

THE 1979 SPRUCE BUDWORM SITUATION
IN ONTARIO

PART A: DAMAGE AND FORECASTS

PART B: AERIAL SPRAYING OPERATIONS

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We wish to remind all management and unit foresters, industrial or provincial, that if they require more specific information than is contained in this report about spruce budworm conditions in their districts they should contact the appropriate Survey field technician or write to the Head, Forest Insect and Disease Survey Unit, Great Lakes Forest Research Centre.

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PART A: DAMAGE AND FORECASTS

INTRODUCTION

The spruce budworm (*Choristoneura fumiferana* [Clem.]) has been and will likely continue to be the most destructive insect in Ontario's forests. There have been eight or nine outbreaks within the province during the past 275 years. The most recent outbreak started in 1967 and may have the unique distinction of being the largest to have occurred in the province. In 1979, a total area of some 18.43 million hectares (45.54 million acres) of forest was infested at population levels capable of causing moderate-to-severe defoliation (Figure 1 and Table 1) and tree mortality is present throughout some 7.52 million hectares (18.57 million acres) (Figure 2 and Table 2).

The primary hosts of budworm in Ontario are balsam fir (*Abies balsamea* [L.] Mill.), white spruce (*Picea glauca* [Moench] Voss) and black spruce (*Picea mariana* [Mill.] B.S.P.) growing on upland sites in mixed stands, usually in association with balsam fir. Feeding damage (defoliation) by spruce budworm larvae is most prominent from early to mid-July when aerial surveys are conducted for the purpose of detecting and mapping the extent of defoliation. These aerial surveys are supported by ground checks wherever possible. Finally, the reader should keep in mind that figures presented in this report describing areas affected by budworm actually represent gross areas within which stands containing one or more of the major host species show moderate-to-severe current defoliation and/or signs of previous damage.

Three separate infestations became evident in 1967 (Tables 1 and 2) and each has followed a different pattern over the years (Figure 3). The outbreak in southern Ontario has gone through a cycle of increase and decline and is building up again. The outbreak in northeastern Ontario has continued to increase steadily with only minor setbacks in 1973 and 1977. In northwestern Ontario, infestations have followed a different pattern, possibly as a result of the influence of suppression spraying conducted from 1968 to 1976.

In 1971, the first of what has developed into an annual series of reports on the status of the spruce budworm in Ontario was prepared by the Forest Insect and Disease Survey (FIDS) Unit of the Great Lakes Forest Research Centre (GLFRC) in Sault Ste. Marie. The purpose of these reports is to provide forest managers with timely, accurate information about Ontario's most important forest insect pest on a province-wide basis. This report, the tenth in the series, describes the 1979 spruce budworm situation in Ontario and provides damage forecasts for 1980. As well, the best available information, data and maps describing budworm-caused tree mortality as of 1979 are included.

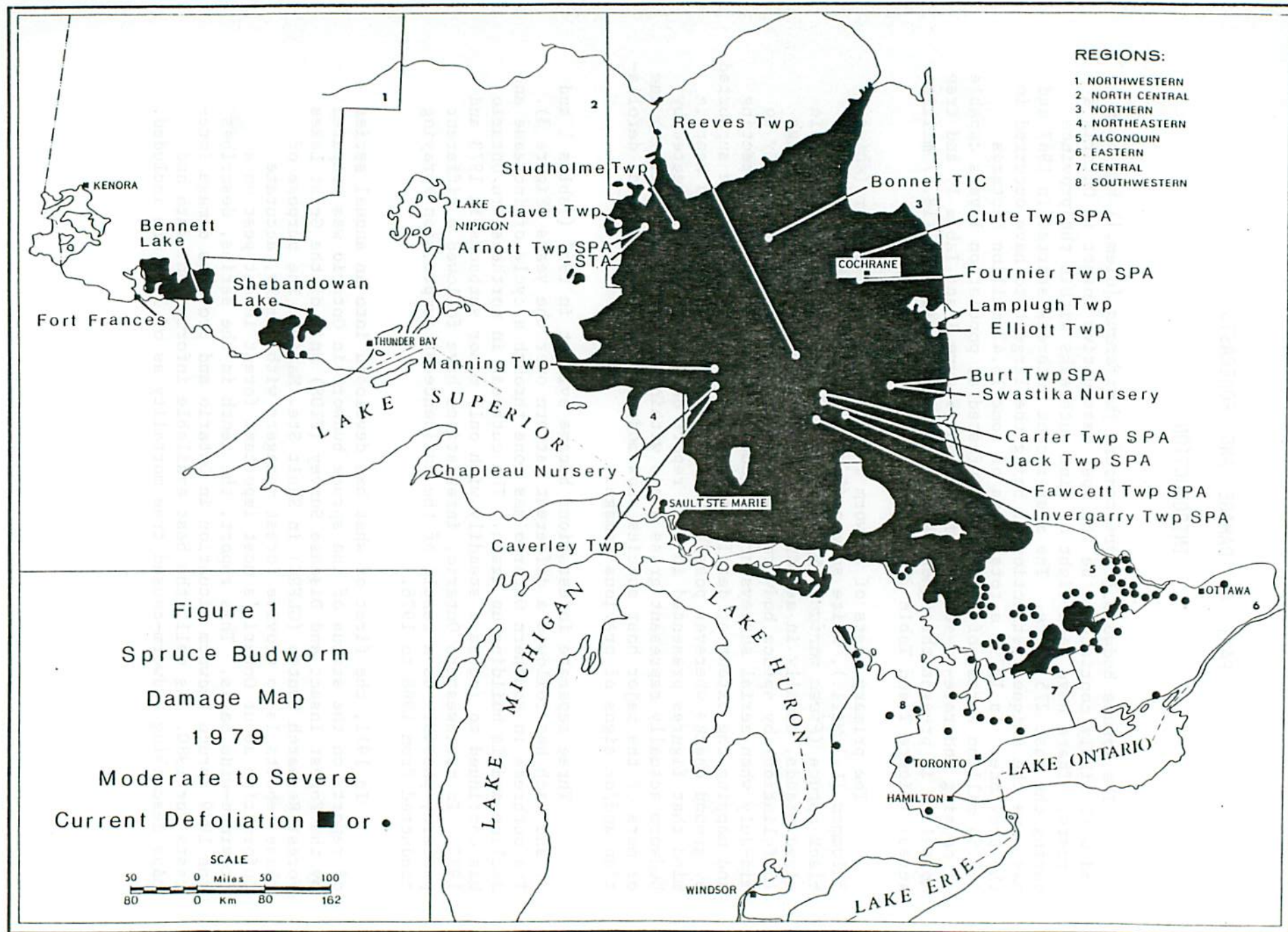


Table 1 . Gross area of moderate-to-severe defoliation mapped
each year for the three regional outbreaks in Ontario

Gross area of moderate-to-severe defoliation in hectares (acres)				
	Southern	Northeastern	Northwestern	Total
1967	60 704 (150,000)	3 035 (7,500)	16 188 (40,000)	79 927 (197,500)
1968	121 408 (300,000)	202 347 (500,000)	0 (0)	323 755 (800,000)
1969	310 805 (768,000)	667 746 (1,650,000)	1 619 (4,000)	980 170 (2,422,000)
1970	647 511 (1,600,000)	2 104 411 (5,200,000)	52 610 (130,000)	2 804 532 (6,930,000)
1971	1 821 125 (4,500,000)	3 480 372 (8,600,000)	52 610 (130,000)	5 354 107 (13,230,000)
1972	2 347 228 (5,800,000)	5 422 906 (13,400,000)	28 329 (70,000)	7 798 463 (19,270,000)
1973	2 428 167 (6,000,000)	5 058 681 (12,500,000)	4 047 (10,000)	7 490 895 (18,510,000)
1974	2 225 820 (5,500,000)	7 486 847 (18,500,000)	4 735 (11,700)	9 717 402 (24,011,700)
1975	2 428 167 (6,000,000)	11 007 689 (27,200,000)	18 211 (45,000)	13 454 067 (33,245,000)
1976	647 511 (1,600,000)	14 042 898 (34,700,000)	61 514 (152,000)	14 751 923 (36,452,000)
1977	407 932 (1,008,000)	13 468 231 (33,280,000)	211 979 (523,800)	14 088 142 (34,811,800)
1978	24 282 (60,000)	14 789 543 (36,544,960)	342 663 (846,720)	15 156 488 (37,451,680)
1979	1 001 534 (2,474,790)	16 939 972 (41,858,670)	487 873 (1,205,533)	18 429 379 (45,538,993)

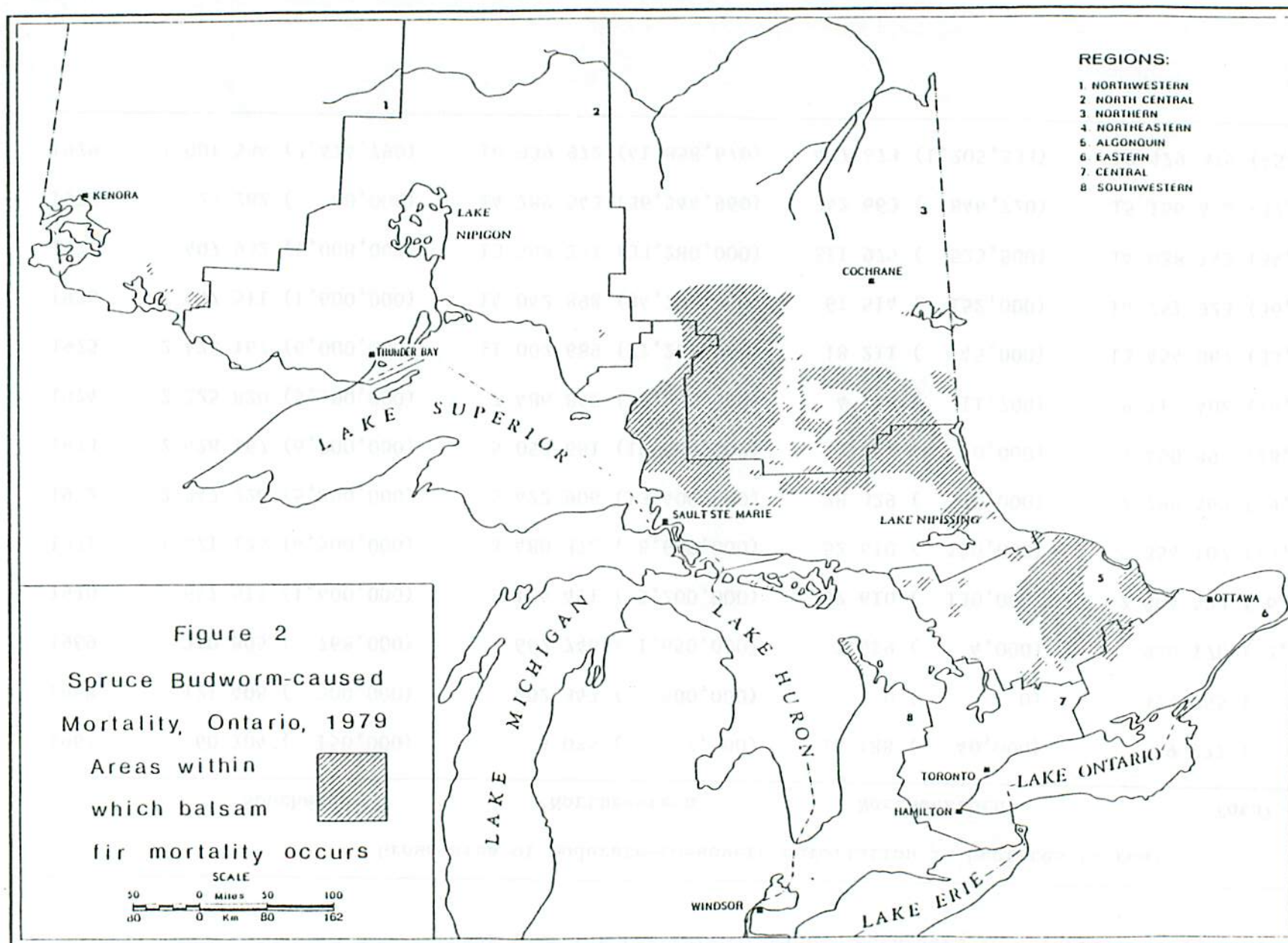


Table 2 . Gross area of budworm-associated tree mortality mapped each year
for the three regional outbreaks in Ontario

	Gross area of budworm-associated tree mortality in hectares (acres)			
	Southern	Northeastern	Northwestern	Total
1970				
1971				
1972	*	80 939 (200,000)		80 939 (200,000)
1973	*	202 347 (500,000)		202 347 (500,000)
1974	*	667 746 (1,650,000)		667 746 (1,650,000)
1975	121 408 (300,000)	1 214 083 (3,000,000)		1 335 491 (3,300,000)
1976	647 511 (1,600,000)	2 630 514 (6,500,000)		3 278 025 (8,100,000)
1977	1 315 257 (3,250,000)	4 168 353 (10,300,000)	405 (1,000)	5 484 015 (13,551,000)
1978	1 347 025 (3,328,500)	4 734 925 (11,700,000)	8 095 (20,000)	6 090 045 (15,048,500)
1979	1 384 055 (3,420,000)	6 110 886 (15,100,000)	20 235 (50,000)	7 515 176 (18,570,000)

* Mortality present but area not determined.



Figure 3. Gross area of moderate-to-severe defoliation mapped each year for each outbreak segment.

OVERALL SITUATION, 1979

In 1979, generally cool weather prevailed during April and May and budworm activity was held back throughout the province. Emergence and larval development took place generally a week or more later than is normal in the Northwestern, North Central and Northeastern regions of the province. However, in Kirkland Lake, Kapuskasing and Cochrane districts of the Northern Region, development occurred at the normal time or slightly earlier through May and was accelerated in early and mid-June as a result of a period of very warm weather. In Gogama and Chapleau districts, development took place at the normal time or somewhat later than normal through May and June, with Gogama several days in advance of Chapleau. Southern Ontario experienced a slower than normal pattern of emergence and early larval development; however, warmer weather at the end of May and early in June accelerated the development of later instars.

Forecasts of population trends and damage expected from larval feeding in the following year (1980) are based on the number of egg-masses per unit area of foliage. These samples, which collectively are termed an egg-mass survey, are collected and counted in August. In 1979, 603 locations were sampled: 129 in southern Ontario, 266 in northeastern Ontario, 75 in north central Ontario and 133 in northwestern Ontario. As in the previous year, FIDS staff placed considerable emphasis on sampling "high value" stands as suggested or requested by OMNR. Some 216 of the 603 locations sampled for egg-mass counts and other information were suggested by OMNR. Over all, egg-mass densities increased by some 60% in 1979 over those of 1978, ranging from 35% in southern Ontario to 48%, 140% and 150% in northeastern, north central and northwestern Ontario, respectively (see individual sections for details). In each case, an index of accumulated damage is included with the egg-mass survey data. This index is an attempt to incorporate cumulative defoliation, top mortality and tree mortality into a classification that describes the condition of the stand.

The 13-year-old spruce budworm outbreak showed no signs of easing; on the contrary, the situation in Ontario worsened in 1979. Aerial and ground surveys showed moderate-to-severe defoliation of susceptible tree species throughout a total area of 18 429 378 ha (45,538,993 acres) (Figure 1 and Table 1). Regionally, in 1979, increases of 977 252 ha (2,414,790 acres), 2 150 429 ha (5,313,710 acres) and 145 210 ha (358,813 acres) occurred in southern, northeastern and northwestern Ontario, respectively. Over all, the increases totalled some 3 272 891 ha (8,087,313 acres) over the area mapped in 1978. The total area of budworm-associated tree mortality (Figure 2 and Table 2) increased from 6 090 045 ha (15,048,500 acres) in 1978 to 7 515 176 ha (18,570,000 acres) in 1979.

In Manitoba in 1979, moderate-to-severe defoliation of current foliage of spruce and fir was mapped over a total area of approximately 520 000 ha (1,285,000 acres), a significant increase over that recorded in 1978. Infestations closest to the Manitoba-Ontario border were reported in the Whiteshell area, north of the Whiteshell area and east of Lake Winnipeg. In Minnesota some 60 700 ha (150,000 acres) of defoliation south of Ely were reported in 1979, an increase from the 21 854 ha (54,000 acres) of defoliation reported in 1978.

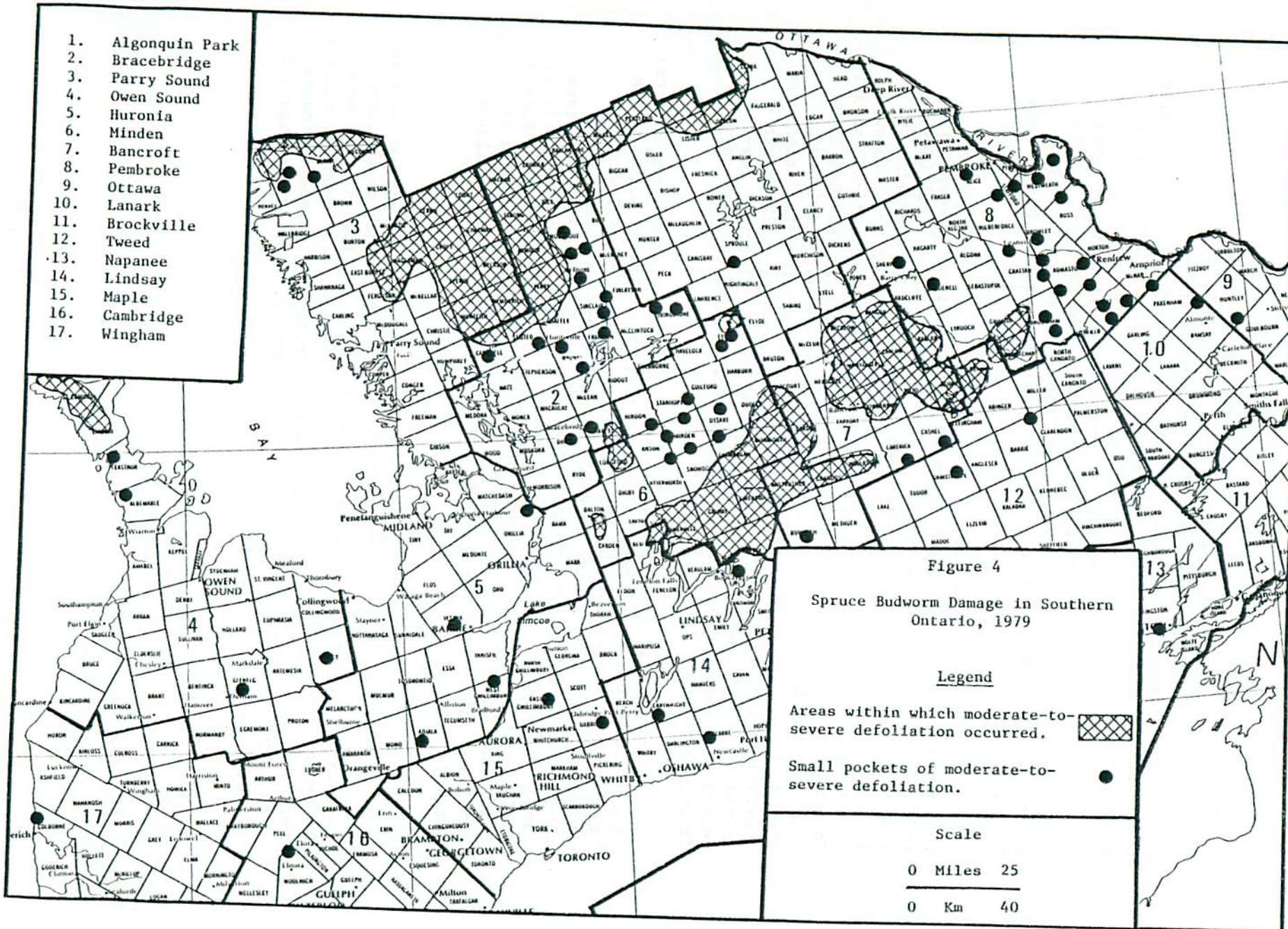
Southern Ontario

Situation in 1979: In southern Ontario, where the outbreak appeared to be collapsing over the past few years, the infestation reversed its pattern of decline and increased to 1 001 534 ha (2,474,790 acres) in 1979 from only 24 282 ha (60,000 acres) in 1978 (Figure 4 and Table 1). Most of the increase occurred in the Algonquin Region (in the Parry Sound, Bracebridge, Minden, Bancroft and Algonquin Park districts). In addition, many new small pockets of defoliation were detected in the five districts mentioned as well as in Pembroke District. The extension of infestations in Parry Sound, Bracebridge and Algonquin Park districts is probably attributable to spread from infestations present in those districts in 1978 as well as to moth influxes from the adjoining districts of Sudbury and North Bay. The increases in Minden, Bancroft and adjoining portions of Pembroke and Tweed districts are likely the result of local population buildups which have been noted for the previous two years, and subsequent spread from these centres of high population.

In the Eastern Region, heavy infestations occurred on balsam fir and white spruce in Ashby, Effingham, Abinger, Grimsthorpe and Denbigh townships in the Tweed District and in Ramsay and Pakenham townships, Lanark District. Medium infestations were common on balsam fir near the city of Kingston, on white spruce in the Larose Forest, Cornwall District and at several locations in small white spruce woodlots in Goulborne, Huntley and Nepean townships, Ottawa District. Low infestations were noted in Torbolton and Fitzroy townships, to the west of Ottawa.

In the Algonquin Region, spruce budworm populations increased in all districts. In the Pembroke District, numbers of small pockets of moderate-to-severe defoliation increased in Stafford, Wilberforce, Ross, Bromley, Admaston, Brougham, Griffith, Matawatchan and Raglan townships. Light defoliation interspersed with small, scattered pockets of moderate defoliation was found throughout the western part of the district. In Bancroft District, pockets of moderate-to-severe defoliation of white spruce were observed in most of the townships. The largest pockets of defoliated spruce occurred in Monteagle, Bangor, Wicklow and Mayo townships, whereas primarily balsam fir was affected in Ashby

1. Algonquin Park
2. Bracebridge
3. Parry Sound
4. Owen Sound
5. Huronia
6. Minden
7. Bancroft
8. Pembroke
9. Ottawa
10. Lanark
11. Brockville
12. Tweed
13. Napanee
14. Lindsay
15. Maple
16. Cambridge
17. Wingham



Township. Populations were low to medium elsewhere in the district. Pockets of moderate-to-severe defoliation were mapped in Wilkes, Ballantyne, Pentland, Lister and Deacon townships in the northern part of the Algonquin Park District, whereas populations were generally low elsewhere in the district. Large increases in population levels and extensions of defoliation occurred in the northern part of the Bracebridge District, in the northern and western part of the Parry Sound District and in the southeastern part of the Minden District. A number of small pockets of severe defoliation was observed in the northern part of Minden District and the southern part of Bracebridge District.

In the Central Region, pockets of heavy infestation were observed in white spruce plantations in West Gwillimbury, Vespra and Adjala townships and on scattered mature white spruce in Orillia Township, Huronia District. Low-to-medium infestations in the Midhurst Nursery were effectively treated with Sumithion applied by mistblower. In the Maple District, heavy infestations recurred in the York Regional Forest near Newmarket and in Durham Regional Forest in Uxbridge Township. In the Lindsay District, moderate-to-severe defoliation was present in Bexley Township and small pockets of severe defoliation were observed in Cartwright Township and in the Orono Nursery in Clarke Township on mature white spruce. In the Cambridge District, low-to-medium infestations were noted near Brantford and in the Sandy Hill Tract, north of Elmira.

