15 cm in diameter, become very susceptible to attack by the feeding bark beetles that are the vector of this disease.

Pockets of dead and dying juvenile elms were noted at numerous locations in the northern portions of the Maple and Midhurst districts, throughout the Niagara and Kitchener areas of Cambridge District, and in much of Aylmer District. The disease was also observed at several locations in the Tweed and Kemptville districts.

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

Surveys have been conducted for the last few years to determine the presence, distribution and damage level of butternut canker in the region. The causal fungus is viewed as a potentially serious threat to the future existence of butternut in southern Ontario (Photo 4). Butternut is not a very abundant tree species and is usually found growing as a single tree or in small clumps in association with other hardwoods. The fungus was identified for the first time in Ontario in 1991 at five locations in the southwestern portion of the region.

Thirty new locations were checked for the presence of the disease in 1992, of which 22 tested positive (Fig. 13).



Photo 4. Dieback of butternut (*Juglans cinerea* L.) caused by the butternut canker (*Sirococcus clavigignenti-juglandacearum* N.B. Nair, Kostichka & Kuntz).



The areas most affected by whole-tree mortality occurred in Ashfield and McKillop Townships in Cambridge District, where eight of 30 trees surveyed had been killed by this canker. In the Tweed and Kemptville districts, no whole-tree mortality was recorded; however, >90% of the trees examined were affected, with branch mortality ranging from 20 to 95%.

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

The aesthetic value of ornamental pines and shelterbelts is often destroyed by heavy shoot, branch and whole-tree mortality caused by Diplodia tip blight. Various degrees of this type of damage were commonly observed on Austrian pine (*Pinus nigra* Arnold), Scots

pine and mugho pine shelterbelts planted along all the major highway corridors across the region.

The most severe damage in 1992 occurred in two semimature Scots pine plantations. In Colborne Township, Cambridge District, a 3-ha area sustained 90% whole-tree mortality, and in Oneida Township, Cambridge District, a 3-ha area of 35-year-old trees was found to have 85% of the trees either dead or severely infected, with heavy branch mortality. In an adjacent 1-ha plantation of 2.2-m Scots pine Christmas trees, 55% of the trees were infected, averaging 15% foliar damage. Severe foliar browning and 10% whole-tree mortality was detected in a 10-ha stand of uneven-aged Scots pine in Grey Township, Cambridge District. Severe branch mortality was reported in a semimature 10-ha Scots pine plantation in Essa Township, Midhurst District.

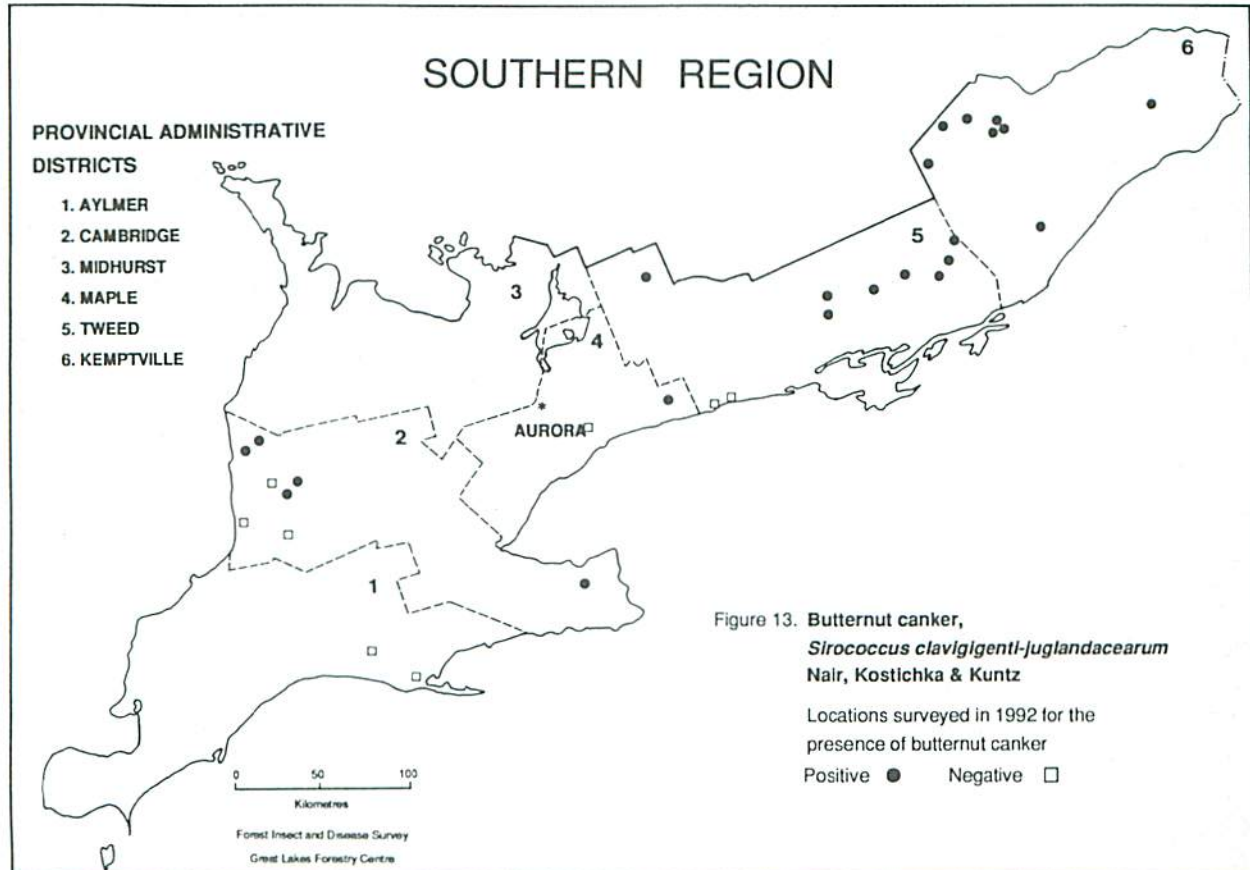
**Table 11. Other forest diseases.**

Organism	Host(s)	Remarks
<i>Apiognomonia veneta</i> (Sacc. & Speg.) Höhnelt Anthracnose	Sy	Foliar damage of 40% was recorded on a single 12-m tree in the National Capital Commission Park, Nepean Twp, Kemptville District.
<i>Cronartium ribicola</i> J.C. Fischer White pine blister rust	ewP	In Charlotteville Twp, Aylmer District, a 2-ha plantation of 1.1-m trees had 1.6% of the trees affected, and in a 3-ha plantation in Holland Twp, Midhurst District, 0.7% were affected.
<i>Cytospora pruinosa</i> (Fr.) Sacc. Cytospora canker	wAs	A 5-ha plantation in Harwich Twp, Aylmer District, sustained 5% mortality and severe top dieback. This disease is often associated with trees stressed by long-term drought conditions.
<i>Cytospora</i> sp.	NM	Twenty dead 5-year-old "Crimson King" maples ( <i>Acer platanoides</i> L. cv. Crimson King) were found in a private nursery in Essa Twp, Midhurst District.
<i>Ascodichaena rugosa</i> Butin Beech bark scurf	Be	This fungus was collected from trees that were previously heavily infested by the beech scale in Presqu'ile Provincial Park, Brighton Twp, Tweed District.
<i>Diplodina acerina</i> (Pass.) B. Sutton Diplodina leaf spot	sM	Foliar damage of up to 20% was recorded on a number of maples in a woodlot in Goderich Twp, Cambridge District.
<i>Endocronartium harknessii</i> (J.P. Moore) Y. Hirats. Western gall rust	ScP	In a 1-ha Christmas tree plantation in Huntingdon Twp, Tweed District, 10% of the 2.1-m trees were found to have main-stem infections. Several trees were found to have main-stem infections in a planted area at the southern gate of Canadian Forces Base Borden, Midhurst District.
<i>Eutypella parasitica</i> Davidson & Lorenz Eutypella canker	sM	This fungus was found on a number of declining roadside maples in Gainsborough and Caistor Townships, Cambridge District, and on a single tree in the Hofstetter Lake Plot in Wilmot Township, Cambridge Twp.
<i>Guignardia aesculi</i> (Peck) V.B. Stewart Leaf blotch	hChe	Nine mature roadside trees averaged 50% foliar damage in the town of Fort Erie, Cambridge District.

(cont'd)

**Table 11. Other forest diseases. (concl.)**

Organism	Host(s)	Remarks
<i>Gymnosporangium juniperi-virginianae</i> Schwein. Cedar-apple rust	erC	Severely affected trees were observed throughout the range of the host in the eastern portion of Tweed District.
<i>Marssonina</i> sp. Leaf spot	W	A number of trees in a marshy area sustained an average of 25% foliar damage at Point Royal, South Walsingham Twp, Aylmer District.
<i>Mycosphaerella dearnessii</i> Barr Brown-spot needle blight	muP	Heavy infection levels (>75%) were recorded on numerous trees in Sauble Falls Provincial Park, Midhurst District, and in the town of Prescott, Augusta Twp, Kemptville District, 1.1-m ornamental trees sustained 40% foliar damage.
<i>Mycosphaerella populorum</i> G.E. Thompson Septoria leaf spot	bPo	More than 75% of the leaves were infected on host trees along County Road 22 in Essa Twp and along County Road 9 in Proton Twp, Midhurst District.
<i>Tubakia dryina</i> (Sacc.) B. Sutton Leaf spot	rO	100% of the trees were affected, resulting in 20% foliar damage on several 14.5-m trees on Cedar Island in Pittsburgh Twp, Tweed District. The disease was also observed on oak trees in Turkey Point Provincial Park, Aylmer District, at defoliation levels of 5 to 10%.





