

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

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SURVEY HIGHLIGHTS

The year 1992 was one of changes. The newly created Central Region required corresponding changes by the Forest Insect and Disease Survey Unit. Coverage of pest problems in Central Region is now met by four FIDS rangers, Chuck Jones, Dave Constable, Tim Bouwmeester and Steve Payne, working out of the following respective locations: Minden, Sault Ste. Marie, Skead and Chalk River. Except for Steve Payne, who replaced Paul Bolan in 1992, the remaining FIDS rangers have spent at least 3 years at the aforementioned field locations. The year was also one of weather extremes, a dry spring followed by a wet and cool summer, delaying insect and disease development. This report reviews the more important insect, disease and abiotic conditions encountered during aerial and ground surveys of the forested areas in the Central Region of Ontario in 1992.

Reduced populations of two major hardwood defoliators were recorded in 1992. The area of moderate-to-severe defoliation caused by the gypsy moth decreased by 81% to 21,112 ha, and the area infested by large populations of the forest tent caterpillar shrank to 78,677 ha, and further decreases are predicted.

Numbers of two major pests of conifers, the eastern spruce budworm and the jack pine budworm, increased, with 30,775 and 157,478 ha of moderate-to-severe defoliation occurring, respectively. Populations of both are forecast to increase. The pine false webworm continued to be a problem in red pine plantations in the southern part of the region.

Surveys for Scleroderma canker, especially infection by the European race of the fungus, were again conducted and positive identification of the European strain was reported in 15 red pine plantations.

Special surveys done in 1992 included assessments for specific insect and disease problems in a number of seed orchards and evaluation of white pine blister rust in several plantations. Drought, insect defoliation, Armillaria root rot and poor site are major factors contributing to widespread decline of some tree species, especially oak, resulting in 38,321 ha of moderate-to-severe decline and tree mortality.

Fifty-five sugar maple health plots, three oak health plots, nine Acid Rain National Early Warning System (ARNEWS) plots and eight North American Maple Project (NAMPP) plots were re-evaluated.

As in previous years, pests in this report are categorized as follows:

Major Insects or Diseases

capable of causing severe injury to or death of living trees or shrubs.

Minor Insects or Diseases

capable of causing sporadic or localized injury but not usually a serious threat to living trees or shrubs.

Other Forest Insects and Diseases (Tables)

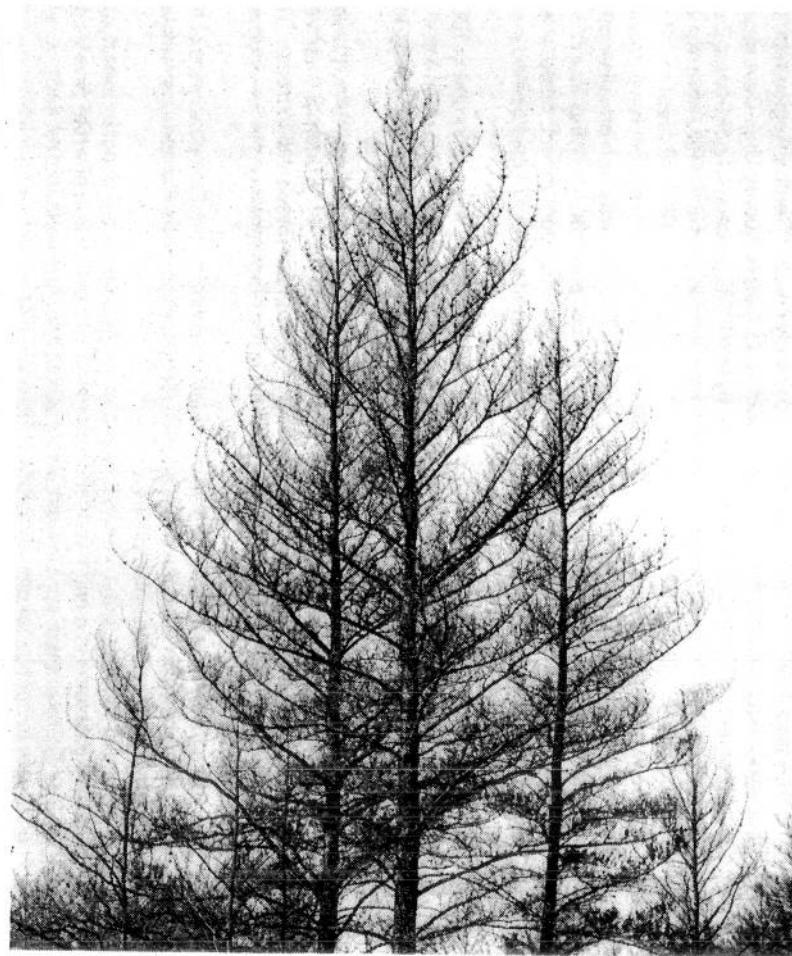
These tables provide information on two types of pest:

- (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 in 1992.

The valuable assistance and cooperation extended to the authors by OMNR staff during the 1992 field season are gratefully acknowledged.

*C.G. Jones
D.C. Constable
S.G. Payne
T. Bouwmeester*

FRONTISPIECE



Moderate-to-severe defoliation of balsam fir (*Abies balsamea* [L.] Mill.) (left) and jack pine (*Pinus banksiana* Lamb.) (right) caused by the eastern spruce budworm (*Choristoneura fumiferana* [Clem.]) and the jack pine budworm (*Choristoneura pinus pinus* Free.), respectively.

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INSECTS

Major Insects

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

The pine false webworm continues to be a serious problem of red pine (*Pinus resinosa* Ait.) plantations in the southern half of the region. Although this insect prefers the older foliage, it will consume the current growth when population levels are high enough, further affecting tree health. Twelve red pine plantations ranging in height from 0.6 to 3.1 m were assessed to determine defoliation levels (Fig. 1).

The incidence of trees attacked in five plantations examined in Bancroft District (in Airy, Mayo, Monteagle, Minden and Snowdon townships) averaged 78% and accompanying defoliation of the previous year's growth ranged from 9 to 57%. Defoliation of current growth averaged 7% at the one location in Monteagle Township (Table 1).

Moderate-to-severe defoliation was encountered in a number of plantations in Parry Sound District. Assessments in three of them (two in McMurrich Township and one in Armour Township) determined that the entire sample was attacked and defoliation of the previous year's growth

averaged 52%. Defoliation of current growth ranging up to 90%, but averaging 24%, on 89% of the sample was recorded at the two locations in McMurrich Township.

Defoliation of the previous year's growth averaged 35% on 85% of the 600 trees sampled in four plantations in Pembroke District, one in each of Bromley and Westmeath townships and two in Horton Township. Loss of current foliage averaged 7% at the two locations in Horton Township.

Control operations against the pine false webworm were carried out by OMNR in a number of red pine plantations in the Bancroft and Parry Sound districts using the chemical insecticide Sevin®.

Bronze Birch Borer, *Agrilus anxius* Gory

Forest and ornamental white birch (*Betula papyrifera* Marsh.) in many parts of the region were attacked by the bronze birch borer. This pest prefers weakened trees, of which there are large numbers stressed by the combination of prolonged drought and defoliation by the forest tent caterpillar; in some areas, there has been defoliation by the gypsy moth as well. Although tree mortality was common to most parts of the region, significant mortality was experienced in some areas, especially those with shallow soils. This included the western part of Bancroft District, a

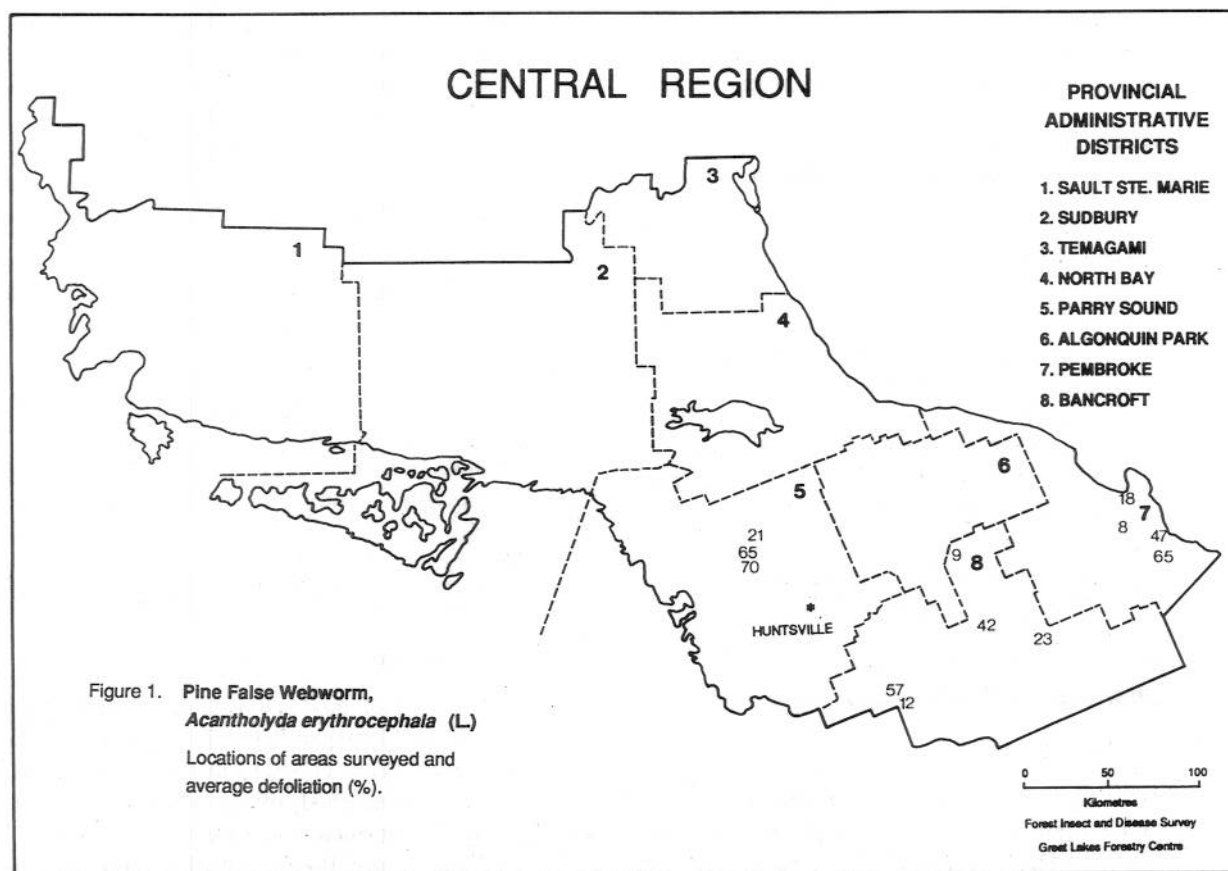


Table 1. Damage caused by the pine false webworm at 12 locations in the Central Region of Ontario in 1992 (counts based on an examination of 150 randomly selected red pine trees at each location).

Location (Township)	Average height of trees (m)	Estimated trees per ha	Estimated area affected (ha)	Trees affected		Average defoliation	
				new growth (%)	old growth (%)	new growth (%)	old growth (%)
<i>Bancroft District</i>							
Airy	0.8	1,500	2	0	14	0	9
Mayo	2.1	2,250	3	0	97	0	23
Minden	2.5	2,700	3	57	100	4	57
Monteagle	1.2	2,500	3	41	97	7	42
Snowdon	3.1	2,300	5	0	81	0	12
<i>Parry Sound District</i>							
Armour	2.7	3,500	3	0	100	0	21
McMurrich	2.4	3,100	15	83	100	29	65
McMurrich	3.8	1,800	11	95	100	19	70
<i>Pembroke District</i>							
Bromley	2.1	1,500	4	0	68	0	8
Horton	0.6	2,200	10	53	87	6	47
Horton	2.2	1,500	7	85	100	8	65
Westmeath	2.0	2,200	2	0	85	0	18

large part of Parry Sound District and the southeastern part of Sudbury District. A 100-tree survey of 13-m white birch in Mowat Township, Parry Sound District, found that 51% of the trees had recently died, and a large number of them had been attacked by this wood borer. Ornamental white birch were also commonly attacked in the region.

Birch Skeletonizer, *Bucculatrix canadensisella* Cham.

In 1992, there was an expansion in the area infested by this late-season insect compared with 1991. High population levels caused moderate-to-severe defoliation (20 to 100%) to all age classes of white birch in infested areas. In Central Region, there was one large area of damage plus two smaller areas (Fig. 2). The large infested area included most of the southeastern portion of the region, encompassing the Algonquin Park and Bancroft districts, northern Parry Sound District, western Pembroke District and south-eastern Sudbury District. A second area of damage was observed in northern North Bay District and in southern Temagami District. In Sault Ste. Marie District, there were a few scattered areas of light-to-moderate damage.

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

Provincial Situation

The area of moderate-to-severe defoliation caused by the eastern spruce budworm in the province increased from 9,065,781 ha in 1991 to 9,595,762 ha in 1992 (Fig. 3 and Table 2). The main body of infestation extended eastwards

from the Manitoba border to the Hearst and Wawa districts of Northeast Region. Separate pockets of moderate-to-severe damage occurred in the Algonquin Park, Sault Ste. Marie and Sudbury districts of Central Region. As well, high population levels continue to infest white spruce (*Picea glauca* [Moench] Voss) in the Kemptville, Maple and Midhurst districts of Southern Region.

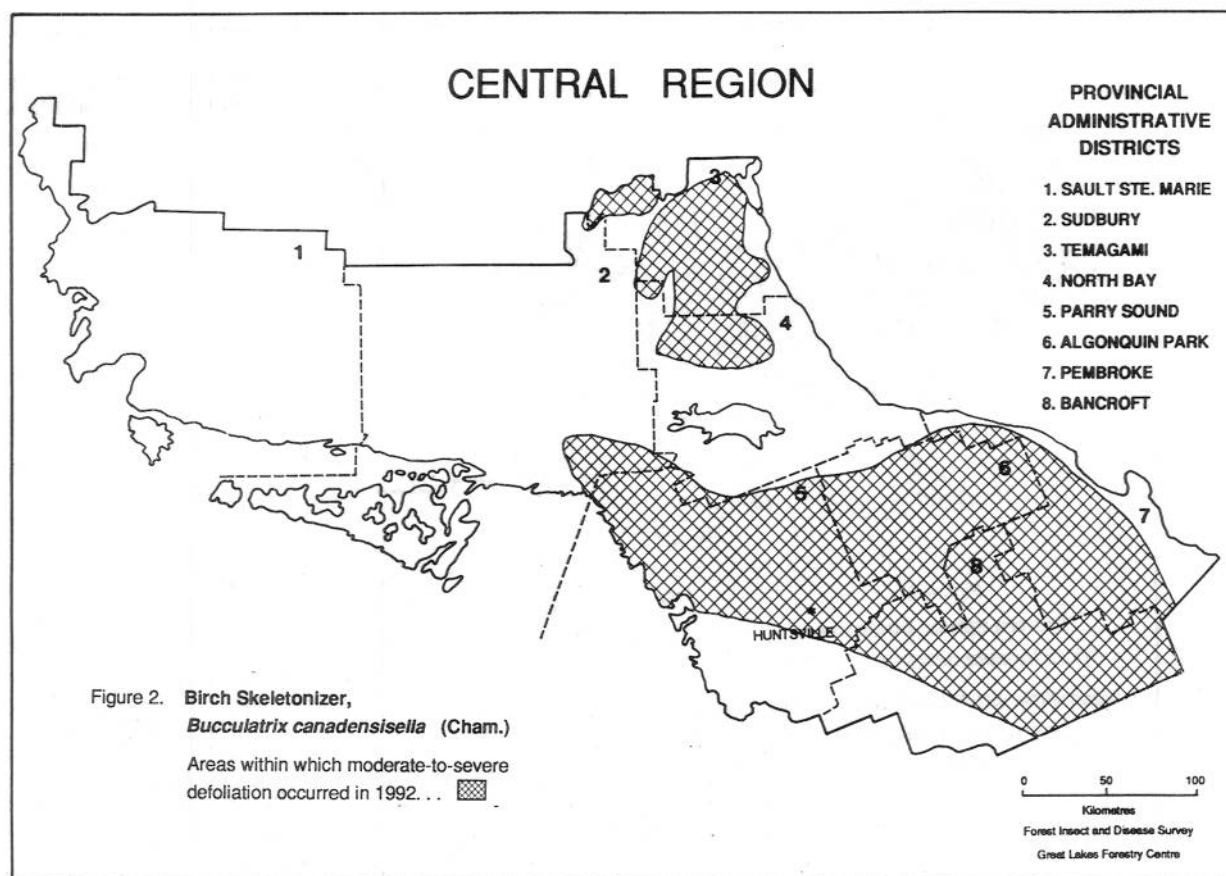
Associated whole-tree mortality and top kill of balsam fir (*Abies balsamea* [L.] Mill.) and white spruce in the province increased by 207,063 ha (to 3,943,442 ha) in 1992.

Table 2. Gross area of moderate-to-severe defoliation caused by the eastern spruce budworm in 1991 and 1992 in Ontario.

Region	Area of defoliation (ha)		Change (ha)
	1991	1992	
Northwestern	8,167,018	7,473,883	-693,135
Northeastern	887,010	2,091,080	+1,204,070
Central	11,720	30,775	+19,055
Southern	33	24	-9
Total	9,065,781	9,595,762	+529,98

Central Region

The area of moderate-to-severe infestation that has occurred in Algonquin Park District since 1990 expanded considerably from 11,640 ha in 1991 to 26,900 ha in 1992 (Table 3). A single body of moderate-to-severe damage was delineated, encompassing parts of Osler, Bishop, Devine, Butt, Paxton and Biggar townships (Fig. 4). Host trees (balsam fir and white spruce) in some areas experienced total



loss of the current year's growth and in some cases extensive backfeeding on the older foliage. An aerial survey detected 2,590 ha of balsam fir tree and top mortality within this infestation. Tree mortality counts for balsam fir, one in the Gibson Lake area and the other at Loontail Lake, indicated 12 and 16% tree mortality, respectively.

Increased populations were also noted in North Bay District and this was reflected in the 1,545 ha of medium-to-heavy infestation delineated in parts of Crerar, Hugel and Kirkpatrick townships.

Populations expanded in Sudbury District, with large numbers of budworms causing 1,365 ha of moderate-to-severe defoliation of balsam fir and white spruce in parts of Henry, Ratter, Dunnet, Hagar, Denison, Bidwell and Allen townships.

Surveys determined 965 ha of medium-to-heavy infestation in Sault Ste. Marie District, occupying parts of Kirkwood, Houghton and Rose townships. Most of the damage in these areas, ranging from 35 to 75%, occurred on semimature or mature white spruce. Moderate-to-severe defoliation of ornamental and forest trees was also re-

corded in the town of Sault Ste. Marie, where assessment disclosed up to 80% defoliation of balsam fir and white spruce.

In 1992, the pheromone trapping program was expanded to a total of 31 locations. Three traps were deployed at each site (Table 4). Trap catches increased at most locations common to 1991 and 1992 and trap catches ranged up to 7,073 moths.

Egg-mass sampling was conducted at 57 locations across the region and 1993 infestation forecasts are that various degrees of damage will occur, with moderate-to-severe defoliation being forecast at a number of locations (Table 5).

Table 3. Gross area of moderate-to-severe defoliation by the eastern spruce budworm in the Central Region of Ontario from 1990 to 1992.

District	Area of defoliation (ha)			Change (ha)	
	1990	1991	1992	1991	1992
Algonquin Park	2,815	11,640	26,900	+8,825	+15,260
North Bay	0	10	1,545	+10	+1,535
Sault Ste. Marie	0	0	965	0	+965
Sudbury	0	70	1,365	+70	+1,295
Total	2,815	11,720	30,775	+8,905	+19,055

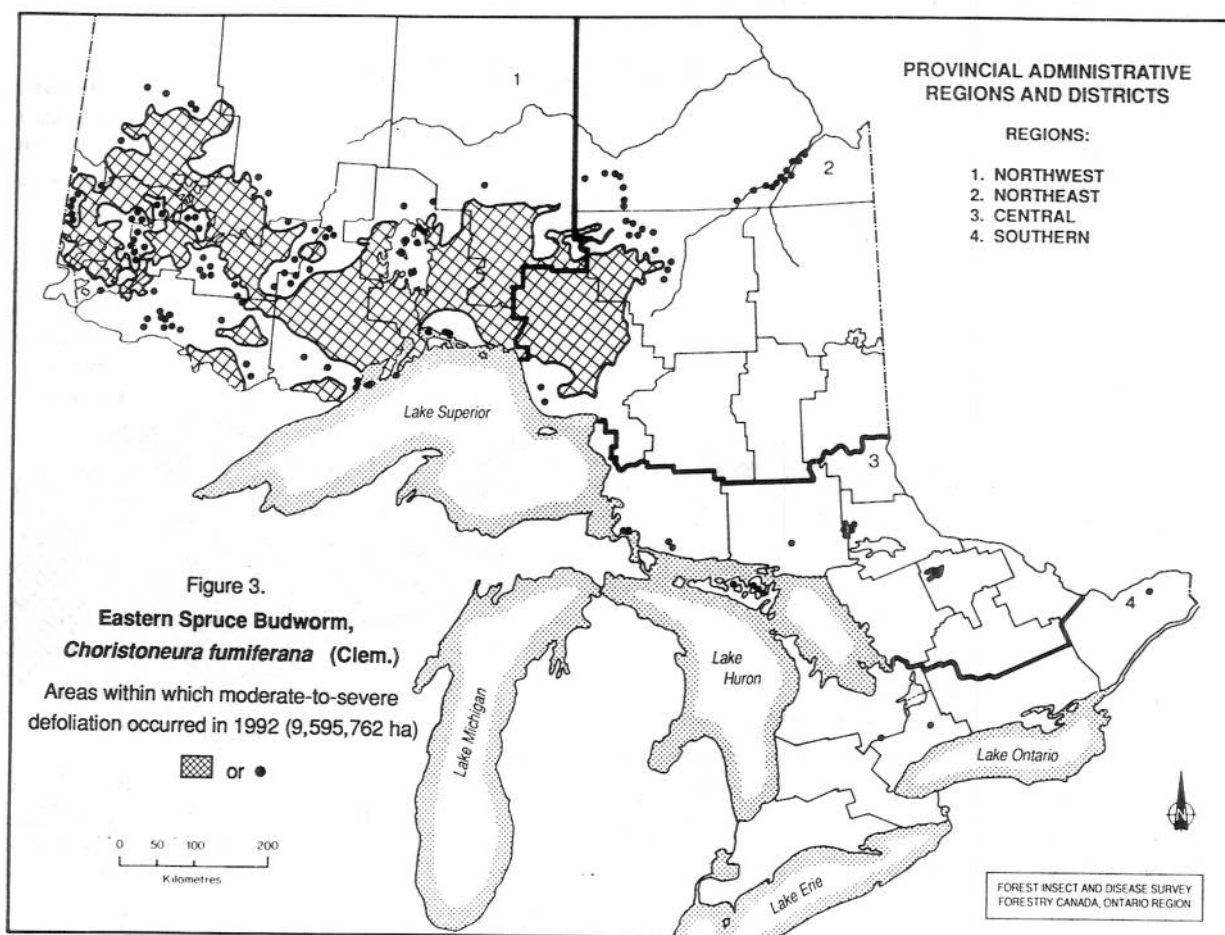


Table 4. Results of eastern spruce budworm pheromone trapping in eight districts of the Central Region of Ontario in 1991 and 1992.

