THE 1981 SPRUCE BUDWORM SITUATION IN ONTARIO

PART A: DAMAGE AND FORECASTS

PART B: AERIAL SPRAYING OPERATIONS

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ABSTRACT

The spruce budworm situation eased somewhat in Ontario in 1981. The area of infested stands and high population levels declined considerably in southern Ontario; decreases were smaller in northeastern and northwestern Ontario. Part A of this report describes changes in the infestations in 1981 and forecasts, in cartographic and tabular form, the damage liable to occur in 1982. Part B describes aerial spraying operations covering 10,233 ha which were conducted against the spruce budworm in Ontario in 1981.

RÉSUMÉ

En 1981, l'infestation de la tordeuse des bourgeons de l'épinette s'est assez apaisée dans l'Ontario. La superficie de peuplements infestés et de populations élevées a décliné considérablement dans le sud de l'Ontario; les déclins ont été plus modestes dans le nord-est et le nord-ouest de l'Ontario. La partie A de ce rapport décrit les fluctuations des infestations survenues en 1981 et prévoit, en se basant sur des cartes et des tableaux, les dégâts probables en 1982. La partie B décrit les arrosages aériens effectués contre la tordeuse des bourgeons de l'épinette en Ontario en 1981 sur une superficie de 10,233 ha.

ACKNOWLEDGMENTS

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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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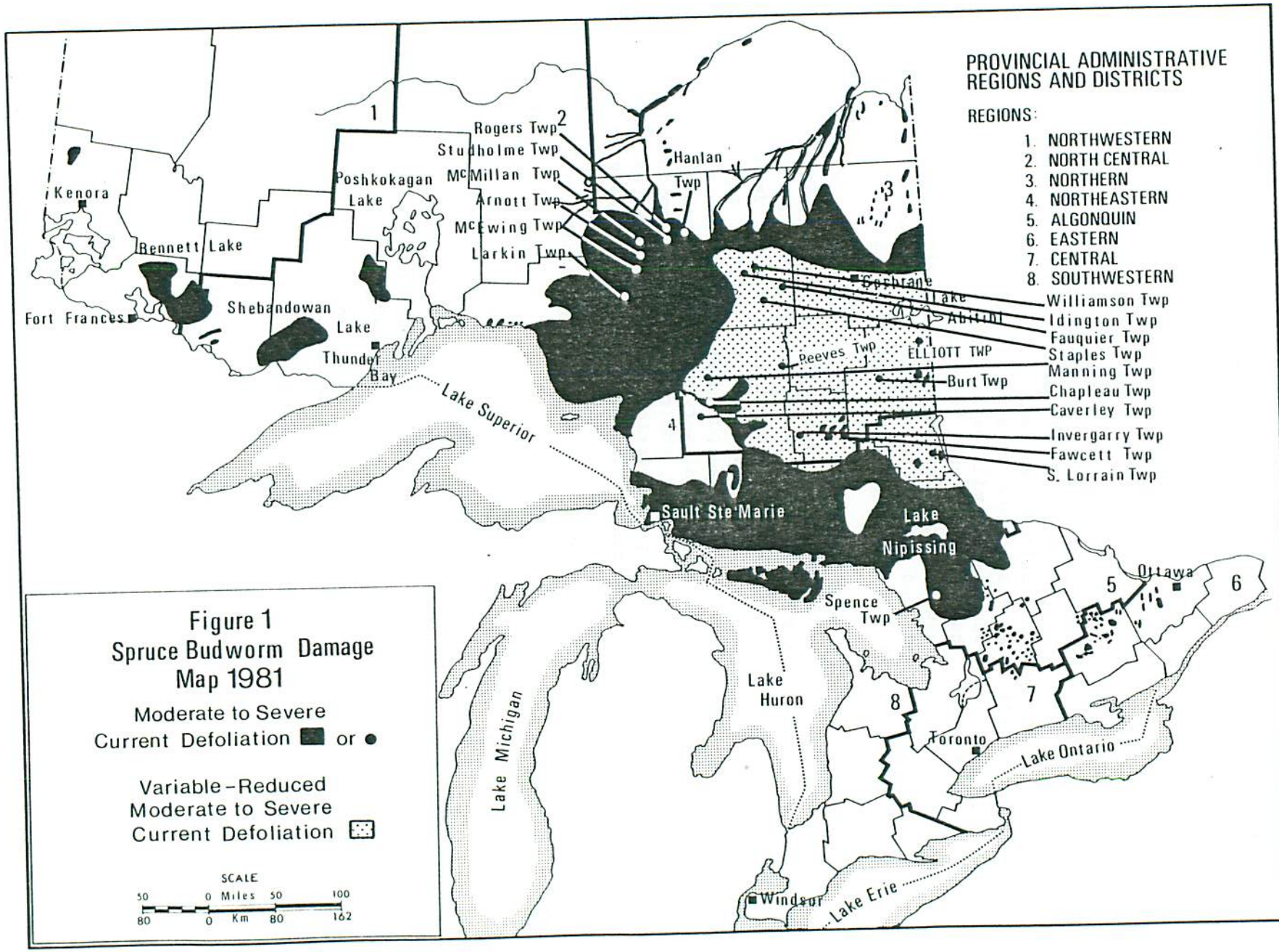
INTRODUCTION

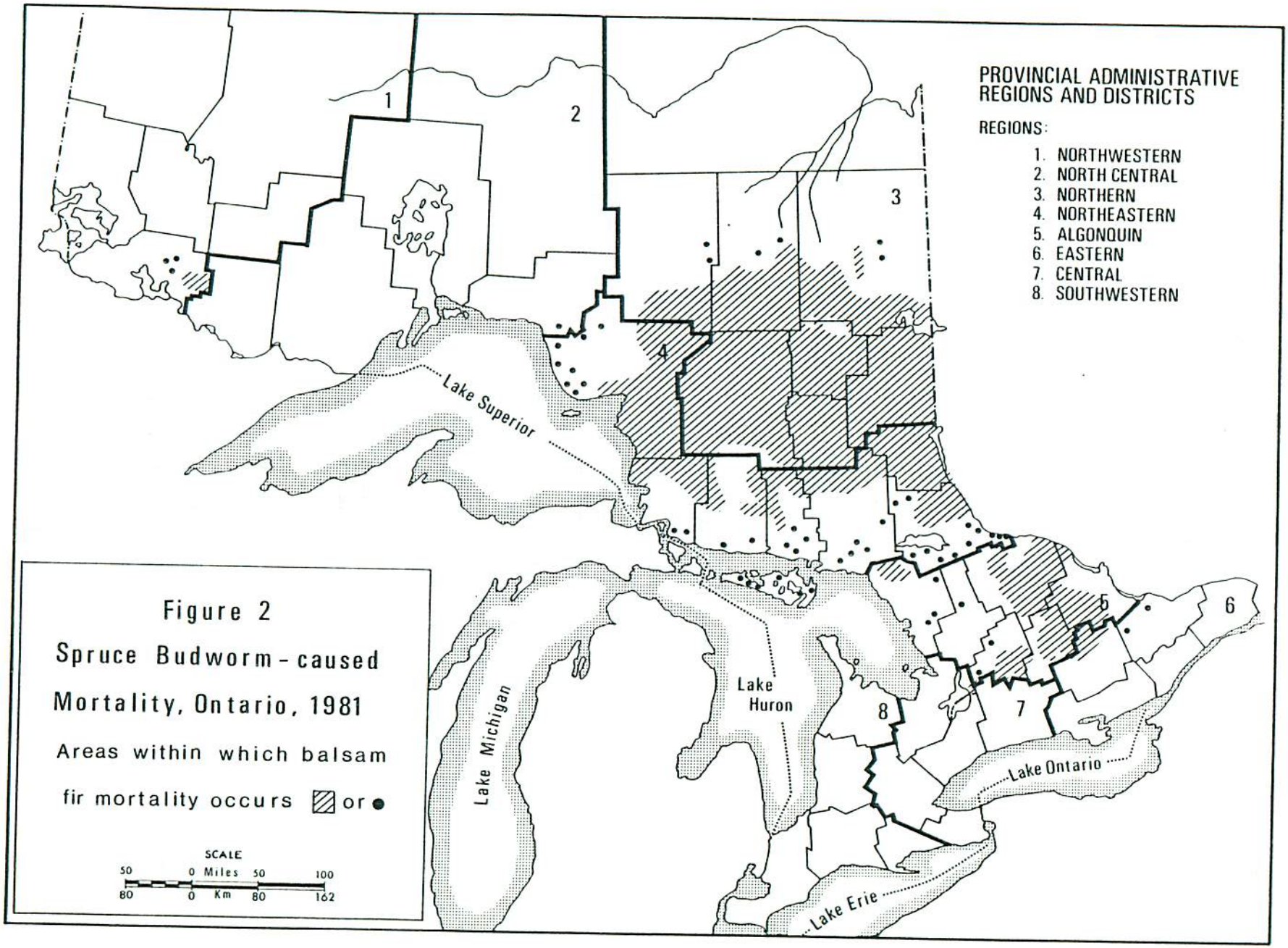
In 1967 the most recent outbreak of spruce budworm (*Choristoneura fumiferana* [Clem.]) began in Ontario. This particular insect has been and will probably continue to be the most destructive pest in Ontario's forests. In 1981 a total of some 18.217 million ha of forest suffered moderate-to-severe defoliation as a result of budworm activity (Fig. 1, Table 1). Varying degrees of budworm-associated mortality have been observed throughout some 11.210 million ha (Fig. 2, Table 2). Indeed, it has been estimated that in 1981 alone, budworm-associated tree mortality and reduced growth resulted in a loss of approximately 16.218 million m^3 of fibre. The accumulated total loss to date in Ontario during the current outbreak has been estimated to exceed 70 million m^3.

The primary hosts of budworm in Ontario are balsam fir (*Abies balsamea* [L.] Mill.), white spruce (*Picea glauca* [Moench] Voss) and black spruce (*P. 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 or signs of previous damage in difficult-to-evaluate instances.

Table 1. Comparison of the area of forest in Ontario defoliated by spruce budworm in 1980 and 1981.

Outbreak region in Ontario	Gross area of moderate-to-severe defoliation (000,000 ha)		
	1980	1980	Change
Northwestern	.724	.658	- .066
Northeastern	17.119	16.958	- .161
Southern	1.007	.601	- .406
Total	18.850	18.217	- .633


PROVINCIAL ADMINISTRATIVE REGIONS AND DISTRICTS
REGIONS:
1. NORTHWESTERN
2. NORTH CENTRAL
3. NORTHERN
4. NORTHEASTERN
5. ALGONQUIN
6. EASTERN
7. CENTRAL
8. SOUTHWESTERN
Rogers Twp
Studholme Twp
McMillan Twp
Arnott Twp
McEwing Twp
Larkin Twp
Hanlan Twp
Cochrane
Williamson Twp
Idington Twp
Fauquier Twp
Staples Twp
Manning Twp
Chapleau Twp
Caverley Twp
Invergarry Twp
Fawcett Twp
S. Lorrain Twp
Abitibi
Reeves Twp
ELLIOTT TWP
Burt Twp
Kenora
Poshkokagan Lake
Bennett Lake
Shebandowan Lake
Fort Frances
Thunder Bay
Lake Superior
Sault Ste Marie
Lake Nipissing
Spence Twp
Ottawa
Lake Michigan
Lake Huron
Toronto
Lake Ontario
Windsor
Lake Erie
Figure 1
Spruce Budworm Damage
Map 1981
Moderate to Severe
Current Defoliation or
Variable-Reduced
Moderate to Severe
Current Defoliation
SCALE
50 0 Miles 50 100
80 0 Km 80 162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Lake Superior
Lake Michigan
Lake Huron
Lake Ontario
Lake Erie
Figure 2
Spruce Budworm-caused Mortality, Ontario, 1981
Areas within which balsam fir mortality occurs or
SCALE
50 0 Miles 50 100
80 0 Km 80 162

Table 2. Comparison of the area of budworm-associated tree mortality in Ontario in 1980 and 1981.

Region in Ontario	Gross area of budworm-associated tree mortality (000,000 ha)		
	1980	1981	Change
Northwestern	.024	.088	+ .064
Northeastern	6.839	9.572	+2.733
Southern	1.493	1.550	+ .057
Total	8.356	11.210	+2.854

Three separate infestations became evident in 1967 and each has followed a different pattern over the years. The outbreak in southern Ontario has gone through periods of increase and decline and is at present on the decline. The infestation in northeastern Ontario seems to have reached a peak and may be on the decline. 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 information about Ontario's most important forest insect pest on a province-wide basis. This report, the twelfth in the series, describes the 1981 spruce budworm situation in Ontario and provides damage forecasts for 1982. As well, the best available information, data and maps describing budworm-caused tree mortality as of 1981 are included.

OVERALL SITUATION, 1981

In 1981, milder than normal weather occurred in February and March throughout the province. This resulted in somewhat earlier than usual budworm emergence in some locations; however, unseasonably cool weather in April and early May delayed emergence and slowed larval development considerably in other locations. For example, in Parry Sound District budworm emergence occurred several days earlier than usual but by the end of May larval development had slowed and was very close to normal. In Elliott Township, Kirkland Lake District, emergence was later

than usual but warm weather in June resulted in rapid development of the larvae. In Cochrane and Kapuskasing districts budworm development was normal while in Hearst District development was slightly ahead of normal.

Forecasts of population trends and damage expected from larval feeding in 1982 are based on the results of an egg-mass survey conducted in August and September, 1981. Some 653 locations throughout the province were sampled this year: 130 in southern Ontario, 334 in northeastern Ontario, 74 in north central Ontario and 115 in northwestern Ontario. As in previous years, FIDS staff placed considerable emphasis on sampling "high value" stands (seed production areas, plantations, nurseries, provincial parks, etc.) as suggested or requested by the Ontario Ministry of Natural Resources (OMNR). For the second consecutive year egg-mass densities decreased on an overall basis (22%); however, there were major regional differences, with substantial increases in some parts of Ontario and large declines in others (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 gross area of forest infested by the spruce budworm in Ontario declined in 1981 (Fig. 1). A total of some 18.217 million ha was infested this year in comparison with 18.850 million ha in 1980. Aerial and ground surveys conducted by the Canadian Forestry Service (CFS) showed that infestations have declined in the three main geographical areas of the province where budworm outbreaks are present (Table 1). In general, larval populations were much lower in 1981 than in previous years. This was not unexpected since the 1980 egg-mass survey had forecast reduced populations in the order of 40-50%. However, in many instances in northeastern and southern Ontario, populations were much lower than expected and the resultant defoliation was quite variable and difficult to map. Aerial surveys, with flying time provided by OMNR, are carried out from early to mid-July when the color of budworm-damaged foliage is at its peak. As expected, the area of budworm-associated tree mortality continued to increase in 1981. The extent of tree mortality in 1981 is compared with that in 1980 in Table 2. A total of 11.210 million ha of tree mortality was mapped this year (Fig. 2).

Southern Ontario

Situation in 1981: In southern Ontario, where the size of the outbreak has fluctuated during recent years, a large decrease (406,000 ha) in budworm-infested forest was mapped in 1981 (Fig. 3). The most spectacular reduction occurred in the large infestation in the Bancroft, Pembroke and northern Tweed districts. This infestation was reduced by over 190,000 ha or 98% and only a few scattered pockets of moderate-to-severe defoliation persist in the

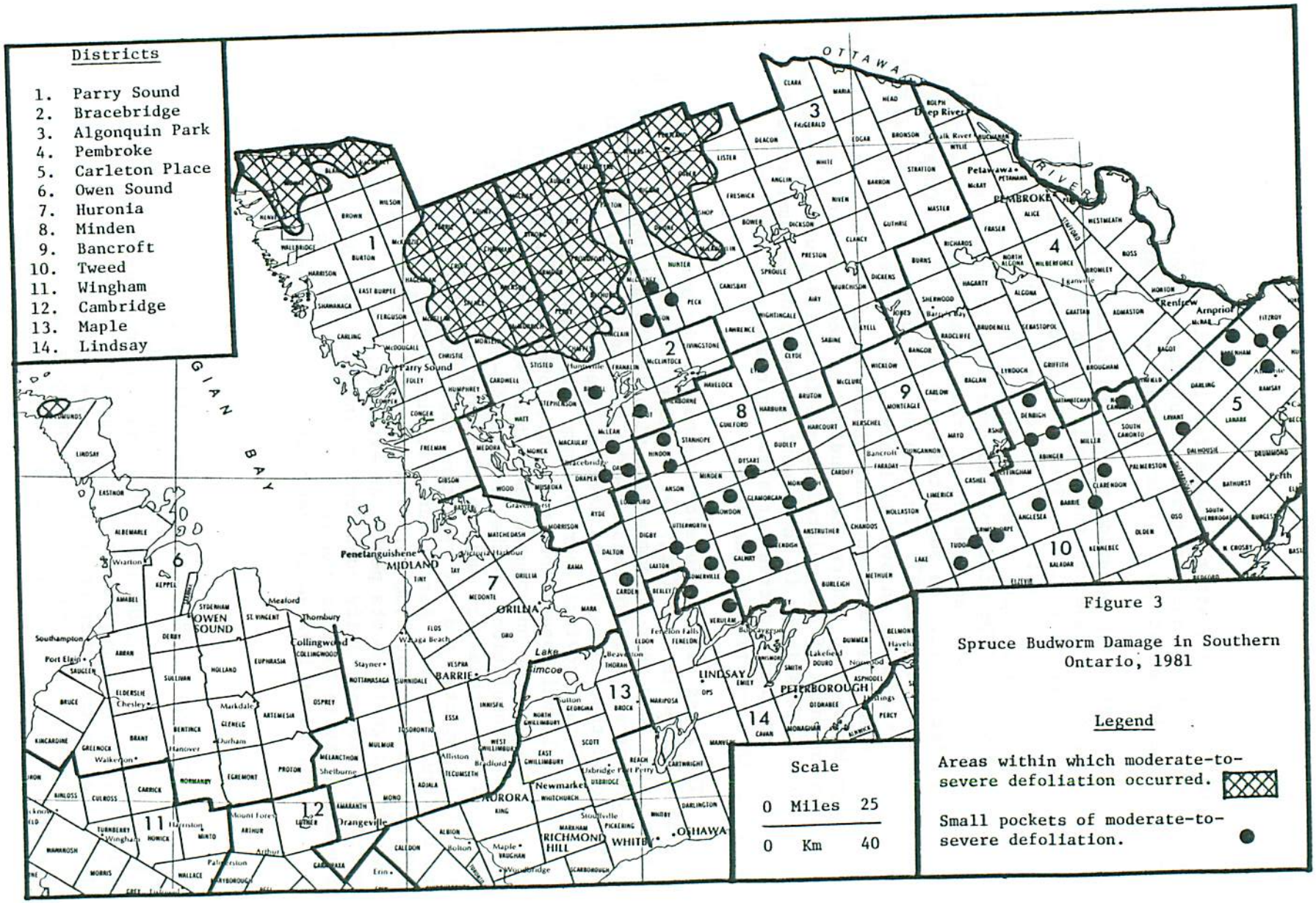

Figure 3

Spruce Budworm Damage in Southern Ontario, 1981

northern Tweed and southeastern Bancroft districts. Infestations in the northern Algonquin Park and southern Lindsay districts were reduced by 36 and 92%, respectively, or by a total of 85,000 ha. A substantial decline was also reported in the infestation which occurred in the Bruce Peninsula, Owen Sound District. Small increases in area infested were mapped in the Parry Sound and Bracebridge districts.

In the Eastern Region there was a marked decrease in the area of infestation. Larval populations were low throughout the region, with the exception of scattered patches of mature white spruce on which moderate populations were detected. A small pocket of severe defoliation was observed on white spruce at a roadside picnic area, west of Casselman in the LaRose Forest, Cornwall District. The largest pockets of damage were in the western portion of Tweed District in Tudor and Grimsthorpe townships and in the northwest corner of Barrie Township. To the north in Denbigh and Abinger townships, which in previous years suffered severe defoliation, only a few scattered pockets of infestation could be detected.

In the Algonquin Region the area of moderate-to-severe defoliation decreased by about 62% over all in 1981. As mentioned earlier, the most dramatic decrease was in Pembroke and Bancroft districts where the infestation suffered an almost total collapse. In Minden District the area of moderate-to-severe defoliation decreased by some 120,000 ha (90%), while in Algonquin Park District the area decreased by about 73,000 ha (37%). Budworm populations remained high in Bracebridge and Parry Sound districts, and this resulted in an increase of some 36,400 ha in the area of moderate-to-severe defoliation. The largest increases in the region were in northern Parry Sound District in Henvey, Mowat, Blair and Wallbridge townships. In Bracebridge District new pockets of defoliation were detected in Draper, McLean and Finlayson townships.

In the Central Region areas of moderate-to-severe defoliation mapped in 1980 all but disappeared in 1981. Although spruce budworm was present in most spruce and balsam fir stands throughout the region, populations declined to the point at which very little damage resulted. The largest decrease (92%) in the region was in northern Lindsay District in Verulam and Bexley townships, where only a few pockets of moderate-to-severe defoliation remain.

In the Southwestern Region, budworm populations declined in 1981, especially in Owen Sound District where budworm has been a perennial problem on the Bruce Peninsula. Here the area of moderate-to-severe defoliation decreased by about 31,190 ha and is currently confined to the Cyprus Lake-Emmett Lake area in St. Edmunds Township. To the south in Lindsay and Eastnor townships, white spruce was often moderately affected while balsam fir generally suffered only light defoliation.

Infestation Forecasts for 1982: Spruce budworm egg-mass surveys were carried out in southern Ontario during late July and early August, 1981. Foliage samples were collected from a total of 130 locations; egg masses were counted, current defoliation and accumulated damage were estimated and damage forecasts were prepared for 1982 (see Table 3 and Fig. 4 for area forecasts).

On the basis of a comparison of counts from 88 locations sampled in 1980 and 1981, egg-mass numbers decreased by about 52% in southern Ontario. The largest decreases were in Bancroft (91%), Bracebridge (75%) and Algonquin Park (73%) districts. Substantial decreases also occurred in Simcoe, Lindsay, Parry Sound and Pembroke districts. There were increases in Aylmer, Huronia, Maple, Owen Sound and Wingham districts; however, populations are expected to remain quite low in 1982, and this will result in generally light-to-moderate defoliation.

The average egg-mass count on balsam fir in southern Ontario this year, on the basis of 24 locations sampled in 1980 and 1981, was 39 per 9.29 sq. m of foliage. This is a decrease of about 66% from the previous year. The average count on white spruce was 93, a decrease of 48%. The highest egg-mass count recorded in southern Ontario was 640 on white spruce in Spence Township, Parry Sound District.

This is the second consecutive year that a large decline in egg-mass numbers has occurred in southern Ontario. As a result, the total area of moderate-to-severe defoliation should continue to decline in 1982. Forecasts call for generally trace or light defoliation interspersed with numerous scattered small pockets of moderate-to-severe defoliation.