## ABIOTIC DAMAGE

### Frost Damage

Frost damage was widespread in the Midhurst, Maple, Cambridge and Aylmer districts; however, damage levels were generally low (<5%) throughout the areas affected. The majority of the damage occurred on open-grown roadside and fenceline trees. The most severe damage occurred on red oak and white oak seedlings at the Midhurst OMNR Tree Nursery, where incidence levels of 100% and foliar damage of 75% were recorded (see *Forest Tree Nursery Report*).

In Mornington Township, Cambridge District, a 1-ha area of 4.2-m white pine had 30% of the trees affected, averaging 5% foliar damage. In Charlotteville Township, Aylmer District, several rows of 0.6-m balsam fir in a lowlying area of a plantation sustained 20% shoot mortality, and in Laxton Township, Lindsay District, an average shoot mortality of 5% was typical of damage observed on various affected coniferous species.

### Hail Damage

A localized midsummer hailstorm in Charlotteville Township, Aylmer District, caused foliar damage averaging 65% in a 48-ha woodlot, composed mainly of beech (*Fagus grandifolia* Ehrh.) and red maple (*Acer rubrum* L.). Surrounding woodlots and adjacent roadside trees also sustained damage, but to a lesser extent. Southwest of the town of Elmvale in Tiny Township, Midhurst District, 35% foliar damage was detected in a 5-ha area of trembling aspen, Scots pine and willow.

### Winter Drying

All of the trees sustained branch-tip mortality in a 1-ha eastern white pine plantation of 1-m trees, and a 5% whole-tree mortality rate occurred in a 1-ha planting of eastern white cedar in Delhi Twp, Aylmer District.

### Herbicide Damage

An effort to control poison ivy with a mixture of 2,4-D and ammonium sulphamate resulted in several pockets of 10 to 15 dead trees in a 17-year-old, 8-ha plantation at Canadian Forces Base Borden, in Midhurst District.

### Leaf Scorch

At one location in Hillier Twp, Tweed District, 39% of the 16-m sugar maple trees sustained an average of 43% foliar damage. Several trees were recorded with a 100% foliar damage level.

## FOREST HEALTH

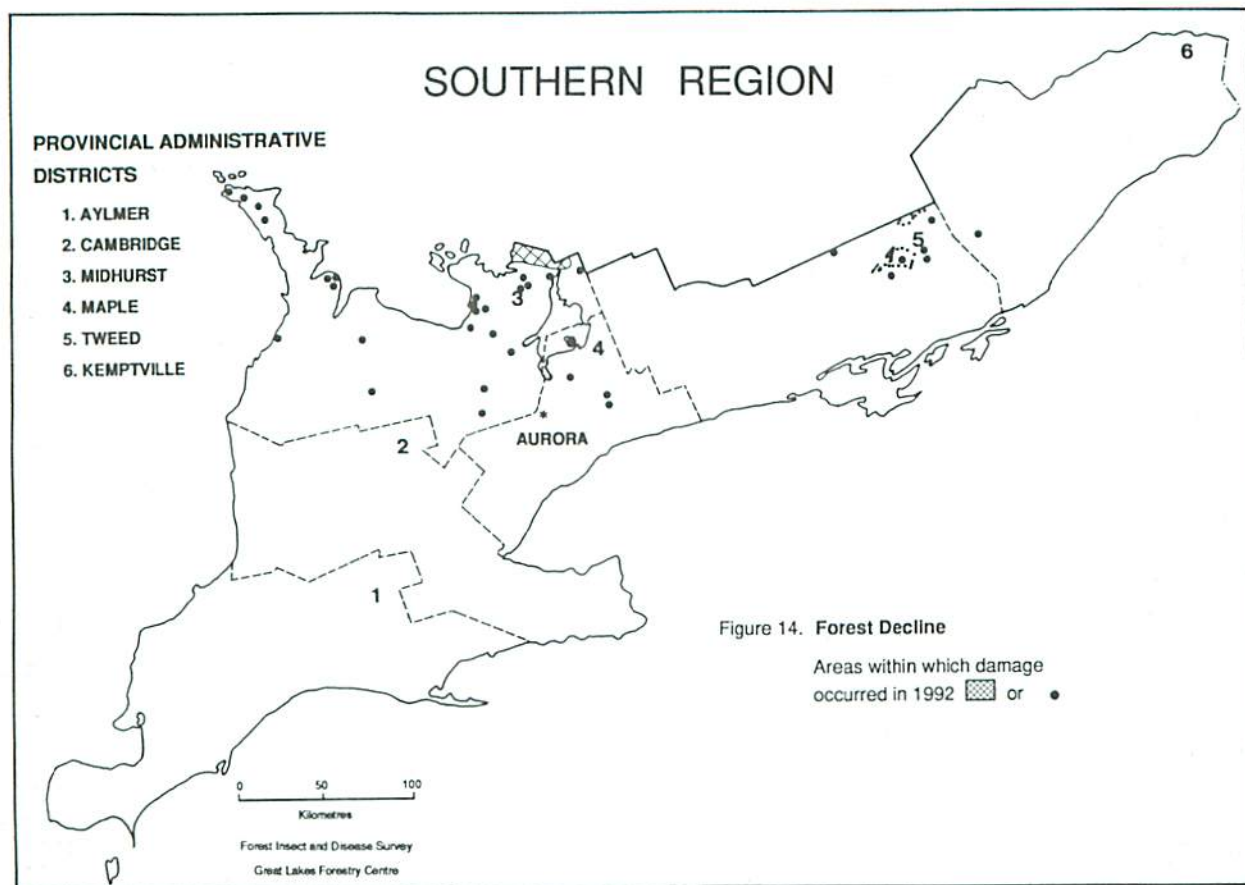
### Decline

Extensive aerial and ground surveys revealed a high incidence of dieback across the north-central portion of the region in both deciduous and coniferous stands. The largest area of continuous damage, some 25,575 ha, was detected where the Cambrian shield extends across the northeastern corner of Midhurst District. The affected zone extends eastward from the shores of Georgian Bay in the Honey Harbour area, encompassing most of Matchedash Township, across the northeastern corner of Orillia Township into the edge of Rama Township. The tree species growing in this area of open rock comprise mainly scrub red oak, scattered immature eastern white pine and pockets of aspen (*Populus* spp.) and white birch. In the eastern end of Tweed District, numerous scattered pockets of dead and dying red oak were aerially sketch-mapped across some 3,880 ha. The two largest areas occurred in the southwestern corner of Kennebec Township, covering some 1,200 ha, and across some 850 ha in the northwestern corner of adjacent Sheffield Township. Several additional pockets were mapped in this township, totaling 755 ha. In Olden Township, nine pockets were mapped, totaling approximately 450 ha. A single 10-ha pocket was detected as far east as the town of Westport, North Crosby Township, in Kemptonville District (Fig. 14).

The majority of the affected areas have very limited access; however, cruise lines were established wherever possible to quantify the level of damage. On the western side of Sparrow Lake in Orillia Township, Midhurst District, 68% of the trees were dead in one red oak stand and the remaining 32% sustained >50% crown dieback; 31% of the trees were dead in a second area along the northwestern edge of Matchedash Township and the remaining trees averaged 30% crown dieback. In Tweed District, similar surveys in Olden Township revealed that 66% of the trees were dead and the remaining 34% sustained an average of 60% crown dieback. In Sheffield Township, a similar survey revealed that 46% of the trees had died and the remaining 54% had sustained an average of 65% crown dieback. Several recently dead trees examined in these areas were found to be heavily infected with *Armillaria* root rot and infested by large populations of woodborers and bark beetles.

Eastern white cedar showed definite signs of decline throughout much of St. Edmunds Township across the northern end of the Bruce Peninsula in Midhurst District. Dead tops and branches within the living crowns were commonly observed in jack pine stands in the southern end of St. Edmunds Township and northern portion of Lindsay township. Branch and whole-tree mortality was also recorded in numerous sugar maple stands in Keppel





Township. The OMNR reported that in one woodlot in this area, >75% of the semimature trees were dead. Moderate levels of decline were also observed in sugar maple stands in Holland Township. In Uxbridge Township, Maple District, and in Sunnidale and Glenelg townships in Midhurst District, large (4 to 5 ha) pockets of decline were found in semimature red pine plantations. Each of these plantations were growing on rocky limestone sites, which is the probable cause of the decline.

Elsewhere, small areas of dead and dying trees were commonly encountered across much of the northern portion of Midhurst District. Damage was observed in small (<0.5 ha) pockets of trembling aspen at numerous locations along the edges of farm fields; in stands of eastern hemlock (*Tsuga canadensis* [L.] Carr.) growing in a lowlying area in Essa Township; and in eastern white cedar stands on sandy ridges in the Wasaga and Sauble beach areas.