In the Southwestern Region, high populations of budworm occurred in the Bruce Peninsula, Owen Sound District, in scattered pockets from Red Bay in Albemarle Township to Tobermory in St. Edmunds Township. Pockets of medium and heavy infestation were found on planted white spruce in Glenelg and Osprey townships. In Wingham District, moderate damage occurred in small pockets on white spruce at the Robertson Tract in Colborne Township. Light defoliation was observed at the Doc Murray Plantation in Downie Township. In Simcoe District, trace levels of defoliation occurred on shelterbelt spruce trees at the St. Williams Nursery.

Infestation Forecasts for 1980: Spruce budworm egg-mass surveys were carried out in southern Ontario during late July and early August, 1979. Foliage samples were collected from a total of 129 locations; egg masses were counted, current defoliation and accumulated damage were estimated and damage forecasts were prepared for 1980. (See Table 3 for detailed results and Figure 5 for area forecasts.)

Table 3. Southern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1979, and infestation forecasts for 1980.

Location	Host	Estimated percent of defoliation 1979	No. of egg-masses per 9.29 sq. m of foliage	Infestation forecasts for 1980 ^a	Accumulated damage ^b
<u>Algonquin Park District</u> (15 locations)					
Airy Twp - East Gate	wS	4	112	M-S	0
Biggar Twp	bF	56	525	S	1
Canisbay Twp					
- Lake of Two Rivers	wS	0	87	M-S	0
Clara Twp	wS	8	168	M-S	1
Clyde Twp	bF	2	110	M-S	5
Deacon Twp - North River	bF	15	82	M-S	1
Freswick Twp - Hogan Lake	bF	13	298	S	0
Guthrie Twp					
- North of Basin Depot	wS	4	119	M-S	1
Head Twp - Grant Creek	wS	9	132	M-S	0
Hunter Twp	bF	2	27	L	0
Preston Twp - Tattler Lake	bF	3	85	M-S	6
Sproule Twp - Opeongo Lake Rd	wS	2	69	M-S	0
Stratton Twp - Achray (Plot C)	bF	14	229	M-S	5
White Twp					
- N. of Petawawa River	bF	15	533	S	5
Wilkes Twp	wS	55	792	S	1
<u>Aylmer District</u> (3 locations)					
McGillivray Twp					
- Conservation Area	wS	0	121	M-S	0
West Oxford Twp					
- Con III - P.U.C.	bF	2	127	M-S	0
West Oxford Twp - P.U.C.	wS	3	191	M-S	0
<u>Bancroft District</u> (10 locations)					
Ashby Twp	bF	90	1245	S	5
*Burleigh Twp					
- Petroglyphs Prov. Pk	wS	84	2502	S	1
Cardiff Twp	wS	62	1113	S	1
Chandos Twp	bF	66	763	S	2
Harcourt Twp	bF	2	82	L-M	0
Limerick Twp	bF	10	0	0	0

Table 3. Southern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1979, and infestation forecasts for 1980 (cont'd).

Location	Host	Estimated percent of defoliation 1979	No. of egg-masses per 9.29 sq. m of foliage	Infestation forecasts for 1980 ^a	Accumulated damage ^b
<u>Bancroft District (cont'd)</u> (10 locations)					
Mayo Twp	WS	75	2228	S	2
Monteagle Twp	WS	45	1540	S	1
Wicklow Twp	WS	80	1940	S	3
Wollaston Twp	WS	44	2490	S	0
<u>Bracebridge District</u> (9 locations)					
*Armour Twp - Pickeral Lake	WS	13	240	M-S	4
Bethune Twp	bF	70	296	S	2
Butt Twp	bF	4	6	L	0
*Chaffey Twp					
- Arrowhead Prov. Pk	WS	5	78	M-S	0
Joly Twp - Paisley Lake	bF	91	699	S	2
*Machar Twp					
- Mikisew Prov. Pk	bF	5	33	L-M	1
*Macaulay Twp					
- Forest Management Unit	bF	1	5	L	0
*Oakley Twp - Clear Lake	bF	66	259	S	1
*Sinclair Twp - Bella Lake	bF	5	0	0	0
<u>Brockville District</u> (1 location)					
*Oxford Twp					
- OMNR Tree Nursery, Kemptville	WS	2	111	M-S	0
<u>Cornwall District</u> (3 locations)					
*Cambridge Twp - Larose Forest	WS	2	33	M-S	0
- Larose Forest	WS	0	0	0	0
*Clarence Twp - Larose Forest	WS	25	83	M-S	1

(cont'd)

Table 3. Southern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1979, and infestation forecasts for 1980 (cont'd).

Location	Host	Estimated percent of defoliation 1979	No. of egg-masses per 9.29 sq. m of foliage	Infestation forecasts for 1980 ^a	Accumulated damage ^b
<u>Huron District</u> (3 locations)					
*Vespra Twp					
- OMNR Tree Nursery Windbreak, Midhurst	wS	60	211	M-S	1
- OMNR Tree Nursery Windbreaks, Midhurst	nS	7	62	M-S	1
- OMNR Tree Nursery Windbreaks, Midhurst	bIS	2	44	L-M	1
<u>Lanark District</u> (5 locations)					
Dalhousie Twp					
- northeast of Dalhousie Lake	bF	0	0	0	0
Darling Twp	bF	35	102	M-S	0
Lavant Twp					
- Robertson Lake	wS	25	24	L-M	0
Pakenham Twp	wS	73	1480	S	3
Ramsay Twp	wS	60	990	S	1
<u>Lindsay District</u> (3 locations)					
Cartwright Twp	wS	67	419	S	1
*Clarke Twp - Windbreaks					
- OMNR Tree Nursery, Orono	wS	11	105	M-S	1
	wS	80	1511	S	3
<u>Maple District</u> (1 location)					
Uxbridge Twp	wS	67	111	M-S	2
<u>Minden District</u> (6 locations)					
Carden Twp	wS	77	459	S	3
Cavendish Twp - Pencil Lake	bF	96	147	M-S	4
Harvey Twp - Nogies Creek	bF	86	83	M-S	4

(cont'd)

Table 3. Southern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1979, and infestation forecasts for 1980 (cont'd).

Location	Host	Estimated percent of defoliation 1979	No. of egg-masses per 9.29 sq. m of foliage	Infestation forecasts for 1980 ^a	Accumulated damage ^b
<u>Minden District (cont'd)</u> (6 locations)					
Hindon Twp	bF	57	315	S	1
Minden Twp	bF	63	177	M-S	1
Somerville Twp	bF	93	429	S	4
<u>Ottawa District</u> (5 locations)					
Fitzroy Twp	WS	28	428	S	1
Goulbourn Twp					
- Hwy 7, Lot 6 Con XI	WS	39	506	S	2
Huntley Twp	WS	80	501	M-S	1
*North Gower Twp	WS	1	7	L	0
Torbolton Twp					
- Lot 20, Con I	WS	4	52	L-M	1
<u>Owen Sound District</u> (4 locations)					
Amabel Twp - Sauble Falls	WS	74	334	S	2
Glenelg Twp	WS	18	10	L-M	1
Lindsay Twp	WS	80	259	S	1
St. Edmunds Twp - Crane River	WS	80	946	S	4
<u>Parry Sound District</u> (29 locations)					
Blair Twp - Lost Channel	bF	50	1022	S	4
Burton Twp	bF	10	203	S	2
Christie Twp	bF	72	709	S	4
Ferguson Twp	bF	5	55	L-M	1
Lount Twp	WS	97	1212	S	5
McConkey Twp	WS	83	714	S	2
McKenzie Twp	bF	16	10	L	0
McMurrich Twp	bF	77	293	S	1

(cont'd)

Table 3. Southern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1979, and infestation forecasts for 1980 (concl'd).

Location	Host	Estimated percent of defoliation 1979	No. of egg-masses per 9.29 sq. m of foliage	Infestation forecasts for 1980 ^a	Accumulated damage ^b
<u>Parry Sound District (cont'd)</u> (29 locations)					
*Mowat Twp - Grundy Prov. Pk					
- Hwy 69	WS	83	1840	S	4
- Clear Lake	WS	76	935	S	3
- Nature Trail	WS	98	696	S	4
- Pakeshkag Lake	WS	85	1043	S	3
- Swan Lake	WS	12	202	S	0
- Gate	WS	5	240	S	0
Ryerson Twp	bF	25	54	L-M	1
*Spence Twp - Nipissing Road	bF	100	739	S	6
- Deer yard 1	bF	91	275	S	2
- Deer yard 1	WS	92	1402	S	3
- Deer yard 2	bF	95	287	S	3
- Deer yard 2	WS	96	2024	S	4
- Deer yard 3	bF	98	641	S	3
- Deer yard 4	bF	85	559	S	3
- Deer yard 5	bF	5	5	L	0
- Deer yard 6	bF	96	471	S	3
- Deer yard 7	bF	7	56	M	1
- Deer yard 8	bF	85	380	S	3
- Deer yard 9	bF	53	268	S	2
- Deer yard 10	bF	64	283	S	2
- Plantation	WS	18	308	S	1
<u>Pembroke District</u> (23 locations)					
Adamston Twp - Bonnecher Rd	WS	17	434	S	2
- Hwy 132	WS	43	606	S	1
Alice Twp	bF	67	435	S	2
Bromley Twp - Cobden	WS	28	1002	S	1
Brougham Twp	bF	5	286	S	0
Brudenell Twp	bF	35	487	S	2
Buchanan Twp					
- 1971 NPV Plot G	WS	7	198	M-S	1

(cont'd)

Table 3. Southern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1979, and infestation forecasts for 1980 (cont'd).

Location	Host	Estimated percent of defoliation 1979	No. of egg-masses per 9.29 sq. m of foliage	Infestation forecasts for 1980 ^a	Accumulated damage ^b
<u>Pembroke District (cont'd)</u> (23 locations)					
Grattan Twp	WS	18	529	S	1
Griffith Twp	WS	95	2212	S	3
Matawatchan Twp	bF	88	852	S	2
McNab Twp	WS	5	199	M-S	0
Raglan Twp	WS	44	620	S	1
Richards Twp - Round Lake	bF	3	16	L-M	1
Rolph Twp	WS	5	401	S	0
Ross Twp - Dist. Boundary	WS	11	684	S	1
Sherwood Twp					
- west of Barry's Bay	WS	3	153	M-S	1
Stafford Twp - Micksburg	WS	42	310	S	1
- NPV, Rankin	WS	80	1258	S	1
- NPV, Rankin	bF	80	532	S	1
Westmeath Twp					
- east of Westmeath	bF	36	164	M-S	1
Wilberforce Twp					
- north of Douglas	WS	31	665	S	1
Wylie and Buchanan Twp (Petawawa National Forestry Institute)					
- Deluthier Rd., 1971 NPV (Plot G)	WS	7	198	M-S	1
- Orange Rd.	WS	0	136	M-S	1
<u>Simcoe District</u> (2 locations)					
Charlotteville Twp					
- Turkey Point	WS	6	376	S	1
South Walsingham Twp					
- OMNR Tree Nursery	WS	5	63	M-S	0
<u>Tweed District</u> (4 locations)					
Clarendon Twp	WS	4	107	M-S	0

(cont'd)

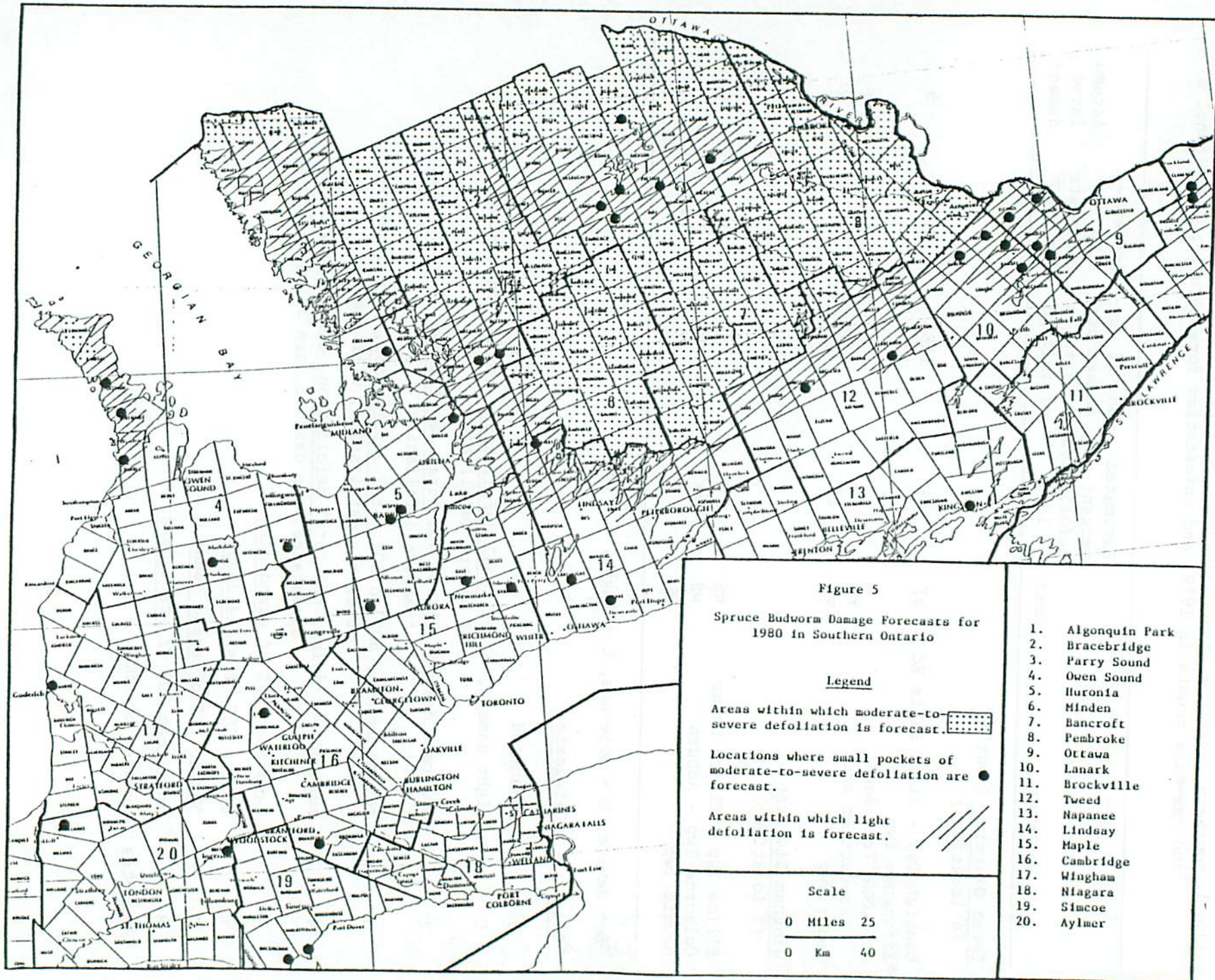
Table 3. Southern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1979, and infestation forecasts for 1980 (concl'd)

Location	Host	Estimated percent of defoliation 1979	No. of egg-masses per 9.29 sq. m of foliage	Infestation forecasts for 1980 ^a	Accumulated damage ^b
<u>Tweed District (cont'd)</u> (4 locations)					
Denbigh Twp - Slate Falls Rd	bF	61	158	M-S	6
*Effingham Twp					
- OMNR Tree Seed Production Area	rS	6	0	0	1
Tudor Twp	WS	25	554	S	2
<u>Wingham District</u> (3 locations)					
Ellice Twp - Ellice Swamp	WS	0	0	0	0
Colborne Twp - Auburn	WS	54	69	M-S	2
Downie Twp	WS	5	56	L-M	0

^aS = severe, M = moderate, L = light, 0 = nil

^b Code	Categories
0	undamaged
1	light damage, < 25% <u>total defoliation</u> , usually one season of severe defoliation
2	moderate damage, 25% to 60% <u>total defoliation</u> , 2 or 3 seasons of severe defoliation
3	severe damage, 60% to 80% <u>total defoliation</u> , 3 to 5 seasons of severe defoliation, will recover
4	moribund or dying, 80% <u>total defoliation</u> , crowns grey in appearance, top dead or bare 50 cm to 150 cm
5	less than 25% of <u>stand dead</u>
6	25% to 50% of <u>stand dead</u>
7	50% to 70% of <u>stand dead</u>
8	more than 70% of <u>stand dead</u>

*Samples requested by OMNR



On an overall basis in southern Ontario, egg-mass numbers increased by about 35% in comparison with counts made in the same locations in 1978. The 1979 increase is the third since 1976, when budworm populations reached their lowest levels in this part of the province in recent years, and it appeared that the outbreak had collapsed. The largest increases occurred in Algonquin Park (+95%) and Parry Sound (+79%) districts, with smaller increases of 14% and 19% being recorded in Pembroke and Bracebridge districts. There was little change in Minden District but Tweed experienced an increase of 53%. In fact, only 4 of 16 districts sampled showed decreases although, in general, the number of samples in many of the districts is too few to permit valid comparison between 1978 and 1979 at the district level. In any case, the general trend is upward.

The average egg-mass count on balsam fir in southern Ontario in 1979, based on 36 locations sampled in 1978 and 1979, was 300 per 9.29 sq. m (100 sq. ft) of foliage, an increase of 51% over the previous year. The average count on white spruce (44 locations) was 452, an increase of 27%. The highest egg-mass count recorded in southern Ontario in 1979 was from a white spruce sample collected at Petroglyphs Provincial Park, Burleigh Township, Bancroft District: 2502 per 9.29 sq. m (100 sq. ft).

This increase in egg-mass populations for the third consecutive year accompanied by an increase in the area infested would seem to confirm that the Algonquin Region is facing a renewal of the outbreak that started in the late 1960s and seemed on the verge of dying out by 1976. Egg-mass counts have increased to levels at which moderate or higher levels of defoliation should occur throughout much of the Algonquin Region in 1980. Light defoliation is expected to occur in the western and southern part of Parry Sound District, the southern part of Bracebridge District, the southwest part of Minden District and throughout some 25 or so townships in the central part of Algonquin Park District. Many pockets of moderate-to-severe defoliation will likely occur throughout the areas in the Algonquin Region where light defoliation prevails, and in adjoining districts such as Ottawa, Lanark, Tweed, Lindsay and Huronia. Defoliation ranging from light to severe is expected to occur throughout most of the Bruce Peninsula in Owen Sound District. Elsewhere in southern Ontario, i.e., throughout the South-western, Central and Eastern regions with the exception of several districts mentioned previously, scattered individuals or groups of white spruce trees (ornamentals, plantations or natural stands) will likely experience moderate or severe defoliation in many locations.

Tree Mortality: The tree mortality situation in southern Ontario as described in the 1978 budworm report (O-X-300) has changed only to a minor degree. The extent of budworm-associated tree mortality increased some 37 030 ha (91,500 acres) for a total area of 1 384 055 ha (3,420,000 acres). Most of the new tree mortality was

mapped in the Bruce Peninsula, Owen Sound District but pockets of new mortality were also found in Armour Township, Bracebridge District, in Carden Township, Minden District and in Hagarty, Brudenell and Sebastopol townships, Pembroke District (Figure 6).

In all, 38 ground checks (28 balsam, 10 white spruce) were made in nine districts in 1979: all districts in the Algonquin Region, Lanark and Tweed districts in the Eastern Region, and Owen Sound District in the Southwestern Region. Twenty balsam fir mortality plots in Algonquin Park, Bancroft, Minden, Parry Sound, Pembroke and Tweed districts have been tallied for the last 3 years. The average mortality for each year for these plots is as follows: 1977 - 36%, 1978 - 40% and 1979 - 48%. Mortality is continuing in stands where budworm populations dropped to relatively low levels in 1977 and 1978. Mortality levels vary considerably from stand to stand, ranging from a low of 5% to a high of 96%. As in previous years, white spruce mortality was not found in significant amounts except in several stands in Minden District, where up to 76% mortality was recorded. A summary of all tree mortality data, based on ground checks for the past six years for southern Ontario, is presented in Table 4.

Northeastern Ontario

Situation in 1979: In northeastern Ontario (Northern and Northeastern regions), the outbreak increased by 2 150 429 ha (5,313,710 acres), from 14 789 543 ha (36,544,960 acres) in 1978 to 16 939 972 ha (41,858,670 acres) in 1979. The extent of moderate-to-severe defoliation mapped in 1979 in northeastern Ontario is shown in Figure 7. Most of the increase occurred in the Northern Region, and was due, in particular, to a northward spread in Cochrane and Moosonee districts. Budworm defoliation was mapped along the Missinaibi, Mattagami and Abitibi rivers as far north as the mouth of the Moose River at James Bay. Budworm spread to the north and west in Hearst District, and the infestation centred in Clavet Township in Geraldton District is now linked with the main outbreak to the east. North of the Hearst District, in the western part of Moosonee District, budworm defoliation was detected along the Kenogami and Albany rivers. Increases or new infestations also occurred in all districts in the Northeastern Region. Budworm populations were higher than last year in Wawa, Sault Ste. Marie and Blind River districts, except in the southern part of Lake Superior Provincial Park (in Wawa District) where larval densities declined to levels capable of causing only light defoliation. In the Wawa District, moderate-to-severe defoliation was mapped throughout all of the northern portion of the district and spread considerably to the west into the White River District. Increased populations and westerly spread resulted in the west part of the Blind River District becoming infested as well as the eastern part of the Sault District. Average levels of defoliation were much higher in 1979 than in 1978, particularly in the Blind River and Sault Ste. Marie districts, as a

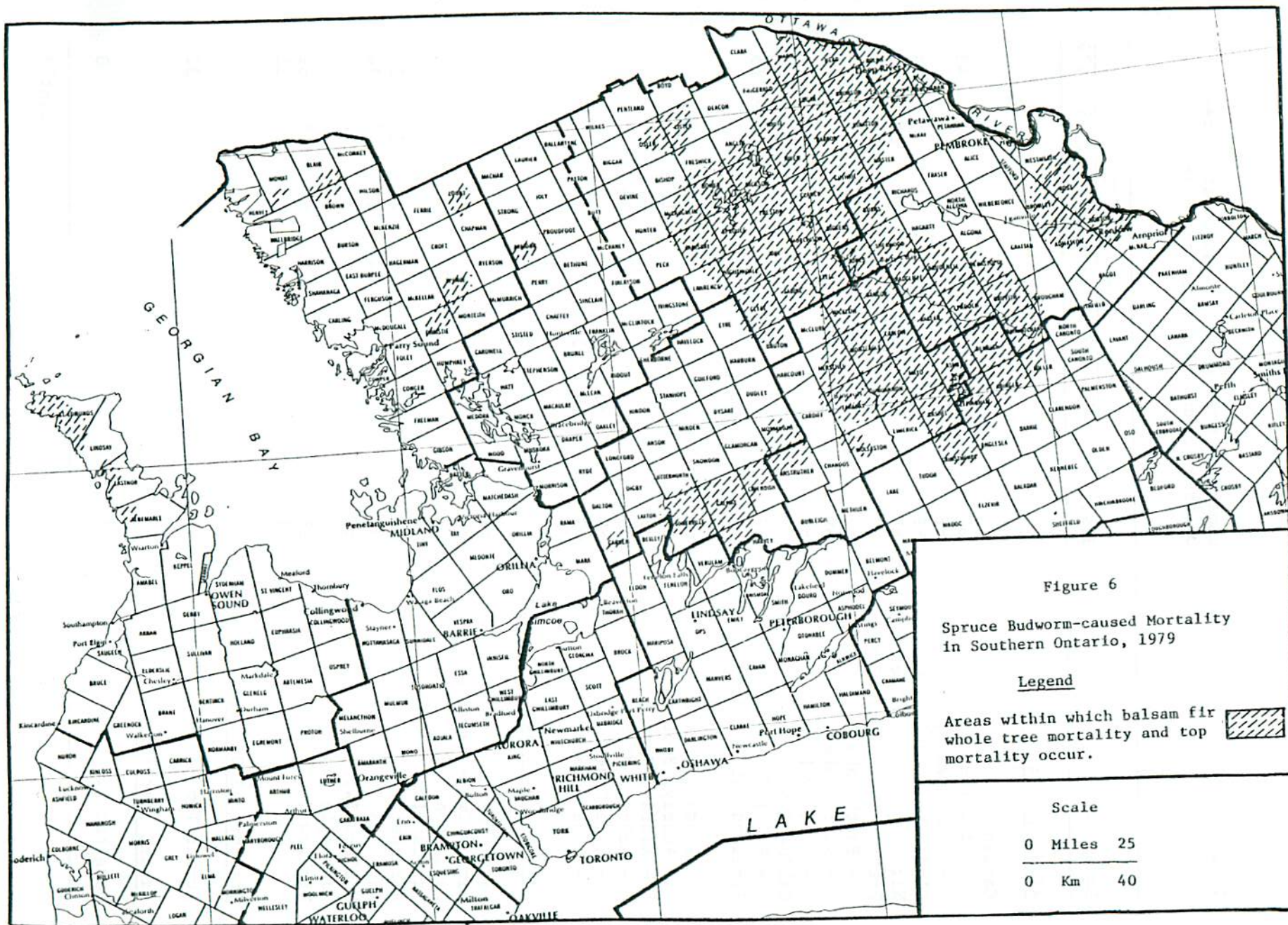


Table 4 . Southern Ontario - Summary of spruce budworm-associated tree mortality based on 100 tree ground checks for the past six years.