Tree Mortality: In southern Ontario budworm-associated tree mortality increased by some 57,134 ha in 1981 and is now found within a total area of about 1.550 million ha (Fig. 5). All of this new tree mortality occurred in Tweed District in the Eastern Region and Parry Sound District in the Algonquin Region. On the basis of observations from 29 ground checks in eight districts examined in 1980 and 1981, average balsam fir mortality increased from 64% to 66%. Average mortality rates ranged from 25% in Tweed District to 92% in Bracebridge District. In white spruce stands average tree mortality increased from 28% in 1980 to 33% in 1981 (16 locations), and ranged from 16% in Bracebridge District to 76% in Bancroft District. While mortality is quite variable from stand to stand, balsam fir mortality is approaching the 80%-90% level in many areas and will continue to increase even though budworm populations have declined. As in previous years, white spruce mortality rates are not generally as high as those of balsam fir, but in several locations in Bancroft and Minden districts it is approaching 80%. A summary of all tree mortality data, based on ground checks for the last eight years for southern Ontario, is presented in Table 4.

Table 3. Southern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1981, and infestation forecasts for 1982.

Location	Host	Estimated % defoliation 1981	No. of egg masses per 9.29 sq. m of foliage	Infestation forecasts for 1982[a]	Accumulated damage[b]
Algonquin Park District (15 locations)					
Airy Twp - East Gate	wS	5	21	L-M	1
Canisbay Twp					
- Lake of Two Rivers	wS	5	26	L-M	0
- Mew Lake Camp Ground	bF	5	0	0	1
Clara Twp	bF	45	11	L	2
Clyde Twp	bF	5	0	0	8
Deacon Twp	bF	8	69	M	5
Freswick Twp - Hogan Lake	bF	5	7	L	5
Guthrie Twp					
- North of Basin Depot	wS	5	13	L	1
Head Twp - Grant Creek	wS	5	0	0	0
Hunter Twp	bF	5	20	L-M	0
Nightingale Twp - Rock Lake	wS	5	0	0	0
Preston Twp - Tattler Lake	bF	5	12	L	6
Stratton Twp - Achray (Plot C)	wS	5	64	M	1
White Twp					
- N. of Petawawa River	bF	5	24	L-M	5
Wilkes Twp	bF	62	214	M-S	1
Aylmer District (3 locations)					
McGillivray Twp					
- Conservation Area	wS	1	22	L-M	0
West Oxford Twp					
- Con III - P.U.C.	bF	3	43	L-M	2
West Oxford Twp - P.U.C.	wS	12	65	M	2
Bancroft District (6 locations)					
Cardiff Twp	wS	7	18	L-M	2
Chandos Twp	bF	5	0	0	0
Harcourt Twp	bF	5	0	0	0
Limerick Twp	bF	5	0	0	0
Mayo Twp	wS	5	151	M-S	1
Wicklow Twp	wS	5	31	L-M	0

(cont'd)

Table 3. Southern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1981, and infestation forecasts for 1982 (cont'd).

Location	Host	Estimated % defoliation 1981	No. of egg masses per 9.29 sq. m of foliage	Infestation forecasts for 1982[a]	Accumulated damage[b]
Bracebridge District (6 locations)					
*Armour Twp - Pickerel Lake	wS	80	207	M-S	2
Brunel Twp	bF	0	9	L	0
Bethune Twp	bF	63	32	L-M	2
*Oakley Twp - Clear Lake	bF	50	48	L-M	1
Ridout Twp	bF	0	4	L-M	0
*Sinclair Twp - Bella Lake	bF	69	45	L-M	0
Brockville District (1 location)					
*Oxford on Rideau Twp - OMNR Tree Nursery, Kemptville	wS	0	40	L-M	0
Carleton Place District (6 locations)					
Fitzroy Twp	wS	10	157	M-S	1
Huntley Twp	wS	0	48	L-M	0
Lavant Twp - Robertson Lake	wS	0	0	0	0
Marlborough Twp	wS	0	17	L-M	0
Pakenham Twp	wS	0	62	M	0
Ramsay Twp	wS	2	74	M-S	1
Cornwall District (3 locations)					
*Cambridge Twp - Larose Forest	wS	1	35	L-M	1
*Cambridge Twp - Larose Forest	wS	28	45	L-M	1
*Clarence Twp - Larose Forest	wS	6	65	M	1
Huronia District (6 locations)					
*Tosorontio Twp - Glencairn Seed Orchard	wS	0	0	0	0
- Glencairn Seed Orchard	bS	0	37	L-M	0

(cont'd)

Table 3. Southern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1981, and infestation forecasts for 1982 (cont'd).

Location	Host	Estimated % defoliation 1981	No. of egg masses per 9.29 sq. m of foliage	Infestation forecasts for 1982[a]	Accumulated damage[b]
Huronia District (cont'd) (6 locations)					
*Vespra Twp					
- F-tract Seed Orchard	wS	0	49	M-S	0
- OMNR Tree Nursery Windbreak, Midhurst	wS	7	64	M-S	2
- OMNR Tree Nursery Windbreak, Midhurst	nS	2	61	M-S	2
- OMNR Tree Nursery Windbreaks, Midhurst	blS	2	43	L-M	2
Lindsay District (6 locations)					
*Bexley Twp					
- Balsam Lake Prov. Pk	wS	28	11	L	2
- Balsam Lake Prov. Pk, Plantation	wS	7	76	M-S	2
Cartwright Twp	wS	5	51	L-M	1
*Clarke Twp					
- OMNR Orono Seed Orchard	wS	5	74	M	0
- Orono hedgerow	wS	5	42	L-M	1
Verulam Twp	bF	33	0	0	3
Maple District (1 location)					
Uxbridge Twp	wS	33	245	S	3
Minden District (5 locations)					
Carden Twp	wS	67	113	M-S	4
Galway Twp	wS	35	50	L-M	0
Hindon Twp	bF	22	77	M-S	3
Minden Twp	bF	17	62	M	2
Somerville Twp	bF	20	78	M-S	3

(cont'd)

Table 3. Southern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1981, and infestation forecasts for 1982 (cont'd).

Location	Host	Estimated % defoliation 1981	No. of egg masses per 9.29 sq. m of foliage	Infestation forecasts for 1982[a]	Accumulated damage[b]
Owen Sound District (5 locations)					
Amabel Twp - Sauble Falls	wS	13	65	M-S	2
*Artemesia Twp	wS	0	29	L-M	0
Glenelg Twp	wS	9	44	L-M	3
Lindsay Twp	wS	6	81	M-S	1
St. Edmunds Twp - Crane River	wS	25	58	M	5
Parry Sound District (39 locations)					
Burton Twp	bF	0	0	0	2
Christie Twp	bF	93	11	L	4
Ferguson Twp	bF	5	0	0	2
McConkey Twp	wS	27	150	M-S	2
McKenzie Twp	bF	5	7	L	2
McMurrich Twp	bF	83	28	L-M	1
*Mowat Twp - Grundy Prov. Pk - Clear Lake	wS	14	47	L-M	2
- Gate	wS	35	100	M-S	1
- Hwy 69	wS	65	98	M-S	3
- Nature Trail	wS	48	125	M-S	4
- Swan Lake	wS	22	23	L-M	1
*Spence Twp - Plot 1[c]	bF	1	8	L	2
	wS	4	36	L-M	2
- Plot 3[c]	bF	1	0	0	3
	wS	6	118	M-S	3
- Plot 4[c]	bF	2	0	0	2
	wS	2	131	M-S	2
- Plot 5[c]	bF	1	27	L	2
	wS	4	44	M	2
- Plot 6[c]	bF	1	0	0	2
	wS	6	19	L-M	2
- Plot 7[c]	bF	1	10	L	2
	wS	5	62	M	2
- Plot 8[d]	bF	1	14	L	3
	wS	16	55	M	3

(cont'd)

Table 3. Southern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1981, and infestation forecasts for 1982 (cont'd).

Location	Host	Estimated % defoliation 1981	No. of egg masses per 9.29 sq. m of foliage	Infestation forecasts for 1982[a]	Accumulated damage[b]
Parry Sound District (cont'd) (39 locations)					
*Spence Twp (cont'd)					
- Plot 10[d]	bF	1	12	L	3
	wS	29	69	M	3
- Plot 11[d]	bF	4	53	L-M	3
	wS	20	155	M-S	3
- Plot 12[d]	bF	1	5	L	2
	wS	2	80	M-S	2
- Plot 13 Check	bF	57	77	M	4
	wS	37	640	S	4
- Plot 14 Check	bF	63	72	M	4
	wS	62	583	S	4
- Plot 15 Check	bF	0	0	0	3
	wS	4	42	L-M	3
- Plot 16 Check	bF	16	24	L-M	3
	wS	42	265	S	3
Pembroke District (18 locations)					
Admaston Twp	wS	5	126	M-S	0
Alice Twp	bF	26	44	L-M	0
Bromley Twp	wS	9	149	M-S	1
Brougham Twp	wS	5	0	0	0
Brudenell Twp	bF	5	25	L-M	1
Buchanan Twp (PNFI)					
- Orange Rd	wS	5	0	0	5
Grattan Twp	wS	5	42	L-M	1
Griffith Twp	wS	12	196	M-S	5
McNab Twp	bF	5	9	L	0
Richards Twp - Round Lake	bF	5	0	0	0
Rolph Twp	bF	5	12	L	0
Ross Twp - Dist. Boundary	wS	5	97	M-S	1
Sherwood Twp					
- west of Barry's Bay	wS	5	0	0	0
Stafford Twp - NPV, Rankin	wS	19	379	S	5
- NPV, Rankin	bF	42	126	M-S	5
- Micksburg	wS	5	75	M-S	5

(cont'd)

Table 3. Southern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1981, and infestation forecasts for 1982 (cont'd).

Location	Host	Estimated % defoliation 1981	No. of egg masses per 9.29 sq. m of foliage	Infestation forecasts for 1982[a]	Accumulated damage[b]
Pembroke District (cont'd) (18 locations)					
Westmeath Twp - east of Westmeath	bF	5	0	0	0
Wilberforce Twp	wS	8	35	L-M	1
Simcoe District (2 locations)					
Charlotteville Twp - Turkey Point	wS	17	27	L-M	1
South Walsingham Twp - OMNR Tree Nursery	wS	15	50	L-M	1
Tweed District (4 locations)					
Clarendon Twp	wS	0	0	0	0
Denbigh Twp - Slate Falls Rd	bF	0	16	L-M	1
*Effingham Twp	rS	0	0	0	0
Tudor Twp	wS	0	13	L	0
Wingham District (4 locations)					
Colborne Twp	wS	1	8	L	1
Downie Twp	wS	23	35	L-M	1
Ellice Twp - Ellice Swamp	wS	2	0	0	0
Minto Twp	wS	19	106	M-S	2

(cont'd)

Table 3. Southern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1981, and infestation forecasts for 1982 (concl'd).

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[a] S = severe, M = moderate, L = light, 0 = nil

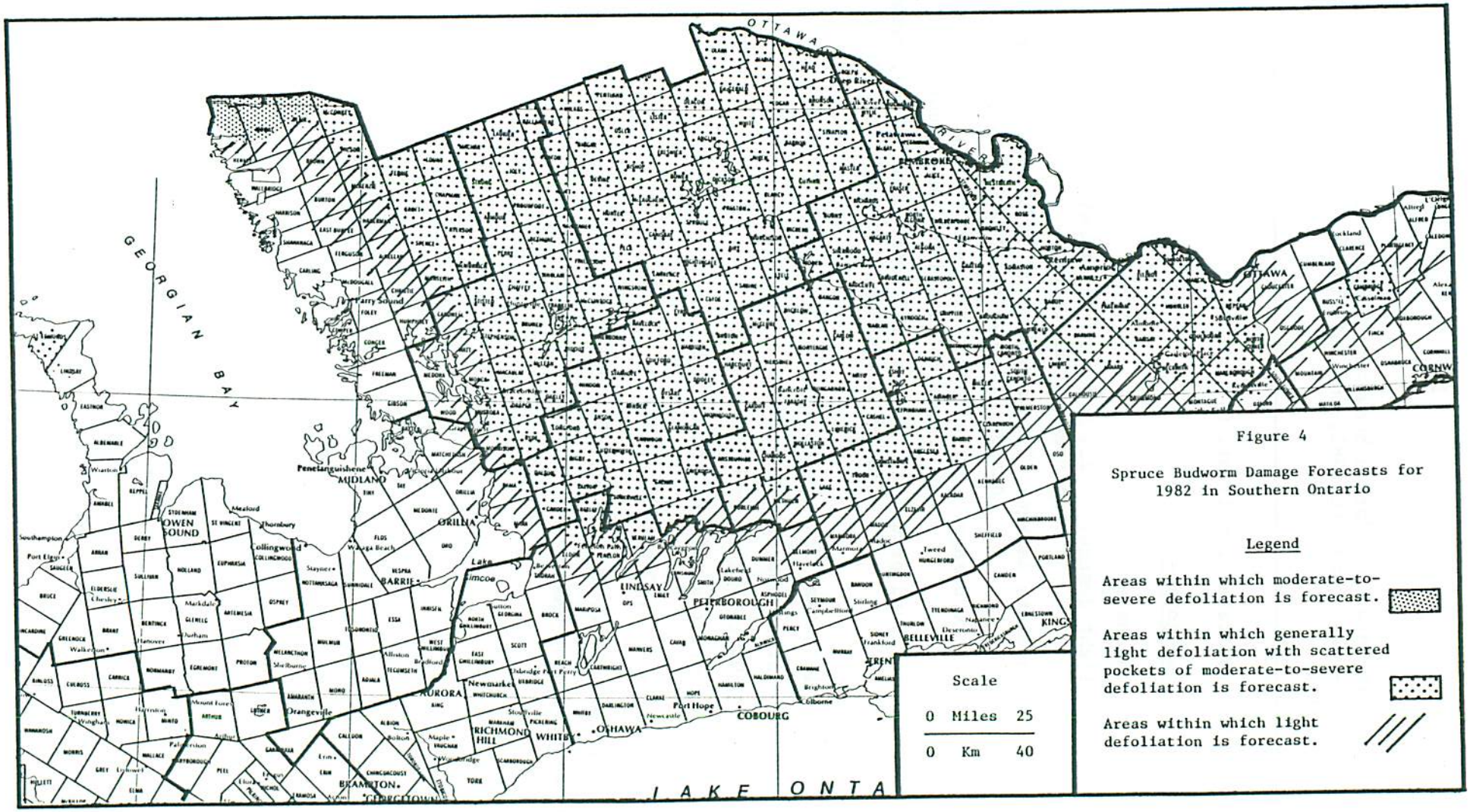
[b]

Code	Categories
0	undamaged
1	light damage. < 25% *total defoliation*, usually one season of severe defoliation.
2	moderate damage. 25% to 60% *total defoliation*, 2 or 3 seasons of severe defoliation.
3	severe damage. 60% to 80% *total defoliation*, 3 to 5 seasons of severe defoliation, will recover.
4	moribund or dying. 80% to 100% *total defoliation*, crowns grey in appearance, top dead or bare 50 cm to 150 cm.
5	less than 25% of *stand dead.*
6	25% to 50% of *stand dead.*
7	50% to 70% of *stand dead.*
8	more than 70% of *stand dead.*

[c] Aerially sprayed, *B.t.*, Dipel 88, 1981.

[d] Aerially sprayed, *B.t.*, Thuricide 32B, 1981.

* Samples requested by OMNR


OTTAWA
RIVER
GEORGIAN BAY
PEMBROKE
OTTAWA
Parry Sound
MIDLAND
Penetanguishene
ORILLIA
Lake Simcoe
BARRIE
OWEN SOUND
Collingwood
LINDSAY
PETERBOROUGH
BELLEVILLE
AURORA
Newmarket
RICHMOND HILL
WHITBY
OSHAWA
Port Hope
COBOURG
Orangeville
BRAMPTON
GEORGETOWN
LAKE ONTA
Scale
0 Miles 25
0 Km 40
Figure 4
Spruce Budworm Damage Forecasts for 1982 in Southern Ontario
Legend
Areas within which moderate-to-severe defoliation is forecast.
Areas within which generally light defoliation with scattered pockets of moderate-to-severe defoliation is forecast.
Areas within which light defoliation is forecast.

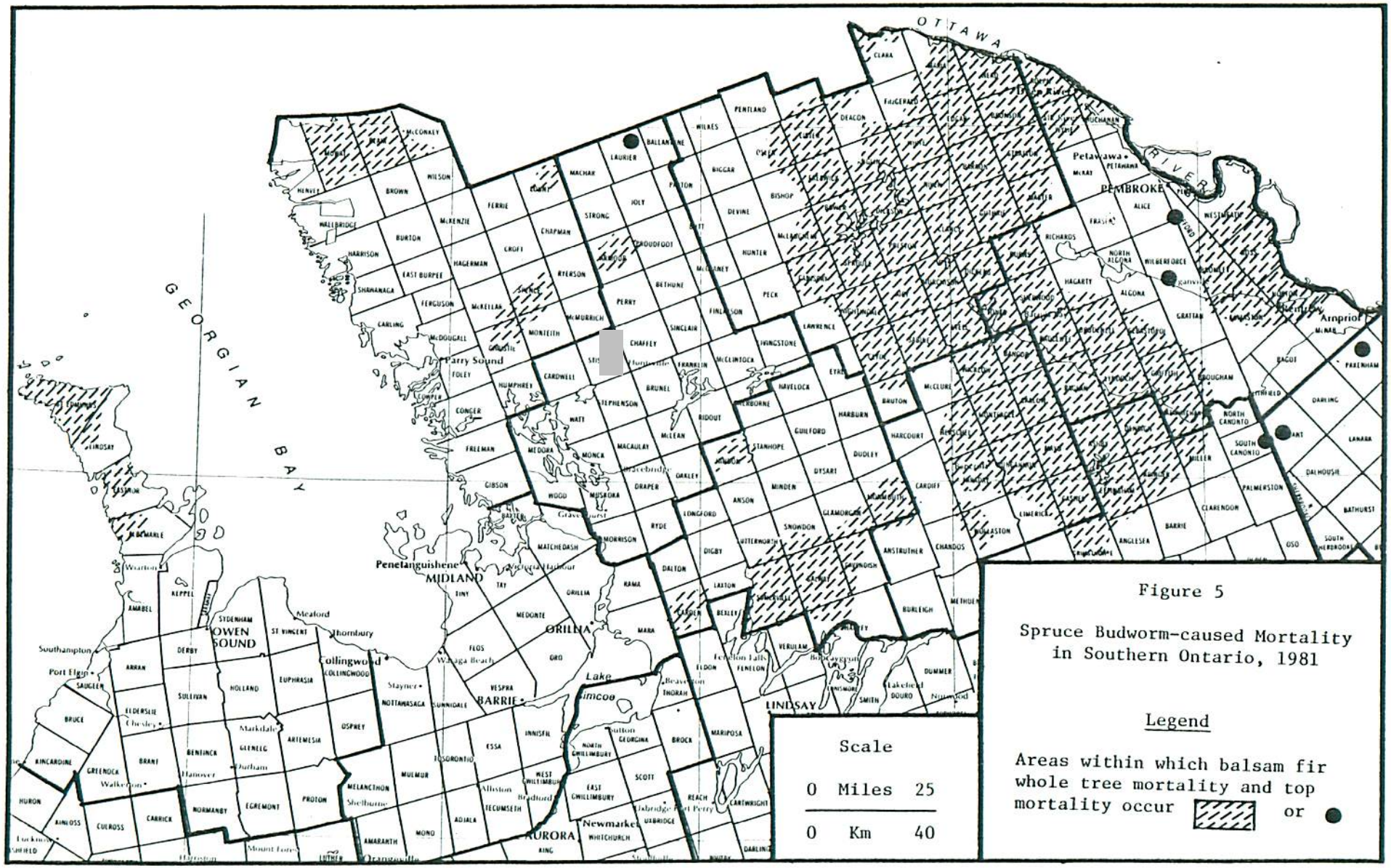


Figure 5

Spruce Budworm-caused Mortality in Southern Ontario, 1981

Legend

Areas within which balsam fir whole tree mortality and top mortality occur ▨ or ●

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

Location	Host	Tree mortality (%) 1974	1975	1976	1977	1978	1979	1980	1981
Algonquin Park District									
Canisbay Twp									
- Wildlife Station	bF	25		32	41	44	49	96	96
	wS							38	60
- Madawaska River	bF	55							
Clara Twp									
- E. of Deux Rivieres	bF							60	48
Clyde Twp									
- Cauliflower Lake	bF				37	47	53	73	97
Deacon Twp - Brent Road	bF							50	
Nightingale Twp									
- Rock Lake	bF		49	33	39	47	45	84	42
	wS							28	10
Preston Twp									
- Annie Bay Dam	bF	38		41				95	98
- 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	78	84
Stratton Twp - Achray	bF	50		56					
	wS	57							
- Achray Plot A	bF				50				
	wS				13				
- Achray Plot B	bF				70				
	wS				36				
- Lone Creek	bF	80	92						
	wS	16	50						
Bancroft District									
Carlow Twp - New Carlow	bF	36							
Dungannon Twp	bF			34	41			44	55
	wS							8	
Faraday Twp	bF		24						
Herschel Twp	bF			21	29	26	29	49	
Mayo Twp	bF			14	21	27	34	100	90
	wS							72	70
McClure Twp	bF	15		21					
Monteagle Twp	bF	39							
Wicklow Twp	bF		45	49	63	66	69		
	wS						22		

(cont'd)

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

Location	Host	Tree mortality (%) 1974	1975	1976	1977	1978	1979	1980	1981
Bancroft District (cont'd).									
Wicklow Twp									
- Papineau Creek	bF							66	
	wS							6	
- Ryan Road	bF							92	100
	wS							44	82
Bracebridge District									
Armour Twp	bF						32	80	92
	wS							18	22
Laurier Twp	bF							82	92
	wS							8	10
Carleton Place District									
Pakenham Twp	wS				0	0	0	0	0
Minden District									
Carden Twp	bF						10	78	84
	wS						52	22	24
Cavendish Twp	bF	32		45	51	56	73	92	
	wS							70	
Galway Twp - Bass Lake	bF	47		68	79	83	84		
	wS						76		
- Crystal Lake	bF	10			45	53	89		
- Union Lake	bF								74
	wS								2
Harvey Twp	bF	15			51	63			
Hindon Twp - Anson Creek	bF							44	60
	wS							16	18
Monmouth Twp	bF			60	63	74			
	wS					38			
Somerville Twp									
- Victoria Co. Forest	bF	31		37	48	60	78	84	92
	wS						64	76	86
Owen Sound District									
St. Edmunds Twp									
- Eagle Hbr. Rd	bF						62	76	86
	wS						0	0	0

(cont'd)

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

Location	Host	Tree mortality (%) 1974	1975	1976	1977	1978	1979	1980	1981
Owen Sound District (cont'd)									
St. Edmunds Twp (cont'd)									
- Johnston's Hbr. Rd	bF						96		
Parry Sound District									
Blair Twp	bF				4	11	51		
Christie Twp	bF								84
	wS								22
Lount Twp	bF								96
	wS								26
Spence Twp									
- Lot 47 Range B	bF					16	62	78	88
	wS					0	6	20	22
- Lot 55 Range B	bF					8	44	76	88
	wS					0	4	14	28
Pembroke District									
Griffith Twp	bF	34	57		68			100	76
	wS				39	43	44	76	
Matawatchan Twp									
- Camel Chute	bF		38	43	52	57	68	78	80
	wS		10					12	16
Sebastopol Twp	bF						16	47	60
Wylie Twp PNFI	bF		65					98	96
	wS							32	22
Tweed District									
Abinger Twp - Hwy 41	bF			35	40	32	55		
- Lot 27 Con XI	bF			32	41	48	41		
	wS			0	0	0	0		
- Hwy 41 at Mackavoy Lk	bF							38	40
	wS							6	6
- Hwy 41 2 km N. of Mackavoy Lk	bF							36	20
	wS							6	4
Ashby Twp	bF			6	8	5	5		
	bF						49	96	92
	wS							42	50

(cont'd)

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

Location	Host	Tree mortality (%) 1974	1975	1976	1977	1978	1979	1980	1981
Tweed District (cont'd)									
Denbigh Twp									
- Slate Falls Road	bF		18	24	34	38	43	15	12
- Hwy 41 near Dist. Bdy	bF		5		7	7	5	2	2
- Hwy 41 near Buckshot Lk. Rd	bF		4		6	8	10	7	7
- Ashby Lake Rd	bF							12	6
	wS							0	0
Effingham Twp	bF			8	8	11	10	11	18
Wingham District									
Minto Twp									
- Lot 1 Con VII	wS							0	0

Northeastern Ontario

Situation in 1981: In northeastern Ontario (Northern and Northeastern regions) the outbreak decreased by approximately 161,000 ha, from 17.119 million ha in 1980 to 16.958 million ha in 1981 (Fig. 6). Significant increases, totalling some 666,000 ha, were mapped to the north in Hearst and Cochrane districts. In Sudbury District the infestation expanded by some 500,000 ha west of the city of Sudbury and northeast of Wanapitei Lake. Smaller increases were also mapped in Kirkland Lake, Temagami and Espanola districts. Moderate-to-severe defoliation was again mapped along the Albany, Moose and Harricanaw river systems as far north as James Bay in the Moosonee District. These increases were more than offset by declines which occurred in a large area encompassing part of the southern Wawa, southeastern Chapleau, and northern Sault Ste. Marie and Blind River districts where stands were generally free of moderate-to-severe defoliation. Changes in the northern boundary of the infestation resulted in a net decline in area infested in the Kapuskasing District. Damage in the remainder of the northeastern outbreak was moderate to severe but a large area in the central portion was much more variable than in recent years. This area encompassed the southern parts of the Cochrane and Kapuskasing districts, virtually all of the Timmins, Kirkland Lake, Gogama and Temagami districts, a large portion of the Chapleau District and small areas in the Sudbury and North Bay districts (Fig. 6). Within this area of more than 7 million ha, defoliation is extremely variable, with ground estimates ranging from a low of 5% to a high of 80%. The situation is further complicated by large patches of dead and dying balsam fir which make defoliation mapping extremely difficult. This is the same part of the province in which cold damage occurred in June, 1980 and caused varying degrees of spruce budworm larval mortality.