### Maple Health

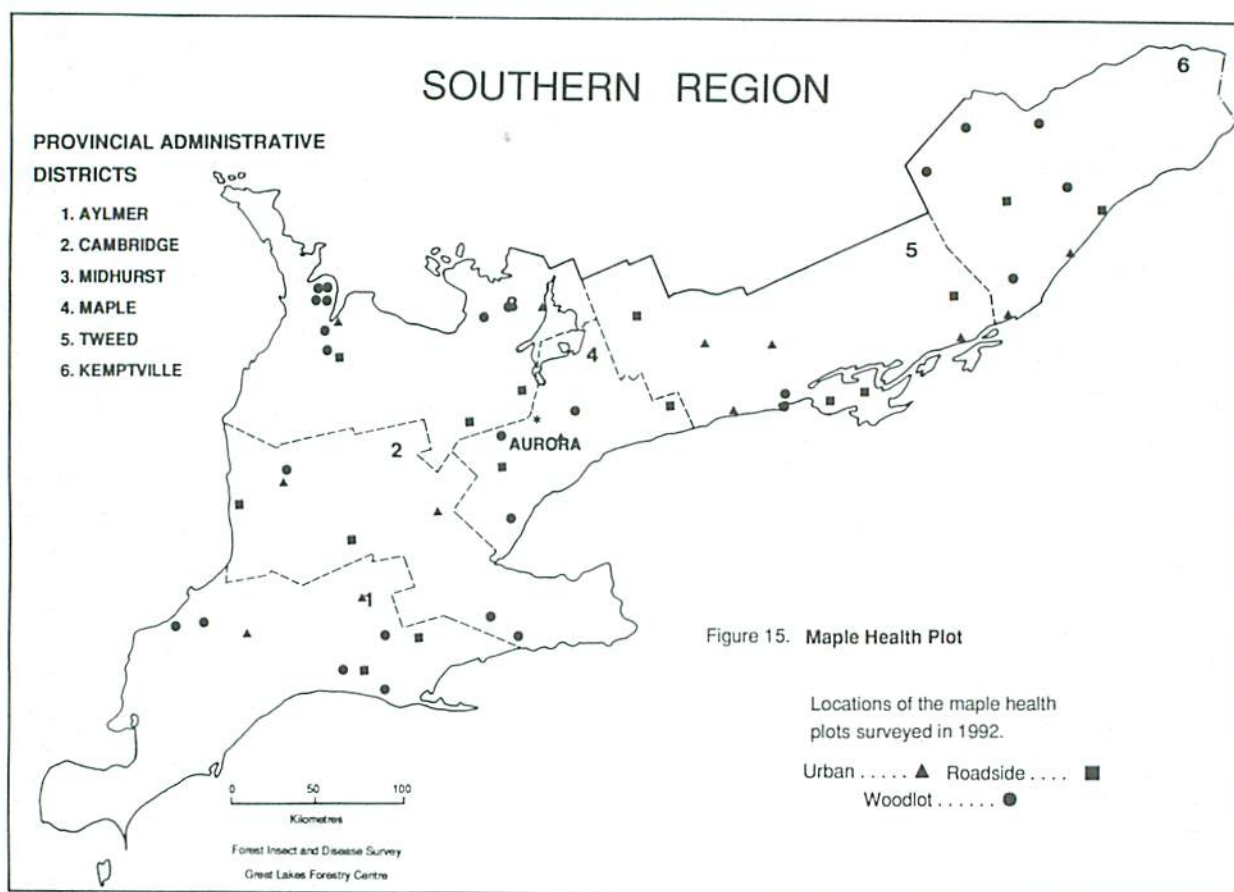
Fifty-six maple health plots, comprising 26 woodlots, 14 urban and 16 roadside stands, are monitored annually across the region (Fig. 15). Twenty-two woodlot plots were established in 1987, and all of the urban and roadside plots were established in 1989. Four additional

woodlot plots were established in Keppel Township, Midhurst District, in 1990 in response to the heavy forest tent caterpillar defoliation occurring in the area. At each of these 25-tree plots, the individual crowns are rated annually to determine the current level of total dieback. All pest conditions that are affecting the vigor of the trees (e.g., defoliation, stem wounds and frost damage) are also recorded. The complete results of the annual crown evaluations for the three different plot types are presented in Tables 12, 13 and 14.

By 1992, 630 (96.9%) of the originally tallied woodlot trees were still alive when the stands were evaluated in early August. The survey revealed that 97.9% of these trees were very healthy, with crown dieback levels of less than 20%. The current mortality level was recorded at 0.2% and an additional 0.2% of the trees had been cut down since last year. Of the remaining trees, only 1.7% were considered to have a severe decline problem, i.e., >20% crown dieback.

Of the original 350 urban trees 334 (95.4%) survived and were evaluated; 89.5% had <20% dieback. No current whole-tree mortality was recorded; however, 2.7% of the trees had been cut down. The remaining 7.8% of the trees were rated as being in a severe state of decline.





**Table 12. Summary of data collected at 26 woodlot maple health plots in the Southern Region of Ontario from 1987 to 1992 (counts based on an examination of 25 sugar maple trees at each location).**

Location (Township)	Average		Year	Cumulative dieback class <sup>a</sup>						Cumulative number of cut/windfall trees
	Height (m)	DBH (cm)		Number of trees						
				0	1	2	3	4	5	
<i>Aylmer District</i>										
Houghton	24	33.3	1987	25	0	0	0	0	0	0
			1988	25	0	0	0	0	0	0
			1989	25	0	0	0	0	0	0
			1990	25	0	0	0	0	0	0
			1991	24	1	0	0	0	0	0
			1992	25	0	0	0	0	0	0
Malahide	22	35.3	1987	25	0	0	0	0	0	0
			1988	25	0	0	0	0	0	0
			1989	24	1	0	0	0	0	0
			1990	22	3	0	0	0	0	0
			1991	22	3	0	0	0	0	0
			1992	23	2	0	0	0	0	0
North Norwich	21	31.0	1987	25	0	0	0	0	0	0
			1988	25	0	0	0	0	0	0
			1989	25	0	0	0	0	0	0
			1990	25	0	0	0	0	0	0
			1991	25	0	0	0	0	0	0
			1992	25	0	0	0	0	0	0

(cont'd)

**Table 12. Summary of data collected at 26 woodlot maple health plots in the Southern Region of Ontario from 1987 to 1992 (counts based on an examination of 25 sugar maple trees at each location). (cont'd)**

Location (Township)	Average		Year	Cumulative dieback class <sup>a</sup>						Cumulative number of cut/windfall trees
	Height (m)	DBH (cm)		Number of trees						
				0	1	2	3	4	5	
<i>Aylmer District (concl.)</i>										
Plympton	22	29.3	1987	24	1	0	0	0	0	0
			1988	23	2	0	0	0	0	0
			1989	23	0	1	1	0	0	0
			1990	21	1	1	0	1	0	1
			1991	22	0	0	1	0	1	1
			1992	20	2	0	0	0	1	2
Warwick	27	31.3	1987	24	1	0	0	0	0	0
			1988	22	1	0	0	1	0	1
			1989	21	1	0	0	1	1	1
			1990	21	1	0	0	0	2	1
			1991	22	0	0	0	0	2	1
			1992	22	0	0	0	0	2	1
<i>Cambridge District</i>										
Morris	21	29.5	1987	25	0	0	0	0	0	0
			1988	25	0	0	0	0	0	0
			1989	24	1	0	0	0	0	0
			1990	23	2	0	0	0	0	0
			1991	23	2	0	0	0	0	0
			1992	25	0	0	0	0	0	0
Oneida	27	40.4	1987	25	0	0	0	0	0	0
			1988	24	1	0	0	0	0	0
			1989	19	1	3	1	0	0	1
			1990	20	4	0	0	0	0	1
			1991	20	3	1	0	0	0	1
			1992	21	3	0	0	0	0	1
South Cayuga	21	21.2	1987	25	0	0	0	0	0	0
			1988	25	0	0	0	0	0	0
			1989	24	1	0	0	0	0	0
			1990	24	1	0	0	0	0	0
			1991	22	2	1	0	0	0	0
			1992	24	1	0	0	0	0	0
<i>Kemptville District</i>										
Oxford on Rideau	24	35.6	1987	12	13	0	0	0	0	0
			1988	9	16	0	0	0	0	0
			1989	5	20	0	0	0	0	0
			1990	2	23	0	0	0	0	0
			1991	11	14	0	0	0	0	0
			1992	21	3	1	0	0	0	0
Rear of Leeds and Lansdowne	28	66.4	1987	16	8	1	0	0	0	0
			1988	12	12	1	0	0	0	0
			1989	0	20	2	0	0	3	3
			1990	2	18	0	0	0	5	5
			1991	13	5	0	0	0	7	7
			1992	16	2	0	0	0	7	7

(cont'd)



**Table 12. Summary of data collected at 26 woodlot maple health plots in the Southern Region of Ontario from 1987 to 1992 (counts based on an examination of 25 sugar maple trees at each location). (cont'd)**

Location (Township)	Average		Year	Cumulative dieback class <sup>a</sup>						Cumulative number of cut/windfall trees
	Height (m)	DBH (cm)		Number of trees						
				0	1	2	3	4	5	
<i>Kemptville District (concl.)</i>										
Nepean	20	37.1	1987	23	2	0	0	0	0	0
			1988	20	4	1	0	0	1	0
			1989	8	16	0	0	0	1	0
			1990	1	23	0	0	0	1	0
			1991	12	12	0	0	0	1	0
			1992	15	9	0	0	0	1	0
Lavant	22	37.6	1987	16	8	1	0	0	0	0
			1988	12	13	0	0	0	0	0
			1989	0	23	2	0	0	0	0
			1990	1	22	2	0	0	0	0
			1991	11	13	1	0	0	0	0
			1992	16	9	0	0	0	0	0
Pakenham	25	50.5	1987	12	11	2	0	0	0	0
			1988	4	19	2	0	0	0	0
			1989	1	22	2	0	0	0	0
			1990	0	18	6	1	0	0	0
			1991	0	24	1	0	0	0	0
			1992	7	13	4	0	0	1	0
<i>Maple District</i>										
Albion	29	39.7	1987	25	0	0	0	0	0	0
			1988	25	0	0	0	0	0	0
			1989	24	1	0	0	0	0	0
			1990	24	1	0	0	0	0	0
			1991	25	0	0	0	0	0	0
			1992	24	1	0	0	0	0	0
Trafalgar	35	43.6	1987	25	0	0	0	0	0	0
			1988	25	0	0	0	0	0	0
			1989	23	2	0	0	0	0	0
			1990	23	2	0	0	0	0	0
			1991	25	0	0	0	0	0	0
			1992	25	0	0	0	0	0	0
Whitchurch	21	35.5	1987	25	0	0	0	0	0	0
			1988	25	0	0	0	0	0	0
			1989	25	0	0	0	0	0	0
			1990	25	0	0	0	0	0	0
			1991	25	0	0	0	0	0	0
			1992	25	0	0	0	0	0	0
<i>Midhurst District</i>										
Derby	24	31.6	1987	25	0	0	0	0	0	0
			1988	25	0	0	0	0	0	0
			1989	25	0	0	0	0	0	0
			1990	25	0	0	0	0	0	0
			1991	25	0	0	0	0	0	0
			1992	25	0	0	0	0	0	0