Location (Township)	Number of adults trapped		Location (Township)	Number of adults trapped	
	1991	1992		1991	1992
Algonquin Park District			Sault Ste Marie District (concl.)		
Stratton	633	643	Kirkwood	915	4,738
White	622	962 ^a	Laronde	—	635
Bancroft District			Nicholas	—	397
Denbigh	—	193	Peever	—	175 ^b
Hindon	140	340	Villeneuve	—	156
North Bay District			Sudbury District		
Macbeth	—	567	Antrim	—	811
Jocko	—	66	Baldwin	—	184
Sisk	—	161	Cleland	—	124
Parry Sound District			Dowling	405	292
Bethune	530	1,169	Drury	—	293
Spence	221	414	Gerow	—	143
Pembroke District			Gervais	—	294
Alice	782	2,447	Hugel	—	7,073 ^b
Sault Ste Marie District			Venturi	—	490
Assalin	—	117	Temagami District		
Gaudette	—	263	Barr	—	222
Jollineau	204	281	Brewster	—	55
Kincaid	—	181	Gillies Limit	—	82 ^a
		(cont'd)	Strathcona	30	71

^a two traps missing

^b one trap missing

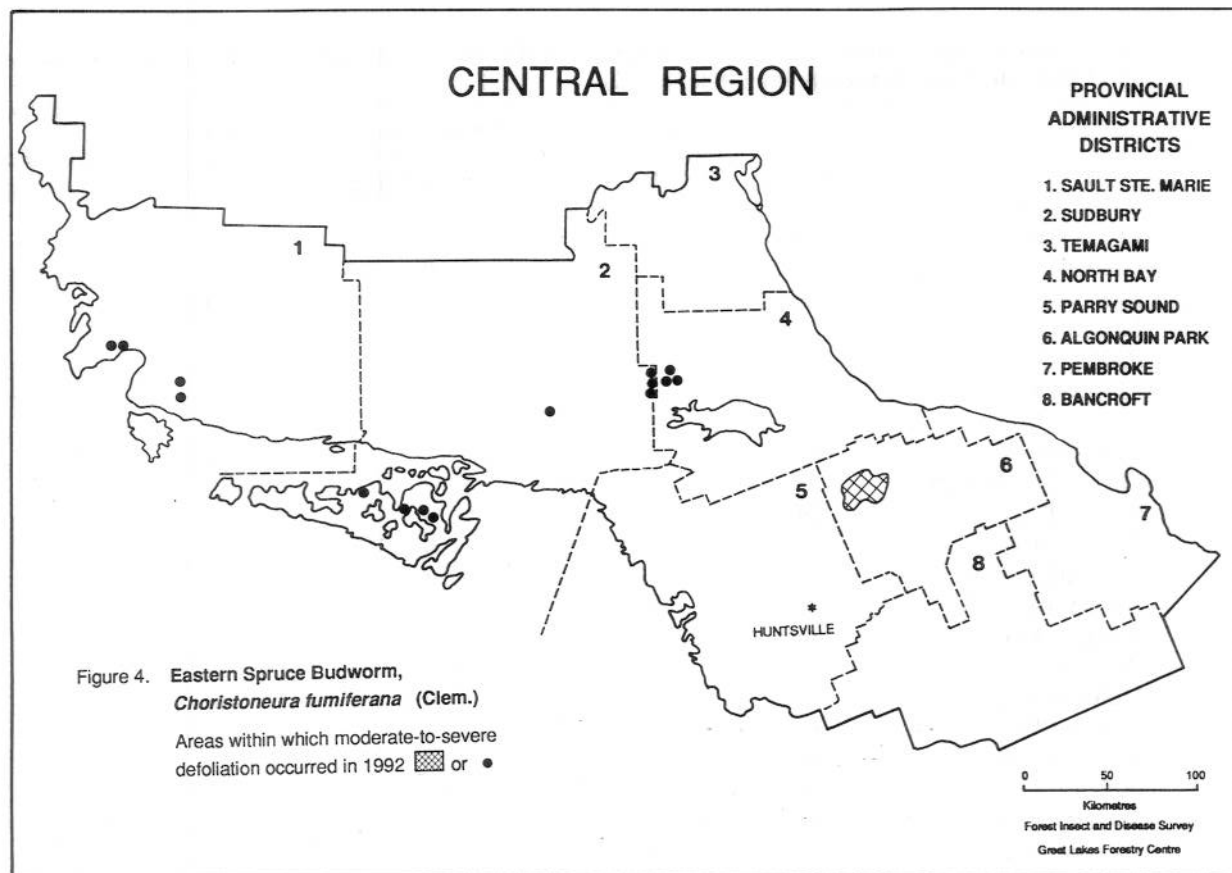


Table 5. Eastern spruce budworm in the Central Region of Ontario: defoliation estimates and egg-mass counts in 1992 and infestation forecasts for 1993.

Location	Host	Estimated % defoliation 1992	Number of egg masses per 9.29 m ² of foliage	Infestation forecast for 1993 ^a	Accumulated damage ^b
<i>Algonquin Park District</i>					
Biggar Twp					
– Gibson Lake	bF	91	131	M–S	3
– Gibson Lake West	bF	85	254	S	2
– Loontail Lake	bF	78	353	S	4
Lister Twp	bF	49	57	M	1
Stratton Twp	wS	2	43	L–M	0
White Twp	bF	4	13	L–M	0
Wilkes Twp	bF	6	0	0	0
<i>Bancroft District</i>					
Denbigh Twp	bF	1	0	0	0
<i>North Bay District</i>					
Crerar Twp	bF	14	80	M–S	0
Hugel Twp	bF	37	650	S	0
Jocko Twp	bF	0	0	0	0
Kirkpatrick Twp	bF	19	10	L	0
Macbeth Twp	bF	0	13	L	0
McWilliams Twp	bF	0	0	0	0
Sisk Twp	bF	0	0	0	0
South Himsworth Twp	bF	3	0	0	0

(cont'd)

Table 5. Eastern spruce budworm in the Central Region of Ontario: defoliation estimates and egg-mass counts in 1992 and infestation forecasts for 1993. (concl.)

Location	Host	Estimated % defoliation 1992	Number of egg masses per 9.29 m ² of foliage	Infestation forecast for 1993 ^a	Accumulated damage ^b
<i>Parry Sound District</i>					
Bethune Twp	bF	1	0	0	0
Laurier Twp	bF	3	0	0	0
McMurrich Twp	bF	0	10	L-M	0
Mowat Twp	bF	0	0	0	0
Ridout Twp	bF	0	7	L	0
Spence Twp	bF	1	0	0	0
<i>Pembroke District</i>					
Alice Twp	bF	4	15	L-M	0
<i>Sault Ste Marie District</i>					
Asselin Twp	bF	0	0	0	0
Gaudette Twp	bF	0	0	0	0
Galbraith Twp	bF	0	8	L	0
Herrick Twp	bF	0	16	L	0
Jollineau Twp	bF	0	0	0	0
Kirkwood Twp	wS	30	345	S	0
LaRonde Twp	bF	0	0	0	0
Nicholas Twp	bF	0	0	0	0
Parkinson Twp	bF	0	0	0	0
Peever Twp	bF	0	0	0	0
Tarentorus Twp	bF	77	708	S	2
Spragge Twp	bF	0	0	0	0
Tarbutt Additional Twp	bF	1	0	0	0
Villeneuve Twp	bF	0	0	0	0
<i>Sudbury District</i>					
Antrim Twp	wS	6	41	L-M	0
Baldwin Twp	bF	0	0	0	0
Bidwell Twp	bF	31	0	0	0
Boon Twp	bF	13	20	L-M	0
Cascaden Twp	bF	18	11	L	0
Densin Twp	wS	27	126	M-S	0
Dunnet Twp	bF	22	55	M	0
Fraleck Twp	bF	0	0	0	0
Mongowin Twp	bF	0	19	L-M	0
Ratter Twp	wS	61	1,123	S	1
Robinson Twp	wS	11	0	0	0
Salter Twp	bF	24	13	L	0
Venturi Twp	bF	0	0	0	0
Waldie Twp	bF	0	0	0	0
Weeks Twp	bF	1	0	0	0
<i>Temagami District</i>					
Barr Township	bF	0	0	0	0
Brewster Twp	bF	0	0	0	0
Gillies Limit	wS	0	0	0	0
Olive Twp	bF	0	7	L	0
Strathcona Twp	bF	0	0	0	0

^a S = severe, M = moderate, L = light, 0 = nil

^b 0 = undamaged; 1 = light damage, <25% total defoliation, usually one season of severe defoliation; 2 = moderate damage, 25-60% total defoliation, two or three seasons of severe defoliation; 3 = severe damage, 60-80% total defoliation, three to five seasons of severe defoliation, will recover; 4 = moribund or dying, 80-100% total defoliation, crowns gray in appearance, top 50-150 cm dead or bare.

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

Provincial Situation

Significant changes in the area and distribution of medium-to-heavy infestation were recorded in 1992. Across the province, 158,704 ha of moderate-to-severe defoliation were aerially mapped, 99.2% of which occurred in Central Region (Fig. 5). The infestation in Northwest Region almost collapsed and a small new area of damage was observed in Tweed District, Southern Region.

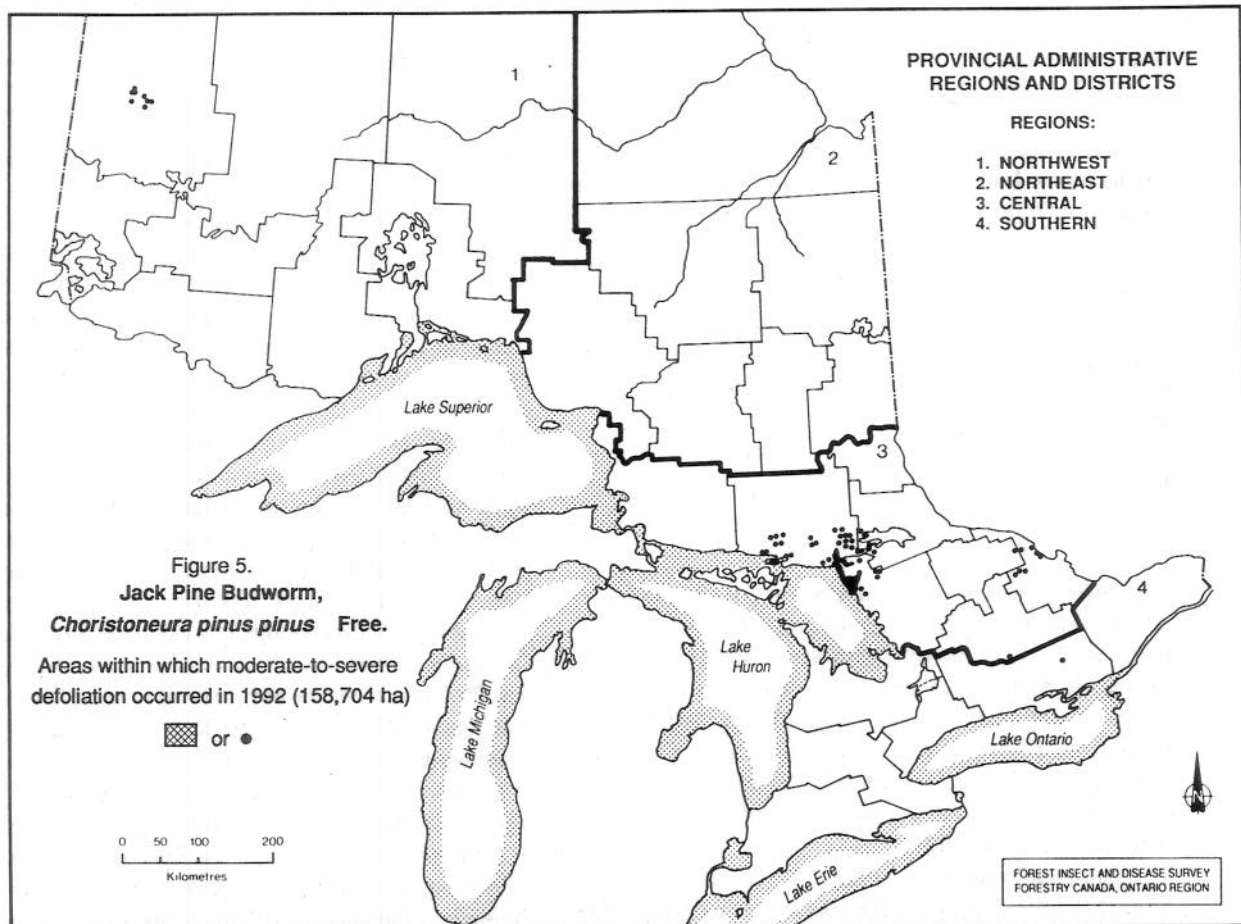
Aerial surveys revealed the following total areas of moderate-to-severe defoliation: 693 ha in Northwest Region, 157,478 ha in Central Region and 533 ha in Southern Region.

Central Region

The area of moderate-to-severe defoliation of jack pine (*Pinus banksiana* Lamb.) in the Parry Sound, Sudbury and North Bay districts has increased substantially (Fig. 6), from 61,084 ha in 1991 to 154,279 ha in 1992 (Table 6). The largest single body of defoliation affected some 81,475 ha stretching from the Pointe Au Baril area of Parry Sound District, north along the Georgian Bay coast to the vicinity of

Cox and Delamere townships in Sudbury District. Another large infestation was noted in the Island Lake area in Wilson, Brown, McKenzie and Ferrie townships in Parry Sound District and in the southwestern portion of East Mills Township in North Bay District. Numerous smaller pockets of defoliation were mapped in the northwestern portion of Parry Sound District and from the Satchels Bay area on Lake Nipissing through the southern portions of the North Bay and Sudbury districts to Eden and Bevin townships and the Beaverstone Bay area in Sudbury District. Further west in Sudbury District, numerous small pockets of defoliation were recorded from the Agnew Lake area south to Great La Cloche Island.

New medium-to-heavy infestations were discovered this year, mainly in Pembroke District but also in the eastern portion of Algonquin Park District. Small pockets of defoliation were observed along the Bonnechere River between the southern boundary of Guthrie Township, Algonquin Park District, and Round Lake, Pembroke District. A number of other small pockets were mapped north and south of the town of Petawawa and between the Petawawa and Baron Rivers in Wylie and McKay townships (Pembroke District) and in Stratton Township (Algonquin Park District). A small pocket of 30 ha of defoliation persisted in Methuen Township, Bancroft District.



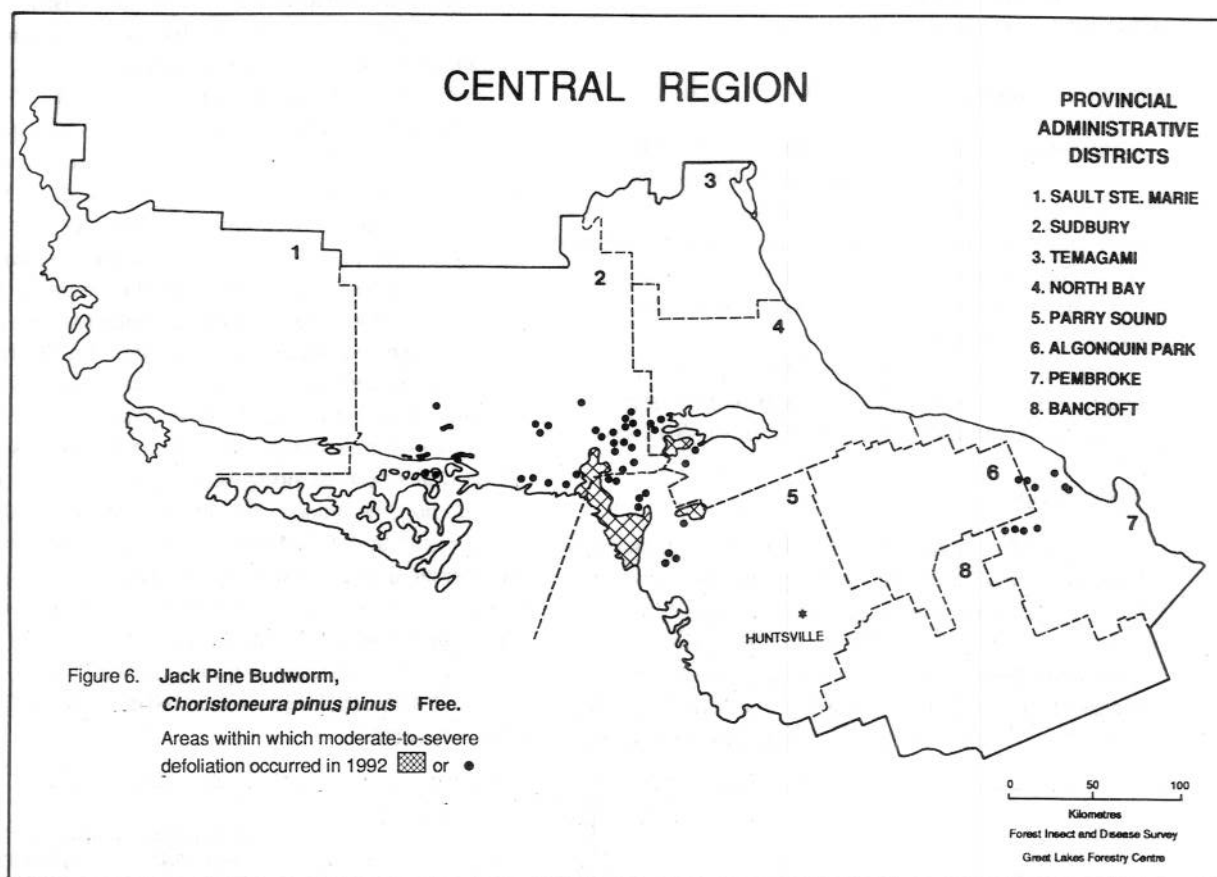


Table 6. Gross area of moderate-to-severe defoliation by the jack pine budworm in 1991 and 1992 in the Central Region of Ontario.

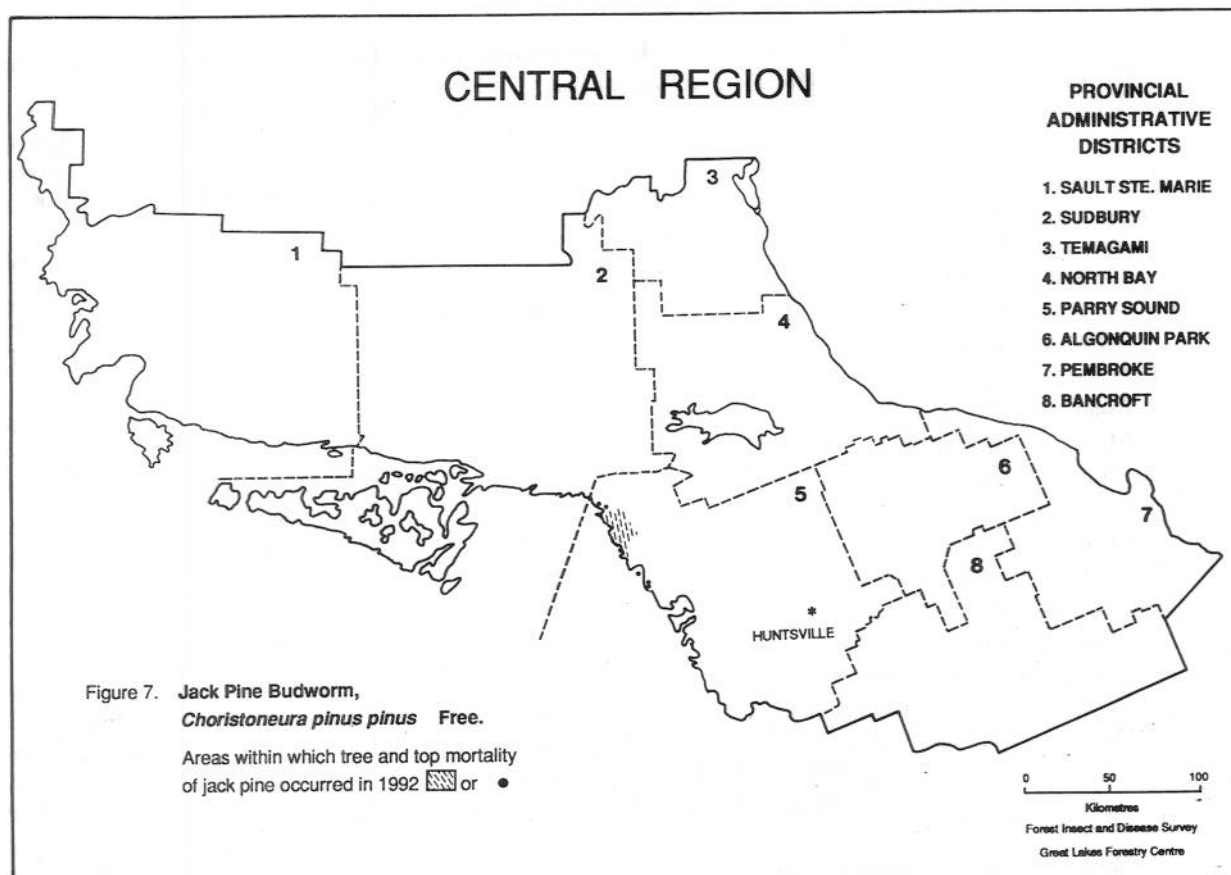
District	Defoliation (ha)		Change (ha)
	1991	1992	
Algonquin Park	0	465	+465
Bancroft	20	30	+10
North Bay	290	16,379	+16,089
Parry Sound	51,276	77,551	+26,275
Pembroke	0	2,704	+2,704
Sudbury	9,518	60,349	+50,831
Total	61,104	157,478	+96,374

Moderate-to-severe defoliation was not observed elsewhere in the Region, although the population levels of this insect appear to be increasing. In Sault Ste. Marie District, low levels of larvae were recorded for the first time in recent years in the Sagard, Nicholas, Bouck, Wells and Parkinson townships. Throughout the northern portion of Sudbury District and in the eastern portion of the region, larvae were commonly found in most stands inspected, at higher population levels than in 1991.

High population levels of the jack pine budworm were present in parts of Parry Sound District for the third consecutive

year. Much of this currently infested area had also been subjected to five consecutive years of moderate-to-severe defoliation by the jack pine budworm, from 1982 to 1986. Some areas, therefore, experienced only a brief respite from the stress of severe defoliation. Jack pine within the area of infestation are for the most part growing on shallow, rocky sites, and have been subjected to the additional stress of below-normal precipitation for at least 3 years. The result has been a large area (22,912 ha) of jack pine mortality (Fig. 7). One large continuous area of tree mortality was mapped along the Georgian Bay coast north of Pointe Au Baril to the Byng Inlet-Britt Station area, with Highway 69 acting as a rough eastern boundary for the damage. Smaller, separate pockets of dead trees were recorded in Shawanaga and Henvey townships. Three 100-tree mortality cruises were conducted, two in Wallbridge Township and one in Harrison Township. At one location in Wallbridge Township there was 26% tree mortality and 26% bare tops (heavy crown defoliation), while at the other location, 27% of the trees examined were dead and 12% had bare tops. The assessment at the Harrison Township location disclosed that 14% of the sample was dead and 45% had bare tops.

Egg-mass sampling for the purpose of population forecasting was carried out at 149 locations in the region (Table 7). In Sudbury District, moderate or heavy infestation



levels are forecast for 62% of the 53 mature or overmature sampled sites in 1993. At the locations that were sampled both in 1991 and 1992 in this district, the average number of egg masses has increased by more than 300%. The area of moderate-to-severe defoliation is expected to increase, particularly to the north. Elsewhere in the region, little change is expected. The areas infested in 1992 will be reinfested in 1993, with some possible expansion of the outbreak. In Parry Sound District, 9 of 14 sample points are predicted to have medium-to-heavy population levels although the average number of egg masses per sample has decreased compared with 1991. The infestation in this area of the region is showing signs of decreasing in intensity of damage. In Pembroke District, high population levels are forecast for 4 of the 11 mature or overmature stands sampled. In the Algonquin Park, North Bay, and Sault Ste. Marie districts, forecasts are for nil to low population levels with the exceptions of Stratton, Latchford, and Sagard townships, respectively. At the two sample locations in Bancroft District, no egg masses were observed.

In 1992, 27 impact plots were established in Sudbury District and nine in the eastern portion of Sault Ste. Marie District. These plots will be monitored annually to determine the effect of the defoliation of trees in different site classes and in various age groups.

Larch Casebearer, *Coleophora laricella* (Hbn.)

In 1992 population levels of this insect decreased compared with 1991. Light damage was observed in many tamarack (*Larix laricina* [Du Roi] K. Koch) stands in the region. Moderate-to-severe damage was found in a few scattered areas. In a 5-ha tamarack stand in Raglan Township, Pembroke District, 100% of the 7-m trees were affected with an average of 65% foliar damage. The heaviest damage in the northern portion of the region occurred in a 1-ha stand in Robinson Township, Sudbury District, where 10% of the trees sustained 20% defoliation.

One possible reason for this regional decline is the high level of parasites found in some areas. Across Parry Sound District, parasitism rates ranged as high as 80%.

Greenstriped Mapleworm, *Dryocampa rubicunda* (F.)

Light-to-moderate defoliation of red maple (*Acer rubrum* L.) was noted at a number of locations in Sault Ste. Marie District. In Thompson Township, 25 to 50% defoliation of red maple was observed at several points along the Mississagi Road. The affected areas were approximately 1 to 3 ha in size.

Table 7. Jack pine budworm in the Central Region of Ontario: defoliation estimates and egg-mass counts in 1992 and infestation forecasts for 1993 on jack pine.