Infestation Forecasts for 1982: A total of 334 locations were sampled for egg masses in 1981 (Table 5). On the basis of a comparison of egg-mass counts from 184 locations sampled in 1980 and 1981 there was an overall decrease of 46% in northeastern Ontario this year. All but two of the districts in the Northeastern and Northern regions showed significant decreases in egg-mass densities. The two exceptions were Hearst and Espanola, with 25% and 24% increases, respectively. Decreases in the other districts ranged from 18% to 90%, with the largest decreases occurring in Chapleau (90%), Kirkland Lake (83%), Blind River (81%) and Gogama (77%) districts.

Over all, the average egg-mass count, per 9.29 sq. m of foliage, in northeastern Ontario decreased from 417 in 1980 to 224 in 1981. The average count on balsam fir in 1981 was 176 and on white spruce 343. The highest average egg-mass numbers were found in Moosonee, Temagami, Hearst and Wawa districts.

Table 5. Northeastern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1981, and infestation forecasts for 1982.

Location	Host	Estimated % defoliation 1981	No. of egg masses per 9.29 sq. m of foliage	Infestation forecasts for 1982[a]	Accumulated damage[b]
Blind River District (18 locations)					
*Bridgland Twp	wS	65	40	L-M	1
- Area 2	wS	0	0	0	0
Bright Twp	bF	78	309	S	5
Dagle Twp	bF	67	53	M	4
Esten Twp	wS	30	198	M-S	2
Galbraith Twp	bF	77	90	M-S	2
*Kirkwood Twp	wS	59	19	L	2
- OMNR Tree Nursery	wS	62	182	M-S	2
Nicholas Twp	wS	57	120	M-S	3
*Parkinson Twp	wS	35	173	M-S	3
*Patton Twp	wS	0	78	M-S	0
Raimbault Twp - Mississagi Prov. Pk	bF	82	100	M-S	5
*Rose Twp - Plantation	wS	22	97	M-S	1
*Tweedle Twp	wS	0	20	L	0
*Vance Twp	wS	1	0	0	0
*Villeneuve Twp	wS	30	134	M-S	7
*Wells Twp	wS	45	229	S	3
*Yaremko Twp	wS	1	0	0	0
Chapleau District (26 locations)					
Barclay Twp - Missinaibi Prov. Pk	bF	57	30	L-M	6
Birch Twp - Horton Lake	bF	7	0	0	5
Borden Twp	bF	48	59	M-S	8
Carew Twp	bF	12	8	L	1
*Caverley Twp - Plantation[c]	wS	1	0	0	1
- Check Plot	wS	1	3	L	1
*Chapleau Twp - OMNR Tree Nursery[c]	bF	2	21	L-M	1
Gallagher Twp - Airport	bF	11	16	L-M	3
Genoa Twp - Rush Lake	bF	20	46	L-M	6
Horwood Twp - Horwood Lake	bF	28	125	M-S	3
*Ivanhoe Twp - Ivanhoe Prov. Pk	bF	63	144	M-S	8

(cont'd)

Table 5. Northeastern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1981, and infestation forecasts for 1982 (cont'd).

Location	Host	Estimated % defoliation 1981	No. of egg masses per 9.29 sq. m of foliage	Infestation forecasts for 1982[a]	Accumulated damage[b]
Chapleau District (cont'd) (26 locations)					
*Kirkwall Twp - Dunrankin Lake	bF	32	0	0	6
Lincoln Twp - Lincoln Lake	bF	16	43	L-M	5
*Manning Twp - Plantation[c]	wS	0	2	L	0
- Check Plot	wS	1	9	L	0
*McNaught Twp	wS	22	0	0	2
Moen Twp	bF	5	0	0	3
Montcalm Twp - Elf Lake	bF	13	0	0	6
*Neelands Twp - Wakami Prov. Pk	bF	40	86	M-S	6
Ossin Twp - Komak Lake	bF	18	0	0	6
*Peters Twp - Shoals Prov. Pk	bF	68	24	L-M	6
Raney Twp - Denyes Lake	bF	6	10	L	2
*Reaney Twp - Five Mile Prov. Pk	bF	40	69	M	6
*Reeves Twp - OMNR SPA[d,e]	wS	50	45	L-M	2
- Check Plot	wS	47	113	M-S	3
Sandy Twp	bF	48	0	0	4
Cochrane District (29 locations)					
Adanac Twp - km 37	bF	1	48	L-M	2
†Aurora Twp - Stand 8	wS	6	132	M-S	3
Blakelock Twp - Mikiwan Lake	bF	54	576	S	3
- Mikiwan Lake	bS	7	165	M-S	1
Bonis Twp	bF	8	102	M-S	5
*Bragg Twp	bS	4	105	M-S	1
*Clute Twp - OMNR SPA[d] #3201	wS	16	299	S	2
- OMNR SPA[d] #3202	wS	8	203	M-S	2
*Colquhoun Twp - Greenwater Prov. Pk[f]	wS	4	22	L-M	2
- Greenwater Prov. Pk (Check Plot)	wS	2	15	L-M	2

(cont'd)

Table 5. Northeastern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1981, and infestation forecasts for 1982 (cont'd).

Location	Host	Estimated % defoliation 1981	No. of egg masses per 9.29 sq. m of foliage	Infestation forecasts for 1982[a]	Accumulated damage[b]
Cochrane District (cont'd) (29 locations)					
*Fournier Twp - OMNR SPA[d] #3220	wS	2	73	M-S	2
Kesagami Lake	bF	28	166	M-S	2
Lake Abitibi - NE of Rabbit Creek	bF	1	65	M-S	5
- Iroquois Pt.	bF	1	16	L-M	5
Moody Twp - Bingle Area	bF	4	62	M	5
Nesbitt Twp	bF	8	25	L-M	2
Natogami Lake	bF	66	560	S	2
†Ottaway Twp - Stand 38	wS	1	114	M-S	3
*Ottaway Twp - OMNR SPA[d]	bS	1	0	0	1
Pinard Twp - Abitibi Canyon	bF	28	229	M-S	2
†Reaume Twp - Stand 128	bF	1	43	L-M	4
Sargeant Twp	bF	24	155	M-S	4
*Sheldon Twp	bS	2	0	0	1
†St. John Twp - Stand 177	bF	9	28	L-M	3
*Swartman Twp - Pierre Lake	wS	53	232	M-S	3
*Thorning Twp - Thorning Lake	bS	1	0	0	2
- Thorning River	wS	21	65	M	2
- Main Road Junction	bF	2	81	M-S	2
- Main Road Junction	bS	2	0	0	1
Espanola District (10 locations)					
Allan Twp	wS	38	326	S	1
Boon Twp	wS	68	654	S	1
Burpee Twp	bF	83	358	S	5
*Curtin Twp - OMNR SPA[d]	wS	77	486	S	1
Dawson Twp	wS	14	130	M-S	0
Foster Twp	wS	2	12	L	0
*Nairn Twp - OMNR SPA[d]	wS	29	398	S	2
Oshell Twp	bF	78	61	M-S	5
Robinson Twp - Deer Yard	bF	100	314	S	6
Tehkummah Twp	bF	59	246	S	1

(cont'd)

Table 5. Northeastern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1981, and infestation forecasts for 1982 (cont'd).

Location	Host	Estimated % defoliation 1981	No. of egg masses per 9.29 sq. m of foliage	Infestation forecasts for 1982[a]	Accumulated damage[b]
Gogama District (10 locations)					
Asquith Twp	bF	25	0	0	6
*Carter Twp - OMNR SPA[d]	wS	28	163	M-S	3
Dublin Twp	bF	22	166	M-S	5
*Fawcett Twp - OMNR SPA[d,g]	bF	18	50	L-M	6
- OMNR SPA[d,g]	wS	35	136	M-S	3
Garvey Twp - Westree	bF	2	7	L	2
Halliday Twp - Relic Lake	bF	25	109	M-S	8
Invergarry Twp - OMNR SPA[d,g]	wS	12	29	L-M	3
Jack Twp - Check Plot	wS	3	116	M-S	5
Kelvin Twp	bF	11	30	L-M	3
Hearst District (88 locations)					
*Arnott Twp					
- .8 km S of East Arnott Rd	wS	74	112	M-S	3
- 1.6 km N of West Arnott Rd	wS	8	427	S	3
- OMNR SPA[d,h]	wS	13	349	S	2
- OMNR Seed Tree Area E side of Twp	wS	8	108	M-S	2
- OMNR Seed Tree Area W side of Twp	wS	21	942	S	2
- Check Plot	wS	79	210	M-S	3
†Bayfield Twp - Stand 11	bF	80	1191	S	4
- Stand 11	wS	58	695	S	4
†Chelsea Twp - Stand 272	bF	75	673	S	3
- Stand 272	wS	48	1135	S	3
- Stand 12	bF	93	423	S	3
- Stand 12	wS	78	671	S	3
†Cholette Twp - Stand 215	bF	95	783	S	3
- Stand 215	wS	49	389	S	3
- Stand 313	bF	70	238	M-S	3
- Stand 313	wS	83	1811	S	3
- Stand 334	bF	86	493	S	3
†Drew Twp - Stand 192	bF	96	578	S	3
- Stand 192	wS	53	790	S	3

(cont'd)

Table 5. Northeastern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1981, and infestation forecasts for 1982 (cont'd).

Location	Host	Estimated % defoliation 1981	No. of egg masses per 9.29 sq. m of foliage	Infestation forecasts for 1982[a]	Accumulated damage[b]
Hearst District (cont'd) (88 locations)					
*Eilber Twp - Plantation	bS	2	45	L-M	2
†Ermine Twp - Stand 48	bF	2	79	M-S	3
- Stand 48	wS	4	249	S	3
- Stand 304	bF	3	143	M-S	3
- Stand 304	wS	13	156	M-S	3
- Stand 437	bF	16	223	M-S	4
- Stand 437	wS	18	194	M-S	4
†Foch Twp - Stand 414	bF	43	514	S	3
- Stand 438	bF	74	304	S	3
- Stand 438	wS	40	529	S	3
Franz Twp	bF	23	36	L-M	5
*Frost Twp					
- 1.8 km N of Nagagamisis River Bridge[c]	wS	18	566	S	3
- 4.8 km N of Nagagamisis River Bridge	bF	70	459	S	4
- 4.8 km N of Nagagamisis River Bridge	wS	43	1028	S	3
- Nagagamisis Prov. Pk,[c] (East Side)	bF	62	203	M-S	2
(East Side)	wS	35	364	S	2
(Centre)	bF	54	178	M-S	2
(Centre)	wS	38	472	S	2
(West Side)	bF	15	58	M	2
(West Side)	wS	22	95	M-S	2
*Fushimi Twp					
- Fushimi Prov. Pk	bF	70	245	S	3
- Fushimi Prov. Pk	wS	5	552	S	2
*Hanlan Twp - OMNR SPA[d,h]	wS	6	43	L-M	2
- Check Plot	wS	12	203	M-S	2
Kabinakagami River	wS	53	572	S	2
Kohler Twp	bF	58	443	S	2
ΦLangemarck Twp - Shekak River	bF	87	566	S	3
*Larkin Twp - Larkin Plantation	wS	3	23	L-M	1

(cont'd)

Table 5. Northeastern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1981, and infestation forecasts for 1982 (cont'd).

Location	Host	Estimated % defoliation 1981	No. of egg masses per 9.29 sq. m of foliage	Infestation forecasts for 1982[a]	Accumulated damage[b]
Hearst District (cont'd) (88 locations)					
*Larkin Twp (cont'd)					
- OMNR Seed Tree Area E of Hwy 631	wS	25	519	S	3
- OMNR Seed Tree Area W of Hwy 631	wS	10	151	M-S	3
†Lessard Twp - Stand 229	wS	86	238	M-S	4
†Lizar Twp - Stand 316	bF	11	210	M-S	3
- Stand 316	wS	8	137	M-S	3
*McEwing Twp					
- 8.8 km N of Nagagamisis River Bridge	wS	14	610	S	3
- 10.1 km N of Nagagamisis River Bridge	wS	6	317	S	3
- Nagagamisis Prov. Pk					
(most easterly shore[c])	wS	12	155	M-S	2
(SE shore[c])	wS	16	409	S	2
(S shore central[c])	wS	8	63	M	2
(NE shore[c])	wS	7	363	S	2
(W of McEwing Creek)	wS	76	580	S	2
McMillan Twp - Spray Plot[j]	bS	2	0	0	1
- Check Plot	bS	10	67	M	1
Minnipuka Twp - Goat Lake	wS	46	35	L-M	8
- Goat Lake	bS	3	28	L-M	7
Mulvey Twp	bF	15	35	L-M	3
ϕNassau Twp - Florin Lake	bF	52	363	S	3
ϕNassau Twp Road East	bF	71	393	S	3
*Rogers Twp					
- Plantation 26[i]	bF	17	188	M-S	1
	wS	12	253	S	1
- Plantation 26N[j]	bF	6	105	M-S	1
	wS	6	116	M-S	1
- Plantation 30-31[e]	bF	28	363	S	2
	wS	12	284	S	2
- Plantation 37[i]	bF	82	97	M-S	2
	wS	4	211	S	2

(cont'd)

Table 5. Northeastern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1981, and infestation forecasts for 1982 (cont'd).

Location	Host	Estimated % defoliation 1981	No. of egg masses per 9.29 sq. m of foliage	Infestation forecasts for 1982[a]	Accumulated damage[b]
Hearst District (cont'd) (88 locations)					
*Rogers Twp (cont'd)					
- Plantation 43[i]	bF	18	139	M-S	1
	wS	3	0	0	1
- Plantation 49[i]	bF	28	119	M-S	2
	wS	10	47	L-M	2
- Check Plot	bF	77	372	S	2
	wS	5	256	S	2
Staunton Twp	bF	44	785	S	3
*Stoddart Twp	bS	5	160	M-S	1
*Studholme Twp					
- Abram Lake (Residual mature)	wS	17	252	S	3
- Abram Lake (Plantation) 37 (69)[i]	wS	3	18	L-M	1
- Abram Lake (Plantation) 37 (69)[i]	bS	2	0	0	1
- Abram Lake (Plantation) 24 (63)	wS	14	141	M-S	1
†Wicksteed Twp - Stand 75	bF	56	750	S	4
Wicksteed Twp					
- .8 km S of Hornepayne	bF	5	105	M-S	2
Kapuskasing District (28 locations)					
Casselman Twp (Check Plot)	bS	1	0	0	1
Cumming Twp	bF	61	275	S	4
	bS	16	72	M-S	2
*Fauquier Twp (Bonner Tree Improvement Centre)					
- Picnic Area (Check Plot)	wS	17	96	M-S	3
- Snow Machine Trail (Check Plot)	bS	1	0	0	1
- Compartment 6B[k]	bS	2	0	0	1
- Compartment 9C	wS	1	0	0	1
- Compartment 14A (Check Plot)	wS	2	62	M	2

(cont'd)

Table 5 . Northeastern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1981, and infestation forecasts for 1982 (cont'd).

Location	Host	Estimated % defoliation 1981	No. of egg masses per 9.29 sq. m of foliage	Infestation forecasts for 1982[a]	Accumulated damage[b]
Kapuskasing District (cont'd) (28 locations)					
*Fauquier Twp (Bonner Tree Improvement Centre) (cont'd)					
- Compartment 16A[l]	wS	2	17	L-M	1
- Compartment 16E[l]	bS	2	16	L-M	1
- Compartment 19C[k]	bS	1	0	0	1
- Compartment 19C[k]	wS	4	24	L-M	1
- Compartment 21D[k]	bS	4	56	L-M	1
- Compartment 22B (Check Plot)	bS	1	0	0	1
*Fauquier Twp					
- OMNR SPA[d,e]	wS	2	73	M	1
- Check Plot	wS	2	0	0	1
- Remi Lake Prov. Pk	bF	62	279	S	4
Fenton Twp					
- km 37, Chain-of-Lakes Rd	bF	7	95	M-S	4
Guilfoyle Twp	bF	86	1323	S	4
*Idington Twp					
- Plantation 05 (64)[g]	bS	13	159	M-S	1
- Plantation 07 (65)[e]	wS	9	0	0	1
- Plantation 07 (65)[e]	bS	4	14	L-M	1
- Check Plot	wS	14	42	L-M	1
	bS	7	10	L	1
Kipling Twp - Kipling Dam	bF	38	479	S	3
Lisgar Twp					
- km 66 Chain-of-Lakes Rd	bF	2	77	M-S	4
*Staples Twp[e]	bS	0	73	M	1
*Williamson Twp	bF	45	229	M-S	4
Kirkland Lake District (44 locations)					
Alma Twp	bF	7	12	L	7
Bowman Twp	bF	0	25	L-M	3
*Burt Twp					
- OMNR Tree Nursery[e]	wS	5	248	M-S	2
- OMNR SPA[d,e]	wS	47	294	S	3
- Check Plot	wS	32	92	M-S	4

(cont'd)

Table 5. Northeastern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1981, and infestation forecasts for 1982 (cont'd).

Location	Host	Estimated % defoliation 1981	No. of egg masses per 9.29 sq. m of foliage	Infestation forecasts for 1982[a]	Accumulated damage[b]
Kirkland Lake District (cont'd) (44 locations)					
Chown Twp	bF	6	136	M-S	4
*Elliott Twp Area					
- Elliott, Plot 1[j]	bF	3	361	S	2
	wS	2	286	S	2
- Plot 2[j]	bF	1	20	L-M	2
	wS	3	87	M-S	2
- Plot 4[j]	bF	3	0	0	2
	wS	5	105	M-S	2
- Plot 5[j]	bF	2	0	0	2
	wS	4	53	L-M	2
- Plot 6[c]	bF	1	0	0	2
	wS	1	156	M-S	2
- Plot 7[c]	bF	1	0	0	2
	wS	2	26	L-M	2
- Plot 8[c]	bF	1	0	0	2
	wS	3	41	L-M	2
- Plot 9[i]	bF	2	105	M-S	2
	wS	4	191	M-S	2
- Plot 10[i]	bF	1	0	0	2
	wS	8	340	S	2
- Plot 11[i]	bF	3	8	L	2
	wS	9	40	L-M	2
- Garrison Twp (Check Plot 1)	bF	6	64	M-S	3
	wS	6	150	M-S	3
- Garrison Twp (Check Plot 2)	bF	51	52	L-M	3
	wS	21	201	M-S	3
- Harker Twp (Check Plot)	bF	8	105	M-S	4
	wS	6	275	S	4
- Imperial Lake (Check Plot)	bF	8	112	M-S	4
	wS	5	280	S	4
- Lamplugh Twp (Check Plot)	bF	29	341	S	4
	wS	16	501	S	4

(cont'd)

Table 5. Northeastern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1981, and infestation forecasts for 1982 (cont'd).

Location	Host	Estimated % defoliation 1981	No. of egg masses per 9.29 sq. m of foliage	Infestation forecasts for 1982[a]	Accumulated damage[b]
Kirkland Lake District (cont'd) (44 locations)					
Hearst Twp	bF	1	185	M-S	7
Katrine Twp	bF	5	72	M-S	3
Maisonville Twp	bF	3	119	M-S	4
Milner Twp	bF	13	412	S	4
Mulligan Twp	bF	2	20	L-M	4
Pacaud Twp	bF	32	45	L-M	3
Truax Twp	bF	38	272	S	3
Yarrow Twp	bF	1	43	L-M	7
Moosonee District (4 locations)					
Albany Forks	wS	28	483	S	2
Albany River - Anderson Island	wS	10	33	L-M	2
Ghost River - Cheepay Island	wS	52	1003	S	2
Moose Factory Island	bF	65	253	S	3
North Bay District (12 locations)					
Bastedo Twp, Hwy 64	wS	18	560	S	1
*Cameron Twp	bF	38	163	M-S	5
*Gurd Twp	wS	18	1703	S	1
*Jocko Twp	bF	77	192	M-S	5
*Latchford Twp - Plantation	wS	0	0	0	0
*Mattawan Twp	bF	52	228	M-S	2
*McNish Twp - Plantation	wS	9	16	L-M	0
Notman Twp	bF	4	72	M-S	1
*Patterson Twp - Restoule Prov. Pk	bF	1	8	L	1
Phelps Twp	bF	97	199	M-S	3
*Sisk Twp - Martin River Prov. Pk	bF	40	185	M-S	4
*South Himsworth Twp - Freeman Chute	bF	29	14	L	3

(cont'd)

Table 5. Northeastern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1981, and infestation forecasts for 1982 (cont'd).