(cont'd)

**Table 12. Summary of data collected at 26 woodlot maple health plots in the Southern Region of Ontario from 1987 to 1992 (counts based on an examination of 25 sugar maple trees at each location). (concl.)**

Location (Township)	Average		Year	Cumulative dieback class <sup>a</sup>						Cumulative number of cut/windfall trees
	Height (m)	DBH (cm)		Number of trees						
				0	1	2	3	4	5	
<i>Midhurst District (concl.)</i>										
Flos	27	33.4	1987	25	0	0	0	0	0	0
			1988	25	0	0	0	0	0	0
			1989	25	0	0	0	0	0	0
			1990	25	0	0	0	0	0	0
			1991	25	0	0	0	0	0	0
			1992	24	1	0	0	0	0	0
Keppel Conc. I	20	27.0	1990	25	0	0	0	0	0	0
			1991	24	1	0	0	0	0	0
			1992	24	1	0	0	0	0	0
Keppel Conc. XII	16	23.0	1991	8	16	1	0	0	0	0
			1992	25	0	0	0	0	0	0
Keppel Conc. XXI – Lot 22	24	32.1	1990	25	0	0	0	0	0	0
			1991	25	0	0	0	0	0	0
			1992	23	1	0	0	0	0	1
Keppel Conc. XXI – Lot 40	22	38.3	1990	25	0	0	0	0	0	0
			1991	25	0	0	0	0	0	0
			1992	25	0	0	0	0	0	0
Medonte	30	38.0	1987	25	0	0	0	0	0	0
			1988	25	0	0	0	0	0	0
			1989	21	4	0	0	0	0	0
			1990	17	7	1	0	0	0	0
			1991	17	7	1	0	0	0	0
			1992	11	13	1	0	0	0	0
Sullivan	26	42.2	1987	25	0	0	0	0	0	0
			1988	24	1	0	0	0	0	0
			1989	24	1	0	0	0	0	0
			1990	24	1	0	0	0	0	0
			1991	20	4	1	0	0	0	0
			1992	22	2	0	0	1	0	0
<i>Tweed District</i>										
Brighton, staff house	23	53.9	1987	14	11	0	0	0	0	0
			1988	10	14	1	0	0	0	0
			1989	5	20	0	0	0	0	0
			1990	5	18	0	0	0	1	0
			1991	5	17	1	1	0	1	0
			1992	14	8	1	0	1	1	0
Brighton, campsite	24	45.2	1987	20	4	1	0	0	0	0
			1988	3	22	0	0	0	0	0
			1989	3	22	0	0	0	0	0
			1990	3	22	0	0	0	0	0
			1991	3	15	2	1	0	4	4
			1992	11	8	0	1	1	4	4

<sup>a</sup> 0 = 0–5%, 1 = 6–20%, 2 = 21–40%, 3 = 41–60%, 4 = >60%, 5 = dead tree



**Table 13. Summary of data collected at 14 urban maple health plots in the Southern Region of Ontario from 1989 to 1992 (counts based on an examination of 25 sugar maple trees at each location).**

Location (Town)	Average		Year	Cumulative dieback class <sup>a</sup>						Cumulative number of cut/windfall trees
	Height (m)	DBH (cm)		Number of trees						
				0	1	2	3	4	5	
<i>Aylmer District</i>										
Strathroy	24	82.5	1989	21	4	0	0	0	0	0
			1990	22	3	0	0	0	0	0
			1991	23	1	0	0	0	0	1
			1992	21	3	0	0	0	0	1
Woodstock	23	63.4	1989	20	2	2	0	0	1	0
			1990	19	1	2	0	0	1	2
			1991	18	1	3	0	0	1	2
			1992	17	3	2	0	0	1	2
<i>Cambridge District</i>										
Blyth	23	74.3	1989	14	5	4	2	0	0	0
			1990	14	4	5	1	2	0	1
			1991	14	3	5	2	0	0	1
			1992	13	6	1	0	0	0	5
Guelph	18	70.5	1990	13	11	1	0	0	0	0
			1991	10	14	1	0	0	0	0
			1992	17	8	0	0	0	0	0
<i>Kemptville District</i>										
Brockville	23	64.0	1989	6	19	0	0	0	0	0
			1990	4	18	3	0	0	0	0
			1991	7	15	3	0	0	0	0
			1992	16	5	1	2	1	0	0
Gananoque	24	59.0	1989	3	19	3	0	0	0	0
			1990	7	12	6	0	0	0	0
			1991	3	21	1	0	0	0	0
			1992	16	4	3	0	0	0	2
<i>Maple District</i>										
Oakville	20	82.5	1989	13	10	2	0	0	0	0
			1990	14	10	1	0	0	0	0
			1991	12	11	1	0	0	0	1
			1992	17	5	1	0	0	0	2
Richmond Hill	15	57.9	1990	19	3	1	2	0	0	0
			1991	16	5	0	1	0	0	3
			1992	17	4	1	0	0	0	3
<i>Midhurst District</i>										
Orillia	21	66.1	1989	7	11	4	3	0	0	0
			1990	7	12	4	1	1	0	0
			1991	10	12	1	2	0	0	0
			1992	15	7	2	0	0	0	1
Owen Sound	26	91.0	1990	21	3	1	0	0	0	0
			1991	17	8	0	0	0	0	0
			1992	22	3	0	0	0	0	0

(cont'd)

**Table 13. Summary of data collected at 14 urban maple health plots in the Southern Region of Ontario from 1989 to 1992 (counts based on an examination of 25 sugar maple trees at each location). (concl.)**

Location (Town)	Average		Year	Cumulative dieback class <sup>a</sup>						Cumulative number of cut/windfall trees
	Height (m)	DBH (cm)		Number of trees						
				0	1	2	3	4	5	
<i>Tweed District</i>										
Cobourg	18	68.5	1989	10	10	3	1	1	0	0
			1990	9	10	3	2	1	0	0
			1991	11	9	3	2	0	0	0
			1992	6	15	2	1	0	0	1
Kingston	23	53.0	1989	11	13	1	0	0	0	0
			1990	6	17	2	0	0	0	0
			1991	3	19	2	0	0	1	1
			1992	12	9	3	0	0	1	1
Peterborough	19	51.1	1989	12	13	0	0	0	0	0
			1990	14	11	0	0	0	0	0
			1991	17	8	0	0	0	0	0
			1992	9	16	0	0	0	0	0
Campbellford	21	68.0	1989	1	20	4	0	0	0	0
			1990	0	12	7	1	0	5	5
			1991	0	16	3	0	0	6	6
			1992	4	10	3	1	1	6	6

<sup>a</sup> 0 = 0–5%, 1 = 6–20%, 2 = 21–40%, 3 = 41–60%, 4 = >60%, 5 = dead tree

**Table 14. Summary of data collected at 16 roadside maple health plots in the Southern Region of Ontario from 1989 to 1992 (counts based on an examination of 25 sugar maple trees at each location).**

Location (Township)	Average		Year	Cumulative dieback class <sup>a</sup>						Cumulative number of cut/windfall trees
	Height (m)	DBH (cm)		Number of trees						
				0	1	2	3	4	5	
<i>Aylmer District</i>										
Bayham	20	85.9	1989	23	2	0	0	0	0	0
			1990	22	2	1	0	0	0	0
			1991	22	2	1	0	0	0	0
			1992	17	8	0	0	0	0	0
Windham	23	81.9	1989	22	3	0	0	0	0	0
			1990	21	4	0	0	0	0	0
			1991	19	6	0	0	0	0	0
			1992	17	6	2	0	0	0	0
<i>Cambridge District</i>										
Goderich	19	72.4	1989	9	4	6	4	2	0	0
			1990	6	5	5	1	4	1	3
			1991	6	4	5	2	1	0	7
			1992	6	4	4	2	2	0	7
North Easthope	18	69.2	1989	4	12	5	2	2	0	0
			1990	2	6	8	4	4	1	0
			1991	2	5	5	7	5	1	0
			1992	4	5	8	1	5	1	1

(cont'd)



Table 14. Summary of data collected at 16 roadside maple health plots in the Southern Region of Ontario from 1989 to 1992 (counts based on an examination of 25 sugar maple trees at each location). (cont'd)