Location	Estimated % defoliation (1992)	Total number of egg masses on six 61-cm branch tips	Infestation forecast for 1993 ^a
<i>Algonquin Park District</i>			
Fitzgerald Township	8	0	N
Guthrie Township	3	1	L
Stratton Township	44	23	H
White Township	8	0	N
<i>Bancroft District</i>			
Chandos Township	1	0	N
Methuen Township	11	0	N
<i>North Bay District</i>			
Latchford Township	69	13	H
McNish Township	2	0	N
Merrick Township	2	0	N
<i>Parry Sound District</i>			
Blair Township	53	2	L
Carling Township – Highway 69	2	2	L
– Snug Harbour	10	2	L
Harrison Township – Highway 529	22	30	H
– Indian Reserve 17A	13	4	M
– south of Pointe au Baril	8	0	N
Henvey Township	31	8	H
Mowat Township – Pickerel River	33	10	H
– 10 km east of Still River	68	25	H
Wallbridge Township – Harris Lake Road	20	2	L
– Magnetawan River	4	4	M
Wilson Township – plot 1	78	22	H
– plot 2	65	17	H
– plot 3	67	24	H
<i>Pembroke District</i>			
Burns Township	1	0	N
Clara Township	7	1	L
Fraser Township	0	0	N
Head Township	5	2	L
Maria Township	2	0	N
Petawawa Township	29	8	H
Richards Township ^b	71	11	H
Richards Township – Bonnechere			
Provincial Park ^b	20	9	H
Wylie Township – CFB – Frontier Lake	68	11	H
– CFB – Montgomery Lake	47	2	L
– PNFI – Stand 96	32	1	L
– PNFI – Exp. 255 ^b	6	2	L
– PNFI – Exp. 431 ^b	2	2	L
<i>Sault Ste. Marie District</i>			
Bouck Township	0	0	N
Gaunt Township	0	0	N
Kirkwood Township	9	0	N

(cont'd)

Table 7. Jack pine budworm in the Central Region of Ontario: defoliation estimates and egg-mass counts in 1992 and infestation forecasts for 1993 on jack pine. (cont'd)

Location	Estimated % defoliation (1992)	Total number of egg masses on six 61-cm branch tips	Infestation forecast for 1993 ^a
<i>Sault Ste. Marie District (concl.)</i>			
Lane Township – Stand 40 ^b	0	0	N
Martel Township – Stand 178 ^b	0	0	N
– Stand 56	0	0	N
– Stand 170	1	0	N
Nicholas Township	3	1	L
Parke Township ^b	0	1	L
Poulin Township – Stand 93	0	0	N
Rioux Township – Stand 31	0	1	L
Sagard Township – Stand 136 ^b	0	0	N
– Stand 113	0	6	H
– Stand 132	7	10	H
Villeneuve Township – Stand 218 ^b	0	0	N
Wardle Township	0	0	N
Wells Township	0	2	L
Wells Township – Stand 69	0	0	N
Winkler Township	0	0	N
<i>Sudbury District</i>			
Antrim Township	8	0	N
Antrim Township – Stand 235	2	2	L
Avis Township – Stand 62	0	0	N
Aylmer Township – Stand 143	12	19	H
Beebe Township – Stand 259	2	0	N
Bigwood Township – west	57	6	H
– Murdock River	90	23	H
Birch Island	3	0	N
Cartier Township – Stand 236	7	6	H
– Stand 367	24	10	H
Cleland Township	63	13	H
Cox Township	46	26	H
Dunbar Township – Stand 227 ^b	0	0	N
Dunbar Township	2	0	N
Dunlop Township	23	0	N
Dunlop Township – Stand 13 ^b	1	0	N
Ermatinger Township – Stand 50	6	6	H
– Stand 70	21	5	M
Foucault Township – Stand 103	3	0	N
Great La Cloche Island	57	13	
Gough Township	6	0	N
Haddo Township	63	11	H
Hallam Township – seed orchard ^b	1	0	N
Hallam Township	11	0	N
Hanmer Township	24	4	M
Hart Township	12	1	L
Hart Township – Stand 73 ^b	0	0	N
– Stand 137 ^b	0	0	N
– Stand 139	15	8	H

(cont'd)

Table 7. Jack pine budworm in the Central Region of Ontario: defoliation estimates and egg-mass counts in 1992 and infestation forecasts for 1993 on jack pine. (concl.)

Location	Estimated % defoliation (1992)	Total number of egg masses on six 61-cm branch tips	Infestation forecast for 1993 ^a
<i>Sudbury District (concl.)</i>			
Hotte Township	0	2	L
Hutton Township – Stand 402	2	1	L
Lefebvre Township ^b	2	0	N
Leinster Township – North	1	0	N
– South	22	6	H
Lumsden Township – seed orchard ^b	2	0	N
Lumsden Township ^b	4	5	M
Mandamin Township – Stand 340	47	7	H
– Stand 48	27	13	H
Merritt Township – Queensway Road east	81	13	H
– Stand 104	33	5	M
Moncrieff Township – Stand 429 ^b	1	0	N
– Stand 441	3	5	M
Monestime Township – Stand 273	24	7	H
– Stand 210	19	9	H
Moses Township – Stand 22 ^b	0	0	N
– Stand 120	35	8	H
– Stand 260 ^b	8	4	M
Munster Township – Stand 66 ^b	0	0	N
Munster Township	16	3	M
Nairn Township – Stand 28	72	6	H
– Stand 125	53	13	H
Olinyk Township – Stand 90	4	2	L
– Stand 290	7	5	M
Prescott Township – Stand 73	3	4	M
– Stand 342	1	3	M
Rhodes Township – Stand 247	2	1	L
Robinson Township	0	0	N
Rowat Township – Stand 160	8	1	L
– Stand 420	2	3	M
Scollard Township	88	12	H
Solski Township – Stand 158	8	2	L
Teasdale Township – Stand 94	41	7	H
– Stand 185	14	12	H
Ulster Township – Stand 308	1	3	M
– east	9	2	L
Weeks Township – Stand 271 ^b	11	9	H

^a N = nil, L = light, M = moderate, H = heavy

^b immature stand sampled (age <40 years)

A defoliation level of 25% was also reported on roadside trees along the Wakomata Lake Road in Casson Township and 5 to 10% defoliation was recorded near Endikai Lake in Albanel Township.

This insect was also observed in and around the city of Sudbury. The most damage occurred on red maple in Broder Township, where 80% of the trees had 50% defoliation.

Red maple and sugar maple (*Acer saccharum* Marsh.) in a small 10- to 12-ha maple woodlot in Maria Township, Pembroke District, experienced 35 to 40% defoliation on trees averaging 10 m in height.

Infestations by this insect are usually of short duration; however, if infestations persist for 3 or 4 years, tree mortality or reduced sap quality can occur. Outbreaks of the

mapleworm are usually regulated by natural control factors such as fungal and bacterial diseases, parasites and birds.

Eastern Pine Shoot Borer, *Eucosma gloriola* Heinr.

Evaluations of damage by this insect were conducted in four districts in 1993 (Table 8). Leader damage on pine ranged up to 32.7%, which was recorded in the Hallam Seed Orchard in Sudbury District. This insect could be found elsewhere in the region, but damage was usually less than 1%.

Saddled Prominent, *Heterocampa guttivita* (Wlk.)

Populations of this pest continued the declining trend that began in 1991. In 1991 there were a few widely scattered areas of light-to-moderate defoliation in the Bancroft and Pembroke districts. Intensive surveys in 1992 failed to detect

any areas of significant damage. Light damage (<10%) to various hardwoods was found in Raglan Township (Pembroke District), Macaulay and Ridout townships (Parry Sound District) and Hindon Township (Bancroft District). No other instances of damage were recorded in the region.

Fall Webworm, *Hyphantria cunea* (Drury)

In 1991, the fall webworm was responsible for moderate-to-severe defoliation at a number of locations in the Bancroft, Parry Sound and Pembroke districts. In 1992 the pest was present in the same areas but at lower levels.

The heaviest damage was reported in Wylie, Buchanan and Petawawa townships, Pembroke District. A survey of 10-m black ash (*Fraxinus nigra* Marsh.) in Buchanan Township revealed that defoliation averaged 65%, which was typical of defoliation in the three townships.

Table 8. Damage caused by the eastern pine shoot borer at 26 locations in the Central Region of Ontario in 1992 (counts based on an examination of 150 randomly selected trees at each location).

Location (Township)	Tree species	Average height of tree (m)	Estimated trees per ha	Estimated area affected (ha)	Leaders affected (%)
<i>North Bay District</i>					
Gurd (seed orchard)	wP	5.9	1,000	4	2.0
Merrick (family test)	jP	3.3	1,600	16	9.0
<i>Sault Ste Marie District</i>					
Curtis	jP	3.0	2,500	40	5.3
Hurlburt	jP	1.2	2,500	50	6.0
Hynes	jP	1.4	2,500	25	8.6
Lamming	jP	1.6	2,500	40	2.0
Lane (family test)	jP	2.8	2,500	4	9.3
Lane	jP	3.6	2,500	40	11.3
Sturgeon	jP	2.1	2,500	20	8.0
Villeneuve	jP	2.7	2,500	4	3.3
<i>Sudbury District</i>					
Durban (seed orchard)	jP	3.4	1,400	15	8.7
Dunbar	jP	1.5	2,000	25	14.0
Hallam (seed orchard)	jP	3.8	1,400	25	32.7
Hallam (seed orchard)	wP	0.8	800	4	4.0
Lumsden (seed orchard)	jP	3.9	2,500	10	16.7
Mandamin (family test)	jP	2.3	1,700	10	7.3
Munster (family test)	jP	0.9	1,700	5	5.3
Olinsky (family test)	jP	1.3	2,500	4	17.3
Salter	jP	2.2	2,200	10	5.3
Street (family test)	jP	2.6	2,000	5	19.3
Venturi	jP	2.0	2,100	30	17.3
<i>Temagami District</i>					
Banting	jP	2.4	3,700	5	2.7
Canton	jP	1.8	3,700	50	2.0
Canton	jP	2.8	4,300	99	8.0
Milne	jP	1.3	2,500	25	0.7
Milne	jP	1.7	4,000	10	2.0

Surveys in Bancroft District disclosed defoliation of black ash, white ash (*F. americana* L.) and white elm (*Ulmus americana* L.) that averaged less than 20% in Dysart, Harburn, Cavendish, Snowden and Guilford townships. Similar damage levels on a variety of hardwood hosts were also observed in Foley, Harrison, Mowat, Blair and Conger townships, Parry Sound District.

Hemlock Looper, *Lambdina f. fiscellaria* (Gn.)

High population levels of this insect occurred over a 10-ha area on the southern shore of Manitoulin Island in Campbell Township, Sudbury District. The damage occurred in a stand of balsam fir and eastern white cedar (*Thuja occidentalis* L.). The mature balsam fir sustained defoliation ranging from 40 to 80%, whereas balsam regeneration experienced up to 100% defoliation. The eastern white cedar were also defoliated, but not to the same extent as the balsam fir. Some mortality of the balsam fir regeneration is expected to occur and surveys will continue in 1993.

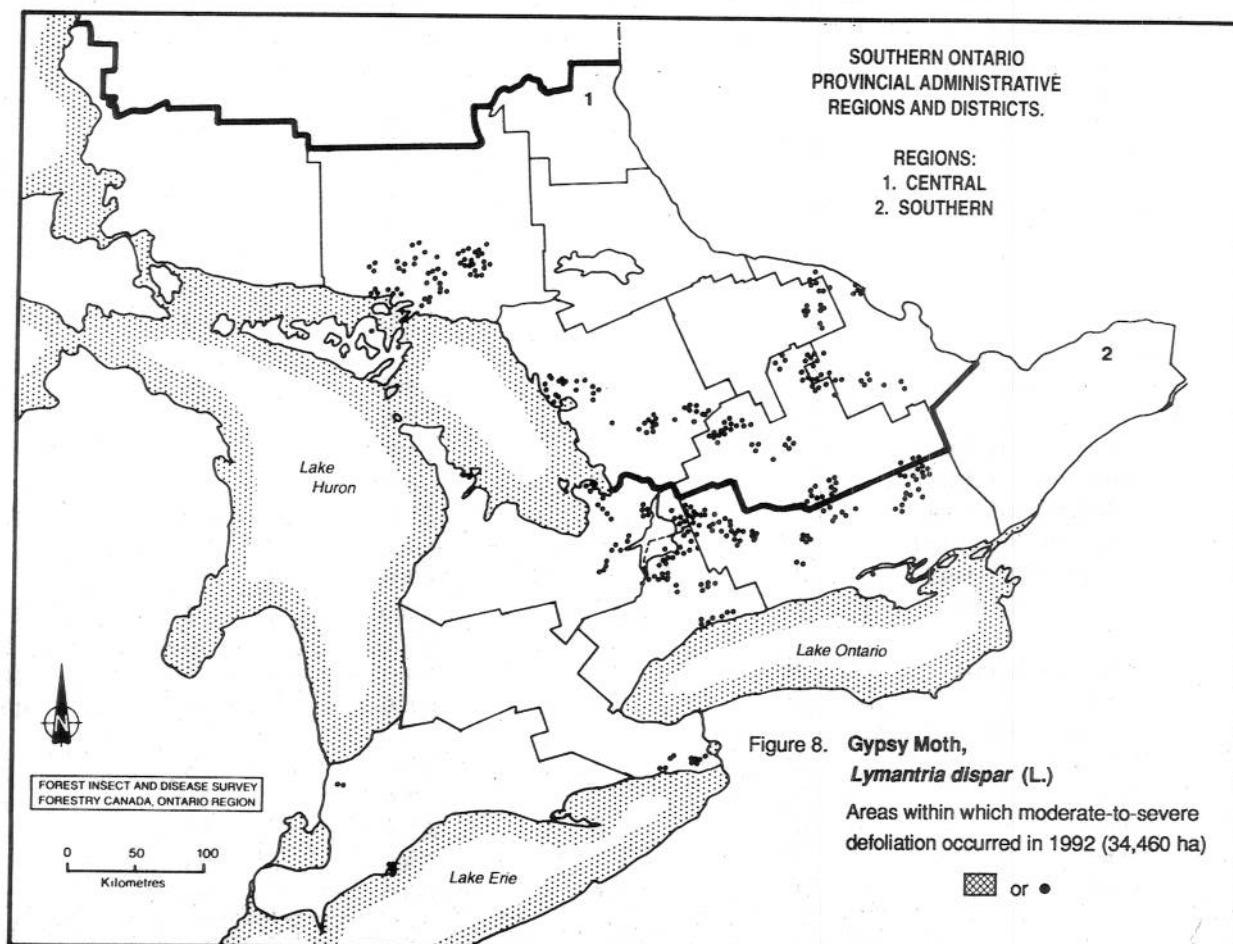
Gypsy Moth, *Lymantria dispar* (L.)

Provincial Situation

In all, 34,460 ha of moderate-to-severe defoliation were recorded in the province in 1992, a significant 312,955-ha decrease from the previous year (Fig. 8). Population increases in the Sudbury District of Central Region were offset by major population collapses elsewhere. The current infestation was typified by small, separate areas or pockets of defoliation as opposed to the large, continuous areas of medium-to-heavy infestation recorded in 1991.

Central Region

A widespread population collapse occurred throughout the southern part of the region in areas that previously hosted large numbers of gypsy moths (Fig. 9). Increases were recorded only in Sudbury District (Table 9). Over all, the area of moderate-to-severe defoliation decreased from 228,162 ha in 1991 to 21,112 ha in 1992. Oak (*Quercus* sp.), aspen (*Populus* spp.) and birch (*Betula* spp.) were the preferred tree species, but moderate-to-severe damage was also encountered on a number of other hardwood hosts.



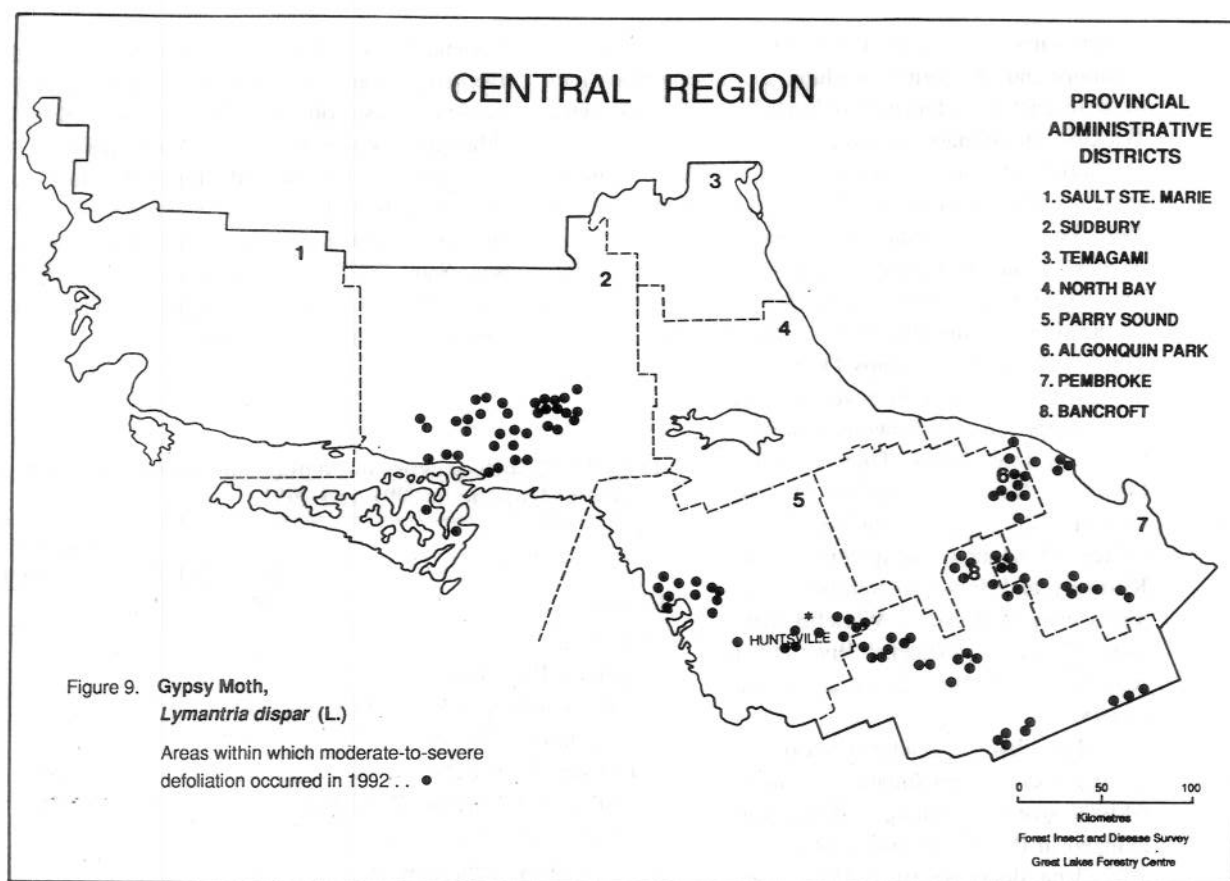


Table 9. Gross area of moderate-to-severe defoliation caused by the gypsy moth in 1991 and 1992 in the Central Region of Ontario.

District	Area of moderate-to-severe defoliation (ha)		Change (ha)
	1991	1992	
Algonquin Park	915	591	-324
Bancroft	61,840	13,205	-48,635
Parry Sound	148,412	1,513	-146,899
Pembroke	16,554	2,301	-14,253
Sudbury	441	3,502	+3,061
Total	228,162	21,112	-207,050

Light-to-moderate defoliation (<75%) of eastern white pine and of eastern hemlock (*Tsuga canadensis* [L.] Carr.) growing in stands of preferred hosts was also recorded. The intensity of defoliation of these two tree species was noticeably less than in 1991. To determine the impact of heavy feeding on white pine, a defoliation assessment of 50 eastern white pine ranging in height from 3 to 15 m was carried out in 1991 in a mixed stand of eastern white pine and red oak (*Quercus rubra* L.) in Medora Township, Parry Sound District. All crown classes were included in the survey. In 1991, defoliation of old foliage in the plot averaged 93%; current

defoliation of up to 95% (suppressed trees) but averaging 52% was recorded. The same 50 eastern white pine were re-assessed in 1992. There was no defoliation of the current year's foliage but one tree was dead. The affected tree was 6 m tall and suppressed, and had experienced 99% defoliation of old foliage and 95% loss of current foliage in 1991.

Dead and diseased larvae infected by the nuclear polyhedrosis virus were found throughout the areas infested by large numbers of gypsy moths. Mummified larvae and pupae infected with a fungus (*Paecilomyces fumosoroseus* [Weize] Brown & Smith) were recovered from Medora and Wood townships, Parry Sound District. Ground surveys for another fungus (*Entomophaga maimaiga* Humber, Shimazu & Soper) considered to be responsible for widespread population collapses in the United States were carried out in the region, but no infected larvae were discovered.

Bancroft District hosted the largest area of moderate-to-severe damage in 1992, with some 13,205 ha of damage, mainly to oak. Much of the damage occurred on open-growing trees on shallow sites. This damage represented a 48,635-ha decrease from 1991. The areas of defoliation were widespread in the district, with 72% of the damage occurring in the southern part, in Methuen, Lake, Grimsthorpe, Anglesea, Barrie and Clarendon townships. Moderate-to-severe defoliation was also recorded in the eastern and

central parts of the district in Cardiff, Dudley, Guilford, Stanhope and Sherborne townships; and in the northern part of the district, including parts of Lyell, Murchison, Dickens, Wicklow and Bangor townships.

Aerial and ground surveys detected 3,502 ha of medium-to-heavy infestation in Sudbury District, 3,061 ha more than in 1991. The areas infested consisted mainly of open-growing red oak on shallow soils and ranged in size from 5 to 225 ha. The largest concentration of moderate-to-severe defoliation occurred south of the city of Sudbury in Dill, Broder, Waters, Tilton and Secord townships. Other areas or pockets of moderate-to-severe damage were mapped in the following townships: Louise, Lorne, Drury, Dieppe, Stalin, Goschen, Burwash, Dryden, Hyman, Dunlop, Shakespeare, Hallam, Nairn, Foster, McKinnon, Mongowin, Curtin, Killarney, and Howland. Similar damage levels were recorded on Whitefish Lake Indian Reserve 6, Whitefish River Indian Reserve 4 and Manitoulin Island Indian Reserve 26.

More than 50 scattered pockets of moderate-to-severe defoliation, averaging 44 ha in size and totalling 2,301 ha, were mapped in Pembroke District in 1992, a 14,253-ha decrease from 1991. High population levels were delineated in Jones, Sherwood, Radcliffe, Brudenell, Lyndoch, Griffith, Sebastopol, Brougham, McKay, Petawawa, Head, Wylie, and Buchanan townships. The majority of defoliated hosts consisted of open-growing oaks on rocky sites.

The infestation in Parry Sound District in 1992 was characterized by 31 pockets of medium-to-heavy damage, totaling 1,513 ha; this represented a 146,899-ha decrease from 1991. The following townships contained large numbers of gypsy moths: Harrison, Shawanaga, Carling, Christie, Humphrey, Ferguson, Watt, Stephenson, Ridout, Franklin and Sherborne.

The 1992 area of medium-to-heavy infestation in Algonquin Park District was 591 ha, a 324-ha decline from 1991. Twelve separate areas of defoliation, the largest totaling 120 ha, were mapped in Stratton, Master, Barron and Guthrie townships.

Later surveys disclosed small pockets of defoliation along the north channel of Lake Huron in Sault Ste. Marie District. These were located near Bootleggers Bay,

Algoma Mills and in Long Township with defoliation averaging about 75% on 4- to 10-m red oak. Numerous larvae were also collected within the city of Sault Ste. Marie although there was no discernible defoliation.

Pheromone traps were deployed at 28 locations, mainly campgrounds, to determine the presence and distribution of the gypsy moth in the northern part of the region, in the North Bay, Sault Ste. Marie, Sudbury and Temagami districts (Table 10). Male moths were trapped at all but two locations, both in Sault Ste. Marie District.

Table 10. Results of gypsy moth pheromone trapping in the Central Region of Ontario in 1991 and 1992.