Location	Host	Estimated % defoliation 1981	No. of egg masses per 9.29 sq. m of foliage	Infestation forecasts for 1982[a]	Accumulated damage[b]
Sault Ste. Marie District (8 locations)					
Butcher Twp	bF	0	25	L-M	7
Gapp Twp - Ragged Lake	wS	0	11	L	0
Haviland Twp	bF	81	161	M-S	1
Herrick Twp - Pancake Prov. Pk	bF	67	117	M-S	1
Jollineau Twp	bF	37	76	M-S	6
McIlveen Twp	wS	3	58	L-M	6
Tarbutt Additional Twp	bF	89	657	S	5
Vibert Twp - Wart Lake	bF	23	47	L-M	3
Sudbury District (8 locations)					
Antrim Twp - Halfway Lake Prov. Pk	wS	18	270	S	3
Attlee Twp, Hwy 637	wS	51	651	S	1
Burwash Twp	wS	5	152	M-S	0
Dowling Twp	bF	9	107	M-S	0
Dunnett Twp	bF	33	261	S	1
Hawley Twp	wS	29	598	S	2
Parkin Twp	wS	12	239	M-S	0
Trill Twp	wS	0	5	L	0
Temagami District (14 locations)					
Askin Twp	bF	6	114	M-S	4
Aston Twp	wS	0	293	S	3
Barr Twp	wS	12	424	S	7
Eldridge Twp	wS	22	487	S	3
Gillies Limit Twp	bF	22	97	M-S	3
Hartle Twp	wS	11	1812	S	3
Olive Twp	wS	44	617	S	4
Riddell Twp	bF	13	152	M-S	4

(cont'd)

Table 5. Northeastern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1981, and infestation forecasts for 1982 (cont'd).

Location	Host	Estimated % defoliation 1981	No. of egg masses per 9.29 sq. m of foliage	Infestation forecasts for 1982[a]	Accumulated damage[b]
Temagami District (cont'd) (14 locations)					
*South Lorrain Twp					
- OMNR Friday Lake SPA[d,g]	wS	14	186	M-S	2
- Friday Lake Check Plot	wS	39	790	S	3
- OMNR Matabitchuan SPA[d,g]	wS	4	319	S	2
- Matabitchuan Check Plot	wS	7	450	S	2
Strathy Twp	bF	22	337	S	4
Yates Twp	bF	11	91	M-S	3
Timmins District (7 locations)					
Carnegie Twp	bF	6	12	L	3
Evelyn Twp	bF	5	23	L-M	3
Godfrey Twp	bF	0	15	L-M	3
Hassard Twp	bF	60	223	M-S	3
Keefer Twp	bF	11	55	M	3
McKeown Twp	bF	0	0	0	3
Robb Twp	bF	18	71	M-S	3
Wawa District (28 locations)					
Abraham Twp	bF	89	233	S	2
Asselin Twp	bF	65	160	M-S	2
Bailloquet Twp					
- Black Trout Lake	bF	51	104	M-S	2
*Bryant Twp - OMNR SPA[d]	bS	6	410	S	1
Challener Twp	bF	21	34	L-M	2
Cudney Twp - Esnagi Lake	bF	65	665	S	5
Dahl Twp - Obatanga Prov. Pk	bF	86	393	S	3
Debassige Twp	wS	1	547	S	6
Dumas Twp	bS	2	70	M-S	0
Dunphy Twp	bF	21	50	L-M	3
Hydro Rd - Umbata Falls	bF	79	833	S	5
Huotari Twp	wS	25	73	M-S	2

(cont'd)

Table 5. Northeastern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1981, and infestation forecasts for 1982 (concl'd).

Location	Host	Estimated % defoliation 1981	No. of egg masses per 9.29 sq. m of foliage	Infestation forecasts for 1982[a]	Accumulated damage[b]
Wawa District (cont'd) (28 locations)					
Labelle Twp					
- Agawa Campground	wS	7	75	M-S	0
McCron Twp - Access Rd	bF	94	804	S	3
*Mikano Twp - Horsehead Lake	wS	21	1726	S	1
Noganosh Twp	wS	3	7	L	5
Peever Twp					
- Crescent Lake Campground	bF	0	0	0	0
Peterson Twp					
- Rabbit Blanket Campground	bF	98	239	S	2
Pukaskwa National Pk					
- Bonami Cove	wS	94	533	S	3
- Cascade River	bF	47	160	M-S	5
- Oiseau Bay - 11.2 km east	bF	46	394	S	3
- Oiseau Bay	bF	70	119	M-S	3
- Simons Harbour	bF	44	96	M-S	3
- Tip Top Mountain	bF	98	26	L-M	5
Regan Rd - 9 km south	bF	100	862	S	3
Simpson Twp	wS	8	360	S	5
Strickland Twp	wS	22	72	M-S	1
*White Lake Prov. Pk	bF	97	524	S	1

[a] S = severe, M = moderate, L = light, 0 = nil
[b] See footnote[b], page 15
[c] Aerially sprayed, *B.t.*, Thuricide, 1981
[d] SPA = Seed Production Area
[e] Aerially sprayed, Virus, 1981
[f] Ground sprayed, *B.t.*, Thuricide, 1981
[g] Aerially sprayed, Matacil, 1981, 2 applications
[h] Aerially sprayed, Matacil, 1981, 3 applications
[i] Aerially sprayed, *B.t.*, Dipel 88, 1981
[j] Aerially sprayed, Matacil, 1981, 1 application
[k] Aerially sprayed, Virus, 1979
[l] Aerially sprayed, Orthene, 1981, 3 applications
* Samples requested by OMNR
† Samples from Ontario Paper Co. Ltd. Limits
ϕ Samples requested by Domtar Forest Products

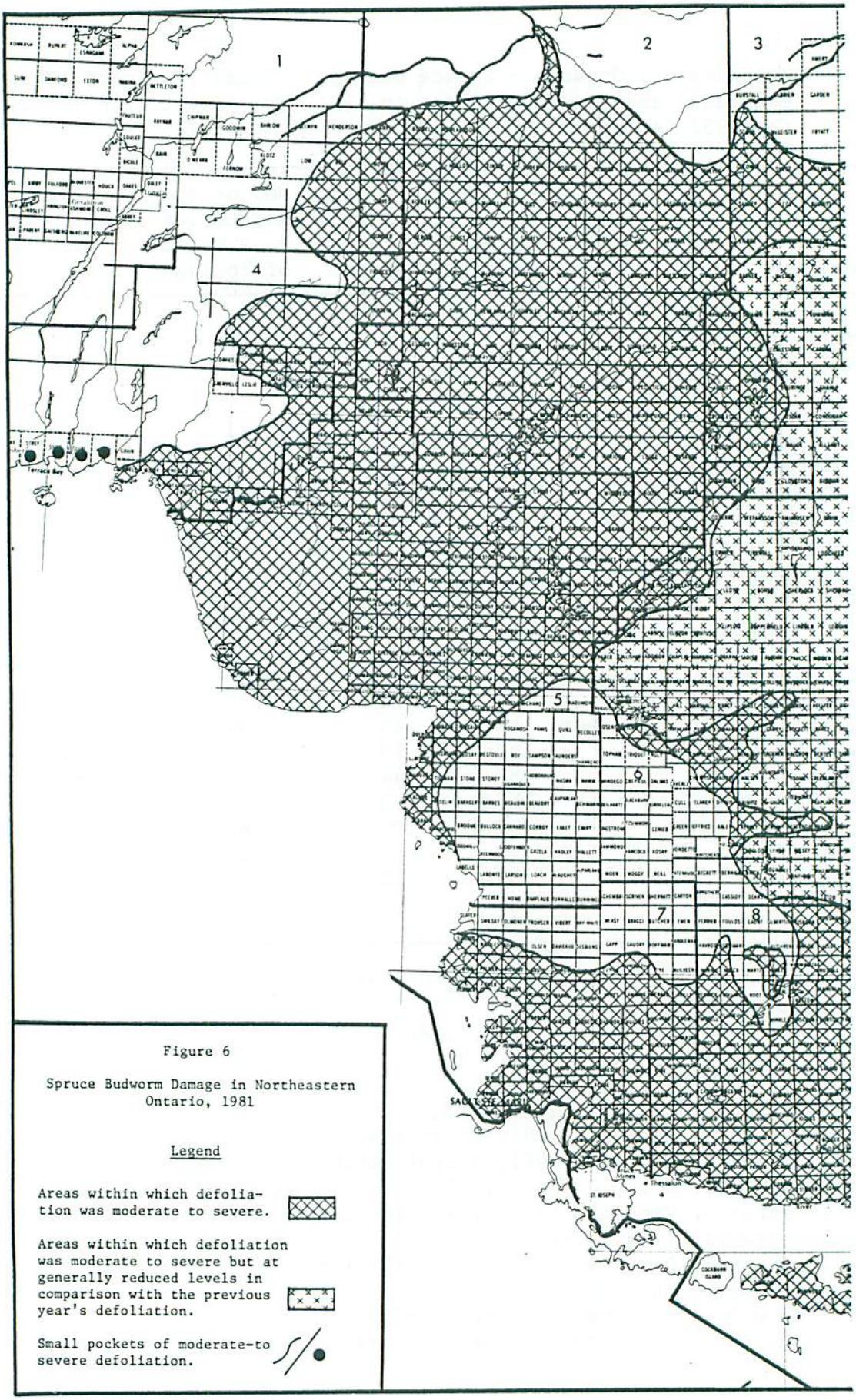


Figure 6

Spruce Budworm Damage in Northeastern Ontario, 1981

Legend

Areas within which defoliation was moderate to severe.

Areas within which defoliation was moderate to severe but at generally reduced levels in comparison with the previous year's defoliation.

Small pockets of moderate-to severe defoliation.

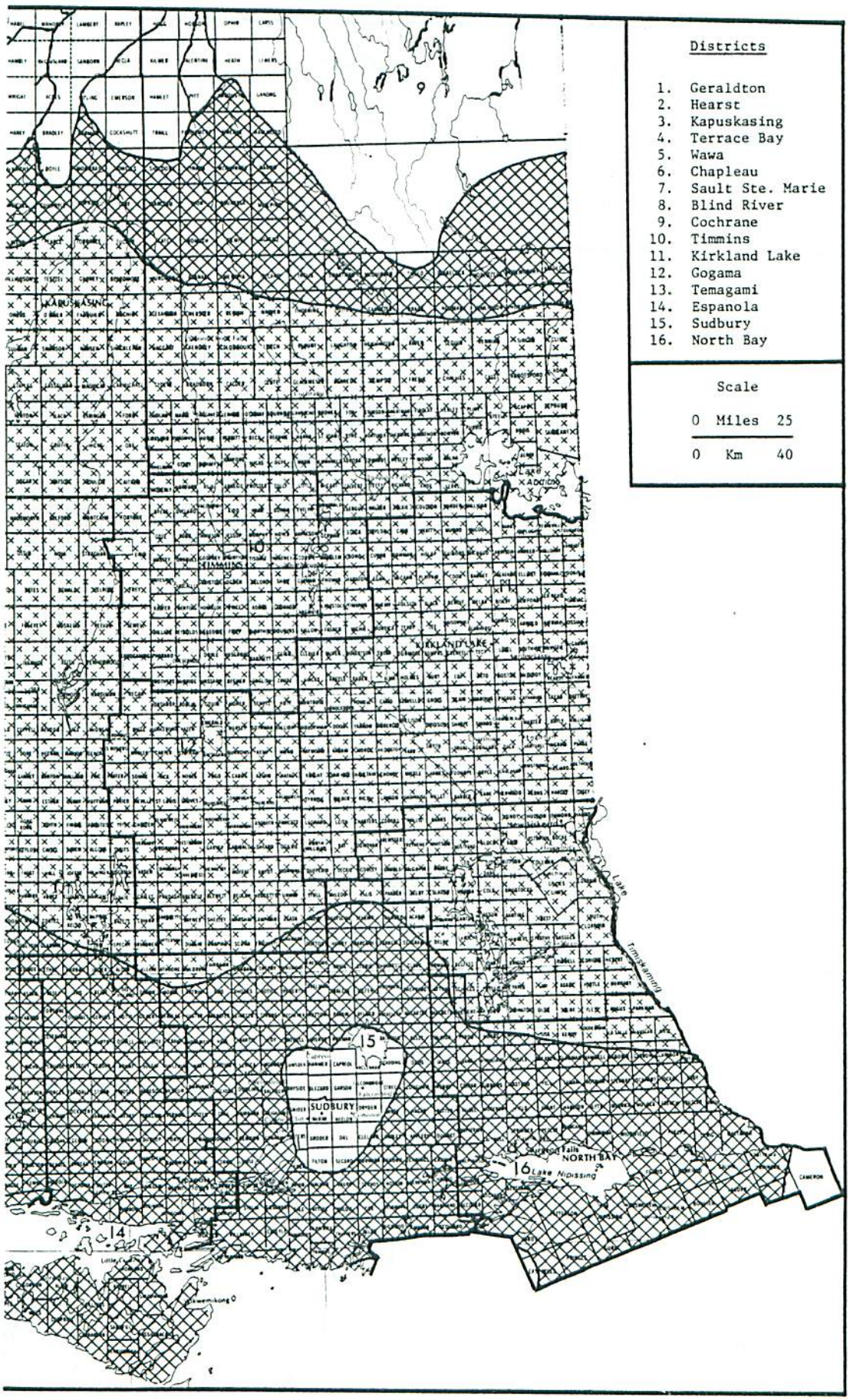
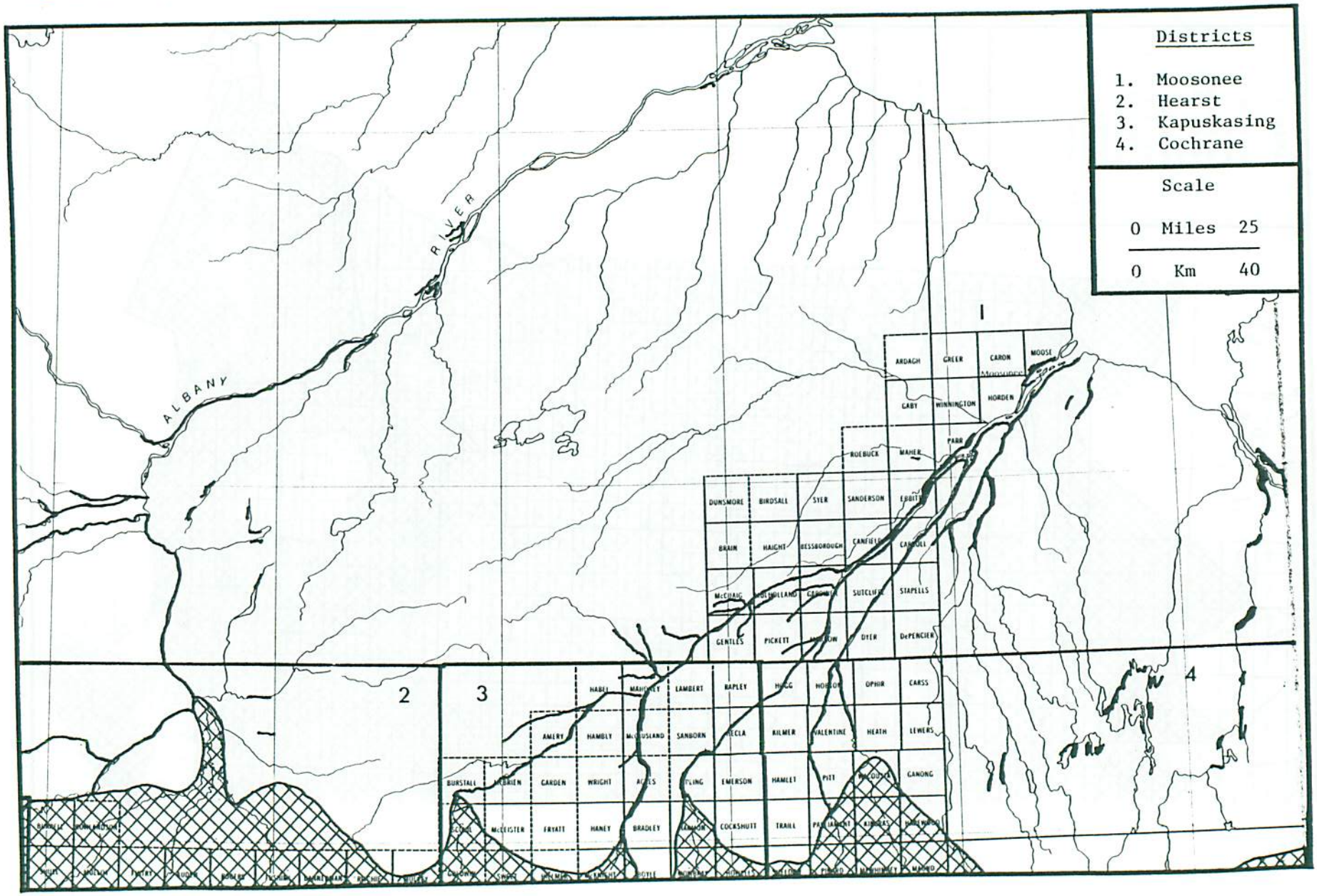

Districts
1. Geraldton
2. Hearst
3. Kapuskasing
4. Terrace Bay
5. Wawa
6. Chapleau
7. Sault Ste. Marie
8. Blind River
9. Cochrane
10. Timmins
11. Kirkland Lake
12. Gogama
13. Temagami
14. Espanola
15. Sudbury
16. North Bay
Scale
0 Miles 25
0 Km 40
KAPUSKASING
TIMMINS
KIRKLAND LAKE
SUDBURY
NORTH BAY
Lake Nipissing
Lake Temiskaming
CAMERON

Figure 6. Spruce Budworm Damage in Northeastern Ontario, 1981 (concl'd).



Forecasts (Fig. 7) call for moderate-to-severe defoliation throughout the area infested in 1981, with the exception that generally light defoliation with scattered pockets of moderate-to-severe defoliation should prevail throughout the central part of the outbreak. This would include most of Timmins, Chapleau and Gogama districts as well as large parts of Wawa, Blind River, Kirkland Lake and Cochrane districts. Some minor expansions of infestations may occur to the west and north in Hearst District.

Tree Mortality: In northeastern Ontario the area of budworm-associated tree mortality increased in 1981 by some 2.733 million ha to a total of about 9.572 million ha (Table 2, Fig. 8). Most of the stands in which new mortality was observed were in Kirkland Lake, Cochrane, Kapuskasing, Timmins, Gogama, Wawa and Blind River districts. Budworm-associated tree mortality is now found throughout the districts of Gogama, Temagami and Kirkland Lake and most of Chapleau and Timmins. Outside the main area of mortality a number of new pockets were discovered (Fig. 8). A new pocket of mortality was observed in Plummer Township, Sault Ste. Marie District, while in North Bay District new pockets were discovered in McNish, Pardo and Hobbs townships in the north and in Pringle and Gurd townships in the south. In the three northern districts of Hearst, Kapuskasing and Cochrane the area of budworm-associated tree mortality continued to increase and now extends north of the towns of Cochrane and Kapuskasing. In Wawa District several new pockets of mortality were detected along the Lake Superior shore in Pukaskwa National Park.

The highest mortality rates of balsam fir were in Blind River (86%), Temagami (75%), Chapleau (74%) and Kirkland Lake (71%) districts (Table 6). The lowest rates were in Cochrane (13%) and Kapuskasing (17%) districts where the current budworm infestation is relatively new. In white spruce stands the average mortality rate increased slightly from 10% to 15% with highs of 29% and 22% in Sault Ste. Marie and Chapleau districts, respectively. These figures are based on ground checks in 27 stands in 12 districts.

In addition, in 1981 seven black spruce stands were examined for tree mortality in four districts in northeastern Ontario. Currently, the average mortality rate in these areas is 17% with highs of 36% in Pine Township, Sault Ste. Marie District. In stands checked in 1980 and 1981, black spruce mortality increased by an average of 6%.

White spruce tree mortality may be much more severe in local situations in some districts than is described in the foregoing paragraphs or is shown in Table 6. For example, in the Wawa District in 1980, white spruce tree mortality totalling 90% in Tiernan Township and 60% in Peterson Township was recorded. Many of these stands were subsequently salvaged. Many locations with high levels of white spruce tree mortality are inaccessible, trees are scattered and such situations are difficult to evaluate solely from the air.

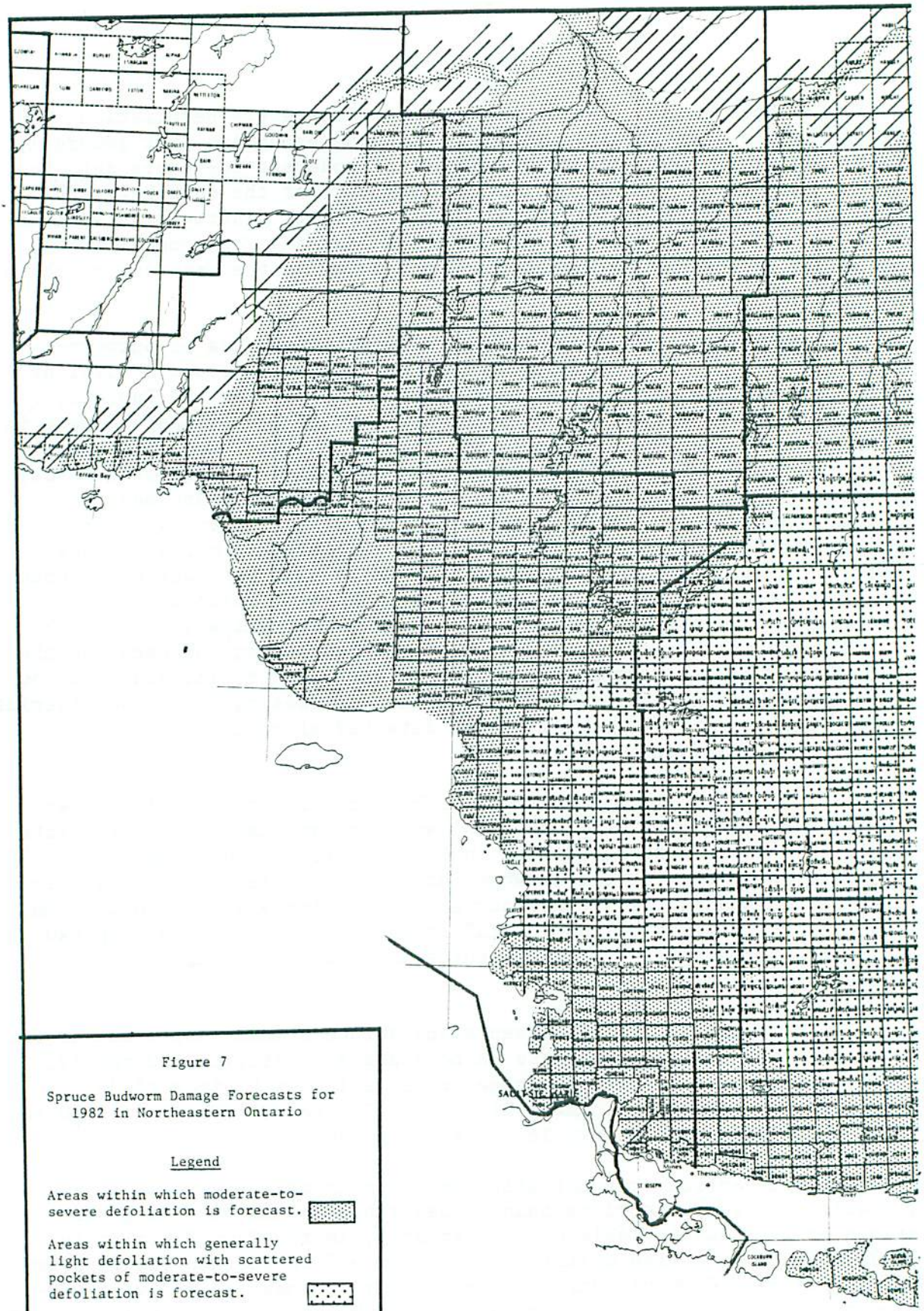


Figure 7

Spruce Budworm Damage Forecasts for 1982 in Northeastern Ontario

Legend

Areas within which moderate-to-severe defoliation is forecast.