Location	Host	Tree mortality (%)					
		1974	1975	1976	1977	1978	1979
<u>Algonquin Park District</u>							
Canisbay Twp							
- Wildlife Station	bF	25		32	41	44	49
- Madawaska River	bF	55					
Clyde Twp - Cauliflower Lake	bF				37	47	53
Nightingale Twp - Rock Lake	bF		49	33	39	47	45
Preston Twp - Annie Bay Dam	bF	38		41			
- Booth Lake	bF	52	71	78	84		
- Kitty Lake	bF	25	68				
- Shirley Lake	bF	24					
Sabine Twp							
- Hwy 127, Hay Lake Rd	bF			49	61	65	65
Stratton Twp - Achray	bF	50		56			
	wS	57					
- Achray, Plot A	bF				50		
- Achray, Plot A	wS				13		
- Achray, Plot B	bF				70		
- Achray, Plot B	wS				36		
- Lone Creek	bF	80	92				
- Lone Creek	wS	16	50				
<u>Bancroft District</u>							
Ashby Twp	bF						49
Carlow Twp - New Carlow	bF	36					
Dungannon Twp	bF			34	41		
Faraday Twp	bF		24				
Herschel Twp	bF			21	29	26	29
Mayo Twp	bF			14	21	27	34
McClure Twp	bF	15		21			
Monteagle Twp	bF	39					
Wicklow Twp	bF		45	49	63	66	69
	wS (50)*						22
<u>Bracebridge District</u>							
Armour Twp	bF						32
<u>Lanark District</u>							
Pakenham Twp	wS				0	0	0

(cont'd)

Table 4 . Southern Ontario - Summary of spruce budworm-associated tree mortality based on 100 tree ground checks for the past six years (cont'd).

Location	Host	Tree mortality (%)					
		1974	1975	1976	1977	1978	1979
<u>Minden District</u>							
Carden Twp	bF (50)*						10
	wS (50)*						52
Cavendish Twp	bF	32		45	51	56	73
Galway Twp - Bass Lake	bF (50)*	47		68	79	83	84
- Bass Lake	wS (50)*						76
- Crystal Lake	bF	10			45	53	89
Harvey Twp	bF	15			51	63	
Monmouth Twp	bF (50)*			60	63	74	
	wS (50)*					38	
Somerville Twp							
- Victoria Co. Forest	bF (50)*	31		37	48	60	78
- Victoria Co. Forest	wS (50)*						64
<u>Owen Sound District</u>							
St. Edmunds Twp							
- Eagle Hbr Rd	bF (50)*	62					
	wS (50)*	0					
- Johnston's Hbr Rd	bF	96					
<u>Parry Sound District</u>							
Blair Twp	bF				4	11	51
Spence Twp - Lot 47, Range B	bF (50)*					16	62
- Lot 47, Range B	wS (50)*					0	6
- Lot 55, Range B	bF (50)*					8	44
- Lot 55, Range B	wS (50)*					0	4
<u>Pembroke District</u>							
Griffith Twp	bF	36	57		68		
	wS				39	43	44
Matawatchan Twp - Camel Chute	bF		38	43	52	57	68
	wS		10				
Sebastopol Twp	bF						16
Wylie Twp - PNFI	bF		65				

(cont'd)

Table 4 . Southern Ontario - Summary of spruce budworm-associated tree mortality based on 100 tree ground checks for the past six years (concl'd).

Location	Host	Tree mortality (%)					
		1974	1975	1976	1977	1978	1979
<u>Tweed District</u>							
Abinger Twp - Hwy 41	bF			35	40	32	55
- Lot 27, Con XI	bF			32	41	48	41
- Lot 27, Con XI	wS (50)*			0	0	0	0
Ashby Twp	bF			6	8	5	5
Denbigh Twp							
- Slate Falls Road	bF		18	24	34	38	43
- North of Denbigh on Hwy 41	bF		5		7	7	5
- South of Denbigh on Hwy 41	bF		4		6	8	10
- South of Denbigh on Hwy 41	wS (50)*				0	0	
Effingham Twp	bF			8	8	11	10

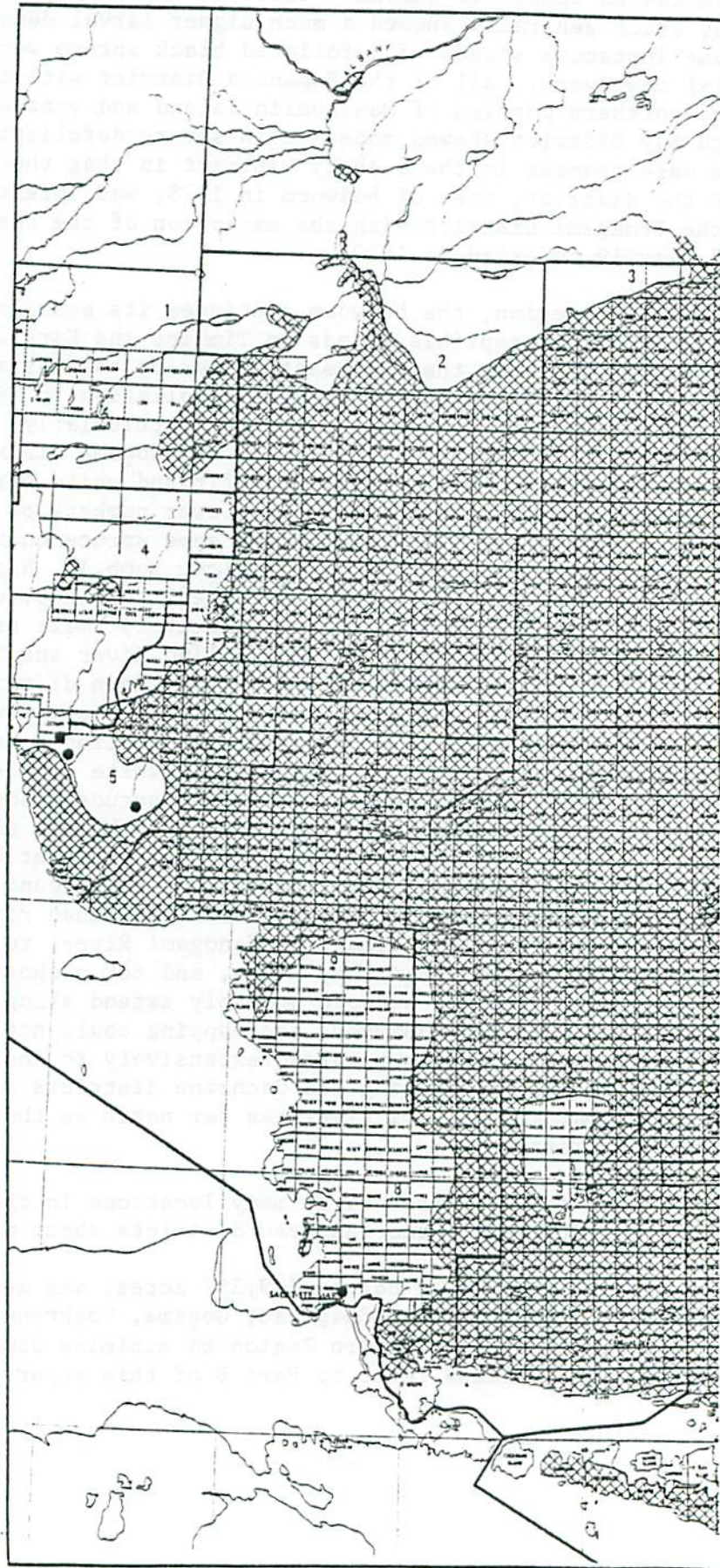
* Indicates no. of trees sampled at each location if other than 100.

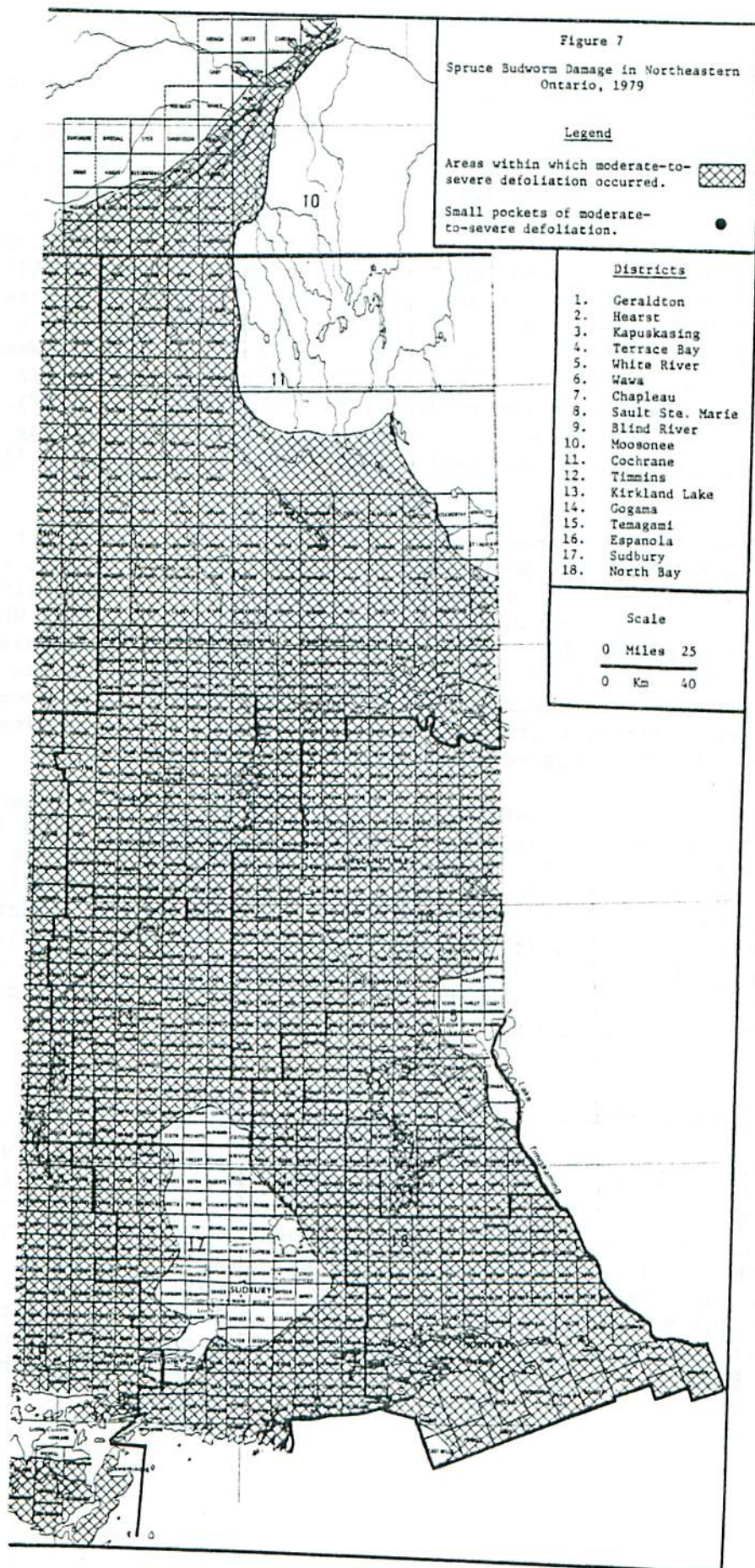
result of the increased number of larvae. This was especially evident on black spruce, which generally showed a much higher larval density in 1979. In some instances stands of defoliated black spruce were noticed by aerial observers. All of the Espanola District with the exception of the northern portion of Manitoulin Island and virtually all of the North Bay District showed moderate-to-severe defoliation in 1979. There were changes in the Sudbury District in that the southwestern part of the district, free of budworm in 1978, was infested in 1979. All of the Temagami District with the exception of the northeast corner remained heavily infested in 1979.

In the Northern Region, the budworm continued its assault unabated. Virtually all susceptible stands in Timmins and Kirkland Lake districts (except those in the southeast corner of the latter district) showed evidence of moderate-to-severe defoliation in 1979. The discoloration of mature white spruce trees was particularly conspicuous from the air this year. In Chapleau and Gogama districts, moderate-to-severe defoliation of living balsam fir and white spruce was evident throughout most of both districts. Lower numbers of budworm were widespread on tamarack and black spruce and some spruce budworm larvae were even found on jack pine (*Pinus banksiana* Lamb.). High populations of spruce coneworm, *Dioryctria reniculelloides* Mut. and Mun., continued to be found on white spruce. Three relatively small areas bordering on the neighboring districts of Wawa, Blind River and Sudbury were unaffected or only lightly affected. In the northern districts of the Region (Hearst, Kapuskasing, Cochrane and Moosonee), many new infestations were found to the north of the 1978 defoliation boundary. Generally, the budworm spread north on any available white spruce host along the rivers that flow into James Bay. Only the spruce along the rivers appeared to be heavily defoliated and understory balsam seemed relatively free of budworm. In the northern part of the Hearst District and southwestern corner of Moosonee, new infestations were found along the Pitopiko, Nagagami, Kabinakagami, Kenogami and Pagwachuan rivers. Infestations continued to the north along the Kenogami River, to where it empties into the Albany River at Albany Forks, and for a short distance down the Albany. Indeed, budworm probably extend along the Albany to its mouth on James Bay; however, the mapping could not be completed at the proper time. Budworm spread extensively to the north in the northern part of the Kapuskasing and Cochrane districts along the Missinaibi, Mattagami and Abitibi rivers as far north as the mouth of the Moose River at James Bay.

Heavy moth flights were observed at many locations in the Timmins, Kirkland Lake, Temagami, and Chapleau districts about mid-July.

In 1979, a total area of 11 881 ha (29,357 acres) was aerially sprayed by OMNR in the Kirkland Lake, Chapleau, Gogama, Cochrane, Hearst and Kapuskasing districts of the Northern Region to minimize damage in high-value forest stands. Please refer to Part B of this report for further details.





Infestation Forecasts for 1980: Egg-mass counts were obtained for 266 locations in northeastern Ontario in 1979 (Table 5). On the basis of data obtained from locations sampled in 1978 and 1979 (181 locations were common to both years), statements about changes in population levels can be made. In northeastern Ontario, there was an increase of some 48% in egg-mass counts on an overall basis. Decreases occurred in only two of the 14 districts sampled in the Northeastern and Northern regions -- Gogama (-26%) and Temagami (-15%). Small increases were recorded for the districts of Chapleau (+9%), Sudbury (+16%), North Bay (+23%) and Espanola (+27%); moderate increases for the districts of Kirkland Lake (+66%), Wawa (+72%) and Blind River (+85%); and large increases for Sault Ste. Marie (+113%), Timmins (117%) and the northern districts of Kapuskasing (+126%), Hearst (+128%) and Cochrane (+258%). Populations are likely increasing in the Moosonee District which was sampled at three locations for the first time this year.

Continued moderate-to-severe defoliation is expected throughout most of the Northern and Northeastern regions in 1980. Indeed, few susceptible stands remain uninfested. Some expansion will likely occur along the western and northwestern boundary of the outbreak in White River and Hearst districts while budworm-free or lightly infested areas in Wawa, Sault Ste. Marie, Blind River and Sudbury districts will be much reduced in size. Moderate-to-severe defoliation should occur in the Moosonee District on overstory white spruce along the major rivers flowing into James Bay. Refer to Figure 8 for area forecasts.

On the basis of data obtained from sample locations common to both years, the average egg-mass count for northeastern Ontario in 1979 was about 853 per 9.29 sq. m (100 sq. ft) of foliage compared to 577 in 1978. On a district basis the highest average egg-mass counts (based on samples common to both 1978 and 1979) were in Timmins District, 1820 per 9.29 sq. m (100 sq. ft), Kapuskasing (1253), Chapleau (1128), Cochrane (1103) and Gogama (1045). The highest single egg-mass count, 3754 per 9.29 sq. m (100 sq. ft), was obtained from a balsam fir stand in Evelyn Township, Timmins District.

Tree Mortality: The extent of tree mortality caused by spruce budworm increased by some 1 375 961 ha (3.4 million acres) from 4 734 925 ha (11.7 million acres) in 1978 to 6 110 886 ha (15.1 million acres) in 1979 in northeastern Ontario (Figure 9). Most of the stands mapped as newly dead were in Wawa, Chapleau, Hearst, Kapuskasing, Gogama, Timmins, Kirkland Lake, Temagami and North Bay districts. Small pockets of mortality were found in Cochrane (near Lake Abitibi), Blind River, Espanola (north part of the district and Manitoulin Island) and Sudbury districts. Mortality in balsam fir increased about 18% from 48% to 66% for 71 plots checked in both 1978 and 1979. The overall average of mortality, in balsam fir

Table 5. Northeastern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1979, and infestation forecasts for 1980.

Location	Host	Estimated percent of defoliation 1979	No. of egg-masses per 9.29 sq. m of foliage	Infestation forecasts for 1980 ^a	Accumulated damage ^b
<u>Blind River District</u> (22 locations)					
Albanel Twp	bF	80	220	M-S	3
*Bridgland Twp	WS	87	146	M-S	2
- Area 2	WS	0	0	0	0
Bright Twp	bF	81	1332	S	4
Dagle Twp	bF	99	506	S	4
Esten Twp	WS	0	8	L	3
Grasett Twp	bF	10	7	L-M	2
Jackson Twp	bF	3	183	M-S	2
*Kirkwood Twp	WS	78	266	S	1
- OMNR Tree Nursery	WS	56	842	S	2
Lewis Twp	WS	3	401	S	1
Morin Twp	bF	76	868	S	1
Nicholas Twp	WS	83	582	S	2
Parkinson Twp	WS	65	957	S	3
*Patton Twp	WS	0	136	M-S	0
Raimbault Twp					
- Mississagi Prov. Pk	bF	8	556	S	3
*Rose Twp - Plantation	WS	64	754	S	1
*Tweedle Twp	WS	1	0	0	0
*Vance Twp	WS	1	100	M-S	0
*Villeneuve Twp	WS	99	1352	S	7
*Wells Twp	WS	85	1263	S	3
*Yaremko Twp	WS	1	64	M-S	0
<u>Chapleau District</u> (35 locations)					
Abney Twp - Spanish Lake	bF	92	1247	S	4
*Barclay Twp					
- Missinaibi Prov. Pk ^c	bF	67	1517	S	5
- Missinaibi Prov. Pk ^c	WS	63	2474	S	4
Birch Twp - Horton Lake	bF	99	921	S	6
Borden Twp	bF	100	1602	S	8
Carew Twp	bF	91	662	S	4
Carruthers Twp					
- Nushotagaini Lake	bF	91	713	S	6

(cont'd)

Table 5. Northeastern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1979, and infestation forecasts for 1980 (cont'd).

Location	Host	Estimated percent of defoliation 1979	No. of egg-masses per 9.29 sq. m of foliage	Infestation forecasts for 1980 ^a	Accumulated damage ^b
<u>Chapleau District (cont'd)</u> (35 locations)					
*Caverley Twp - Plantation ^d	WS	2	16	L	0
- Check Plot	WS	2	15	L	0
*Chapleau Twp					
- OMNR Tree Nursery ^d	bF	11	488	S	1
- OMNR Tree Nursery, 60 seedlings ^d	WS	0	5 total	-	-
Cull Twp - Sample Lake	bF	98	2355	S	6
Denyes Twp - Denyes Lake	bF	98	468	S	6
Fawn Twp	bF	99	1002	S	4
Genoa Twp - Rush Lake	bF	93	503	S	5
Horwood Twp - Horwood Lake	bF	81	959	S	4
*Ivanhoe Twp					
- Ivanhoe Prov. Pk ^c	bF	40	1775	S	6
Kirkwall Twp					
- Dunrankin Lake	bF	98	1957	S	6
Kosny Twp	bF	100	430	S	7
Lincoln Twp - Lincoln Lake	bF	84	1093	S	5
Lloyd Twp - Makonie Lake	bF	96	1418	S	6
*Manning Twp - Plantation ^d	WS	4	36	L-M	0
- Check Plot	WS	16	384	S	0
Margaret Twp	bF	94	376	S	6
Moen Twp	bF	69	674	S	7
Montcalm Twp - Elf Lake	bF	97	916	S	4
*Neelands Twp					
- Wakami Prov. Pk ^c	bF	93	643	S	5
Ossin Twp - Komak Lake	bF	58	624	S	6
Pattinson Twp	bF	94	418	S	7
Penhorwood Twp	bF	74	822	S	5
*Peters Twp					
- Shoals Prov. Pk ^c	bF	60	784	S	6
*Reaney Twp					
- Five Mile Prov. Pk ^c	bF	97	1892	S	5
*Reeves Twp					
- OMNR Tree Seed Production Area ^d	WS	47	1233	S	3

(cont'd)

Table 5. Northeastern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1979, and infestation forecasts for 1980 (cont'd).

Location	Host	Estimated percent of defoliation 1979	No. of egg-masses per 9.29 sq. m of foliage	Infestation forecasts for 1980 ^a	Accumulated damage ^b
<u>Chapleau District (cont'd)</u> (35 locations)					
Sandy Twp	bF	99	1206	S	6
Windego Twp - Much Lake	bF	10	127	M-S	8
<u>Cochrane District</u> (16 locations)					
Adanac Twp - km 37	bF	100	158	M-S	2
*Bonis Twp	bF	71	454	S	3
Blakelock Twp - Mikiwan Lake	bF	50	458	S	3
Colquhoun Twp					
- Greenwater Prov. Pk	bF	89	256	M-S	2
- Greenwater Prov. Pk	WS	66	1293	S	2
*Clute Twp					
- OMNR Tree Seed Production Area #3202 ^e	WS	66	1245	S	3
- OMNR Tree Seed Production Area #3201 ^e	WS	58	3383	S	3
*Fournier Twp					
- OMNR Tree Seed Production Area #3220 ^e	WS	38	820	S	2
*Lake Abitibi					
- NE of Rabbit Creek	bF	81	756	S	2
- East of Swampy Creek	bF	96	595	S	5
*Moody Twp - Bingle Area	bF	98	654	S	3
Nesbitt Twp	bF	100	989	S	3
Ottaway Twp	bS	10	742	S	1
Pinard Twp - Abitibi Canyon	bF	93	948	S	2
Sargeant Twp	bF	96	376	S	3
*Swartman Twp - Pierre Lake	WS	73	723	S	3
<u>Espanola District</u> (16 locations)					
*Allan Twp - Deer Yard	WS	41	1190	S	0
Baldwin Twp	bF	4	89	M-S	0

(cont'd)

Table 5. Northeastern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1979, and infestation forecasts for 1980 (cont'd).