Location	Number of traps		Number of males captured	
	1991	1992	1991	1992
<i>North Bay District</i>				
Antoine Prov. Park	2	1	33	19
Lake Nipissing scenic lookout	1	1	25	19
Marten River Prov. Park	2	2	9	34
Restoule Prov. Park	2	1	33	19
Samuel de Champlain Prov. Park	2	1	24	18
<i>Sault Ste. Marie District</i>				
Agawa Bay Campgrounds	2	2	2	1
Bellevue Park	—	3	—	73
City of Sault Ste. Marie	—	3	—	41
City of Sault Ste. Marie	—	3	—	9
Crescent Lake Campgrounds	2	2	0	0
Hilton Beach	—	3	—	98
Mississagi Prov. Park	2	2	11	21
Pancake Bay Provincial Park	2	2	0	11
Rabbit Blanket Campgrounds	10	2	0	0
Rankin Indian Reserve	—	3	—	30
Striker Township	—	3	—	56
Striker Township	—	1	—	16
Striker Township	—	1	—	21
Thessalon Township	—	3	—	58
Thessalon Township	—	3	—	66
<i>Sudbury District</i>				
Bidwell Township	2	2	29	66
Chutes Prov. Park	1	2	36	53
Fairbanks Prov. Park	2	1	26	16
Gordon Township	2	2	54	55
Halfway Lake Prov. Park	2	1	4	4
Killarney Prov. Park	2	2	44	45
South Baymouth — ferry dock	2	1	44	19
— trailer park	1	1	23	19
Windy Lake Prov. Park	2	2	27	26
<i>Temagami District</i>				
Finlayson Point Prov. Park	2	6	13	43

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

High population levels and accompanying moderate-to-severe defoliation of cherry (*Prunus* spp.) were observed in the Parry Sound, Algonquin Park, Bancroft and Pembroke districts. This contrasted with the declining populations observed in the northern portion of the region.

The heaviest damage occurred over a 0.1-ha area in Methuen Township, Bancroft District. At this location, 100% of the 1.5-m trees were affected, with an average of five tents per tree and defoliation up to 100%. Elsewhere in Bancroft District, surveys conducted in Draper, Dysart, Hindon, Minden and Stanhope townships revealed defoliation of susceptible hosts in the 30–100% range. Similar levels of damage also occurred in Blair, McDougall, Armour, Macaulay and Stephenson townships, Parry Sound District.

Forest Tent Caterpillar, *Malacosoma disstria* Hbn.

Provincial Situation

The forest tent caterpillar caused a provincewide total of 16,051,424 ha of moderate-to-severe defoliation in 1992

(Fig. 10), a decrease from the 1991 total of 18,870,508 ha. Declines were recorded in the Central, Northwestern and Southern regions, whereas increased areas of medium-to-heavy infestation occurred in Northeastern Region.

Aerial surveys revealed the following total areas of moderate-to-severe defoliation: 10,457,746 ha in Northwest Region, 5,479,481 ha in Northeast Region, 78,677 ha in Central Region and 35,520 ha in Southern Region.

Central Region

The area of medium-to-heavy infestation in Central Region continued to decline, from 953,245 in 1991 to 78,677 ha in 1992 (Table 11). The intensity of defoliation was also less than in previous years, particularly in the southern portion of the region. Defoliation in many stands ranged from 15 to 30%, with occasional trees in the same stand experiencing 50 to 60% defoliation. A major reason for this limited foliar damage was that although large numbers of caterpillars successfully hatched and progressed to later instars, many were heavily diseased and too sick to feed.

Aspen and oak were the preferred host species, but a number of other hardwoods, including white birch and sugar maple, experienced moderate-to-severe defoliation. Medium-to-heavy infestations were recorded in five districts (Fig. 11).

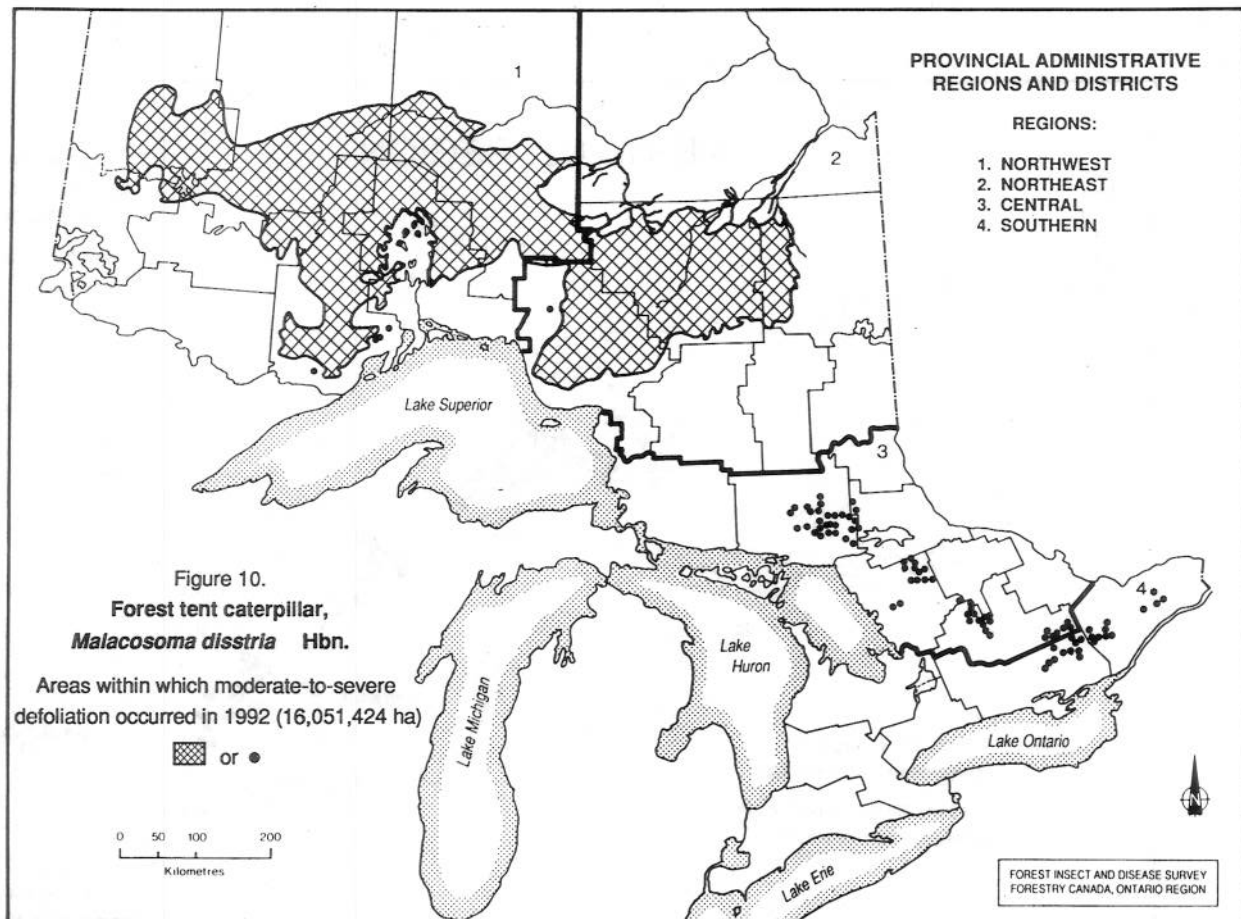


Table 11. Gross area of moderate-to-severe defoliation by the forest tent caterpillar in 1991 and 1992 in the Central Region of Ontario.

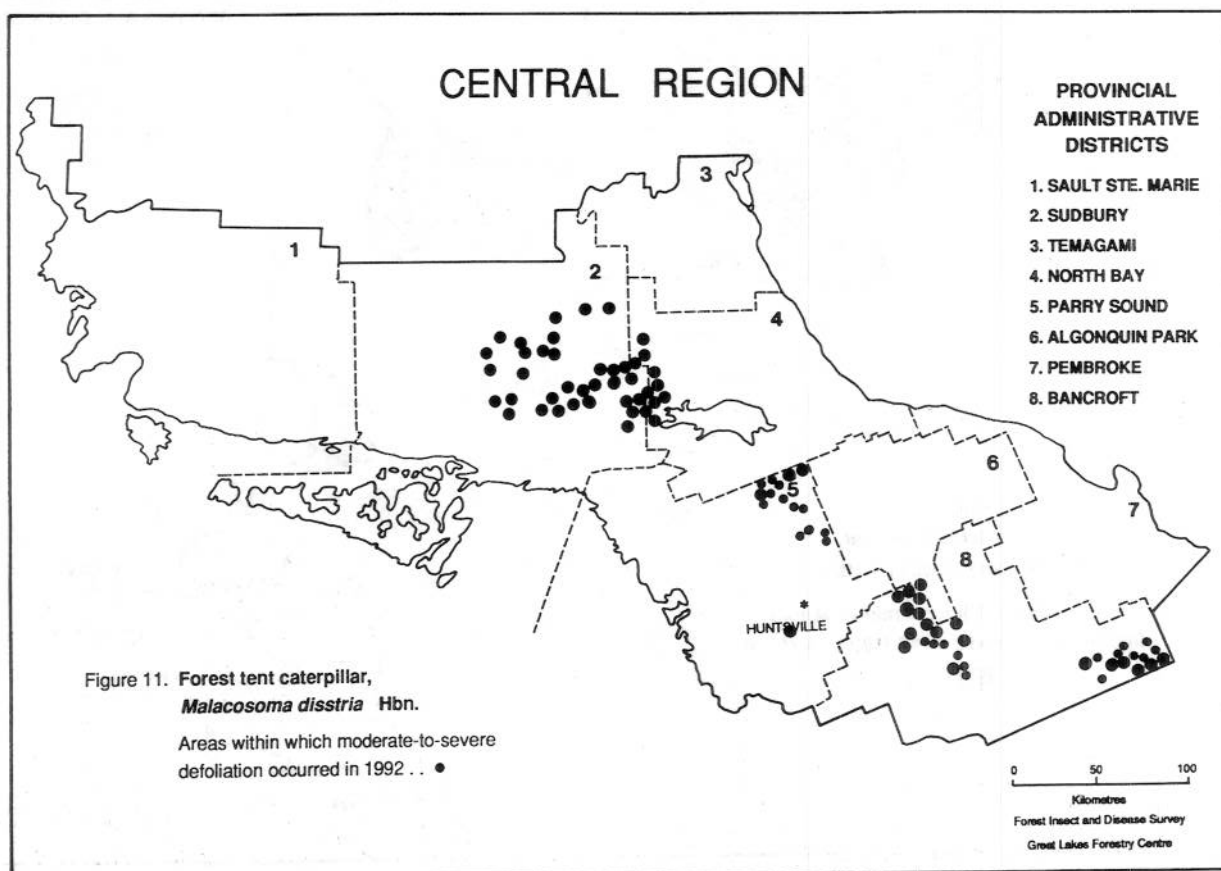
District	Defoliation (ha)		Change (ha)
	1991	1992	1992
Algonquin Park	0	3,555	+3,555
Bancroft	115,720	28,279	-87,441
North Bay	60,152	9,445	-50,707
Parry Sound	24,408	3,933	-20,475
Sault Ste. Marie	71,383	0	-71,383
Sudbury	681,582	33,465	-648,117
Total	953,245	78,677	-874,568

In the Sudbury and North Bay districts, the area of moderate-to-severe defoliation declined substantially (by 698,824 ha) to a total of 42,910 ha in 1992. The single most extensive area of medium-to-heavy infestation occurred along the Sudbury-North Bay district border, extending from the West Arm vicinity north to Highway 17. Numerous smaller patches of defoliation occurred east of the town of Cartier in Sudbury District, and extended north to Aylmer and Janes townships (Sudbury and North Bay districts, respectively), and south to the West Arm area.

Surveys of the Algonquin Park and Bancroft districts revealed 3,555 and 28,279 ha, respectively, of moderate-to-severe defoliation in 1992. The two largest areas of moderate-to-severe defoliation occurred north and south of the Percy-Haliburton lakes area in Havelock, Harcourt, Guilford, Dudley, Harburn and Eyre townships, Bancroft District, and in Eyre (shared township) and Bruton townships, Algonquin Park District. Smaller pockets of light-to-moderate defoliation (<40%) occurred from Eels Lake-Anstruther Township north to Havelock Township and west into Minden Township. In the southeastern portion of Bancroft District, the infestation continued to decline, with small scattered pockets occurring from the Bon Echo Provincial Park area east to Palmerston Township.

The infestation in Parry Sound District has continued to collapse. Numerous small, scattered patches of light-to-moderate defoliation were aerially surveyed from Watt Township north to the town of Trout Creek, North Bay District, and east into Butt Township. Four small pockets of defoliation occurred in the northwestern portion of the district in Blair and McConkey townships.

Further decreases in the area of medium-to-heavy infestation are expected in 1993 based on a combination of factors. Egg-band counts were carried out at 19 locations and



nil-to-light defoliation of hardwoods is predicted at 12 of these (Table 12, Fig. 12). It also should be noted that this forecast procedure tends to overestimate defoliation in an aging infestation. Taking into consideration parasitism, overwintering mortality, the presence of smaller and poorly formed egg bands, and the widespread presence of viral, fungal and microsporidian diseases, the following forecasts can be made.

Areas of moderate defoliation may persist in the Sudbury, North Bay and Bancroft districts. The largest area of moderate damage, along the Sudbury-North Bay district boundary, is expected to break up and decrease in size in 1993. Small pockets of moderate defoliation may persist in the southeastern and central portions of Bancroft District and in the area surrounding the city of Sudbury; however, populations will generally continue to decline. A population collapse is probable in Parry Sound District.

Balsam Fir Sawfly, *Neodiprion abietis* complex

Light-to-medium infestations by the balsam fir sawfly were again reported causing defoliation and discoloration of the older foliage of balsam fir at a number of locations in Central Region.

A large body of light-to-moderate foliar damage encompassed a number of townships in the southwestern part of Bancroft District. The affected townships included: Anson, Minden, Dalton, Digby, Lutterworth, Snowdon, Glamorgan, Monmouth, Galway, Cavendish, Harvey, Cardiff, Anstruther, Chandos, Burleigh, Methuen and Wollaston. Ground surveys in stands of balsam fir averaging 10 m in height at several areas within this infestation determined that associated foliar damage was confined mainly to the upper crown and averaged 15%. Small pockets of moderate-to-severe foliar damage were observed within this larger area. One such stand, 1 ha in size and averaging 8 m in height, was noted in Dalton Township. A 100-tree assessment at this location disclosed foliar damage on individual trees ranging up to 100%, but overall associated foliar discoloration averaged 50%. Current defoliation of <10% was recorded on a number of trees.

Defoliation levels averaging 10 to 15% were noted in stands of balsam fir throughout Chisholm Township, North Bay District, and Armour Township, Parry Sound District. As well, low-to-moderate numbers of sawflies caused an average of 25% defoliation in stands of semimature balsam fir in an area encompassing parts of Maitland, Cosby, Haddo, Cherriman, Casimir, Appleby and Dunnet townships, Sudbury District.

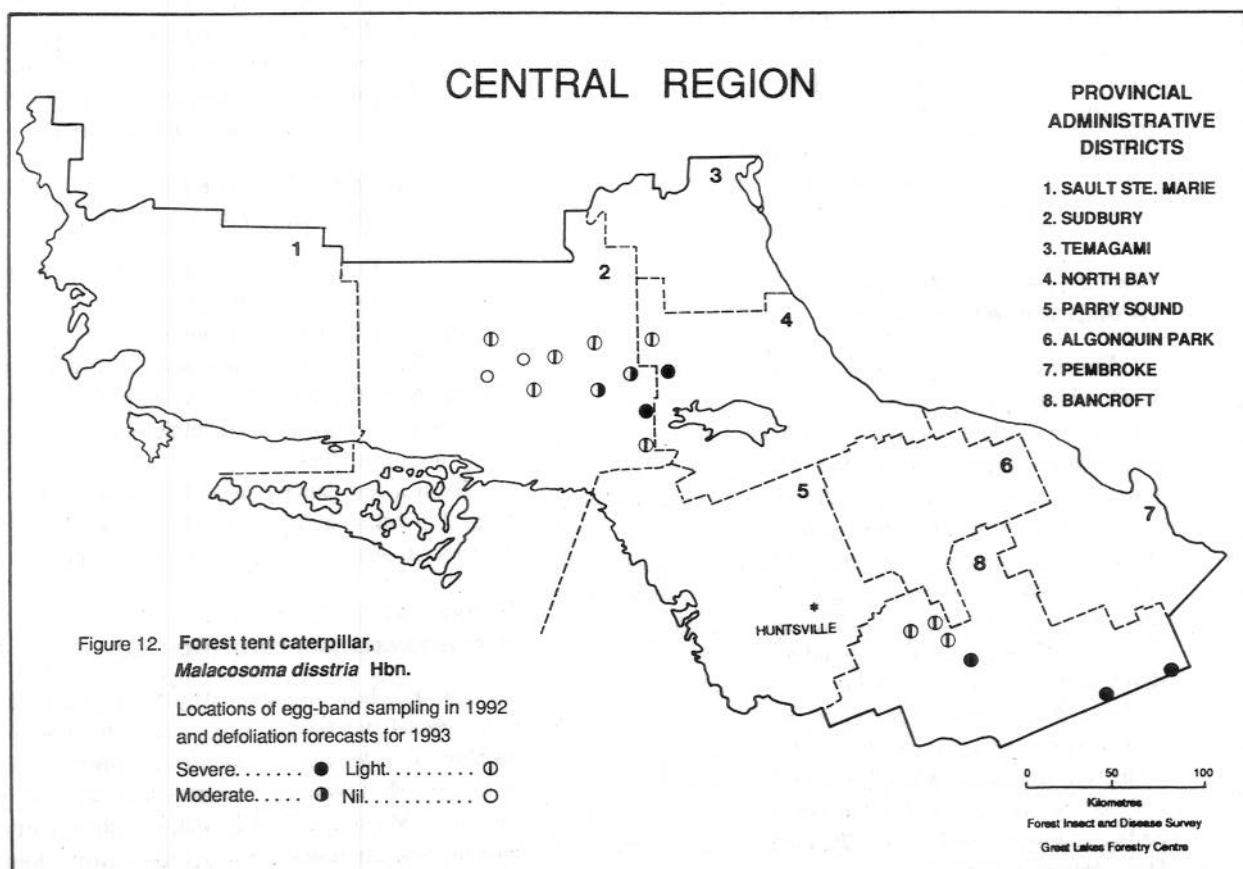


Table 12. Forest tent caterpillar egg-band counts on trembling aspen and sugar maple at 19 locations in the Central Region of Ontario in 1992 and infestation forecasts for 1993.

Location (Township)	Host	Average DBH of sample tree (cm)	Average number of egg bands per tree	Infestation forecasts for 1993 ^a
<i>Bancroft District</i>				
Anglesea	tA	16.7	17	S
Cardiff	tA	15.0	12	S
Clarendon	tA	9.5	19	S
Dudley ^b	sM	21.0	1	L
Eyre	tA	11.4	0	N
Guilford ^b	sM	16.0	1	L
Harburn ^b	sM	30.0	1	L
<i>North Bay District</i>				
Janes	tA	9.9	1	L
Hugel	tA	11.8	22	S
<i>Sudbury District</i>				
Balfour	tA	11.2	0	N
Bleazard	tA	10.2	1	L
Cartier	tA	10.8	1	L
Casimir	tA	13.2	53	S
Cleland	tA	10.1	4	M
Graham	tA	12.8	1	L
Hagar	tA	12.3	3	M
MacLennan	tA	12.7	1	L
Martland	tA	9.5	1	L
Trill	tA	8.3	0	N

^a N=nil, L=light, M=moderate, S=severe

^b sequential sampling method used on two branches from the upper crown of each sugar maple tree

Redheaded Pine Sawfly, *Neodiprion lecontei* (Fitch)

This defoliator was commonly observed in all districts of Central Region with the exception of the Sault Ste. Marie and Temagami districts. A wide range of defoliation was observed in plantations across the region (Table 13) and it was not unusual to observe single trees with 100% current defoliation.

Although population levels of this insect have decreased in the western portion of Sudbury District compared with levels in 1990 and 1991, damage was still evident in many areas. In May Township, four plantations incurred damage on 5 to 20% of the trees. Although individual trees were totally defoliated, the average defoliation ranged from 15 to 30%. In 1991 an 80-ha red pine plantation in Tennyson Township sustained a very large population of this insect over an area of 20 ha. The plantation was sprayed in 1991 with Malathion® but not before severe damage occurred. The population collapsed in 1992, with only 0.7% of the trees affected, with 5% defoliation, but defoliation in previous years has caused

mortality of 26.7% of the 1.6-m trees. Most of the remaining living trees sustained severe branch mortality.

Elsewhere in the region, population levels were generally low, but there were some exceptions (Table 13). An average of 45% current defoliation occurred on 40% of the 1.2-m trees in a 0.5-ha red pine plantation in Peck Township, Algonquin Park District. High mortality (80%) was also recorded in this plantation. In North Bay District, the population levels of this insect have increased in a number of plantations in Cameron Township. The number of trees affected ranged from 2 to 17%, with average defoliation ranging from 20 to 25%. In Pembroke District the heaviest damage occurred in a 1.5-ha red pine plantation in Maria Township. At this location, 6% of the 0.9-m trees sustained an average of 30% defoliation. In a 10-ha plantation of 0.9-m red pine trees in Paxton Township, Parry Sound District, 13% of the trees sustained defoliation averaging 29%. Elsewhere in Parry Sound District, 10% defoliation of current foliage of individual trees was recorded in a number of plantations in McMurrich and Ryerson townships.

Numerous spray operations using Lecontivirus and Malathion® were carried out by OMNR and E.B. Eddy staff in young plantations in the western portion of Sudbury District. Spray operations using Lecontivirus were also carried out by OMNR staff in the North Bay and Bancroft districts.

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

This insect was found in small numbers in the Sault Ste. Marie and Sudbury districts. In the city of Sault Ste. Marie, defoliation varied from 10 to 100% on ornamental shrubs of mugho pine (*Pinus mugo* Turra var. *mughus* Zenari). An evaluation in a Scots pine (*Pinus sylvestris* L.) plantation in the city revealed defoliation averaging 5% on 7% of the 1.6-m trees.

The heaviest damage in Sudbury District occurred in Allan Township on Manitoulin Island, where 90% of the 3.5-m Scots pine sustained 40% defoliation in a 0.5-ha area.

European Fruit Lecanium, *Parthenolecanium corni* (Bouché)

Unusually heavy infestations by this scale insect occurred in hardwood stands in several areas of the region. Large numbers of scales were found infesting sugar maple stands in Cavendish Township, Bancroft District, and in Butt, Proudfoot, Machar and McClintock townships, Parry Sound District. Moderate infestations were found in predominantly sugar maple stands in Glamorgan, Monmouth and Harvey

Table 13. Defoliation caused by the redheaded pine sawfly at 19 locations in the Central Region of Ontario in 1992 (counts based on an examination of 150 randomly selected trees at each site).

Location (Township)	Tree species	Average height of trees (m)	Estimated area affected (ha)	Trees affected (%)	Average defoliation (%)	Current mortality (%)
<i>Algonquin Park District</i>						
Peck	rP	1.2	1	40	45	8
<i>Bancroft District</i>						
McClure	rP	2.6	2	72	14	0
Stanhope	rP	1.1	26	4	10	0
Wicklow	rP	1.6	5	11	19	0
<i>North Bay District</i>						
Cameron	rP	1.3	1	17	20	0
Cameron	rP	1.1	1	14	25	0
Cameron	rP	1.0	10	2	20	0
Phelps	rP	1.2	2	2	10	0
<i>Pembroke District</i>						
Clara	rP	1.6	2	3	10	0
Maria	rP	0.9	2	6	30	0
<i>Sudbury District</i>						
Balfour	rP	0.9	1	12	60	2
Carnarvon	rP	2.0	3	60	10	0
May	rP	0.8	4	12	20	0
May	jP	1.3	5	8	15	0
May	jP	0.7	2	5	35	0
May	jP	1.0	1	20	30	0
Salter	rP	1.8	5	18	10	0
Tennyson	rP	1.6	20	1	5	27
<i>Parry Sound District</i>						
Paxton	rP	0.9	10	13	29	0

townships, Bancroft District; in Sproule Township, Algonquin Park District; and in Commanda Township, North Bay District. Low population levels were widespread in these districts as well as in several areas of Pembroke District. Low or occasionally moderate population levels of the European fruit lecanium along with the oak lecanium (*P. quercifex* [Fitch]) were evident in hardwood stands in the North Bay and Sudbury districts. High population levels of both species were observed on red oak and sugar maple in Jocelyn Township, and in the city of Sault Ste. Marie, Sault Ste. Marie District.

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

The yellowheaded spruce sawfly was commonly found in Central Region in 1992, attacking the current growth of young open-growing spruce (*Picea* spp.), such as ornamentals and roadside trees. Repeated heavy defoliation resulted in tree mortality in some areas.