Areas within which generally light defoliation with scattered pockets of moderate-to-severe defoliation is forecast.

Areas within which light defoliation is forecast.

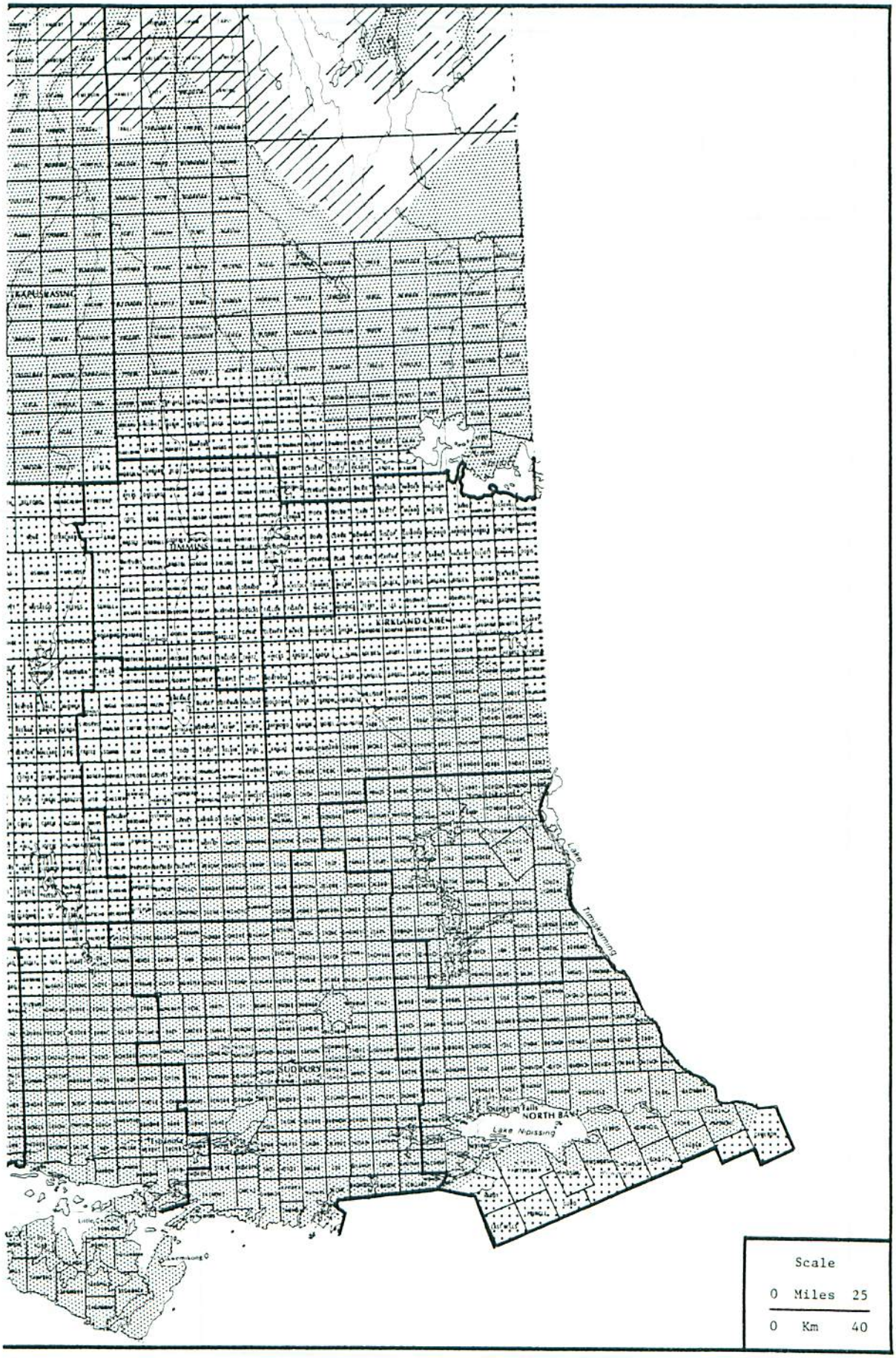

KAPUSKASING
TIMMINS
KIRKLAND LAKE
Lake Temiskaming
SUDBURY
Sturgeon Falls
NORTH BAY
Lake Nipissing
Scale
0 Miles 25
0 Km 40

Figure 7. Spruce Budworm Damage Forecasts for 1982 in Northeastern Ontario (concl'd).

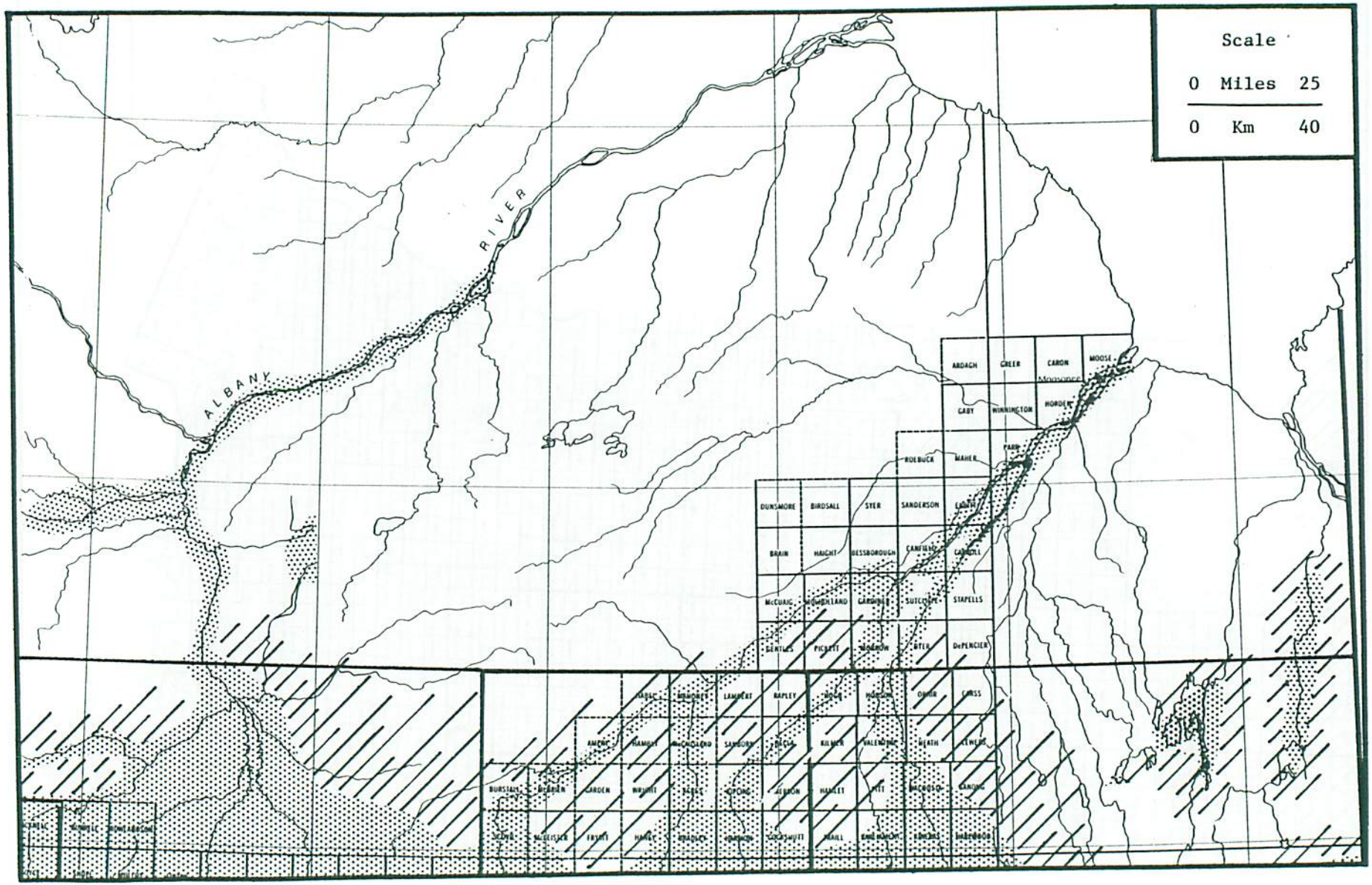


Table 6. Northeastern Ontario - Summary of spruce budworm-associated tree mortality based on ground checks for the past seven years.

Location	Host	Tree mortality (%)						
		1975	1976	1977	1978	1979	1980	1981
Blind River District								
McNie Twp	bF	4		49	66	94		
Nicholas Twp	bF					23	40	58
	wS					0	0	0
Renwick Twp	bF	26	68	77	85	97		
	bF	15	24	55	63	77	72	98
	bF	2	47	56	43	70	87	97
Sturgeon Twp	bF	1	6	10	29	56	81	83
	wS					0	2	4
Timbrell Twp	bF	16	55	61	88	91		
Villeneuve Twp	bF	3	10	11	34	69	84	94
	wS					0	6	6
Chapleau District								
Abney Twp	bF					12		36
	wS					0		9
Birch Twp	bF			20	29	37	46	67
	wS				0	0	0	22
Bliss Twp	bF	14	30	51	55		61	64
	wS				0		0	0
Bonar Twp	bF		25		68			
Bordeleau Twp - Gale Lake	bF	64		70			90	
Borden Twp								
- E. of old CIP Rd	wS				9	17		
- 18.7 km E. of Hwy 129	wS							42
- 19.8 km E. of Hwy 129	bF	55	73	85	87	90		
	wS			12	18	22	32	
- Westover Lake	bF	19	20				72	83
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		71	87
Chewett Twp - Hwy 101	bF	10	15		37	69	72	89
- Cedric Lake Rd	bF	0		12		39		
Cochrane Twp - Kanipahow Rd	bF	28	32			62		87
	wS						6	18
- Hwy 101	bF	52		62				
Cosens Twp	bF	2	10		23		38	52
Dalmas Twp	bF	32		72	83	84	90	
	wS	2		28	28	29	30	38

(cont'd)

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

Location	Host	Tree mortality (%) 1975	1976	1977	1978	1979	1980	1981
Chapleau District (cont'd)								
Dupuis Twp	bF	56	71	75	78	93		
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			24	42
	wS						2	12
Gilliland Twp	bF	21	33		40	63	68	73
	wS				11	12	12	22
Green Twp	bF	8	10		15	37	58	76
Halsey Twp - Nemegos Rd	bF	42		58		69	91	
Heenan Twp	bF			8				
Hill Twp	bF	8				95		
Hoey Twp - Lawson Lake	bF	55	55	76	76	79	83	
	wS			14	14	26	28	
- Hwy 101	bF						38	92
	wS						12	34
- Wildwood Camp	bF							42
	wS							16
Ivanhoe Twp - Ivanhoe Park	bF				30	54	69	86
	wS					23	29	46
Kelsey Twp - Wakami Park	bF				63		98	
	wS						4	
Kildare Twp	bF			43				
Kosny Twp	bF				68	87		
	wS				5	12		
Lemoine Twp	bF				41			
Lipsett Twp								
- Lafreniere Lumber Rd	bF		30					
- Chapleau Lumber Rd	bF		35					
Margaret Twp	bF				48	78	84	87
	wS						2	0
Marshall Twp	bF	23				93		
McNaught Twp	bF							68
	wS							8
Muskego Twp	bF				33		78	87
Nimitz Twp	bF						14	20
	wS						4	6

(cont'd)

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

Location	Host	Tree mortality (%) 1975	1976	1977	1978	1979	1980	1981
Chapleau District (cont'd)								
Pattinson Twp	bF	9		34		72	94	
Reaney Twp	bF	10		22		35	58	89
	bF	22					43	90
Sadler Twp	bF	21		42		87	93	
Sandy Twp	bF						69	72
	wS						14	22
Windego Twp	bF		66		68	78		
Cochrane District								
Abitibi Lake - north	bF					0	0	14
- south	bF					8	7	21
Aurora Twp	bF							62
Bonis Twp	bF					0	3	7
Haggart Twp	bF						0	
Moody Twp	bF					0	2	5
Mortimer Twp	bF							13
	wS							0
Nesbitt Twp	bF					0	0	
	wS						0	
Potter Twp	bF							3
Stimson Twp	bF						8	16
Sydere Twp	bF							4
	wS							0
Espanola District								
Allan Twp	bF						6	4
	wS						2	0
Gaiashak Twp	bF						11	23
Hallam Twp	bF						9	
Hotte Twp	bF			64	64	78		
Ouellette Twp	bF			60	95	96		
Robinson Twp	bF					32		
	bF					28		
- Burnt Island Rd	bF						69	80
- Wood Carrol Bay Rd	bF						42	61
Salter Twp	bF						15	16
Teasdale Twp	bF						12	18

(cont'd)

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

Location	Host	Tree mortality (%)						
		1975	1976	1977	1978	1979	1980	1981
Gogama District								
Asquith Twp	bF		39	86	88	94		
	bF				18	47	50	53
Chester Twp	bF					12	16	29
Dublin Twp	bF					13	17	31
Fawcett Twp	bF				10		39	48
Garibaldi Twp	bF				99			
	bF				31	43	49	52
Gouin Twp	bF					14	19	
Hazen Twp	bF			36	38	58	69	81
Invergarry Twp	bF						16	20
	wS						2	2
Kelvin Twp	bF				6	23	38	42
Macmurchy Twp	bF			15	27	76	89	
Marshay Twp	bF	39						
Miramichi Twp	bF		70	100				
	bF				87			
Ogilvie Twp	bF			4	20			
Onaping Twp	bF	77						
Paudash Twp	bF					21	33	43
St. Louis Twp	bF				20	40	48	
Valin Twp - Welcome Lake	bF			75				
Hearst District								
Cholette Twp	bF				0	0		0
	wS						0	0
Franz Twp	bF					14	6	28
	wS						0	0
Hook Twp	bF				34			
Minnipuka Twp	bF				16			
	wS				4			
	bF				37	87	95	97
	wS				14	40		
	wS						7	9
Rogers Twp	bF							0
	wS							0
Shannon Twp	bF							3
Staunton Twp	bF					0	0	2

(cont'd)

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

Location	Host	Tree mortality (%) 1975	1976	1977	1978	1979	1980	1981
Kapuskasing District								
Abbott Twp - Brunswick Lake	bF				71	96		
	wS					22		
- Main Road	bF						94	
	wS							14
Cromlech Twp	bF		14		0			
Cummings Twp	bF					2	0	4
	wS						0	0
Fauquier Twp	bF					2	7	4
Fenton Twp	bF					0	0	4
Gurney Twp	bF							3
Lisgar Twp	bF					4	21	47
Machin Twp								
-Groundhog River (Plantation)	wS							0
- Main Road	bF						2	27
	wS							0
Mons Twp	bF				61			
	wS				36			
Opasatika Twp								
- Opasatika Lake	bF		2		0	2		
- Rufus Lake	bF						6	39
Shanley Twp	bF					3	4	3
	wS							0
Slack Twp	bF						0	0
Stringer Twp								
- Groundhog R. Jct.	bF					0	0	4
	wS						0	6
- Ten Mile Rapids	bF							84
Torrance Twp	bF							0
	wS							0
Williamson Twp	bF							3
Kirkland Lake District								
Alma Twp	bF			46	78	86	96	98
Charters Twp - Montreal R.	bF	14	44	53	64			
Chown Twp	bF		3	8	17	23	26	50
Doon Twp	bF			75	92			
Dufferin Twp - McKee Lake	bF			83	87			

(cont'd)

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

Location	Host	Tree mortality (%) 1975	1976	1977	1978	1979	1980	1981
Kirkland Lake District (cont'd)								
Elliott Twp - Dickson Check	bF						4	
- Plots C & D (1981 Plots 1 & 2)	bF						9	17
- Plot E	bF						8	
- Plot G	bF						17	
- Plot 1 (1981 Plot 9)	bF						21	37
- Plot 3	bF						0	
- Plot 4	bF						4	
- Plot 5 (1981 Plot 6)	bF						5	18
- Plot 6	bF						8	
- Plot 7 (1981 Plot 7)	bF						16	37
- Plot 9	bF						16	
- Plot 10 (1981 Plot 10)	bF							42
- Plot 11 (1981 Plot 8)	bF						16	16
- Plot 11	wS						0	
- Plot 12	bF						14	
- 1981 Plot 4	bF							23
- 1981 Plot 5	bF							14
- 1981 Plot 11	bF							38
Garrison Twp	bF						24	52
	wS						1	1
- East Check	bF							28
- West Check	bF							21
Gauthier Twp	bF			13	17	35	58	77
Gross Twp	bF		7	10	24	45	93	100
Harker Twp	bF						21	22
	bS						1	1
- Check Plot	bF							41
- Imperial Lake Check	bF							19
	bS							20
Hearst Twp	bF			4	25	71	97	100
Hincks Twp	bF			53				
James Twp	bF			18	32	58	79	81
Lamplugh Twp - Check Plot	bF							4
McFadden Twp	bF			16	20	49	54	56
McNeil Twp	bF				11			
Milner Twp	bF	4						
Truax Twp	bF		36	46	87	87		

(cont'd)

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

Location	Host	Tree mortality (%)						
		1975	1976	1977	1978	1979	1980	1981
Kirkland Lake District (cont'd)								
Van Hise Twp	bF		51	62	95	95		
Yarrow Twp - Mistinikon Lake	bF		75					
Yarrow Twp	bF			70	91			
North Bay District								
Angus Twp	bF							74
Bastedo Twp	bF					2		10
Cameron Twp	bF					11		22
Clarkson Twp	bF						28	17
	wS						7	7
French Twp	bF						8	4
Jocko Twp	bF						23	28
	bS						10	10
Kirkpatrick Twp	bF						12	8
	wS						0	0
Lyman Twp	bF					9		36
Mattawan Twp	bF						54	31
	wS						12	14
McLaren Twp	bF					8		19
McNish Twp	bF						39	37
	wS						8	10
Nipissing Twp	bF						3	10
Pedley Twp	bF					8		9
Sisk Twp	bF					29		22
Thistle Twp	bF					40		55
Sault Ste. Marie District								
Bracci Twp - North Chubb Lake	bF	13		68		79		93
Butcher Twp - Goulais Lake	bF	22		70				
Hoffman Twp	bF	6		43				
Jollineau Twp	bF						2	2
	wS						0	0
Pine Twp - (km 34.6 Aubinadong Rd)	bF	7	22	42	49	74	69	91
	bS						8	14
- (km 31.1 Aubinadong Rd)	bF	9	27	52	59	80	92	94
	wS						20	56

(cont'd)

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

Location	Host	Tree mortality (%) 1975	1976	1977	1978	1979	1980	1981
Sault Ste. Marie District (cont'd)								
Pine Twp								
- (km 31.1 Aubinadong Rd)	bS						16	36
Smilsky Twp	bF	44	93	100				
Snow Twp	bF					19	25	43
	wS						0	2
Wlasy Twp - Dyson Lake	bF	29		66		73		90
Sudbury District								
Antrim Twp - Halfway Lake	bF	62	86	94	97			
	wS	0	0	8				
- Halfway Lake Prov. Pk.	bF						66	71
	wS						20	0
Attlee Twp								
- Tyson Lake								
(1980 Sale Twp)	bF						68	58
	wS						25	10
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		
Cascaden Twp - Cascaden Rd	bF						37	
- Ministic Lake Rd	bF						24	31
Dunbar Twp - Scotia Lake	bF	93		88	81	96		
Ellis Twp - Scarecrow Lake	bF			40	35	41		65
Emo Twp - Onaping Lake	bF	54		69	91	90		
Fairbairn Twp - Onaping Lake	bF	68		63	98			
Hawley Twp								
- Nepawassi Lk. Rd	bF						74	85
	wS						21	8
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		86
Stobie Twp	bF						87	
	wS						33	
Sweeny Twp - Ayotte Lake	bF	67		80		94		

(cont'd)

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

Location	Host	Tree mortality (%) 1975	1976	1977	1978	1979	1980	1981
Sudbury District (cont'd)								
Telfer Twp	bF						65	
	wS						9	
Ulster Twp - Sideburn Lake	bF	38		79		95		
Temagami District								
Barr Twp - Mowat Landing	bF		7	24	62	83	97	97
Best Twp	bF			11	21	35	49	77
Corley Twp - Smoothwater Lake	bF	11	56	74	96			
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	66	70
Flett Twp - Fanny Lake	bF			10	28	52		
Gillies Limit Twp - Bay Lake	bF		0	1	4	6	15	24
	wS							0
Hartle Twp	bF						52	68
	wS						4	6
Hebert Twp	bF				34	39		
Hebert Twp - East of Angle Lake	bF				33	53	57	77
Medina Twp	bF			32	58	78		
Milne Twp - Boyce Lake	bF			32	43	59		
Parker Twp - Florence Lake	bF			28	21	52		64
Riddell Twp - Camp 16 Rd	bF			6	49	72	75	86
	wS							0
Speight Twp - Mendelssohn Lake (S end)	bF	17			54	78		
- Mendelssohn Lake (N end)	bF	36	65	81				
Strathcona Twp	bF		4		38		94	99
Trethewey Twp - Banks Lake	bF			41	83	91		96
Vogt Twp	bF			21	28	61		
Wallis Twp	bF		33					

(cont'd)

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

Location	Host	Tree mortality (%) 1975	1976	1977	1978	1979	1980	1981
Timmins District								
Bartlett Twp - Scott Lake	bF				25	63	95	97
Carnegie Twp	bF						0	0
	wS							0
English Twp - Ferrier Lake	bF				7			
Hassard Twp	bF					21	33	35
Hillary Twp	bF					3	29	90
Kidd Twp	bF					0		
McKeown Twp	bF					4	6	7
Semple Lake	bF				28			
Wawa District								
Asselin Twp - Gargantua Rd	bF		15	23	46	61	68	67
- Gargantua Rd	wS					18	24	32
Beaudry Twp - Black Spruce Lake	bF	91		74		96		
Beauparlant Twp - McEwen Lake	bF	47		70		83		97
Brimacombe Twp - Hwy 17	bF		4	16	19	20	23	29
Broome Twp	bF			82		89		
Cecile Twp	bF					34	59	77
Copenace Twp - Poon L.	bF	27		46				
Esquega Twp - Hwy 101	bF		8	15	13	12	32	49
	wS						0	0
Giles Twp - Coldwater R.	bF	31				45	34	39
Hallett Twp - Hoppy Lake	bF	71		98				
- Convey Lake	bF							80
	bS							34
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	95	93
Larson Twp - Little Agawa Lake	bF	48		75		82	91	90
Makawa Twp - Woodesgoon Lake	bF					35	33	
- Fire River	wS					17		
Michano Twp - Miskokomon Twp boundary	bF	63	89	92				