Location (Township)	Average		Year	Cumulative dieback class <sup>a</sup>						Cumulative number of cut/windfall trees
	Height (m)	DBH (cm)		Number of trees						
				0	1	2	3	4	5	
<i>Kemptville District</i>										
Edwardsburgh	21	47.0	1990	7	14	4	0	0	0	0
			1991	7	17	0	0	0	0	1
			1992	17	4	3	0	0	0	1
North Elmsley	22	68.0	1989	1	21	3	0	0	0	0
			1990	10	13	2	0	0	0	0
			1991	9	13	1	0	0	2	2
			1992	18	3	1	0	0	0	3
<i>Maple District</i>										
Chinguacousy	18	70.9	1990	6	8	5	5	0	0	0
			1991	6	8	5	1	4	0	1
			1992	8	8	2	3	3	0	1
Clarke	15	72.9	1989	9	7	6	1	2	0	0
			1990	7	10	5	1	0	1	1
			1991	6	16	1	0	0	1	1
			1992	5	16	2	0	0	1	1
<i>Midhurst District</i>										
Mono	18	54.0	1989	1	9	5	7	2	1	0
			1990	1	10	4	4	4	2	0
			1991	6	5	4	3	5	2	0
			1992	9	2	4	3	5	2	0
Sullivan	20	84.4	1990	9	11	5	0	0	0	0
			1991	12	11	2	0	0	0	0
			1992	13	10	1	0	0	0	1
West Gwillimbury	15	69.9	1989	8	7	4	5	1	0	0
			1990	8	7	4	4	2	0	0
			1991	9	7	7	0	2	0	0
			1992	12	9	2	0	2	0	0
<i>Tweed District</i>										
Fenelon	14	57.3	1989	12	7	5	1	0	0	0
			1990	5	14	3	3	0	0	0
			1991	5	14	4	2	0	0	0
			1992	2	17	3	1	1	0	1
Hallowell	26	59.0	1989	1	14	10	0	0	0	0
			1990	1	15	8	1	0	0	0
			1991	1	17	6	0	0	1	1
			1992	8	12	4	0	0	1	1
Hillier	19	67.0	1989	3	11	7	2	2	0	0
			1990	1	18	2	0	4	0	0
			1991	1	12	5	1	2	4	4
			1992	6	7	4	1	3	4	4

(cont'd)

**Table 14. Summary of data collected at 16 roadside maple health plots in the Southern Region of Ontario from 1989 to 1992 (counts based on an examination of 25 sugar maple trees at each location). (concl.)**

Location (Twp)	Average		Year	Cumulative dieback class <sup>a</sup>						Cumulative number of cut/windfall trees
	Height (m)	DBH (cm)		Number of trees						
				0	1	2	3	4	5	
<i>Tweed District (concl.)</i>										
Loughborough	22	70.0	1989	1	18	5	1	0	0	0
			1990	0	19	5	1	0	0	0
			1991	1	20	4	0	0	0	0
			1992	10	10	4	1	0	0	0
Somerville	25	49.0	1989	7	16	2	0	0	0	0
			1990	7	15	3	0	0	0	0
			1991	18	7	0	0	0	0	0
			1992	14	11	0	0	0	0	0

<sup>a</sup> 0 = 1–5%, 1 = 6–20%, 2 = 21–40%, 3 = 41–60%, 4 = >60%, 5 = dead tree

The survey of the 379 surviving roadside trees (94.8% of the original 400) found 78.6% to be very healthy, with <20% crown dieback. Once again, no current whole-tree mortality was found, but 1.1% of the trees had been cut down for one reason or another. The remaining 20.3% of the trees had severe crown dieback, with 27.3% of these trees with >60% dieback. This high incidence of dieback among the roadside trees is partially explained by root damage that resulted from road construction and ditching, and the annual plowing of adjacent farm fields.

It should be noted that in both the urban and roadside plots often the most severely declining trees on the plot are removed annually by municipalities, thereby affecting the overall percentage of severely declining trees. At a few locations, this has definitely changed the overall state of health of the plots.

Table 15 summarizes the yearly change in the crowns of the trees in the three different plot types, i.e., the percentage of trees that remained static, improved or declined from year to year. Examination of this table reveals that the crown condition of approximately 80% of the trees in the woodlot plots has remained unchanged through 6 years of surveys. The trend of woodlot trees declining, which reached a maximum of 13.9% in 1989, appears to be reversing since 1990, with 13.6% showing improvement in 1992. A similar pattern is evident in the urban and roadside plots.

A review of the yearly pest evaluations concluded that no serious defoliation levels had been recorded. Moderate-to-severe (>26%) defoliation was only recorded on 0.6% of the woodlot and urban trees and on 4.3% of the roadside trees. The majority of this defoliation was caused by a leaf disease (an anthracnose). This disease was most prevalent in the woodlot plots; however, higher levels of defoliation were recorded in the roadside plots. The roadside plots sustained the majority of the stem wounds and scars that were recorded, followed closely by the urban plots. The roadside plots also had the highest incidence of attacks by wood borers and bark beetles, an expected condition.

**Table 15. Summary of the yearly trend in maple health at 22 woodlot, 14 urban and 16 roadside plots in the Southern Region of Ontario from 1987 to 1992 (counts based on an examination of 25 trees at each location).**

Plot type	Years	Yearly trend (% of trees)			Percent of dead trees	Percent of cut/windfall trees
		Improved	Static	Declined		
Woodlot	1987–1988	1.6	91.0	7.2	0.2	0.2
	1988–1989	2.2	83.2	13.9	0.7	0.7
	1989–1990	3.3	88.9	7.7	0.0	0.5
	1990–1991	13.2	79.7	6.3	0.7	1.1
	1991–1992	13.6	80.0	6.4	0.2	0.2
Urban	1989–1990	8.0	73.4	15.7	2.9	2.6
	1990–1991	15.8	72.1	10.0	2.0	2.0
	1991–1992	23.6	62.6	11.1	0.0	2.7
Roadside	1989–1990	7.4	72.5	18.8	1.2	1.1
	1990–1991	21.3	63.1	12.8	2.8	3.2
	1991–1992	21.9	65.2	11.9	0.0	1.1



Armillaria root rot was recorded on a single tree in both a woodlot and an urban plot, and stem cankers, possibility caused by the fungus *Eutypella*, were found affecting four woodlot, three urban and 12 roadside trees.

### North American Maple Project (NAMP)

In 1988, 16 plots comprising a total of 778 trees were established across the region to monitor the crown conditions of sugar maple trees annually and to determine any possible causes of decline. These plots are part of a major project that involves four Canadian provinces and seven American states. Half of the plots are located in sugar bushes that are currently being tapped for maple syrup production and the other half are in untapped maple woodlots or stands.

In 1992, 96% of the original trees were still alive and were evaluated. The remaining 4.0% died (1.7%) or were cut down (2.3%). The overall condition this season for the majority of the trees was very healthy, with improvement seen in 63% of the plots. In 1992, 84% of the crowns were rated with 5% or less total dieback and only 0.9% had >50% of the crown dead. A current mortality rate of 0.4% was recorded, which equates to a single tree on each of three plots. These results are very similar to last year's, when it was determined that 83% of the trees were very healthy, with 5% or less dieback, and 0.7% had >50% crown dieback (Table 16).

Two plots in Midhurst District, however, showed definite signs of decline. In a tapped bush in Orillia Township, 18.9% of the trees were rated with 6 to 25% of the crown dead, virtually doubling the number rated at this level last year (9.4%). In an untapped bush in Adjala Township, 32.8% of the trees were also rated at this level, compared with only 12.9% in 1991. A similar condition was detected in an untapped bush in Hallowell Township, Tweed District, where 46.7% of the trees were rated in the 6-25% class versus 33.3% in 1991.

All pest problems that might affect the overall vigor of the trees are also rated annually. The gypsy moth was found causing approximately 5% defoliation in an untapped woodlot in Oro Township, Midhurst District, and the forest tent caterpillar was detected causing 10 to 20% defoliation in a tapped bush in South Burgess Township, Kemptville District. At nine of the plots, trace levels of defoliation (<5%) were recorded, caused by a combination of leaf rollers, a leaf midge and a leaf spot disease. The maple trumpet skeletonizer (*Epinotia aceriella* [Clem.]) was found at similar levels at six locations and an anthracnose disease in three plots caused 10 to 15% foliar damage. Trace levels of damage caused by the pear thrips (*Taeniothrips inconsequens* [Uzell]) were recorded in the Hallowell Township plot, Tweed District. This is a noticeable decline from the high levels of damage caused by this pest for the last few years. Selective logging in the early summer caused heavy damage to the crowns of the

**Table 16. Summary of the crown conditions of sugar maples at 16 North American Maple Project plots from 1989 to 1992 in the Southern Region of Ontario.**

Location (Township)	DBH (cm)	Year	Number of trees examined	Percentage of dead crown					Annual number of trees dead	Annual number of cut/windfall trees
				Number of trees						
				0-5	6-25	26-45	46-65	>65		
<i>Aylmer District</i>										
Bayhamb	73.5	1988	40	36	2	1	0	1	0	0
		1989	39	36	2	1	0	0	1	0
		1990	39	36	3	0	0	0	1	0
		1991	39	32	7	0	0	0	1	0
		1992	39	35	3	1	0	0	1	0
Blandforda	29.6	1988	42	42	0	0	0	0	0	0
		1989	42	42	0	0	0	0	0	0
		1990	42	41	1	0	0	0	0	0
		1991	42	41	1	0	0	0	0	0
		1992	42	41	1	0	0	0	0	0
Townsendb	41.1	1988	32	23	5	3	1	0	0	0
		1989	32	23	4	3	1	1	0	0
		1990	32	20	8	1	2	1	0	0
		1991	32	20	7	2	1	2	0	0
		1992	32	23	3	2	1	2	0	1

(cont'd)

**Table 16. Summary of the crown conditions of sugar maples at 16 North American Maple Project plots from 1989 to 1992 in the Southern Region of Ontario. (cont'd)**