High population levels were recorded in Bancroft District, causing 20 to 100% defoliation of ornamental and roadside white spruce 1 to 3 m in height in Minden, Dysart, Digby, Somerville, Galway, Dalton and Harvey townships. Recent tree mortality of 2-m ornamental white spruce was noted in Minden and Harvey townships. A 25-tree survey of ornamental white spruce and Colorado blue spruce (*Picea pungens* Engelm.) in the town of Bancroft found that 68% of the trees were affected and defoliation averaged 35%.

Surveys in Parry Sound District disclosed 30 to 95% defoliation of 1- to 3-m ornamental and roadside white spruce in Armour, Chaffey and Draper townships. Assessment of 16 roadside white spruce averaging 2 m in height in Armour Township revealed defoliation that ranged from 40 to 95% and averaged 70%.

Large populations resulted in 75% defoliation to 70% of the roadside white spruce, averaging 2 m in height, along Highway 69 in Bigwood, Cox, Delamere and Servos townships, Sudbury District.

Observation disclosed up to 75% defoliation of 1- to 2-m ornamental white spruce in the town of Pembroke, Pembroke District, and in the town of Iron Bridge and the city of Sault Ste. Marie, Sault Ste. Marie District.

White Pine Weevil, *Pissodes strobi* (Peck)

Surveys for this pest conducted in 38 plantations revealed an incidence of attack that ranged from 0 to 30.7% in the region (Table 14). The highest incidence of leader damage occurred in a 2-ha white pine plantation of 2.7-m trees in Sisk Township, North Bay District. Elsewhere in the region, damage was less than 20%, with the majority of the plantations having less than 10% of the trees affected.

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

Moderate-to-severe defoliation occurred over 116,893 ha in the northern portion of Sudbury District (Fig. 13). The main body of defoliation occurred from Rhodes Township west into Dennie Township and north into Timmmins District. Three smaller pockets (1,770, 3,310 and 14,890 ha) of defoliation also occurred west of the main body of defoliation and affected parts of Alton, Jasper, Avis, Beebe, Durban, Ethel and Assel townships and extended north into the Chapleau

District of Northeastern Region. All age classes of aspen were affected, but the bulk of the leaf-curling occurred on semimature and mature trees.

In Sault Ste. Marie District, moderate-to-severe defoliation also occurred in parts of Hodgins and Nouvel townships. However, the areas affected were less than 1 ha in size and the height of affected trembling aspen (*Populus tremuloides* Michx.) varied from 2 to 12 m. Leaf-curling averaged 80% in these areas.

Trace levels of damage were observed at widely scattered points elsewhere in the region.

Minor Insects

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

Widespread light defoliation was reported in 1991 in stands of eastern white pine throughout the southern part of Parry Sound District. In 1992, a population collapse was recorded within this area and only scattered, small numbers of sawflies could be found.

Small numbers of this sawfly were also found causing less than 5% total defoliation in two red pine plantations averaging 2.5 m in height, one in McMurrich Township, Parry Sound District, and the other in Minden Township, Bancroft District.

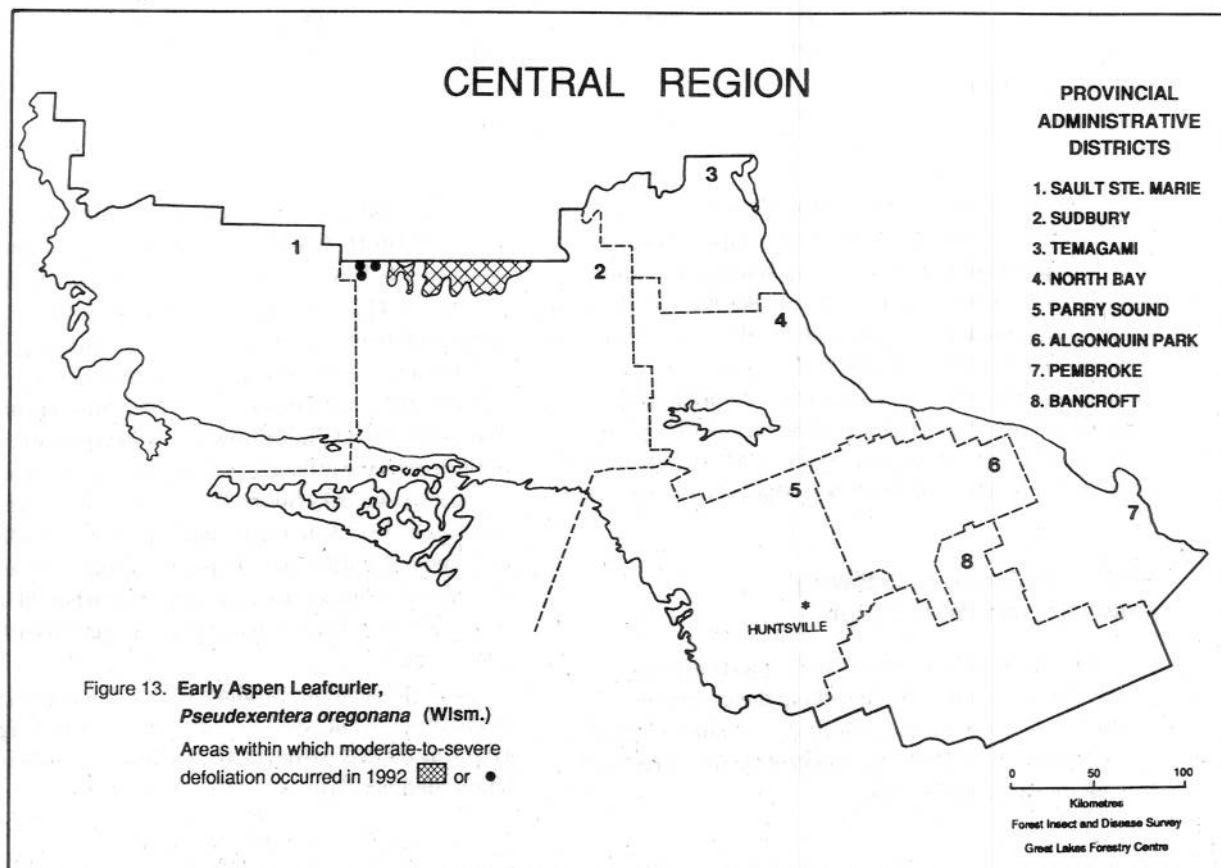


Table 14. Damage caused by the white pine weevil at 38 locations in the Central Region of Ontario in 1992 (counts based on an examination of 150 randomly selected trees at each location).

Location (Township)	Tree species	Average height of trees (m)	Estimated trees per ha	Estimated area affected (ha)	Trees affected (%)
<i>Bancroft District</i>					
Monteagle	ewP	1.8	2,000	3	5.0
North Bay District					
Gurd – seed orchard	ewP	5.9	1,000	2	7.3
Merrick – family test	jP	3.3	1,600	8	0
Mattawan – seed orchard	ewP	1.4	800	5	2.0
Olrig	ewP	2.1	2,000	1	9.0
Sisk	ewP	2.7	2,100	2	30.7
<i>Parry Sound District</i>					
Armour	ewP	3.1	2,220	2	8.0
Cardwell	ewP	2.3	2,800	5	14.0
Pembroke District					
Lyndoch	ewP	1.7	2,200	3	10.7
Sherwood	ewP	2.5	1,500	2	6.0
<i>Sault Ste. Marie District</i>					
Curtis	jP	3.0	2,500	40	13.3
Grasett	rP	1.7	2,500	50	6.6
Hurlburt	jP	1.2	2,500	50	17.0
Hynes	jP	1.4	2,500	25	16.0
Lamming	jP	1.6	2,500	40	2.0
Lane	jP	3.6	2,500	40	8.0
Lane	jP	2.8	2,500	4	7.0
Sturgeon	jP	2.1	2,500	20	9.3
Timbrell	rP	3.2	2,500	40	7.3
Villeneuve	jP	2.7	2,500	4	2.7
<i>Sudbury District</i>					
Dunbar	jP	1.5	2,000	25	2.7
Durban – seed orchard	jP	3.4	1,400	15	1.3
Hallam – seed orchard	ewP	0.8	800	4	8.0
Hallam – seed orchard	jP	3.8	2,400	25	1.3
Lumsden – seed orchard	jP	3.9	2,500	5	8.7
Mandamin – family test	P	2.3	1,700	10	9.3
Munster – family test	jP	0.9	1,700	5	0.7
Olinyk – family test	jP	1.3	2,500	4	1.3
Salter – family test	jP	2.2	2,200	10	14.7
Street – family test	tjP	2.6	2,000	5	7.3
Tennyson	jP	1.9	2,200	4	20.7
Venturi	jP	2.0	2,100	30	9.3
<i>Temagami District</i>					
Banting	jP	2.4	3,700	5	2.7
Canton	jP	2.8	4,900	100	2.0
Canton	jP	1.8	3,700	50	2.0
Milne	ewP	2.0	3,700	2	2.0
Milne	jP	1.7	4,000	10	1.3
Milne	jP	1.3	2,500	25	2.0

Table 15. Other forest insects.

Insect	Host(s)	Remarks
<i>Acleris semipurpurana</i> (Kft.) Oak leaf shredder	rO	Defoliation ranged from 25 to 60% in one stand in Tarentorus Twp, and 25% defoliation was reported in stands in Long and Thessalon twps, Sault Ste. Marie District.
<i>Acrobasis betulella</i> Hlst. Birch tubemaker	wB	Small numbers of tubemakers were recorded on host trees throughout Bancroft District.
<i>Agonopterix robiniella</i> (Pack.) Micro moth	black locust	Surveys disclosed 90% defoliation of 14-m trees in a 2-ha woodlot in Wilberforce Township, Pembroke District. A 1-ha stand in Minden Township, Bancroft District, experienced 30% defoliation.
<i>Aphrophora cribrata</i> (Wlk.) Pine spittlebug	ScP	A survey found 23% of 3.5-m trees were attacked in Dawson Township, Sudbury District.
<i>Archips cerasivorana</i> (Fitch) Uglynest caterpillar	cherry	Varying degrees of damage occurred throughout the region.
<i>Caliroa cerasi</i> (L.) Pearslug sawfly	aMo	Moderate numbers of sawflies were observed feeding in conjunction with the mountain-ash sawfly (see below) in Fenwick Township, Sault Ste. Marie District.
<i>Caloptilia invariabilis</i> (Braun) Cherry leafcone caterpillar	pCh	Defoliation of 75% was observed on scattered trees in Mississagi Provincial Park, Sault Ste. Marie District.
<i>Caulocampus acericaulis</i> (MacG.) Maple petiole borer	sM	High population levels were observed in Somerville, Laxton, Dalton and Minden townships, Bancroft District, and in McMurrich, McLean and Medora townships, Parry Sound District.
<i>Corthyus punctatissimus</i> (Zimm.) Pitted ambrosia beetle	sM	Surveys determined that the mortality of trees <1 m in height was <1% in Christie, Gibson, Machar, Ridout and Stisted townships, Parry Sound District.
<i>Epinotia aceriella</i> (Clem.) Maple trumpet skeletonizer	sM	Foliar damage of 20% was reported in a 10-ha stand of mature trees in Lyndoch Township, Pembroke District.
<i>Fenusa pusilla</i> (Lep.) Birch leafminer	wB	Observations disclosed small areas, <1 ha in size, that experienced 50 to 80% defoliation in Fenwick and Hodgins twps, Sault Ste. Marie District.
<i>Leucoma salicis</i> (L.) Satin moth	siPo	Trace populations caused 2 to 3% defoliation in the Petawawa and Pembroke areas, Pembroke District.
<i>Macrohaltica ambiens</i> LeC. Alder flea beetle	alder	Small clumps of trees experienced 75% defoliation at scattered points along Highway 552 in Albanel Township, Sault Ste. Marie District.

(cont'd)

Table 15. Other forest insects. (concl.)

Insect	Host(s)	Remarks
<i>Neodiprion n. nanulus</i> Schedl. Red pine sawfly	rP	This sawfly was observed causing 70% defoliation on 3-m roadside trees in Blair Township, Parry Sound District. Defoliation averaging 45% was recorded in Martland Township, Sudbury District.
<i>Neodiprion pratti banksianae</i> Roh. Jack pine sawfly	jP	In Broder Township, Sudbury District, 50% of the 4-m trees sustained 75% defoliation over a 0.5-ha area.
<i>Neodiprion swainei</i> Midd. Swaine jack pine sawfly	jP	Light defoliation (20%) was recorded on mature jack pine trees on Island 27 in Lake Temagami, Temagami District.
<i>Neodiprion virginiana</i> complex Redheaded jack pine sawfly	jP	Low population levels were found in Raimbault and Esten townships, Sault Ste. Marie District.
<i>Oligonychus ununguis</i> (Jac.) Spruce spider mite	wS	Large populations were observed at a campground in Concobar Township, Algonquin Park District, causing 30% foliar damage.
<i>Petrova albicapitana</i> (Bsk.) Northern pitch twig moth	jP	An average of 3% of the trees were attacked in Milne and Firstbrook twps, Temagami District.
<i>Phyllonorycter ontario</i> (Free.) Aspen leafblotch miner	tA	Foliar damage in small pockets of regeneration averaged 75% at several points in Kirkwood and Haughton townships, Sault Ste. Marie District.
<i>Pristiphora geniculata</i> (Htg.) Mountain-ash sawfly	aMo	This sawfly was commonly observed at numerous locations and caused varying amounts of defoliation, especially on ornamental plantings throughout the region.
<i>Pristiphora erichsonii</i> Htg. Larch sawfly	tL	A survey disclosed 10% defoliation on 5-m trees over a 0.25-ha area in Wicklow Township, Bancroft District.
<i>Sochnus rufipes</i> (LeC.) Willow flea weevil	W	Defoliation averaged 75% on ornamental and roadside trees from Chelmsford to the town of Wahnapiatae, Sudbury District.
<i>Toumeyella parvicornis</i> (Ckll.) Pine tortoise scale	jP	Small populations were present across Sudbury District. The heaviest damage occurred at the Family Test Site in Mandamin Township, with 5% of the 1.8-m trees affected.
<i>Zeiraphera canadensis</i> Mut. & Free. Spruce bud moth	wS	Shoot damage on 1.2-m trees averaged 10% in a 1-ha area in Burpee Township, Sudbury District.
<i>Zelleria haimbachi</i> Bsk. Pine needle sheathminer	jP	In Sagard Township, Sault Ste. Marie District, shoot damage averaged 50% on immature trees. Lower population levels were also recorded in Bigwood Township, Sudbury District, and Carling Township, Parry Sound District.

TREE DISEASES

Major Diseases

Armillaria Root Rot, *Armillaria ostoyae* (Romagn.) Herink

The presence of this disease organism was detected in plots at 24 of 49 plantations across seven districts in the region (Table 16). The average height of the sample trees was less than 6 m and current tree mortality as high as 6% was reported. Some of the locations at which the disease was not detected on the survey plots were the Gurd and Mattawan seed orchards and Merrick family-test site, North Bay District; the Curtis seed orchard and the Lane family-test site, Sault Ste. Marie District; the Dunbar, Hallam and Lumsden seed orchards and the Mandamin, Munstar and Street family-test sites, Sudbury District.

Table 16. Damage caused by *Armillaria* root rot in the Central Region of Ontario in 1992 (counts based on an examination of 150 trees at each location).

Location (Township)	Tree species	Average height of trees (m)	Estimated stand area (ha)	Current mortality (%)
<i>Bancroft District</i>				
Cardiff seed orchard	wP	1.0	5	4
Cardiff	rP	0.7	2	6
<i>North Bay District</i>				
Chisholm	rP	3.0	2	2
Phelps	rP	1.2	1	2
<i>Parry Sound District</i>				
Ballantyne	rP	1.5	15	<1
Humphrey	rP	3.0	2	<1
Joly	rP	2.4	10	<1
McMurrich	rP	2.5	11	<1
McMurrich	rP	2.6	11	<1
McMurrich	rP	1.0	8	<1
McMurrich	rP	1.5	30	<1
Paxton	rP	0.9	10	<1
Ryerson	rP	1.5	5	<1
Ryerson	rP	2.0	8	<1
Ryerson	rP	1.8	10	<1
Ryde	rP	1.8	8	<1
Stephenson	rP	2.1	5	<1
<i>Pembroke District</i>				
Clara	wP	0.4	5	2
Head	rP	2.9	10	3
Wilberforce	rP	1.5	20	1
Wylie	rP	1.0	3	5
<i>Sault Ste. Marie District</i>				
Hynes	jP	1.6	25	<1
<i>Sudbury District</i>				
Dunbar	jP	1.5	25	<1
Olinyk family test	jP	1.3	5	<1

Anthracnose, *Aureobasidium apocryptum* (Ell. & Ev.) Hermanides-Nijhof

This disease was noticeably widespread in southern Parry Sound District and in the western portion of Bancroft District. Roadside, forest edge, ornamental and open-grown sugar maple were most severely affected. Foliar infection levels as high as 100% were recorded on trees up to 20 m in height. Premature defoliation as high as 80% was recorded in Oakley and Draper townships, Parry Sound District, and in Hindon Township, Bancroft District. Leaf scorch was also associated with the anthracnose in many areas.

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

Because this fungus has been a serious problem in eastern white pine plantations in the Temagami and North Bay districts during the past several years, a special survey was conducted to determine the impact of this disease in these areas in 1992. The OMNR in Temagami District provided additional assistance to complete the survey. The results are shown in Table 17. The highest incidence of infection was recorded in Orlig Township, North Bay District, where 20.7% of the 2.3-m trees were affected, of which 10.7% were main-stem infections.

An additional objective of this study was to determine if trees on different slope positions were more susceptible to blister rust infections. The various positions compared in the survey were:

- Depression: any area that is concave in all directions.
- Level: any level area excluding toe slopes.
- Toe slope: the lowermost portion of the slope immediately below and adjacent to the mid-slope.
- Mid-slope: the area of the slope between the crest and the toe, and which has a specific aspect.
- Crest: the uppermost portion of the slope, with a shape usually convex in all directions (Kershaw 1990).

Table 17. Damage caused by white pine blister rust in plantations of eastern white pine in the North Bay and Temagami districts of Ontario in 1992.

Temagami districts of Ontario in 1992.						
Location (Township)	Average height of trees (m)	Live trees cankered			Dead	
		Stem (%)	Severe branch ^a (%)	Non-lethal branch ^b (%)	Cankered (%)	Not cankered (%)
<i>North Bay District</i>						
Antoine	1.5	2.0	0.7	0	0.7	0
Eddy	1.9	4.0	2.7	0.7	0.7	0
French	1.1	0.7	0	0	0	0
Olrig	2.3	10.7	4.0	2.7	3.3	0
Mattawan	2.2	0	0.7	0	0	0
Mattawan	1.8	4.7	4.7	0	0.7	0
Mattawan – seed orchard	1.4	0	0	0	0	0
Sisk	1.8	1.3	0.7	1.3	2.0	0
<i>Temagami District</i>						
Askin	0.4	0	0	0	0	1.3
Askin	0.2	1.3	0	0	0	0
Askin	1.0	10.0	1.3	7.3	0	4.7
Chambers	1.7	10.7	2.0	0	0.7	2.0
Chambers	0.8	3.3	0	0	0	2.2
Chambers	2.0	6.7	3.3	0	2.0	2.0
Milne	1.7	6.0	0	0	1.3	0.7
Milne	1.8	8.7	0.7	0	0.7	0.7
Milne	1.4	14.0	4.7	0	0	0
Olive	2.2	4.5	6.7	0	0.7	0.7
Olive	1.6	5.3	0	0	2.7	2.7
Olive	0.2	0	0	0	0	0

^a located within 46 cm of the stem

^b located farther than 46 cm from the stem

Surveys in the current study revealed that a greater percentage of the trees located in flat areas and at the base of slopes are infected (stem plus all branch infections) with blister rust than are affected on higher positions on the slope (Fig. 14). It should be noted that because of the lack of sample

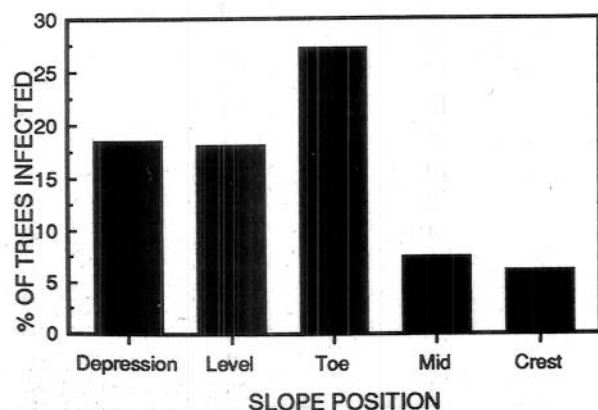


Figure 14. Summary of the white pine blister rust survey in the Temagami District of Ontario in 1992.

areas in the toe slope position, the sample size for this category was relatively small ($n=44$). The sample sizes for all other categories ranged between 135 and 524.

Elsewhere in the region, the incidence of blister rust was generally low, but there were a few exceptions. Over a 2-ha area of 4-m trees in Biggar Township, Algonquin Park District, the incidence of infection was 52%, of which 40% were stem cankers. Of the 2-m trees growing in a 3-ha area in Monteagle Township, Bancroft District, 30% were infected, of which 18% were stem cankers. As well, 5% of the trees were recently dead, mainly as a result of rodents chewing on the cankered areas and girdling the stem. Severe damage was also observed in Ashby Township, Bancroft District, where a 1-ha, plantation of 2.4-m trees sustained damage to 30% of the trees; 20.6% of the cankers were located on the stem, and there was a 4% current mortality rate. A survey in a 5-ha, 2.3-m plantation in Cardwell Township, Bancroft District, revealed a 4.7% incidence of infection, with 4% stem cankers and <1% current mortality. Surveys conducted in two other plantations in Parry Sound District (one in Monck Township, the other in Ryde Township) disclosed an incidence of infection that averaged 1.3%, 0.7% with stem infections and

0.7% recent tree mortality. In a 3-ha plantation of 3.7-m trees in Allan Township, Sudbury District, the incidence of infection was 1.4%, half of which were main-stem infections.

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

A total of 119 red pine plantations ranging in height from 0.5 to 9.0 m was surveyed in 1992 to determine the presence and distribution of the North American race and the more virulent European race of the *Scleroderris* canker fungus. Serological testing confirmed the presence of the European race at 15 locations, five of which also harbored the North American race. The North American race was found by itself at 12 locations.

The European strain was found for the first time in two townships in Parry Sound District (Table 18). In Joly Township (concessions X and XI, Lot 11) the disease was found in a 10-ha plantation of 2.4-m red pine. Less than 1% of the trees were affected. Similar damage levels were found in a 10-ha plantation of 2.1-m trees (Concession III, Lot 24) in Perry Township.

The remaining plantations in which the European race was found were in townships with a previous history of this race. The associated incidence of affected trees ranged from <1% to 8%.

Seven plantations averaging 1.7 m in height in McMurrich Township, Parry Sound District, were found hosting the European race at an incidence of up to 8% at the following

Table 18. Results of a special survey for *Scleroderris* canker in the Central Region of Ontario in 1992 (counts based on an examination of more than 500 red pine trees at each location.)

Location (Township)	Average height of trees (m)	Estimated trees per hectare	Total area affected (ha)	Trees affected (%)	Trees dead ^a (%)
<i>Bancroft District</i>					
Mayo	0.7	2,000	6	<1	0 ^b
<i>North Bay District</i>					
Olrig	2.2	2,200	10	41	0
<i>Parry Sound District</i>					
Chaffey	3.0	3,000	4	<1	0
Joly ^d	2.4	3,000	10	<1	0 ^c
Macaulay	2.9	3,000	1	<1	0
McMurrich	2.2	2,500	18	1	1 ^b
McMurrich	1.9	2,800	5	8	<1 ^c
McMurrich	1.9	1,800	9	3	0 ^b
McMurrich	1.5	1,800	30	1	0
McMurrich	1.6	2,900	4	1	<1 ^b
McMurrich	1.1	3,200	14	1	<1
McMurrich	1.1	2,200	8	1	<1
McMurrich	2.6	1,400	11	<1	<1
McMurrich	1.0	1,500	8	3	0 ^c
McMurrich	0.9	3,000	3	7	<1 ^c
McMurrich	2.6	2,600	30	<1	<1 ^b
McMurrich	2.5	3,000	11	3	<1
Perry ^d	2.1	2,900	10	<1	0 ^b
Ryerson	1.5	2,800	5	<1	0 ^b
Ryerson	1.8	3,300	10	<1	0 ^b
Ryerson	2.0	3,000	8	1	0 ^b
Ryerson	3.4	2,800	4	2	0
Ryerson	3.3	3,000	15	2	<1 ^c
Ryerson	3.6	2,000	12	<1	0
Stephenson	2.1	2,200	5	<1	0 ^b
Stisted	1.2	3,000	6	<1	<1
Strong	2.4	2,500	3	33	<1

^a Unless otherwise noted, only the North American race was found.