(cont'd)

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

Location	Host	Tree mortality (%) 1975	1976	1977	1978	1979	1980	1981
Wawa District (cont'd)								
Naveau Twp - High Falls Rd	bF	16	21	43	39	37	35	38
	bS						2	4
Nebonaionquet Twp - Anjigami Rd	bF	53						
Pukaskwa National Park - White Gravel River Trail	bF							14
- N. of White Gravel River Trail	bF							17
- Oiseau Bay	bF							12
- N. of Oiseau Bay	bF							3
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					

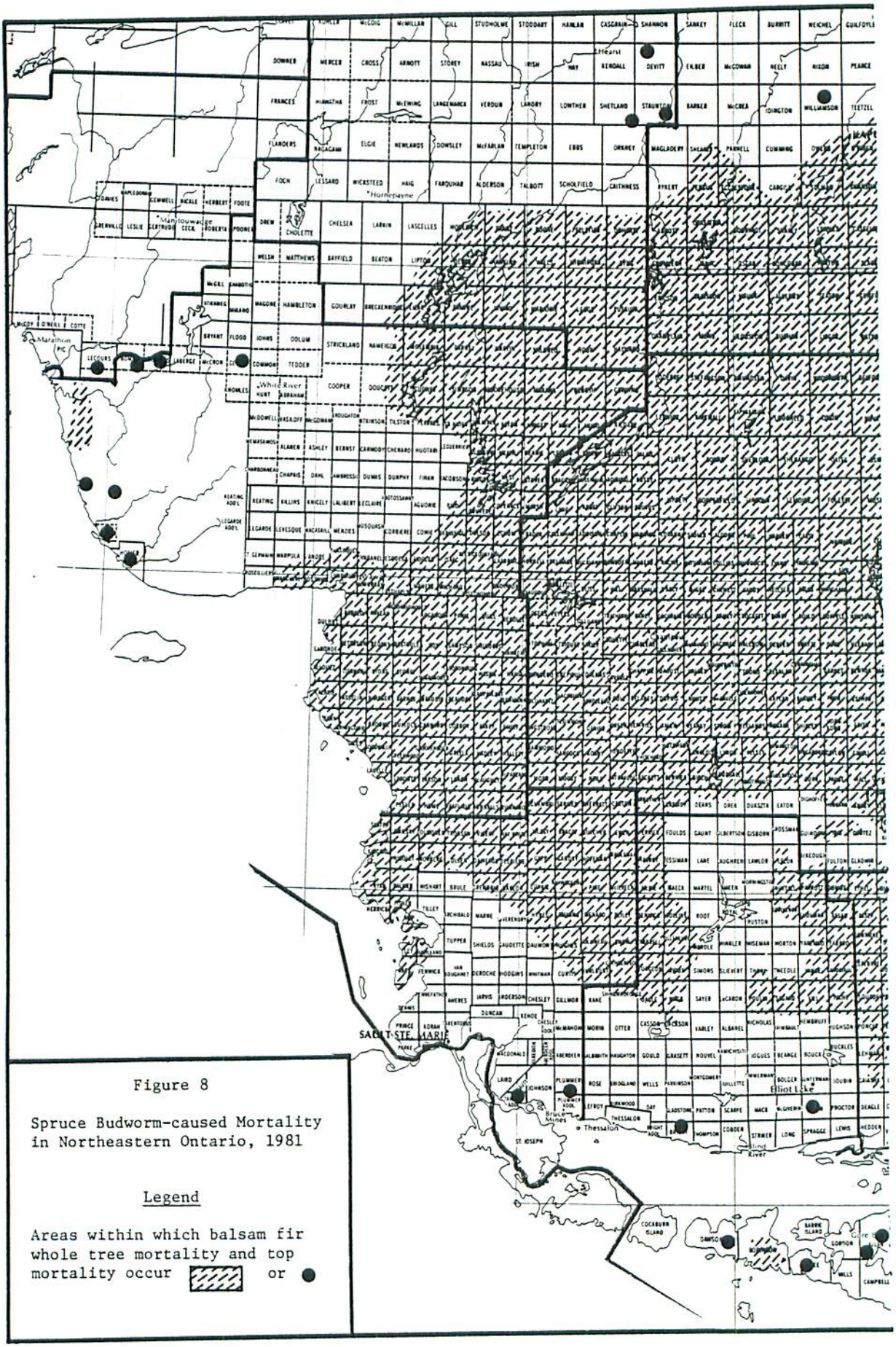
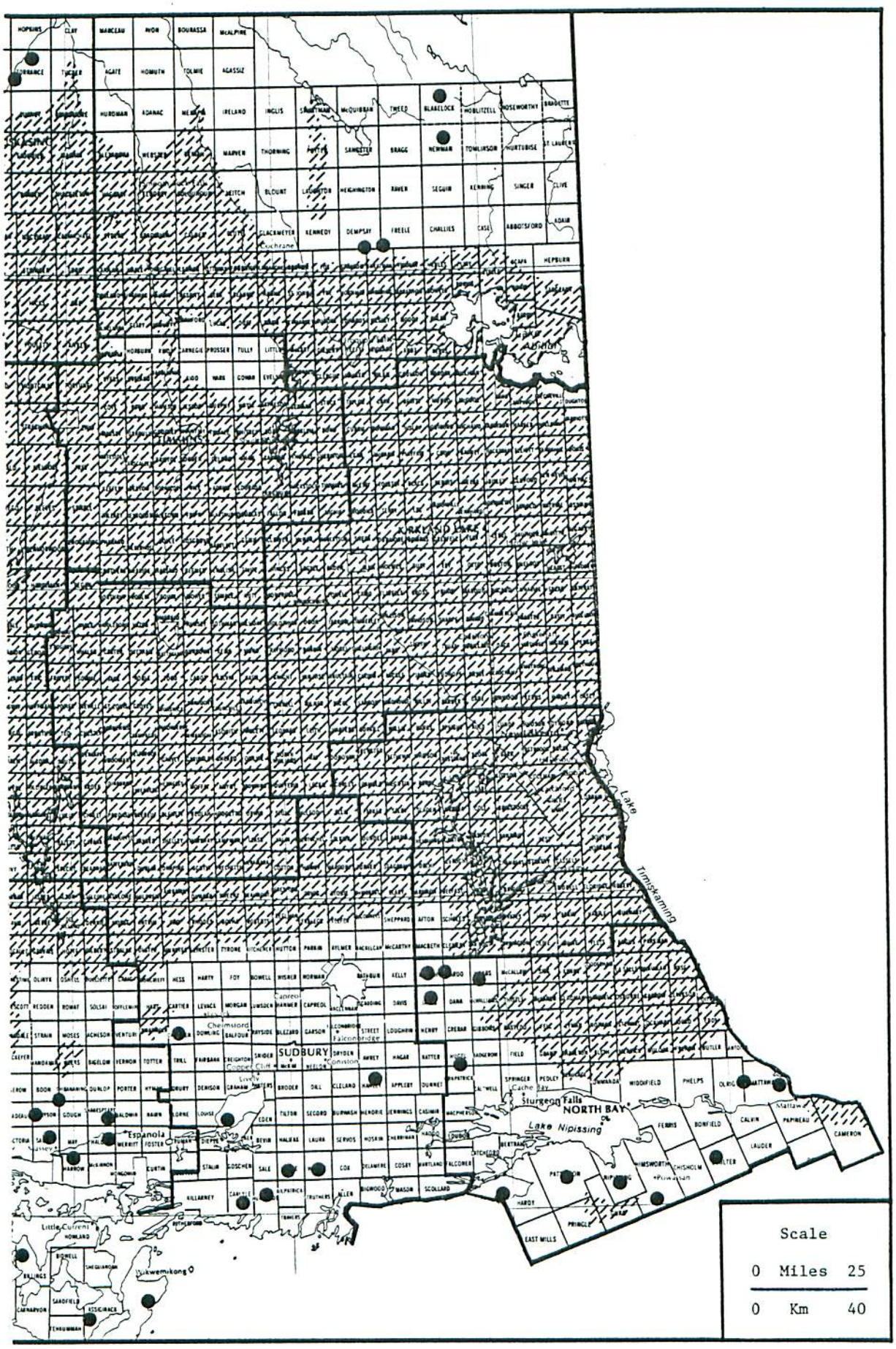


Figure 8

Spruce Budworm-caused Mortality in Northeastern Ontario, 1981

Legend

Areas within which balsam fir whole tree mortality and top mortality occur ▨ or ●


Lake Timiskaming
SUDBURY
Sturgeon Falls
NORTH BAY
Lake Nipissing
Espanola
Little Current
Wikwemikong
Scale
0 Miles 25
0 Km 40

In July, 1979 spraying began on a large area of mature balsam fir and white spruce in Elliott Township, Kirkland Lake District to protect this forest until it could be harvested. Spraying was repeated in 1980 and 1981 (see Part B: Aerial Spraying Operations). A number of mortality ground checks were conducted within the treated area in each of the last two years. Average balsam fir mortality in the treated area in 1981 was 27%, which is considerably lower than the 71% average throughout the rest of Kirkland Lake District. Therefore, in terms of protection, the spraying program conducted against the spruce budworm in Elliott Township during the last three years appears to have been quite successful.

North Central Ontario

Situation in 1981: For the purpose of this report, north central Ontario is considered to be that part of the province that includes the districts of Terrace Bay, Geraldton and Nipigon. Areas infested in north central Ontario are included in the totals, previously quoted, for budworm defoliation in northeastern Ontario (Tables 1 and 2).

In 1981, the total area of moderate-to-severe defoliation increased by about 185,700 ha (47%) in north central Ontario (Fig. 6). Most of this increase occurred in Terrace Bay District where pockets of moderate-to-severe damage mapped in 1980 in the Manitouwadge area and Davis Township coalesced and merged with the main body of infestation to the east.

In the southern part of the district the area of moderate-to-severe defoliation spread in a northwesterly direction and now includes all of Pic, Cotte, O'Neill and McCoy townships and Neys Provincial Park in Coldwell Township. Pockets of severely defoliated white spruce and balsam fir were observed in Tuuri, Syine and Walsh townships. In Geraldton District, there was very little change in the area of moderate-to-severe defoliation mapped in 1980. New areas of heavy budworm defoliation of white spruce and balsam fir were observed along the Kenogami and Flint rivers and on the west shore of Jag Lake. Light defoliation was observed to the east of Klotz Lake. The only detectable budworm activity in Nipigon District was west of Lake Nipigon in the Disraeli-Leckie lakes area (see *Northwestern Ontario*).

Infestation Forecasts for 1982: A total of 74 locations were sampled during the budworm egg-mass survey in north central Ontario this year (Table 7). On an overall basis, egg-mass densities showed a slight decrease of less than 1% over those of 1980. In Geraldton District egg-mass numbers decreased by almost 40% from an average of 720 in 1980 to 427 in 1981. This was offset, however, by large increases in both Nipigon and Terrace Bay districts where egg-mass densities increased by 471% and 146%, respectively.

Table 7. North Central Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1981, and infestation forecasts for 1982.

Location	Host	Estimated % defoliation 1981	No. of egg masses per 9.29 sq. m of foliage	Infestation forecasts for 1982[a]	Accumulated damage[b]
Geraldton District (36 locations)					
*Bicknell Twp					
- Clark Creek and C.N.R.	bF	31	414	S	1
- km 36.5, Pagwa Rd	bF	76	199	M-S	3
	wS	78	785	S	3
*Boyce Twp - Clark Creek	bF	38	68	M	3
	wS	62	636	S	2
- Clark Lake	bF	69	632	S	2
	wS	84	408	S	2
- New Access Road	bF	65	207	M-S	3
	wS	43	251	S	3
- NE of Korky Lake	bF	25	82	M-S	1
	wS	4	251	S	0
- NE of Lemon Lake	bF	92	285	S	3
	wS	43	971	S	3
- 88 cut near Island in Pagwa River	bF	98	576	S	3
	wS	41	1558	S	3
Caramat Rd					
- 2.8 km south of Hwy 11	bF	0	0	0	0
- km 24	bF	0	43	L-M	0
Catlonite Rd - km 115.7	bF	0	0	0	0
*Clavet Twp					
- Check Plot 1, Jinx Lake	bF	85	1073	S	3
	wS	62	364	S	3
	bS	2	333	S	3
- Plot A, Hwy 11, E of W Twp Line	bF	99	644	S	3
	wS	73	320	S	3
- Plot B, Pagwa R. Rd	bF	100	567	S	3
	wS	100	729	S	3
- Plot E, Hwy 11, 4.5 km E of W Twp Line	bF	81	147	M-S	3
	wS	55	145	M-S	3
Croll Twp	bF	0	0	0	0
Eastside Lake					
- east of, 83 cut	bF	79	361	S	3
	wS	33	567	S	3

(cont'd)

Table 7. North Central Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1981, and infestation forecasts for 1982 (cont'd).

Location	Host	Estimated % defoliation 1981	No. of egg masses per 9.29 sq. m of foliage	Infestation forecasts for 1982[a]	Accumulated damage[b]
Geraldton District (cont'd) (36 locations)					
Hwy 11 - SE of Nibs Lake	bF	95	638	S	2
Hwy 11 - W of Pipeline, Check Plot 3	bF	76	375	S	3
	wS	62	411	S	3
θKimberly-Clark - Seed Production Area	wS	1	0	0	0
Klotz Lake Prov. Pk	bF	9	0	0	0
Wintering Lake Rd - km 89.8	bF	0	23	L-M	0
Nipigon District (8 locations)					
Black Sturgeon Lake	wS	14	111	M-S	0
Kilkenny Twp - Macdiarmid	bF	0	0	0	0
Legault Twp	bF	0	0	0	0
Muskrat Lake - 3.2 km S of Parks Lake	bF	2	80	M-S	0
- km 48, Domtar Rd	bF	0	0	0	0
Patience Twp - Jackpine River	bF	0	0	0	0
Shillabeer Creek	bF	1	26	L-M	0
Summers Twp	bF	0	0	0	0
Terrace Bay District (30 locations)					
†Agonzon Lake - Stand 459	bF	23	353	S	0
*Barbara Lake - OMNR Tree Seed Production Area[c]	wS	3	987	S	0
†Bomby Twp - Stand 396	bF	98	1339	S	3
†Camp 60 Rd - N of Billet Lake Rd, Stand #377	bF	37	333	S	1
*Cat Island	bF	0	0	0	0
Catlonite Rd - km 46.7, Monitor Plot	bF	0	0	0	0

(cont'd)

Table 7. North Central Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1981, and infestation forecasts for 1982 (cont'd).

Location	Host	Estimated % defoliation 1981	No. of egg masses per 9.29 sq. m of foliage	Infestation forecasts for 1982[a]	Accumulated damage[b]
Terrace Bay District (cont'd) (30 locations)					
*Copper Island	bF	0	0	0	0
†Garnham Lake					
- E side, Stand 204	bF	51	146	M-S	3
†Harriet Lake - Stand 375	bF	12	84	M-S	1
†Herbert Twp					
- Ice Cream Lake, Stand 525	bF	45	145	M-S	2
Hourglass Lake	bF	83	165	M-S	2
†Hwy 614					
- E of Barehead Lake, Stand 360	bF	54	1429	S	1
- S of Billet Lake, Stand 561	bF	46	245	S	1
- Stand 312	bF	100	1704	S	3
Industrial and Camp 15 Rd	bF	80	1398	S	1
Killraine Twp					
- Rainbow Falls Prov. Pk	bF	0	0	0	0
†Lecours Twp - Stand 364	bF	98	2881	S	3
†Lunny Lake - Stand 201	bF	89	392	S	2
McCoy Twp					
- 3.1 km E of Mink Creek	bF	47	139	M-S	0
*Mortimer Island	bF	0	0	0	0
Neys Prov. Pk	bF	42	95	M-S	0
	wS	6	167	M-S	0
*Patterson Island					
- Lawrence Bay	bF	0	0	0	0
Pic Twp					
- Black River, Hwy 17	wS	8	356	S	1
Priske Twp - Hays Lake	bF	90	239	S	0
Stevens - Microwave Tower	bF	32	790	S	1
Syine Twp					
- Jackfish Lake Monitor Plot	wS	38	746	S	0

(cont'd)

Table 7. North Central Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1981, and infestation forecasts for 1982 (concl'd).

Location	Host	Estimated % defoliation 1981	No. of egg masses per 9.29 sq. m of foliage	Infestation forecasts for 1982[a]	Accumulated damage[b]
Terrace Bay District (cont'd) (30 locations)					
†Wabikoba Rd - Stand 616	bF	99	1415	S	3
Walsh Twp - Ripple Lake	bF	42	25	L-M	0
Wiggins Twp - 1.6 km E of Gravel River	bF	0	0	0	0

[a] S = severe, M = moderate, L = light, 0 = nil

[b] See footnote *b*, page 15

[c] Ground sprayed, Orthene, 1981

* Samples requested by OMNR

† Samples from Ontario Paper Co. Ltd. Limits

θ Samples requested by Kimberly-Clark of Canada Ltd.

In 1982, it is expected that the areas currently infested in Geraldton and Terrace Bay districts will again suffer moderate-to-severe defoliation. Some expansion of the infestation to the north and west is expected next year in both districts but especially in Terrace Bay District (Fig. 7). In Nipigon District, while the average egg-mass density increased in 1981, budworm populations and resultant defoliation are still expected to be very low in 1982. In fact, budworm damage will probably be restricted to the area southwest of Lake Nipigon near Black Sturgeon Lake.

Northwestern Ontario

Situation in 1981: In northwestern Ontario, the total area suffering moderate-to-severe defoliation decreased by some 66,765 ha (Fig. 9). The bulk of this decrease occurred around the outer edges of the infestation between Kawnipi Lake in the Atikokan District and Lower Shebandowan Lake in the Thunder Bay District. Moderate-to-severe defoliation declined in this area by approximately 41,500 ha. Generally, budworm populations were down in both Atikokan and Thunder Bay districts, and this resulted in a more scattered distribution of the areas of moderate-to-severe defoliation. The largest areas of heavy defoliation were in the Burchell-Greenwater lakes area and along the Atikokan-Thunder Bay district line. There was a similar decline in the infestation located mainly in the Fort Frances District between Bennett Township and Lower Manitou Lake. Here, a number of boundary changes are evident, and there was a net decrease in the infestation of 10,000 ha. The smaller infestations near Wolseley Lake in the Atikokan District and in the Arrow Lake-Sandstone Lake area of the Thunder Bay District also declined appreciably in size. The infestation which was discovered in the Poshkokagan Lake area of Thunder Bay District in 1980 decreased by about 2,400 ha. This infestation extends to the northwest to the vicinity of Cheeseman and Geikie lakes and southeast into the Nipigon District between Disraeli and Leckie lakes. A small infestation found in 1980 at Umfreville Lake, Kenora District, increased in size as defoliation was mapped on the south side of the lake for the first time.

Infestation Forecasts for 1982: In northwestern Ontario a total of 115 locations were sampled for egg-mass counts in 1981 (Table 8). On the basis of 92 locations sampled in 1980 and 1981, there was an overall increase in egg-mass densities of about 113% this year. Large increases occurred in Atikokan (848%), Thunder Bay (155%) and Fort Frances (56%) districts, whereas egg-mass numbers declined somewhat in Kenora District (341%). In Ignace and Red Lake districts, single locations were sampled during this year's egg-mass survey at Smirch Lake and Moar Lake, respectively.

On the basis of the results of this year's survey it is expected that the area of moderate-to-severe defoliation will increase by some 30-40% in 1982 to approximately 1.0 million ha (Fig. 10).

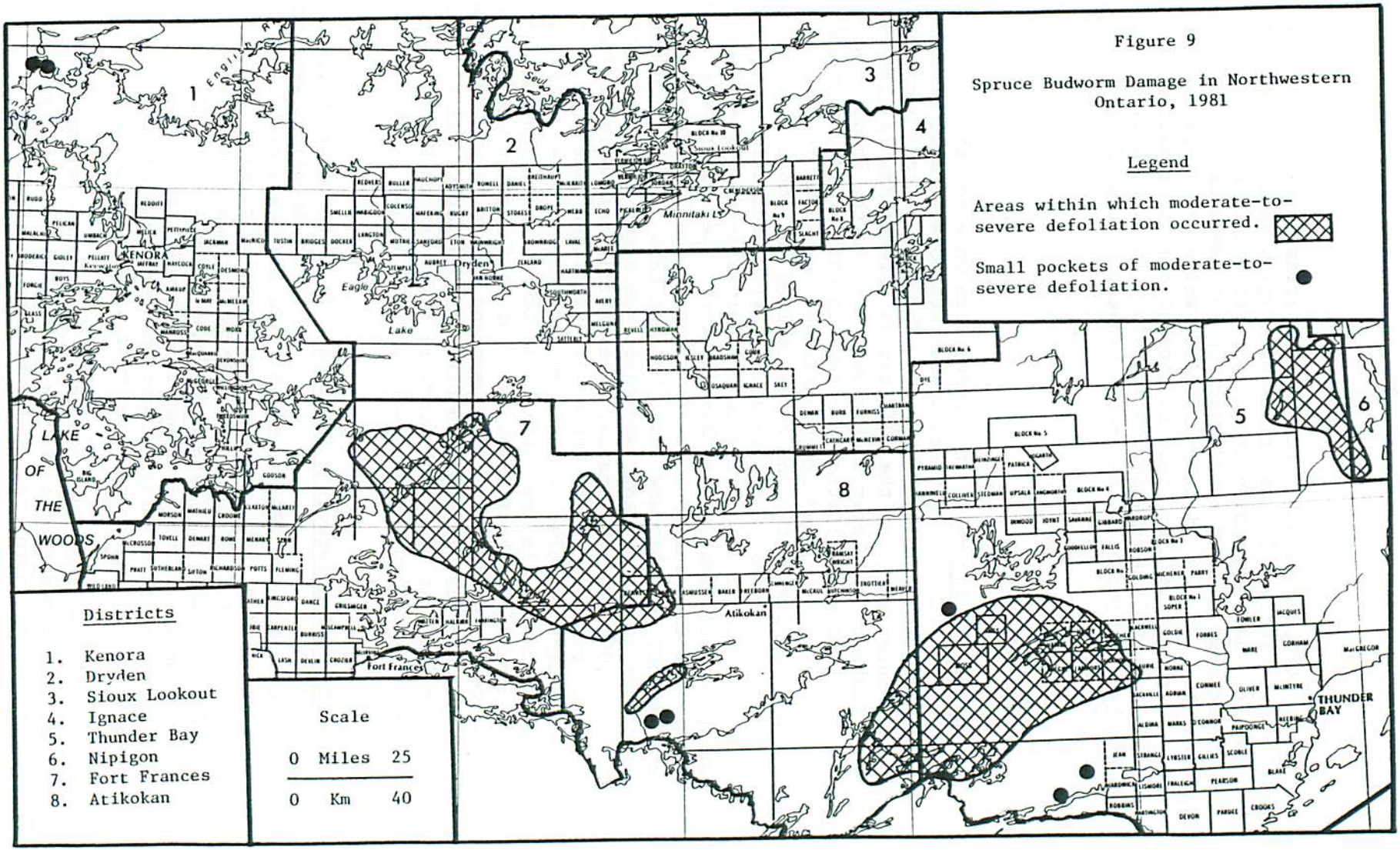


Figure 9
Spruce Budworm Damage in Northwestern Ontario, 1981
Legend
Areas within which moderate-to-severe defoliation occurred.
Small pockets of moderate-to-severe defoliation.
Districts
1. Kenora
2. Dryden
3. Sioux Lookout
4. Ignace
5. Thunder Bay
6. Nipigon
7. Fort Frances
8. Atikokan
Scale
0 Miles 25
0 Km 40
KENORA
Dryden
Eagle Lake
Minnitaki Lk
LAKE OF THE WOODS
Fort Frances
Atikokan
THUNDER BAY

Table 8. Northwestern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1981, and infestation forecasts for 1982.