Location (Township)	DBH (cm)	Year	Number of trees examined	Percentage of dead crown					Annual number of trees dead	Annual number of cut/windfall trees
				Number of trees						
				0-5	6-25	26-45	46-65	>65		
<i>Aylmer District (concl.)</i>										
Warwick <sup>a</sup>	26.5	1988	48	47	1	0	0	0	0	0
		1989	47	47	0	0	0	0	1	0
		1990	47	44	3	0	0	0	1	0
		1991	47	45	2	0	0	0	1	0
		1992	47	37	5	0	0	0	1	5
<i>Cambridge District</i>										
Goderich <sup>b</sup>	32.3	1988	62	53	7	0	1	1	0	0
		1989	60	53	5	2	0	0	1	1
		1990	60	54	5	0	1	0	1	1
		1991	60	53	5	1	0	1	0	2
		1992	60	56	2	1	0	0	1	2
West Wawanosha <sup>a</sup>	29.9	1988	36	34	2	0	0	0	0	0
		1989	36	35	1	0	0	0	0	0
		1990	36	33	3	0	0	0	0	0
		1991	36	33	3	0	0	0	0	0
		1992	36	35	1	0	0	0	0	0
<i>Kemptville District</i>										
South Burgess <sup>b</sup>	38.4	1988	42	31	9	2	0	0	0	0
		1989	42	14	27	1	0	0	0	0
		1990	42	31	11	0	0	0	0	0
		1991	42	37	5	0	0	0	0	0
		1992	42	34	7	1	0	0	0	0
Rear of Yonge and Escott <sup>a</sup>	19.1	1988	60	44	16	0	0	0	0	0
		1989	60	49	11	0	0	0	0	0
		1990	60	53	7	0	0	0	0	0
		1991	60	44	15	0	0	0	1	0
		1992	59	54	5	0	0	0	1	0
<i>Maple District</i>										
Nassagaweya <sup>a</sup>	30.0	1988	49	45	3	1	0	0	0	0
		1989	49	44	5	0	0	0	0	0
		1990	49	39	10	0	0	0	0	0
		1991	49	39	9	0	0	0	1	0
		1992	48	42	5	0	0	1	1	0
Vaughan <sup>b</sup>	30.8	1988	47	41	5	1	0	0	0	0
		1989	47	42	4	0	1	0	0	0
		1990	47	45	1	1	0	0	0	0
		1991	45	40	5	0	0	0	0	2
		1992	44	41	3	0	0	0	0	3
<i>Midhurst District</i>										
Adjala <sup>a</sup>	30.4	1988	65	61	4	0	0	0	0	0
		1989	65	51	12	1	0	1	0	0
		1990	63	43	19	0	0	1	2	0
		1991	62	53	8	0	0	1	3	0
		1992	61	38	20	1	1	1	4	0

(cont'd)



**Table 16. Summary of the crown conditions of sugar maples at 16 North American Maple Project plots from 1989 to 1992 in the Southern Region of Ontario. (concl.)**

Location (Township)	DBH (cm)	Year	Number of trees examined	Percentage of dead crown					Annual number of trees dead	Annual number of cut/windfall trees
				Number of trees						
				0-5	6-25	26-45	46-65	>65		
Midhurst District (concl.)										
Orillia <sup>b</sup>	36.7	1988	53	49	4	0	0	0	0	0
		1989	53	45	8	0	0	0	0	0
		1990	53	47	5	1	0	0	0	0
		1991	53	48	5	0	0	0	0	0
		1992	53	42	10	1	0	0	0	0
Oroa	23.5	1988	80	77	3	0	0	0	0	0
		1989	66	63	3	0	0	0	0	14
		1990	66	54	12	0	0	0	0	14
		1991	66	63	1	0	0	0	2	14
		1992	64	63	0	1	0	0	2	14
Saugeen <sup>b</sup>	30.8	1988	38	36	2	0	0	0	0	0
		1989	38	31	6	1	0	0	0	0
		1990	38	30	7	1	0	0	0	0
		1991	38	24	13	1	0	0	0	0
		1992	38	35	2	1	0	0	0	0
Tweed District										
Belmont <sup>b</sup>	26.6	1988	54	43	11	0	0	1	0	0
		1989	54	38	16	0	0	1	0	0
		1990	54	46	8	0	0	1	0	0
		1991	52	34	19	0	0	0	1	1
		1992	52	37	15	0	0	0	1	1
Hallowella	33.0	1988	30	15	15	0	0	0	0	0
		1989	30	17	13	0	0	0	0	0
		1990	30	17	13	0	0	0	0	0
		1991	30	20	10	0	0	0	0	0
		1992	30	15	14	0	0	0	1	0

<sup>a</sup> undisturbed woodlot

<sup>b</sup> trees currently tapped for maple syrup

residual trees in an untapped woodlot in Warwick Township, Aylmer District. A heavy seed crop, which caused the production of dwarf foliage, was recorded on many of the trees in several of the plots.

### Oak Health

The 10 oak health plots that were established across the region in 1977 are monitored annually to determine the extent of total crown dieback, damage by foliar pests, stem defects and abiotic conditions. Each plot consists of 100 mature or semimature oak trees. Table 17 provides the cumulative dieback per plot since 1984, broken into five classes, plus the number of windfall and cut trees per plot.

Over all, the percentage of dieback on the healthier trees decreased this season, with 22.5% showing virtually no dieback (0-5%), compared with 19.7% in the same category in 1991, and 39.0% of the trees falling into the 6-20% category, compared with 43.0% in 1991.

The proportion of trees showing a severe degree of decline (>61%) increased from 13% to 22% in 1992. This is to be expected, as a tree that sustains this high level of dieback is not likely to recover. Overall mortality increased marginally from 18.6% to 20.1%, with two plots showing no new mortality. This increase was skewed by a 7% increment in mortality in the plot near Flower Station in Lavant Township, Kemptonville District. This plot has been severely affected by drought conditions and defoliation

caused by the forest tent caterpillar and the gypsy moth in the last few years.

Table 18 summarizes the changes in crown conditions of all the trees on an annual basis since 1984. This table reveals that the majority of the trees (65.8%) have remained static over the years. Between 1990 and 1991, the trees improved in health following 3 years of decline. However, in the past year the increase in the amount of decline, as

mentioned above, is evident, with 21.3% of the trees declining.

The only major insect pest recorded this season was the gypsy moth. Six of the 10 plots were affected, with an incidence level of 34.7% and an average defoliation level of <5%. Similar defoliation levels were found on 39% of the trees in Clarke Township, Maple District, caused by the saddled prominent. The overall incidence of Armillaria

**Table 17. Summary of data collected at 10 oak health plots in the Southern Region of Ontario from 1984 to 1992 (counts based on an examination of 100 oak trees at each location since 1977).**

Location	Average height (m)	DBH (cm)	Year	Cumulative dieback classes <sup>a</sup>						Cumulative number of cut/windfall trees <sup>b</sup>
				Number of trees						
				0	1	2	3	4	5	
<i>Midhurst District</i>										
Tiny Twp – Awenda Prov. Pk	22.1	28.5	1984	6	56	10	3	1	9	15
			1985	4	62	8	1	1	9	15
			1986	30	42	3	0	0	10	15
			1987	41	29	4	0	0	11	15
			1988	30	37	7	0	0	11	15
			1989	8	50	12	4	0	11	15
			1990	7	48	11	7	1	11	15
			1991	7	57	4	1	1	15	15
			1992	20	39	6	2	1	17	15
Tiny Twp – Farlain Lake	22.0	26.0	1984	0	31	25	6	5	33	0
			1985	0	48	13	3	1	34	1
			1986	28	25	7	1	0	35	4
			1987	36	22	2	1	0	35	4
			1988	22	33	5	1	0	35	4
			1989	25	27	8	1	0	35	4
			1990	3	36	17	3	1	36	4
			1991	3	42	9	1	3	38	4
			1992	32	19	1	2	3	39	4
Mulmur Twp	21.0	28.8	1984	1	52	33	6	0	4	4
			1985	0	71	19	2	0	4	4
			1986	55	35	2	0	0	4	4
			1987	64	22	3	0	1	6	4
			1988	52	33	3	0	1	7	4
			1989	39	34	12	2	0	9	4
			1990	25	48	10	3	1	9	4
			1991	35	45	5	1	0	10	4
			1992	49	29	5	0	1	12	4
<i>Maple District</i>										
Uxbridge Twp	21.5	26.2	1984	0	40	27	6	3	24	0
			1985	0	53	17	4	1	25	0
			1986	0	62	12	1	0	25	0
			1987	4	46	24	0	0	26	0
			1988	3	46	24	1	0	26	0
			1989	7	47	17	2	0	27	0
			1990	10	44	14	1	0	31	0
			1991	13	47	9	0	0	31	0
			1992	20	45	2	0	1	32	0

(cont'd)



Table 17. Summary of data collected at 10 oak health plots in the Southern Region of Ontario from 1984 to 1992 (counts based on an examination of 100 oak trees at each location since 1977). (cont'd)

Location	Average height (m)	DBH (cm)	Year	Cumulative dieback classes <sup>a</sup>						Cumulative number of cut/windfall trees <sup>b</sup>
				Number of trees						
				0	1	2	3	4	5	
<i>Maple District (concl.)</i>										
Clarke Twp	20.6	24.5	1984	37	39	10	2	2	10	0
			1985	21	45	19	2	2	11	0
			1986	28	38	16	5	2	11	0
			1987	37	42	6	2	1	12	0
			1988	23	54	7	1	2	13	0
			1989	28	48	7	1	2	14	0
			1990	15	62	5	1	0	17	0
			1991	18	61	4	0	0	17	0
			1992	15	64	3	1	0	17	0
<i>Aylmer District</i>										
Bosanquet Twp	16.6	29.0	1984	0	80	12	2	2	4	0
			1985	60	27	3	1	4	5	0
			1986	70	20	1	0	2	7	0
			1987	76	13	0	1	3	7	0
			1988	73	13	0	2	4	8	0
			1989	50	29	7	1	1	12	0
			1990	41	31	10	0	4	14	0
			1991	42	30	6	2	4	16	0
			1992	38	29	6	5	6	16	0
South Walsingham Twp	17.0	22.0	1984	0	64	20	5	0	11	0
			1985	0	87	2	0	0	11	0
			1986	64	25	0	0	0	11	0
			1987	72	16	1	0	0	11	0
			1988	73	12	3	0	1	11	0
			1989	49	26	9	0	5	11	0
			1990	30	36	14	2	6	12	0
			1991	49	23	8	0	1	19	0
			1992	35	37	4	2	2	20	0
Charlotteville Twp	20.1	32.0	1984	4	75	16	2	2	1	0
			1985	6	82	6	2	3	0	0
			1986	29	62	4	2	1	2	0
			1987	35	56	4	2	1	2	0
			1988	40	48	8	1	1	2	0
			1989	3	53	38	0	1	5	0
			1990	1	37	48	8	0	6	0
			1991	25	50	19	0	0	6	0
			1992	14	52	23	3	1	7	0
<i>Kemptville District</i>										
Lavant Twp – Joe Lake	12.5	25.5	1984	0	26	44	15	8	7	0
			1985	0	26	48	14	5	7	0
			1986	0	30	43	12	5	10	0
			1987	3	40	32	11	3	11	0
			1988	4	58	23	4	0	11	0
			1989	2	49	26	11	0	12	0
			1990	0	43	37	2	3	15	0
			1991	0	26	56	1	1	16	0
			1992	0	31	41	7	4	17	0