^b Only the European race was found.

^c Both the North American and European strains were found.

^d This represents an extension of the range of the European race.

locations: Woodlot Improvement Act area (WIA) number 158, concessions XI and XII, Lot 9; WIA 175, Concession VII, Lot 14; WIA 131, Concession VIII, Lot 14; WIA 92, Concession V, Lot 26; WIA 178, Concession II, Lot 22; WIA 173, Concession IV, Part Lot 20; and WIA 108, Concession VI, lots 12 and 13. The fungus was also recovered from four plantations averaging 2.2 m in height in Ryerson Township, Parry Sound District: WIA 174, Concession X, Lot 27; WIA 167, Concession X, Lot 26; WIA 147, Concession II, Lot 8; and WIA 153, Concession V, lots 12 and 13. The European race was found in a 10-ha plantation of 2.1-m trees (Concession III, Lot 24) in Stephenson Township, Parry Sound District, and in a 6-ha area of 0.7-m red pine (Concession XIII, Lot 24) in Mayo Township, Bancroft District (Fig. 15).

In all the above plantations that hosted the European race of the fungus, recent tree mortality on the survey plots was absent or <1%.

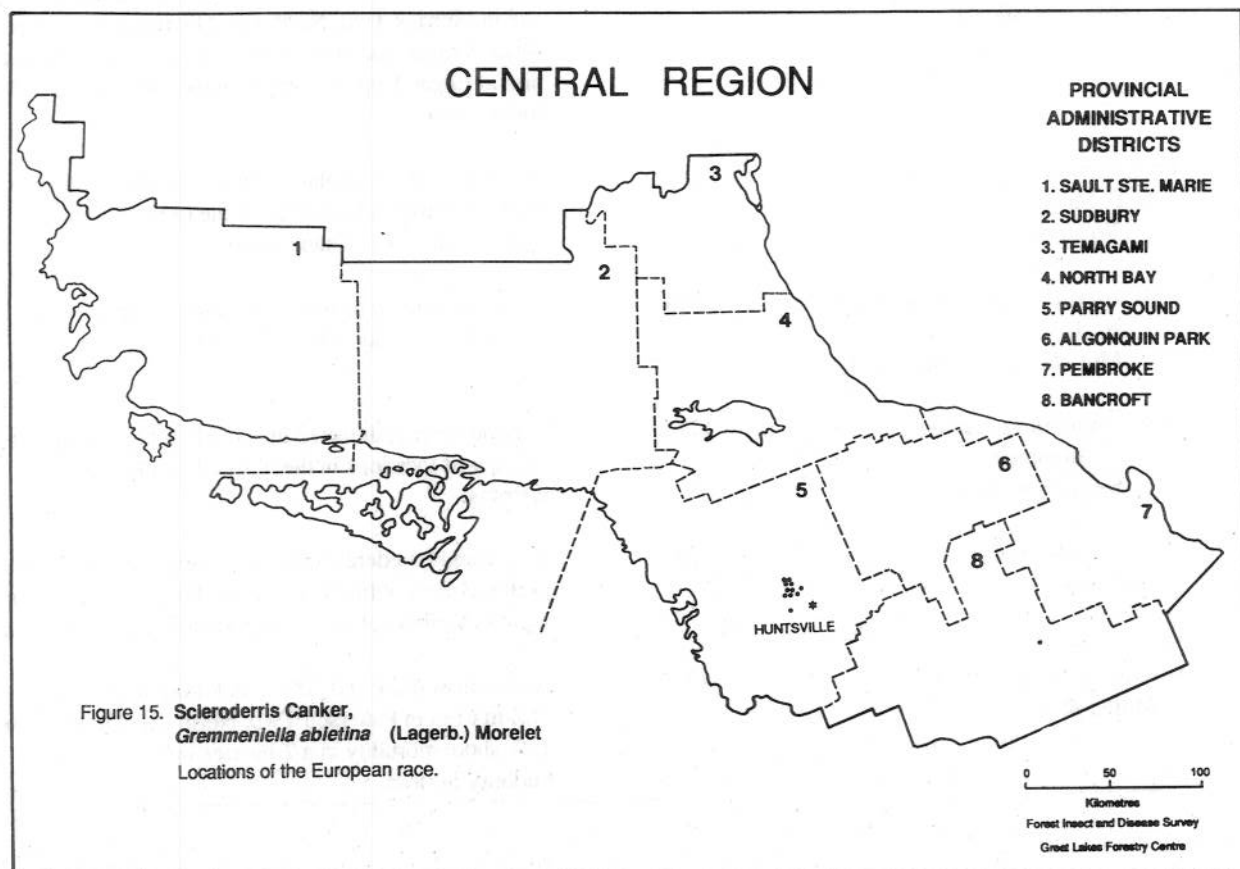
The North American race was found by itself at 11 locations averaging 2.3 m in height in Parry Sound District. Surveys determined the incidence of infection and of recent tree mortality caused by the fungus to be 3% or less and 1% or less, respectively. Seven of the positive surveys occurred at the following locations in McMurrich Township: Concession II, lots 13 & 14; Concession III, Lot 4; Concession

VIII, Lot 20; Concession II, Lot 21; and Concession IX, Lot 20. The North American race was also identified in plantations in: Concession VII, Lot 25 and Concession X, lots 28 and 29, Ryerson Township; Concession XIII, Lot 15, Chaffey Township; Concession XII, Lot 7, Stisted Township; Concession XIII, Lot 13, Macaulay Township; and Concession XIV, Lot 20, Strong Township.

Aerial and ground surveys were also conducted outside of the Bancroft and Parry Sound districts. No evidence of the disease was found in the Algonquin Park, Pembroke, Sudbury, Temagami or Sault Ste. Marie districts. However, an assessment in a 10-ha plantation of 2.2-m red pine in Olrig Township, North Bay District, disclosed that 41% of the trees were infected by the North American race of the fungus. Only lower branches were killed and no recent tree mortality was observed outside the survey plots.

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

To determine the deposition rates of airborne *H. annosum* spores, a survey was conducted at three locations in the region. The three locations were the FIDS field stations in Minden, at the Petawawa National Forestry Institute (PNFI, Chalk River) and in Skead, northeast of Sudbury.



At these locations, two freshly cut red pine discs less than 10 cm in diameter were exposed overnight once a week. These exposed discs were then submitted to the Forestry Canada laboratory in Sault Ste. Marie, where they were examined to detect the presence of spores of this fungus.

All samples that were submitted from Minden and Skead were negative. Six of thirteen samples from PNFI were positive, which indicates the presence of the pathogen in the area. Although the spores of this root pathogen are present, no tree mortality has been detected in any red pine plantation.

Table 19. Other forest diseases.

Insect	Host(s)	Remarks
<i>Chrysomyxa ledi</i> (Alb. & Schwein.) de Bary var. <i>ledi</i> Small-spored spruce-Labrador tea rust	bS	A survey in a 5-ha stand in Halfway Lake Provincial Park, Sudbury District, determined that 70% of the 6-m hosts were infected, with light infections (<5%).
<i>Chrysomyxa pirolata</i> (Körn.) Winter Spruce cone rust	bS	Light cone infections were recorded in a 1-ha stand of 6-m trees in Halfway Lake Provincial Park, Sudbury District.
<i>Coleosporium asterum</i> (Dietel) Sydow Pine needle rust	jP, rP	Light infections caused <5% foliar damage to jack pine in Sudbury District and 10% foliar damage to 40% of the 1.5-m red pine in a 1-ha area in Raglan Twp, Pembroke District.
<i>Davisomycella ampla</i> (J. Davis) Darker Tar spot needle cast	jP	60% of the 2.2-m trees in a 10-ha area of a family-test site in Merrick Twp, North Bay District, experienced 20% foliar damage and 60% of the 2-m hosts in a 2-ha plantation in Edgar Twp, Algonquin Park District, had 35% foliar damage.
<i>Endocronartium harknessii</i> (J.P. Moore) Y. Hirats. Western gall rust	jP	A survey in a 10-ha plantation of 4-m trees in Moses Twp, Sudbury District, found 9% of the trees had branch cankers and 1% had stem cankers.
<i>Gymnosporangium cornutum</i> Arthur ex Kern Mountain-ash-juniper rust	aMo	Moderate infections were noted on regeneration in LaRonde Twp, Sault Ste. Marie District.
<i>Mycosphaerella populicola</i> G.E. Thompson Septoria leaf spot	bPo	Ground surveys detected up to 30% foliar damage at a number of locations in the North Bay and Sudbury districts.
<i>Septoria betulae</i> Pass. Leaf spot	wB	Widespread moderate infections were observed in the northern parts of the Sudbury and North Bay districts, with up to 30% foliar damage occurring in some areas.
<i>Venturia macularis</i> (Fr.) E. Müller & v. Arx Shoot blight of aspen	tA	Assessment disclosed 20% shoot mortality in a 4-ha area of 2-m trees in Patterson Twp, North Bay District, and 15% shoot mortality in a 2-ha area in Cleland Twp, Sudbury District.

ABIOTIC DAMAGE

Forest Decline

Forests in the region continue to show the effects of a combination of prolonged drought, insect defoliation and poor site conditions in the form of foliar discoloration, branch dieback and tree mortality.

The health of a number of coniferous species, notably balsam fir and eastern hemlock, reflected the cumulative result of below-normal precipitation. This stress caused foliar discoloration and tree mortality of balsam fir throughout the region and caused branch and tree mortality of eastern hemlock in parts of the Bancroft and Parry Sound districts.

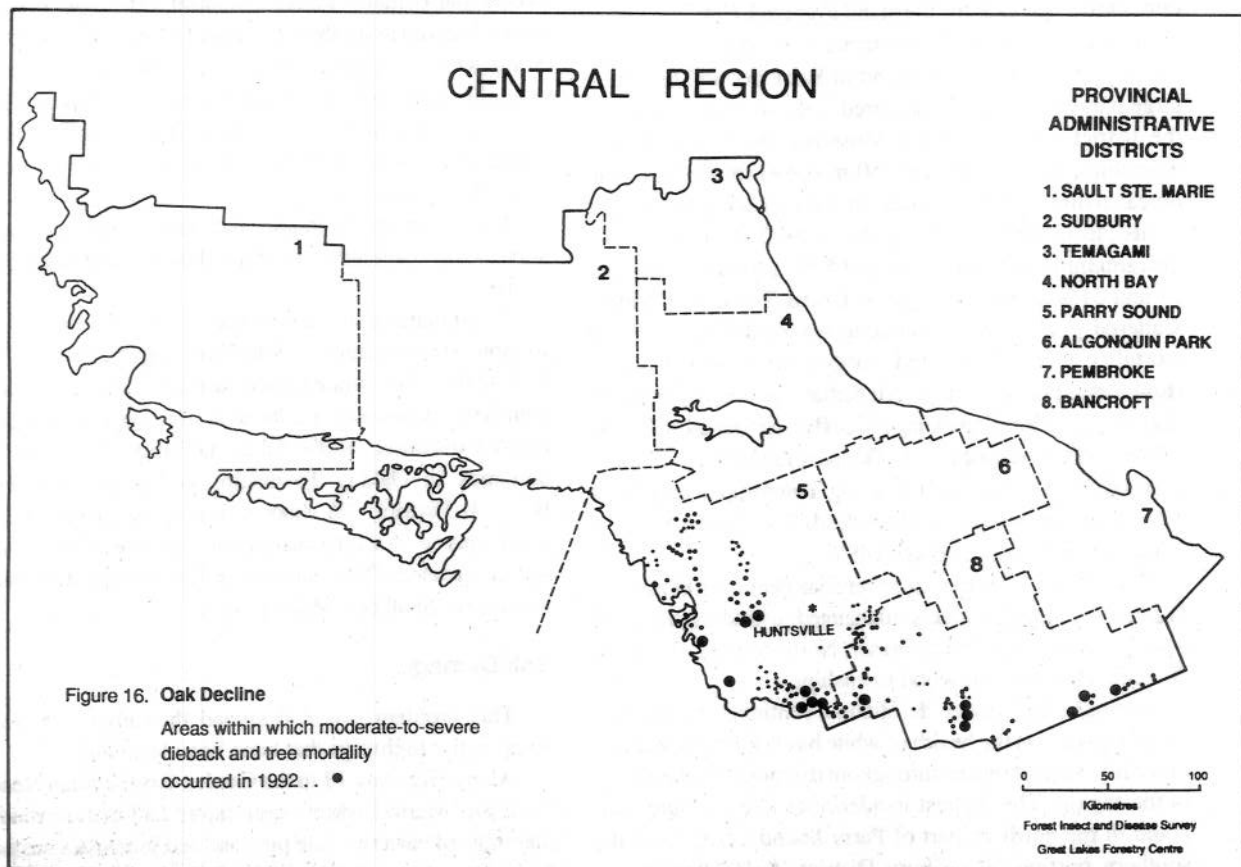
Dieback and mortality of hardwood tree species such as aspen, sugar maple, beech (*Fagus grandifolia* Ehrh.), ash (*Fraxinus* spp.), black cherry (*Prunus serotina* Ehrh.), white birch and oak were observed in Central Region, especially in the southern parts of the Bancroft and Parry Sound districts.

Mortality of sugar maple in undisturbed stands (no harvesting in recent years) was low, but cumulative dieback ranged from 6% to as high as 22% (see the *Maple Health* write-up under *Forest Health*). Increased decline at some locations was also associated with the additional stress of harvesting. A 25-tree rating of 18-m residual sugar maple in a heavily cutover area in Guilford Township, Bancroft

District, disclosed that total dieback averaged 42%. A survey of 17-m beech in the same harvested area revealed total dieback averaging 36%. Across the road in an undisturbed stand, cumulative dieback of the 20-m beech averaged 11%. Increased soil temperature and evapotranspiration, and the large moisture demand of regeneration, are factors that contributed to increased decline in some harvested areas.

Stress also affected black cherry in parts of the Bancroft and Parry Sound districts. Total dieback averaged 28% in an assessment of 25 black cherry averaging 20 m in height in McCraney Township, Parry Sound District. Recent tree mortality of <1% was also recorded at this site.

Oak (especially red oak) sustained widespread dieback and tree mortality, mainly in the southern parts of the region (Fig. 16). Bancroft District hosted the largest area of damage (23,721 ha). Large areas of open-growing oak on shallow soils (site class 4) experienced moderate-to-severe dieback and tree mortality west of Gull Lake in the Minden work area in Lutterworth, Dalton, Digby, Anson and Longford townships. A 50-tree cruise of 11-m red oak at one location in Lutterworth Township disclosed that 90% of the trees were dead. Extensive areas of moderate-to-severe oak decline were also mapped in the Mississauga-Anstruther lakes area, mostly in Cavendish, Anstruther, Harvey and Burleigh townships. A plot with 18 white oak (*Quercus alba* L.) and



7 red oak was established in 1990 in Harvey Township in a typical affected area of open-growing oak on a rocky site. Since the plot's establishment, 36% of the trees have died and cumulative dieback of the remaining trees averaged 32% in 1992. Reassessment of a 50-tree (45 red oak, 5 white oak) mortality plot at this location disclosed 90% tree mortality, unchanged from the previous year. Another 50-tree mortality plot (32 red oak, 18 white oak) established in 1992 in Methuen Township revealed 62% mortality of the 10-m trees. Mortality averaged 44% in a 50-tree mortality plot of 17-m red oak in Anstruther Township. Reassessment of a 25-tree plot established in 1990 in Anstruther Township revealed 16% cumulative tree mortality and 28% total crown dieback. Other large areas of mortality in Bancroft District were recorded in the Mount Moriah-Lingham Lake area of Grimsthorpe Township and the Gull Lake area of Barrie and Clarendon townships. Tree mortality averaged 66% and cumulative dieback averaged 51% in a 50-tree survey of 15-m red oak (site class 4) in Clarendon Township. Pockets of decline and mortality were also mapped around the Highway 35 corridor north of Carnarvon to the Lake of Bays area in Stanhope, Hindon, Sherborne and Franklin townships. A 50-tree survey in Stanhope Township disclosed 36% of the 19-m red oak (site class 3) were recently dead and cumulative dieback in the stand averaged 34%. Mortality of 18-m red oak (site class 2) in Hindon Township averaged 8%, and cumulative dieback for the stand averaged 23%.

Numerous areas of moderate-to-severe oak decline, totaling 14,600 ha, were found in Parry Sound District. A large part of the damage occurred in the southern portion of the district in Baxter, Wood, Muskoka, Morrison and Ryde townships. Reassessment of a 50-tree plot in Ryde Township revealed that mortality of the 6-m open-growing red oak had tripled, from 16% in 1991 to 48% in 1992. Total dieback of the remaining plot trees averaged 53%. Mortality averaged 38 and 31% at two locations in Baxter Township. Widely scattered pockets of moderate-to-severe dieback and tree mortality were also noted northward through Conger, Humphrey, Foley, Christie, McKellar, Spence, McDougall, Carling, Ferguson, Shawanaga, East Burpee, Harrison, Burton and McKenzie townships. A 100-tree mortality cruise of 10-m red oak (site class 4) in Carling Township showed that 91% of the trees were recently dead. Total dieback on the remaining nine trees averaged 49%.

The area of moderate-to-severe oak decline in Pembroke District remained relatively unchanged, with some 568 ha of damage being recorded in Fraser, North Algona, Richards, Burns, Jones and Sherwood townships.

Drought and insect defoliation continued to have an adverse affect on the health of white birch. Dieback and tree mortality were observed throughout the range of white birch in the region. The highest incidence of tree mortality was noted in the northern part of Parry Sound District and the southern portion of Sudbury District. A 100-tree survey

conducted in Mowat Township, Parry Sound District, indicated that 51% of the 12-m white birch were recently dead (i.e., fine branches were still attached).

Moderate-to-severe dieback and light tree mortality of aspen were observed in Bancroft District, again more commonly on shallow sites that have experienced defoliation by the forest tent caterpillar and/or the gypsy moth. Moderate-to-severe decline and light tree mortality of white ash were noted in the western part of Bancroft District and the eastern portion of Parry Sound District.

Frost Injury

Late-spring frosts during mid-to-late May killed the foliage of a number of hardwoods and conifers in the Algonquin Park, Bancroft, North Bay, Parry Sound and Sudbury districts. The tree species most often affected included red oak, trembling aspen, sugar maple, beech, black ash, tamarack and white spruce.

The largest area of damage occurred in scattered pockets of various sizes in southern North Bay District and north-central Algonquin Park District. The primary species affected in this area was red oak. In North Bay District, the red oak often had 100% of its foliage killed. An evaluation of red oak in Deacon Township, Algonquin Park District, revealed that 100% of its mature red oak were affected, with an average of 60% foliar damage. Pockets of similar damage to red oak were observed in southern Sudbury District. In eastern Parry Sound District, scattered red oak stands sustained 70% foliar mortality in Ryerson, Croft and Spence townships. In Dalton Township, Bancroft District, damage to immature red oak ranged from 60 to 100%. In most cases, damaged trees had refoliated by late June.

Light damage to maple and beech regeneration was surveyed in scattered areas of the Bancroft and Parry Sound districts.

Frost damage to conifers was also observed in Central Region. At one location in Hotte Township, Sudbury District, 60% of the 1.5-m white spruce sustained damage to 75% of their new shoots over a 5-ha area. Surveys in Parry Sound District disclosed 100% foliar mortality of 15- to 18-m tamarack in Oakley Township. In Harburn Township, Bancroft District, 7% shoot mortality occurred on 1.4-m white spruce in a 2-ha plantation. Scattered mature white spruce sustained 25% damage in Kirkwood and Thessalon townships, Sault Ste. Marie District.

Salt Damage

This problem was widespread throughout the region along major highways that were heavily salted.

Along Highway 17 in the Garden River Indian Reserve Sault Ste. Marie District, semimature and mature roadside plantings of eastern white pine and red pine trees sustained foliar damage ranging from 25 to 75%. In the Callander area

of North Bay District, 60 to 90% foliar damage was recorded on roadside eastern white pine regeneration along Highway 11.

In other areas of the region, various degrees of damage were also noted on other species such as Scots pine, spruce and balsam fir.

Wind Damage

On 17 June, a severe thunderstorm travelled across Manitoulin Island and winds of up to 150 km/hour were reported at the Gore Bay weather station. Although extensive damage was reported on the western portion of the island, the majority of the damage occurred in Gordon, Allan and Barrie Island townships. In a 15-ha stand of sugar maple in Allan Township, 11% of the trees were blown over or broken off.

Other species damaged by the storm were horse-chestnut (*Aesculus hippocastanum* L.) throughout the town of Gore Bay, and white ash in the surrounding areas.

Winter Drying

Winter drying is caused by unusually warm weather in late winter and early spring. Moisture lost from needle tissues cannot be replaced by the frozen stems or root systems, which results in needle browning and possible needle mortality.

Moderate-to-severe browning of the older foliage of red pine trees ranging in height from 1 to 5 m was observed in the majority of the red pine plantations examined during the spring across the Parry Sound and Bancroft districts. An evaluation conducted in Montegale Township, Bancroft District, revealed 90% of the 1.5-m red pine affected in a 10-ha plantation, with 45% of the foliage damaged. This level of injury was representative of damage found in many of the affected plantations in the Bancroft and Parry Sound districts.

Elsewhere in the region, this condition was reported only at trace levels at scattered locations.

FOREST HEALTH

Acid Rain National Early Warning System (ARNEWS)

The nine ARNEWS plots in the region are part of a nationwide network of monitoring plots established to detect changes in forest trees, ground vegetation and soils. The plots cover conditions in a variety of stand types. The plot in Wishart Township, Sault Ste. Marie District, is in an immature sugar maple–yellow birch (*Betula alleghaniensis* Britton) stand; the Hyman Township, Sudbury District, plot is in an immature mixed hardwood stand; the plot located in Calver Township, North Bay District, is in an overmature white birch–largetooth aspen (*Populus grandidentata* Michx.) stand; immature red oak is the primary species in the Sproule

Township, Algonquin Park District, plot; the two plots in Wylie Township, Pembroke District, are in plantations of immature white spruce and Norway Spruce (*Picea abies* [L.] Karst.); the Ridout Township plot in Parry Sound District consists of mature sugar maple and yellow birch; the Mowat Township, Parry Sound District, plot is in an immature stand of red maple, white birch and trembling aspen; and the plot located in Sherborne Township, Bancroft District, consists of mature white pine and sugar maple. Information is collected annually from these plots on branch and crown conditions, current insect- and disease-related damage, and any occurrence of damage from aerial pollutants.

No acid rain damage was observed in any plots; however, some insect and disease problems were encountered. At both spruce plots in Wylie Township, Pembroke District, low levels of the eastern spruce budworm caused 5% defoliation. At the Hyman Township plot in Sudbury District, five trees have recently died. Samples taken from one tree indicated the mortality was caused by *Armillaria ostoyae* and this disease is the suspected cause of mortality of the other four trees. Since 1990, seven of the nine white birch in this plot have died, with *Armillaria* root rot the suspected cause. Similar damage has been surveyed in the plot located in Mount Township, Parry Sound District. Red oak in the Sproule Township, Algonquin Park District, plot showed symptoms of oak decline, with 70% of the trees having dead branches in the living crown and 5% of the trees dying in the past year, bringing accumulated mortality in the plot since establishment to 16%.

Maple Health

Since 1987, 55 sugar maple plots were established in woodlot stands to study the condition of sugar maple in the region (Fig. 17). In 1989, the project was expanded to include two other types of conditions in which maple is commonly found in southern Ontario (Fig. 18). The first was a rural location at which trees are growing adjacent to a roadway. The other included trees planted as ornamentals in urban centers, usually as boulevard or park trees. Four such roadside plots and three urban plots were established. All of the plots comprise 25 semimature or mature maple trees. The crown condition of each tree was rated up to 1992 with a dieback classification that evaluated total dieback in five categories: 0=0–5%, 1=6–20%, 2=21–40%, 3=41–60%, 4=>60% and 5=dead tree.