Location	Host	Estimated % defoliation 1981	No. of egg masses per 9.29 sq. m of foliage	Infestation forecasts for 1982[a]	Accumulated damage[b]
Atikokan District (26 locations)					
Agnes Lake	bF	10	215	M-S	0
Allan Lake	bF	2	0	0	0
Basswood Lake - Prairie Portage	bF	0	54	L-M	0
Beaverhouse Lake	bF	2	86	M-S	0
Burton Lake - south of	bF	92	528	S	3
Cache Bay	bF	78	1336	S	3
Clearwater West Lake	bF	0	109	M-S	0
Crowrock Lake	bF	0	112	M-S	0
Eye Lake	bF	0	89	M-S	0
Factor Lake	bF	7	277	S	1
Flood River	bF	0	14	L	0
French Lake	bF	0	35	L-M	0
Greer Lake	bF	0	19	L-M	0
Joe Lake	bF	9	438	S	0
Kawa Bay	bF	75	184	M-S	2
Kawnipi Lake - Divine Creek	bF	93	1978	S	3
Little Eva Lake	bF	0	0	0	0
McKenzie Lake	bF	96	436	S	2
Melema Lake	bF	0	16	L-M	0
Oriana Lake	bF	0	15	L-M	0
Poohbah Lake	bF	1	13	L	0
Quetico Lake	bF	0	26	L-M	0
Sturgeon Lake - west end	bF	2	28	L-M	0
Thompson Lake	bF	0	0	0	0
Tuck Lake	bF	0	33	L-M	0
Wolseley Lake	bF	2	22	L-M	1
Fort Frances District (28 locations)					
Bear Pass - km 2.4 west	bF	50	93	M-S	2
Bennett Lake	bF	78	300	S	3
Big Sawbill Lake	bF	0	10	L	0
Boffin Lake - northeast side	bF	0	0	0	0
Carleton Lake	bF	0	56	L-M	0
Eltrut Lake	bF	98	1760	S	3

(cont'd)

Table 8. Northwestern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1981, and infestation forecasts for 1982 (cont'd).

Location	Host	Estimated % defoliation 1981	No. of egg masses per 9.29 sq. m of foliage	Infestation forecasts for 1982[a]	Accumulated damage[b]
Fort Frances District (cont'd) (28 locations)					
Entwine Lake	bF	0	100	M-S	0
Eric Lake	bF	1	409	S	0
Farrington Twp - Hwy 11	bF	0	0	0	0
Jones Lake	bF	2	197	S	0
Kaiarskons Lake	bF	3	80	M-S	0
Katimiagamak Lake	bF	1	0	0	0
Kawawia Lake	bF	11	1000	S	0
*Lake of the Woods Prov. Pk	wS	0	8	L	0
Lawrence Lake	bF	0	754	S	0
Little Turtle Lake Rd - km 15	bF	0	26	L-M	0
Makomesut Lake - southeast side	bF	21	599	S	0
Manion Lake Rd - Hillyer Creek	bF	85	348	S	3
Manion Lake Rd - km 23.2	bF	85	1243	S	2
Manitou Stretch	bF	99	610	S	3
Mather Twp	bF	0	12	L	0
Mount Lake	bF	2	204	S	0
Penassi Lake	bF	1	52	L-M	0
Pipestone Lake - east end	bF	3	17	L-M	0
Potts Twp	bF	0	0	0	0
Rainy Lake - Ash Bay, west end	bF	0	0	0	0
Sphene Lake	bF	0	0	0	0
Vickers Lake	bF	98	902	S	2
Ignace District (1 location)					
Smirch Lake	bF	0	134	M-S	0
Kenora District (6 locations)					
Crowduck Lake - north of	bF	0	9	L	0
Rowan Lake - south	bF	0	0	0	0
Tetu Lake - north end	bF	0	0	0	0

(cont'd)

Table 8. Northwestern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1981, and infestation forecasts for 1982 (cont'd).

Location	Host	Estimated % defoliation 1981	No. of egg masses per 9.29 sq. m of foliage	Infestation forecasts for 1982[a]	Accumulated damage[b]
Kenora District (cont'd) (6 locations)					
Umfreville Lake - east end	bF	0	0	0	0
- central	wS	23	402	5	2
- west end	bF	0	0	0	0
Thunder Bay District (53 locations)					
Abitibi-Price Camp 230					
- 1.6 km W of	bF	1	22	L-M	0
Aldina Twp	bF	13	398	S	1
Arrow Lake	bF	36	912	S	0
Bedivere Lake	bF	1	34	L-M	0
Blackwell Twp	bF	2	14	L	0
Burchell Lake	bF	92	721	S	2
Camp 45					
- Great Lakes Forest Products Co.	bF	87	1233	S	2
- km 1.6 on Camp Rd	bF	2	111	M-S	0
Cheeseman Lake					
- km 130 Hwy 527	bF	22	655	S	1
Circle Lake - 4.8 km W of	bF	18	56	M	1
Conacher Twp - Drift Lake Rd	bF	2	154	M-S	0
Crayfish Lake	bF	62	974	S	1
Flatrock Lake	bF	1	74	M-S	0
Forbes Twp - N of Flett	bF	0	14	L	0
Fowler Twp					
- SW of Hawkeye Lake	bF	0	15	L-M	0
Glen Twp - Wolf Lake Road	bF	0	0	0	0
Golding Twp					
- Microwave Tower	bF	0	0	0	0
Gorham Twp					
- S of Stepstone	bF	2	14	L	0
Greenwater Lake - east side	bF	8	463	S	0
- Shelter Island	bF	30	663	S	1
Greenwood Lake	bF	97	1819	S	3
Hagey Twp - Hwy 586	bF	54	312	S	2
Haines Twp - Postans	bF	26	193	M-S	2

(cont'd)

Table 8. Northwestern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1981, and infestation forecasts for 1982 (cont'd).

Location	Host	Estimated % defoliation 1981	No. of egg masses per 9.29 sq. m of foliage	Infestation forecasts for 1982[a]	Accumulated damage[b]
Thunder Bay District (cont'd) (53 locations)					
Hood Lake	bF	98	780	S	3
Hoof Lake	bF	67	405	S	3
Kabitotikwia Lake	bF	2	54	L-M	0
Kekekuab Lake	bF	72	1056	S	3
Lac Des Mille Lacs					
- Baril Bay	bF	3	108	M-S	0
- Bolton Bay	bF	1	101	M-S	0
- Poplar Point	bF	0	35	L-M	0
Marks Lake	bF	0	111	M-S	0
*Matawin Road					
- OMNR Tree Seed Orchard	wS	0	60	M	0
Mawn Lake - NE of	bF	0	0	0	0
McGinnis Lake	bF	82	769	S	3
McTavish Twp					
- Ministry of Transportation and Communications	wS	4	22	L-M	0
Moss Lake	bF	88	985	S	2
Mountain Lake	bF	2	27	L-M	0
Northern Light Lake					
- Curran Bay	bF	96	728	S	3
- Trout Bay Rd, km 16.8	bF	40	282	S	2
North Fowl Lake Rd					
- km 3.7 S of	bF	11	68	M	0
*O'Connor Twp					
- OMNR Tree Seed Orchard	wS	0	77	M-S	0
- OMNR Tree Seed Production Area	wS	0	109	M-S	0
*Pearson Twp					
- OMNR Tree Seed Orchard	wS	0	0	0	0
Plummes Lake	bF	97	1624	S	3
Ross Lake	bF	99	520	S	4
Sandstone Lake	bF	12	94	M-S	1
Scoble Twp					
- S of Oliver Lake	bF	0	20	L-M	0
Shebandowan Lake					
- Sawmill Bay	bF	68	419	S	3

(cont'd)

Table 8. Northwestern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1981, and infestation forecasts for 1982 (concl'd).

Location	Host	Estimated % defoliation 1981	No. of egg masses per 9.29 sq. m of foliage	Infestation forecasts for 1982[a]	Accumulated damage[b]
Thunder Bay District (cont'd) (53 locations)					
Squeers Lake - W of	bF	100	497	S	3
Sump Lake	bF	17	480	S	1
*Thunder Bay - OMNR Tree Nursery	wS	1	99	M-S	0
Ware Twp	bF	0	58	M	0
Wolf River Rd - km 28	bF	0	0	0	0
Red Lake District (1 location)					
Moar Lake	bF	8	149	M-S	0

[a] S = severe, M = moderate, L = light, 0 = nil

[b] See footnote b, page 15

* Samples requested by OMNR

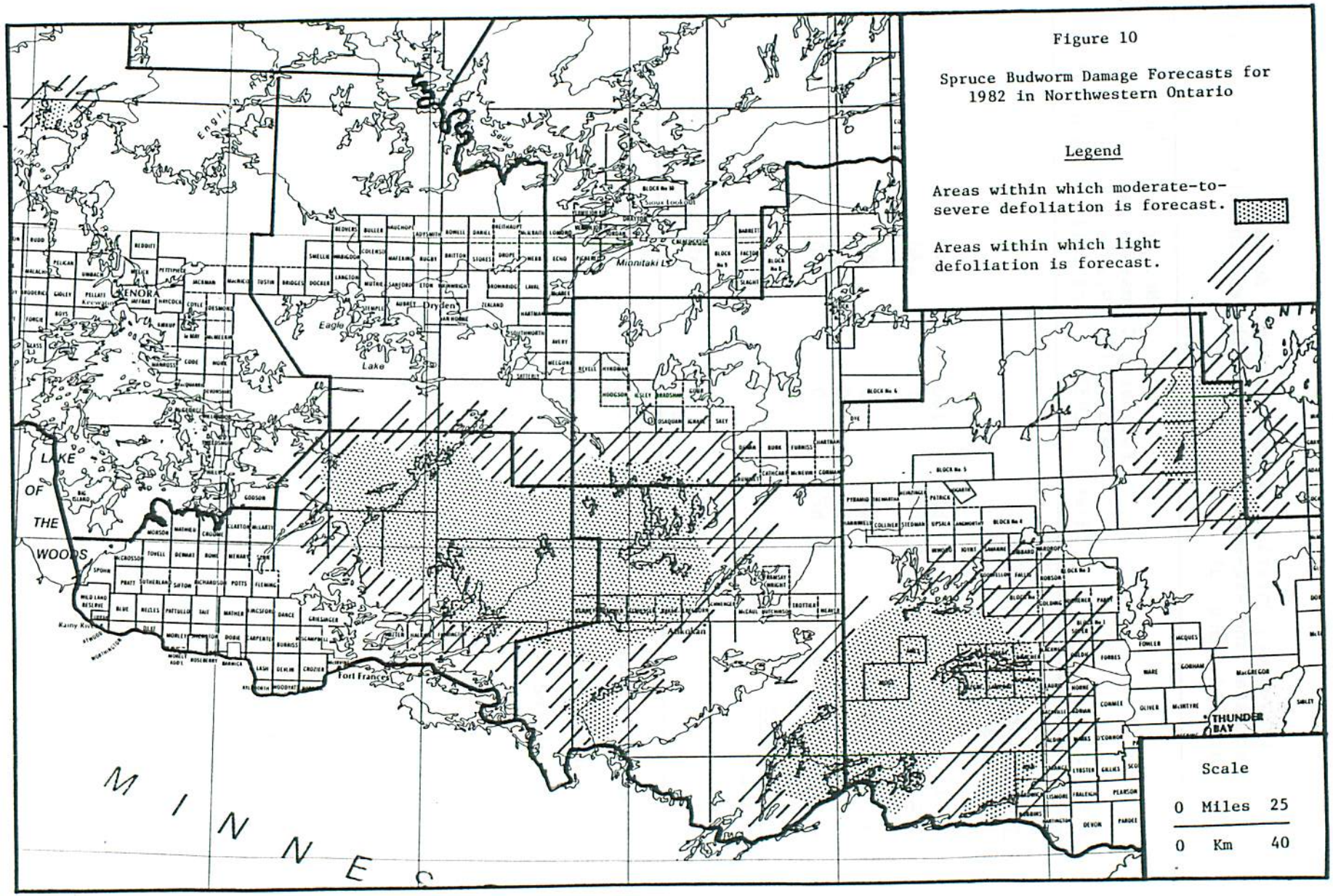


Figure 10
Spruce Budworm Damage Forecasts for 1982 in Northwestern Ontario
Legend
Areas within which moderate-to-severe defoliation is forecast.
Areas within which light defoliation is forecast.
Scale
0 Miles 25
0 Km 40
KENORA
Dryden
Eagle Lake
LAKE OF THE WOODS
Fort Frances
THUNDER BAY
MINNESOTA

The large infestation in Fort Frances District is expected to expand both to the north and to the southeast (further into Atikokan District). The other large infestation straddling the Atikokan-Thunder Bay district line will probably expand in all directions as will the smaller infestation between Cheeseman and Lecki lakes near Lake Nipigon. Some expansion is also forecast for the other small infestations.

Tree Mortality: In northwestern Ontario the area of budworm-associated tree mortality increased by about 64,000 ha in 1981 to a total of 88,000 ha (Table 2, Fig. 11). Several new mortality plots were established in 1981 at Eltrut, Harris and Strong lakes (Table 9). Balsam fir mortality on these plots averaged 7%. Light-to-moderate budworm-associated tree mortality was also observed west of Lower Manitou Lake, east of Kaiarskons Lake and in Bennett Township.

Table 9. Northwestern Ontario - Summary of spruce budworm-associated tree mortality based on ground checks for the past five years.

Location	Host	Tree mortality (%)				
		1977	1978	1979	1980	1981
Fort Frances District						
Bat Lake Rd - km 13.0	bF			5	12	
- km 15.3	bF			17	23	
Bennett Lake - north of	bF		38			
Eltrut Lake	bF					5
Harris Lake	bF					9
Hillyer Creek - south of	bF		35			
- southeast of	bF		32			
Little Turtle River	bF	76				
- Falls	bF		73			
- North of	bF	64				
Strong Lake	bF					7

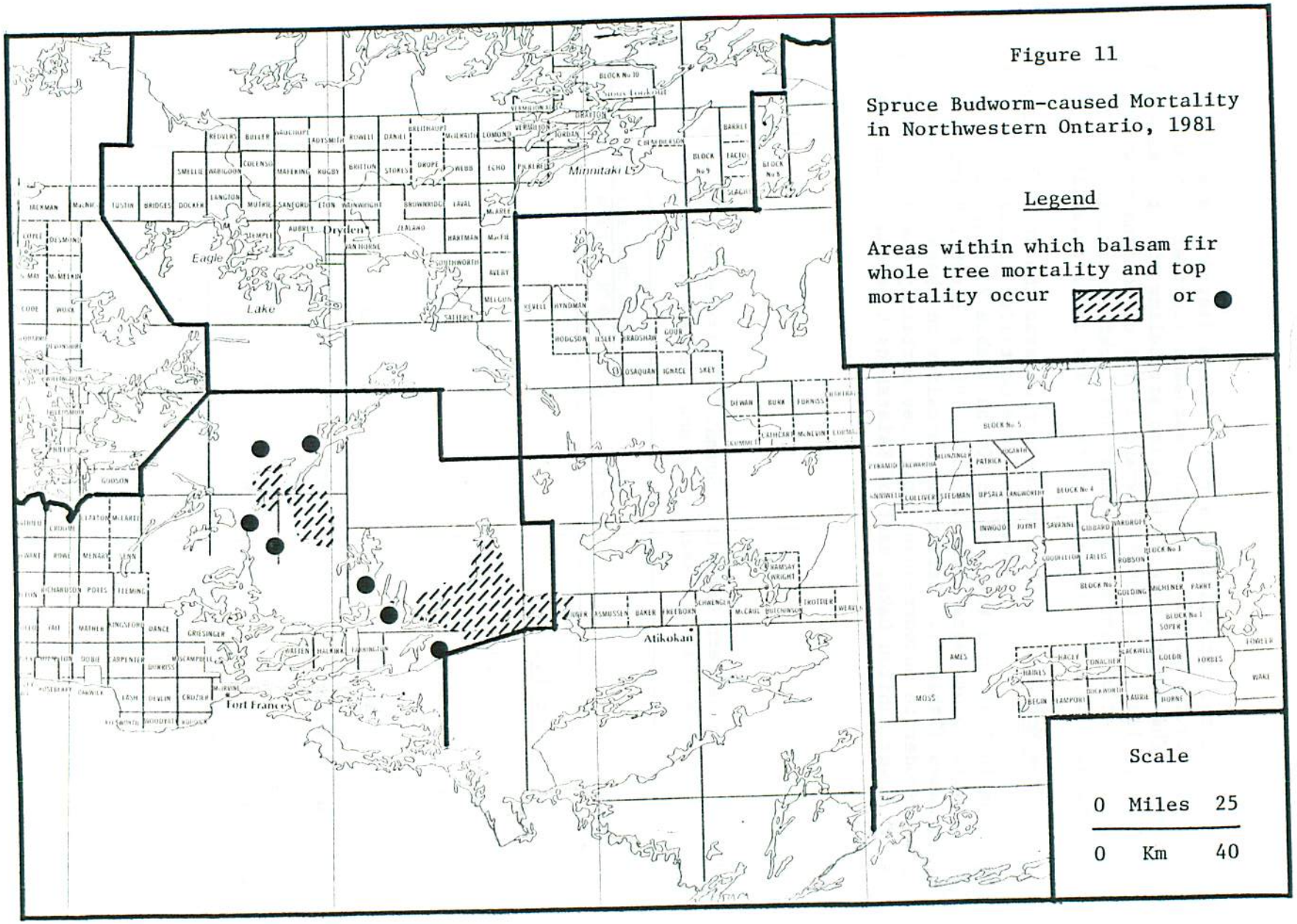


Figure 11
Spruce Budworm-caused Mortality in Northwestern Ontario, 1981
Legend
Areas within which balsam fir whole tree mortality and top mortality occur
or
Scale
0 Miles 25
0 Km 40
Eagle Lake
Dryden
Minnitaki L.
Atikokan
Fort Frances

PART B: AERIAL SPRAYING OPERATIONS

INTRODUCTION

Aerial spraying operations were carried out in June, 1981 to protect high value areas in the districts of Hearst, Kapuskasing, Gogama, Chapleau and Kirkland Lake in the Northern Region, Temagami in the Northeastern Region and Parry Sound in the Algonquin Region. In total, approximately 10,233 ha were sprayed. Matacil was applied to a total of 3,225 ha, Thuricide 16B to 3,473 ha, Thuricide 32BX to 324 ha, Dipel 88 to 3,103 ha and nuclear polyhedrosis virus (NPV) to 108 ha. Areas sprayed included commercial forests, provincial parks, plantations, seed production areas, potential cone collection areas and a deer yard. A summary of aerial spraying conducted in Ontario in 1981, with the location, area treated, date sprayed and treatment, is provided in Table 10. The results of the various spray treatments used are presented in Tables 12 to 25. Basic data such as pre- and post-spray population densities, larval mortality (due to treatment) and foliage protection are presented in each table.

OMNR was responsible for the logistics of the spray operations. The CFS provided the biological information necessary for the planning and timing of operations (Table 11) and biologically assessing the various treatments (Tables 12-25). In addition, aerial and ground surveys to map the extent of spruce budworm defoliation and to determine, by egg-mass counts, damage forecasts for 1982 were carried out by FIDS field technicians using some 300 hours of aircraft time provided by OMNR.

Southern Ontario

1981 Operations and Results: For the second consecutive year an aerial spraying operation was carried out against the spruce budworm in Parry Sound District. On 2 June, a 620 ha deer yard in Spence Township was treated with two different *B.t.* formulations. Results of these treatments were generally very good (Table 12). In terms of population reduction and defoliation, excellent results were achieved in the area treated with Dipel 88. Results in the area treated with Thuricide 32BX were not as good as in the Dipel-treated area, especially on white spruce. This may be due, in part, to the poor spray deposits recorded for the morning application (Table 13). Generally, however, results of previous *B.t.* treatments have been less satisfactory on white spruce than on balsam fir.

Table 10. Summary of aerial spraying in Ontario against spruce budworm in 1981.

Location	Hectares	Date sprayed	Treatments
Parry Sound District			
Spence Twp	296	2 June	Dipel 88, 24 BIU/7.0 L/ha, sprayed once
	324	2 June	Thuricide 32BX, 20 BIU/4.7 L/ha, sprayed once
	620		
Hearst District			
Rogers Twp	547	7 June	Matacil, 86 g/3.0 L/ha, sprayed once
	1,099	7 to 9 June	Dipel 88, 20 BIU/5.9 L/ha, sprayed once
	28	12 June	Virus, 741 billion P1B/9.4 L/ha, sprayed once
Studholme Twp	862	9 & 10 June	Dipel 88, 20 BIU/2.4 L/ha, sprayed once
Arnott SPA	16	(28 May, 2 June,	Matacil, 86 g/9.4 L/ha, sprayed 3 times
Hanlan SPA	8	(19 June	Matacil, 86 g/9.4 L/ha, sprayed 3 times
McMillan SPA	40	19 June	Matacil, 86 g/4.7 L/ha, sprayed once
Nagagamisis Provincial Park	670	10 & 12 June	Thuricide 16B, 20 BIU/7.2 L/ha, sprayed once
	3,270		
Kapuskasing District			
Idington Twp Plantation #5	64	28 May, 3 June	Matacil, 86 g/9.4 L/ha, sprayed twice
Idington Twp Plantation #7	68	17 June	Virus, 741 billion P1B/9.4 L/ha, sprayed once
Williamson Twp	77	17 June	Matacil, 86 g/4.7 L/ha, sprayed once
Fauquier Twp	81	17 June	Thuricide 16B, 20 BIU/7.0 L/ha, sprayed once
Staples/Casselman	385	19 & 20 June	Thuricide 16B, 20 BIU/7.0 L/ha, sprayed once
	675		
Kirkland Lake District			
Elliott Twp	2,424	11, 12 & 20 June	Matacil, 86 g/3.0 L/ha, sprayed once
	846	13 June	Dipel 88, 20 BIU/5.1 L/ha, sprayed once
	1,731	14, 17 & 20 June	Thuricide 16B, 16 BIU/6.2 L/ha, sprayed once
	262	20 June	Thuricide 16B, 16 BIU/6.2 L/ha, sprayed twice
Swastika Nursery	97	7 June	Thuricide 16B, 20 BIU/7.0 L/ha, sprayed once
Burt Twp SPA	123	7 June	Thuricide 16B, 20 BIU/7.0 L/ha, sprayed once
	5,483		
Gogama District			
Fawcett Twp SPA	29	22 May	Matacil, 86 g/9.4 L/ha, sprayed twice
Invergarry Twp SPA	6	28 May	Matacil, 86 g/9.4 L/ha, sprayed twice
	35		
Chapleau District			
Chapleau Nursery	2.5	10 June	Thuricide 16B, 20 BIU/7.0 L/ha, sprayed once
Caverley Twp	32.5	14 June	Thuricide 16B, 20 BIU/7.0 L/ha, sprayed once
Manning Twp	89	12 June	Thuricide 16B, 20 BIU/7.0 L/ha, sprayed once
Reeves Twp SPA	12	14 June	Virus, 2470 billion P1B/18.8 L/ha, sprayed once
	136		
Temagami District			
Friday Lake SPA	8.5	20 & 25 May	Matacil, 86 g/9.4 L/ha, sprayed twice
Matabitchuan SPA	6.0	20 & 26 May	Matacil, 86 g/9.4 L/ha, sprayed twice
	14.5		

Program total: 10,233.5 ha

Table 11. Spruce budworm development, 1981.