(cont'd)

**Table 17. Summary of data collected at 10 oak health plots in the Southern Region of Ontario from 1984 to 1992 (counts based on an examination of 100 oak trees at each location since 1977). (concl.)**

Location	Average height (m)	DBH (cm)	Year	Cumulative dieback classes <sup>a</sup>						Cumulative number of cut/windfall trees <sup>b</sup>
				Number of trees						
				0	1	2	3	4	5	
<i>Kemptville District (concl.)</i>										
Lavant Twp – Flower Station	13.6	20.6	1984	0	19	49	19	3	10	0
			1985	0	31	47	11	1	10	0
			1986	0	39	43	4	2	12	0
			1987	5	51	26	3	3	12	0
			1988	6	59	22	1	0	12	0
			1989	1	70	11	5	0	13	0
			1990	2	75	5	1	2	15	0
			1991	5	53	28	3	3	18	0
1992	2	45	21	4	3	25	0			

<sup>a</sup> 0 = 0–5%, 1 = 6–20%, 2 = 21–40%, 3 = 41–60%, 4 = 61–100%, 5 = dead tree

<sup>b</sup> cumulative total from 1977

**Table 18. Summary of the yearly trend in tree health at 10 oak health plots from 1984 to 1992 (counts based on an examination of 100 oak trees at each location).**

Years	Yearly trend (% of trees)			Number of newly dead trees
	Improved	Static	Declined	
1984–1985	25.9	67.4	6.6	0.1
1985–1986	37.3	56.8	5.6	0.4
1986–1987	18.9	73.2	7.9	0.0
1987–1988	10.8	74.2	15.1	0.0
1988–1989	10.0	58.6	31.4	0.0
1989–1990	8.8	64.5	26.7	0.0
1990–1991	23.8	61.0	15.2	0.0
1991–1992	19.4	59.4	21.3	7.0

root rot remained at only 1%, with the incidence of this disease minimal in any one plot. In Clarke Township, Maple District, 12% of the trees showed damage from frost cracks, up by 1% from 1991. In South Walsingham Township, Aylmer District, 7% of the trees sustained trace levels of the foliar anthracnose disease *Apiognomonia errabunda*.

#### Acid Rain National Early Warning System (ARNEWS)

In 1984 and 1985, eight ARNEWS plots, targeting four specific tree species, were established across the region. The primary function of these plots is to monitor the effect of airborne pollutants on forest trees. An evaluation of all trees in the plots is conducted annually and, in addition to

possible pollution damage, all biotic and abiotic conditions affecting the trees are recorded. One sugar maple stand is monitored in each of the Aylmer, Cambridge, Kemptville and Midhurst districts, white pine plantations are monitored in the Cambridge and Tweed districts, a white spruce plantation is monitored in Kemptville District and a mixed red oak and black oak (*Quercus velutina* Lam.) stand in Aylmer District is monitored. To date, no visible damage caused by airborne pollutants has been recorded on any of the plot trees.

In each of the four sugar maple plots, 68 sugar maple trees are monitored yearly. Since the start of the project, five trees have died in these plots, one in 1992 of various causes determined to be other than acid rain. Armillaria root rot was identified as the cause of death for one tree. Stem decay has been reported on one tree at each of three plots, and on six trees at the Midhurst District plot. Because of the original guidelines established at the time the project was initiated, the actual plots trees cannot be destructively sampled; therefore, the fungi causing these stem decays has not been identified. In 1992, dead branch tips and dead branches within the living crown were recorded on >90% of the trees in the Aylmer and Midhurst plots and <30% of the trees in the Cambridge and Kemptville plots. Trace defoliation caused both by open defoliators, such as gypsy moth, leaf rollers, and leaf diseases, such as leaf spots and anthracnoses, was recorded in all of the plots.

In the two white pine plots, 93 trees are monitored yearly and 13 trees have died to date in the Tweed District plot and one in the Cambridge District plot. White pine blister rust has been reported annually in the Tweed District plot and may be the main reason for the high mortality rate in this plot. Three trees were listed as being currently



affected by this disease in 1992. Dead branches within the living crown were recorded on every tree in the Cambridge District plot. No insects or diseases were recorded causing defoliation, but it was recorded that only 3 years of foliage is being retained by the trees at each plot. Healthy, vigorously growing white pine can reportedly retain 5 to 7 years of foliage.

The single white spruce plot consisted originally of 69 trees, of which seven have now died, including two suppressed trees in 1992. The only major problem recorded in 1992 was moderate-to-severe defoliation on all of the trees, caused by the eastern spruce budworm. No dead branches or branch tips within the living crown were recorded.

All of the original 16 oak trees in the Aylmer District plot are still alive. The gypsy moth has caused severe defoliation on the plot trees in the past couple of years; however, only light-to-moderate defoliation occurred in 1992. Trace damage levels caused by the oak twig pruner (*Elaphidionoides* sp.) were detected on several plot trees. Dead branches within the living crown were recorded on 13 of the trees and the remaining three had dead branch tips.

## SPECIAL SURVEYS

### Forest Tree Nursery Reports

There are four OMNR Forest Tree Nurseries in Southern Region: the St. Williams nursery in Aylmer District, the Kemptville nursery in Kemptville District, the Orono nursery in Maple District and the Midhurst nursery in Midhurst District. The Midhurst District nursery, which is scheduled to be permanently closed in April 1993, only had a few compartments still operational in 1992. The following is a summary of information collected in the four nurseries during the 1992 field season.

#### St. Williams Forest Tree Nursery

Six routine inspections were made in this nursery. In Compartment C11, approximately 10% of the rising 1+2 Norway spruce were damaged by root girdling. Some pockets sustained damage as high as 15 to 20%, with overall mortality of <5%. Cutworm (*Euxoa* sp.) larvae were found in the soil and adults of the marsh crane fly (*Tipula paludosa* Meigen) were also identified in this compartment. Although both species probably contributed to the injuries, the feeding symptoms were more typical of the crane fly. The black vine weevil (*Otiorhynchus sulcatus* [F.]) caused root girdling on rising 1½+1½ eastern white cedar in Compartment D4, which resulted in trace levels of mortality. An adelgid (*Pineus* sp.) affected about 20% of the stems of rising 3-0 white pine in Compartment D2, with very little apparent damage. Cedar leafminers caused foliar browning of 10 to 15% on cedar hedgerows along

compartments A14, A15, B2, D5 and C2. Several 2-m eastern white pine in Compartment D3 were killed by two species of bark beetle, the pine engraver and the northern pine weevil (*Pissodes approximatus* Hopk.).

In Compartment D5, 5 to 10% of the rising 3-0 Norway spruce were affected by various degrees of shoot mortality. This problem was encountered to a lesser degree in other Norway spruce beds. The causal agent was never satisfactorily identified, but the presence of *Cladosporium* sp. was confirmed in the samples; this fungus usually causes a secondary infection on weakened trees. Fusarium root rot (*Fusarium* sp.) was identified in samples of 1+1 and G+1 eastern white pine in compartments B1 and E5, although not in enough quantity to be the main cause of the chlorosis and mortality observed in each compartment.

#### Kemptville Forest Tree Nursery

Four routine inspections were completed at this nursery. Low population levels of cedar leafminers caused <5% foliar damage on windbreaks throughout the nursery. The anthracnose *Gnomonia leptostyla* was found affecting 100% of the black walnut trees in Compartment C1, causing 20% foliar damage. Conifer-aspen rust (*Melampsora medusae* Thüm.) affected 100% of the poplar stool beds in compartments B4, 5, 7 and 8, and A1, 2, 7 and 11. Heavy infections by a leaf spot (*Mycosphaerella* sp.) on green ash (*Fraxinus pennsylvanica* Marsh. var. *subintegerrima* [Vahl] Fern.) in Compartment B1 caused 5% foliar discoloration, and another species of leaf spot (*Tubakia dryina* [Sacc.] B. Sutton) caused 80% foliar damage on 65% of the red oak seedlings in Compartment 49.

#### Orono Forest Tree Nursery

Six routine inspections were made in this nursery, and no major problems were detected. The eastern spruce budworm caused 30% defoliation on 16-m European larch windbreaks along Compartment S41 and light damage (<10%) in a white spruce seed production area and on white spruce windbreaks. Low population levels of a cedar leafminer also caused <10% foliar damage on cedar nursery windbreaks. In Compartment S43, less than 1% of the 1.2-m Scots pine were affected by the European pine sawfly.