In 1992, 11.1% of the woodlot trees declined (moved into a higher dieback class), whereas 4.4% improved and 83.9% remained in the same dieback class as in 1991 (Table 20). The greater number of trees that declined rather than improving may be attributed to a combination of factors such as forest tent caterpillar and gypsy moth defoliation, a number of years of below-normal precipitation, and site condition. Forest decline is covered more fully in the section *Abiotic*

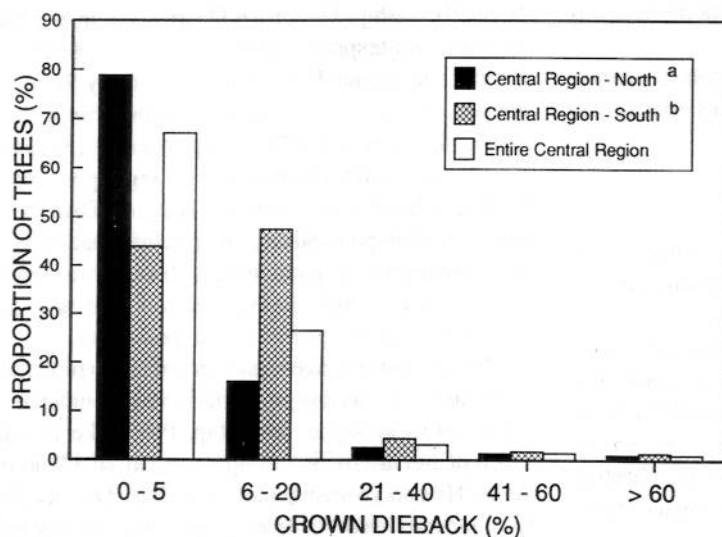


Figure 17. Summary of sugar maple dieback in woodlot plots in the Central Region of Ontario in 1992.

Damage. It should be noted that although 84% of the trees showed no change in their dieback rating, this does not necessarily mean they are healthy. Table 21 indicates that 94% of the sugar maple surveyed had up to 20% cumulative dieback. However, Figure 17 shows that if the region is divided into northern and southern parts, the plots in the northern portion have a significantly higher percentage of trees in the 0-5% crown dieback category (79% versus

44%). In this analysis, the northern portion includes the Sault Ste. Marie, Sudbury, and North Bay districts, whereas the southern portion includes the Parry Sound, Bancroft, Algonquin Park, and Pembroke districts. This comparison appears to be indicative of the dieback situation: maple stands in the northern portion of the region are showing less decline than in the south.

As well as crown dieback, other variables were recorded at the 55 plots in natural stands. Damage by the forest tent caterpillar occurred in 12% of the plots and the gypsy moth was found in four plots. Defoliation by both insects was less than 20% at all locations. Stem decay, including the presence of fungal fruiting bodies, occurred on 4.5% of the trees. Damage characteristic of the sugar maple borer (*Glycobius speciosus* [Say]) was noted on 4.1% of the trees. Injuries to the main stem, including seams, frost cracks, and open or

closed wounds, were found on 49.9% of the trees surveyed.

In the three urban plots, 87% of the trees had 20% or less total dieback, versus 95% of the roadside trees (Table 22). Other problems were recorded in the seven plots. Stem damage in the form of seams, frost cracks, etc. was found on 30% of the trees. Six of the trees were damaged by the sugar maple borer and 3% of the trees were infested with carpenter ants (*Camponotus* sp.).

Table 20. Yearly trend for maple health in 55 woodlot, three urban and four roadside plots in the Central Region of Ontario from 1987 to 1992 (counts based on an examination of 25 sugar maple trees at each location).

Plot type	Years	Tree condition (% of trees)			Dead trees (%)	Downed or missing trees (%)
		Improved	Static	Declined		
Woodlot	1987-88	3.8	83.6	12.6	0	0
	1988-89	20.1	66.2	13.6	0.4	0.1
	1989-90	8.0	83.6	8.4	0.9	0
	1990-91	29.5	64.8	5.7	0.6	0
	1991-92	4.4	83.9	11.1	0.7	0
Urban	1989-90	0.0	80.0	20.0	0	0
	1990-91	21.3	50.7	9.3	0	18.7
	1991-92	6.6	70.5	21.3	0	1.6
Roadside	1989-90	0.0	46.7	53.3	0	0
	1990-91	34.7	65.3	0.0	0	0
	1991-92	4.0	85.0	11.0	0	0

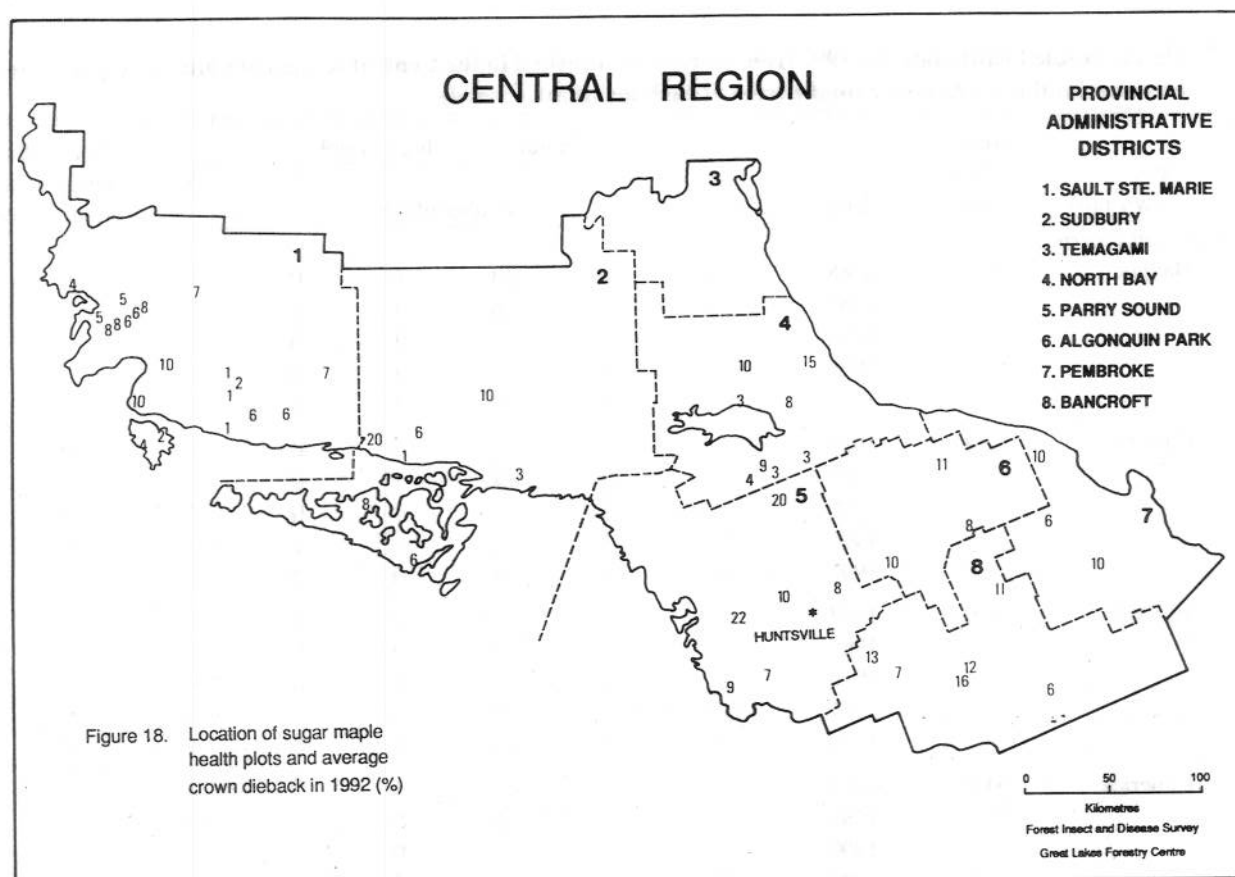


Table 21. Maple health data for 1992 from 55 plots established in the Central Region of Ontario (counts based on an examination of 25 sugar maple trees at each location).

Location (Township)	Average DBH (cm)	Year	Cumulative dieback class ^a						Cumulative number of cut/ windfall trees
			0	1	2	3	4	5	
			----- Number of trees -----						
<i>Algonquin Park District</i>									
Deacon	32.5	1988	0	3	16	6	0	0	0
		1989	0	16	8	1	0	0	0
		1990	0	13	12	0	0	0	0
		1991	11	14	0	0	0	0	0
		1992	7	18	0	0	0	0	0
Peck	36.3	1988	0	5	16	4	0	0	0
		1989	0	13	11	1	0	0	0
		1990	0	20	3	0	1	1	0
		1991	18	5	0	0	1	1	0
		1992	18	5	0	0	0	2	0
Murchison	41.0	1988	0	9	16	0	0	0	0
		1989	0	21	4	0	0	0	0
		1990	0	23	2	0	0	0	0
		1991	24	1	0	0	0	0	0
		1992	14	11	0	0	0	0	0

(cont'd)

Table 21. Maple health data for 1992 from 55 plots established in the Central Region of Ontario (counts based on an examination of 25 sugar maple trees at each location). (cont'd)

Location (Township)	Average DBH (cm)	Year	Cumulative dieback class ^a						Cumulative number of cut/ windfall trees
			0	1	2	3	4	5	
----- Number of trees -----									
<i>Bancroft District</i>									
Bangor	44.9	1988	0	6	13	6	0	0	0
		1989	0	16	6	1	1	0	1
		1990	0	17	5	1	0	1	1
		1991	13	9	0	1	0	1	1
		1992	12	10	0	1	0	1	1
Cardiff	32.3	1988	0	3	15	7	0	0	0
		1989	1	18	4	1	0	1	0
		1990	1	21	1	1	0	1	0
		1991	22	1	0	0	1	1	0
		1992	14	8	1	0	0	2	0
Hindon	35.9	1988	7	17	1	0	0	0	0
		1989	11	12	2	0	0	0	0
		1990	9	11	5	0	0	0	0
		1991	11	10	4	0	0	0	0
		1992	9	12	3	1	0	0	0
Limerick	31.8	1988	0	6	16	3	0	0	0
		1989	0	19	6	0	0	0	0
		1990	0	21	4	0	0	0	0
		1991	20	5	0	0	0	0	0
		1992	20	5	0	0	0	0	0
Monmouth	30.4	1988	9	12	4	0	0	0	0
		1989	7	12	3	2	0	1	0
		1990	4	13	3	2	0	3	0
		1991	2	17	2	0	0	4	0
		1992	1	18	1	1	0	4	0
<i>North Bay District</i>									
Blyth	18.4	1988	14	5	4	2	0	0	0
		1989	15	7	2	0	1	0	0
		1990	10	11	2	0	1	1	0
		1991	14	8	1	0	0	2	0
		1992	14	6	2	1	0	2	0
Chisholm	23.7	1989	25	0	0	0	0	0	0
		1990	24	1	0	0	0	0	0
		1991	24	1	0	0	0	0	0
		1992	24	1	0	0	0	0	0
Commanda	22.8	1989	18	7	0	0	0	0	0
		1990	16	9	0	0	0	0	0
		1991	24	1	0	0	0	0	0
		1992	23	2	0	0	0	0	0
French	16.3	1988	13	6	5	1	0	0	0
		1989	12	8	3	2	0	0	0
		1990	11	10	1	3	0	0	0
		1991	13	9	1	2	0	0	0
		1992	12	7	2	2	1	1	0

(cont'd)

Table 21. Maple health data for 1992 from 55 plots established in the Central Region of Ontario (counts based on an examination of 25 sugar maple trees at each location). (cont'd)

Location (Township)	Average DBH (cm)	Year	Cumulative dieback class ^a						Cumulative number of cut/ windfall trees
			0	1	2	3	4	5	
----- Number of trees -----									
<i>North Bay District (concl.)</i>									
Nipissing	22.0	1988	21	4	0	0	0	0	0
		1989	11	12	1	0	1	0	0
		1990	11	10	2	1	1	0	0
		1991	18	4	1	0	0	2	0
		1992	17	4	1	0	1	2	0
Nipissing	20.6	1989	17	9	0	0	0	0	0
		1990	16	9	0	0	0	0	0
		1991	24	1	0	0	0	0	0
		1992	23	2	0	0	0	0	0
Pringle	22.5	1989	19	6	0	0	0	0	0
		1990	18	7	0	0	0	0	0
		1991	24	0	1	0	0	0	0
		1992	24	0	1	0	0	0	0
Pringle	22.3	1988	16	9	0	0	0	0	0
		1989	14	10	0	1	0	0	0
		1990	14	10	0	1	0	0	0
		1991	25	0	0	0	0	0	0
		1992	23	2	0	0	0	0	0
Widdifield	31.1	1989	7	14	4	0	0	0	0
		1990	7	13	5	0	0	0	0
		1991	17	7	1	0	0	0	0
		1992	15	7	3	0	0	0	0
<i>Pembroke District</i>									
Richards	40.5	1988	0	7	17	1	0	0	0
		1989	0	16	9	0	0	0	0
		1990	0	20	5	0	0	0	0
		1991	17	8	0	0	0	0	0
		1992	21	4	0	0	0	0	0
Sebastopol	40.2	1988	0	15	9	1	0	0	0
		1989	0	23	1	1	0	0	0
		1990	0	21	3	1	0	0	0
		1991	20	4	1	0	0	0	0
		1992	12	12	1	0	0	0	0
Wylie	37.0	1988	0	4	14	7	0	0	0
		1989	0	15	7	3	0	0	0
		1990	0	17	6	2	0	0	0
		1991	17	5	1	1	0	1	0
		1992	13	9	1	1	0	1	0
<i>Parry Sound District</i>									
Carling	30.6	1988	24	1	0	0	0	0	0
		1989	21	4	0	0	0	0	0
		1990	20	4	1	0	0	0	0
		1991	21	3	1	0	0	0	0
		1992	16	7	1	0	0	1	0

(cont'd)

Table 21. Maple health data for 1992 from 55 plots established in the Central Region of Ontario (counts based on an examination of 25 sugar maple trees at each location). (cont'd)

Location (Township)	Average DBH (cm)	Year	Cumulative dieback class ^a						Cumulative number of cut/ windfall trees
			0	1	2	3	4	5	
----- Number of trees -----									
<i>Parry Sound District (concl.)</i>									
Chaffey	31.6	1988	11	12	1	0	1	0	0
		1989	16	6	1	0	1	1	0
		1990	11	11	0	0	1	2	0
		1991	15	7	0	0	0	3	0
		1992	9	7	0	0	0	3	6
Christie	31.7	1988	2	16	6	1	0	0	0
		1989	1	13	11	0	0	0	0
		1990	1	19	5	0	0	0	0
		1991	3	17	4	1	0	0	0
		1992	2	17	3	2	1	0	0
Gibson	27.1	1988	16	8	10	0	0	0	0
		1989	18	6	1	0	0	0	0
		1990	18	6	1	0	0	0	0
		1991	12	13	0	0	0	0	0
		1992	8	17	0	0	0	0	0
Machar	34.4	1988	9	13	3	0	0	0	0
		1989	3	17	5	0	0	0	0
		1990	0	18	5	1	0	1	0
		1991	5	15	3	1	0	1	0
		1992	1	17	3	3	0	1	0
Stisted	29.9	1988	2	12	9	2	0	0	0
		1989	1	16	6	1	1	0	0
		1990	0	16	8	1	0	0	0
		1991	3	19	1	2	0	0	0
		1992	2	18	3	0	2	0	0
Wood	31.3	1988	14	8	3	0	0	0	0
		1989	15	8	0	0	1	1	0
		1990	16	7	0	0	1	1	0
		1991	14	9	0	0	0	2	0
		1992	15	8	0	0	0	2	0
<i>Sault Ste. Marie District</i>									
Aweres	27.3	1988	12	12	1	0	0	0	0
		1989	9	16	0	0	0	0	0
		1990	11	14	0	0	0	0	0
		1991	15	10	0	0	0	0	0
		1992	14	10	0	0	0	0	1
Casson	23.2	1988	24	1	0	0	0	0	0
		1989	22	2	1	0	0	0	0
		1990	24	0	1	0	0	0	0
		1991	25	0	0	0	0	0	0
		1992	25	0	0	0	0	0	0

(cont'd)

Table 21. Maple health data for 1992 from 55 plots established in the Central Region of Ontario (counts based on an examination of 25 sugar maple trees at each location). (cont'd)

based on an examination of 25 sugar maple trees at each location: (cont'd)									
Location (Township)	Average DBH (cm)	Year	Cumulative dieback class ^a						Cumulative number of cut/ windfall trees
			0	1	2	3	4	5	
----- Number of trees -----									
<i>Sault Ste. Marie District (cont'd)</i>									
Deroche	18.4	1988	17	7	1	0	0	0	0
		1989	21	3	1	0	0	0	0
		1990	24	1	0	0	0	0	0
		1991	19	6	0	0	0	0	0
		1992	18	7	0	0	0	0	0
Fenwick	23.1	1988	22	3	0	0	0	0	0
		1989	13	10	2	0	0	0	0
		1990	21	3	1	0	0	0	0
		1991	19	5	0	0	1	0	0
		1992	18	6	0	0	0	1	0
Gladstone	30.6	1988	21	3	1	0	0	0	0
		1989	23	2	0	0	0	0	0
		1990	24	1	0	0	0	0	0
		1991	22	1	1	1	0	0	0
		1992	20	3	1	1	0	0	0
Gould	24.9	1988	18	7	0	0	0	0	0
		1989	18	7	0	0	0	0	0
		1990	21	4	0	0	0	0	0
		1991	25	0	0	0	0	0	0
		1992	24	1	0	0	0	0	0
Gunterman	23.2	1988	22	2	1	0	0	0	0
		1989	23	1	1	0	0	0	0
		1990	23	2	0	0	0	0	0
		1991	21	3	1	0	0	0	0
		1992	19	5	0	1	0	0	0
Hilton	23.0	1988	19	6	0	0	0	0	0
		1989	22	3	0	0	0	0	0
		1990	24	1	0	0	0	0	0
		1991	23	2	0	0	0	0	0
		1992	22	3	0	0	0	0	0
Hodgins	24.5	1988	15	6	2	2	0	0	0
		1989	13	8	3	1	0	0	0
		1990	18	5	1	0	0	1	0
		1991	20	3	1	0	0	1	0
		1992	22	2	0	0	0	1	0
Jocelyn	33.5	1988	22	2	1	0	0	0	0
		1989	22	3	0	0	0	0	0
		1990	17	8	0	0	0	0	0
		1991	18	7	0	0	0	0	0
		1992	20	5	0	0	0	0	0

(cont'd)

Table 21. Maple health data for 1992 from 55 plots established in the Central Region of Ontario (counts based on an examination of 25 sugar maple trees at each location). (cont'd)

Location (Township)	Average DBH (cm)	Year	Cumulative dieback class ^a						Cumulative number of cut/ windfall trees
			0	1	2	3	4	5	
			----- Number of trees -----						
Sault Ste. Marie District (cont'd)									
Jollineau	25.8	1988	13	10	1	1	0	0	0
		1989	13	7	4	1	0	0	0
		1990	13	9	2	1	0	0	0
		1991	16	7	1	1	0	0	0
		1992	17	7	0	0	0	1	0
Laird	23.9	1988	14	5	5	1	0	0	0
		1989	16	9	0	0	0	0	0
		1990	14	10	0	1	0	0	0
		1991	20	4	1	0	0	0	0
		1992	12	10	0	1	0	0	2
Meredith	35.0	1988	13	5	5	1	0	1	0
		1989	14	7	3	0	0	1	0
		1990	16	6	2	0	0	1	0
		1991	13	8	3	0	0	1	0
		1992	15	6	3	0	0	1	0
Palmer	32.0	1988	17	7	1	0	0	0	0
		1989	20	5	0	0	0	0	0
		1990	20	5	0	0	0	0	0
		1991	19	6	0	0	0	0	0
		1992	20	5	0	0	0	0	0
Scarfe	18.4	1988	24	1	0	0	0	0	0
		1989	22	3	0	0	0	0	0
		1990	23	2	0	0	0	0	0
		1991	20	3	2	0	0	0	0
		1992	19	5	1	0	0	0	0
Shield	26.0	1988	15	6	3	1	0	0	0
		1989	20	5	0	0	0	0	0
		1990	19	5	0	0	0	1	0
		1991	23	1	0	0	0	1	0
		1992	23	1	0	0	0	1	0
Thessalon	22.0	1988	22	3	0	0	0	0	0
		1989	22	3	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
VanKoughnet	20.8	1988	21	4	0	0	0	0	0
		1989	23	1	0	0	0	1	0
		1990	23	0	1	0	0	1	0
		1991	20	2	1	1	0	1	0
		1992	20	2	1	0	1	1	0
Wells	24.5	1988	22	2	1	0	0	0	0
		1989	20	4	1	0	0	0	0
		1990	22	3	0	0	0	0	0
		1991	25	0	0	0	0	0	0
		1992	25	0	0	0	0	0	0

(cont'd)

Table 21. Maple health data for 1992 from 55 plots established in the Central Region of Ontario (counts based on an examination of 25 sugar maple trees at each location). (concl.)

Location (Township)	Average DBH (cm)	Year	Cumulative dieback class ^a						Cumulative number of cut/ windfall trees
			0	1	2	3	4	5	
			----- Number of trees -----						
<i>Sault Ste. Marie District (concl.)</i>									
Whitman	26.5	1988	16	7	1	1	0	0	0
		1989	14	9	0	2	0	0	0
		1990	18	5	0	1	0	1	0
		1991	20	2	1	1	0	1	0
		1992	21	2	0	0	1	1	0
<i>Sudbury District</i>									
Allan	28.0	1989	8	12	4	1	0	0	0
		1990	6	13	5	1	0	0	0
		1991	13	9	4	0	0	0	0
		1992	16	6	1	0	0	0	2
Billings	18.5	1988	22	3	0	0	0	0	0
		1989	16	8	1	0	0	0	0
		1990	16	8	1	0	0	0	0
		1991	24	1	0	0	0	0	0
		1992	24	1	0	0	0	0	0
Gough	23.3	1988	21	4	0	0	0	0	0
		1989	8	15	2	0	0	0	0
		1990	6	17	2	0	0	0	0
		1991	17	8	0	0	0	0	0
		1992	20	5	0	0	0	0	0
Killarney	21.0	1988	23	1	0	1	0	0	0
		1989	18	6	1	0	0	0	0
		1990	16	8	1	0	0	0	0
		1991	23	2	0	0	0	0	0
		1992	22	2	0	0	0	1	0
Spanish River Indian Reserve	21.4	1988	23	2	0	0	0	0	0
		1989	20	5	0	0	0	0	0
		1990	21	4	0	0	0	0	0
		1991	25	0	0	0	0	0	0
		1992	25	0	0	0	0	0	0
Tehkummah	28.6	1989	13	10	1	1	0	0	0
		1990	12	11	1	1	0	0	0
		1991	14	9	1	0	0	1	0
		1992	17	6	1	0	0	1	0
Trill	16.9	1988	22	3	0	0	0	0	0
		1989	12	8	3	0	0	1	0
		1990	10	10	4	0	0	1	0
		1991	17	4	1	2	0	1	0
		1992	15	7	1	1	0	1	0
Victoria	33.3	1989	3	12	8	2	0	0	0
		1990	3	11	9	1	0	1	0
		1991	5	11	7	1	0	1	0
		1992	5	11	5	3	0	1	0

^a Dieback classes: 0 = 0-5%, 1 = 6-20%, 2 = 21-40%, 3 = 41-60%, 4 = >60%, 5 = dead tree

Table 22. Maple health data for 1992 from three urban and four rural roadside plots established in the Central Region of Ontario (counts based on an examination of 25 sugar maple trees at each location).

Location (Township)	Plot type	Average DBH (cm)	Year	Cumulative dieback class ^a						Cumulative number of cut/ windfall trees
				0	1	2	3	4	5	
				----- Number of trees -----						
<i>Bancroft District</i>										
Carlow	rural	60.7	1991	19	3	3	0	0	0	0
			1992	16	6	3	0	0	0	0
Dungannon	rural	67.7	1989	23	2	0	0	0	0	0
			1990	16	9	0	0	0	0	0
			1991	19	6	0	0	0	0	0
			1992	19	6	0	0	0	0	0
<i>Pembroke District</i>										
Arnprior	urban	54.8	1990	12	9	4	0	0	0	0
			1991	11	8	2	1	1	0	2
			1992	6	13	3	1	0	0	2
Pembroke	urban	63.2	1989	21	2	1	1	0	0	0
			1990	16	7	1	1	0	0	0
			1991	11	1	1	0	0	0	12
			1992	12	0	1	0	0	0	12
Renfrew	urban	62.4	1990	8	16	1	0	0	0	0
			1991	19	5	1	0	0	0	0
			1992	13	9	2	0	0	0	1
Ross	rural	67.1	1989	21	4	0	0	0	0	0
			1990	9	14	2	0	0	0	0
			1991	17	8	0	0	0	0	0
			1992	15	10	0	0	0	0	0
Westmeath	rural	58.3	1989	20	5	0	0	0	0	0
			1990	5	15	4	1	0	0	0
			1991	14	11	0	0	0	0	0
			1992	15	10	0	0	0	0	0

^a Dieback classes: 0 = 0–5%, 1 = 6–20%, 2 = 21–40%, 3 = 41–60%, 4 = >60%, 5 = dead tree

North American Maple Project (NAMP)

A cooperative project was initiated by the United States Forest Service and Forestry Canada to study the health of sugar maple, with the following objectives:

1. to determine the rate of change in sugar maple tree-condition ratings from 1988 to 1993;
2. to determine if the rate of change in sugar maple tree-condition ratings differed between: (a) various levels of pollution, measured as wet deposition, (b) sugar bush and undisturbed forest, and (c) various levels of initial stand conditions.
3. to determine the possible causes of sugar maple decline and the geographical relationship between the causes and extent of decline.