Location	Host	Estimated percent of defoliation 1979	No. of egg-masses per 9.29 sq. m of foliage	Infestation forecasts for 1980 ^a	Accumulated damage ^b
<u>Espanola District (cont'd)</u> (16 locations)					
Billings Twp	bF	7	72	M-S	0
Boon Twp	wS	33	1296	S	1
Burpee Twp	bF	31	80	M-S	5
Cockburn Island	bF	0	35	L-M	0
*Curtin Twp					
- Deer Yard (understory)	bF	15	116	M-S	0
- Deer Yard (intermediate)	wS	44	220	S	1
Dawson Twp	wS	37	624	S	0
*Foster Twp	wS	2	43	L-M	0
*Nairn Twp	wS	15	121	M-S	1
Oshell Twp	bF	74	1013	S	2
Plourde Twp - Plaunt Rd	bF	4	407	S	0
*Robinson Twp - Deer Yard	bF	40	750	S	2
Tehkummah Twp	bF	14	194	M-S	0
Weeks Twp	bF	6	140	M-S	1
<u>Gogama District</u> (12 locations)					
Browning Twp	bF	97	1494	S	6
*Carter Twp					
- OMNR Tree Seed Production Area ^d	wS	64	489	S	5
Dublin Twp	bF	94	780	S	5
*Fawcett Twp					
- OMNR Tree Seed Production Area ^d	wS	64	2601	S	3
Garvey Twp - Westree	bF	100	1874	S	6
Hazen Twp	bF	83	1187	S	5
Halliday Twp - Relic Lake	bF	100	1145	S	5
*Jack Twp					
- OMNR Tree Seed Production Area ^d	wS	52	1519	S	3
Kelvin Twp	bF	100	1022	S	5

(cont'd)

Table 5. Northeastern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1979, and infestation forecasts for 1980 (cont'd).

Location	Host	Estimated percent of defoliation 1979	No. of egg-masses per 9.29 sq. m of foliage	Infestation forecasts for 1980 ^a	Accumulated damage ^b
<u>Gogama District (cont'd)</u> (12 locations)					
*Invergarry Twp					
- OMNR Tree Seed Production Area ^d	wS	69	1817	S	3
Paudash Twp - Jack Lake	bF	100	451	S	5
Scotia Twp - Scotia Lake	bF	1	115	M-S	6
<u>Hearst District</u> (21 locations)					
*Arnott Twp					
- OMNR Seed Tree Area #1 ^f	wS	8	1057	S	2
- OMNR Seed Tree Area #2 ^f	wS	19	303	S	2
- OMNR Tree Seed Production Area ^f	wS	30	614	S	3
Cholette Twp	wS	45	373	S	2
Franz Twp - Oba	bF	100	689	S	5
Frost Twp					
- Nagagamisis Prov. Pk	bF	62	569	S	2
Fushmi Twp - Fushmi Prov. Pk	wS	100	590	S	2
*Hanlan Twp	wS	82	1783	S	2
Kabicagami River	bF	77	814	S	2
Kohler Twp	bF	15	20	L-M	1
*Larkin Twp	wS	67	446	S	3
Minnipuka Twp	wS	97	122	M-S	8
Mulvey Twp	bF	28	428	S	2
Rogers Twp - Plantation	wS	31	1040	S	2
*Stoddart Twp	wS	91	2479	S	2
- near Picnic Area	bS	5	375	S	1
*Studholme Twp					
- Residual Mature ^f	wS	13	340	S	2
- Residual Mature Check Plot	wS	25	351	S	2
- Plantation ^f	wS	0	19	L	1
- Plantation Check Plot	wS	8	0	0	1
Wicksteed Twp					
- .8 km S Hornepayne	bF	70	610	S	2

(cont'd)

Table 5. Northeastern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1979, and infestation forecasts for 1980 (cont'd).

Location	Host	Estimated percent of defoliation 1979	No. of egg-masses per 9.29 sq. m of foliage	Infestation forecasts for 1980 ^a	Accumulated damage ^b
<u>Kapuskasing District</u> (20 locations)					
Cromlech Twp - Brunswick Lake	wS	100	515	S	8
Cumming Twp	bF	100	1074	S	3
*Fauquier Twp (Bonar Tree Improvement Centre)					
- Compartment 6B ^g	bS	2	1250	S	1
- Compartment 10B	wS	54	897	S	2
- Compartment 10B Plot 11	wS	2	2199	S	2
- Compartment 10B Plot 26	wS	14	1988	S	2
- Compartment 15	bS	19	2935	S	1
- Compartment 15 Row 4	bS	33	1436	S	1
- Compartment 15 Row 10	bS	10	1505	S	1
- Compartment 21C ^g	wS	11	3517	S	2
- Compartment 22 ^g	bS	4	115	M-S	1
- Compartment 26D ^g	wS	3	1239	S	2
*Fauquier Twp					
- Plantation 19 (65)	wS	32	1833	S	1
- Remi Lake Prov. Pk	bF	95	1014	S	5
Fenton Twp					
- km 37 Chain of Lakes Rd	bF	100	2111	S	3
*Idington Twp - 07 (65)	bS	2	101	M-S	1
- 07 (65)	wS	8	270	S	1
- 05 (64)	bS	1	313	S	1
Kipling Twp - Kipling Dam	bF	82	506	S	3
Lisgar Twp					
- km 66 Chain of Lakes Rd	bF	100	800	S	4
<u>Kirkland Lake District</u> (26 locations)					
Alma Twp	bF	83	797	S	4
Ben Nevis Twp	bF	6	355	S	3
Blain Twp	bF	78	804	S	4
Bowman Twp	bF	77	783	S	3

(cont'd)

Table 5. Northeastern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1979, and infestation forecasts for 1980 (cont'd).

Location	Host	Estimated percent of defoliation 1979	No. of egg-masses per 9.29 sq. m of foliage	Infestation forecasts for 1980 ^a	Accumulated damage ^b
<u>Kirkland Lake District (cont'd)</u> (26 locations)					
*Burt Twp					
- OMNR Tree Nursery ^e	WS	3	1012	S	2
- OMNR Tree Seed Production Area ^e	WS	8	355	S	3
Chown Twp	bF	94	350	M-S	4
Dack Twp	bF	78	374	S	3
Eby Twp	bF	63	659	S	3
*Elliott Twp - Center ^h	bF	47	1450	S	3
- Dickson Lake ^e	bF	4	450	S	3
- Dickson Lake Check Plot	bF	78	756	S	3
- East Pond ^e	bF	33	516	S	3
- Gost Lake ^e	bF	19	803	S	3
- Junction Pond ^e	bF	73	518	S	3
- Magusi River ^e	bF	50	471	S	3
- Top (north) side ^h	bF	20	305	S	3
Hearst Twp	bF	84	324	S	4
Katrine Twp	bF	49	933	S	3
*Lamplugh - Check Plot	bF	97	719	S	3
Maisonville Twp	bF	95	994	S	3
Marriott Twp	bF	95	537	S	3
Mulligan Twp	bF	85	1256	S	3
Pacaud Twp	bF	68	359	S	3
Truax Twp	bF	90	643	S	4
Yarrow Twp	bF	92	914	S	4
<u>Moosonee District</u> (3 locations)					
Albany Forks	WS	13	96	M-S	1
Moose Twp - Moose Factory	WS	52	1514	S	3
Ghost River - Cheepay Island	WS	71	608	S	3
<u>North Bay District</u> (19 locations)					
*Angus Twp	bF	90	258	S	5
Calvin Twp	bF	70	568	S	2

(cont'd)

Table 5. Northeastern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1979, and infestation forecasts for 1980 (cont'd).

Location	Host	Estimated percent of defoliation 1979	No. of egg-masses per 9.29 sq. m of foliage	Infestation forecasts for 1980 ^a	Accumulated damage ^b
<u>North Bay District (cont'd)</u> (19 locations)					
*Cameron Twp	bF	28	456	S	0
- West Aumond Creek	bF	90	734	S	6
Clement Twp	bF	86	411	S	5
*Gurd Twp	wS	80	1139	S	1
*Jocko Twp	bF	93	550	S	5
- Big Jocko River	bF	96	316	S	2
- Little Jocko River	bF	47	337	S	2
*Latchford Twp	wS	1	0	0	0
*Mattawan Twp	bF	75	126	M-S	1
*McNish Twp	wS	0	0	0	0
Notman Twp	bF	91	495	S	5
*Patterson Twp					
- Restoule Prov. Pk	bF	23	182	M-S	0
Phelps Twp	bF	26	163	M-S	0
*Sisk Twp					
- Martin River Prov. Pk	bF	93	185	M-S	5
*South Himsforth Twp	bF	43	718	S	1
- Freeman Chute	bF	80	478	S	2
*Wyse Twp	bF	90	305	S	5
<u>Sault Ste. Marie District</u> (12 locations)					
Butcher Twp	bF	35	721	S	7
Daumont Twp	wS	0	74	M-S	6
Fisher Twp	bF	35	1070	S	0
Gapp Twp - Ragged Lake	wS	53	714	S	2
*Gaudette Twp					
- Abitibi Plantation, (Tree Seed Orchard)	wS	1	123	M-S	0
Haviland Twp	bF	53	1186	S	1
*Herrick Twp					
- Pancake Prov. Pk	bF	4	162	M-S	0
Jollineau Twp	bF	8	683	S	3

(cont'd)

Table 5. Northeastern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1979, and infestation forecasts for 1980 (cont'd).

Location	Host	Estimated percent of defoliation 1979	No. of egg-masses per 9.29 sq. m of foliage	Infestation forecasts for 1980 ^a	Accumulated damage ^b
<u>Sault Ste. Marie District (cont'd)</u> (12 locations)					
McIlveen Twp	wS	99	1514	S	5
Pine Twp - Tujak Lake	bF	99	1158	S	4
Tarbutt Additional Twp	bF	73	867	S	3
Vibert Twp - Wart Lake	bF	3	59	L-M	3
<u>Sudbury District</u> (15 locations)					
Antrim Twp - Halfway Lake	bF	31	351	S	2
Beaumont Twp - Helen Lake	bF	17	418	S	0
Delamere Twp	wS	73	958	S	1
Dowling Twp	bF	3	77	M-S	0
Dunnett Twp	bF	53	276	S	1
Drury Twp	bF	3	146	M-S	0
Hawley Twp	wS	28	1275	S	1
Indian Reserve #6					
- La Vase Lake	wS	30	759	S	1
*Killarney Twp					
- Killarney Prov. Pk	bF	1	20	L-M	0
- east of Park Plantation	wS	1	9	L	0
Lorne Twp	wS	17	628	S	0
Parkin Twp	wS	18	319	S	1
Street Twp	bF	81	266	M-S	2
Tyrone Twp - Michaud Lake	bF	6	68	M-S	0
Waldie Twp	wS	43	1719	S	5
<u>Temagami District</u> (16 locations)					
Askin Twp	bF	99	779	S	4
Aston Twp	wS	68	898	S	2
Aston Twp	bF	91	632	S	2
Banks Twp	bF	88	808	S	4
Barr Twp	bF	93	744	S	4
Cynthia Twp	wS	74	709	S	2
Eldridge Twp	wS	82	1393	S	3

(cont'd)

Table 5 . Northeastern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1979, and infestation forecasts for 1980 (cont'd).

Location	Host	Estimated percent of defoliation 1979	No. of egg-masses per 9.29 sq. m of foliage	Infestation forecasts for 1980 ^a	Accumulated damage ^b
<u>Temagami District (cont'd)</u> (13 locations)					
Gillies Limit Twp	bF	98	505	S	3
Hartle Twp	wS	81	2018	S	3
Parker Twp	bF	8	266	S	4
Riddell Twp	bF	69	477	S	3
Shelburne Twp	bF	41	365	S	4
South Lorrain Twp	wS	62	1380	S	3
South Lorrain Twp	bF	95	400	S	3
*South Lorrain Twp - OMNR Tree Seed Production Area	wS	75	738	S	3
Strathy Twp	bF	59	400	S	4
<u>Timmins District</u> (12 locations)					
Bartlett Twp	bF	95	2928	S	3
Bristol Twp	bF	95	2159	S	3
English Twp	bF	23	240	S	4
Evelyn Twp	bF	98	3754	S	3
Godfrey Twp	bF	93	1642	S	3
Hassard Twp	bF	91	558	S	3
Keefer Twp	bF	97	2119	S	3
Matheson Twp	bF	100	2622	S	3
McKeown Twp	bF	95	2060	S	3
Robb Twp	bF	98	2306	S	3
Semple Twp	bF	29	638	S	4
Sewell Twp	bF	94	815	S	3
<u>Wawa District</u> (22 locations)					
Asselin Twp					
- Gargantua Rd at Hwy 179	bF	30	257	M-S	2
Bailloquet Twp					
- Black Trout Lake	bF	35	314	S	1

(cont'd)

Table 5. Northeastern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1979, and infestation forecasts for 1980 (concl'd).

Location	Host	Estimated percent of defoliation 1979	No. of egg-masses per 9.29 sq. m of foliage	Infestation forecasts for 1980 ^a	Accumulated damage ^b
<u>Wawa District (cont'd)</u> (21 locations)					
Challener Twp - Stand 56	bF	99	927	S	3
Cudney Twp	wS	92	714	S	3
- Esnagi Lake	bF	100	632	S	3
Debassige Twp	wS	89	3243	S	5
Dumas Twp	bS	24	1604	S	1
Dunphy Twp	bF	89	1121	S	2
Dunphy Twp	bS	36	536	S	
Huotari Twp	wS	99	3111	S	2
Labelle Twp					
- Agawa Prov. Pk.	bF	3	45	L-M	0
LaRonde Twp - Old Woman Bay	bF	2	111	M-S	1
Makawa Twp					
- Fire River Stand #57	wS	90	557	S	4
- Fire River Stand #57	bF	99	688	S	4
Miskokomon Twp	bF	2	80	M-S	5
Noganosh Twp	wS	11	583	S	0
Pearkes Twp	bF	99	980	S	4
Peever Twp					
- Crescent Lake Campground	bF	1	11	L	0
Peterson Twp					
- Rabbit Blanket Campground	bF	28	284	S	1
Simpson Twp - Oba Lake	wS	99	1946	S	3
Tiernan Twp					
- Hwy 17 & Mijin Rd	bF	2	73	M-S	2

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

^b See footnote b, Table 3, p. 17

^c Ground sprayed, B.t. (Dipel), 1979

^d Aerially sprayed, B.t. (Novabac), 1979

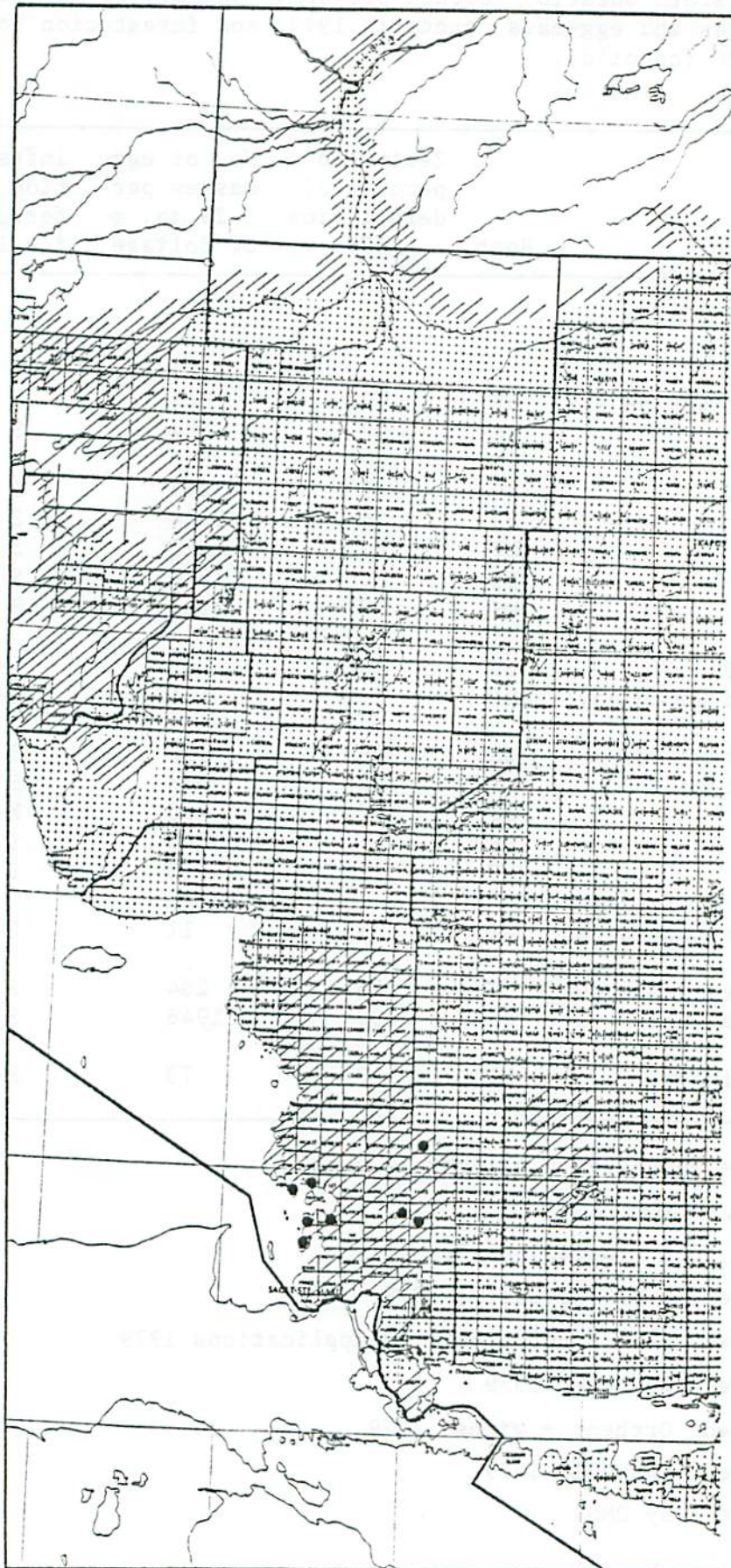
^e Aerially sprayed, B.t. (Thuricide), 2 applications 1979

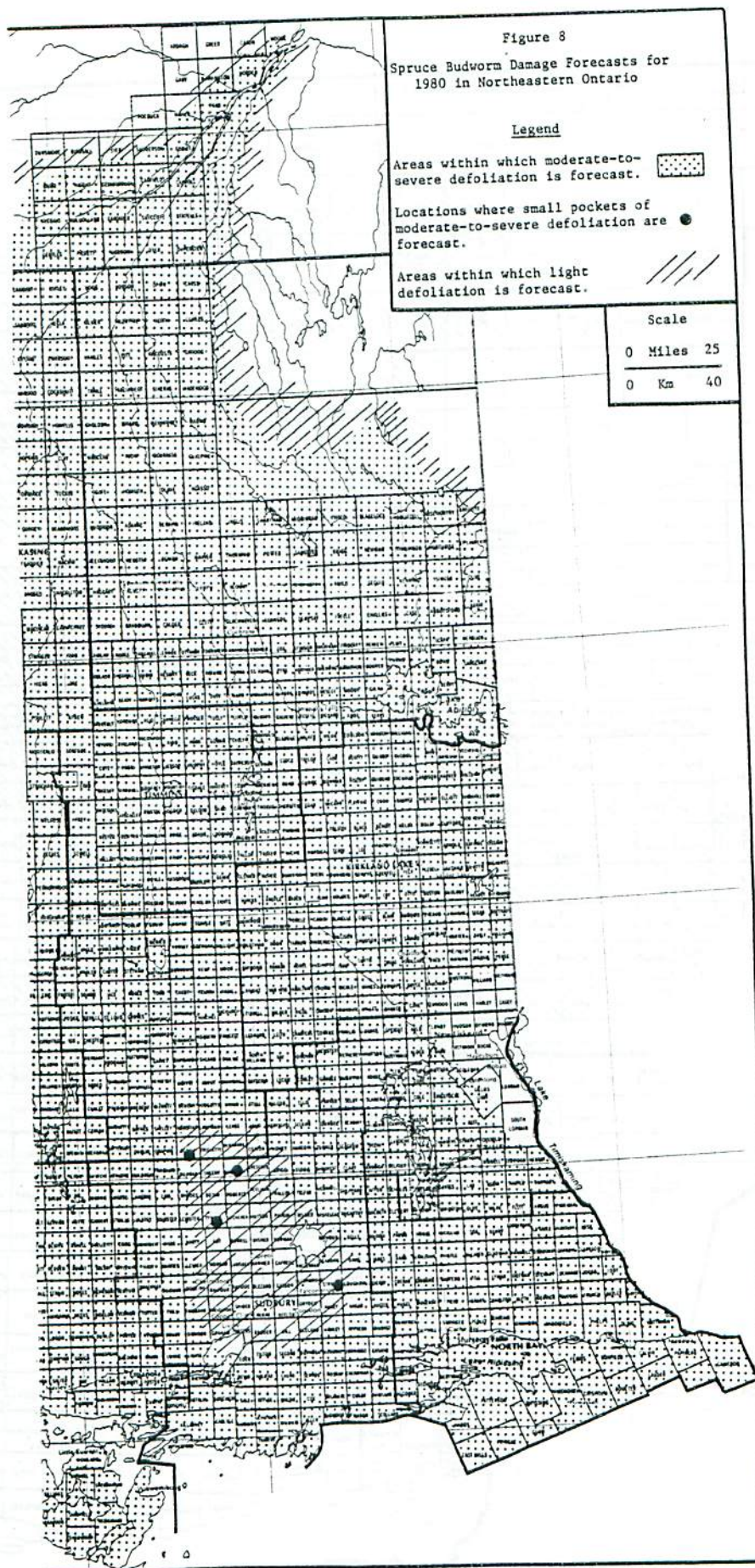
^f Aerially sprayed, Orthene, 1979

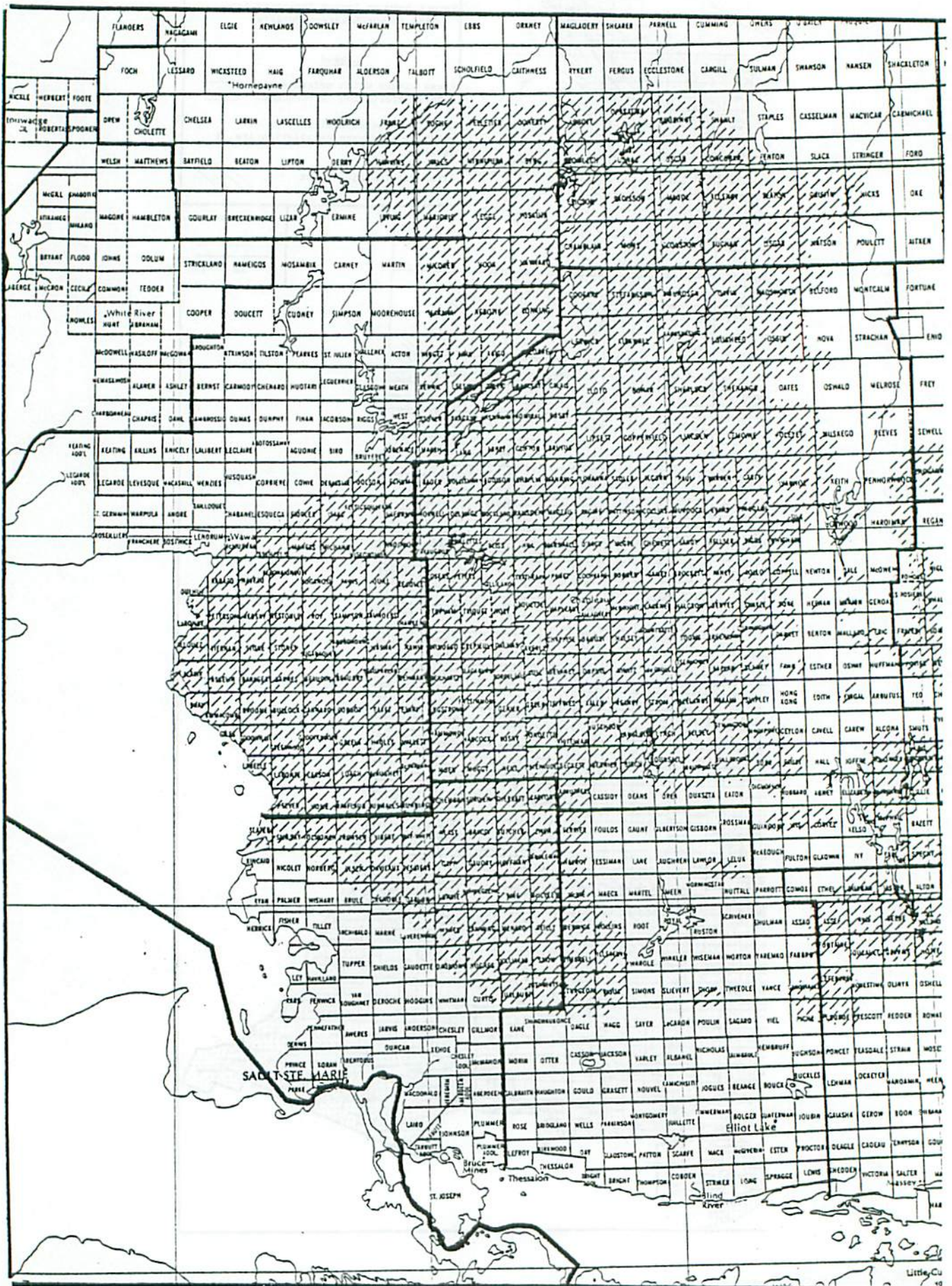
^g Aerially sprayed, Orthene + virus, 1979