Approximately 85% of the terminal shoots died on the European larch in Compartment S25. Damage was due in part to frost and winter desiccation, but *Cladosporium* sp., a tip blight, was also identified from samples. Frost heave affected 30% of 1+2 Norway spruce in compartments S23 and T43. An anthracnose (*Apiognomonia errabunda*) was found affecting 80% of the rising red oak seedlings in Compartment T92. Diplodia tip blight caused 40 to 60% shoot and whole-tree mortality (four trees) in 7-m Scots



pine. *Fusarium* root rot caused <1% mortality to white spruce in Compartment T53 and a 1% incidence level on red pine in Compartment S13.

#### Midhurst Forest Tree Nursery

Six routine inspections were completed at this nursery. The most serious condition encountered was frost damage on red oak, white oak and hybrid poplar. In compartments A39 and A3, rising 2-0 red oak and white oak had 100% of the seedlings affected, with 75% foliar damage. Compartment B3, rising 1-0 red oak, sustained similar damage levels on 25% of the seedlings, and Compartment C21, hybrid poplar clones (DN70 and DN2), had 100% of the seedlings affected, with 90% foliar damage. Despite the high injury levels, these seedlings recovered completely. Compartment B3 also had 20% of the seedlings infested by the gypsy moth, at a level of one or two insects per tree. Winter drying resulted in 40% top kill on rising 1½-2½ eastern white cedar in Compartment B7. Rising 2-0 eastern

white pine in Compartment A59 sustained 15% mortality from unidentified causes, but a root disease was suspected. In Compartment K6, *Fusarium* root rot caused mortality of less than 1% in the eastern white pine.

#### Climatic Data

The FIDS Unit maintains daily and monthly averages of weather conditions for numerous locations throughout the province. This is done because seasonal variations and sudden and extreme changes in normal weather patterns have a direct effect on the occurrence of both biotic and abiotic conditions. The data is also compiled to permit accurate prediction of the emergence of overwintering larvae of some of the major forest pests. Table 19 summarizes the weather data for 1992 provided by Atmospheric Environment Service weather offices in the Southern Region of Ontario. The "normals" quoted were taken directly from the Canadian Climate Normals for Ontario from 1951 to 1980.

**Table 19. A summary of temperatures and precipitation in 1992 at seven locations in the Southern Region of Ontario, and deviations from the 30-year norms.**

Location	Month	Mean temperature (°C)		Deviation from normal (°C)	Total precipitation (mm)		Deviation from normal (%)
		Normal	Actual		Normal	Actual	
Peterborough Airport	Jan.	-9.3	-7.4	+1.9	44.1	52.0	+17.9
	Feb.	-8.5	-6.8	+1.7	48.9	47.0	-3.9
	March	-2.5	-3.9	-1.4	62.9	62.6	-0.5
	April	6.0	4.7	-1.3	71.8	95.8	+33.4
	May	12.1	11.6	-0.5	57.1	81.8	+43.2
	June	16.8	14.9	-1.9	60.4	33.2	-45.0
	July	19.2	16.5	-2.7	77.9	61.6	-20.9
	Aug.	18.1	16.5	-1.6	74.2	154.8	+108.6
	Sept.	14.0	13.3	-0.7	72.9	95.8	+31.4
	Oct.	7.9	5.8	-2.1	59.9	54.6	-8.8
	Nov.	2.1	1.7	-0.4	69.4	100.4	+44.6
	Dec.	-6.0	-5.0	+1.0	74.3	90.0	+21.1
Lester B. Pearson International Airport	Jan.	-6.7	-4.2	+2.5	50.4	37.2	-26.2
	Feb.	-6.1	-3.9	+2.2	46.0	35.0	-23.9
	March	-1.0	-1.2	-0.2	61.1	21.7	-64.5
	April	6.2	5.6	-0.6	70.0	133.8	+91.1
	May	12.3	12.3	0.0	66.0	69.7	+5.6
	June	17.7	16.4	-1.3	67.1	37.2	-44.6
	July	20.6	18.0	-2.6	71.4	134.5	+88.4
	Aug.	19.7	17.9	-2.0	76.8	154.4	+101.0
	Sept.	15.5	14.7	-0.8	63.5	98.4	+54.9
	Oct.	9.3	7.4	-1.9	61.8	65.8	+6.4
	Nov.	3.3	2.8	-0.5	62.7	107.2	+70.9
	Dec.	-3.5	-1.7	+1.7	64.7	56.5	-12.7

(cont'd)



**Table 19. A summary of temperatures and precipitation in 1992 at seven locations in the Southern Region of Ontario, and deviations from the 30-year norms. (cont'd)**

Location	Month	Mean temperature (°C)		Deviation from normal (°C)	Total precipitation (mm)		Deviation from normal (%)
		Normal	Actual		Normal	Actual	
London	Jan.	-6.6	-4.3	+2.3	75.2	93.2	+23.9
	Feb.	-6.1	-4.4	+1.7	60.5	66.3	+9.6
	Mar.	-0.9	-0.7	+0.2	75.1	53.2	-29.2
	April	6.4	5.3	-1.1	81.2	86.8	+6.9
	May	12.4	12.9	-0.5	66.9	55.0	-17.8
	June	17.9	15.9	-2.0	73.6	65.8	-10.6
	July	20.3	18.1	-2.2	72.4	204.8	+182.9
	Aug.	19.5	17.3	-2.2	80.3	138.4	+72.3
	Sept.	15.4	15.0	-0.4	78.6	150.2	+91.0
	Oct.	9.4	7.5	-1.9	73.4	86.1	+17.3
	Nov.	3.1	2.9	-0.2	84.7	162.3	+91.6
	Dec.	-3.5	-1.7	+1.8	87.5	101.8	+16.3
Delhi	Jan.	-6.0	-3.7	+2.3	68.8	96.7	+40.5
	Feb.	-5.4	-3.4	+2.0	56.8	64.6	+13.7
	March	-0.3	-0.4	-0.1	84.4	55.8	-33.9
	April	6.7	5.6	-1.1	93.6	103.3	+10.4
	May	12.8	13.4	+0.6	73.7	41.2	-44.0
	June	18.3	16.7	-1.6	75.0	77.7	+3.6
	July	20.7	18.9	-1.8	76.6	174.5	+127.8
	Aug.	19.8	18.2	-1.6	96.3	102.0	+5.9
	Sept.	15.9	15.6	-0.3	88.4	120.2	+35.9
	Oct.	9.9	7.8	-2.1	90.3	80.4	-10.9
	Nov.	3.7	3.7	0.0	101.4	161.8	+59.6
	Dec.	-2.9	-1.0	+1.9	116.2	84.1	-27.6
Blyth	Jan.	-7.9	-5.6	+2.3	105.8	193.0	+82.4
	Feb.	-8.2	-4.8	+3.4	67.2	65.0	-3.3
	Mar.	-2.8	-2.6	+0.2	62.7	74.0	+18.0
	April	5.1	4.7	-0.4	71.9	150.5	+109.3
	May	11.8	12.3	+0.5	73.7	105.5	+43.0
	June	17.0	15.3	-1.7	75.0	80.5	+7.3
	July	19.7	16.7	-3.0	76.6	145.5	+89.9
	Aug.	18.8	16.7	-2.1	96.3	160.0	+66.1
	Sept.	15.1	14.9	-0.2	88.4	150.0	+69.6
	Oct.	8.7	n/a	n/a	90.3	n/a	n/a
	Nov.	2.5	n/a	n/a	101.4	n/a	n/a
	Dec.	-4.3	n/a	n/a	116.2	n/a	n/a
Ottawa International Airport	Jan.	-7.6	-11.6	-0.7	61.0	72.8	+19.3
	Feb.	-9.5	-9.6	-0.1	60.3	78.2	+29.7
	Mar.	-3.0	-6.0	-3.0	67.5	97.0	+43.7
	April	5.6	4.9	-0.7	69.1	51.4	-25.6
	May	12.8	13.3	+0.5	67.9	63.6	-6.3
	June	18.0	17.1	-0.9	73.4	57.8	-21.2
	July	20.6	17.9	-2.7	85.9	186.3	+116.9
	Aug.	19.2	18.2	-1.0	88.4	105.0	+18.8
	Sept.	14.3	13.9	-0.4	79.3	76.6	-3.4

(cont'd)

**Table 19. A summary of temperatures and precipitation in 1992 at seven locations in the Southern Region of Ontario, and deviations from the 30-year norms. (concl.)**

Location	Month	Mean temperature (°C)		Deviation from normal (°C)	Total precipitation (mm)		Deviation from normal (%)
		Normal	Actual		Normal	Actual	
Ottawa International Airport (concl.)	Oct.	8.1	6.0	-2.1	68.1	46.6	-34.5
	Nov.	1.2	1.2	0.0	86.1	94.0	+9.1
	Dec.	-7.7	-5.3	-2.4	82.9	51.7	-37.6
Trenton Air Base	Jan.	-7.6	-7.0	+0.6	68.9	33.5	-51.3
	Feb.	-6.5	-5.6	+0.9	57.0	46.0	-19.3
	Mar.	-1.0	-3.4	-2.4	72.0	89.6	+24.4
	April	6.4	5.2	-1.2	76.1	86.2	+13.3
	May	12.5	12.1	-0.4	73.0	76.0	+4.1
	June	17.8	15.8	-2.0	63.7	27.4	-57.0
	July	20.6	17.8	-2.8	60.9	78.2	+28.4
	Aug.	19.7	17.4	-2.3	71.9	72.2	+0.4
	Sept.	15.3	14.0	-1.3	72.8	115.0	+57.9
	Oct.	9.2	2.3	-6.9	70.1	125.9	+79.6
	Nov.	3.2	6.3	+3.1	86.1	58.8	-31.7
	Dec.	-4.5	-3.6	+0.9	82.9	90.1	+8.7