In all, 106 plots were established in the northeastern United States; in Canada, 60 plots were set up in Quebec,

Newfoundland, New Brunswick and Nova Scotia. Ontario was responsible for 24 plots, which were paired in each deposition zone: one was in an undisturbed stand and one in a bush being tapped for maple syrup production. Eight plots are located in Central Region, two in each of the Bancroft, North Bay, Parry Sound and Sault Ste. Marie districts (Table 23).

Although sugar maple was the primary species of interest, all trees in the plot were examined and the following quantitative and qualitative information was recorded for each: DBH, vigor (five ratings), crown condition, tapping status (sugar maple only), bole quality, location of bole defects, type of bole injury, percentage of crown dieback, foliar transparency and discoloration, dwarfed foliage, and defoliation. This information was obtained by a minimum of two FIDS rangers.

Table 23. Sugar maple crown conditions recorded in eight North American Maple Project (NAMP) plots established in 1988 in the Central Region of Ontario.

Location (Twp)	Average	Year	Number of trees examined	Total percentage of dead crown											Trees dead	Trees blown down or cut
	DBH			0	1-5	6-15	16-25	26-35	36-45	46-55	56-65	66-75	76-85	>86		
	(cm)															
Number of trees																
<i>Bancroft District</i>																
Cardiff ^a	20.2	1988	94	1	54	24	11	2	1	0	0	0	0	1	0	0
		1989	92	0	28	50	12	2	0	0	0	0	0	0	2	0
		1990	90	0	38	35	4	6	2	1	3	1	0	0	4	0
		1991	89	0	35	30	10	5	2	2	2	3	0	0	5	0
		1992	89	0	34	29	13	5	1	2	2	2	1	0	5	0
Bangor ^b	37.1	1988	53	0	13	27	11	2	0	0	0	0	0	0	0	0
		1989	50	0	18	25	6	1	0	0	0	0	0	0	0	3
		1990	49	0	27	16	3	2	0	1	0	0	0	0	0	4
		1991	49	0	26	16	5	0	1	0	0	1	0	0	0	4
		1992	47	0	7	32	6	1	0	1	0	0	0	0	2	4
<i>North Bay District</i>																
Nipissing ^b	19.6	1988	113	56	39	13	3	1	1	0	0	0	0	0	0	0
		1989	113	20	69	16	6	2	0	0	0	0	0	0	0	0
		1990	113	0	102	7	2	1	1	0	0	0	0	0	0	0
		1991	112	0	101	7	1	2	1	0	0	0	0	0	1	0
		1992	112	0	85	21	4	0	1	0	0	0	0	1	1	0
Patterson ^a	19.6	1988	65	23	29	7	5	0	0	0	1	0	0	0	0	0
		1989	65	22	23	16	3	0	0	0	0	1	0	0	0	0
		1990	64	0	62	2	0	0	0	0	0	0	0	0	1	0
		1991	64	0	61	1	1	1	0	0	0	0	0	0	1	0
		1992	64	0	58	3	3	0	0	0	0	0	0	0	1	0
<i>Parry Sound District</i>																
Ridout ^a	25.4	1988	61	0	36	15	5	2	1	0	0	0	2	0	0	0
		1989	59	0	42	10	4	3	0	0	0	0	0	0	2	0
		1990	56	0	34	19	2	0	1	0	0	0	0	0	5	0
		1991	56	0	33	19	3	0	0	0	1	0	0	0	5	0
		1992	56	0	33	19	2	0	1	1	0	0	0	0	5	0
Franklin ^b	32.3	1988	44	0	32	8	3	1	0	0	0	0	0	0	0	0
		1989	44	0	29	12	1	1	1	0	0	0	0	0	0	0
		1990	42	0	25	14	0	2	1	0	0	0	0	0	2	0
		1991	41	0	21	13	1	4	1	1	0	0	0	0	3	0
		1992	41	0	23	10	4	2	0	1	1	0	0	0	3	0
<i>Sault Ste. Marie District</i>																
Wishart ^a	27.6	1988	74	27	21	10	11	4	0	0	0	1	0	0	0	0
		1989	72	19	31	14	4	3	0	0	1	0	0	0	1	1
		1990	72	0	49	12	5	5	0	0	1	0	0	0	1	1
		1991	71	0	53	7	6	4	0	0	1	0	0	0	2	1
		1992	70	3	49	8	2	5	3	0	0	0	0	0	2	2
Tarentorus ^b	24.4	1988	84	8	57	16	2	1	0	0	0	0	0	0	0	0
		1989	82	3	31	27	19	0	0	1	0	0	0	0	0	2
		1990	81	0	63	11	6	1	0	0	0	0	0	0	1	2
		1991	81	0	71	10	0	0	0	0	0	0	0	0	1	2
		1992	80	0	58	19	3	0	0	0	0	0	0	0	2	2

^a undisturbed woodlot

^b trees currently tapped for maple syrup

Table 23 compares the results of the assessments from 1988 to 1992. There was very little change except for three new dead sugar maple, two in the Bangor Township plot (Bancroft District) and one in the Tarentorus Township plot (Sault Ste. Marie District). One tree was cut in the Wishart Township plot (Sault Ste. Marie District). The pest that caused the most damage in the plots was the forest tent caterpillar. In the Ridout and Franklin township plots, Parry Sound District, 82 and 41% of the trees were affected, respectively, with light-to-moderate levels of defoliation in both plots. In the Tarentorus Township plot, Sault Ste. Marie District, the incidence level of leaf scorch was 75%, with foliar damage also averaging 75%. Over all, the plots are relatively healthy; the current survey indicates that >75% of the sugar maple in all eight plots had 15% or less cumulative dieback in 1992.

Oak Health

In 1977, three survey plots were set up in red oak stands to monitor crown decline of this tree species. These 100-tree plots are assessed annually. One plot is located in Macaulay Township, Parry Sound District. The other two are located in Pembroke District, one in Alice Township and the second in Wylie Township.

In 1992, surveys showed that tree condition declined slightly when compared with 1991 (Table 24). In Macaulay Township in 1991, 27% of the trees had more than 20% total dieback versus 33% with greater than 20% dieback in 1992.

In Alice Township, 40% of the oak had more than 20% dieback in 1991 versus 52% in 1992. In Wylie Township in 1991, 23% of the trees had more than 20% dieback versus 34% in 1992.

Current mortality was encountered at two of the plots. In Wylie Township, 2% of the trees died in the past year whereas 5% died in Alice Township. Over all, 15% of the trees have died since plot establishment.

Populations of the gypsy moth collapsed in 1992 in the areas where these oak plots are located, resulting in only light defoliation.

SPECIAL SURVEYS

Seed Orchard Survey

In 1990, a special survey to develop an inventory of disease and insect problems in seed orchards was requested by the OMNR. Twenty-two seed orchards were selected for the survey across the northern portion of the province, three of which are located in Central Region. Two jack pine seed orchards were monitored in Sudbury District, one each in Lumsden and Hallam townships. A single eastern white pine seed orchard was surveyed in Gurd Township, North Bay District. At each orchard, two visits were made to detect the damage caused by early- and late-season pests. This survey was continued in 1992 and the results are shown in Tables 25 and 26.

Table 24. Oak health at three locations in the Central Region of Ontario from 1989 to 1992 (data based on an examination of 100 host trees at each location).

Location (Township)	Average DBH (cm)	Year	Cumulative dieback class ^a						Trees blown down or cut
			0	1	2	3	4	5	
			----- Number of trees -----						
<i>Parry Sound District</i>									
Macaulay Twp	35	1989	2	54	29	4	0	11	0
		1990	2	52	33	1	1	11	0
		1991	1	72	15	0	0	12	0
		1992	1	66	18	3	0	12	0
<i>Pembroke District</i>									
Alice Twp	18	1989	0	25	53	7	6	5	4
		1990	0	25	51	4	5	11	4
		1991	2	58	14	3	5	14	4
		1992	1	47	22	1	6	19	4
Wylie Twp	25	1989	0	11	65	15	0	9	0
		1990	0	23	59	7	1	10	0
		1991	1	76	9	1	1	12	0
		1992	0	66	18	1	1	14	0

^a Dieback classification: 0 = 0-5%, 1 = 6-20%, 2 = 21-40%, 3 = 41-60%, 4 = >60%, 5 = dead tree

Table 25. Damage in two jack pine seed orchards in the Sudbury District of Ontario in 1992 (results based on an examination of 150 randomly selected trees at each location).

	Hallam Township	Lumsden Township
Average height (m)	3.0	2.7
Area (ha)	25	10
Density (trees/ha)	2,400	2,500
Jack pine budworm		
Trees affected (%)	67	4
Defoliation of affected trees (%)	2	1
Jack pine sawflies		
Trees affected (%)	0	0
White pine weevil		
Leaders affected (%)	1.3	8.7
Eastern pine shoot borer		
Laterals affected (%)	34.0	14.7
Leaders affected (%)	32.7	16.7
Jack pine tip beetle		
Leaders affected	0	0.7
Swaine sawfly		
Trees affected (%)	0	0
Pine spittlebug		
Trees affected (%)	0	0
Needle rust		
Trees affected (%)	22.6	44.7
Defoliation of affected trees (%)	1	1
Needle cast		
Trees affected (%)	20.7	2.7
Defoliation of affected trees (%)	5.3	5
Armillaria root rot		
Trees affected (%)	0	0
Scleroderris canker		
Trees affected (%)	0	0
Western gall rust		
Trees affected (%)	0	0
Stem rust		
Trees affected (%)	0	0

Table 26. Damage in one eastern white pine seed orchard in the North Bay District of Ontario in 1992 (results based on an examination of 150 randomly selected trees at each location).

	Gurd Township
Average height (m)	7.1
Area (ha)	2.5
Density (trees/ha)	1,700
White pine weevil	
Leaders affected (%)	7.3
Pine shoot borer	
Leaders affected (%)	2.0
Pine bark adelgid	
Trees affected (%)	0
Pine sawflies	
Trees affected (%)	0
Pine spittlebug	
Trees affected (%)	0
White pine blister rust	
Trees affected (%)	0.7
Stem cankers (%)	0.7
Basal stem cankers	
Trees affected (%)	0
Armillaria root rot	
Trees affected (%)	0
Needle rust	
Trees affected (%)	0
Needle cast	
Trees affected (%)	0

The organism that caused the most damage in the jack pine seed orchards was the eastern pine shoot borer, which killed 32.7 and 16.7% of the leaders in the Hallam and Lumsden township orchards, respectively. The jack pine budworm was observed on 67 and 4% of the trees in the Hallam and Lumsden township orchards, but caused only light defoliation. Egg-mass samples taken in the fall at both locations revealed no budworm eggs, so the damage caused by this insect in 1993 is expected to be minimal.

Few pests were found in the Gurd Township seed orchard. The organism that caused the most damage was the white pine weevil, which killed 7.3% of the leaders.

Other Seed Orchard Surveys and Family-test Surveys

In addition to the special seed orchard survey previously mentioned, general assessments were completed at three

jack pine seed orchards and nine jack pine family-test sites (Tables 27 and 28), at two eastern white pine seed orchards and at a black spruce family-test site. The white pine weevil and the eastern pine shoot borer caused the most damage in the jack pine areas. At the Mandamin Township family-test site in Sudbury District, 9.3% of the leaders were killed by the white pine weevil, whereas the Merrick Township family-test site in North Bay District sustained the same level of damage but caused by the eastern pine shoot borer. The additional eastern white pine seed orchards surveyed were located in Hallam Township, Sudbury District, and in Mattawan Township, North Bay District. The insect that caused the most damage was again the white pine weevil, which infested 2.7% of the 0.8-m trees in the Hallam Township orchard. The single black spruce family-test site surveyed, in Gillies Limit Township, Temagami District, sustained minimal damage from biotic pests. However, 72.7% of the 0.4-m trees incurred frost damage on an average of 15% of the foliage.

Light Traps

As in previous years, operation of the light trap was conducted at the Forest Insect and Disease Survey field headquarters at the Petawawa National Forestry Institute. The light trap was set up on 8 June, and due to the cool weather this year (which delayed insect development), was

continued until 13 August, two weeks longer than normal. This light trap is used to monitor the spruce budworm during its flight period as well as populations of other major insects. In 1992, 29 spruce budworm adults were caught, an increase from the four moths trapped in 1991. The number of forest tent caterpillar adults captured was 130, which was similar to the 133 found in 1991. As well, 133 jack pine budworm moths were recovered during the trapping period.

Nursery Report

Thessalon Tree Nursery

Four routine visits to the Thessalon Tree Nursery revealed no major insect or disease problems. Insects that were present and that were identified by the Forest Insect and Disease Survey unit as causing minimal damage were: the balsam twig aphid (*Mindarus abietinus* Koch), collected on potted white spruce; the six-spotted leafhopper (*Macrostes* sp. probably *fascifrons* Stal.), collected on eastern white pine in Compartment 5; an owl moth (*Simyra henrici* [Grt.]), collected on white spruce in Greenhouse 7; springtails (*Hypogastrura* sp., Collembola), collected on 1-year-old eastern white pine in Compartment 8; and the strawberry rootweevil (*Otiorynchus ovatus* [L.]).

In an eastern white pine breeding orchard within the nursery, the white pine aphid (*Cinara strobi* [Fitch]) was observed on eastern white pine trees 1 to 1.5 m in height;

Table 27. Results of insect surveys conducted at three jack pine seed orchards and nine family-test sites in the Central Region of Ontario in 1992 (counts based on an examination of 150 randomly selected trees at each location).

Location (Township)	Average height of trees (m)	Estimated trees/ha	Estimated area affected (ha)	Jack pine budworm		Eastern pine	Pine	Jack pine	White pine	Jack pine
				Trees attacked (%)	Defol- iation (%)	shoot borer Leaders attacked (%)	spittlebug Trees affected (%)	tip beetle Leaders attacked (%)	weevil Leaders attacked (%)	sawflies Trees attacked (%)
<i>North Bay District</i>										
Merrick (family test)	5.3	1,600	16	0	0	9.3	n/aa	0	0	0
<i>Sault Ste. Marie District</i>										
Kirkwood (family test)	4.1	2,500	4	0	0	0	0	0	0	0
Lane (family test)	2.8	2,500	4	0	0	9.3	0	0	2.8	0
<i>Sudbury District</i>										
Durban (seed orchard)	3.4	1,400	15	0	0	8.7	0	0	1.3	0
Mandamin (family test)	2.3	1,700	10	0	0	7.3	0	0	9.3	0
Munster (family test)	0.9	1,700	5	0	0	5.3	0	0	0.7	0
Olinyk (family test)	1.3	2,500	4	0	0	17.3	0	0	1.3	0
Street (family test)	2.6	2,000	5	0	0	19.3	n/a	0	7.3	0
<i>Temagami District</i>										
Coleman (seed orchard)	3.4	2,500	15	0	0	—b	0	0	—b	0
Coleman (family test)	3.3	2,500	6	0	0	—b	0	0.7	—b	0
Firstbrook (seed orchard)	1.2	2,500	18	0	0	—b	0.7	0	—b	0
Firstbrook (family test)	1.3	2,500	7	1	<1	—b	0	0	—b	0

^a information not available

^b control measures taken before survey completed

Table 28. Results of disease surveys conducted at three jack pine seed orchards and nine family-test sites in the Central Region of Ontario in 1992 (counts based on an examination of 150 randomly selected trees at each location).

Location (Township)	Average height of trees (m)	Esti- mated trees/ha	Esti- mated area affected (ha)	Needle rust		Gall rust		Stem rust	Needle cast		Armillaria root rot	Sclero- derris canker
				Trees	Foliar	Trees	Severely	Trees	Trees	Foliar	Trees	Trees
				affected	damage	affected	affected	affected	affected	damage	affected	affected
				(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
North Bay District												
Merrick (family test)	5.3	1,600	16	0	0	0	0	0	60	20	0	0
Sault Ste. Marie District												
Kirkwood (family test)	4.1	2,500	4	0	0	7.3	0	0	0	0	2	0
Lane (family test)	2.8	2,500	4	0	0	10.6	1.3	0	0	0	0	0
Sudbury District												
Durban (seed orchard)	3.4	1,400	15	0	0	0	0	0	10	20	0	0
Mandamin (family test)	2.3	1,700	10	0	0	2	0.7	0	30	20	0	0
Munster (family test)	0.9	1,700	5	0	0	0	0	0	0	0	0	0
Olinyk (family test)	1.3	2,500	4	n/a ^a	n/a	n/a	n/a	n/a	n/a	n/a	0.7	n/a
Street (family test)	2.6	2,000	5	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0	n/a
Temagami District												
Coleman (seed orchard)	3.4	2,500	15	0	0	0	0	0	8	30	0	0
Coleman (family test)	3.3	2,500	6	1.3	1.0	0	0	0	37.3	15	0	0
Firstbrook (seed orchard)	1.2	2,500	18	54.7	3.2	0	0	0	0	0	0.7	0
Firstbrook (family test)	1.3	2,500	7	29.3	1.8	0	0	0	11.3	2.5	0.7	0

^a information not available

however, only trace levels of damage occurred. At this same site, 10% of the trees were affected as a result of winter drying, with less than 5% foliar damage occurring.

Other insects found and observed at trace levels on windbreaks and trees adjacent to nursery compartments were: the European pine sawfly, the white pine weevil, the eastern pine shoot borer and the yellowheaded spruce sawfly. The eastern spruce budworm was also present on semimature and mature balsam fir and white spruce, causing defoliation near 30% at several points. The jack pine budworm was also found on trees surrounding the nursery, but foliar damage was less than 10%.

No significant disease organisms were observed causing losses to nursery stock. Trace levels of a leaf anthracnose (*Mycosphaerella* sp. probably *effigurata* [Schwein.] House) was observed at trace levels in Compartment 2 on green ash

(*Fraxinus pennsylvanica* var. *subintegerrima* [Vahl] Fern.). Other organisms observed at low levels on windbreak trees outside the nursery compartments were Armillaria root rot and western gall rust.

Climatic Data

Environmental factors such as temperature and precipitation play an important role in the development of insects and diseases and in tree growth in the forest. Certain weather conditions can predispose the forest to damage, and can be the cause of marked fluctuations in insect problems or in the incidence of disease. Adverse weather conditions can cause abiotic damage from factors such as frost, winter drying, breakage due to heavy winds, and drought, and also can be a contributing agent to forest decline. Weather data for five locations across Central Region are recorded in Table 29.

Table 29. Summary of mean temperatures and total precipitation at five locations in the Central Region of Ontario in 1992.

Location	Month	Mean temperature (°C)		Deviation from normal (°C)	Total precipitation (mm)		Deviation from normal (mm)
		Normal	Actual		Normal	Actual	
<i>Parry Sound District</i>							
Muskoka Airport							
	January	-10.4	-9.5	+0.9	85.9	71.9	+14.0
	February	-9.4	-8.7	+0.7	62.4	79.3	+16.9
	March	-3.8	-4.9	-1.1	66.3	87.1	+20.8
	April	+4.5	+5.1	+0.6	73.3	64.0	-9.3
	May	+10.9	+11.4	+0.5	77.8	63.4	-14.4
	June	+15.9	+14.2	-1.7	81.9	53.0	-28.9
	July	+18.3	+15.6	-2.7	77.5	127.4	+49.9
	August	+17.4	+15.4	-2.0	89.0	110.4	+21.4
	September	+13.2	+12.5	-0.7	102.4	129.6	+27.2
	October	+7.5	+5.1	-2.4	93.9	101.8	+7.9
	November	-1.1	-0.5	+0.6	101.0	196.5	+95.5
	December	-7.1	-4.7	+2.4	97.8	70.7	-27.1
<i>North Bay District</i>							
North Bay Airport							
	January	-13.0	-12.8	+0.2	63.5	58.0	-5.5
	February	-11.3	-11.7	-0.4	56.2	57.8	+1.6
	March	-5.3	-8.3	-3.0	61.1	69.0	+7.9
	April	+3.2	+1.4	-1.8	62.3	27.6	-34.7
	May	+10.6	+10.6	0	69.3	40.0	-29.3
	June	+15.7	+14.3	-1.4	85.1	47.6	-37.5
	July	+18.3	+15.4	-2.9	102.4	66.4	-36.0
	August	+17.0	+15.7	-2.3	98.7	109.4	+10.7
	September	+12.2	+12.0	-0.2	115.9	153.6	+38.3
	October	+6.4	+4.2	-2.2	87.7	74.6	-13.1
	November	-1.0	-1.7	-0.7	86.6	96.8	+10.2
	December	-9.7	-6.8	+2.9	75.4	43.2	-32.2
<i>Pembroke District</i>							
Petawawa Weather							
	January	-12.8	-13.2	-0.4	46.7	58.9	+12.2
	February	-11.2	-12.0	-0.8	51.0	74.3	+23.3
	March	-4.6	-8.2	-3.6	50.5	55.1	+5.1
	April	+4.2	+2.9	-1.3	59.6	21.2	-38.4
	May	+11.5	+11.0	-0.5	60.0	58.3	-1.7
	June	+16.3	+14.8	-1.5	87.5	27.4	-60.1
	July	+18.7	+16.3	-2.4	84.5	167.2	+82.7
	August	+17.6	+16.3	-1.3	79.8	127.4	+48.6
	September	+12.6	+12.8	+0.2	83.1	110.2	+27.1
	October	+7.1	+4.3	-2.8	66.7	82.1	+15.4
	November	-0.1	-0.3	-0.2	65.8	85.2	+19.4
	December	-9.7	-6.0	+3.7	64.8	31.7	-33.1

(cont'd)

Table 29. Summary of mean temperatures and total precipitation at five locations in the Central Region of Ontario in 1992. (concl.)

Ontario in 1992: (concl.)

Location	Month	Mean temperature (°C)		Deviation from normal (°C)	Total precipitation (mm)		Deviation from normal (mm)
		Normal	Actual		Normal	Actual	
<i>Sault Ste. Marie District</i>							
<i>Sault Ste. Marie Airport</i>							
	January	-10.1	-8.7	+1.4	74.0	77.3	+3.3
	February	-10.0	-8.9	+1.1	68.0	31.8	-37.2
	March	-5.1	-6.6	-1.5	60.4	38.6	-21.8
	April	+3.1	+1.7	-1.4	64.4	70.4	+6.0
	May	+9.1	+10.3	+1.2	84.2	40.0	-44.2
	June	+14.6	+12.8	-1.6	74.3	43.3	-31.0
	July	+17.3	+13.7	-3.6	55.6	124.7	+69.1
	August	+16.9	+15.1	+1.8	82.7	47.4	-35.3
	September	+12.8	+12.2	-0.6	95.3	141.1	+45.8
	October	+7.6	+5.8	-1.8	74.2	77.9	+5.7
	November	+0.7	-0.8	-1.5	85.7	133.4	+47.7
	December	-6.7	-4.5	+2.2	79.6	107.9	+28.3
<i>Sudbury District</i>							
<i>Sudbury Airport</i>							
	January	-13.7	-13.1	+0.6	57.5	61.5	+14.0
	February	-12.5	-11.4	+1.1	47.0	52.2	+5.2
	March	-6.0	-7.9	-1.9	55.2	89.2	+34.0
	April	+2.7	+1.8	-0.9	61.1	45.7	-15.4
	May	+10.5	+10.5	0	67.1	48.0	-19.1
	June	+16.0	+14.7	-1.3	82.8	90.4	+7.6
	July	+18.7	+15.4	-3.3	83.1	85.5	+2.4
	August	+17.3	+15.8	-1.5	82.9	117.2	+34.3
	September	+12.2	+11.8	-0.4	106.5	114.5	+8.0
	October	+6.3	+4.5	-1.8	74.6	65.2	-9.4
	November	-1.2	-2.2	-1.0	77.8	99.6	+21.8
	December	-10.2	-7.6	+2.6	65.8	70.7	+4.9

LITERATURE CITED

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