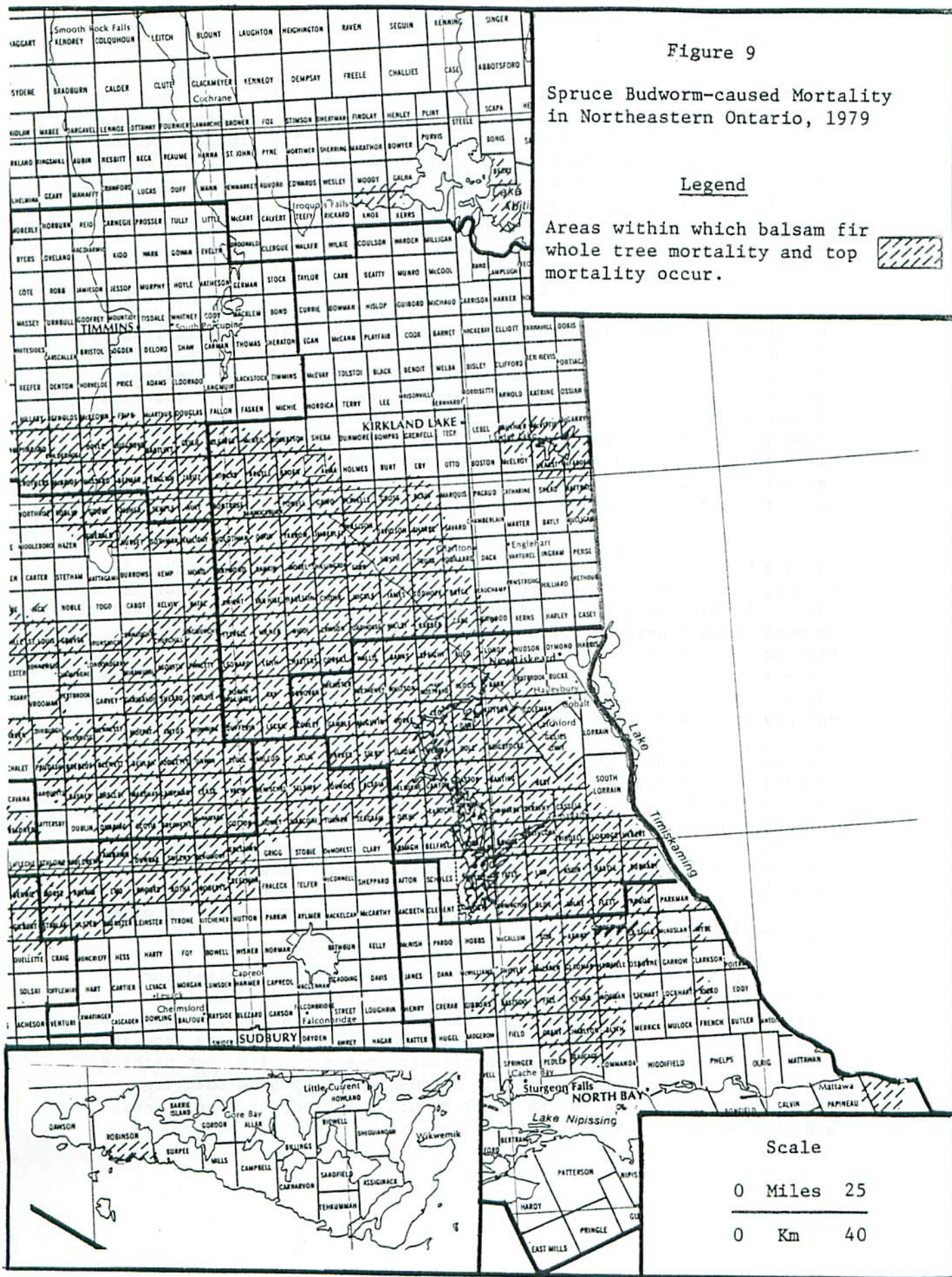
^h Aerially sprayed, Matacil, 1979

* Samples requested by OMNR









stands, was approximately 64%, a figure which indicates no change from 1978, but nevertheless is significant because of the increase in area affected. Furthermore, it should be kept in mind that these averages can be deceiving since plots with high levels of mortality, 90% or higher, are dropped and new plots are located in areas where mortality has been detected for the first time and is likely to be at low levels. A summary of all tree mortality data based on ground checks for the past five years for northeastern Ontario is presented in Table 6.

On the basis of mortality data from northeastern Ontario from 1975 to 1979, the following pattern of balsam fir tree mortality can be expected to occur in stands once mortality starts: 1st year, about 5%; 2nd year, 20%; 3rd year, 35-40%; 4th year, 50-55%; 5th year, 75%; 6th year, 80-85%; 7th year, 90% and 8th year, 95%. Balsam fir tree mortality generally starts after 4 or 5 consecutive years of moderate-to-severe defoliation. After balsam fir tree mortality begins in a stand it should progress along the lines depicted in Figure 10, although it should be recognized that there will be considerable variation among stands depending on site, amount of balsam and other susceptible species, weather and budworm populations.

White spruce mortality is increasing in Chapleau District. Seven plots, with a total of 590 white spruce trees, were checked in both 1978 and 1979. Mortality increased from 15% in 1978 to 24% in 1979. The highest mortality level recorded for white spruce in 1979 in northeastern Ontario was 50% in Fitzsimmons Township, Chapleau District. Elsewhere, the story was the same as in 1978. Very little white spruce mortality was detected that could be confirmed by ground checks, although several instances of new mortality were recorded, notably in Wawa and Kapuskasing districts. Much of the problem in detecting and confirming the condition of white spruce is due to the low volumes per unit area of this species and the scattered, interspersed or inaccessible nature of its presence in the forest. Hence, it is difficult, at this time, to make general statements about the current condition of this species in the outbreak area. The most difficult figure to establish is the proportion of white spruce affected over large areas. A total of 146 ground checks was made in 1979, 17 of which were in white spruce and 129 in balsam fir. In five of the 17 white spruce checks, no mortality was present; in the other 12, mortality averaged 24%.

In August 1979, tree mortality levels were determined for stands that had been sprayed for spruce budworm and for similar untreated stands in Lake Superior Provincial Park, Wawa District. Very simplistically, if we ignore the details of spraying history, the data in Table 7 show that spraying can prevent tree mortality, but perhaps more importantly, in terms of this discussion, they show that some mortality is occurring in the black spruce component of these stands and that white spruce mortality is fairly high in some cases.

Table 6 . Northeastern Ontario - Summary of spruce budworm-associated tree mortality based on 100 tree ground checks for the past five years.

Location	Host	Tree mortality (%)				
		1975	1976	1977	1978	1979
<u>Blind River District</u>						
McNie Twp	bF	4		49	66	94
Nicholas Twp	bF					23
	wS					0
Renwick Twp	bF	26	68	77	85	97
	bF	15	24	55	63	77
	bF	2	47	56	43	70
Sturgeon Twp	bF	1	6	10	29	56
	wS (50)*					0
Timbrell Twp	bF	16	55	61	88	91
Villeneuve Twp	bF	3	10	11	34	69
	wS (50)*					0
<u>Chapleau District</u>						
Abney Twp	bF (65)*					12
	wS					0
Birch Twp	bF			20	29	37
	wS (35)*				0	0
Bliss Twp	bF	14	30	51	55	
	wS (35)*				0	
Bonar Twp	bF		25		68	
Bordeleau Twp - Gale Lake	bF	64		70		
Borden Twp - Westover Lake	bF	19	20			
Borden Twp	bF	55	73	85	87	90
	wS (40)*			12	18	22
	wS				9	17
Bounsall Twp	bF				41	68
Brackin Twp	bF			61		
Brutus Twp	bF		13		19	72
Buckland Twp - Addison Lake	bF		74			
Caouette Twp	bF	27	39		62	
Chewett Twp - Hwy 101	bF	10	15		37	69
- Cedric Lake Rd	bF	0		12		39
Cochrane Twp - Kaniphow Rd	bF	28	32			
- Hwy 101	bF	52		62		
Cosens Twp	bF	2	10		23	
Dalmas Twp	bF (40)*	32		72	83	84
	wS	2		28	28	29
Dupuis Twp	bF	56	71	75	78	93

(cont'd)

Table 6. Northeastern Ontario - Summary of spruce budworm-associated tree mortality based on 100 tree ground checks for the past five years (cont'd).

Location	Host	Tree mortality (%)				
		1975	1976	1977	1978	1979
<u>Chapleau District (cont'd)</u>						
Evans Twp	bF			9		
Fingal Twp	bF					20
Fitzsimmons Twp	bF	25				
	bF			44	83	95
	wS			0	21	50
Foleyet Twp - Hwy 101	bF	0		0		
Gilliland Twp	bF	21	33		40	63
	wS (50)*				11	12
Green Twp	bF	8	10		15	37
Halsey Twp - Nemegos Rd	bF	42		58		69
Heenan Twp	bF				8	
Hill Twp	bF	8				95
Hoey Twp - Lawson Lake	bF	55	55	76	76	79
	wS			14	14	26
Ivanhoe Twp - Ivanhoe Park	bF				30	54
	wS					23
Kelsey Twp - Wakami Park	bF (157)*				63	
Kildare Twp	bF			43		
Kosny Twp	bF				68	87
	wS				5	12
Lemoine Twp	bF				41	
Lipsett Twp						
- Lafrienier Lumber Rd	bF		30			
- Chapleau Lumber Rd	bF		35			
Margaret Twp	bF				48	78
Marshall Twp	bF	23				93
Muskego Twp	bF				33	
Pattinson Twp	bF	9		34		72
Reaney Twp	bF	10		22		35
	bF	22				
Sadler Twp	bF	21		42		87
Windego Twp	bF		66		68	78
<u>Cochrane District</u>						
Abitibi Lake - north	bF					0
- south	bF					8
Bonis Twp	bF					0
Moody Twp	bF					0
Nesbitt Twp	bF					0

(cont'd)

Table 6 . Northeastern Ontario - Summary of spruce budworm-associated tree mortality based on 100 tree ground checks for the past five years (cont'd).

Location	Host	Tree mortality (%)				
		1975	1976	1977	1978	1979
<u>Espanola District</u>						
Hotte Twp	bF			64	64	78
Ouellette Twp	bF			60	95	96
Robinson Twp	bF					32
	bF					28
<u>Gogama District</u>						
Asquith Twp	bF		39	86	88	94
	bF				18	47
Chester Twp	bF					12
Dublin Twp	bF					13
Fawcett Twp	bF				10	
Garibaldi Twp	bF				99	
	bF				31	43
Gouin Twp	bF					14
Hazen Twp	bF			36	38	58
Kelvin Twp	bF				6	23
MacMurchy Twp	bF			15	27	76
Marshay Twp	bF	39				
Miramichi Twp	bF		70	100		
	bF				87	
Ogilvie Twp	bF			4	20	
Onaping Twp	bF	77				
Paudash Twp	bF					21
St. Louis Twp	bF				20	40
Valin Twp - Welcome Lake	bF			75		
<u>Hearst District</u>						
Cholette Twp	bF				0	0
Franz Twp	bF					14
Hook Twp	bF				34	
Minnipuka Twp	bF				16	
	wS (26)*				4	
	bF				37	87
	wS (30)*				14	40
Stanton Twp	bF					0
<u>Kapuskasing District</u>						
Abbott Twp - Brunswick Lake	bF				71	96
- Brunswick Lake	wS (50)*					22

(cont'd)

Table 6 . Northeastern Ontario - Summary of spruce budworm-associated tree mortality based on 100 tree ground checks for the past five years (cont'd).

Location	Host	Tree mortality (%)				
		1975	1976	1977	1978	1979
<u>Kapuskasing District (cont'd)</u>						
Cromlech Twp	bF		14		0	
Cummings Twp	bF					2
Fauquier Twp	bF					2
Fenton Twp	bF					0
Lisgar Twp	bF					4
Mons Twp	bF (75)*				61	
	wS (25)*				36	
Opasatika Twp - Opasatika Lake	bF		2		0	2
Shanley Twp	bF					3
Stringer Twp	bF					0
<u>Kirkland Lake District</u>						
Alma Twp	bF				46	78
Charters Twp - Montreal R.	bF	14	44	53	64	86
Chown Twp	bF		3	8	17	23
Doon Twp	bF			75	92	
Dufferin Twp - McKee Lake	bF			83	87	
Gauthier Twp	bF			13	17	35
Gross Twp	bF		7	10	24	45
Hearst Twp	bF			4	25	71
Hincks Twp	bF			53		
James Twp	bF			18	32	58
McFadden Twp	bF			16	20	49
McNeil Twp	bF				11	
Milner Twp	bF	4				
Truax Twp	bF		36	46	87	
Van Hise Twp	bF		51	62	95	
Yarrow Twp - Mistimikon Lake	bF		75			
Yarrow Twp	bF			70	91	
<u>North Bay District</u>						
Bastedo Twp	bF					2
Cameron Twp	bF					11
Lyman Twp	bF					9
McLaren Twp	bF					8
Pedley Twp	bF					8

(cont'd)

Table 6 . Northeastern Ontario - Summary of spruce budworm-associated tree mortality based on 100 tree ground checks for the past five years (cont'd).

Location	Host	Tree mortality (%)				
		1975	1976	1977	1978	1979
<u>North Bay District (cont'd)</u>						
Sisk Twp	bF					29
Thistle Twp	bF					40
<u>Sault Ste. Marie District</u>						
Bracci Twp - North Chubb Lake	bF	13		68		79
Butcher Twp - Goulais Lake	bF	22		70		
Hoffman Twp	bF	6		43		
Pine Twp	bF	9	27	52	59	80
	bF	7	22	42	49	74
Smilsky Twp	bF	44	93	100		
Snow Twp	bF					19
Wlasy Twp - Dyson Lake	bF	29		66		73
<u>Sudbury District</u>						
Antrim Twp - Halfway Lake	bF	62	86	94	97	
- Halfway Lake	wS	0	0	8		
Beaumont Twp - Graveyard Lake	bF	89		87		74
- Helen Lake	bF	81		62		
Botha Twp - Rome Lake Rd	bF	82		94		
- near Morin Lake	bF	65		82		96
Dunbar Twp - Scotia Lake	bF	93		88	81	96
Ellis Twp - Scarecrow Lake	bF			40	35	41
Emo Twp - Onaping Lake	bF	54		69	91	90
Fairbairn Twp - Onaping Lake	bF	68		63	98	
Howey Twp - Laundrie Lake	bF			59	53	88
Muldrew Twp - Elboga Lake	bF	54	71	54	93	95
Munster Twp - Rome Lake Rd	bF	64		84	93	82
Rhodes Twp - Richardson Lake	bF	30		69	92	
Seagram Twp - Linger Lake	bF			16	34	62
Sweeny Twp - Ayotte Lake	bF	67		80		94
Ulster Twp - Sideburn Lake	bF	38		79		95
<u>Temagami District</u>						
Barr Twp - Mowat Landing	bF		7	24	62	83
Best Twp	bF			11	21	35
Corley Twp - Smoothwater Lake	bF	11	56	74	96	

(cont'd)

Table 6 . Northeastern Ontario - Summary of spruce budworm-associated tree mortality based on 100 tree ground checks for the past five years (cont'd).

Location	Host	Tree mortality (%)				
		1975	1976	1977	1978	1979
<u>Temagami District (cont'd)</u>						
Delhi Twp - Wakimika Lake	bF			63	51	68
Donovan Twp - Smoothwater Lake	bF	15				
- Lady Dufferin Lake	bF			36		
Eldridge Twp	bF			19	24	37
Flett Twp - Fanny Lake	bF			10	28	52
Gillies Limit Twp						
- Bay Lake	bF		0	1	4	6
Hebert Twp	bF				34	39
Hebert Twp - East of Angle Lake	bF				33	53
Medina Twp	bF			32	58	78
Milne Twp - Boyce Lake	bF			32	43	59
Parker Twp - Florence Lake	bF			28	21	52
Riddell Twp - Camp 16 Rd	bF			6	49	72
Speight Twp						
- Mendelssohn Lake (S. end)	bF	17			54	78
- Mendelssohn Lake (N. end)	bF	36	65	81		
Strathcona Twp	bF		4		38	
Trethewey Twp - Banks Lake	bF			41	83	91
Vogt Twp	bF			21	28	61
Wallis Twp	bF		33			
<u>Timmins District</u>						
Bartlett Twp - Scott Lake	bF				25	63
English Twp - Ferrier Lake	bF				7	
Hassard Twp	bF					21
Hillary Twp	bF					3
Kidd Twp	bF					0
McKeown Twp	bF					4
Semple Lake	bF				28	
<u>Wawa District</u>						
Asselin Twp - Gargantua Rd	bF		15	23	46	61
- Gargantua Rd	wS (50)*					18
Beaudry Twp - Black Spruce Lake	bF	91		74		96
Beuparlant Twp - McEwen Lake	bF	47		70		83
Brimacombe Twp - Hwy 17	bF		4	16	19	20
Broome Twp	bF			82		89

(cont'd)

Table 6 . Northeastern Ontario - Summary of spruce budworm-associated tree mortality based on 100 tree ground checks for the past five years (concl'd).

Location	Host	Tree mortality (%)				
		1975	1976	1977	1978	1979

<u>Wawa District</u> (cont'd)						
Copenace Twp - Poon L.	bF	27		46		
Esquega Twp - Hwy 101	bF		8	15	13	12
Giles Twp - Coldwater R.	bF	31				45
Hallett Twp - Hoppy Lake	bF	71		98		
Labelle Twp - Agawa	bF	8	14	19		
Laforme Twp - Hwy 651	bF	31	53	81	87	98
LaRonde Twp - Hwy 17	bF		23	56	77	84
Larson Twp - Little Agawa Lake	bF	48		75		82
Makawa Twp - Weedesgoon Lake	bF					35
- Fire River	wS (75)*					17
Michano Twp						
- Miskokomon Twp boundary	bF	63	89	92		
Naveau Twp - High Falls Rd	bF	16	21	43	39	37
Nebonaionquet Twp - Anjigami Rd	bF	53				
Quill Twp - Budd Lake Rd	bF		95	96		
Rennie Twp	bF			2		43
Runnalls Twp - Grey Owl Lake	bF	30		89		94
Simpson Twp	bF					0
Tiernan Twp - Peller Lake	bF	40	61			

* Indicates no. of trees sampled at each location if other than 100.

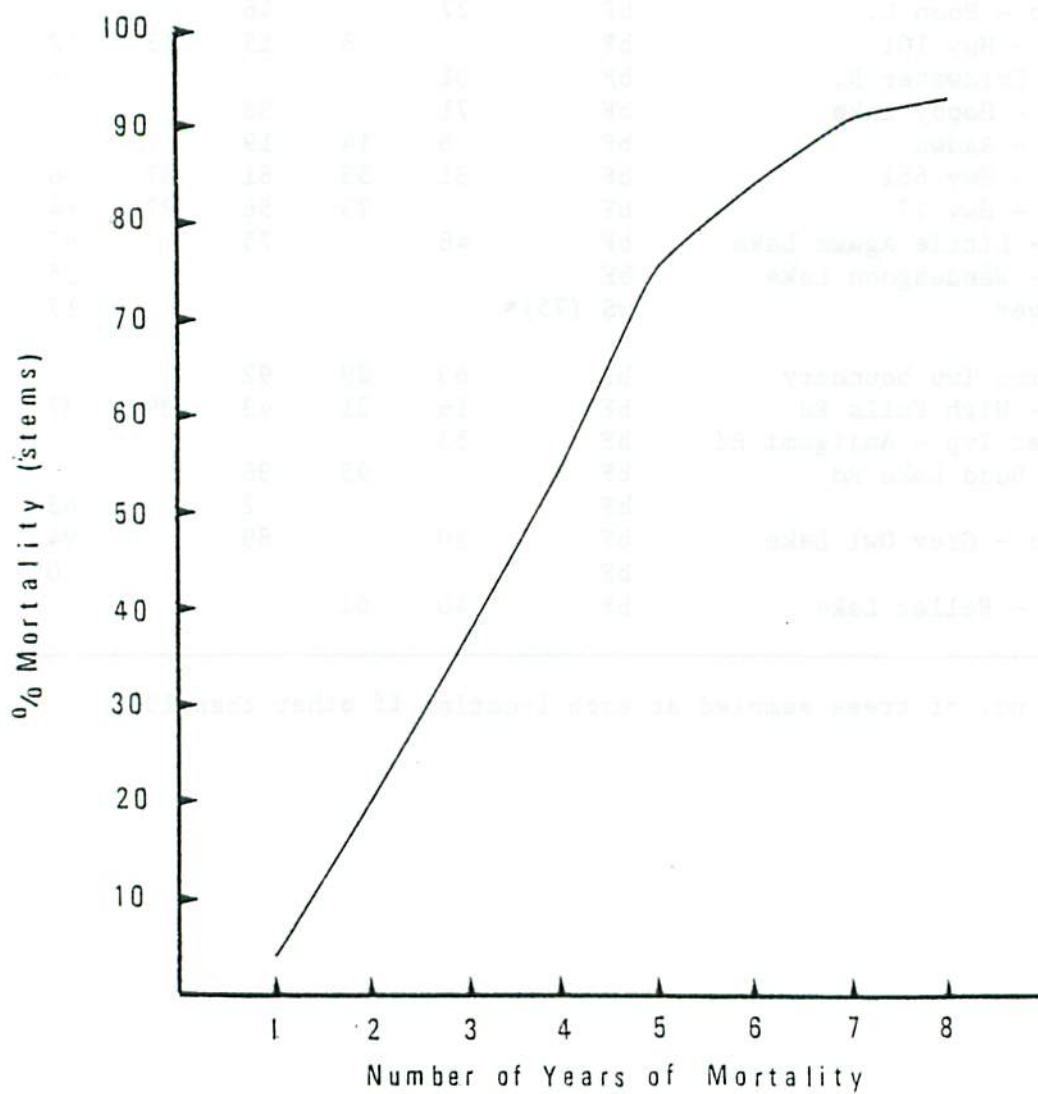


Figure 10. Tree mortality curve for balsam fir based on data from northeastern Ontario 1975-1979.