Area	Sampled	Species	Larval development (%) II	III	IV	V	VI	Date sprayed
Parry Sound Dist., Spence Twp	21 May	wS	86	14				2 June
		bF	92	8				
	28 May	wS	24	64	12			
		bF	44	50	6			
Hearst Dist., Rogers Twp	4 June	wS	37	28	35			7-12 June
		bF	28	56	16			
	5 June	wS	24	38	36			
		bF	18	16	66			
	9 June	wS	6	22	71			
		bF	10	23	67			
	11 June	wS	22	8	67	2		
		bF	3	6	89	1		
Hearst Dist., Nagagamisis Provincial Park	1 June	wS	72	28				12 June
		bF	48	52				
	10 June	wS	2	8	24	46	20	
		bF	6	16	48	18	12	
Kirkland Lake Dist., Elliott Twp	2 June	wS	100	Buds				11-20 June
		bF	100	tight				

(cont'd)

Table 11. Spruce budworm development, 1981 (concl'd).

Area	Sampled	Species	Larval development (%) II	III	IV	V	VI	Date sprayed
Kirkland Lake Dist., Elliott Twp (cont'd)	11 June	wS	23	36	36	4		
		bF	14	16	64	5		
	13 June	wS	7	20	57	17		11-20 June
		bF	2	16	63	19		
	15 June	wS		4	62	32		
		bF		7	39	32	9	
	17 June	wS		9	62	30		
		bF	14	11	46	29		
Cochrane Dist., Greenwater Provincial Park	3 June	wS	70	30				
	10 June	wS	19	12	67	2		
Kapuskasing Dist., Bonner T.I.C.	2 June	wS	52	36	12			26 May-26 June
		bF	64	24	12			
Kapuskasing Dist., Fauquier Twp	9 June	bS	64	36				17 June

Table 12. Population reduction, pupal survival and foliage protection attributable to *B.t.* aerial treatments in a deer yard in Spence Township, Parry Sound District. Sprayed 2 June, 1981.

	Host	Prespray larvae per 46 cm branch tip	Surviving pupae per 46 cm branch tip	Population reduction due to treatment (%)	1981 defoliation (%)
Dipel 88, 24 BIU/7.0 L/ha					
Treated	bF	7.2	0	100	2
Check	bF	8.2	0.8		31
Treated	wS	15.9	0.3	81	7
Check	wS	23.2	2.3		29
Thuricide 32BX, 20 BIU/4.7 L/ha					
Treated	bF	5.5	0.2	63	3
Check	bF	8.2	0.8		31
Treated	wS	17.4	1.2	30	25
Check	wS	23.2	2.3		29

Table 13. Summary, spray deposit, 1981 (Krome Kote cards).

Location and treatment	Date	Time	No. of cards	Avg no. of droplets/cm^2	Range
Spence Twp Thuricide 32BX	2 June	a.m.	10	.4	0- 1.6
Spence Twp Thuricide 32BX	2 June	p.m.	40	35.9	12.8-94.2
Spence Twp Dipel 88	2 June	a.m.	34	8.8	2.0-16.6
Spence Twp Dipel 88	2 June	p.m.	17	33.1	16.0-57.4
Rogers Twp Dipel 88	9 June	a.m.	50	32.9	18.2-66.4
Studholme Twp Dipel 88	9 June	p.m.	50	12.9	3.0-29.6
Nagagamisis Prov. Park Thuricide 16B	12 June	a.m.	50	16.5	0-91.6

Northern Ontario

1981 Operations and Results: A total of 9,613 ha were aerially sprayed in the Northern and Northeastern regions in 1981. Over half of this area involved a commercial operation in Elliott Township, Kirkland Lake District which was first treated in 1979. Another large operation was conducted in Hearst District where over 3,000 ha of high value spruce plantations were protected. The remaining area was distributed among 20 other high value areas throughout northern Ontario.

In an effort to protect female flowers in Seed Production Areas (SPAs) from budworm feeding, an early or pre-emergence spray was planned for several white spruce and black spruce SPAs (Table 14). Originally Orthene was to be applied at the time of flowering on spruce and was to be followed by an application of either Permethrin or Matacil at the time of budworm emergence. However, permits for Orthene and Permethrin were denied and Matacil was used in their place. In all cases the budworm had emerged before the first application of insecticide. It is very difficult to measure the success of this program in terms of flower protection, as there was very little, if any, flower production on white spruce in these areas in 1981. Nevertheless, in terms of larval mortality and defoliation, excellent results were achieved in both SPAs in Temagami District. There was some population reduction and foliage protection on black spruce in Idington Township #5 but results in the Gogama and Hearst SPAs were variable. A check of larval populations in Arnott and Hanlan townships after the second Matacil treatment revealed high budworm populations in both SPAs. Therefore, a third application of Matacil was given to each SPA, and this provided some foliage protection.

In Chapleau District three high value white spruce areas were treated with a single application of Thuricide 16B (Table 15). Plantations in Caverley and Manning townships were sprayed in 1981 for the third consecutive year as part of a field trial to determine the impact of budworm on young, planted white spruce trees. However, budworm populations failed to increase significantly in treated areas or untreated check plantations throughout the duration (1979-1981) of the trial. Very low pre-spray population densities and light defoliation in both the treated and untreated areas make it difficult to interpret the results of this operation.

For the third consecutive year a large area (5,260 ha) of mature (commercial) balsam fir and white spruce in Elliott Township, Kirkland Lake District was treated to decrease damage until harvesting can take place (Table 16). Two *B.t.* formulations (Dipel 88 and Thuricide 16B) and Matacil were applied when the majority of budworm larvae were in the fourth instar (Table 11). Excellent results were achieved on balsam fir with all treatments. Larval mortality due to treatment was not as good on white spruce, but with such low population densities within the

Table 14. Population reduction, pupal survival and foliage protection attributable to pre-emergence treatments of aerially applied Matacil (.86 g/9.4 L/ha) on high value stands, 1981.

	L_2 per branch[a]		Surviving pupae per 46 cm branch tip		Population reduction due to treatment (%)		1981 defoliation (%)	
	bS	wS	bS	wS	bS	wS	bS	wS
Gogama District								
Invergarry SPA		22.6		1.3		0		42
Check		10.3		0.4				23
Kapuskasing District								
Idington Twp #5 (Pipeline)	5.7		0.8		40		7	
Check	1.6		0.4				19	
Hearst District								
Arnott Twp SPA[b]		36.1		1.5		20		44
Check		25.1		1.3				86
Hanlan Twp SPA[b]		17.7		0.6		0		8
Check		13.9		0.2				21
Temagami District								
Friday Lake SPA		29.5		3.0		76		20
Check		20.1		8.4				50
Matabitchuan SPA		30.8		2.5		81		8
Check		20.1		8.4				50

[a] L_2 per branch was determined by collecting foliage in March and forcing and/or washing larvae.

[b] Three applications of Matacil.

Table 15. Population reduction, pupal survival and foliage protection attributable to *B.t.* treatments (20 BIU/7.0 L/ha) on high value stands in Chapleau District, 1981.

	Host	Prespray larvae per 46 cm branch tip	Surviving pupae per 46 cm branch tip	Population reduction due to treatment (%)	1981 defoliation (%)
Chapleau Nursery	wS	1.2	0.3	0	4
Check	wS	5.5	0.4		7
Caverley Twp	wS	1.0	0.1	60	1
Check	wS	0.4	0.1		2
Manning Twp (plantation)	wS	0.1	0	0	1
Check	wS	0.3	0		3

Table 16. Population reduction, pupal survival and foliage protection attributable to various aerial treatments in Elliott Twp, Kirkland Lake District, 1981.

	Host	Prespray larvae per 46 cm branch tip	Surviving pupae per 46 cm branch tip	Population reduction due to treatment (%)	1981 defoliation (%)
Matacil, 86 g/3.0 L/ha					
Treated	bF	5.7	0.1	94	4
Check	bF	6.1	1.8		34
Treated	wS	8.7	0.4	61	7
Check	wS	15.4	1.8		22
Thuricide 16B, 16 BIU/6.2 L/ha					
Treated	bF	0.7	0	100	1
Check	bF	6.1	1.8		34
Treated	wS	1.7	0.1	50	4
Check	wS	15.4	1.8		22
Dipel 88, 20 BIU/5.1 L/ha					
Treated	bF	3.4	0.2	80	4
Check	bF	6.1	1.8		34
Treated	wS	5.6	0.4	39	10
Check	wS	15.4	1.8		22

treatment area, defoliation was very light. Both Matacil and Thuricide 16B provided good-to-excellent population reduction and foliage protection on both tree species. Dipel 88 was quite effective on fir but less effective on white spruce.

Two other high value areas in Kirkland Lake District were treated with Thuricide 16B (Table 17). In both cases population reduction due to treatment was low, but for some reason there was good foliage protection in the Swastika Nursery. In Kapuskasing District the same *B.t.* formulation was used to treat two high value spruce stands (Table 17). Pre-spray populations on both white spruce and black spruce in both areas were quite low, and this made it very difficult to determine spray efficacy.

In Hearst District over 3,000 ha of high value forests, including white spruce and black spruce plantations and a provincial park, were treated with *B.t.* or Matacil. Five plantations in Rogers Township were treated with Dipel 88 (Table 18). Spraying began on 7 June, when most larvae were in the fourth instar (Table 11), and was completed by 12 June. Although foliage protection on balsam fir was quite variable, generally high population reductions were achieved in most areas. Results on white spruce were less encouraging in terms of larval mortality; however, in at least two plantations (#26 and #49) some foliage protection seems to have been afforded. In Nagagamisis Provincial Park a rather substantial jack pine (*Pinus banksiana* Lamb.) and poplar (*Populus* spp.) overstory may have limited insecticide penetration, thereby reducing treatment effectiveness. The situation was different in Studholme Township where young (planted 1969) black spruce and white spruce were treated with Dipel 88 at 20 BIU in 2.4 L per ha. Again, because of extremely low populations, spray effectiveness was difficult to assess. Matacil was used very effectively in plantation 43 in Rogers Township (Table 19), but because of extremely low pre-spray populations in MacMillan Township, the effect of Matacil on budworm there cannot be determined.

As part of an ongoing effort to further the development of biological control agents, three high value areas in the Northern Region were treated with NPV. These virus applications were carried out by OMNR with the help and cooperation of Dr. J.C. Cunningham of the Forest Pest Management Institute as well as staff of the Great Lakes Forest Research Centre. The virus was applied at the peak of the fifth instar and, as expected, foliage protection was limited. Larval mortality, while quite variable, was, in the case of Reeves Township, very encouraging (Table 20). Excellent larval mortality was achieved on white spruce, which, in this SPA, were quite large and generally overtopped the balsam fir. This fact may account for the lower population reduction observed on this species. Also, the high defoliation observed in this SPA can be explained, in part, by the large numbers of spruce coneworm (*Dioryctria reniculelloides* Mut. & Mun.) larvae observed during pre-spray sampling. Each area will continue to be monitored during the

Table 17. Population reduction, pupal survival and foliage protection attributable to *B.t.* (Thuricide 16B, 20 BIU/7.0 L/ha) aerial treatments in high value areas in Kapuskasing and Kirkland Lake districts, 1981.

	Prespray larvae per 46 cm branch tip		Surviving pupae per 46 cm branch tip		Population reduction due to treatment (%)		1981 defoliation (%)	
	bS	wS	bS	wS	bS	wS	bS	wS
Kapuskasing District								
Fauquier Twp SPA	0.9	3.5	0.3	1.3	0	0	5	9
Check	1.6	10.8	0.4	1.2			10	16
Staples/Casselman	0.4		0		100		0	
Check	0.2		0.2				3	
Kirkland Lake District								
Burt Twp SPA		14.2		3.0		0		59
Check		7.5		1.5				45
Swastika Nursery		7.3		1.2		18		9
Check		7.5		1.5				45

Table 18. Population reduction, pupal survival and foliage protection attributable to *B.t.* aerial treatments in Hearst District, 1981.

	Prespray larvae per 46 cm branch tip		Surviving pupae per 46 cm branch tip		Population reduction due to treatment (%)		1981 defoliation (%)	
	bF	wS	bF	wS	bF	wS	bF	wS
Dipel, 88, 20 BIU/5.9 L/ha								
Rogers Twp #26	28.0	25.2	4.8	1.1	69	71	43	16
Check	8.3	10.7	4.6	1.6			56	9
Rogers Twp #30	14.3	24.1	4.0	7.1	50	0	44	30
Check	8.3	10.7	4.6	1.6			56	9
Rogers Twp #37	8.7	8.5	0.5	0.7	90	45	60	2
Check	8.3	10.7	4.6	1.6			56	9
Rogers Twp #43 (east side of road)	11.7	11.6	0.5	1.3	92	25	18	7
Check	8.3	10.7	4.6	1.6			56	9
Rogers Twp #49	14.2	23.1	1.4	1.5	82	56	35	9
Check	8.3	10.7	4.6	1.6			56	9
Thuricide 16B, 20 BIU/7.2 L/ha								
Nagagamisis Prov. Park	7.4	18.4	1.6	3.1	42	55	33	63
Check	11.8	4.0	4.4	1.5			77	64
Dipel 88, 8 BIU/2.4 L/ha								
Studholme Twp #37	0.1[a]	3.1	0	0	100	100	1	1
Check	0.1	10.7	0.1	1.6			10	9

[a] Black spruce.

Table 19. Population reduction, pupal survival and foliage protection attributable to aerial treatments with Matacil in Hearst District, 1981.

	Host	Prespray larvae per 46 cm branch tip	Surviving pupae per 46 cm branch tip	Population reduction due to treatment (%)	defoliation (%)
Matacil, 86 g/3.0 L/ha					
Rogers Twp #43 (west side of road)	bF	11.7	0	100	4
Check	bF	8.3	4.6		56
Rogers Twp #43	wS	16.2	0.2	92	3
Check	wS	10.7	1.6		9
Matacil, 86 g/4.7 L/ha					
McMillan Twp	bS	0	0	0	2
Check	bS	0.1	0.1		10

Table 20. Population reduction, pupal survival and foliage protection attributable to NPV aerially applied on high value stands, 1981.

	Host	Prespray larval population	Surviving pupae per 46 cm branch tip	Population reduction due to treatment (%)	1981 defoliation (%)
Kapuskasing District (741 billion P1B/9.4 L/ha)					
Idington Twp #7					
Beartooth L.	wS	5.7	0.4	35	8
Check	wS	7.0	0.7		11
Idington #7	bS	1.2	0.2	33	5
Check	bS	1.6	0.4		19
Chapleau District (2,470 billion P1B/18.8 L/ha)					
Reeves Twp SPA	bF	14.7	2.2	40	61
Check[a]	bF	11.8	4.4		77
Reeves Twp SPA	wS	9.1	0.6	90	61
Check	wS	6.3	3.7		41
Hearst District (741 billion P1B/9.4 L/ha					
Rogers Twp #31	bF	19.9	8.9	19	82
Check	bF	8.3	4.6		55
Rogers Twp #31	wS	19.3	5.6	0	43
	wS	10.7	1.6		9

[a] Check data from Nagagamisis Provincial Park, Hearst District

next two or three years for the effects of virus carryover on budworm control.

In 1979 several compartments of black spruce and white spruce in the Bonner Tree Improvement Centre, Kapuskasing District, were treated with Orthene followed by NPV. Since then these plots have been monitored to determine the beneficial effects, if any, of this treatment. Results of the 1981 effort are given in Tables 21 and 22. While results were variable, some protection seems to have been afforded a few compartments. However, in the absence of virus infectivity information for 1981 and in the face of low populations, it is difficult to assess the degree and impact of NPV carryover.

Results of ground spraying operations in Ontario in 1981 are given in Tables 23, 24 and 25. In Cochrane District the results of the *B.t.* treatment at Greenwater Provincial Park were good in terms of population reduction (Table 23). Populations were such that only light defoliation occurred in both the treated and untreated areas. At Barbara Lake SPA, Terrace Bay District, Orthene was used quite successfully to limit budworm damage on white spruce even though budworm larval mortality due to treatment was not exceptionally high (Table 23). Orthene was also used in several compartments of white spruce and black spruce at the Bonner Tree Improvement Centre (Tables 24 and 25). Initial populations on both species were generally quite low, and this resulted in very light defoliation in both treated and untreated areas. Excellent population reduction was achieved in most compartments.

To summarize, it is evident from the results that a number of factors influenced the outcome of this year's spraying operations. Variables such as density of budworm populations, absence of developing flowers on spruce, presence of other species of defoliating insects and interference by non-target overstory tree species affected various operations this year. Another major factor affecting all spraying operations, of course, is the weather and this is often the single most important factor determining the outcome of a spray program. Weather not only affects insect and tree development, it also limits the occasions when effective spraying can be conducted. This year the weather was generally very good and spraying conditions were sufficiently good to ensure that the various operations began and were completed on schedule (except the early or pre-emergence operation which began shortly after budworm emergence).

Other factors affecting spray efficacy to varying degrees include the pesticide itself, the application rate, the delivery system, the type of aircraft and pilot experience. All of these factors played a role in the 1981 spray program; however, it would be impossible to analyze every factor for each operation. On the basis of an analysis of the pre- and post-spray budworm populations we can make some general statements as to the effectiveness of the insecticides used this year.

Table 21. Population reduction, pupal survival and foliage protection to *white spruce* attributable to NPV carryover from 1979 spray applications at Bonner Tree Improvement Centre, Kapuskasing District, 1981.

Compartment	Prespray larvae per 46 cm branch tip	Surviving pupae per 46 cm branch tip	Population reduction due to NPV carryover (%)	1981 defoliation (%)
19C	6.3	0.2	78	4
Check	4.7	0.7		2
21D	4.5	0.4	43	3
Check	4.7	0.7		2
22A	3.2	0.5	0	2
Check	4.7	0.7		2
Overall	4.7	0.4	43	3
Check	4.7	0.7		2

Table 22. Population reduction, pupal survival and foliage protection to *black spruce* attributable to NPV carryover from 1979 spray applications at Bonner Tree Improvement Centre, Kapuskasing District, 1981.

Compartment	Prespray larvae per 46 cm branch tip	Surviving pupae per 46 cm branch tip	Population reduction due to NPV carryover (%)	1981 defoliation (%)
6B	.2	0	0	7
Check	1.6	0		3
19C	3.2	0.2	67	5
Check	2.9	0.5		5
21B	3.8	1.2	0	7
Check	2.9	0.5		5
21D	5.0	0.4	56	8
Check	2.9	0.5		5
Overall	3.1	0.4	20	7
Check	2.6	0.4		4

Table 23. Population reduction, pupal survival and foliage protection attributable to treatments applied by mistblower on *white spruce* in Cochrane and Terrace Bay districts, 1981.

	Prespray larvae per 46 cm branch tip	Surviving pupae per 46 cm branch tip	Population reduction due to treatment (%)	1981 defoliation (%)
Cochrane District, Thuricide 16B				
Greenwater Provincial Park	10.2	0.05	59	18
Check	5.0	0.06		5
Terrace Bay District, Orthene				
Barbara Lake SPA	48.3	2.60	43	12
Check	34.7	3.30		38

Table 24. Population reduction, pupal survival and foliage protection attributable to Orthene applied by mistblower on *white spruce* at Bonner Tree Improvement Centre, Kapuskasing District, 1981.

Compartment	L_2 per branch[a]	Surviving pupae per 46 cm branch tip	Population reduction due to treatment (%)	1981 defoliation (%)
Orthene, 2 applications				
10B	5.2	0.4	60	4
Check	3.6	0.4		2
Orthene, 3 applications				
16A	15.2	0.1	96	11
Check	3.6	0.7		2
22C	5.0	0.2	80	2
Check	3.6	0.7		2
26D	5.6	0.6	45	3
Check	3.6	0.7		2
Overall (Orthene 3X)	8.6	0.3	82	5
Check	3.6	0.7		2

[a] L_2 per branch was determined by collecting foliage in May at time of emergence and by visual examination and washing of larvae.

Table 25. Population reduction, pupal survival and foliage protection attributable to three applications of Orthene by mistblower on *black spruce* at Bonner Tree Improvement Centre, Kapuskasing District, 1981.

Compartment	L_2 per branch[a]	Surviving pupae per 46 cm branch tip	Population reduction due to treatment (%)	1981 defoliation (%)
16E	7.8	0	100	1
Check	11.0	0.5		5
17A	1.2	0	100	1
Check	4.0	0.9		7
26B	2.0	0	100	1
Check	4.0	0.9		7
Overall	3.7	0	100	1
Check	6.3	0.8		6

[a] L_2 per branch was determined by collecting foliage in May at time of emergence and by visual examination and washing of larvae.

Matacil was the only chemical insecticide aerially applied in 1981. When applied at the proper time (third and fourth instars) it was very effective in reducing populations and saving foliage. However, when it was applied too early, as it was in the pre-emergence program, its effectiveness was drastically reduced. The three *B.t.* materials used in this year's program were somewhat inconsistent in reducing populations and protecting foliage. Dipel 88 seemed to be quite effective on balsam fir but was generally less effective on white spruce. Results in the areas treated with the two Thuricide products (16B and 32BX) were quite variable, but as was the case with Dipel, both were somewhat more effective on fir. The other biological insecticide used in 1981, NPV, gave promising results in the SPA that received the triple dosage.

Plans for 1982

Spraying in 1982 may be limited to two small SPAs in Temagami District and about 2,800 ha in the Hearst District, Northern Region. The reduced level of spraying anticipated in 1982 is due to decreased budworm populations in a large portion of northeastern Ontario.