Table 7 . Tree mortality (based on stems) of balsam fir, white spruce and black spruce in sprayed and unsprayed areas in Lake Superior Provincial Park, Wawa District, August 1979.

Location	% Mortality (No. of trees examined)		
	bF	WS	bS
<u>Tiernan Twp</u>			
Sprayed - R.R.R. Rd., East Block	27 (250)	4 (250)	6 (34)
- R.R.R. Rd., West Block	57 (256)	12 (250)	0 (7)
Unsprayed - R.R.R. Rd.	90 (209)	22 (209)	6 (17)
<u>Tiernan Twp</u>			
Sprayed - Mijin Rd	27 (293)	7 (284)	0 (2)
- J.R. Camp	17 (250)	7 (250)	0 (12)
- HW 17 - West Side) (opposite J.R. Camp)	58 (43)	18 (83)	
Unsprayed - south of J.R. Camp, east side of HW 17	83 (342)	56 (355)	38 (26)
<u>Asselin Twp</u>			
Sprayed - Gargantua, East Block	10 (281)	3 (297)	0 (17)
- Gargantua, West Block	16 (238)	5 (219)	0 (12)
Unsprayed - Gargantua Rd., west of the Baldhead R.	61 (100)	18 (50)	

Moderate-to-severe defoliation was first noted in these stands in 1971 and has occurred each year since, although populations declined considerably in the two townships, Tiernan and Asselin, in 1978 and 1979. Significant tree mortality was recorded by ground checks in stands close to the spray plots in 1975 and 1976, although mortality was mapped as early as 1974 along the eastern edge of the two townships. In any event, it would seem reasonable to suggest that, in fir-spruce stands elsewhere in northeastern Ontario with a similar history of budworm infestation, balsam mortality is heavy (50% or more), white spruce mortality is variable, ranging from light to heavy (10% - 50%), and black spruce mortality is variable, ranging from light to moderate (10% - 30%), depending to a large extent on the stand composition.

Incidentally, it is expected that a report will be prepared describing in greater detail the impact of budworm on treated and untreated stands in Lake Superior Provincial Park. Details concerning spraying history, treatments (materials and dosages), effectiveness of treatments (in terms of larval mortality and foliage protection), and population densities of spruce budworm will be provided.

North Central Ontario

Situation in 1979: For the purposes of this report, north central Ontario is considered to be that part of the province that includes the districts of White River, Terrace Bay, Geraldton and Nipigon. Areas infested in north central Ontario are included in the totals, previously quoted, for budworm defoliation in northeastern Ontario.

In 1979, increased areas of moderate-to-severe defoliation were found as the infestation spread to the west. Moderate-to-severe defoliation is now present throughout most of the White River District with the exception of the northwest corner and the south central portion of the district, east of Pukaskwa National Park, and in the northeast corner of the park. The infestation boundary extends slightly into the southeast side of the Terrace Bay District at the junction of Highways 17 and 611. The infestations near the town of Manitouwadge, Terrace Bay District in Davies, Mapledoram and Gemmell townships increased in size. In the Pagwachuan River area (Boyce, Clavet and Downer townships) in the eastern part of the Geraldton District, budworm spread north into Bicknell Township and west into Bell Township (north of Highway 11) and the junction of the South Pagwachuan River and the Pagwachuan River (south of Highway 11). The infestation did not spread to the south or southeast. Nipigon District remained free of budworm defoliation.

The results of the monitoring plot samples (Table 8) indicate a decrease in larval populations at many locations, particularly those in the Nipigon District. Indeed, larvae were found at only four of the 13 stations in the three districts.

A total area of 8 367 ha (20,675 acres) was aerially sprayed by OMNR in Geraldton District in the North Central Region in 1979. Please refer to Part B of this report for further details.

Infestation Forecasts for 1980: Egg-mass counts were obtained from 75 locations in north central Ontario in 1979. These data are listed in Table 9. Some 35 of the samples were collected in the Pagwachuan River area of Geraldton District (Bicknell, Boyce, Clavet and Downer townships) where aerial spraying operations were conducted in 1979. The other 40 samples were located more generally throughout the four districts. On the basis of 56 locations that are common to both 1978 and 1979, egg-mass counts have increased on an overall basis by some 140%. There is considerable variation among and within these districts both in average egg-mass densities and the changes that occurred from 1978 to 1979. For example, the average egg-mass density for Nipigon District was 14 per 9.29 sq. m (100 sq. ft) in 1978. This increased by 370% to 66 per 9.29 sq. m (100 sq. ft) in 1979. Other increases were White River (+290%), Terrace Bay (+123%) and Geraldton (+74%).

For 1980, it appears that most of the White River District will be heavily infested, and population levels and area defoliated will continue to increase in the central and eastern part of Terrace Bay District and the eastern part of Geraldton District. The districts of Nipigon, most of Geraldton (west of Klotz Lake) and the western part of Terrace Bay should remain relatively free of budworm.

Tree Mortality: A small pocket of balsam fir mortality was found in the southeast corner of Cecile Township in the White River District. A check of 100 trees showed that 34 of them were dead.

Northwestern Ontario

Situation in 1979: In northwestern Ontario, a total area of some 487 873 ha (1,205,533 acres) of moderate-to-severe defoliation was mapped in Fort Frances, Atikokan and Thunder Bay districts in 1979 (Figure 11). This represented an increase of some 145 210 ha (358,813 acres) over the 342 663 ha (846,270 acres) of defoliation mapped in 1978. The two major areas of infestation both

Table 8 . Results of monitoring plot samples for a six-year period
for plots in north central Ontario

Location	Host	1974	1975	1976	1977	1978	1979
<u>Nipigon District</u>							
Black Sturgeon Road	bF	0	7	6	4	-	2
Purdum Twp	wS	0	4	23	36	1	0
Legault Twp	bF	0	0	0	0	-	0
Ledger Twp	bF	1	3	13	3	0	0
Summers Twp	bF	<u>0</u>	<u>0</u>	<u>2</u>	<u>4</u>	<u>0</u>	<u>0</u>
		1	14	44	47		2
<u>Geraldton District</u>							
Caramat Road	wS	0	1	0	0	-	0
Croll Twp	bF	3	0	2	1	1	0
Klotz Lake	bF	<u>0</u>	<u>0</u>	<u>2</u>	<u>4</u>	<u>21</u>	<u>15</u>
		3	1	4	5		15
<u>Terrace Bay District</u>							
Amwri	bF	11	5	5	4	-	0
Syine Twp	wS	1	16	16	0	-	0
Lecours Twp	wS	4	8	6	5	-	11
Stevens Tower Hill	bF	3	2	0	3	-	3
Catlonite Lake	bF	<u>5</u>	<u>2</u>	<u>2</u>	<u>0</u>	<u>-</u>	<u>0</u>
		24	33	29	12		14
Totals		28	48	77	64		31

Table 9. North Central Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1979, and infestation forecasts for 1980.

Location	Host	Estimated percent of defoliation 1979	No. of egg-masses per 9.29 sq. m of foliage	Infestation forecasts for 1980 ^a	Accumulated damage ^b
<u>Geraldton District</u>					
(41 locations)					
Caramat					
- 2.8 km south of Hwy 11	bF	0	14	L	0
Caramat Road - km 24	bF	0	15	L-M	0
Catlonite Rd - km 115.7	bF	0	34	L-M	0
Croll Twp	bF	0	0	0	0
Klotz Lake	bF	17	62	M-S	1
Osawin - Pagwachuan Area					
*Bicknell Twp					
- Pagwa R Rd, km 36.5	bF	57	856	S	2
- Pagwa R Rd, km 36.5	wS	38	739	S	2
*Boyce Twp					
- Pagwa & Eastside rivers	bF	100	373	S	3
- Pagwa & Eastside rivers	wS	98	598	S	3
- Pagwa R Rd, km 22.5 (Check Plot 2)	bF	90	2015	S	3
- Pagwa R Rd, km 22.5 (Check Plot 2)	wS	77	3089	S	3
*Clavet Twp					
- Block A, Hwy 11 E of W Twp Line ^c	bF	42	254	S	2
- Block A, Hwy 11 E of W Twp Line ^c	wS	47	502	S	2
- Block A, Hwy 11 E of W Twp Line ^c	bS	9	17	L-M	1
- Block B, km 4, Pagwa Rd ^d	bF	78	371	S	3
- Block B, km 4, Pagwa Rd ^d	wS	29	1131	S	2
- Block D, W of Pagwa River ^e	bF	77	220	M-S	3
- Block D, W of Pagwa River ^e	wS	73	559	S	3
- Block E, Hwy 11, 4.5 km E of W Twp Line ^e	bF	27	114	M-S	2
- Block E, Hwy 11, 4.5 km E of W Twp Line ^e	wS	46	305	S	2
- Block E, Lake W of Mistake River ^e	bF	88	459	S	3

(cont'd)

Table 9. North Central Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1979, and infestation forecasts for 1980 (cont'd)

Location	Host	Estimated percent of defoliation 1979	No. of egg-masses per 9.29 sq. m of foliage	Infestation forecasts for 1980 ^a	Accumulated damage ^b
<u>Geraldton District (cont'd)</u> (41 locations)					
Osawin - Pagwachuan Area					
Clavet Twp					
- Block E, Lake W of Mistake R ^e	wS	93	972	S	3
- Block E, 3.2 km SW of rapids, Pagwa R ^e	bF	100	1181	S	3
- Block E, 3.2 km SW of rapids, Pagwa R ^e	wS	98	1685	S	3
- Block F, Hwy 11 and hairpin bend on Pagwa R ^f	bF	6	139	M-S	1
- Block F, Hwy 11 and hairpin bend on Pagwa R ^f	wS	20	287	S	2
- Block F, Hwy 11 N of Pagwa R Bridge ^f	wS	79	332	S	3
- Block F, Osawin and Pagwa rivers ^f	bF	99	347	S	3
- Block F, Osawin and Pagwa rivers ^f	wS	97	1043	S	3
- Check Plot 1, Jinx Lake	bS	91	808	S	3
- Check Plot 1, Jinx Lake	bF	99	1277	S	3
- Check Plot 1, Jinx Lake	wS	99	1056	S	3
- Hwy 11, S of Pagwa R Bridge	bF	82	338	S	3
*Downer Twp					
- Osawin River, S of rapids	bF	91	595	S	3
- Osawin River, S of rapids	wS	94	2258	S	3
- Osawin River at Loughlan Cr	bF	98	649	S	3
- Osawin River at Loughlan Cr	wS	94	301	S	3
*Highway 11, Check Plot 3A					
- W of Pipeline	bF	70	647	S	3
- Check Plot 3A W of Pipeline	wS	88	1376	S	3
- SE of Nibs Lake	bF	24	274	S	1
Wintering Lake Rd - km 89.8	bF	0	0	0	0

(cont'd)

Table 9. North Central Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1979, and infestation forecasts for 1980 (cont'd).

Location	Host	Estimated percent of defoliation 1979	No. of egg-masses per 9.29 sq. m of foliage	Infestation forecasts for 1980 ^a	Accumulated damage ^b
<u>Nipigon District</u> (7 locations)					
Kilkenny Twp - Macdiarmid	bF	0	0	0	0
Ledger Twp - gas line	bF	0	10	L	0
Legault Twp	bF	0	0	0	0
Parks Lake					
- km 48 Domtar Rd	bF	0	0	0	0
Patience Twp - Jackpine River	bF	0	11	L	0
Purdom Twp - Cameron Falls	wS	0	13	L-M	0
Summers Twp	bF	0	32	L-M	0
<u>Terrace Bay District</u> (14 locations)					
Amwri Station - Hwy 614	bF	0	35	L-M	0
Catlonite Lake - km 50	bF	0	0	0	0
Davies Twp - Manitou Falls	wS	0	92	M-S	0
Gertrude Twp	bF	3	46	L-M	0
Hourglass Lake	wS	86	663	S	3
- 2.6 km Husak Rd	bF	2	131	M-S	1
Jct. of Industrial and Camp 15 Rd	bF	1	189	M-S	0
Killraine Twp					
- Rainbow Falls Prov. Pk	bF	0	60	M	0
Lecours Twp - Hydro Rd - km 3.2	bF	1	13	L-M	0
O'Neil Twp					
- .8 km north of Hwy 17	bF	0	63	M-S	0
Pic Twp					
- Black River, Hwy 17	wS	0	62	M-S	0
Stevens - microwave tower	bF	0	106	M-S	0
Syine Twp					
- Jackfish Lake	bF	0	17	L-M	0
Wiggins Twp					
- Gravel River, 1.6 km east	bF	0	0	0	0

(cont'd)

Table 9. North Central Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1979, and infestation forecasts for 1980 (concl'd).

Location	Host	Estimated percent of defoliation 1979	No. of egg-masses per 9.29 sq. m of foliage	Infestation forecasts for 1980 ^a	Accumulated damage ^b
<u>White River District</u> (13 locations)					
Abraham Twp	bF	35	203	M-S	2
Cecile Twp	bF	41	390	S	2
Cooper Twp	wS	92	1060	S	3
Dahl Twp					
- Obatanga Prov. Pk	bF	30	393	S	2
Hydro Rd - Umbata Falls	bF	95	2317	S	3
McCron Twp - Access Rd	bF	93	3307	S	3
Pukaskwa National Pk					
- Bonamie Cove	bF	1	378	S	1
- Cascade River	bF	96	1958	S	3
- Oiseau Bay	bF	4	187	M-S	1
- Oiseau Bay - 11.2 km east	bF	98	531	S	3
- Simons Harbour	bF	13	183	M-S	1
- Tip Top Mountain	bF	92	1125	S	3
Regan - 14.1 km south	bF	98	1828	S	3

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

^b See footnote, Table 3, p. 17

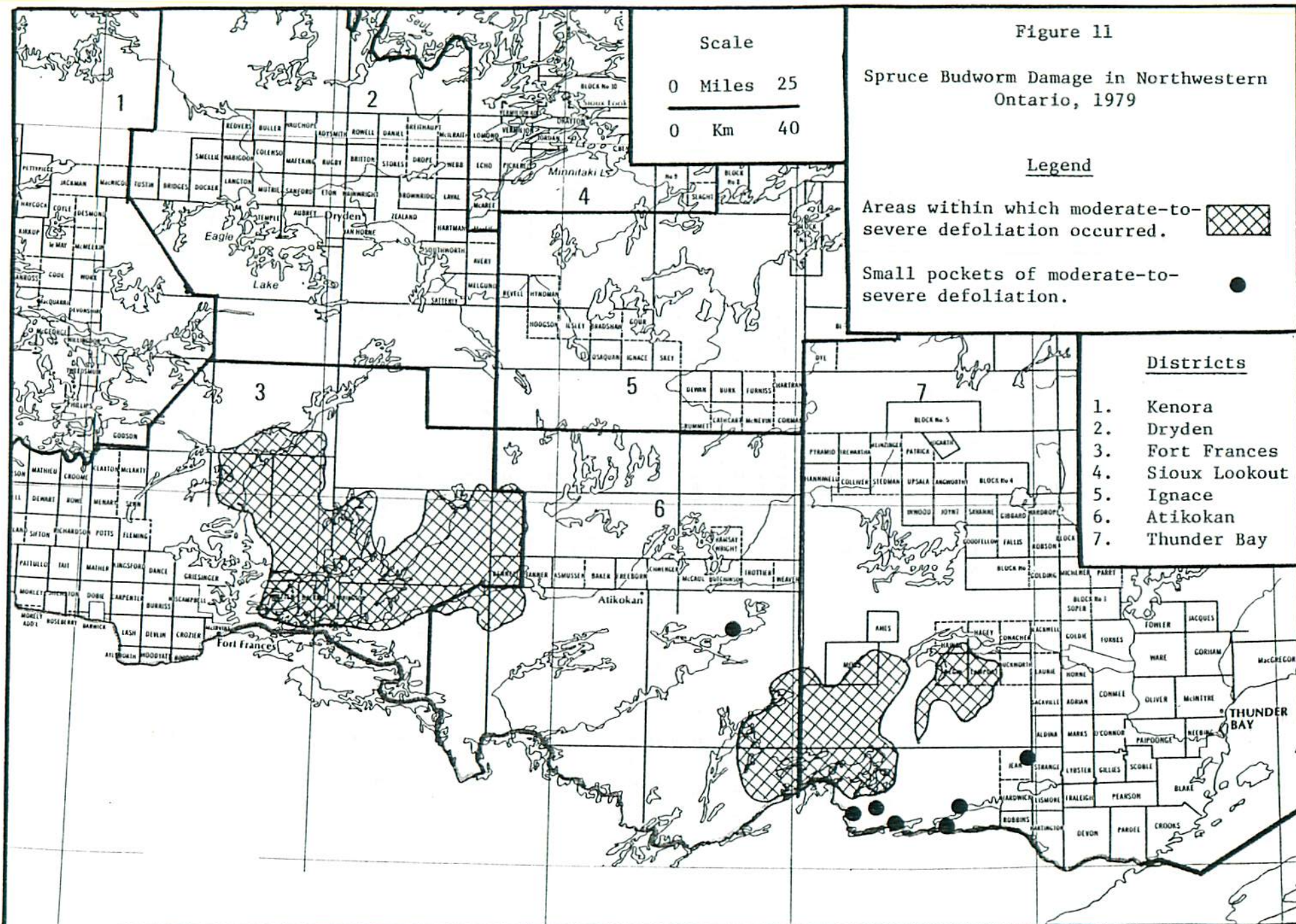
^c Aerially sprayed, Orthene 1979

^d Aerially sprayed, Orthene + B.t. (Novabac) 1979

^e Aerially sprayed, Matacil 1979

^f Aerially sprayed, B.t. (Thuricide) 2 applications 1979

* Samples requested by OMNR



increased in extent. The larger of the two, which is primarily in the Fort Frances District between Bennett Lake and the town of Fort Frances, increased in 1979 to 306 000 ha (756,126 acres) from 255 566 ha (631,505 acres) in 1978. The second infestation, which extends eastward from Kawnipi Lake in the Atikokan District to Lower Shebandowan Lake in the Thunder Bay District, increased from 87 096 ha (215,215 acres) in 1978 to 181 873 ha (449,407 acres) in 1979. The results of the monitoring plot samples (Table 10) indicate an overall decrease in larval populations since 1977. The decrease in larval numbers is most pronounced in Thunder Bay District whereas increases occurred in four other districts: Atikokan, Fort Frances, Kenora and Dryden.

In the Thunder Bay District, increases in the extent of defoliation occurred throughout the Northern Light Lake to Saganagons Lake area on the south edge of the infestation, from Clovenhoof Lake to Titmarsh Lake in the central part of the infestation, and in the Squeers Lake-Burchell Lake-Moss Lake area on the north edge of the 1978 infestation. The area infested in 1979 was double that of 1978. The area infested in Quetico Provincial Park was also double that of 1978 as budworm spread to the south, west and north of the Kawnipi Lake-Mack Lake area. Further to the west in the Atikokan District near the Atikokan-Fort Frances district boundary along the Seine River, an area of approximately 20 235 ha (50,000 acres) was moderately to severely defoliated. This defoliation was likely an extension of the infestation in Fort Frances District. New infestations were detected at Win Lake in the Atikokan District and at Granite Lake, Melvin Lake, Gunflint Lake, Arrow Lake (three pockets) and north of Whitefish Lake in Thunder Bay District.

In the Fort Frances District, the northward spread was generally along the northern boundary of the 1978 defoliation, particularly in the northeastern part of the infestation between Manion Lake and Mount Lake and further to the west, from Otukamoan Lake to Harris Lake. Ground checks at various points throughout the known area of infestation determined that populations were as high as or higher than in previous years and heavy backfeeding was noted along the Manion Lake Road, in the vicinity of Bear Pass and in the Vista-Moose lakes area. The only significant area of decline was along the northeast shore of Rainy Lake, from Reef Point north to Manitou Sound. A survey, involving ground checks and larval counts, was made along the Ontario-Manitoba border in the Kenora District where it was suspected that budworm populations were increasing. However, the survey showed that only a trace population, one budworm or fewer per 46 cm (18 inch) branch tip, was present in the area.

Infestation Forecasts for 1980: A total of 133 locations was sampled for egg-mass counts in 1979 with all but two of the samples from Thunder Bay, Atikokan and Fort Frances districts (Table 11). On the basis of locations sampled in 1978 and 1979, 121 in total, egg-mass densities increased by some

Table 10. Results of monitoring plot samples for an eight-year period for plots in northwestern Ontario.

District and Location	Host	No. of larvae per 20-mat sample							
		1972	1973	1974	1975	1976	1977	1978	1979
<u>Sioux Lookout</u>									
McAree Twp	bF	0	0	0	0	0	0	-	0
Drayton Twp	wS	0	0	0	0	0	0	-	0
Minnitaki Lake	bF	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	-	<u>0</u>
		0	0	0	0	0	0		0
<u>Red Lake</u>									
Wenasaga Lake	bF	0	0	0	0	0	1	-	0
<u>Dryden</u>									
Aubrey Twp	bF	0	0	1	3	0	2	-	4
Redvers Twp	bF	<u>0</u>	<u>0</u>	<u>1</u>	<u>6</u>	<u>0</u>	<u>0</u>	-	<u>0</u>
		0	0	2	9	0	2		4
<u>Kenora</u>									
Melick Twp	bF	0	0	0	0	0	0	-	11
Redditt Twp	bF	<u>-</u>	<u>0</u>	<u>0</u>	<u>2</u>	<u>1</u>	<u>1</u>	-	<u>4</u>
		0	0	0	2	1	1		15
<u>Fort Frances</u>									
Sifton Twp	wS	-	0	1	2	0	0	-	1
Potts Twp	bF	1	0	1	0	0	0	0	1
Mather Twp	bF	<u>3</u>	<u>1</u>	<u>1</u>	<u>2</u>	<u>0</u>	<u>1</u>	<u>0</u>	<u>2</u>
		4	1	3	4	0	1	0	4
<u>Ignace</u>									
Norway Lake	bF	0	0	0	0	1	0	-	0
Lumberjack Lodge	wS	<u>0</u>	<u>0</u>	<u>0</u>	<u>2</u>	<u>1</u>	<u>0</u>	-	<u>0</u>
		0	0	0	2	2	0		0
<u>Atikokan</u>									
White Otter Lake	wS	0	0	2	7	2	1	-	0
Saganagons Lake	bF	0	2	0	12	2	2	-	5
Tanner Lake	bF	<u>-</u>	<u>19</u>	<u>1</u>	<u>8</u>	<u>1</u>	<u>1</u>	-	<u>1</u>
		0	21	3	27	5	4		6
<u>Thunder Bay</u>									
McTavish Twp	wS	0	6	0	0	33	4	1	1
Sibley Peninsula	bF	0	0	0	0	7	5	-	0
Little Harry Lake	bF	0	0	0	4	0	2	-	0
Hagey Twp	bF	0	1	5	14	5	3	-	1
Aldina Twp	bF	1	0	0	1	75	123	10	1
Spruce River Road	bF	0	0	1	4	1	1	-	0
Holingshead Lake	bF	<u>0</u>	<u>0</u>	<u>0</u>	<u>1</u>	<u>0</u>	<u>0</u>	-	<u>0</u>
		1	7	6	24	121	138		3
Total		5	29	14	68	129	147		32

Table 11. Northwestern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1979, and infestation forecasts for 1980.

Location	Host	Estimated percent of defoliation 1979	No. of egg-masses per 9.29 sq. m of foliage	Infestation forecasts for 1980 ^a	Accumulated damage ^b
<u>Atikokan District</u> (33 locations)					
Agnes Lake	bF	0	12	L	0
Allan Lake	bF	3	11	L	0
Basswood Lake - Bayley Bay	bF	1	11	L	0
- Prairie Portage	bF	0	20	L-M	0
Cache Bay	bF	10	215	M-S	0
Clearwater West Lake	bF	0	11	L	0
David Lake	bF	1	8	L	0
Delahey Lake	bF	0	0	0	0
Eye Lake	bF	2	10	L	0
Factor Lake	bF	35	211	M-S	1
Flood River	bF	5	46	L-M	0
French Lake	wS	0	18	L-M	0
French Lake	bF	2	0	0	0
Greer Lake	bF	2	0	0	0
Joe Lake	bF	4	9	L	0
Joyce Lake	bF	0	0	0	0
Kawa Bay	bF	12	298	S	2
Kawnipi Lake - Devine Creek	bF	22	277	S	2
Little Eva Lake	bF	1	18	L-M	0
Louisa Lake - north end	bF	0	0	0	0
McKenzie Lake	bF	0	63	M-S	0
Melema Lake	bF	9	23	L-M	0
Niven Lake	bF	3	18	L-M	0
Oriana Lake	bF	0	0	0	0
Pipestone River					
- Whalen Lake Rd	bF	33	133	M-S	1
Poohbah Lake	bF	1	8	L	0
Quetico Lake	bF	0	18	L-M	0
Saganagons Lake					
- north side	bF	36	415	S	1
Sturgeon Lake - west end	bF	1	0	0	0
Sunday Lake	bF	0	0	0	0
Tanner Lake	bF	5	10	L-M	0
Thompson Lake	bF	3	20	L-M	0
Tuck Lake	bF	0	0	0	0

(cont'd)

Table 11. Northwestern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1979, and infestation forecasts for 1980 (cont'd).

Location	Host	Estimated percent of defoliation 1979	No. of egg-masses per 9.29 sq. m of foliage	Infestation forecasts for 1980 ^a	Accumulated damage ^b
<u>Fort Frances District</u> (41 locations)					
Bear Pass					
- km 2.4 (1.5 miles) west	bF	46	267	S	1
Bennett Lake	bF	11	647	S	2
Beynon Lake	bF	1	38	L-M	1
Big Sawbill Lake	bF	1	43	L-M	1
Boffin Lake - northeast side	bF	0	0	0	0
Crilly Rd					
- km 4.0 (mile 2.5)	bF	54	457	S	1
Eltrut Lake	bF	81	827	S	3
Entwine Lake	bF	1	51	M-S	1
Eric Lake	bF	0	33	L-M	0
Essox Lake	bF	97	546	S	2
Glenorchy Rd, Bennett Cr.	bF	37	2403	S	1
Harris Lake	bF	82	507	S	1
Heron Lake	bF	0	30	L-M	0
Hwy 11 - Farrington Twp	bF	0	12	L	1
- Mine Centre	bF	1	204	M-S	1
Jones Lake	bF	1	59	M-S	1
Kaiarskons Lake	bF	1	12	L	0
Kawawia Lake	bF	1	67	M-S	1
*Lake of the Woods Prov. Pk.	wS	0	0	0	0
Lawrence Lake	bF	3	111	M-S	1
Little Turtle Lake Rd					
- km 15 (mile 9.4)	bF	1	0	0	1
Lower Manitou Lake	bF	1	73	M-S	1
Makomesut Lake					
- southeast side	bF	8	69	L-M	2
Manion Lake Rd - at Hwy 11	bF	11	360	S	1
- Hillyer Creek	bF	98	771	S	2
Manion Lake Rd					
- km 17.6 (mile 11)	bF	75	906	S	1
- km 23.2 (mile 14.5)	bF	80	1083	S	1
Manitou Stretch	bF	20	528	S	1
Mather Twp	bF	0	10	L	0
Moosetract Lake - west side	bF	96	1919	S	3
Mount Lake	bF	72	857	S	2

(cont'd)

Table 11. Northwestern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1979, and infestation forecasts for 1980 (cont'd).

Location	Host	Estimated percent of defoliation 1979	No. of egg-masses per 9.29 sq. m of foliage	Infestation forecasts for 1980 ^a	Accumulated damage ^b
<u>Fort Frances District (cont'd)</u>					
(41 locations)					
Otukamamoan Lake					
- southeast side	bF	1	16	L-M	1
Pettit Lake	bF	1	16	L-M	1
Pipestone Lake - east end	bF	0	12	L-M	0
Potts Twp	bF	0	12	L	0
Rainy Lake					
- Ash Bay, west end	bF	0	0	0	0
- Black Sturgeon Bay	bF	1	0	0	0
Shoal Lake	bF	0	41	L-M	1
Sphene Lake	bF	1	34	L-M	1
Vickers	bF	1	154	M-S	1
Vista Lake	bF	93	545	S	2
<u>Ignace District</u>					
(1 location)					
Smirch Lake	bF	0	0	0	0
<u>Kenora District</u>					
(1 location)					
Forgie Twp - Rush Bay Rd.	bF	45	107	M-S	1
<u>Thunder Bay District</u>					
(57 locations)					
*Aldina Twp					
- 102, (Pheromone Plot)	bF	0	0	0	0
*Arrow Lake	bF	23	205	M-S	0
*Batwing & Marks Lake Rd Jct	bF	0	14	L	0
Blackwell Twp	bF	3	0	0	0
*Burchell Lake	bF	7	59	M-S	0
*Clay Lake	bF	58	538	S	3
*Clovenhoof Lake	bF	0	211	M-S	0
Crayfish Lake	bF	1	0	0	0

(cont'd)

Table 11. Northwestern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1979, and infestation forecasts for 1980 (cont'd).

Location	Host	Estimated percent of defoliation 1979	No. of egg-masses per 9.29 sq. m of foliage	Infestation forecasts for 1980 ^a	Accumulated damage ^b
Thunder Bay District (cont'd) (57 locations)					
*Devil's Elbow	bF	2	22	L-M	0
*Drift Lake Road	bF	2	0	0	0
*Flatrock Lake	bF	1	0	0	0
*Fountain Lake	bF	10	181	M-S	0
*Greenwater Lake - east side	bF	24	848	S	2
- Shelter Island	bF	1	42	M-S	0
*Greenwood Lake	bF	86	828	S	1
*Gunflint Lake - west end	bF	2	22	L-M	0
*Hagey Twp - Hwy 586	bF	5	111	M-S	0
*Haines Twp - Postans	bF	2	77	M-S	0
*Hood Lake	bF	61	1082	S	2
*Hoof Lake	bF	56	1171	S	1
Kashabowie Lake	bF	0	34	L-M	0
*Kekekuab Lake	bF	2	255	S	0
Lac des Mille Lacs					
- Baril Bay	bF	1	102	M-S	0
- Bolton Bay	bF	4	88	M-S	0
- Pine Point	bF	4	0	0	0
- Poplar Point	bF	0	9	L	0
*Marks Lake	bF	0	0	0	0
*Matawin River					
- OMNR Seed Orchard	wS	0	0	0	0
*McGinnis Lake	bF	73	215	M-S	2
McTavish Twp					
- Ministry of Transportation and Communications	wS	0	19	L-M	0
*Moss Lake	bF	61	845	S	1
*Mountain Lake	bF	9	42	L-M	0
*Northern Light Lake					
- Curran Bay	bF	47	412	S	1
- Gravel Pit	bF	3	26	L-M	0
- South Island	bF	0	0	0	0
- Trafalgar Bay	bF	10	69	M-S	0
- Trout Bay Rd	bF	28	352	S	1

(cont'd)

Table 11. Northwestern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1979, and infestation forecasts for 1980 (concl'd).

Location	Host	Estimated percent of defoliation 1979	No. of egg-masses per 9.29 sq. m of foliage	Infestation forecasts for 1980 ^a	Accumulated damage ^b
<u>Thunder Bay District (cont'd)</u> (57 locations)					
*North Fowl Lake Rd - km 3.7 (mile 2.3) south	bF	11	19	L-M	0
*O'Connor Twp - OMNR Seed Orchard	WS	0	0	0	0
- OMNR Seed Production Area	WS	1	0	0	0
*Pearson Twp - OMNR Seed Orchard	WS	0	0	0	0
*Pigeon River area - Hwy 597	bF	5	20	L-M	0
- Arrow R. on Hwy 593	bF	1	10	L	0
*Plummes Lake	bF	30	394	S	2
*Powell Lake	bF	67	530	S	3
*Prelate Lake	bF	1	0	0	0
*Ross Lake	bF	83	757	S	3
*Sandstone Lake	bF	3	23	L-M	0
*Shebandowan Lake - Sawmill Bay	bF	1	107	M-S	0
*Sleigh Lake	bF	45	389	S	1
*Squeers Creek - 1.6 km (1 mile) north	bF	10	24	L-M	0
*Squeers Lake	bF	19	236	M-S	1
*Swallow Lake	bF	71	1312	S	3
Thunder Bay Centennial Pk	WS	0	10	L	0
Tilly Lake	bF	1	0	0	0
*Weikwabinonaw Lake - NW corner	bF	0	32	L-M	0
*Whitefish Lake	bF	0	0	0	0

^aS = severe, M = moderate, L = light, 0 = nil

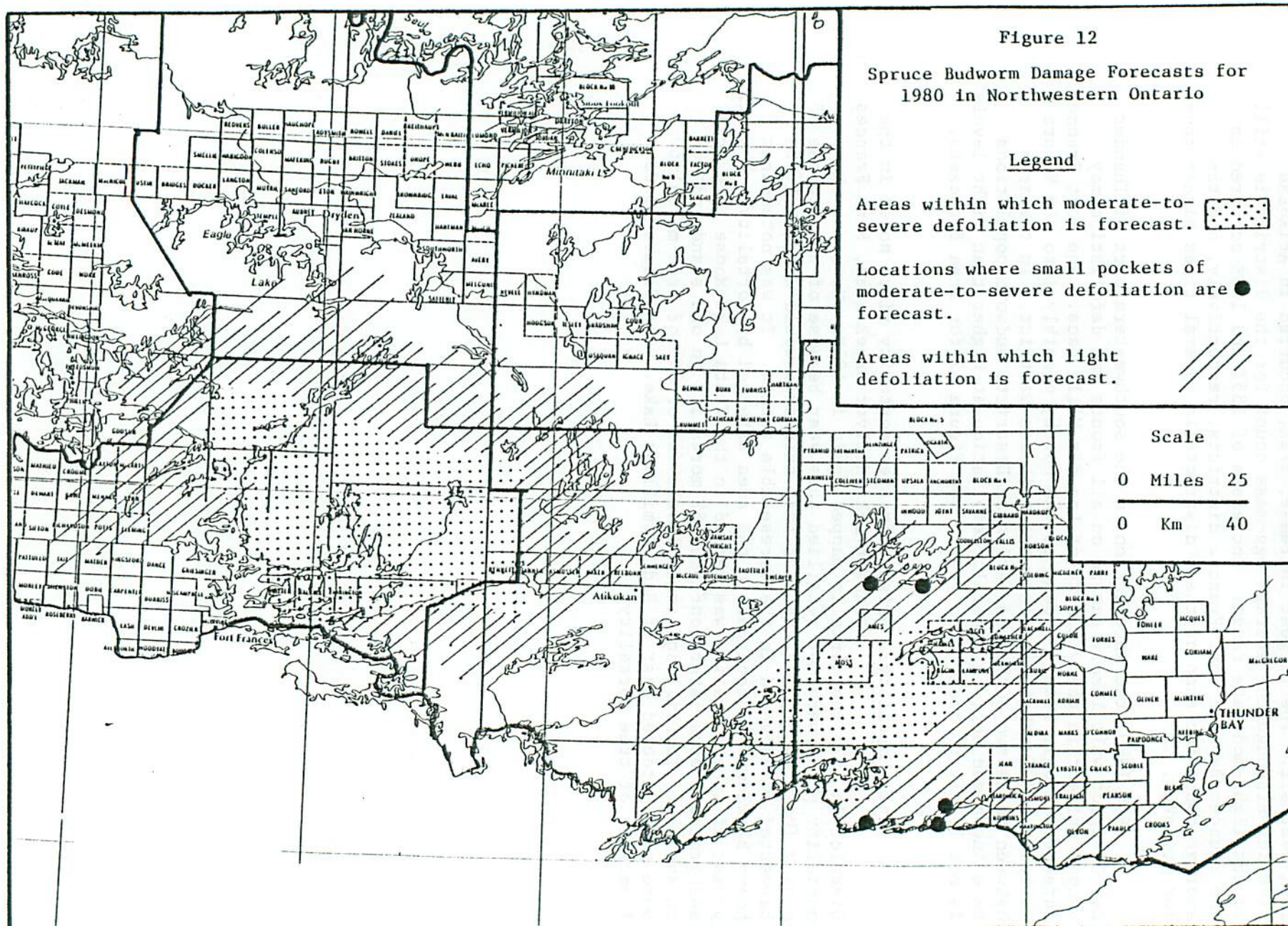
^bSee footnote, table 3, p. 17

*Samples requested by OMNR

150% over all. The largest increase, 272%, occurred in Atikokan District although the average egg-mass count for the district is still in the light-moderate range. Increases of 185% and 109% occurred in the Thunder Bay and Fort Frances districts, respectively, and the average count for each of these districts is several times higher than for Atikokan.

For 1980, the infestation in the southwestern part of Thunder Bay District will likely expand on all fronts and defoliation may become evident in the vicinity of Lac des Mille Lacs. The Fort Frances infestation will likely expand to the north, possibly into the Kenora District and further east into the Atikokan District. In the area between these two outbreaks, Atikokan District, budworm populations have increased but, in general, defoliation at higher than light levels is not likely to occur next year. See Figure 12 for area forecasts.

Tree Mortality: Balsam fir tree mortality first noted in the Bennett Lake-Hillyer Creek area, Fort Frances District in 1977 was aerially mapped again in 1979. However, the mortality plots were not retallied this year because of the expense of access (helicopter) and the fact that this area would not likely be harvested or salvaged in the foreseeable future. It was noted that heavy blowdown had occurred in the area affected by mortality. A small pocket of tree mortality was mapped in the Vista Lake-Moose Lake area and ground checks later confirmed 5% mortality in one stand and 17% in another. Top kill and trace levels (1% or 2%) of tree mortality were also detected east of Bad Vermillion Lake. See Figure 13 for locations of tree mortality.



PART B: AERIAL SPRAYING OPERATIONS

INTRODUCTION

The Ontario Ministry of Natural Resources sprayed a total area of 20 248 ha (50,032 acres) in seven districts in northern Ontario against spruce budworm in 1979. Insecticides used in the program were Matacil (aminocarb, Chemagro Ltd.), Orthene (Chevron Chemical Ltd.) and two *Bacillus thuringiensis* formulations, Thuricide 16B (Sandoz Inc.) and Novabac 32B (Cyanamid Canada Ltd.). In addition, about 54 ha (134 acres) were sprayed in Chapleau District from the ground using the B.t. product Dipel WP (Abbott Laboratories Ltd.) applied by mistblower (Rotomist 100H). A breakdown of area, dates and treatment for all operations appears in Table 12. A more complete description of the 1979 operations is available in Pest Control Report No. 8 from the Ministry of Natural Resources.

OMNR was responsible for the logistics of the spray operations. Input by the CFS consisted of providing the biological information necessary for the planning and timing of operations (Table 13) and biologically assessing the various treatments (Tables 14-24). In addition, aerial and ground surveys to map the extent of spruce budworm defoliation and to determine, by egg-mass counts, damage forecasts for 1980 were carried out by FIDS field technicians using some 200 hours of aircraft time provided by OMNR.

In 1979, budworm emergence and larval development was generally a week or more later than normal in Northwestern, North Central and Northeastern regions of the province. However, in Kirkland Lake, Kapuskasing and Cochrane districts of the Northern Region development was normal or slightly ahead of normal with rapid development occurring in early and mid-June at the time the spraying operations began.

Northern Ontario

1979 Operations: A total of 20 248 ha (50,032 acres) was aerially sprayed in 1979 in the Northern and North Central regions, and this represents a considerable increase over 1978. The majority of the increase involved protection spraying of high-value timber areas, to minimize damage until harvesting, in Kirkland Lake and Geraldton districts (Table 12). The remaining 18 areas were selected high-value stands in provincial parks, forest nurseries, seed production areas or white spruce plantations and were sprayed to minimize damage caused by budworm feeding.

Initial plans were to spray double applications of Matacil over some 15 263 ha (37,714 acres). However, because of adverse weather conditions and rapid larval development only one application was completed.

Table 12. Summary of aerial spraying in Ontario against spruce budworm in 1979

Location	Area hectares	(acres)	Spray dates	Treatment
<u>Kirkland Lake District</u>				
Lamplugh and	1 579	(3,903)	June 12	1 application, Thuricide 16B, 10 BIU/4.7 L/ha (4 BIU/.5 gal/acre)
Elliott twp	9 597	(23,714)	to	1 application, Matacil, 63 g/L/ha (.9 oz/14 fl. oz/acre)
Swastika Nursery	117	(290)	June 24	2 applications, Thuricide 16B, 10 BIU/4.7 L/ha each (4 BIU/.5 gal/acre)
and Burt Twp S.P.A.	81	(200)	"	" " " " " " " " " " " "
	11 374	(28,107)		
<u>Geraldton District</u>				
Clavet Twp	5 666	(14,000)	June 13	1 application, Matacil, 87.5 g/1.5 L/ha (1.25 oz/20 fl. oz/acre)
	809	(2,000)	to	1 application, Orthene, 560 g/4.7 L/ha (8 oz/.5 gal/acre)
	809	(2,000)	June 25	1st application, Orthene, 280 g/1.5 L/ha (4 oz/20 fl. oz/acre)
	860	(2,125)		2nd application, Novabac 32B, 20 BIU/4.7 L/ha (8 BIU/.5 gal/acre)
	223	(550)		2 applications, Thuricide 16B, 10 BIU/4.7 L/ha each (4 BIU/.5 gal/acre)
	8 367	(20,675)		1 application, Novabac 32B, 20 BIU/4.7 L/ha (8 BIU/.5 gal/acre)
<u>Chapleau District</u>				
Reeves Twp S.P.A.	12	(30)	June 9	
Nursery	9	(23)	and	
Manning Twp (plantation)	85	(210)	June 16	
Caverley Twp (")	33	(80)		
	139	(343)		2 applications, Novabac 32B, 20 BIU/4.7 L/ha each (8 BIU/.5 gal/acre)
<u>Gogama District</u>				
Carter Twp S.P.A.	3	(8)	June 8	
Fawcett Twp S.P.A.	13	(32)	and	
Invergarry Twp S.P.A.	8	(20)	June 17	
Jack Twp S.P.A.	12	(30)		
	36	(90)		2 applications, Novabac 32B, 20 BIU/4.7 L/ha each (8 BIU/.5 gal/acre)
<u>Cochrane District</u>				
Clute Twp S.P.A. (3201)	2	(5)	June 13	
Clute Twp S.P.A. (3202)	7	(16)	and	
Fournier Twp S.P.A. (3220)	5	(13)	June 19	
	14	(34)		2 applications, Thuricide 16B, 10 BIU/4.7 L/ha each (4 BIU/.5 gal/acre)
<u>Hearst District</u>				
Studholme Twp (plantation)	41	(100)		
Arnott Twp S.T.A.	122	(300)		
Arnott Twp S.T.A.	109	(270)		
Arnott Twp S.P.A.	5	(13)		
	277	(683)	June 16	1 application, Orthene, 560 g/4.7 L/ha (8 oz/.5 gal/acre)
<u>Kapuskasing District</u>				
Fauquier Twp - Bonner Tree			June 12	1st application, Orthene, 560 g/4.7 L/ha (8 oz/.5 gal/acre)
Improvement Centre	41	(100)	and	2nd application, NPV (Nuclear polyhedrosis virus) 750 billion
			June 20	PIB/9.4 L/ha (300 billion PIB/gal/acre)
Total	20 248	(50,032)		

Table 13. Summary of spruce budworm larval development on host species at various stages of the spray operations in seven districts in 1979.

District	Date	Tree species	Developmental Stage (%)						Pupae	Remarks
			II	III	IV	V	VI			
Gogama	June 4	wS	10	55	25	10				1st application on June 8
Chapleau	June 8	bF		23	75	2				1st application started on June 9
		wS	2	46	50	2				
Cochrane	June 13	wS		11	61	28				1st spray application
	June 19	wS			47	40	13			2nd spray application
Hearst	June 16	wS		14	52	34				Sprayed on this date
Geraldton	June 13	bF		22	58	17	3			Start of spray applications
		wS		29	52	17	2			" " "
		bS	10	30	20	40				
	June 18	bF			42	33	25			
		wS			26	50	24			
		bS			15	50	35			
	June 25	bF			18	23	58	1		End of spray operation
		wS			5	6	89			
Kapuskasing	June 12	wS		16	61	23				1st spray application
	June 20	wS					100			2nd spray application
	June 20	bS			4	36	60			
Kirkland Lake (Elliott Twp)	June 15	bF		12	44	38	6			Spraying started June 12
	June 22	bF				6	90	4		Spraying ended June 24

Matacil, mixed with diluent 585, was applied at 87.5 g/1.5 L/ha (1.25 oz/20 fl. oz/acre) and 63 g/1.0 L/ha (9 oz/14 fl. oz/acre) in Clavet Township, Geraldton District and Elliott Township, Kirkland Lake District, respectively.

B.t. was applied to 3 049 ha (7,535 acres) in two product forms: Thuricide 16B (Sandoz Inc.) at various dosages and application rates, and Novabac 32B (Cyanamid Canada Ltd.) at 20 BIU/4.7 L/ha (8 BIU/.5 gal/acre) per application. In addition, *B.t.* was applied to 54 ha (134 acres) in Chapleau District using a ground mistblower.

The remaining 1 936 ha (4,783 acres) were treated with Orthene, a water-soluble chemical with a relatively low oral and dermal toxicity, applied in three different treatment combinations: one application at 560 g/4.7 L/ha (8 oz/.5 gal/acre); an application of 280 g/1.5 L/ha (4 oz/20 fl. oz/acre) followed by an application of Novabac eight days later; and an experimental treatment of Orthene followed by NPV virus which was conducted by Dr. J.C. Cunningham, Forest Pest Management Institute, Sault Ste. Marie.

Generally speaking, spraying was supposed to start when larval development reached equal proportions of third and fourth instar larvae on the primary host species. Exceptions were the first applications of Orthene at Clavet Township, Geraldton District at the peak of the third instar and the Orthene applications in Hearst District at the peak of the fourth instar. Development at the time of the spray applications is shown in Table 13.

The aerial spraying was carried out by three companies (General Airspray, St. Thomas, Ontario; Crop Protection Services, Cambridge, Ontario; Can-Ag Air Service, Kincardine, Ontario), using Grumman Agcats and Piper Pawnees, all fitted with Micronair rotary atomizers. The costs (aircraft and materials) of the preceding aerial applications were as follows: Matacil \$3.19 per ha (\$1.29 per acre), Orthene \$13.49 per ha (\$5.46 per acre), Thuricide 16B \$11.09 per ha (\$4.49 per acre) and Novabac 32B \$14.97 per ha (\$6.06 per acre) (average of *B.t.* products based on combined formulations). The aircraft costs varied considerably from a low of \$1.31 per ha (53¢ per acre) on large spray blocks to a high of \$10.37 per ha (\$4.20 per acre) on the small, high-value stands.

Results: The various spray treatments conducted in northeastern Ontario in 1979 were assessed for effectiveness and results are presented in Tables 14-24. Basic data such as pre- and postspray population densities, larval mortality (due to treatment) and foliage protection are presented in each table.

Mature white spruce and balsam fir in Clavet Township, Geraldton District were sprayed to minimize damage until harvesting can take place. Of the five spray regimes, the best foliage protection on all

host tree species was achieved with a single application of Orthene, although population reduction was less than expected (Table 14). The best population reductions combined with good foliage protection resulted from the Orthene spray followed by an application of Novabac eight days later. Over all, better population reductions were recorded on balsam fir than on white spruce in all but one treatment. *B.t.* treatments showed the poorest results, with several exceptions.

In the Kirkland Lake District the two separate areas of operation (Burt Township and Elliott Township) had different forest conditions and produced distinctively different results. Double applications of Thuricide 16B provided excellent foliage protection of white spruce at the seed production area in Burt Township and at the Swastika nursery (Table 15). Results were less outstanding from the Matacil application on natural stands in Elliott Township, whereas the Thuricide 16B double application was very effective. However, weather and mechanical problems played an important part in delaying the operation and hence affected the results.

Of the seed production areas sprayed, those in Gogama and Cochrane districts harbored the highest budworm populations. Aerial applications of *B.t.* on these 18 m or higher white spruce provided very little or no foliage protection except at Jack Township, Gogama District (Table 16). Larval mortality was inconsistent, ranging from 0 to 76%. A better level of protection and population reduction was noted on balsam fir in some of the stands.

The same spray regime used in Gogama District produced better results in the Reeves Township seed production area, Chapleau District (Table 17). Some population reduction was evident in white spruce plantations in Caverley and Manning townships. However, population levels were initially low and defoliation on checks was minimal, so the benefits of spraying are questionable. The only ground spray operations carried out this year were in two parks in Chapleau District. These produced good results on balsam fir and, even though no population reduction could be measured, there was modest foliage protection on white spruce.

In Studholme Township, Hearst District, a field trial, to determine the impact of budworm on young, planted white spruce was initiated in 1978. This area, along with a seed production area and two seed tree areas in Arnott Township (Table 18), was treated with a single application of Orthene. Good results were achieved on the residual mature white spruce as well as on the planted trees. However, the hoped-for budworm population increase on these young trees did not materialize, and consequently there would have been little or no impact on the untreated check plot. Protection of the seed production area in Arnott Township was comparable to that in other seed production areas treated, but was not as good as that achieved on natural white spruce in Clavet Township, where one application of Orthene was also used.

Table 14. Population reduction and foliage protection attributable to various aerial spray treatments on balsam fir, white spruce and black spruce in Claver Township, Geraldton District, 1979.

	Prespray larvae per 46 cm branch tip	Surviving pupae per 46 cm branch tip	Spray deposic drops/cm ²	% population reduction due to treatment	% 1979 defoliation
<u>Orthene, 1 applic., 560 g/4.7 L/ha (3 oz./1.5 gal/acre)</u>					
Balsam fir - spray	26.8	2.4	37.2	69	51
- check	26.6	7.3			76
White spruce - spray	31.5	2.6		47	40
- check	39.5	6.2			85
Black spruce - spray	9.7	2.4		57	16
- check	10.8	6.2			65
<u>Orthene, 1st applic., 230 g/1.5 L/ha (4 oz/20 fl. oz./acre) + Novabac, 2nd applic., 20 BIU/4.7 L/ha (3 BIU/1.5 gal/acre)</u>					
Balsam fir - spray	24.6	1.0	7.5 + 29.1	86	80
- check	26.6	7.8			76
White spruce - spray	46.9	2.7		65	69
- check	39.5	6.2			85
Black spruce - spray	8.6	.6		88	50
- check	10.8	6.2			65
<u>Matacil, 1 applic., 2 replicates, 37.5 g/1.5 L/ha (1.25 oz/20 fl. oz/acre)</u>					
Balsam fir - spray	18.6	.9	2.1	94	52
- check	19.6	6.0			74
White spruce - spray	18.0	1.5		74	56
- check	15.0	4.8			68
Black spruce - spray	3.9	.4		92	32
- check	10.3	6.2			65
Balsam fir - spray	21.2	3.8	.2	42	69
- check	19.6	6.0			74
White spruce - spray	29.0	2.9		51	70
- check	27.2	5.5			76
Black spruce - spray	12.6	2.1		48	16
- check	12.0	3.8			71
<u>Thuricide 168, 2 applic. of 10 BIU/4.7 L/ha each (4 BIU/1.5 gal/acre)</u>					
Balsam fir - spray	16.0	1.9	35.0 + 13.4	64	55
- check	12.6	4.2			71
White spruce - spray	23.3	4.7		19	63
- check	27.2	5.5			76
Black spruce - spray	6.9	3.8		5	42
- check	10.8	6.2			65

Table 15. Population reduction and foliage protection attributable to various aerial spray treatments on balsam fir and white spruce in Elliott and Burt townships, Kirkland Lake District, 1979.

	Prespray larvae per 46 cm branch tip		Surviving pupae per 46 cm branch tip		% population reduction due to treatment		% 1979 defoliation	
	bF	wS	bF	wS	bF	wS	bF	wS
<u>Matacil, 1 applic., 2 replicates, 63 g/L/ha (.9 oz/14 fl. oz/acre)</u>								
Elliott Twp - spray	17.6	43.4	2.0	1.3	62	66	57	55
- check	26.0	60.1	7.8	5.3			82	72
Elliott Twp - spray	43.5	52.6	.8	1.3	93	72	83	41
- check	35.6	60.1	9.9	5.3			97	72
<u>Thuricide 16B, 1 applic., 10 BIU/4.7 L/ha (4 BIU/.5 gal/acre)</u>								
Elliott Twp - spray	13.2	9.0	.2	.5	94	64	7	12
- check	26.0	17.7	7.8	2.9			82	74
<u>Thuricide 16B, 2 applic., 10 BIU/4.7 L/ha each (4 BIU/.5 gal/acre)</u>								
Burt Twp - Swastika Nursery		27.2	2.6			43		12
- Check		17.7	2.9					74
Burt Twp - S.P.A.		23.1	1.4			63		38
- Check		17.7	2.9					74

Table 16. Population reduction and foliage protection attributable to aerial applications of *B.t.* on seed production areas in Gogama and Cochrane districts, 1979.

	Prespray larvae per 46 cm branch tip		Surviving pupae per 46 cm branch tip		% Population reduction due to treatment		% 1979 defoliation	
	bF	wS	bF	wS	bF	wS	bF	wS
<u>Gogama District, Novabac 32B, 2 applic. of 20 BIU/4.7 L/ha each (8 BIU/.5 gal/acre)</u>								
Carter Twp S.P.A.	33.5	46.2	2.4	4.4	76	0	59	80
Check	41.8	45.4	12.8	3.8			92	84
Invergarry Twp S.P.A.	44.4	54.7	2.4	1.1	82	76	73	92
Check	41.8	45.4	12.8	3.8			92	84
Jack Twp S.P.A.	29.7	54.4	1.1	2.2	93	52	34	47
Check	22.8	45.4	11.5	3.8			96	84
<u>Cochrane District, Thuricide 16B, 2 applic. of 10 BIU/4.7 L/ha each (4 BIU/.5 gal/acre)</u>								
Clute Twp S.P.A. 3202		42.3		3.2		48		91
Check		38.4		5.6				73

Table 17. Population reduction and foliage protection attributable to aerial and ground applications of *B.t.* in Chapleau District, 1979.

	Prespray larvae per 46 cm branch tip		Surviving pupae per 46 cm branch tip		% population reduction due to treatment		% 1979 defoliation	
	bF	wS	bF	wS	bF	wS	bF	wS
<u>Aerial application of Novabac 32B, 2 applic. of 20 BIU/4.7 L/ha each (8 BIU/.5 gal /acre)</u>								
Reeves Twp S.P.A.		34.1		.6		81		68
Check		25.6		2.3				84
Manning Twp - plantation*		3.9		.2		78		3
Check		7.3		1.7				8
Caverley Twp - plantation**		4.7**		.3**		62		1
Check		5.8		1.0				1
<u>Ground application (mistblower) of Dipel, 450 g/37.85 L (1 lb/10 U.S. gal)</u>								
Shoals Prov. Park	54.4	63.8	3.9	4.8	71	0	38	55
Check	58.1	75.1	14.4	1.8			96	91
Ivanhoe Prov. Park	41.0	55.5	1.1	3.4	87	0	20	53
Check	42.1	49.0	8.6	2.8			97	79

* Planted white spruce, 1970, about 1.1 metres in height.

**Planted white spruce, 1968, about .7 metre in height - budworm counts per tree.

Table 18. Population reduction and foliage protection attributable to an aerial application of Orthene 560 g/4.7 L/ha (8 oz/.5 gal/acre) on white spruce in Arnott and Studholme townships, Hearst District, 1979.

	Prespray larvae per 46 cm branch tip	Surviving pupae per 46 cm branch tip	% population reduction due to treatment	% 1979 defoliation
Arnott Twp S.P.A.	32.0	2.5	74	58
Check	29.1	8.7		75
Studholme Twp - Overstory*	17.3	0.1	93	6
Check	21.0	1.8		16

* Residual mature white spruce trees left in a clearcut as seed trees.

	Prespray larvae per tree	Surviving pupae per tree	% population reduction due to treatment	% 1979 defoliation
Studholme Twp - Regen**	2.4	0	100	1
Check	1.8	.1		2

**White spruce planted in clearcut, 1969, about 1 metre in height.

At the Bonner Tree Improvement Centre in Fauquier Township, Kapuskasing District, poor results were obtained in 1978 using Dipel applied by hydraulic sprayer. In 1979 the same area was aerially treated with Orthene followed by an aerial application of NPV (nuclear polyhedrosis virus) eight days later, with assessment based on five white spruce and five black spruce compartments. This was an experiment carried out by Dr. J.C. Cunningham of FPMI to ascertain what additional benefits, if any, can be obtained by introducing a virus once the initial population has been reduced by a chemical. The 1979 operation produced substantially better overall results than in 1978 on both host species (Table 19). The population reduction on white spruce ranged from 59 to 100%, with good protection in all compartments except 23B. Black spruce plots were more variable, with the poorest results occurring in compartment 16E which had no larval reduction and 32% defoliation. Orthene was applied on 12 June at the peak of the fourth instar. The majority of the population reduction occurred as a result of the Orthene spray (85% of the white spruce population and 74% of the black spruce population, Table 20). When NPV was introduced on 20 June, almost all larvae on white spruce were L6 and those on black spruce were L5 or L6 (Table 15). Following the application of NPV the populations on white spruce were further decreased by an average of 47% but on black spruce no additional mortality was evident over all (Table 21). Even though the initial population reduction by Orthene was generally high, additional larval mortality among the remaining populations in some plots indicates a good infection rate by NPV (Table 22). Level of NPV infection in samples collected 6 days after spraying were 37% for larvae on white spruce and 36% for larvae on black spruce. Therefore, it is to be hoped that the virus will carry over in these plots in 1980.

The spruce coneworm, *Dioryctria reniculelloides*, an insect associated with spruce budworm, is reported to be an important occasional defoliator of white spruce and is destructive to cones. Again in 1979 significant coneworm populations were present, the average number of prespray larvae in spray areas being 7.6 per 46 cm branch tip. Many of the spray operations were carried out in seed production areas, so for the second consecutive year the various treatments to control spruce budworm were also assessed for their effects on spruce coneworm populations. In addition to the coneworm, other associated species are found and are hard to distinguish from coneworm in early instars. Since the majority of associated insects are coneworms, all larvae are recorded in prespray samples. Initial populations and present mortality per location resulting from five treatments are presented in Table 23. The highest population was 17.6 larvae per 46 cm branch tip in Jack Township S.P.A., Gogama District, which represented 37% of the total larval population (budworm + coneworm) found on sampled branches. This population was reduced 72% by a double application of Novabac 32B. However, this treatment was less successful on other plots. Population reductions ranged from 0 to 97%, with more than a 50% reduction in 71% of locations checked.

Table 19. Population reduction and foliage protection attributable to an aerial application of Orthene followed by nuclear polyhedrosis virus (NPV) on white spruce and black spruce at the Bonner Tree Improvement Centre, Fauquier Township, Kapuskasing District, 1979. Orthene was applied at 360 g/4.7 L/ha (3 oz/.5 gal /acre); NPV at 750 billion PIB/9.4 L/ha (300 billion PIB/1 gal /acre). Larval development at time of Orthene application (June 12/79) was primarily L4, NPV application (June 20/79) L5-L6.

Compartment	Prespray larvae per 46 cm branch tip	Surviving pupae per 46 cm branch tip	% population reduction due to treatment	% successful pupal emergence*	% 1979 defoliation
<u>White Spruce</u>					
16A	33.3	.8	93	80	10
Check	22.0	7.6		97	36
21D	12.9	.2	96	50	5
Check	16.5	6.8		92	35
22C	21.2	0	100	0	6
Check	22.0	7.6		97	36
23B	26.3	3.8	59	86	23
Check	22.0	7.6		97	36
26D	13.8	.4	95	100	1
Check	16.5	6.8		94	35
Overall	22.6	1.0	88	81	9
Check	19.8	7.3		95	36
<u>Black Spruce</u>					
6B	9.6	4.4	0	79	7
Check	8.8	3.2		59	47
16E	11.2	4.2	0	70	32
Check	8.8	3.2		59	47
21D	9.0	.2	94	100	3
Check	8.8	3.2		59	47
22B	11.0	0	100	0	8
Check	8.8	3.2		59	47
26B	4.9	.2	90	50	4
Check	3.3	1.4		88	22
Overall	9.1	1.8	45	75	11
Check	7.7	2.3		61	42

* % Successful pupal emergence = $\frac{\text{emerged budworm}}{\text{budworm alive on sample date}} \times 100$

Table 20. Population reduction attributable to an aerial application of Orthene 560 g/4.7 L/ha (8 oz/.5 gal/acre) on white spruce and black spruce at the Bonner Tree Improvement Centre, Kapuskasing District, 1979. Treatment was on June 12, 1979 and larval development was primarily L4. Postspray samples were collected on June 19, 1979 (7 days after spraying).

Compartment	Prespray larvae per 46 cm branch tip	Surviving larvae per 46 cm branch tip	% Population reduction due to treatment
<u>White Spruce</u>			
16A	33.3	1.9	96
Check	22.0	29.3	
21D	12.9	1.9	84
Check	16.5	15.0	
22C	21.2	.2	99
Check	22.0	29.3	
23B	26.8	16.0	55
Check	22.0	29.3	
26D	18.8	.6	96
Check	16.5	15.0	
Overall	22.6	4.1	85
Check	19.8	23.6	
<u>Black Spruce</u>			
6B	9.6	4.7	68
Check	8.8	13.3	
16E	11.2	7.0	59
Check	8.8	13.3	
21D	9.0	1.5	89
Check	8.8	13.3	
22B	11.0	1.9	89
Check	8.8	13.3	
26B	4.9	1.9	55
Check	3.3	2.8	
Overall	9.1	3.4	74
Check	7.7	11.2	

Table 21. Population reduction attributable to an aerial application of NPV, 750 billion PlB/9.4 L/ha (300 billion PlB/1 gal/acre) on white spruce and black spruce at the Bonner Tree Improvement Centre, Kapuskasing District, 1979. Treatment was on June 20 and larval development was L5-L6. Post-spray samples were collected July 10, 1979 (20 days after spraying).

Compartment	Prespray larvae per 46 cm branch tip	Surviving pupae per 46 cm branch tip	% population reduction due to treatment
<u>White Spruce</u>			
16A	1.9	.8	11
Check	15.0	6.8	
21D	1.9	.2	78
Check	15.0	6.8	
22C	.2	0	100
Check	15.0	6.8	
23B	16.0	3.8	48
Check	15.0	6.8	
26D	.6	.4	0
Check	15.0	6.8	
Overall	4.1	1.0	47
Check	15.0	6.8	
<u>Black Spruce</u>			
6B	4.7	4.4	0
Check	2.8	1.4	
16E	7.0	4.2	0
Check	11.5	4.0	
21D	1.5	.2	75
Check	2.8	1.4	
22B	1.9	0	100
Check	2.8	1.4	
26B	1.9	.2	80
Check	2.8	1.4	
Overall	3.4	1.8	0
Check	4.5	1.9	

Table 22. Summary of population reductions attributable to each treatment and overall population reduction and foliage protection at the Bonner Tree Improvement Centre, Kapuskasing District, Ontario, 1979.

Compartment	% Population reduction			% foliage protection*
	Orthene	NPV	Both treatments	
<u>White Spruce</u>				
16A	96	11	93	72
21D	84	78	96	86
22C	99	100	100	83
23B	55	48	59	36
26D	96	0	95	97
Overall	85	47	88	75
<u>Black Spruce</u>				
6B	68	0	0	85
16E	59	0	0	32
21D	89	75	94	94
22B	89	100	100	83
26B	55	80	90	82
Overall	74	0	45	74

$$* \% \text{ foliage protection} = \frac{\% \text{ defoliation check} - \% \text{ defoliation treatment}}{\% \text{ defoliation check}} \times 100$$

Table 23. Population reduction of associated species (mainly spruce coneworm, *Dioryctria reniculelloides*) on white spruce due to various treatments in six districts in 1979.

District	Location	Prespray larvae per 46 cm branch tip	Surviving pupae per 46 cm branch tip	% population reduction due to treatment
<u>Orthene, 1 application, 560 g/4.7 L/ha (4 oz/20 fl. oz/acre)</u>				
Geraldton	Claver Twp	6.81	1.41	57
	Check	4.80	2.33	
Hearst	Arnot S.P.A.	12.86	4.08	68
	Check	4.57	4.53	
	Studholme	7.50	.04	97
	Check	5.23	.38	
<u>Orthene, 1st application, 280 g/1.5 L/ha (4 oz/20 fl. oz/acre)</u> <u>Novabac 32B, 2nd application, 20 BIU/4.7 L/ha (8 BIU/.5 gal/acre)</u>				
Geraldton	Claver Twp	11.24	.76	85
	Check	11.50	5.08	
<u>Matacil, 1 application, 87.5 g/1.5 L/ha (1.25 oz/20 fl. oz/acre) - Geraldton District</u> <u>63 g/L/ha (.9 oz/14 fl. oz/acre) - Kirkland Lake District</u>				
Geraldton	Claver Twp	6.59	2.38	26
	Check	4.80	2.33	
	Claver Twp	11.65	2.52	51
	Check	11.50	5.08	
Kirkland Lake	Elliott Twp	9.10	3.07	0
	Check	8.49	1.60	
	Elliott Twp	7.99	.73	51
	Check	8.49	1.60	
<u>Thuricide 168, 1 or 2 applications, 10 BIU/4.7 L/ha (4 BIU/.5 gal/acre)</u>				
Geraldton	Claver Twp (2 applic.)	4.62	2.51	48
	Check	4.80	4.85	
Cochrane	Clute Twp S.P.A. (2 applic.)	7.49	1.64	52
	Check	5.44	2.47	
Kirkland Lake	Burt Twp Nursery (2 applic.)	5.43	.88	72
	Check	4.08	2.40	
	Burt Twp S.P.A. (2 applic.)	11.06	1.95	70
	Check	4.08	2.40	
	Elliott Twp, Dickson L. (1 applic)	3.80	.20	96
	Check	4.00	5.93	
<u>Novabac 32B, 2 applications, 20 BIU/4.7 L/ha (8 BIU/.5 gal/acre)</u>				
Chapleau	Caverley Twp (Seedlings)	.52	.04	85
	Check	.14	.07	
	Reeves Twp S.P.A.	12.59	4.00	64
	Check	9.07	8.00	
Gogama	Carter Twp	4.56	2.70	0
	Check	4.58	1.60	
	Invergarry Twp	11.81	2.75	39
	Check	6.30	2.40	
	Jack Twp S.P.A.	17.61	3.95	72
	Check	6.52	5.30	

The overall comparison of treatments indicates that a greater mortality rate (85%) was achieved with an application of Orthene followed by an application of Novabac 32B (Table 24). If we compare treatment effectiveness with that of 1978, we note the following similarities: Matacil is not very effective alone; Orthene is moderately effective; *Bacillus thuringiensis* formulations appear most promising. However, not enough data have been gathered to be conclusive.

Proposed Aerial Spraying Operations for 1980: The proposed area of 10 680 ha (26,389 acres) to

be protected from spruce budworm damage by aerial spray operations is almost half that of 1979. The majority of the spray operations will be carried out in the Northern Region with a small project in Algonquin Region. Insecticides used will include Matacil, Orthene, Cygon, and *B.t.*

The 27 high-value locations in the Northern Region include provincial parks, seed production areas, seed tree areas, plantations and nurseries and involve Chapleau, Cochrane, Gogama, Hearst, Kapuskasing and Kirkland Lake districts. Operational spraying will involve 8 202 ha (20,268 acres) and approximately 1 951 ha (4,821 acres) will be experimentally sprayed.

In the Algonquin Region a spray operation, the first since 1976, will be undertaken in Spence Township, Parry Sound District to protect host trees in a deer yard.

Table 24. Overall population reduction of spruce budworm and associated species (mainly spruce coneworm, *Dioryctria reniculelloides*) and foliage protection on white spruce due to various treatments in six districts in Ontario, in 1979.

Treatment	Plots	Prespray larvae per 46 cm branch tip		Surviving pupae per 46 cm branch tip		% population reduction due to treatment		%** foliage protection
		SBW*	<i>Dioryctria</i>	SBW	<i>Dioryctria</i>	SBW	<i>Dioryctria</i>	
Orthene, 1 application	sprays	26.93	9.06	1.73	1.84	65	62	41
	checks	29.87	4.87	5.57	2.58			
Orthene, 1st application Novabac 32B, 2nd application	sprays	46.90	11.24	2.70	.76	65	85	19
	checks	39.50	11.50	6.20	5.08			
Matacil, 1 application	sprays	35.75	8.83	1.75	2.12	62	24	22
	checks	40.60	8.32	5.22	2.65			
Thuricide 16B, 2 applications	sprays	30.35	6.48	2.98	1.44	41	72	31
	checks	25.25	4.48	4.22	3.61			
Novabac 32B, 2 applications	sprays	33.0	9.42	1.47	2.69	53	56	17
	checks	29.15	5.32	2.73	3.47			

* SBW = Spruce budworm, *Choristoneura fumiferana*

** % foliage protection = $\frac{\% \text{ defoliation check} - \% \text{ defoliation treatment}}{\% \text{ defoliation check}} \times 100$